COVER SHEET

DRAFT ENVIRONMENTAL IMPACT REPORT/ENVIRONMENTAL IMPACT STATEMENT CADIZ GROUNDWATER STORAGE AND DRY-YEAR SUPPLY PROGRAM SAN BERNARDINO COUNTY, CALIFORNIA

LEAD AGENCIES:

Metropolitan Water District of Southern California
Los Angeles, California

U.S. Department of the Interior
Bureau of Land Management
Riverside, California

PROPOSED ACTION:

Construction and operation of the Cadiz Groundwater Storage and Dry-Year Supply Program (Cadiz Project), amendment of the California Desert Conservation Area (CDCA) Plan, and issuance of associated right-of-way grants and permits.

Written information regarding the Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS) should be submitted to the Metropolitan Water District of Southern California (Metropolitan) and the Bureau of Land Management (BLM) at the addresses below. For further information, contact Metropolitan or BLM at:

Metropolitan Water District
Water Resource Management Group
P.O. Box 54153
Los Angeles, CA 90054-0153
Attention:
Mr. Dirk Reed (213) 217-6163
Mr. Jack Safely (213) 217-6981

Bureau of Land Management
California Desert District
6221 Box Springs Boulevard
Riverside, CA 92507-0714
Attention:
Mr. James Williams (909) 697-5390

DESIGNATION:

Draft EIR/EIS

ABSTRACT:

In February 1999, Metropolitan issued a Notice of Preparation of an EIR for the Cadiz Project which would be constructed and operated by Metropolitan in the Cadiz and Fenner valleys of the eastern Mojave Desert, San Bernardino County, California. The BLM has determined that an EIS would be required as the proposed action includes an amendment of the CDCA Plan and right-of-way easements across federal lands. The BLM issued a Notice of Intent to Prepare an

EIS for the proposed action in March 1999. In May 1999, the BLM issued a Notice of Public Meeting and extension of the scoping comment period. In accordance with the California Environmental Quality Act and the National Environmental Policy Act, Metropolitan and the BLM are preparing a joint EIR/EIS.

The Cadiz Project is proposed by Metropolitan who is acting in partnership with the private company Cadiz, Inc. The project would involve construction and operation of an approximate 35-mile pipeline for conveying water between the Iron Mountain Pumping Plant on the Colorado River Aqueduct and the Cadiz/Fenner area, a Cadiz Pumping Plant at Metropolitan's existing Iron Mountain Pumping Plant facility, 390 acres of spreading basins for percolation of Colorado River water into the groundwater basin in the Cadiz/Fenner area, a wellfield for extracting stored and indigenous groundwater, and associated power poles and lines along the conveyance pipeline and in the wellfield.

The Cadiz Project would involve storage of a minimum of 1.0 million acre-feet depending on availability of Colorado River water for storage, storage or extraction at a rate of approximately 150,000 acre-feet per year, and transfer of up to 2.0 million acre-feet of indigenous groundwater depending on the natural recharge of the groundwater basin over the 50-year term of the Cadiz Project.

Alternatives to the proposed Cadiz Project include:

- Western Alternative
- Combination Alternative
- Eastern Alternative
- Eastern/Canal Alternative
- No Project Alternative

Additional alternatives for the proposed project were considered, but eliminated from further analysis as they were determined not to be feasible for one or more of the following reasons:

- Proposal withdrawn by another lower Colorado River basin state;
- Inadequate storage capacity;
- Open basin with high potential for migration of stored groundwater out of the basin;
- Incompatible overlying land use (e.g. national park; critical habitat for endangered desert tortoise);
- Extremely poor quality of indigenous groundwater; and
- Very high cost of implementation.

This Draft EIR/EIS is being distributed for a 90-day review and comment period (November 26, 1999 to February 23, 1999). During the review and comment period, Metropolitan and BLM will hold three public hearings to obtain verbal comments on the Draft EIR/EIS. The public hearings will be held as follows:

- Cadiz Office at 11:00AM on December 15, 1999 at 96-726 Highway 66, Cadiz, California;
- Twentynine Palms City Hall at 7:00PM on December 15, 1999 at 6136 Adobe Road, Twentynine Palms, California; and

- Needles City Council Chambers at 7:00PM on December 16, 1999 at 1111 Bailey Avenue, Needles, California.

If needed, additional public meetings will be held during the 90-day comment period. Written comments regarding the Draft EIR/EIS should be submitted to the Metropolitan and BLM at the above addresses prior to the close of the comment period. Various technical reports have been prepared to support the EIR/EIS analyses. These reports are available for review on request at the Metropolitan and BLM offices listed above, and at the following public libraries:

- San Bernardino County Library
  104 West 4th Street
  San Bernardino, CA 92401

- Needles Branch Library
  1111 Bailey Avenue
  Needles, CA 92363

- Twentynine Palms Branch Library
  6078 Adobe Road
  Twentynine Palms, CA 92277

- Barstow Branch Library
  304 East Buena Vista Street
  Barstow, CA 92311

Because there is no existing utility corridor that corresponds to the Cadiz Project Alternatives, the Cadiz Project would not be in conformance with the CDCA Plan. As a result, the proposed Cadiz Project would need an amendment of the CDCA Plan for an exception to the utility corridor requirement. This proposed amendment of the CDCA Plan is a planning action by the BLM and involves a separate decision by the BLM as that required for the proposed issuance of right-of-way easements.

This Draft EIR/EIS has been approved for public distribution.

11-17-99

Tim Salt
District Manager
California Desert District
U.S. Bureau of Land Management

Date

Stephen N. Arakawa

11/17/99

Stephen N. Arakawa
Manager, Water Resource Management Group
Metropolitan Water District of Southern California

Date

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CADIZ GROUNDWATER STORAGE AND DRY-YEAR SUPPLY PROGRAM

The following technical reports and documents for the Cadiz Project are available:

- Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS, November 1999)
- EIR/EIS Executive Summary (November 1999)
- EIR/EIS Public Participation (November 1999)
- Environmental Planning Technical Reports:

  - Project Feasibility and Facilities (November 1999)
  - Groundwater Resources (November 1999)
  - Biological Resources (November 1999)
  - Cultural Resources (November 1999)

The Draft EIR/EIS shall govern over the Environmental Planning Technical Reports in the event of any discrepancies between the documents.

The EIR/EIS and technical reports are available for review at the Metropolitan Water District office located at 700 North Alameda Street, 9th Floor, Los Angeles, California and at the BLM offices in Needles (101 West Spike's Road, Needles, California) and Riverside (6221 Box Springs Boulevard, Riverside, California).

TABLE OF CONTENTS

Section **Page**

EXECUTIVE SUMMARY

Introduction ES-1
Project Overview ES-1
Purpose and Scope of the EIR/EIS ES-3
Project Need ES-3
Formulation and Evaluation of Project Alternatives ES-5
Selection of the Environmentally Preferred Alternative ES-9
Selection of the Preferred Alternative ES-10
Summary of Project Description and Key Issues ES-10
Operations and Maintenance ES-16
Environmental Consequences and Mitigation Measures ES-16
Mitigation Monitoring Program ES-16
Unavoidable Adverse Impacts ES-32
Irreversible and Irretrievable Commitment of Resources ES-33
Growth Inducement Impacts ES-35
Cumulative Impacts ES-35
Short Term Versus Long Term Productivity Impacts ES-37
Project Approvals and Permits ES-38
Final EIR Certification ES-38
Record of Decision ES-39

1.0 INTRODUCTION

1.1 Background and Purpose of This Document 1-1
1.2 Background of the Metropolitan Water District 1-1
1.3 Cadiz Project Overview 1-3
1.3.1 Metropolitan's Role 1-3
1.3.2 BLM's Role 1-5
1.4 Propose of EIR/EIS 1-5
1.5 Background to the EIR/EIS 1-6
1.6 Overview of Public Comments 1-7
1.7 EIR/EIS Format 1-8
1.8 Mitigation Monitoring Plan 1-11
1.9 Project Approvals and Permits 1-11
1.10 Final EIR Certification 1-11
1.11 EIS Record of Decision 1-12
1.12 Documents Incorporated by Reference 1-13

2.0 ASSESSMENT OF PROJECT NEED AND PURPOSE

2.1 General Approach to Needs Assessment 2-1
2.2 Dry-Year Water Supply Needs 2-3
2.2.1 General 2-3
2.2.2 The Role of Storage 2-4
2.2.3 The Role of Conservation 2-5

TABLE OF CONTENTS

Section			Page
		2.2.4 The Role of Transfers	2-5
	2.3	Projection of Dry-Year Demand: 2000-2020	2-6
		2.3.1 General	2-6
		2.3.2 SCAG, SANDAG and DWR Population Projections	2-6
		2.3.3 Forecasts of Agricultural Water Demand	2-7
		2.3.4 Current and Potential Conservation Programs	2-11
		2.3.5 Municipal, Industrial and Agricultural Demands	2-14
		2.3.6 Total Dry-Year Demand in the Metropolitan Area	2-14
	2.4	Existing Dry-Year Supply from All Sources	2-14
		2.4.1 General	2-14
		2.4.2 Metropolitan's Existing State Water Project Contract Entitlements	2-15
		2.4.3 Existing Colorado River Contract Allocations	2-16
		2.4.4 Other Existing Programs to Meet Water Supply and Water Quality Objectives	2-17
		2.4.5 Total Projected 2020 Dry-Year Supply With Existing Programs	2-21
	2.5	Metropolitan's Integrated Program To Meet 2020 Dry-Year Demands	2-21
		2.5.1 Projected Dry-Year Yields for Non-Colorado River Resource Areas	2-22
		2.5.2 Needs Analysis for the Colorado Resource Area	2-24
	2.6	Remaining Colorado River Resource Area Dry-Year Need	2-26
	2.7	Summary of Needs Analysis	2-26
3.0	**FORMULATION AND EVALUATION OF PROJECT ALTERNATIVES**		
	3.1	Introduction	3-1
	3.2	Project Background	3-2
	3.3	Project Objectives	3-2
	3.4	Step One: Identification of Potential Alternatives	3-3
		3.4.1 General	3-3
		3.4.2 Groundwater Project	3-3
		3.4.3 Transfer Project	3-10
		3.4.4 Desalting Projects	3-10
	3.5	Step Two: Screening of Potential Alternatives	3-11
		3.5.1 General	3-11
		3.5.2 Environmental Considerations	3-12
		3.5.3 Alternatives Considered But Eliminated From Detailed Analysis	3-12
		3.5.4 Alternatives Carried Forward for Detailed Analysis	3-16
	3.6	Step Three: Formulation and Evaluation of Project-Level Alternatives	3-17
		3.6.1 General	3-17
		3.6.2 Phase 1 – Alternative Operational Scenarios	3-17
	3.7	Phase 2 – Site-Specific Project Alternatives	3-20
		3.7.1 Siting of Project Spreading Basins and Wellfield	3-20
		3.7.2 Siting of Pumping Stations	3-24
		3.7.3 Screening-Level Alternatives Considered	3-24
		3.7.4 Results of Initial Screening-Level of Alternatives Evaluation	3-28
		3.7.5 Detailed Evaluation of Project-Level Alternatives	3-28
		3.7.6 Results of Project-Level Alternatives Evaluation	3-35

TABLE OF CONTENTS

Section		Page
3.8	Selection of the Environmentally Preferred Alternative	3-39
3.8.1	Impacts to Desert Tortoise	3-39
3.8.2	Impacts to Wildlife Corridors	3-39
3.8.3	Wilderness Area Compatibility	3-40
3.8.4	Other Environmental Impacts	3-41
3.9	Selection of the Preferred Alternative	3-40
4.0	**DESCRIPTION OF THE PROJECT ALTERNATIVES**	
4.1	Introduction	4-1
4.2	Eastern Alternative	4-2
4.2.1	General Description	4-2
4.2.2	Hydraulic Characteristics	4-2
4.2.3	Construction Activities	4-6
4.2.4	Construction Schedule	4-9
4.2.5	Right-of-Way Requirements	4-9
4.2.6	Feasibility Capital Cost	4-9
4.3	Western Alternative	4-11
4.3.1	General Description	4-11
4.3.2	Hydraulic Characteristics	4-11
4.3.3	Construction Activities	4-11
4.3.4	Construction Schedule	4-17
4.3.5	Right-of-Way Requirements	4-17
4.3.6	Feasibility Capital Cost	4-17
4.4	Combination Alternative	4-18
4.4.1	General Description	4-18
4.4.2	Hydraulic Characteristics	4-18
4.4.3	Construction Activities	4-18
4.4.4	Construction Schedule	4-23
4.4.5	Right-of-Way Requirements	4-23
4.4.6	Feasibility Capital Cost	4-24
4.5	Eastern/Canal Alternative	4-24
4.5.1	General Description	4-24
4.5.2	Hydraulic Characteristics	4-26
4.5.3	Construction Activities	4-26
4.5.4	Construction Schedule	4-30
4.5.5	Right-of-Way Requirements	4-31
4.5.6	Feasibility Capital Cost	4-31
4.6	Characteristics Common to All Alternatives	4-31
4.6.1	Project Spreading Basins	4-35
4.6.2	Project Wellfield	4-42
4.6.3	Project Wellfield Power Supply and Distribution	4-48
4.6.4	Power Distribution Facilities	4-48
4.6.5	Power Supply Facilities	4-51
4.6.6	Staging Areas	4-51

TABLE OF CONTENTS

Section			Page
	4.6.7	Appurtenances	4-54
	4.6.8	Instrumentation and Control System	4-59
4.7		Operations and Maintenance	4-60
	4.7.1	Spreading Basins	4-60
	4.7.2	Project Wellfield Facilities	4-60
	4.7.3	Water Conveyance Facilities	4-60
4.8		The No Project Alternative	4-62
	4.8.1	Planning Assumptions for the No Project Alternative	4-62
	4.8.2	Operating Options Evaluated	4-62
	4.8.3	Most Probable No-Project Scenario	4-64
5.0		**AFFECTED ENVIRONMENT, IMPACTS AND MITIGATION**	
5.1		Agriculture	5-1
	5.1.1	Affected Environment	5-1
	5.1.2	Thresholds of Significance	5-4
	5.1.3	Methodology	5-4
	5.1.4	Impacts	5-5
	5.1.5	Mitigation Measures	5-7
	5.1.6	Level of Significance After Mitigation	5-7
5.2		Land Use, Planning and Policies	5-8
	5.2.1	Affected Environment	5-8
	5.2.2	Thresholds of Significance	5-15
	5.2.3	Methodology	5-15
	5.2.4	Impacts	5-16
	5.2.5	Mitigation Measures	5-20
	5.2.6	Level of Significance After Mitigation	5-20
5.3		Socioeconomics	5-21
	5.3.1	Affected Environment	5-21
	5.3.2	Thresholds of Significance	5-24
	5.3.3	Methodology	5-24
	5.3.4	Impacts	5-25
	5.3.5	Mitigation Measures	5-30
	5.3.6	Level of Significance After Mitigation	5-31
5.4		Topography, Geology, Seismicity and Soils	5-32
	5.4.1	Affected Environment	5-32
	5.4.2	Thresholds of Significance	5-51
	5.4.3	Methodology	5-52
	5.4.4	Impacts	5-52
	5.4.5	Mitigation Measures	5-64
	5.4.6	Level of Significance After Mitigation	5-65
5.5		Water Resources	5-66
	5.5.1	Affected Environment	5-66
	5.5.2	Thresholds of Significance	5-83
	5.5.3	Methodology	5-83
	5.5.4.	Impacts	5-90

TABLE OF CONTENTS

Section		Page
	5.5.5 Mitigation Measures	5-105
	5.5.6 Level of Significance After Mitigation	5-107
5.6	Air Quality	5-109
	5.6.1 Affected Environment	5-109
	5.6.2 Thresholds of Significance	5-114
	5.6.3 Methodology	5-114
	5.6.4 Impacts	5-114
	5.6.5 Mitigation Measures	5-119
	5.6.6 Level of Significance After Mitigation	5-119
5.7	Transportation	5-120
	5.7.1 Affected Environment	5-120
	5.7.2 Thresholds of Significance	5-122
	5.7.3 Methodology	5-123
	5.7.4 Impacts	5-124
	5.7.5 Mitigation Measures	5-138
	5.7.6 Level of Significance After Mitigation	5-139
5.8	Biological Resources	5-140
	5.8.1 Affected Environment	5-140
	5.8.2 Thresholds of Significance	5-158
	5.8.3 Methodology	5-158
	5.8.4 Impacts	5-159
	5.8.5 Mitigation Measures	5-177
	5.8.6 Level of Significance After Mitigation	5-184
5.9	Energy and Mineral Resources	5-187
	5.9.1 Affected Environment	5-187
	5.9.2 Thresholds of Significance	5-189
	5.9.3 Methodology	5-189
	5.9.4 Impacts	5-194
	5.9.5 Mitigation Measures	5-200
	5.9.6 Level of Significance After Mitigation	5-200
5.10	Hazardous Materials	5-202
	5.10.1 Affected Environment	5-202
	5.10.2 Thresholds of Significance	5-205
	5.10.3 Methodology	5-205
	5.10.4 Impacts	5-206
	5.10.5 Mitigation Measures	5-209
	5.10.6 Level of Significance After Mitigation	5-210
5.11	Noise	5-211
	5.11.1 Affected Environment	5-211
	5.11.2 Thresholds of Significance	5-215
	5.11.3 Methodology	5-216
	5.11.4 Impacts	5-216
	5.11.5 Mitigation Measures	5-229
	5.11.6 Level of Significance After Mitigation	5-230

TABLE OF CONTENTS

Section		Page
5.12	Public Services	5-231
	5.12.1 Affected Environment	5-231
	5.12.2 Thresholds of Significance	5-232
	5.12.3 Methodology	5-233
	5.12.4 Impacts	5-233
	5.12.5 Mitigation Measures	5-235
	5.12.6 Level of Significance After Mitigation	5-236
5.13	Utilities and Service Systems	5-237
	5.13.1 Affected Environment	5-237
	5.13.2 Thresholds of Significance	5-239
	5.13.3 Methodology	5-240
	5.13.4 Impacts	5-240
	5.13.5 Mitigation Measures	5-243
	5.13.6 Level of Significance After Mitigation	5-243
5.14	Aesthetics	5-244
	5.14.1 Affected Environment	5-244
	5.14.2 Thresholds of Significance	5-256
	5.14.3 Methodology	5-256
	5.14.4 Impacts	5-257
	5.14.5 Mitigation Measures	5-265
	5.14.6 Level of Significance After Mitigation	5-265
5.15	Cultural Resources	5-266
	5.15.1 Affected Environment	5-266
	5.15.2 Thresholds of Significance	5-270
	5.15.3 Methodology	5-271
	5.15.4 Impacts	5-272
	5.15.5 Mitigation Measures	5-276
	5.15.6 Level of Significance After Mitigation	5-277
5.16	Paleontological Resources	5-278
	5.16.1 Affected Environment	5-278
	5.16.2 Thresholds of Significance	5-280
	5.16.3 Methodology	5-281
	5.16.4 Impacts	5-282
	5.16.5 Mitigation Measures	5-285
	5.16.6 Level of Significance After Mitigation	5-286
5.17	Wilderness/Recreation	5-287
	5.17.1 Affected Environment	5-287
	5.17.2 Thresholds of Significance	5-291
	5.17.3 Methodology	5-291
	5.17.4 Impacts	5-291
	5.17.5 Mitigation Measures	5-293
	5.17.6 Level of Significance After Mitigation	5-294
5.18	Indian Trust Assets	5-295
	5.18.1 Affected Environment	5-295
	5.18.2 Thresholds of Significance	5-295
	5.18.3 Methodology	5-295

TABLE OF CONTENTS

Section			Page
	5.18.4	Impacts	5-296
	5.18.5	Mitigation Measures	5-296
	5.18.6	Level of Significance After Mitigation	5-296
5.19		Environmental Justice	5-297
6.0	**GROWTH INDUCEMENT IMPACTS**		
6.1		Background	6-1
6.2		Growth and Its Potential Socioeconomic Effects	6-1
	6.2.1	Population	6-3
	6.2.2	Employment and Industry	6-3
	6.2.3	Housing	6-4
	6.2.4	Jobs/Housing Balance	6-4
6.3		Relation of the Project to Regional Growth Management Plans	6-4
6.4		Growth Inducement	6-5
6.5		Conclusions	6-6
7.0	**CUMULATIVE IMPACTS**		
7.1		Background	7-1
7.2		Cumulative Projects	7-1
	7.2.1	Regional Plans	7-1
	7.2.2	Approved and Proposed Land Development in the Cadiz Project Area	7-2
	7.2.3	Other Water Supply Projects	7-2
7.3		Thresholds of Significance	7-3
7.4		Methodology	7-3
7.5		Cumulative Impacts	7-3
	7.5.1	Agriculture	7-3
	7.5.2	Land Use, Planning and Policies	7-3
	7.5.3	Socioeconomics and Growth Inducement	7-4
	7.5.4	Topography, Geology, Seismicity and Soils	7-4
	7.5.5	Water Resources	7-5
	7.5.6	Air Quality	7-5
	7.5.7	Transportation	7-6
	7.5.8	Biological Resources	7-6
	7.5.9	Energy and Mineral Resources	7-6
	7.5.10	Hazards and Hazardous Materials	7-7
	7.5.11	Noise	7-7
	7.5.12	Public Services	7-8
	7.5.13	Utilities and Service Systems	7-8
	7.5.14	Aesthetics	7-8
	7.5.15	Cultural Resources	7-9
	7.5.16	Paleontological Resources	7-9
	7.5.17	Wilderness/Recreation	7-10
	7.5.18	Environmental Justice	7-10
	7.5.19	Indian Trust Assets	7-10

TABLE OF CONTENTS

Section **Page**

8.0 UNAVOIDABLE ADVERSE IMPACTS

8.1 Introduction 8-1
8.2 Seismicity 8-2
8.3 Water Resources 8-2
8.4 Air Quality 8-2
8.5 Biological Resources 8-2
8.6 Hazardous Materials 8-3

9.0 SHORT TERM VERSUS LONG TERM PRODUCTIVITY IMPACTS

9.1 Short Term Use Versus Long Term Productivity 9-1
9.1.2 Agricultural Resources 9-1
9.1.3 Land Use, Planning and Policies 9-1
9.1.4 Socioeconomics 9-1
9.1.5 Topography, Geology, Seismicity and Soils 9-2
9.1.6 Water Resources 9-2
9.1.7 Air Quality 9-2
9.1.8 Transportation 9-2
9.1.9 Biological Resources 9-3
9.1.10 Energy and Mineral Resources 9-3
9.1.11 Hazardous Materials 9-3
9.1.12 Noise 9-3
9.1.13 Public Services 9-4
9.1.14 Utilities and Service Systems 9-4
9.1.15 Aesthetics 9-4
9.1.16 Cultural Resources 9-4
9.1.17 Paleontological Resources 9-4
9.1.18 Wilderness/Recreation 9-5
9.1.19 Indian Trust Assets 9-5
9.1.20 Environmental Justice 9-5

10.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

10.1 Introduction 10-1
10.2 Land Use 10-1
10.3 Topography, Geology, Seismicity and Soils 10-1
10.4 Water Resources 10-2

TABLE OF CONTENTS

Section **Page**

10.5 Biological Resources 10-2
10.6 Energy and Minerals 10-2
10.7 Aesthetics 10-3
10.8 Cultural Resources 10-3
10.9 Paleontological Resources 10-3

11.0 PUBLIC INVOLVEMENT AND AGENCIES AND PERSONS CONSULTED

11.1 Introduction 11-1
11.2 EIR/EIS Scoping Process and Input Received 11-1
11.2.1 Notification 11-1
11.2.2 Scoping Meetings 11-2
11.2.3 Written Comments 11-3
11.2.4 Overview of Comments 11-3
11.3 Agency Consultation 11-4

12.0 PERMITS REQUIRED FOR THE CADIZ PROJECT

12.1 Federal Agencies 12-1
12.2 State Agencies 12-1
12.3 Local/Regional Agencies 12-1

13.0 LIST OF PREPARERS

13.1 Metropolitan Water District of Southern California 13-1
13.2 United States Bureau of Land Management 13-1
13.3 P&D Environmental 13-1
13.4 Applied Earthworks 13-2
13.5 Black and Veatch 13-2
13.6 Circle Mountain Biological Consultants 13-2
13.7 Geoscience Support Services, Inc. 13-2
13.8 Gust Osteological 13-2
13.9 Hernandez Kroone 13-2
13.10 Laer Pearce Associates 13-2
13.11 Woodward Clyde 13-2

14.0 REFERENCES

15.0 GLOSSARY OF TERMS, ACRONYMS AND UNITS OF MEASUREMENT

15.1 Terms 15-1
15.2 Acronyms 15-13
15.3 Units of Measurement 15-17

APPENDICES

A.	California Desert Plan Amendment Process	A-1
B.	Traffic Analysis Tables	B-1
C.	Air Quality Analysis Tables	C-1

LIST OF TABLES

Table **Page**

EXECUTIVE SUMMARY

ES-1 Colorado River Resource Area Dry-Year Need (acre-feet) ES-5
ES-2 Project Level Alternative Analysis (Listed in Order of Weight in Ranking of Alternatives) ES-8
ES-3 Summary of Significant Environmental Impacts, Mitigation Measures and Unavoidable Adverse Impacts ES-17
ES-4 Permits That May Be Required ES-38

1.0 INTRODUCTION

1-1 Permits That May Be Required 1-12

2.0 ASSESSMENT OF PROJECT NEED AND PURPOSE

2-1 Projected Population for the Metropolitan Service Area 2-8
2-2 Projected Dry-Year Retail Demand in Metropolitan's Service Area (acre-feet) 2-8
2-3 Existing In-Service Area Surface Storage Available to Metropolitan and Member Agencies (acre-feet) 2-18
2-4 Existing Dry-Year Supplies in 2020 (acre-feet) 2-21
2-5 Projected New 2020 Dry-Year Supply Program (acre-feet) 2-24
2-6 Projected Colorado River Resource Area 2020 Dry-Year Needs (acre-feet) 2-24
2-7 Colorado River Resource Area Dry-Year Need (acre-feet) 2-26

3.0 FORMULATION AND EVALUATION OF PROJECT ALTERNATIVES

3-1 Operational Scenarios Considered 3-18
3-2 Summary Evaluation Storage/Transfer Alternative Operational Scenarios 3-19
3-3 Seventeen Conveyance Alternatives Given Screening-Level Evaluation 3-25
3-4 Evaluation Criteria for the Project Alternatives 3-29
3-5 Project-Level Alternative Analysis (Listed in Order of Weight in Ranking of Alternatives) 3-34
3-6 Relative Ranking of Alternatives 3-37

4.0 DESCRIPTION OF PROJECT ALTERNATIVES

4-1 Construction Equipment Required for the Eastern Alternative 4-6
4-2 Cadiz Pumping Plant Construction Equipment 4-8
4-3 Eastern Alternative Estimated Construction Cost (1999 $) 4-11
4-4 Western Alternative Construction Equipment 4-14
4-5 Construction Equipment Cadiz Pumping Plant (West Portal) 4-15
4-6 Western Alternative Estimated Construction Cost (1999 $) 4-18
4-7 Combination Alternative Construction Equipment 4-21
4-8 Cadiz Pumping Plant (West Portal) Construction Equipment 4-23
4-9 Combination Alternative Estimated Construction Cost (1999 $) 4-24
4-10 Eastern/Canal Alternative Construction Equipment 4-26
4-11 Intermediate Pumping Plant No. 1 Construction Equipment 4-29
4-12 Intermediate Pumping Plant No. 2 Construction Equipment 4-30

LIST OF TABLES

Table		Page
4-13	Eastern/Canal Alternative Estimated Construction Cost (1999 $)	4-31
4-14	Construction Equipment Required for the Project Spreading Basins	4-42
4-15	Construction Equipment Required for the Project Wellfield	4-48
5.0	**AFFECTED ENVIRONMENTAL, IMPACTS AND MITIGATION**	
5.1-1	Current Agricultural Cultivation on the Project Site	5-4
5.3-1	Socioeconomic Trends and Forecasts for the Cadiz Project Area, Surrounding Area and Region	5-21
5.3-2	Housing	5-24
5.3-3	Estimated Construction Employment for the Eastern Alternative	5-25
5.3-4	Estimated Operations Employment for the Eastern Alternative	5-25
5.5-1	Average Temperature Data	5-69
5.5-2	Summary of Project Operational Scenarios (in thousands of acre-feet)	
5.5-3	Mass Balance for Indigenous Groundwater	5-89
5.5-4	Mass Balance for Colorado River Water	5-96
5.5-5	Maximum and Minimum Groundwater Levels During the 50-Year Cadiz Project	5-96
5.6-1	Designations and Classifications for Air Quality in the Mojave Desert Air Basin	5-111
5.6-2	Air Quality Levels Measured at the Twentynine Palms Ambient Air Monitoring Station	5-112
5.6-3	Summary of Estimated Construction Emissions	5-115
5.7-1	Summary of Traffic Estimates During Construction	5-126
5.8-1	Special Interest Plant Species	5-146
5.8-2	Special Interest Wildlife Species Observed or Expected on the Project Site	5-149
5.8-3	Plant Community Impacts by Alternative	5-161
5.9-1	Potential Mineral Resources	5-195
5.9-2	Daily Consumption of Fossil Fuel During Construction	5-196
5.9-3	Daily Power Consumption in kWh/Day	5-197
5.11-1	Typical Distances to Noise Contours	5-215
5.11-2	Existing Noise Levels	5-215
5.11-3	Interior/Exterior Noise Level Standards for Mobile Noise Sources	5-217
5.11-4	Typical Construction Equipment Noise Levels (dBA)	5-218
5.15-1	Reported Cultural Resources in the Cadiz Project APE and Significance Evaluations	5-268
5.16-1	Fossil Localities Documented in the Cadiz Project Field Survey	5-279
6.0	**GROWTH INDUCEMENT IMPACTS**	
6-1	Population Trends (Millions of People)	6-4
11.0	**PUBLIC INVOLVEMENT AND AGENCIES AND PERSONS CONSULTED**	
11-1	Agencies, Organizations and Individuals and Contacts	11-5
12.0	**PERMITS**	
12-1	Permits That May Be Required	12-1

LIST OF FIGURES

Figure **Page**

EXECUTIVE SUMMARY

ES-1 Generalized Location of the Cadiz Project Facilities ES-2
ES-2 Metropolitan's Service Area ES-4
ES-3 Relative Ranking of the Alternatives ES-11
ES-4 Cadiz Project Alternatives ES-13

1.0 INTRODUCTION

1-1 Generalized Location of the Cadiz Project Facilities 1-2
1-2 Metropolitan's Main Supply Lines 1-4
1-3 Cadiz Project Alternatives 1-10

2.0 ASSESSMENT OF PROJECT NEED AND PURPOSE

2-1 Metropolitan's Service Area 2-2
2-2 Metropolitan Member Agencies 2-9
2-3 Groundwater Basins Within Metropolitan's Service Area 2-20

3.0 FORMULATION AND EVALUATION OF PROJECT ALTERNATIVES

3-1 Bristol, Cadiz and Fenner Basins 3-21
3-2 Generalized Location of the Cadiz Project Facilities 3-22
3-3 Proposed Wellfield and Manifold System 3-23
3-4 Screening – Level Water Conveyance Alternatives 3-26
3-5 Relative Ranking of Alternatives 3-36

4.0 DESCRIPTION OF PROJECT ALTERNATIVES

4-1 Alternatives 4-3
4-2 Eastern Alternative 4-4
4-3 Eastern Alternative Hydraulic Profile 4-5
4-4 Typical Cross Section for Water Conveyance Facilities Construction and Operations 4-10
4-5 Western Alternative 4-12
4-6 Western Alternative Hydraulic Profile 4-13
4-7 Cadiz Pumping Plant (West Portal) 4-16
4-8 Combination Alternative 4-19
4-9 Combination Alternative Hydraulic Profile 4-20
4-10 Eastern/Canal Alternative 4-25
4-11 Eastern/Canal Alternative Hydraulic Profile 4-27
4-12 Typical Cross Section for Canal Construction 4-32
4-13 Intermediate Pumping Plant No. 1 4-33
4-14 Intermediate Pumping Plant No. 1 Detail 4-34
4-15 Project Wellfield and Manifold System 4-36
4-16 Project Spreading Basins Profile 4-37

LIST OF FIGURES

Figure		Page
4-17	Project Spreading Basins Profile	4-38
4-18	Typical Project Spreading Basin Control Structure	4-39
4-19	Typical Project Spreading Basin Inlet Structure	4-40
4-20	Typical Project Spreading Basin Flow Control Structure	4-41
4-21	Project Wellfield Spreading Basin Site Plan	4-43
4-22	Typical Well Cross Section	4-45
4-23	Typical Well Plan and Profile	4-46
4-24	Instrumentation and Controls	4-47
4-25	Typical Project Wellfield Substation	4-49
4-26	Typical 69 kV Power Pole	4-50
4-27	Electric Facilities at Iron Mountain Pumping Plant	4-52
4-28	Intermediate Staging Area	4-53
4-29	Cadiz Pumping Plant (West Portal) Staging Area	4-55
4-30	Cadiz Pumping Plant Access Road	4-56
4-31	Cadiz Pumping Plant Staging Area	4-57
4-32	Typical Appurtenant Facilities	4-58

5.0 AFFECTED ENVIRONMENT, IMPACTS AND MITIGATION

5.1-1	Land Zoned for Agriculture in the Project Area	5-2
5.1-2	Crops Cultivated On and Adjacent to the Project Site	5-3
5.2-1	Land Ownership in Relation to the Cadiz Project Facilities	5-9
5.2-2	BLM Multiple – Use Classes	5-12
5.3-1	Project Site, Surrounding and Regional Areas	5-22
5.4-1	Geologic Map of the Project Area, Showing Alternative Water Conveyance Alignments	5-33
5.4-2	Sensitivity of Soils to Disturbance	5-38
5.4-3	Quaternary Fault Zones in Relation to the Project Area	5-40
5.4-4	Generalized Geologic Map of Fenner Gap	5-41
5.4-5	Simplified Cross-Section of Fenner Gap	5-42
5.4-6	Definitions of Fault Activity	5-43
5.4-7	Recorded Earthquake Epicenters in Relation to Quaternary Fault Zones	5-45
5.5-1	Watersheds of the Eastern Mojave Desert	5-67
5.5-2a	Annual Precipitation and Cumulative Departure from Mean Precipitation – Amboy Station	5-70
5.5-2b	Annual Precipitation and Cumulative Departure From Mean Precipitation - Mitchell Caverns Station	5-71
5.5-3	Comparison of Precipitation Frequency Patterns - Mountainous and Valley Regions	5-72
5.5-4	Wind Data Analysis	5-74
5.5-5	Average Monthly Evaporation	5-75
5.5-6	Generalized Aquifer Cross Section from Fenner Valley to Bristol Dry Lake	5-78
5.5-7	Groundwater Elevation Contour Map for Fenner Gap Portion of the Project Area (Contours in Feet AMSL)	5-79
5.5-8	Total Dissolved Solids in Groundwater in the Fenner Gap and Bristol Lake Areas (Contours in mg/L)	5-82
5.5-9	Locations of Boreholes, Monitoring Wells, Production Well and Pilot Spreading Basin in Fenner Gap	5-86
5.5-10	Conceptual Diagram of the Spreading Basin Test	5-87

LIST OF FIGURES

Figure		Page
5.5-11	Maximum Projected Subsidence Due to Cadiz Project Operations (Contours in Feet)	5-93
5.5-12	Maximum Projected Movement of Saline Water/Fresh Water Interface	5-98
5.5-13	Area of Influence of Project Storage and Extraction Operations	5-101
5.5-14	Maximum Change in Underflow to Bristol Dry Lake	5-102
5.5-15	Maximum Change in Underflow to Cadiz Dry Lake	5-104
5.6-1	Mojave Desert Air Basin and Air Quality Management District	5-110
5.7-1	Transportation Network	5-121
5.7-2	Project-Related Average Daily Traffic	5-130
5.8-1	Plant Community Map	5-141
5.8-2	Desert Tortoise Sign Map	5-153
5.8-3	Wildlife Corridor Movement Map	5-157
5.9-1	Economic Mineral Resources	5-188
5.9-2	Potential for Locatable Minerals	5-190
5.9-3	Potential for Leasable Minerals	5-191
5.9-4	Potential for Saleable Minerals	5-192
5.9-5	Potential for Energy Georesources	5-193
5.10-1	Gunnery Range and Sonic Bombing Targets 3 and 4	5-203
5.11-1	Typical Ambient Noise Levels (in CNEL)	5-212
5.11-2	Noise Measurement Locations	5-214
5.11-3	Potential Blasting Locations	5-220
5.13-1	Railroads and Pipelines in Proximity to the Project Wellfield and Spreading Basins	5-238
5.14-1	Eastern Alternative Photo Key Map	5-245
5.14-2	Eastern Alternative Site Photos	5-246
5.14-3	Western Alternative Photo Key Map	5-250
5.14-4	Western Alternative Site Photos	5-251
5.14-5	Combination Alternative Photo Key Map	5-254
5.14-6	Combination Alternative Site Photos	5-255
5.16-1	Paleontologic Sensitivity	5-283
5.17-1	Wilderness Areas in the Project Vicinity	5-288
5.17-2	Johnson Valley to Parker Route	5-290

Executive Summary

EXECUTIVE SUMMARY
INTRODUCTION

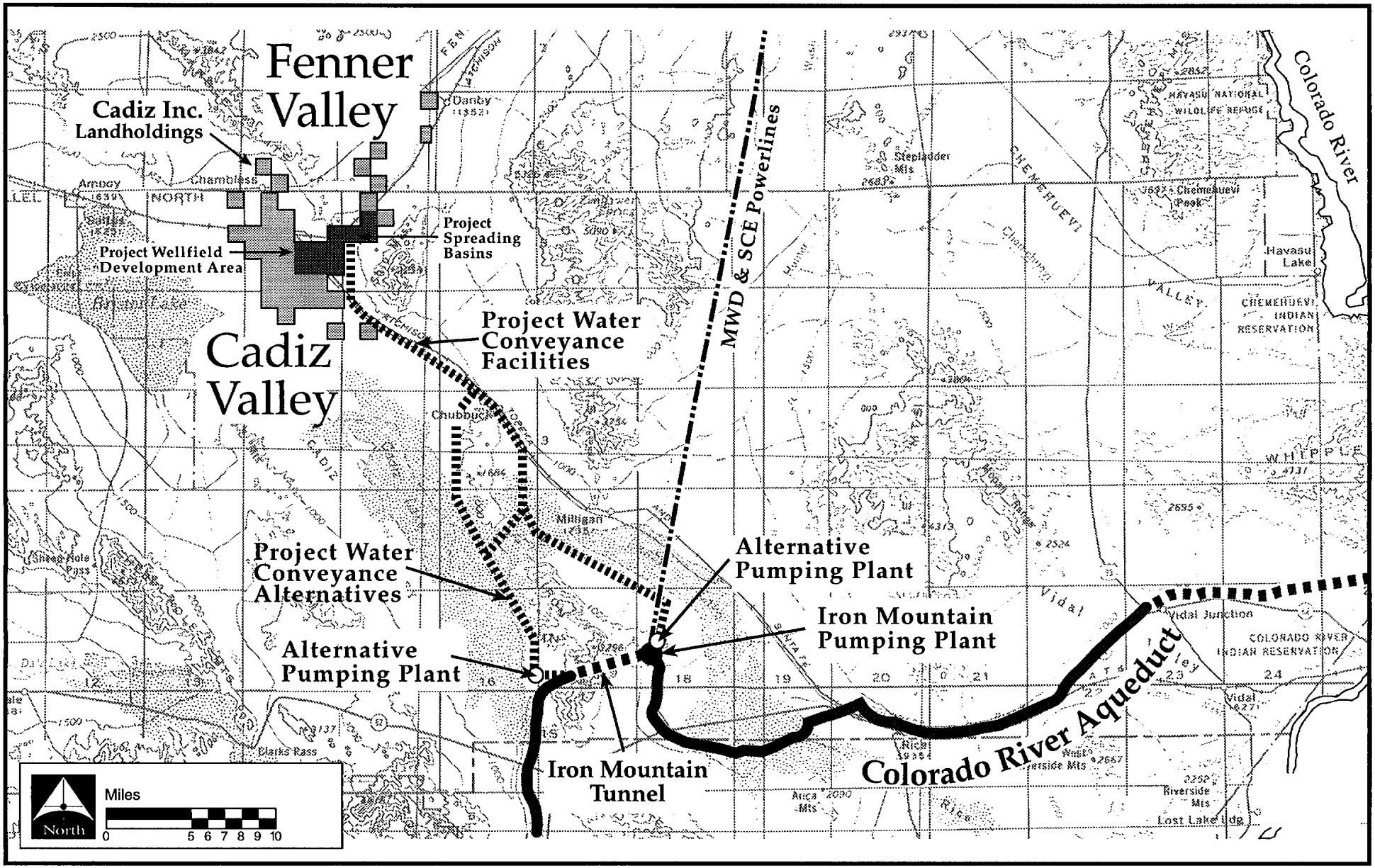
This Executive Summary provides an overview of the Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Cadiz Groundwater Storage and Dry-Year Supply Program (Cadiz Project), a cooperative program between the Metropolitan Water District of Southern California (Metropolitan) and Cadiz Inc. (Figure ES-1). The Cadiz Project would use the groundwater basin underlying part of the Cadiz and Fenner Valleys for the storage of Metropolitan water supplies from the Colorado River for later recovery and would provide for transfer of some indigenous groundwater to Metropolitan for use in dry years. The Cadiz Project components include a water conveyance facility, spreading basins, pumping plant, wellfield and power distribution facilities. The EIS/EIR evaluates and documents the potential environmental impacts associated with four Cadiz Project Alternatives and the No Project Alternative.

Metropolitan is the California Environmental Quality Act (CEQA) lead agency for the Cadiz Project and is responsible for the environmental and technical studies conducted for this project and would be responsible for the design, construction, operation and maintenance of the facilities constructed for the selected Project Alternative. The United States Bureau of Land Management (BLM) is the federal lead agency for the preparation of the EIS in accordance with National Environmental Policy Act. The construction and operation of the Cadiz Project would require a grant of right-of-way from BLM to Metropolitan and an amendment to the utility corridor element of BLM's California Desert Conservation Area Plan (CDCA Plan). Metropolitan and BLM have prepared this EIR/EIS and completed field studies and technical analyses in compliance with the applicable CEQA and NEPA regulations and guidelines.

PROJECT OVERVIEW

Formed in 1928 by an enabling act of the California Legislature, Metropolitan is the primary supplier of supplemental water to approximately 16 million people in 240 cities and unincorporated areas in the six Southern California counties of San Bernardino, Riverside, San Diego, Orange, Los Angles and Ventura. Metropolitan imports water from the Colorado River via its Colorado River Aqueduct and from northern California's Sacramento/San Joaquin Bay-Delta via the State Water Project's California Aqueduct. Metropolitan also operates an extensive system of storage facilities, water conveyance facilities and water treatment plants in Southern California. Metropolitan and its 27 member agencies are committed to effective water management programs and are leaders in the development and implementation of water conservation, groundwater management and water recycling.

As an element of these water management programs, the Cadiz Project is intended to meet projected dry-year water demand through 2020. The Cadiz Project would utilize the groundwater basin underlying the Cadiz and Fenner valleys for storage of part of Metropolitan's Colorado River supplies, during wet-years, for later recovery and use during dry-years. To



Source: Metropolitan (1999).

Figure ES-1

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Generalized Location of the Cadiz Project Facilities

accomplish this, Colorado River water would be conveyed approximately 35 miles from Metropolitan's Colorado River Aqueduct to spreading basins in Fenner Gap, located between the Marble and Ship mountains, where the imported water would percolate into the groundwater basin. When needed, the stored water would be extracted by wells and returned to the Aqueduct. In addition, indigenous groundwater would be transferred to Metropolitan during dry-year periods.

PURPOSE AND SCOPE OF THE EIR/EIS

The purpose of the EIR/EIS is to provide Metropolitan, BLM, other public agencies and the general public with a detailed project description and an analysis which fully evaluates the potential environmental impacts and mitigation measures for the proposed project. CEQA and NEPA specifically require that an EIR/EIS identify any potential adverse impacts determined to be significant after mitigation. Detailed descriptions of such impacts by specific topical category are provided in the EIR/EIS and are summarized later in this Executive Summary.

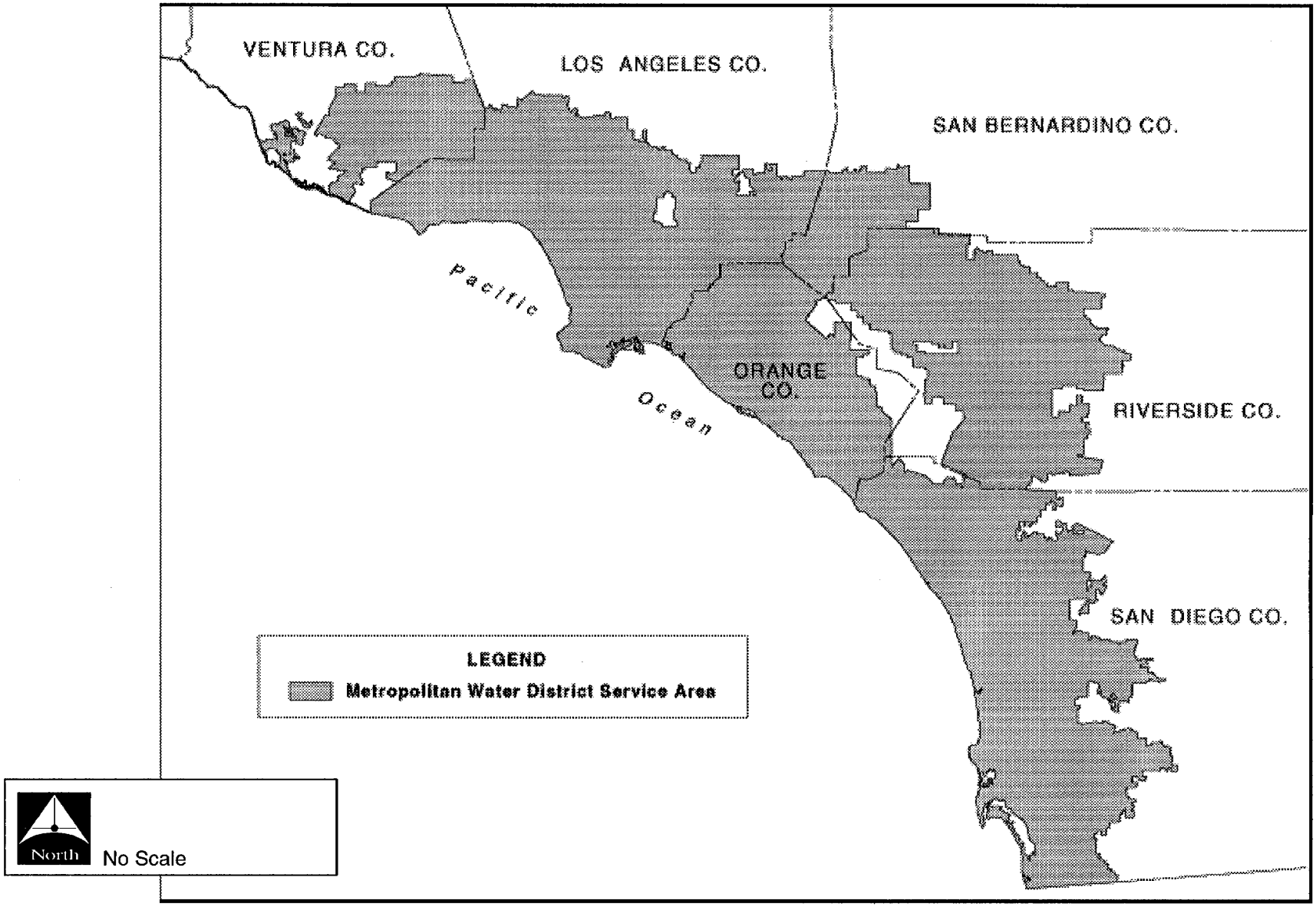
The EIS/EIR begins with a discussion of the need for the Cadiz Project, followed by a detailed discussion of the process used to formulate and evaluate all potential alternatives. This is followed by a comprehensive description of the four project alternatives considered for detailed analysis. For each of these alternatives, a description of potential impacts including, but not limited to, the potential for growth inducement and cumulative impacts, and proposed mitigation measures is provided. This information is provided later in Table ES-3.

In accordance with the requirements of CEQA and NEPA, Metropolitan and the BLM carried out a public information and participation program to ensure that public concerns have been fully addressed during the study of the Cadiz Project. To ensure public understanding of the proposed project and seek public discussion and opinion concerning the alternatives, Metropolitan and the BLM conducted their public information program in a manner that exceeded the requirements of CEQA and NEPA. In addition to mandated public involvement efforts, Metropolitan and the BLM conducted additional public scoping meetings, conducted in-depth informational briefings with interested organizations, agencies, and individuals and distributed informational materials and handouts.

The EIR/EIS and the technical reports used for preparing the EIR/EIS are bound separately and are available for review at the Metropolitan Water District office located at 700 North Alameda Street, Los Angeles, California; at the BLM offices in Needles (101 West Spike's Road, Needles, California) and Riverside (6221 Box Springs Boulevard, Riverside, California); and at five libraries in the general project area. The Metropolitan-BLM public involvement effort is detailed in the Public Participation Report which is a part of the EIR/EIS.

PROJECT NEED

As a part of Metropolitan's on-going efforts to improve management of its water supplies, the Cadiz Project is proposed to meet part of the need for supplemental dry-year supply in Metropolitan's six-county service area shown on Figure ES-2. Based on



Source: Metropolitan Water District (1999).

Figure ES-2

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Metropolitan's Service Area

population and demographic projections adopted by the Southern California Association of Governments and other regional planning agencies, dry-year demand is estimated to exceed dependable supply from all sources in 2020 by approximately 1,588,000 acre-feet, despite an aggressive water conservation program projected to save an additional 560,000 acre-feet per year. Metropolitan projects that approximately 870,000 acre-feet of this supply deficit can be met through currently identified programs in the Central Valley and/or in Metropolitan's service area. These programs include water and groundwater recycling and recovery, in-service area storage, Central Valley transfers and groundwater storage, and enhanced State Water Project programs.

To meet as much of the remaining dry-year supply deficit of 718,000 acre-feet as feasible on the Colorado River Aqueduct, Metropolitan has established a target of 594,000 acre-feet for Colorado River Aqueduct programs, including up to an estimated 424,000 acre-feet from a San Diego-Imperial Irrigation District transfer, lining of the Coachella and All-American canals, and the recently implemented Hayfield Valley Water Storage Program. The Cadiz Project is intended to provide up to 150,000 acre-feet per year, leaving a deficit of about 20,000 acre-feet in the Colorado River Resource Area. Even if all currently identified targets are reached in all resource areas, dry-year demand will still exceed dry-year supply by approximately 170,000 acre-feet in 2020, if the Cadiz Project is not implemented as shown in Table ES-1.

TABLE ES-1
COLORADO RIVER RESOURCE AREA
DRY-YEAR NEED
(acre-feet)

Target for dry-year supply on the Colorado River Aqueduct	594,000
SDCWA-IID Transfer	130,000-200,000
All American and Coachella canals lining projects	74,000
Hayfield Valley Water Storage Program	150,000
Cadiz Groundwater Storage and Dry-Year Supply	150,000
Remaining Colorado River Resource Area Dry-Year Need	**20,000**

The Cadiz Project has the following objectives: (a) delivery capability to storage up to 150,000 acre-feet of Colorado River water annually; (b) provide a storage capacity for 1.0 million acre-feet (maf) at any one time; (c) provide approximately up to 2.0 maf of indigenous groundwater for transfer; (d) recover capability of stored or indigenous water at a rate of up to 150,000 acre-feet for delivery to the Metropolitan service area during dry years and (e) enhancement of water quality. The accomplishment of these objectives would depend on the availability of Colorado River water for storage and the natural recharge of the groundwater basin. Consistent with Metropolitan's environmental policies, these objectives are to be achieved with acceptable levels of post-mitigation environmental impacts.

FORMULATION AND EVALUTATION OF PROJECT ALTERNATIVES

Initially, 13 potential alternatives for meeting the dry-year supply deficit on the Colorado River Aqueduct were identified, primarily on the basis of numerous unsolicited proposals submitted to Metropolitan. These included ten groundwater storage and conjunctive-use projects, one transfer project, and two

projects involving desalination of agricultural drainage water. Each alternative was evaluated based on its ability to meet the following screening criteria:

1. Meet objectives for dry-year water storage and withdrawal;

2. Meet water quality objectives;

3. Be operational prior to 2005 - 2010;

4. Have acceptable levels of construction difficulty, and long-term maintenance (potential for subsidence, ground stability/ liquefaction effects, corrosion); and

5. Be feasible from an environmental perspective, with levels of potential environmental impacts that could be mitigated to acceptable levels.

Based on this analysis, all but three alternatives were eliminated from further consideration, for the reasons outlined below:

- Arizona Banking Project : Proposal withdrawn by State of Arizona.

- Palen Valley Storage Project: Eliminated due to unacceptable environmental impacts to Joshua Tree National Park and desert tortoise, poor water quality and low storage potential.

- Pinto Valley Storage Project: Eliminated due to impacts to Joshua Tree National Park.

- Rice Valley Storage Project: Eliminated due to low storage capacity and poor water quality.

- Shavers Valley Storage Project: Eliminated due to low storage potential.

- Upper Chuckwalla Valley Storage Project: Eliminated due to impacts to Joshua Tree National Park and desert tortoise.

- Vidal Valley Storage Project: Eliminated due to low storage potential and poor water quality.

- Ward Valley Storage Project: Eliminated due to construction difficulties and uncertainty regarding storage potential and water quality.

- Alamo River Agricultural Drainage Desalination Project: Eliminated from short-term consideration due to unresolved environmental and technical issues.

- Whitewater River Agricultural Drainage Desalination Project: Eliminated from short-term consideration due to unresolved environmental and technical issues.

After eliminating these projects from further consideration due to technical and/or environmentally issues, three potential alternative projects were carried forward. First, the two Cadiz Valley Storage and Cadiz Valley Transfer projects were initially proposed as part of the original 13 alternatives. A combined project was found to meet all objectives with acceptable levels of impact. Second, the Hayfield Groundwater Storage Project was found to meet objectives with minimal environmental impacts and was further evaluated in a separate CEQA document and is currently being implemented.

A combined Cadiz Groundwater Storage and Dry-Year Supply Project was then explored in detail. The initial step was to evaluate a variety of potential project operation scenarios, combinations of various levels of storage and transfer elements. This analysis was conducted to (a) determine the necessary size and basic configuration of project facilities and (b) to eliminate operation scenarios which would have unacceptable levels of impact. Based on this operational analysis, a combination groundwater storage and dry-year transfer project was determined to be most feasible.

Next, feasible locations for project spreading basins and for connection to the Colorado River Aqueduct were evaluated. A spreading basin site was selected based on minimizing potential for adverse groundwater impacts and on minimizing environmental impacts by optimizing recharge rate per acre. Two potential connections to the Colorado River Aqueduct were identified (east and west of Iron Mountain) based on the need to minimize the distance (and associated impacts) between the Aqueduct and the spreading basins, on the need to avoid highly corrosive soils at dry lake beds and on the need to avoid wilderness areas.

Seventeen possible pipeline and canal alternatives were then evaluated and four feasible alternatives were carried forward for detailed analysis. These alternatives were then formulated and studied in detail. A 500-foot wide corridor for each conveyance facility and power line access was defined. The location of spreading basins and wellfield was refined to avoid and minimize environmental effects. Power lines, pumping stations and other associated facilities were defined. Preliminary designs were formulated and the construction footprint for each alternative was defined, including permanent and temporary impact zones. These potential impact areas were then surveyed for a full range of environmental, cultural and social impacts as required by CEQA and NEPA. These alternatives were refined as field data indicated ways to avoid and/or minimize impacts.

Based on field studies, 27 categories of impact and technical feasibility information were then used to score and rank the Project-level alternatives. Raw data on these 27 measures were converted to relative scores. The relative importance of each of the 27 measures was then evaluated by a team of experts and each measure was given a weight. Raw scores were multiplied by weights to produce a set of weighted scores. These weighted scores were then summed, allowing Project alternatives to be compared quantitatively on the basis of individual and aggregate weighted scores. For convenience, aggregate scores on all 27 measures were converted to a 0 to 1 scale, one being the highest (best) score as shown in Table ES-2.

The four Project-level alternatives differ most on several high priority measures. First, they differ significantly on four practicality measures: construction completion, risk to infrastructure, construction within sand dunes and construction-maintenance access. The Eastern Alternative has the best raw score on three of these measures, and this is reflected in its overall ranking for practicality. Second, they differ significantly on desert tortoise impacts, on wildlife corridors and on total acres of

TABLE ES-2
PROJECT-LEVEL ALTERNATIVE ANALYSIS
(LISTED IN ORDER OF WEIGHT IN RANKING OF ALTERNATIVES)

Criteria	Measure	Project Level Alternative			
		Eastern	Western	Combination	East/Canal
Practicability Measures					
Project cost	$ (millions)	150	150	153	165
Const. Completion	Months beyond target date	0	0	5	5
Risk to infrastructure	Miles adj. to infrastructure	14	11	14	11
Proximity to salt playas	Miles within sand dunes	14	10	6	15
Construction in sand dunes	Miles in sand dunes	6	14	13	6
Construction -maintenance. access	Miles away from road or railroad	2	6	6	2
Internal pressure	Feet (elevation) of head	580	650	655	460
Arroyo crossings	Number	25	25	20	25
Construction in rock	Miles	3	3	3	3
R-O-W acquisition	Miles in private ownership	1.5	2.5	2.25	1.5
Environmental Measures					
Desert tortoise	Scat Active burrows Old burrows	11 1 1	11 6 4	11 6 5	11 1 1
Wilderness area compatibility	Miles adjacent to wilderness areas	7.35	7.65	7.35	7.35
Wildlife corridors crossed	Miles of corridors blocked	0	0	0	0.17
Air quality	Tons NO_x and PM_{10} during construction	49,564	56,248	56,053	84,692
Mojave fringe-toed lizard	Miles of habitat crossed	5.5	7.7	2.7	5.5
Cultural/Ethnographic Resources	Historic/Pre-Historic Ethnographic Sites/Issues Paleontological Resources	4 - -	1 - -	4 - -	4 - -
Mojave wash scrub	Acres impacted Temporary Permanent	 11.5 2.2	 12.3 2.7	 13.2 2.8	 11.0 2.7
Aesthetics	Length visible from wilderness (miles)	34	33	34	34
Desert dunes and sand fields	Acres Impacted Temporary Permanent	 148.7 16.5	 169.9 18.9	 177.8 19.8	 130.0 35.2
Business/mining claims impacts	Number of mining claims	1	1	1	1
Ordnance and explosives	Potential for encountering	Medium	Medium	Medium	Medium
Mojave creosote bush	Acres Impacted Temporary Permanent	 634.0 465.2	 650.7 492.8	 883.7 518.7	 595.9 505.0
Energy	KWh/day	187,500	178,600	187,500	129,400
Common chuckwalla	Number of signs	1	2	3	1
Ribbed cryptantha	Est. number of plants	306	261	270	306
Noise	Amount of blasting	Low	Low	Low	Low
Traffic/access disruption	Estimated hours of cumulative delay	100	0	100	100

impacts. Again, the Eastern Alternative scores high on all of these measures. The alternatives do not vary significantly on many of the other measures considered, and the effective weight of these measures with high variation among alternatives is therefore great.

Based on this evaluation, the conclusions of this analysis are:

- The Eastern/Canal Alternative has significant disadvantages. It has higher costs than pipeline alternatives, it blocks wildlife movement and has higher habitat impacts. Therefore, the Eastern/Canal Alternative has a lower overall ranking.

- The Western and Combination alternatives receive a number of low scores on both practicality and environmental impact measures, and they have no significant advantages on high priority measures. The result is a low overall ranking for both alternatives.

- The rankings of the Project-level alternatives do not change when the weight given to practicality measures, costs and environmental impacts are varied. Weighting, therefore, does not bias the evaluation and selection of the environmentally-preferred alternative or the preferred alternative.

SELECTION OF THE ENVIRONMENTALLY PREFERRED ALTERNATIVE

The primary and distinguishing criteria for selection of the environmentally preferred alternative were impacts to desert tortoise, impacts to wildlife corridors and wilderness area compatibility. Desert tortoise might be found near any of the Cadiz Project alternatives. Desert tortoise sign was observed in very low densities on each of the Cadiz Project alternatives, primarily in Mojave creosote bush scrub. This animal was relatively more common in the Western and Combination alternatives due to the greater abundance of sign located on the transmission line for these alternatives than for the Eastern and Eastern/Canal alternatives. Desert tortoise sign observed along the Eastern and Eastern/Canal alternatives included one active burrow and one cover site, one set of tracks and eleven scat. Six active burrows, four carcasses and eleven scat were observed in the Western Alternative. Six active burrows, five carcasses and eleven scat were observed in the Combination Alternative.

The Western and Combination alternatives cross a 10-mile wildlife movement corridor between the Iron Mountains and the Calumet Mountains. In contrast, the Eastern Alternative crosses a similar designated wildlife movement corridor from the Old Woman Mountain Wilderness Area to the Iron Mountains, but the length of that crossing is only five miles. As a result, both short-term construction impacts to wildlife movement and long-term impacts as a result of routine inspection and maintenance of pipelines and power lines would be lower for the Eastern Alternative. During construction, the Western and Combination alternatives would also interrupt wildlife movement between two other wilderness areas, separating the Kilbeck Hills from the Cadiz Dunes Wilderness Area or the Kilbeck Hills from the Iron Mountains, respectively. Construction of the Eastern Alternative would not affect movement among these wildlife areas. The

Eastern/Canal Alternative would effectively cut the movement corridor between the Iron Mountains and the Old Woman Mountain Wilderness Area, with potentially significant implications for populations of many wildlife species. While these impacts to wildlife movement would be short-term for all alternatives except the Eastern/Canal Alternative, the Eastern Alternative would nonetheless have lower construction-period impacts than the other alternatives.

Although all alternatives would probably be visible from nearby wilderness areas during construction, and power distribution lines would be visible from many areas in the long term for all alternatives, the Eastern Alternative has the lowest potential for conflicts with these areas. All alternatives include approximately five miles of construction adjacent to the northeastern boundary of the Cadiz Dunes Wilderness Area. In addition, the Eastern Alternative and Combination alternatives lie within three miles of the Old Woman Mountains Wilderness Area for a short one-mile segment, but are otherwise relatively distant from designated wilderness areas. In contrast, the Western Alternative has a three-mile segment along the eastern boundary of the Cadiz Dunes Wilderness Area. The canal segment of the Eastern/Canal Alternative would be a highly visible, permanent man-made feature on the landscape, visible from the Iron Mountains, the valley floor and the Old Woman Mountains Wilderness Area.

The No Project Alternative is not the environmentally preferred alternative. While it would minimize project area environmental and social impacts, it would generate its own adverse environmental and social impacts associated with water supply deficits and rationing during future droughts. Rationing has adverse short-term impacts on the environment associated with potential groundwater over-drafting within Metropolitan's service area, resulting in lowering of groundwater levels and salinity intrusions. Rationing would affect agricultural production and land use and would impact landscaping at public parks and recreation areas due to reduced irrigation. Significant short-term economic impacts are also associated with rationing.

SELECTION OF THE PREFERRED ALTERNATIVE

The preferred alternative is the alternative which best optimizes practicability and environmental impacts; that is, which has relatively high practicability combined with acceptable levels of impact.

The environmentally preferred Eastern Alternative also has the highest practicability score, which is not affected by changing the overall weight given to the practicability and environmental/social measures as shown on Figure ES-3. The Eastern Alternative, therefore, would be preferred for its practicability and its low environmental impacts. Therefore, it was designated as the preferred alternative.

SUMMARY OF PROJECT DESCRIPTION AND KEY ISSUES

A majority of key environmental and technical issues were resolved in the early stages of project formulation with the sequential evaluation, screening and elimination of preliminary alternatives. This effort effectively eliminated all alternatives with high levels of impacts on key resources such as Joshua Tree National

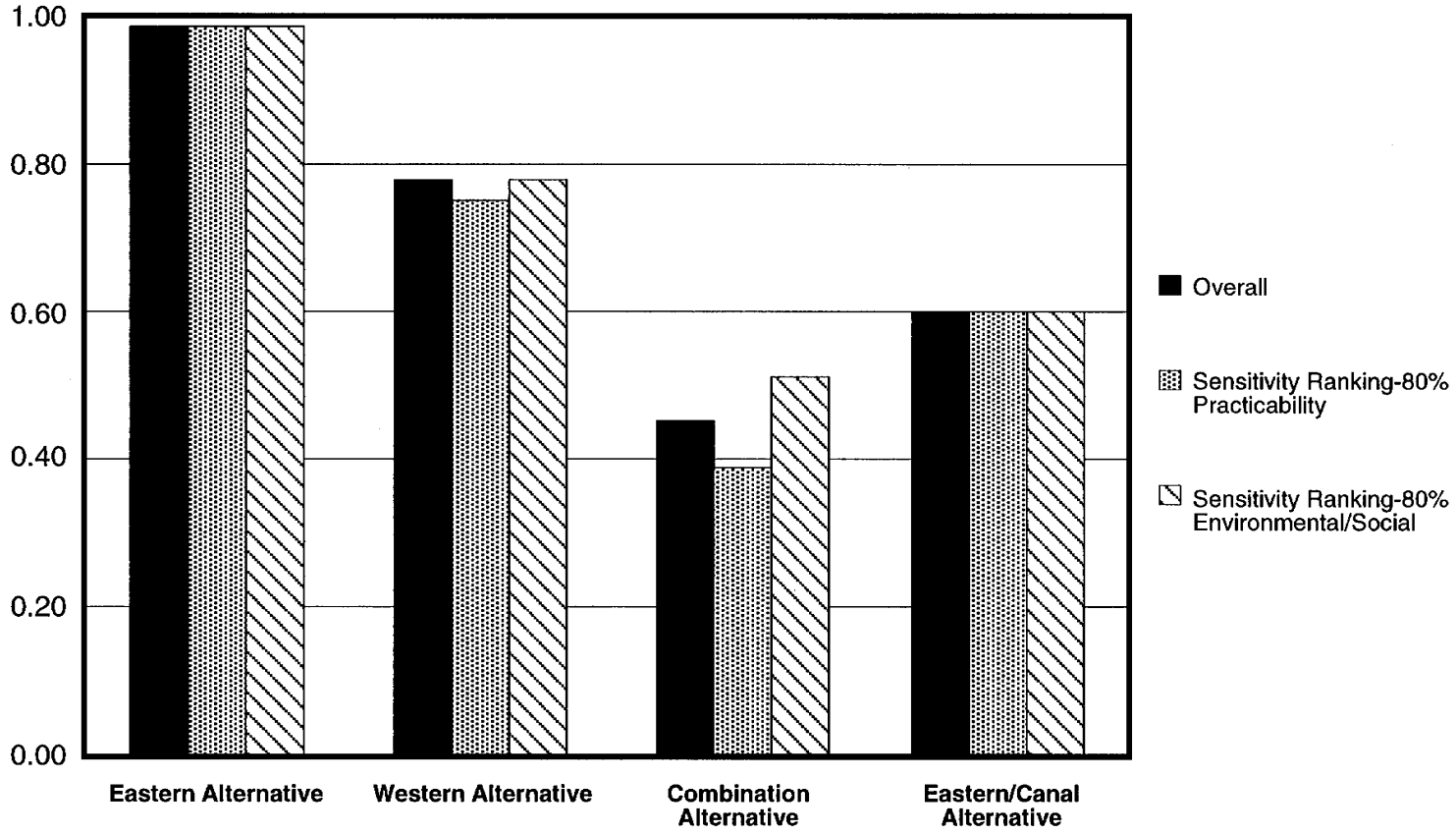


Figure ES-3

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

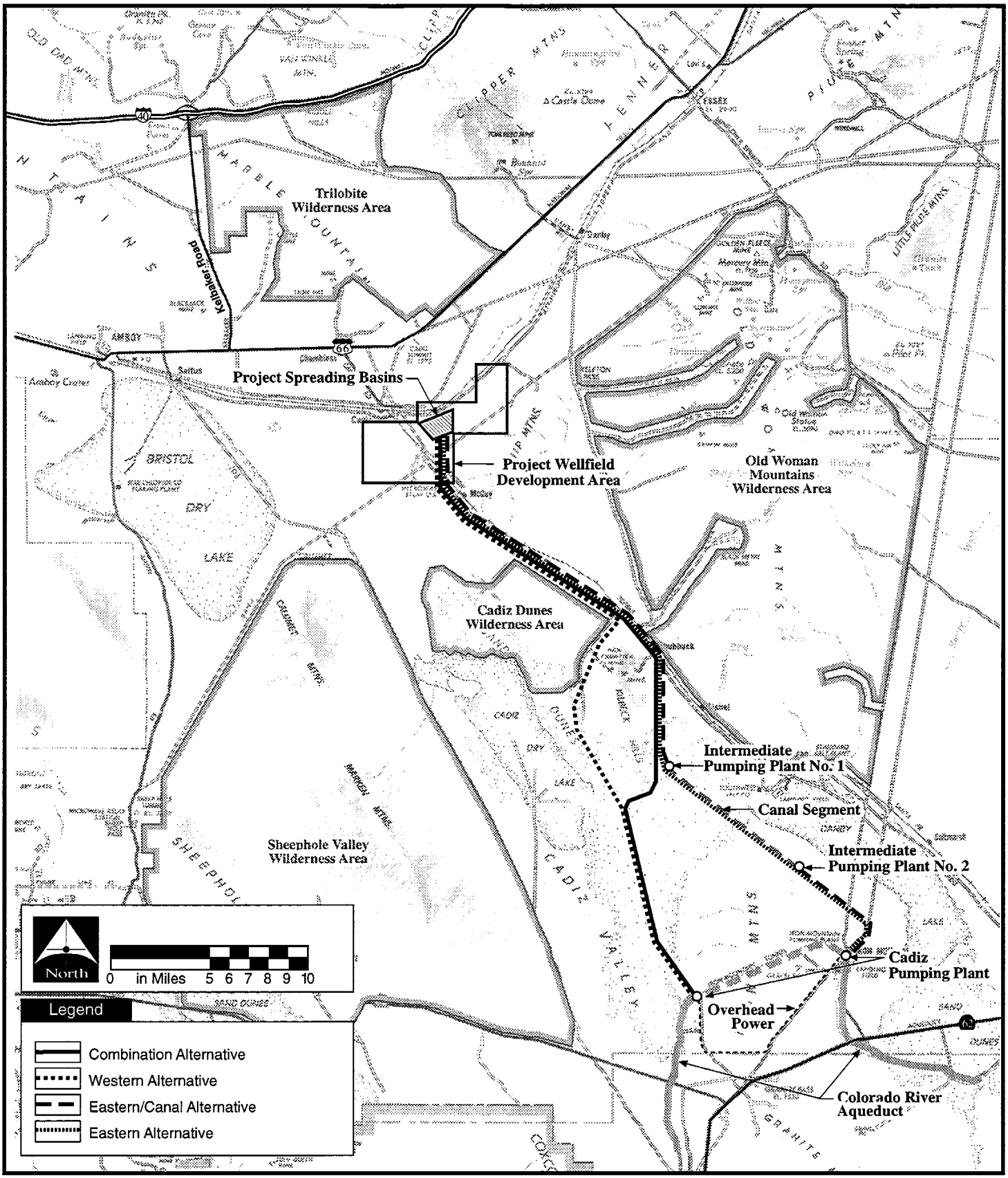
Relative Ranking of Alternatives

Park, desert tortoise and big horn sheep, and wilderness areas. In addition, major technical issues such as basin storage capacity, indigenous groundwater quality and construction difficulty were addressed during the screening process. Potential impacts to water resources, both the potential for the project to impact local groundwater resources and the potential for introduction of groundwater into the Colorado River Aqueduct to impact drinking water quality, have been addressed by establishing water quality monitoring programs and carefully defining operational parameters to ensure no net adverse impact.

The Cadiz Project consists of four primary elements: project spreading basins, water conveyance and power distribution facilities between the Colorado River Aqueduct and the spreading basins, pumping plants to pump water from the Colorado River Aqueduct through the water conveyance facility to the Project spreading basins and a project wellfield in the Fenner Gap to extract water from the groundwater aquifer system and pump it back to the Colorado River Aqueduct, as shown on Figure ES-4.

The 390-acre spreading basins would be located to the south of the Burlington Northern and Santa Fe railroad lines, and northeast of the proposed wellfield. This location was selected to take advantage of hydrogeologic features and to avoid potential connection with highly saline soils underlying Bristol Dry Lake to the west and Cadiz Dry Lake to the south. Each spreading basin would range in size from about 10 to 15 acres. A total of 20 to 30 cells would be constructed. Individual basins would be about 400 feet wide and range from 1,700 to 2,100 feet long. It is the intent of the Project spreading basin design to have balanced cut and fill over the entire basin area. Construction activities for the Project spreading basins would include site preparation, clearing and grubbing, excavation, embankment or berm construction, utility preservation and/or relocation, pipe placement, backfill and the installation of gates, valves and appurtenances.

The Project wellfield would be constructed in the Fenner Gap in the vicinity of the spreading basins to localize the recharge and extraction operations. It would consist of approximately 30 interconnected wells to recover from 200-250 cubic feet per second (cfs). The Project wellfield would include three existing agricultural irrigation wells, which would be upgraded to meet the Cadiz Project requirements. Motors used to operate the wells would range from 1,000 to 1,250 horsepower, and would be electrically powered using power supplied through Metropolitan's existing Colorado River Aqueduct power transmission system. Most of the construction-related activities and installation would take place on the site of the wellfield facility. The only substantial off-site activities would be those associated with transporting construction materials and appurtenances, and process equipment to the site. Power would be supplied to the Project wellfield via a 69kV overhead transmission line from the existing Iron Mountain Pumping Plant switchyard. Power to individual wells could be supplied overhead or underground. If overhead means were used, power poles would be installed in the wellfield area. Power distribution facilities for the Project wellfield would parallel the water conveyance facility between the Colorado River Aqueduct and the Fenner Gap area.



Source: P&D Consultants, Inc. (1999).

Figure ES-4

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Cadiz Project Alternatives

In addition to the Project spreading basins and wellfield, several other elements are common to the four Project-level alternatives. These include several staging areas for the temporary storage of equipment and materials during construction of the Cadiz Project. All pipelines also be fitted with eight "blowoff" valves located at low points along the water conveyance facilities, generally where they cross a wash, to allow them to be drained for inspection and maintenance, and with access manholes for inspection. The wellfield would have extensive electronic monitoring equipment. The location and design of these appurtenant features would be determined during final design. Above ground power lines are anticipated for the length of each pipeline/canal water conveyance facility. Impacts associated with these features are addressed as part of the impact analysis for each conveyance facility.

Eastern Alternative

The Eastern Alternative begins at the Project spreading basins in the Fenner Gap area, approximately three miles north of unimproved Cadiz-Rice Road. The all-pipeline conveyance facility proceeds due south for three miles, then parallels Cadiz-Rice Road and the Arizona California Railroad Company (ARZC) rail lines in a southeasterly direction towards abandoned Chubbuck Station. Southeast of abandoned Chubbuck Station, the water conveyance facilities turn south, generally following the 820-foot contour for approximately three miles around the west edge of Danby Dry Lake. The pipeline then turns southeast, generally following the 820-foot contour, between the south side of Danby Dry Lake and along the Iron Mountains for approximately ten miles until crossing Metropolitan's power transmission right-of-way. The water conveyance facilities continue around the east side of the Iron Mountains where they connect to an unimproved road. The water conveyance facilities parallel the unimproved road, enter the Iron Mountain Pumping Plant site, and discharge into the existing Iron Mountain Pumping Plant forebay. The total length of the Eastern Alternative is approximately 34.6 miles.

Construction of the water conveyance facility would be conducted in segments and would include trench excavation, utility preservation and/or relocation, pipe placement, backfill, appurtenant construction and restoration along the entire pipeline route. The pipeline would be buried, with a minimum earth cover of three feet. Where the facilities cross drainages, the depth of cover might be up to ten feet, and scour protection for the pipeline would be provided. The rail line crossings would either be bore and jack or conventional tunnel with ribs and lagging or linear plate.

Throughout construction, the top three to four inches of topsoil would be removed from the trench areas and stockpiled. Vegetation that is cleared from the trenching areas would be mulched and set aside with the topsoil. At the completion of construction of each segment of the pipeline, the stockpiled topsoil and mulch would be re-spread over the re-contoured permanent right-of-way. The surface would be re-contoured to preserve the original runoff pattern. Topsoil and mulch would be stockpiled for a maximum of three months prior to re-spreading.

A temporary construction easement, 200 feet wide, would generally be required for construction of the water conveyance

facilities, but in the vicinity of Chubbuck Station, a sensitive historic resource, the construction and permanent right-of-way would be narrowed to a maximum of 40 feet for approximately 1.25 miles adjacent to this site, in consultation with the Project Archaeologist. Otherwise, permanent right-of-way for facility inspection and maintenance would be 80 feet wide.

The Cadiz Pumping Plant would be built adjacent to the existing Iron Mountain Pumping Plant on land owned by Metropolitan. It would be designed and constructed in a style compatible with the existing architecture of the Iron Mountain Pumping Plant complex.

The Eastern Alternative is estimated to require 503 acres of temporary construction easement and 336 acres of permanent right-of-way. The total cost of the Eastern Alternative is estimated at $150 million.

Western Alternative

The Western Alternative would begin at a new pumping station on about eight acres at the West Portal of the Iron Mountain Tunnel. The pipeline would run north along the eastern edge of the Cadiz Valley and pass between the Kilbeck Hills and the Cadiz Dunes Wilderness Area. The pipeline would then follow the Eastern Alternative water conveyance facility to the spreading basins. New overhead power lines would be required from the Iron Mountain Pumping Plant to the new pumping plant, a distance of approximately eight miles. Right-of-way requirements (width of permanent and temporary construction easements) would be similar to those of the Eastern Alternative, with a total of 484 acres of temporary easements required and 323 acres of permanent rights-of-way for construction, operation, and maintenance.

Combination Alternative

The Combination Alternative follows the Western Alternative north from the new pumping plant until it reaches the south end of the Kilbeck Hills, where it turns east to skirt around the eastern boundary of these hills and thereby avoids the Cadiz Dunes Wilderness Area. The Combination Alternative joins the Eastern Alternative water conveyance facility at Chubbuck Station. The Combination Alternative would also require new power lines from the Iron Mountain Pumping Plant to the new pumping plant. Right-of-way requirements (width of temporary and permanent construction areas) would be similar to those of the Eastern Alternative, with a total of 495 acres of temporary easements required and 330 acres of permanent rights-of-way for construction, operation, and maintenance.

Eastern/Canal Alternative

This alternative follows the Eastern Alternative but would substitute an approximately eight-mile canal section for pipeline where the alternative extends southwest of Danby Dry Lake to a point at the south end of the Kilbeck Hills. Pumping stations would be required at both ends of this canal segment. The Eastern/Canal Alternative is otherwise identical to the Eastern Alternative, with a total of 525 acres of temporary easements required and 350 acres of permanent rights-of-way for construction, operation, and maintenance.

OPERATIONS AND MAINTENANCE

Project Spreading Basins

The Project spreading basins would consist of multiple cells into which Colorado River water could be selectively discharged. As percolation rates in a given cell decline, water would be discharged to new spreading basin cells. Routine maintenance would include periodic cleaning of fine-grained sediment from the bottom of the spreading basins. All inspection and maintenance activities would be performed within the permanent Cadiz Project right-of-way.

Project Wellfield Facilities

The Project wellfield facilities would be controlled and monitored remotely to maintain the water delivery rate at the Colorado River Aqueduct consistent with desired parameters. Routine inspection would be performed weekly and/or monthly. All inspection and maintenance activities would be performed within the permanent Cadiz Project right-of-way.

Water Conveyance Facility

Routine maintenance would be performed weekly and would consist of two maintenance personnel driving the right-of-way to inspect the above ground facilities. Approximately every five years, the pipeline segments would be drained and maintenance personnel would enter the pipeline and perform an inspection of the underground facilities. All appropriate safety procedures for access and work in a confined space would be followed. If the Eastern/Canal Alternative were constructed, the canal segments would be drained on an annual basis for inspection and cleaning.

ENVIRONMENTAL CONSEQUENCES AND MITIGATION MEASURES

Table ES-3 summarizes the potential environmental impacts under each of the Cadiz Project alternatives, mitigation measures to avoid or substantially reduce significant adverse impacts and the level of significance of the impacts after mitigation. For many of the environmental parameters shown in this table, mitigation included in the Cadiz Project alternatives would avoid or substantially reduce potentially significant adverse project impacts, to below a level of significance. For other environmental parameters, as described in the following sections, the Cadiz Project alternatives will result in significant adverse impacts, which cannot be avoided or mitigated to below a level of significance.

MITIGATION MONITORING PROGRAM

Pursuant to the California Public Resources Code (Section 21081.6) and State Assembly Bill 3180, a Mitigation Monitoring Plan will be developed to ensure the implementation of the mitigation measures identified in this EIR/EIS. The Metropolitan Board of Directors would adopt the Mitigation Monitoring Plan in conjunction with the findings required under CEQA, at the time the Board considers certification of the Final EIR. The Mitigation Monitoring Plan would be included in the final EIR/EIS and will include the following elements:

TABLE ES-3
SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS,
MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Eastern Alternative			
Aesthetics	Construction of the Eastern Alternative could result in changes of views in the Project area from undisturbed/agriculture to disturbed areas that could take a substantial period of time before the new vegetation is mature enough to be indistinguishable from the surrounding landscape. Some of these changes would be visible to viewers in wilderness areas near the Cadiz Project area. New night lighting would be introduced at the Project wellfield, substations and pumping plants.	Mitigation measure AS-2 (lighting) addresses potential impacts associated with night lighting under the Cadiz Project.	None.
Agriculture	Loss of less than six acres of agricultural land for permanent Project easements. No impacts related to Prime Farmland, Unique Farmland or Farmland of Statewide Importance; General Plan land use designations and Williamson Act Contracts. Minor impacts during construction to Cadiz Inc. agricultural operation. Therefore, impacts of the Eastern Alternative related to agriculture would not be significant.	No mitigation is necessary.	None.
Air Quality	During construction, the Eastern Alternative would generate air emissions in excess of existing levels of non-attainment pollutants (NO_x, VOC and PM_{10}).	Mitigation measures AQ-1 (minimize exposed soils), AQ-2 (disposal of excavated material), AQ-3 (watering of the site and construction equipment), AQ-4 (dust control), AQ-5 (use of non-toxic soil stabilizers), AQ-6 (maintenance of construction equipment) and AQ-7 (rideshare and transit incentives) address short term air quality emissions during construction of the Cadiz Project.	After implementation of mitigation measures AQ-1 through AQ-7, the short-term construction air quality impacts would contribute to the continued non-attainment for these pollutants. This would be a significant unavoidable adverse impact of the Cadiz Project that would occur during construction only.
	The Eastern Alternative would not result in significant adverse air quality impacts in the long term.	No mitigation is necessary.	None.

TABLE ES-3
SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS,
MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Biological Resources	The Eastern Alternative would have the potential to remove native vegetation and wildlife habitat, to adversely impact adjacent wildlife habitat, to impact the threatened desert tortoise and to interfere with movement of bighorn sheep. The Eastern Alternative would temporarily disturb 634 acres and permanently disturb 465.2 acres of Mojave creosote scrub; would temporarily disturb 148.7 acres and permanently disturb 16.5 acres of desert dunes/sand fields; and would temporarily disturb 11.5 acres and permanently disturb 2.2 acres of Mojave wash scrub.	Mitigation measures B-1 through B-5 (native plant communities and wildlife habitat), B-6 (burrowing owl), B-7 (American badger and desert kit fox) and B-8 through B-33 (desert tortoise) address short and long term impacts on native plant communities, wildlife habitat and wildlife during construction and operation of the Cadiz Project.	None.
Cultural Resources	The Eastern Alternative could affect cultural resources by destroying or altering the resources and/or their environments in such a way that their significant qualities would be diminished. There are no previously documented sites anticipated to be impacted by the Eastern Alternative.	Mitigation measures CR-2 (Buried Site Treatment Plan), CR-3 (monitoring during construction) and CR-4 (post-construction report) address potential impacts of the construction of the Cadiz Project on cultural resources.	None.
Energy and Mineral Resources	The Eastern Alternative would have the potential to interfere with the future recovery of economic mineral deposits but this would not be considered significant because of the limited area and prospective classification of most mineral resources in the Cadiz Project area. Construction of the Eastern Alternative could result in temporary access impacts or restrictions to mineral resources. The construction and operation of the Eastern Alternative would require the use of energy and some mineral resources. This demand would be within available resources in the region and would not be significant.	Mitigation measure E-1 (access for mineral extraction operations) addresses potential construction related impacts of the Cadiz Project on access to mineral extraction operations. No mitigation is necessary.	None. None.

TABLE ES-3
SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS,
MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Environmental Justice	No disadvantaged populations, households or businesses are within the proposed construction zone of the Eastern Alternative, and none are expected to be in the future. Therefore, the Eastern Alternative would not result in adverse impacts related to environmental justice.	No mitigation is necessary.	None.
Hazardous Materials	The Eastern Alternative would have the potential to unearth unexploded military ordnance during construction.	Mitigation measures HM-1 through HM-3 (ordnance) address impacts related to discovery of unexploded ordnance prior to and during construction of the Cadiz Project.	Measures HM-1 to HM-3 would not reduce impacts to below a level of significance related to the potential to unearth unexploded ordnance. Because survey and clearance techniques cannot absolutely remove this hazard, a potential significant adverse impact would remain after mitigation related to risks associated with unexploded ordnance.
	During construction, there would be potential for the accidental release or fuels, oils and lubricants and for the required use of explosives during construction.	The use, handling, storage, transport and disposal of hazardous materials during construction and operation of the Cadiz Project would be conducted consistent with existing federal, state and local regulations. Mitigation measures HM-4 (temporary fuel storage areas), HM-5 (oily water/residues) and HM-6 (hazardous wastes found during construction) address additional hazardous materials impacts during construction of the Cadiz Project.	None.
	There would be potential for temporary flooding in the event of catastrophic failure or rupture of the water conveyance facility.	Mitigation measure HM-7 (design of the water conveyance facility) addresses potential impacts associated with failure of the pipeline.	None.
Indian Trust Assets	There are no Indian Trust Assets (ITAs) in the Cadiz Project area. Therefore, there would be no impacts on ITAs.	No mitigation is necessary.	None.

TABLE ES-3
SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS,
MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Land Use, Planning and Policies	The Eastern Alternative would require amendment of the California Desert Conservation Area (CDCA) Plan to allow an exception to the Energy Production and Utility Corridor Element for the water conveyance and power distribution facilities. Potential land use incompatibility would not be significant due to the general absence of existing sensitive uses in the Cadiz Project vicinity and the low level of development under the Cadiz Project. Incompatibility with the CDCA Plan would be potentially significant, if the Plan were not amended.	Because amendment to allow an exception of the Energy Production and Utility Corridor of the CDCA Plan is proposed as part of the Cadiz Project, no mitigation is necessary.	None
	Temporary delays on Cadiz Rice-Road during construction. (Refer to Transportation later in this table).	Refer to Transportation.	None.
Noise	The Eastern Alternative would have the potential to generate short term noise impacts during construction including short term noise impacts on visitors to wilderness areas in the Cadiz Project area and short term impacts associated with blasting.	Mitigation measures N-1 (construction equipment noise muffling) and N-2 (noise monitoring during blasting) address short term noise impacts during construction of the Cadiz Project.	None.
	Construction of the Eastern Alternative would not result in adverse noise impacts related to surface transportation, trains, or exposure of construction workers to noise and aircraft. Operation of the Eastern Alternative would not result in adverse noise impacts related to facility operations, raven control at the spreading basins and aircraft.	No mitigation is necessary.	None.
Paleontological Resources	The Eastern Alternative could affect paleontological resources by destroying or altering the resources and/or their environments in such a way that their significant qualities would be diminished.	Mitigation measures P-1 (document previously recorded fossil sites), P-2 (monitoring during construction), P-3 (salvage of fossils unearthed during construction), P-4 (collection of soil samples), P-5 (processing of fossils and soil samples) and P-6 (cost of paleontological resources program) address potential construction impacts of the Cadiz Project on paleontological resources.	Mitigation measures P-1 to P-6 would not reduce construction impacts of the Cadiz Project related to paleontological resources to below a level of significance.

TABLE ES-3
SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS,
MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Public Services	During construction, the Eastern Alternative may result in slightly increased demand for police, fire and emergency medical services. Open trenches and construction areas could temporarily block access in the Cadiz Project area for emergency service providers.	Mitigation measures PS-1 (coordination with the San Bernardino County Fire Department), PS-2 (coordination with public service providers) and PS-1 (use of warnings/barriers at open trenches and active construction areas) address potential short term impacts during construction of the Cadiz Project on emergency services providers.	None.
	Operation of the Eastern Alternative would not result in adverse impacts related to police, fire and emergency medical services. Construction and operation of the Eastern Alternative would not result in adverse impacts related to schools and libraries.	No mitigation is necessary.	None.
Socioeconomics	Due to the temporary nature of impacts during project construction and the negligible impacts during operations and maintenance, the impacts of the Eastern Alternative related to socioeconomics would not be significant.	No mitigation is necessary.	None.
Topography, Geology, Soils and Seismicity	The Cadiz Project area is composed of gently sloping, broad alluvial valleys and small hills. Substantial topographic alterations would not be required. This impact would not be significant.	No mitigation is necessary.	None.
	The Cadiz Project area is not subject to landslides, sand flow, tsunami/seiche, percolation of waste materials and volcanic hazards. Therefore, the Cadiz Project would not be subject to impacts related to these types of geologic hazards. The Cadiz Project would not result in the construction of substantial impervious surfaces.	No mitigation is necessary.	None.

TABLE ES-3
SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS,
MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Topography, Geology, Soils and Seismicity (Continued)	The Eastern Alternative would have the potential to create or expose people and Project facilities to unstable soil conditions, including liquefaction, slope and foundation instability, erosion/ sedimentation, land surface subsidence and hydrocompaction. These impacts would be potentially significant.	Mitigation measures G-2 (liquefaction), G-3 (slope and foundation instability) and G-4 (erosion, sedimentation and flooding) address Cadiz Project impacts related to soil.	None.
	The Eastern Alternative facilities would be exposed to regional seismic hazards throughout the life of the Project.	Mitigation measure G-1 (seismicity) addresses Cadiz Project impacts related to faults and seismicity.	None.
Transportation	During construction, the Eastern Alternative would have the potential to cause delays to other users on Cadiz-Rice Road and could potentially interfere with movement of emergency vehicles.	Mitigation measures T-1 (coordination with local jurisdictions), T-2 (coordination with emergency service providers), T-3 (traffic assistance/controls during construction) and T-4 (increased surface transportation capacity on Cadiz-Rice Road) address short term surface transportation impacts during construction of the Cadiz Project.	None.
	Operation of the Eastern Alternative would not result in adverse impacts related to surface transportation delays or emergency access.	No mitigation is necessary.	None.
	The Eastern Alternative would not result in adverse impacts related to rail and air transportation during construction or operation.	No mitigation is necessary.	None.
Utilities and Service Systems	Construction of the Eastern Alternative would result in crossings of existing utility facilities and, therefore, could result in accidental damage to these lines during construction.	Mitigation measures USS-2 (utility crossings) and USS-3 (accidental damage) address potential impacts during construction associated with Cadiz Project crossings of existing utilities and accidental damage to existing utilities during construction, respectively.	None.

TABLE ES-3
SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS,
MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Utilities and Service Systems (Continued)	Construction and operation of the Eastern Alternative would result in a slight increase in the demand for telephone, water, storm water, electricity and solid waste services in the area. These impacts would be within the capacity of existing services and facilities and, therefore, would not be significant.	No mitigation is necessary.	None.
	Construction of the Eastern Alternative would result in crossings of existing crude oil pipelines.	Mitigation measure USS-1 (pipeline crossings) addresses potential short term impacts during construction of the Cadiz Project associated with crossings of existing crude oil lines.	None
Water Resources	Surface water would be affected primarily during construction of Project spreading basins, water conveyance and power distribution facilities, appurtenances and the wellfield. The Eastern Alternative could introduce sediment and contaminants into surface waters. However, due to the general lack of surface water in the region, the ability to control erosion and sedimentation, existing regulations on the use of potential contaminants and the ability to clean up accidental spills, combined with the short-term construction schedule, these impacts would not be significant.	Mitigation is provided by existing regulations, including the Federal Clean Water Act (Sections 401 and 404) and the State Fish and Game Code (Section 1601). No additional mitigation is necessary.	None.
	Water quantity impacts would include potentially adverse changes in the volume and location of surface water flow. These impacts would be created by construction of Project facilities and would generally continue through the term of the Cadiz Project. The Eastern Alternative would create small impermeable areas at the well heads and pumping plants. The spreading basins would be earthen and would not change surface water characteristics appreciably.	No mitigation is necessary.	None.

TABLE ES-3
SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS,
MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Water Resources (Continued)	Construction of the spreading basins would require diversion of surface water flows. Diverted flows would maintain existing volumes and return water to their existing paths downstream of Project facilities. Consequently, the Eastern Alternative would not be anticipated to have a demonstrable adverse impact on surface water quantity and would have only minor adverse impacts due to the relocation of surface water flow.	No mitigation is necessary.	None
	Groundwater quantity impacts would include reduction in flow or otherwise making groundwater unavailable for existing beneficial uses due to groundwater elevation changes. The groundwater levels and volumes would be managed through Project operation. As required in the Groundwater Monitoring and Management Plan (WR-1), groundwater elevations would be monitored and Project operations adjusted to avoid significant adverse impacts.	Mitigation measure WR-1 (Groundwater Monitoring and Management Plan) addresses Cadiz Project impacts related to ground structure instability (subsidence, hydrocompaction and liquefaction) and water quality (changes in groundwater quality, aquifer characteristics and movement of the saline/fresh water interface).	None.
	Groundwater quality impacts would include the introduction of undesirable constituents from Colorado River water into the groundwater aquifer system and the introduction of undesirable constituents from the indigenous groundwater into the Colorado River Aqueduct. Project operations would transfer undesirable constituents, however, such transfer would not cause exceedance of any drinking water standards. Therefore, this impact would be adverse but less than significant.	Mitigation measure WR-1 (Groundwater Monitoring and Management Plan) addresses Cadiz Project impacts related to ground structure instability (subsidence, hydrocompaction and liquefaction) and water quality (changes in groundwater quality, aquifer characteristics and movement of the saline/fresh water interface).	None.

TABLE ES-3
SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS,
MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Wilderness/Recreation	Construction of the Eastern Alternative could result in short term adverse impacts related to disruption of the Johnson Valley to Parker Route, views from adjacent wilderness areas and noise levels in adjacent wilderness areas. Operation of the Eastern Alternative would not result in adverse impacts on wilderness/recreation resources.	Mitigation measures REC-1 (construction scheduling near the Johnson Valley to Parker Route), AS-2 (Aesthetics), N-1 (noise) and N-2 (noise) address potential short term adverse impacts on wilderness/recreation resources during construction of the Cadiz Project. No mitigation is necessary.	None.
Western Alternative			
Aesthetics	Construction of the Western Alternative could result in changes of views in the Project area from undisturbed/agriculture to disturbed areas that could take a substantial period of time before the new vegetation is mature enough to be indistinguishable from the surrounding landscape. Some of these changes will be visible to viewers in wilderness areas near the Cadiz Project area. New night lighting would be introduced at the Project wellfield, substations and pumping plants.	Mitigation measure AS-2 (lighting) addresses potential impacts associated with night lighting under the Cadiz Project. Mitigation measure AS-1 (pumping plant design) addresses the use of earth-toned materials for these facilities.	None.
Agriculture	The impacts of the Western Alternative would be the same as under the Eastern Alternative	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Air Quality	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Biological Resources	The Western Alternative would have the potential to remove native vegetation and wildlife habitat, to adversely impact adjacent wildlife habitat, to impact the threatened desert tortoise and to interfere with movement of bighorn sheep.	Mitigation measures B-1 through B-5 (native plant communities and wildlife habitat), B-6 (burrowing owl), B-7 (American badger and desert kit fox) and B-8 through B-33 (desert tortoise) address short and long term impacts on native plant communities, wildlife habitat and wildlife during construction and operation of the Cadiz Project.	None.

TABLE ES-3
SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS,
MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Biological Resources (Continued)	The Western Alternative would temporarily disturb 650.7 acres of Mojave creosote scrub and permanently disturb 492.8 acres; would temporarily disturb 169.8 acres of desert dunes/sand fields and permanently disturb 18.9 acres; and would temporarily disturb 12.3 acres of Mojave wash scrub and permanently disturb 2.7 acres.	See above.	None.
Cultural Resources	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Energy and Mineral Resources	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Environmental Justice	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Hazards and Hazardous Materials	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Indian Trust Assets	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Land Use, Planning and Policies	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Noise	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Paleontological Resources	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Public Services	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Socioeconomics	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Topography, Geology, Soils and Seismicity	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Water Resources	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Transportation	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Utilities and Service Systems	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.

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MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Wilderness/Recreation	The impacts of the Western Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Combination Alternative			
Aesthetics	Construction of the Combination Alternative could result in changes of views in the Project area from undisturbed/agriculture to disturbed areas that could take a substantial period of time before the new vegetation is mature enough to be indistinguishable from the surrounding landscape. Some of these changes would be visible to viewers in wilderness areas near the Cadiz Project area. New night lighting will be introduced at the Project wellfield, substations and pumping plants.	Mitigation measure AS-2 (lighting) addresses potential impacts associated with night lighting under the Cadiz Project. Mitigation measure AS-1 (pumping plant design) address the use of earth-toned materials for these facilities.	None.
Agriculture	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative
Air Quality	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative	Refer to the Eastern Alternative
Biological Resources	The Combination Alternative would have the potential to remove native vegetation and wildlife habitat, to adversely impact adjacent wildlife habitat, to impact the threatened desert tortoise and to interfere with movement of bighorn sheep. The Combination Alternative would temporarily disturb 883.7 acres of Mojave creosote scrub and permanently disturb 518.7 acres; would temporarily disturb 177.8 acres of desert dunes/sand fields and permanently disturb 19.8 acres; and would temporarily disturb 13.2 acres of Mojave wash scrub and permanently disturb 2.8 acres.	Mitigation measures B-1 through B-5 (native plant communities and wildlife habitat), B-6 (burrowing owl), B-7 (American badger and desert kit fox) and B-8 through B-33 (desert tortoise) address short and long term impacts on native plant communities, wildlife habitat and wildlife during construction and operation of the Cadiz Project.	None.

TABLE ES-3
SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS,
MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Cultural Resources	The Combination Alternative could affect cultural resources by destroying or altering the resources and/or their environments in such a way that their significant qualities would be diminished. There are no previously documented sites anticipated to be impacted by the Cadiz Project. Construction of the Combination Alternative could adversely affect one previously documented cultural resources site (AE-CAD-7H).	Mitigation measures CR-2 (Buried Site Treatment Plan), CR-3 (monitoring during construction) and CR-4 (post-construction report) address potential impacts of the construction of the Cadiz Project on cultural resources. Mitigation measure CR-1 (Site AE-CAD-7H) addresses potential adverse impacts during construction of the Combination Alternative on cultural resources.	None.
Energy and Mineral Resources	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Environmental Justice	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Hazards and Hazardous Materials	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Indian Trust Assets	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Land Use, Planning and Policies	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative	Refer to the Eastern Alternative
Noise	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Paleontological Resources	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Public Services	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Socioeconomics	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative	Refer to the Eastern Alternative
Topography, Geology, Soils and Seismicity	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative	Refer to the Eastern Alternative
Water Resources	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative	Refer to the Eastern Alternative
Transportation	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative	Refer to the Eastern Alternative

TABLE ES-3
SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS,
MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Utilities and Service Systems	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Wilderness/Recreation	The impacts of the Combination Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Eastern/Canal Alternative			
Aesthetics	Construction of the Eastern/Canal Alternative could result in changes of views in the project area from undisturbed/agriculture to disturbed areas that could take a substantial period of time before the new vegetation is mature enough to be indistinguishable from the surrounding landscape. Some of these changes would be visible to viewers in wilderness areas near the Cadiz Project area. New night lighting would be introduced at the Project wellfield, substations and pumping plants.	Mitigation measure AS-2 (lighting) addresses potential impacts associated with night lighting under the Cadiz Project. Mitigation measure AS-1 (pumping plant and canal design) address the use of earth-toned materials for these facilities.	None.
Agriculture	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Air Quality	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Biological Resources	The Eastern/Canal Alternative would have the potential to remove native vegetation and wildlife habitat, to adversely impact adjacent wildlife habitat, to impact the threatened desert tortoise and to interfere with movement of bighorn sheep. The Eastern/Canal Alternative would temporarily disturb 595.9 acres of Mojave creosote scrub and permanently disturb 505.0 acres; would temporarily disturb 130.0 acres of desert dunes/sand fields and permanently disturb 35.2 acres; and would temporarily disturb 11.0 acres of Mojave wash scrub and permanently disturb 2.2 acres.	Mitigation measures B-1 through B-5 (native plant communities and wildlife habitat), B-6 (burrowing owl), B-7 (American badger and desert kit fox) and B-8 through B-33 (desert tortoise) address short and long term impacts on native plant communities, wildlife habitat and wildlife during construction and operation of the Cadiz Project.	None.
Cultural Resources	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.

TABLE ES-3
SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS,
MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Energy and Mineral Resources	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Environmental Justice	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Hazards and Hazardous Materials	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Indian Trust Assets	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Land Use, Planning and Policies	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Noise	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Paleontological Resources	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Public Services	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Socioeconomics	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Topography, Geology, Soils and Seismicity	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Transportation	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Utilities and Service Systems	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.

TABLE ES-3
SUMMARY OF SIGNIFICANT ENVIRONMENTAL IMPACTS,
MITIGATION MEASURES AND UNAVOIDABLE ADVERSE IMPACTS

Impact Category	Significant Adverse Impacts	Mitigation Measures	Unavoidable Adverse Impacts After Mitigation
Water Resources	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.
Wilderness/Recreation	The impacts of the Eastern/Canal Alternative would be the same as under the Eastern Alternative.	Refer to the Eastern Alternative.	Refer to the Eastern Alternative.

- All the mitigation measures identified in Section 5 of the EIR/ EIS.

- Any revisions to the mitigation measures developed during the preparation of the responses to comments on the Draft EIR/EIS

- The party or parties responsible for the implementation of each measure.

- The timing of implementation of each measure.

- The standards or criteria necessary to determine the satisfactory implementation of each measure.

- The documentation and reporting procedures for the Mitigation Monitoring Plan.

UNAVOIDABLE ADVERSE IMPACTS

Potential environmental impacts resulting from the Cadiz Project alternatives are evaluated for both construction and operations in the EIR/EIS. Construction impacts would occur during the building of the water conveyance facilities, power distribution facilities, pumping and/or booster stations, Project spreading basins and the Project wellfield. These impacts would be generally temporary, extending only through the construction period, but would typically be relatively short in duration at any one location along the Cadiz Project (i.e. at any one place along the water conveyance facilities). Some construction activities would result in longer term impacts, such as scarification from trench excavation or displacement of existing uses or biological resources. Operations and maintenance activities could also result in environmental impacts.

Based on detailed analysis of impacts and proposed mitigation, the Cadiz Project will not result in significant adverse effects after mitigation related to the following parameters:

- Aesthetics
- Agriculture
- Biological Resources
- Cultural Resources
- Energy and Mineral Resources
- Environmental Justice
- Indian Trust Assets
- Land Use Plans and Policies
- Noise
- Public Services
- Socioeconomics
- Topography, Geology, Seismicity and Soils
- Transportation
- Utilities and Service Systems
- Water Resources
- Wilderness/Recreation

For each of these resource areas, impacts have been avoided to the extent feasible by selecting the environmentally preferred alternative as the overall preferred alternative. Where there would be unavoidable residual impacts, they have been reduced through the mitigation measures shown on Table ES-3. The combination of monitoring to detect conditions which could lead to impacts and then adjusting operations to avoid these impacts and off-site protection of resources subject to impact reduces many potentially significant impacts to below a level of significance.

For the following parameters, however, the possibility of some adverse impacts remains, even after the implementation of

the mitigation measures identified in the EIR/EIS: .

- Air Quality
- Hazardous Materials
- Paleontological Resources

Air Quality

The Cadiz Project would be anticipated to result in significant adverse air quality impacts during construction. Because of the magnitude of the Project and the simultaneous construction by multiple construction teams, air emissions standards will be exceeded for CO, ROC (VOC), NO_x and PM_{10}. During operations of the Cadiz Project, there would be occasions, typically once a year during maintenance of the Project spreading basins, that localized PM_{10} emissions would exceed standards. These impacts are unavoidable. When not undergoing maintenance and not being used for water recharge, it would be expected that the Project spreading basins would not contribute to PM_{10} levels any more than the surrounding open desert land. This is because the surface soils of the basins provide a finite volume of this size of soil material.

Hazardous Materials

The Cadiz Project area was used in the past for military exercises resulting in the presence of unexploded ordnance in this area. Implementation of the Cadiz Project mitigation measures would substantially reduce potential impacts from unknown explosive wastes. However, methodologies used to detect ordnance and explosive wastes may not be 100 percent effective. Therefore, some ordnance may remain within the construction zone after pre-screening has been conducted. As a result, the potential hazards related to ordnance and explosive wastes remain an unavoidable adverse impact of the Cadiz Project.

Paleontological Resources

Much of the Cadiz Project area consists of lake beds, paleosols and carbonate beds with a high potential for subsurface paleontological resources. Prior projects in the general area recovered fossils from 23 of 24 identified sites. Paleosols along the Eastern Alternative are overlain by more recent alluvium. Depending on the depth of these resources, trenching for the pipeline may or may not disturb the paleosols along this alternative. Under the worst case, trenching would disturb a substantial portion of these sub-soils, resulting in loss of paleontological resources. Therefore, the Cadiz Project could directly or indirectly destroy a unique paleontological resource or site. Whether or not this occurs cannot be determined until excavation begins. The mitigation measures for paleontological resources would reduce these impacts to below a level of significance if trenching does not generally reach the depth of the paleosols or if only portions of the paleosols are disturbed. Under the worst case, however, significant and unmitigated adverse impacts to paleontological resources would be anticipated under the Cadiz Project.

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The planned life of the Cadiz Project is 50 years. For the evaluation of irreversible and irretrievable commitment of resources, it has been assumed that the water conveyance facilities would be a

permanent facility that could be operated indefinitely and, therefore, it would not be feasible to restore all natural resources to their pre-Cadiz Project conditions. The irreversible and irretrievable commitments of resources that would occur as a result of the Cadiz Project would impact the categories of resources described in the following sections. Implementation of the Cadiz Project would not cause an irreversible or irretrievable commitment of resources as described in the EIR/EIS related to agriculture, air quality, environmental justice, hazards and hazardous materials, Indian Trust Assets, noise, public services, socioeconomics and growth inducement, transportation, utilities and service systems, and wilderness and recreation.

The primary long-term commitment of resources associated with the Cadiz Project would be related to the commitment of land. While some of the land required for the Project would be located in and around previously disturbed areas, there would be a substantial commitment of land located in areas that are currently undeveloped and relatively undisturbed, including six acres of agricultural land committed to wells, 390 acres of land committed to the spreading basins, about eight acres of land committed to pumping stations, and the land within the permanent rights-of-way for each conveyance facility.

Although construction would involve replacement of topsoils and cryptogamic soil crust may eventually be reestablished, exposed soils would suffer some long-term loss during and following construction as a result of wind erosion and runoff. Most losses would be relatively minor.

The Cadiz Project would have some minor long-term effects on water resources, including surface and subsurface flows, but no significant irretrievable or irreversible changes to water resources in the project area. All naturally-occurring flows would pass largely unaffected to the downstream watersheds. A Groundwater Monitoring and Management Plan implemented as an integral part of the Cadiz Project would include monitoring and adjustment of Project operations, if and when appropriate, based on the response of the groundwater basin to Cadiz Project operations.

The Cadiz Project would result in minor irreversible and irretrievable impacts to habitats and the species which depend on them over the life of the Project. There would be long-term loss of habitat at spreading basins and along the project conveyance facility right-of-way. Mitigation for these losses would protect at least an equivalent area, which is now unprotected, from detrimental uses and would, therefore, result in no net long-term loss of habitat or habitat value.

Consumption of construction grade minerals (sand, gravel, rock) in cement, bedding material, blocks, metallic minerals (iron, steel) would be necessary for the Cadiz Project. This would represent an irreversible and irretrievable commitment of these resources to this Project.

The construction and operation of the Cadiz Project would result in minor permanent and irreversible changes in the visual nature of the area. These changes would be minor in scale and magnitude. They would diminish through time but are expected to be discernible after 2050. Therefore, these impacts are considered to be a irreversible and irretrievable resource commitment for visual resources.

One significant archaeological resource would be disturbed by construction of the Cadiz Project, and only if the Combination Alternative is built. Despite the best application of mitigation measures, some unavoidable losses could occur. Even data recovery would involve some loss because it would require removal of artifacts from their original context.

Under the worst-case scenario, potentially significant paleontological resources could be disturbed by construction of the Cadiz Project. Despite the best application of mitigation measures, some unavoidable losses could occur. Even data recovery involves some loss because it requires excavation and removal of artifacts from their depositional context.

GROWTH INDUCEMENT IMPACTS

Regional service and planning agencies, such as the Southern California Association of Governments, San Bernardino Association of Governments, San Diego Association of Governments, South Coast Air Quality Management District, the California Department of Finance and the California Department of Transportation, have prepared extensive studies and reports forecasting the region's economy, population and resources. The Growth Management Plan (GMP), Regional Mobility Plan (RMP) and Air Quality Management Plan (AQMP) and their respective EIRs have been approved and adopted by these agencies, in cooperation with local jurisdictions, as the most likely scenarios for growth in this region. The primary objectives of these demographic projections and the planning policies on which they are based are to evaluate the potential social, economic, environmental and fiscal impacts that may result from this level of projected growth and to identify mitigation required to reduce or eliminate these impacts.

The growth projections for Southern California anticipate and take into account the predicted adverse impacts of growth, and state and regional planning agencies project growth to occur despite shortfalls in water supply, heavy traffic, poor air quality and other factors which are often assumed to be growth limiting. Development of infrastructure is explicitly not considered a factor that induces growth. The Cadiz Groundwater Storage and Dry-Year Supply Program responds to projections of growth and the anticipated demand for dry-year water supply. Many factors affect the rate and location of growth in a region. However, the Cadiz Project would not significantly affect any of these factors. The Cadiz Project would neither induce growth nor remove a constraint shown to limit growth. This is clearly evident from growth rates in Southern California during previous dry years, including the significant droughts of 1976-1977 and 1987-1992. During these droughts, Southern Californians implemented significant conservation efforts to reduce demand. These temporary efforts did not affect population growth and development. For example, during the 1987 to 1992 drought, the rate of population growth in Southern California remained at 2.5 percent per year.

CUMULATIVE IMPACTS

There are no known closely related, past, present and reasonably foreseeable probable future projects in the Cadiz Project Area. A solid waste disposal project (Rail Cycle Project) has been proposed for the region and a nuclear waste disposal facility (Ward Valley

Project) was also proposed. Neither of these projects is currently in advanced planning stages and their implementation is uncertain. There are significant legal, financial and environmental hurdles facing both projects before they can be considered likely to be implemented. In addition, official projections of population and development do not predict significant development in the region of the Cadiz Project. For purposes of cumulative analysis, then, Metropolitan's Hayfield Groundwater Storage Project was considered the only other project in the region. In combination, the Hayfield Project and the Cadiz Project are not anticipated to result in significant cumulative impacts, after mitigation, as described below.

- Aesthetics: Neither project would cause significant adverse aesthetic impacts during or following construction because both are in remote areas and both provide for visible facilities to be consistent with existing aesthetics.

- Agriculture: No significant agricultural land conversion would occur with either project.

- Air Quality: Both projects would cause temporary and significant short-term, construction impacts. Long-term operations of these projects would not significantly impact regional air quality.

- Biological Resources: Mitigation plans for both projects would provide long-term protection of resources currently not protected, offsetting project related impacts.

- Cultural Resources: Neither project would cause significant adverse impacts related to cultural resources after mitigation.

- Energy and Mineral Resources: Cadiz Project facilities would be operated when Colorado River Aqueduct pumps are taken off line, freeing up the existing available power supply. The two projects would not affect mineral resources.

- Environmental Justice: Neither project would have environmental justice impacts because no homes or businesses are located in either project area. Water supply from both projects would be equitably distributed by Metropolitan consistent with Board policy.

- Hazards and Hazardous Materials: Construction of both projects would include measures to avoid and minimize releases of hazardous materials. Although there is potential for the Cadiz Project to have adverse impacts associated with exposure of ordnance and explosives, the Hayfield Project has no such potential and, therefore, cumulative impacts are not anticipated.

- Indian Trust Assets: No Indian Trust Assets are located in the areas of these projects.

- Land Use, Planning and Policies: There are no significant conflicts with existing land uses for either project. Granting an amendment to the CDCA Plan for an exemption to the utility corridor element by the BLM would not result in adverse impacts.

- Noise: Neither project would result in significant adverse noise impacts.

- Paleontological Resources: No paleontological resources are within the impact area of the Hayfield Project. Therefore, cumulative impacts of the two projects would not exceed the impacts of the Cadiz Project.

- Public Services: Due to their limited scope and remoteness, neither project would significantly affect demand for public services during construction or operations.

- Socioeconomics and Growth Inducement: Neither project would result in displacement of housing, induced population growth or adverse impacts related to employment.

- Topography, Geology, Seismicity and Soils: Neither project would reduce in adverse impacts related to these geologic parameters.

- Transportation: Neither project would generate significant transportation impacts because background traffic levels are extremely low and work in the vicinity of railroads would be conducted to minimize potential impacts on rail operations.

- Utilities and Service Systems: Neither project would significantly impact utilities. Both projects would use existing power and roads.

- Water Resources: Monitoring and management of groundwater resources would ensure that no significant impacts occur under either project.

- Wilderness/Recreation: Neither project would have significant short- or long-term impacts to wilderness areas or other recreation resources.

SHORT TERM VERSUS LONG TERM PRODUCTIVITY IMPACTS

The Cadiz Project would have positive short-term impacts on productivity due to jobs created by the project and demand for construction materials and would contribute to long-term steady productivity by maintaining water supply for business and industry during periods of drought. Some lands would be precluded from future development by the project, but development is extremely sparse in the project area. Regional productivity would not be affected by the project's demand for resources, as adequate supplies of construction materials are available in the region.

Adverse impacts to water resources are also not anticipated because the Cadiz Project would utilize water made available during surplus periods and would transfer indigenous groundwater only to the extent that this may be done without adverse impact to groundwater levels. The Cadiz Project would not appreciably affect the short-term supply of energy in the region and would not impact mineral extraction in the area, in the short- and long-term. The amount of energy required to operate the Cadiz Project would be available from the dedicated electrical supply established by Metropolitan for their Iron Mountain Pumping Plant. The Cadiz Project would not appreciably create a long-term effect on wilderness or recreation resources and would, therefore, not adversely affect the long-term productivity of the region related to these resources.

TABLE ES-4
PERMITS THAT MAY BE REQUIRED

Federal Agencies	
United States Army Corps of Engineers	Section 404 permit pursuant to the Clean Water Act
United States Bureau of Land Management	Permits for use of land for geotechnical exploration Permits for construction areas and associated activity Right-of-way grant for conveyance facilities and power distribution line Amendment for an exception to the utility corridor requirements of the California Desert Conservation Area Plan
United States Fish and Wildlife Service	Section 7 consultation pursuant to the Endangered Species Act
State Agencies	
California Department of Fish and Game	Section 1601 permit pursuant to the Fish and Game Code (Streambed Alteration Agreement) Section 2081 permit or Section 2080.1 consistency determination pursuant to the California Endangered Species Act
Regional Water Quality Control Board	Permit for construction water discharge certification for placement of fill Clean Water Act Section 401 water quality certification for placement of fill
State Lands Commission	Construction easement (Western and Combination Alternatives)
Local/Regional Agencies	
Mojave Desert Air Quality Management District	Permits for stationary emissions sources

PROJECT APPROVALS AND PERMITS

To construct the Cadiz Project, Metropolitan would be required to obtain permits and/or approvals from other agencies. These agencies and possible permits or approvals may include, but are not limited to, those listed in Table ES-4.

FINAL EIR CERTIFICATION

Metropolitan is the CEQA lead agency for the EIR and has the responsibility for certifying the EIR as adequate pursuant to CEQA and implementing the Cadiz Project. In arriving at its decision whether to proceed with the Cadiz Project, the Metropolitan Board of Directors will consider the information in the EIR and will determine the adequacy of the environmental documentation under CEQA. In conjunction with the EIR certification, the Board would adopt the Mitigation Monitoring Plan, to reduce or eliminate project-related impacts, and adopt a Statement of Overriding Considerations recognizing any significant adverse impacts that cannot be mitigated to below a level of significance and

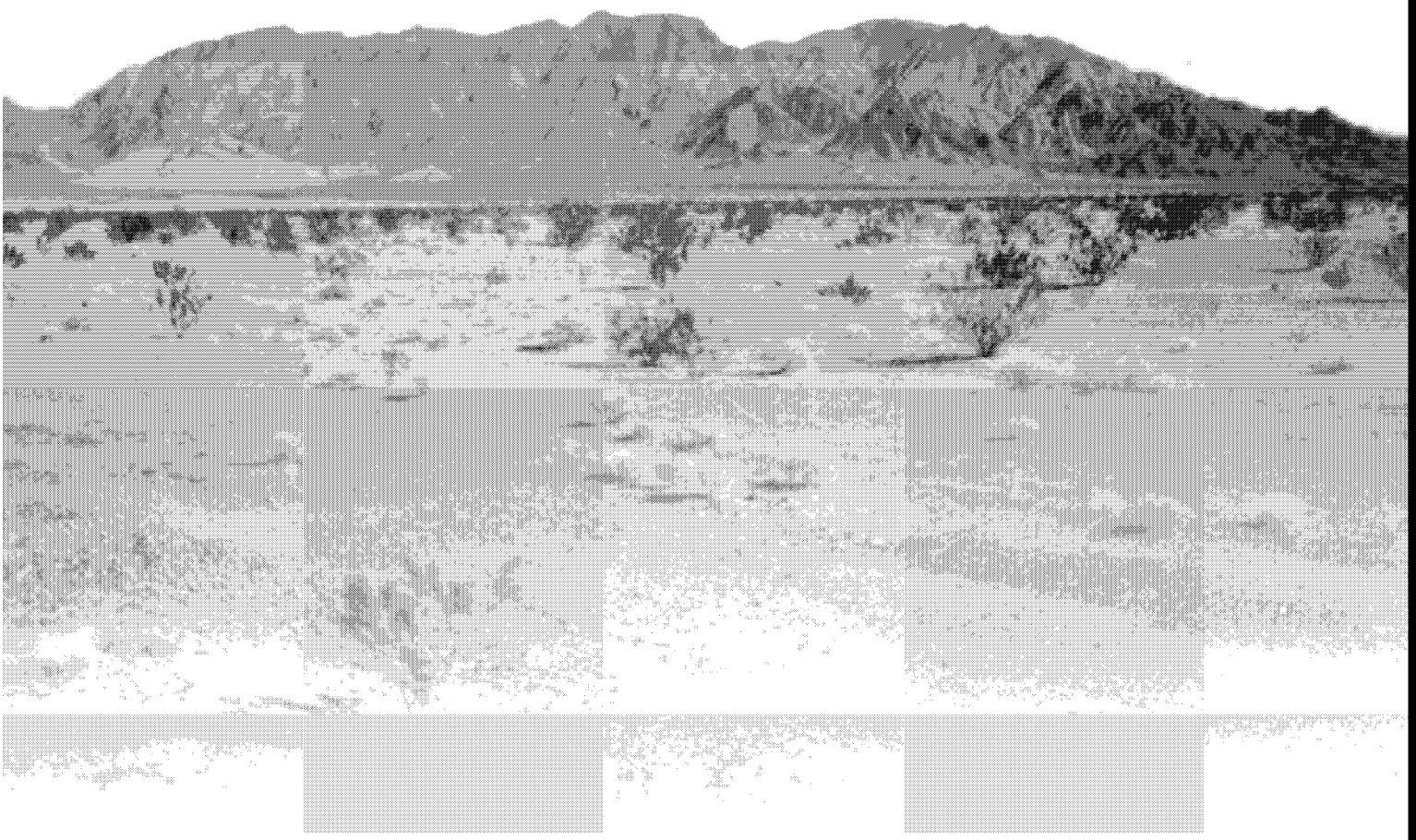
determining that the project warrants implementation despite these impacts. After posting the Notice of Determination, CEQA provides for a 30-day period during which the public has an opportunity to challenge the Board's decision.

RECORD OF DECISION

BLM is the NEPA lead agency for the EIS and has the responsibility for publishing Records of Decision (ROD), granting a right-of-way and permitting an amendment to the CDCA Plan to allow for an exception to the utility corridor element. A ROD is a separate public record document that shows how environmental impacts and other factors were considered in BLM's decision making process. It describes the decision made by the BLM, mitigation measures that may be required as part of the decision, all of the alternatives considered, the alternative(s) considered to be environmentally preferable, whether or not all practicable measures to reduce environmental harm were adopted and if not, why not. A ROD also summarizes the enforcement activities for the mitigation measures and is signed and dated by the authorizing BLM official. The ROD for the proposed action will not be signed until 30 days or more after the release of a Final EIS. The public has an opportunity to protest to the Director of the BLM the proposed Plan Amendment during that 30-day period.

SECTION 1.0

Introduction



SECTION 1.0
INTRODUCTION

1.1 BACKGROUND AND PURPOSE OF THIS DOCUMENT

The Metropolitan Water District of Southern California (Metropolitan) and the United States Department of the Interior, Bureau of Land Management (BLM) are jointly evaluating the implementation of the Cadiz Groundwater Storage and Dry-Year Supply Program (Cadiz Project). The location of the Cadiz Project is shown in Figure 1-1. Metropolitan is seeking to improve the management of its water supplies through cost-effective groundwater basin conjunctive-use, storage, and transfer programs with both public and private organizations. The BLM is involved as the federal lead agency since the Cadiz Project would require a grant of right-of-way on BLM lands and an amendment to the BLM's California Desert Conservation Area Plan (CDCA Plan). The amendment would allow the Cadiz Project to be constructed in an area not currently designated as a utility corridor in the CDCA Plan.

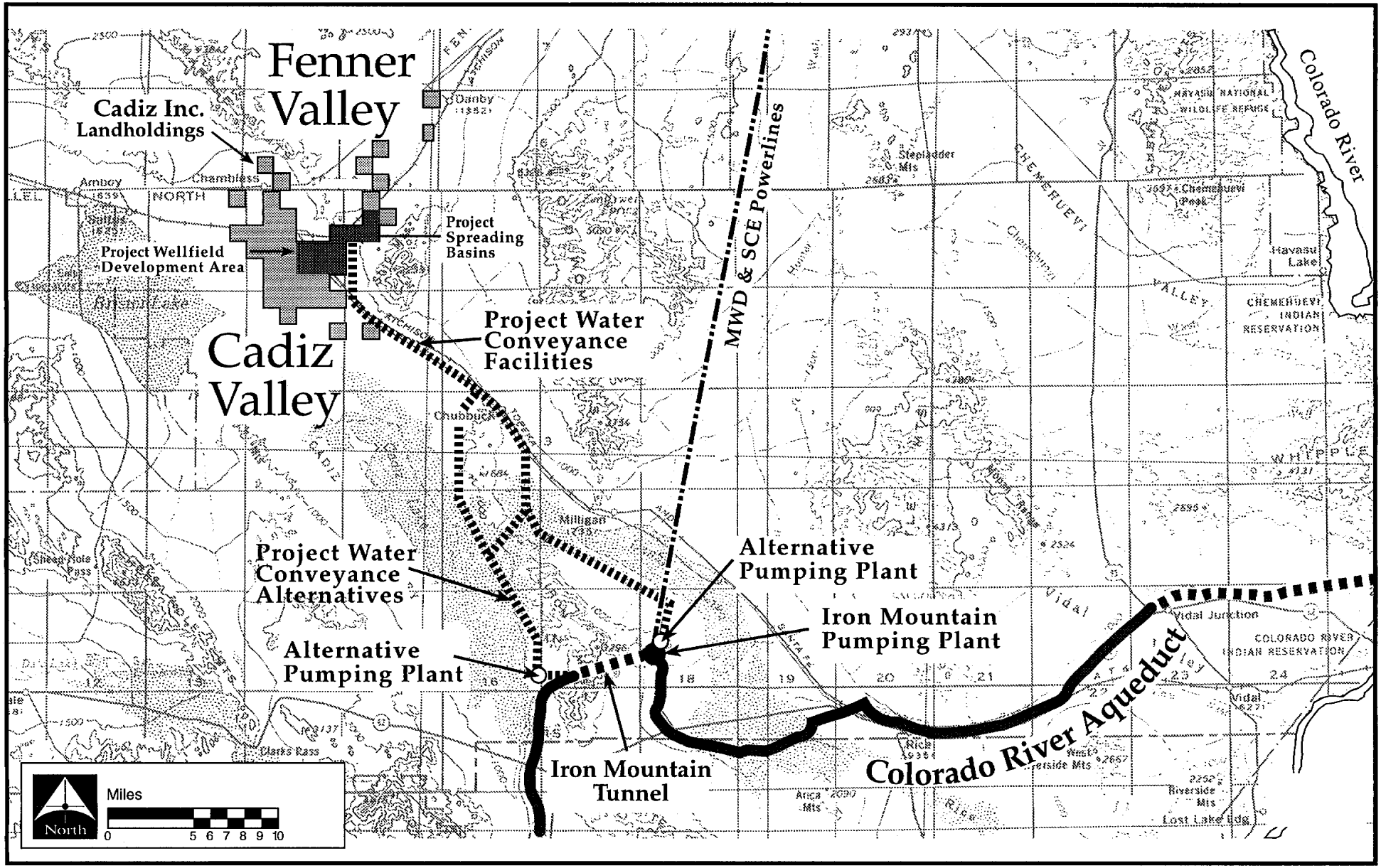
The California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) require the preparation of an Environmental Impact Report (EIR) and an Environmental Impact Statement (EIS), respectively, for any discretionary action which might have the potential to significantly affect the quality of the environment in an adverse manner. This EIR/EIS for the Cadiz Project was prepared jointly by Metropolitan to comply with the provisions of CEQA and by the BLM to comply with the provisions of NEPA. Both agencies will use the information in this document in their decision-making processes.

1.2 BACKGROUND OF THE METROPOLITAN WATER DISTRICT

Metropolitan was formed in 1928 under an enabling act of the California Legislature. Historically, Metropolitan has provided supplemental water to the coastal plain of Southern California. Metropolitan's deliveries augment local water supplies developed through surface catchment, groundwater production, and water recycling. This supplemental water is provided to Metropolitan's 27 member agencies through a regional network of canals, pipelines, reservoirs, treatment plants, and related facilities.

In recent years, Metropolitan has broadened its mission to include a number of regional water management activities. The focus of these water management activities has been to provide leadership and financial incentives to local water managers for development of:

- Groundwater recharge and production facilities;
- Water recycling projects;
- Water conservation programs; and
- Groundwater recovery and reclamation projects.



Source: Metropolitan (1999).

Figure 1-1

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Generalized Location of the Cadiz Project Facilities

Metropolitan has also encouraged local water managers to maintain groundwater reserves to meet needs during periods of drought (Metropolitan Water District of Southern California 1990b).

To respond to the needs of its member agencies, Metropolitan contracts with federal and state agencies for water supplies. The United States Department of Interior, Bureau of Reclamation supplies water from the Colorado River via the Colorado River Aqueduct. Water from State Water Project sources in northern California is delivered via the Governor Edmund G. Brown California Aqueduct (California Aqueduct) under contract with the California Department of Water Resources (DWR).

State Water Project and Colorado River Aqueduct water reaches Metropolitan's service area through the two aqueducts shown on Figure 1-2 and described below:

- The Colorado River Aqueduct begins on the Colorado River at Lake Havasu and terminates at Lake Mathews.

- The California Aqueduct originates at the Harvey O. Banks Delta Pumping Plant and splits into the west and east branches of the California Aqueduct after passing through the Edmonston Pumping Plant. The west and east branches terminate at Castaic Lake and Lake Perris, respectively.

From Castaic Lake, Lake Perris, Lake Mathews and two other delivery points on the east branch, water is delivered to Metropolitan's member agencies via 775 miles of pipelines, five regional water treatment plants, and several smaller regulating reservoirs.

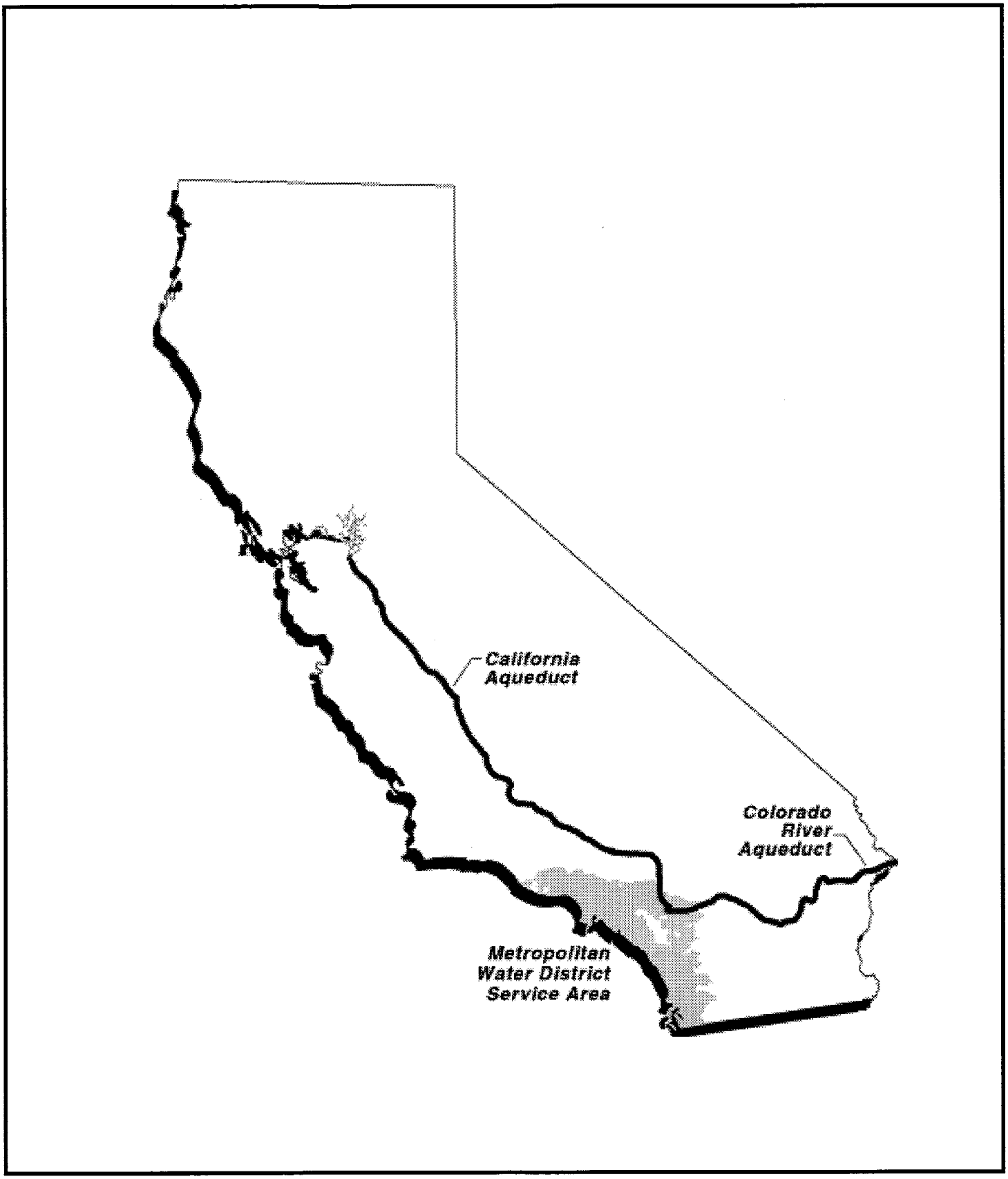
Water from these and other sources is delivered to about 240 cities and unincorporated municipalities in the 5,200 square-mile Metropolitan service area covering the six-county region of San Bernardino, Riverside, San Diego, Ventura, Los Angeles and Orange counties. Metropolitan currently provides approximately 60 percent of the total water used in its service area. Metropolitan also operates an extensive system of storage facilities, water conveyance facilities and water treatment plants in Southern California. Metropolitan and its 27 member agencies are leaders in the development and implementation of conservation technology, groundwater management and water recycling.

1.3 CADIZ PROJECT OVERVIEW

1.3.1 METROPOLITAN'S ROLE

Metropolitan is the primary supplier of supplemental water to approximately 16 million people in the six-county Southern California area. Metropolitan imports water from the Colorado River (via its Colorado River Aqueduct) and northern California's Sacramento/San Joaquin Bay Delta (via the State Water Project's California Aqueduct). The Cadiz Project, evaluated in this EIR/EIS, would enhance the management of water from the Colorado River.

The Cadiz Project would involve use of the aquifer system underlying a portion of the Cadiz and Fenner Valleys for storage of Metropolitan supplies from



Source: Metropolitan Water District (1999)

Figure 1-2

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Metropolitan's Main Supply Lines

the Colorado River for later recovery and use during dry years. In addition, indigenous groundwater from the aquifer system would be transferred to help Metropolitan to meet projected dry-year demands in its service area through 2020 and beyond.

Operation of the Cadiz Project would involve the storage of available Colorado River supplies not needed to meet demands in wet years. These supplies would be conveyed to the Cadiz Project spreading basins where this water would be percolated into the aquifer system.

The Cadiz Project would require that water in the Colorado River Aqueduct be pumped approximately 34 miles to the northwest of the existing Iron Mountain Pumping Plant. Construction of new pumping facilities, a conveyance facility (pipeline, or pipeline and canal and appurtenances), spreading basins and a wellfield would be necessary.

The Cadiz Project is needed to meet current and projected dry-year water demand through 2020 and beyond. By 2020, dry-year supplies from all existing sources for Metropolitan's service area will be approximately 1.5 million acre-feet (maf) below dry-year demand levels, even with full implementation of Metropolitan's aggressive program of water conservation measures. To meet this demand, Metropolitan has developed an integrated approach to obtain additional dry-year supplies that includes water recycling, groundwater banking, water transfers and other programs. The Cadiz Project is one element of Metropolitan's effort to meet dry-year demand.

1.3.2 BLM'S ROLE

The BLM holds title to and administers the use of vast areas of land in the vicinity of the Cadiz Project. Project water conveyance facilities and power distribution facilities will traverse these lands and will be in close proximity to designated wilderness areas. The CDCA Plan governs the use of these lands and guides the BLM in its decision making when new land use proposals are considered. In the case of the Cadiz Project, the BLM will consider the grant of a right-of-way to Metropolitan to allow Metropolitan to build certain Cadiz Project facilities on federal land. The BLM must also consider an amendment to the CDCA Plan, since the various water conveyance alignments evaluated for the Cadiz Project do not fall within existing designated utility corridors. These two actions are being considered concurrently, with this EIR/EIS providing the required environmental review documentation to meet NEPA mandates and to allow for informed decision-making.

1.4 PURPOSE OF EIR/EIS

The purpose of this EIR/EIS is to provide decision makers, public agencies and the general public with an objective and informational description and analysis of the Cadiz Project; and which fully discloses the potential environmental effects of the Cadiz Project. The EIR/EIS process is designed to facilitate the objective evaluation of potentially significant direct, indirect and cumulative impacts of the Cadiz Project alternatives; to provide analysis of the alternatives; to identify mitigation measures to lessen potential adverse impacts; and to

identify implementation procedures, responsibilities and timing for each mitigation measure.

Discussion of an issue in this EIR/EIS does not imply that a significant adverse impact would occur if the Cadiz Project were implemented. In many cases, the potential impacts discussed in this EIR/EIS would not be significant. The analyses of potentially significant impacts presented in this document are intended to demonstrate, document, and explain the processes leading to the conclusions reached in this EIR/EIS.

CEQA and NEPA specifically require that an EIR/EIS identify those potentially adverse impacts determined to be significant after mitigation. References in this EIR/EIS to the significance of adverse impacts by specific topical category such as geology or biology are made to fulfill the requirements of both CEQA and NEPA.

Metropolitan is the lead agency under CEQA for the EIR for the Cadiz Project. Metropolitan is responsible for the environmental and technical studies conducted for this project and would be responsible for the design, construction, operation and maintenance of the facilities constructed for the selected project alternative.

The BLM is the lead agency under NEPA for the EIS for this project. The BLM is responsible for the environmental and technical studies conducted for the Cadiz Project, for issuance of needed grants of right-of-way for the construction, operation and maintenance of the conveyance facilities included in the selected project alternative and for granting an amendment to the CDCA Plan to allow construction of the Cadiz Project outside an existing designated utility corridor. The latter is discussed in more detail in Section 5.2 (Land Use, Planning and Policies) of this EIR/EIS.

1.5 BACKGROUND TO THE EIR/EIS

As required under CEQA and NEPA, a Notice of Preparation (NOP) and Notice of Intent (NOI) were prepared and circulated for the Cadiz Project. The NOP and NOI indicated that the Cadiz Project would have the potential to have a significant adverse effect on the environment, and that an EIR/EIS should be prepared. The NOP and NOI are included in the Public Participation Report, incorporated by reference in this EIR/EIS.

The 45-day review period for the NOP and NOI ended on March 31, 1999. During this public review period, comments and input were solicited from all local jurisdictions and districts, and state and local governmental agencies that would affect or be affected by the Cadiz Project. Additionally, on May 4, 1999, a notice of public meeting and extension of the public comment period was published, adding a public meeting in the City of Needles and extending the public review and comment period for the Cadiz Project through May 30, 1999. Examples of agencies that received the NOP and NOI for the Cadiz Project include, but are not limited to, United States Army Corps of Engineers, United States Fish and Wildlife Service, California Department of Fish and Game, California Water Quality Control Board Colorado River Basin Region and

Mojave Desert Air Quality Management District.

In addition to the distribution of the NOP and NOI to these agencies, copies were also made available to the general public throughout the Cadiz Project area, to three area newspapers and to a number of service organizations and utilities. The distribution list for government agencies, the general public, newspapers and service organizations is provided in the Draft Environmental Impact Report/Environmental Impact Statement: Public Participation Report (Public Participation Report) referenced later in Section 1.11.

Approximately 150 copies of the NOP and NOI were distributed. Written comments received during the public scoping period for the NOP and NOI are contained in the Public Participation Report. Comments were received from a total of six agencies and 17 members of the general public. The written comments received in response to the NOP are summarized in the Draft Environmental Impact Report/Draft Environmental Impact Statement: Public Participation Report.

Three public scoping meetings were held on February 23 and 25 and May 10, 1999, to solicit input from agencies and members of the general public for consideration in this EIR/EIS. The presentations and public input at the scoping meetings are summarized in Section 11 (Public Involvement and Agencies and Persons Consulted), and are described in detail in the Draft Environmental Impact Report/ Environmental Impact Statement: Public Participation Report (Public Participation Report). Metropolitan and the BLM prepared this EIR/EIS based on the information in the NOP and NOI and on the issues raised during the public scoping process.

1.6 OVERVIEW OF PUBLIC COMMENTS

Many of the comments received at the scoping meetings and from written correspondence addressed similar issues of concern. A summary of the issues is provided here.

The inter-relationship of groundwater basins in the area. Will the Cadiz Project affect neighboring groundwater basins? Are the groundwater basins in the area hydrologically connected?

Water quality. What happens to water quality when you import Colorado River water into the groundwater basin?

Withdrawals of indigenous water during dry years. Will withdrawals of indigenous water impact the groundwater basin or the water supplies of neighboring communities?

Monitoring. Through what mechanism will the storage and withdrawal of water be monitored to ensure safe operation of the groundwater basin?

Evaporation. Will a large amount of water evaporate off the spreading basins during storage operations, and should injection wells be considered as an alternative?

Earthquakes. Could earthquakes create fractures within the neighboring groundwater basins, allowing stored Colorado River water to travel to those neighboring basins? Could the storage of water instigate future fault activity?

Endangered, threatened and sensitive species. What would be the Cadiz Project's potential impact on native plant and animal species? Would appropriate mitigation measures be implemented to offset adverse impacts?

Contingency Plans. Will there be a contingency plan to prevent flooding or erosion in the event of a failure of the water conveyance facilities?

Economic and population impacts. Are there any potential economic and population impacts in the Lower Colorado River Valley?

Use of Canals. Would the use of canals, as conveyance facilities, impact native animal species?

Cost. How much would the Cadiz Project cost, specifically the environmental documentation and who would bear those costs?

San Bernardino County. How will San Bernardino County residents benefit from this Project?

The following two comments were also received which are not environmental issues under CEQA and NEPA, and therefore are not addressed in this document.

California law and groundwater transfers. Will the proposed transfer of indigenous water meet all requirements under California law?

Relationship of Best, Best and Kreiger. Is there a conflict of interest because the firm of Best, Best and Krieger represents Metropolitan, the City of Needles and the County's Local Area Formation Commission?

1.7 EIR/EIS FORMAT

This EIR/EIS documents the process used to formulate alternatives and evaluates the potential environmental impacts of those Project alternatives and the No Project Alternative. It is organized to facilitate a basic understanding of the Cadiz Project alternatives and the potential environmental implications of their construction and operation. The following is a brief description of the sections contained in this EIR/EIS.

Section 1 describes the environmental analysis and compliance processes leading to the preparation of this EIR/EIS. Section 2 describes the purpose and need for the Cadiz Project, including objectives and specific issues and concerns related to the Cadiz Project identified during this environmental evaluation.

Section 3 describes the formulation and evaluation of potential alternative projects in increasingly detailed studies, beginning with the initial evaluation of an array of 13 potential alternative sites; narrowing to a more detailed evaluation of alternative operational scenarios and facility configurations, including review of possible alternative facility configurations, and operational scenarios. As part of this analysis, alternatives were evaluated progressively, ultimately being evaluated in a decision model that enabled a quantitative technical comparison of the alternatives on the basis of 27 independent criteria. These independent criteria included major categories of

engineering, geotechnical, operations, cost and environmental factors such as air quality, noise, traffic, biological resources, socioeconomics and cultural resources.

Section 4 describes the resulting four Cadiz Project alternatives and their operational scenarios in detail along with the No Project Alternative. The project alternatives carried forward for detailed analysis included various levels of storage and yield from the proposed water storage and transfer program as well as four distinct alternative alignments for water conveyance facilities shown on Figure 1-3. Sections 2 through 4 of this EIR/EIS, therefore, constitute a feasibility study that explains and documents the alternatives evaluation process and the results of that process.

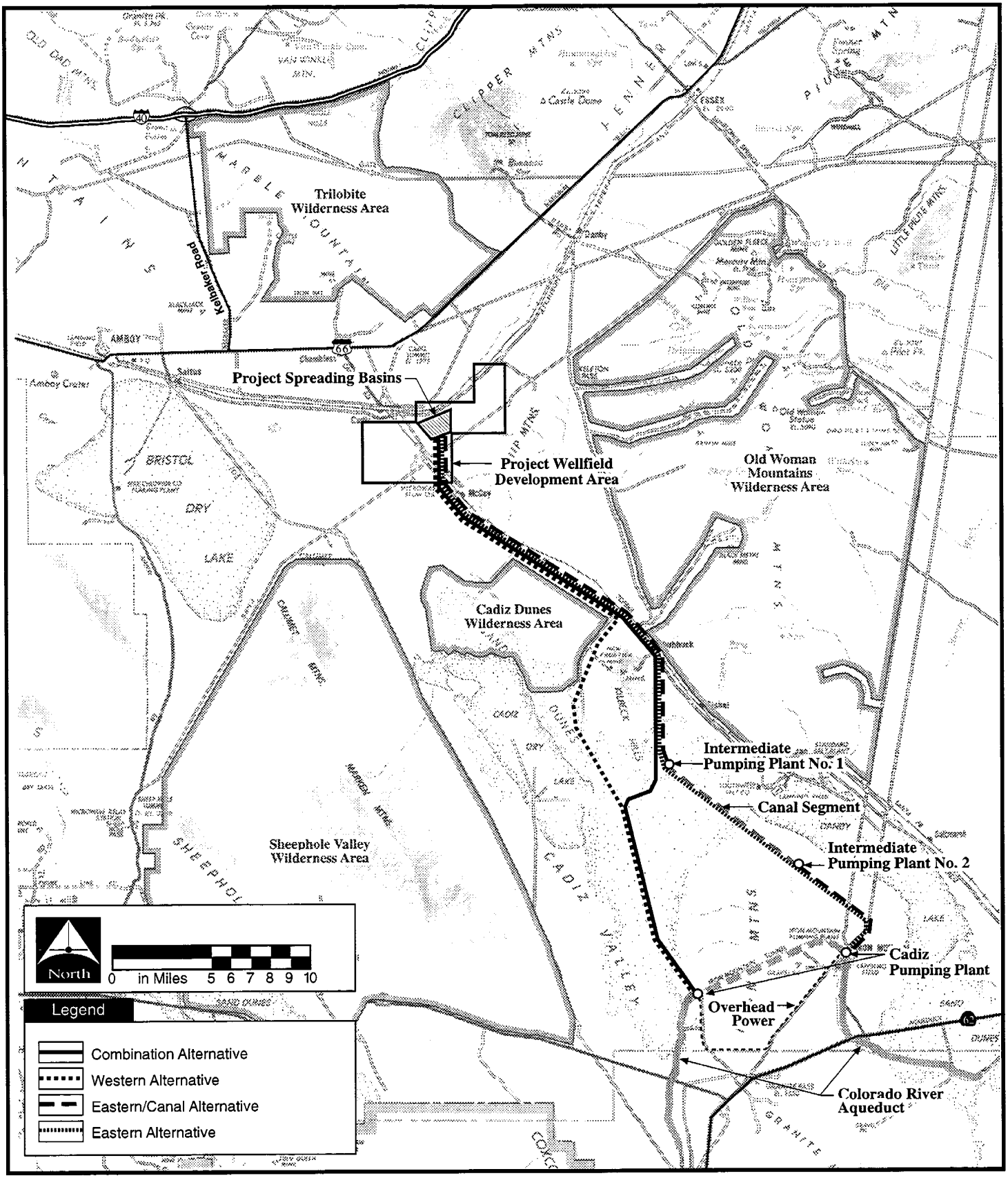
Section 5 describes the environmental setting in the Cadiz Project area and the potential environmental impacts of the Cadiz Project alternatives. The environmental conditions and impacts evaluated include agriculture; land use, planning and policies; socioeconomics; topography, geology, seismicity and soils; water resources; air quality; transportation; biological resources; energy and mineral resources; hazards and hazardous materials; noise; public services; utilities and service systems; aesthetics; cultural resources; paleontological resources; wilderness/recreation; environmental justice; and Indian Trust Assets. Mitigation measures were developed for each significant adverse impact identified in Section 5. The development of these measures was based on the objectives to avoid the potential for significant adverse impacts, minimize significant adverse impacts where avoidance was not possible, and to reduce those residual adverse effects that could not be avoided.

Section 6 addresses the potential growth-inducing impacts of the Cadiz Project. The potential cumulative effects of the Cadiz Project and other development projects in the area are identified in Section 7.

Section 8 lists the significant unavoidable adverse impacts that would result from implementation of the Cadiz Project. Section 9 discusses the relationship between short-term uses of the environment and the long-term maintenance and enhancement of productivity associated with the Cadiz Project. Section 10 summarizes the irreversible and irretrievable commitment of resources that could occur if the Cadiz Project were implemented.

Section 11 provides a detailed description of the public agency and public involvement process for the Cadiz Project; a listing of all the agencies, groups, and individuals consulted; and a description of the NOP/NOI and scoping processes. The comments received during this public input process are summarized in this section.

Section 12 provides a listing of the permits and agency approvals that would be necessary for implementation of the Cadiz Project. Section 13 lists the professional and technical staff who contributed to this EIR/EIS. Section 14 lists the references used in the development of the technical information for the EIR/EIS. Section 15



Source: P&D Consultants, Inc. (1999).

Figure 1-3

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Cadiz Project Alternatives

provides a glossary of the terms, acronyms and units of measurement used in the EIR/EIS.

The technical reports used for preparing the EIR/EIS, listed later in Section 1.11, are bound separately and are available for review at the Metropolitan Water District office located at 700 North Alameda Street, 9th Floor, Los Angeles, California and at the BLM offices in Needles (101 West Spike's Road, Needles, California) and Riverside (6221 Box Springs Boulevard, Riverside, California).

A separate Executive Summary is provided for those readers interested in an overview of the Cadiz Project, the alternatives analysis and the environmental evaluation. The Executive Summary is organized in parallel form to this EIR/EIS.

1.8 MITIGATION MONITORING PLAN

Pursuant to the California Public Resources Code (Section 21081.6) and State Assembly Bill AB 3180, a Mitigation Monitoring Plan would be developed to ensure the implementation of the mitigation measures identified in this EIR/EIS. The Metropolitan Board of Directors would adopt the Mitigation Monitoring Plan in conjunction with the findings required under CEQA, at the time the Board considers certification of the Final EIR. The Mitigation Monitoring Plan would include the following elements for the selected Cadiz Project alternative:

- All the mitigation measures identified in Section 5 of this EIR/ EIS;
- Any revisions to the mitigation measures developed during the preparation of the responses to comments on the Draft EIR/EIS;
- The party or parties responsible for the implementation of each measure;
- The timing of implementation of each measure;
- The standards or criteria necessary to determine the satisfactory implementation of each measure; and
- The documentation and reporting procedures for the Mitigation and Monitoring Plan.

The Mitigation Monitoring Plan will be included as part of the Final EIR/EIS.

1.9 PROJECT APPROVALS AND PERMITS

To construct the Cadiz Project, Metropolitan would be required to obtain permits and/or approvals from other agencies depending on the alternative selected. These agencies and possible permits or approvals may include, but are not limited to, those listed in Table 1-1.

1.10 FINAL EIR CERTIFICATION

Metropolitan is the CEQA lead agency for the EIR and has the responsibility for certifying the EIR, as adequate pursuant to CEQA, and implementing the Cadiz Project. In arriving at its decision whether to proceed with the Cadiz Project, the Metropolitan Board of Directors will consider the information in the EIR and will determine the adequacy of the environmental

TABLE 1-1
PERMITS THAT MAY BE REQUIRED

Federal Agencies	
United States Army Corps of Engineers	Section 404 permit pursuant to the Clean Water Act
United States Bureau of Land Management	Permits for use of land for geotechnical exploration Permits for construction areas and associated activity Right-of-way grant for conveyance facilities and power distribution line Amendment for an exception to the utility corridor requirements of the California Desert Conservation Area Plan
United States Fish and Wildlife Service	Section 7 consultation pursuant to the Endangered Species Act
State Agencies	
California Department of Fish and Game	Section 1601 permit pursuant to the Fish and Game Code (Streambed Alteration Agreement) Section 2081 permit or Section 2080.1 consistency determination pursuant to the California Endangered Species Act
Regional Water Quality Control Board	Permit for construction water discharge certification for placement of fill Clean Water Act Section 401 water quality certification for placement of fill
State Lands Commission	Construction easement (Western and Combination Alternatives)
Local/Regional Agencies	
Mojave Desert Air Quality Management District	Permits for stationary emissions sources

documentation under CEQA. In conjunction with EIR certification, the Board would consider the adoption of a Mitigation Monitoring Plan, to reduce or eliminate project-related impacts, and whether or not it must adopt a Statement of Overriding Considerations recognizing any significant adverse effects that can not be mitigated to below a level of significance. Following the certification of the EIR, CEQA provides for a 30-day period during which the public has an opportunity to challenge the Board's decision.

1.11 EIS RECORD OF DECISION

The BLM is the NEPA lead agency for the EIS and has the responsibility for publishing Records of Decision (ROD), granting a right-of-way and approving an amendment to the CDCA Plan. A ROD is a separate public record document that shows how environmental impacts and other factors were considered in the BLM's decision making process. It describes the decision made by the BLM, mitigation measures that may be required as part of the decision, all of the alternatives considered, the alternative(s) considered to be environmentally preferable, whether or not all practicable measures to reduce environmental harm were adopted and if not, why not. A ROD also summarizes the enforcement activities for the mitigation measures and is signed and dated by the authorizing BLM official. The ROD for the proposed action will not be signed

until 30 days or more after the release of the Final EIS. The public has an opportunity to protest to the Director of the BLM the proposed plan amendment during that 30-day period.

1.12 DOCUMENTS INCORPORATED BY REFERENCE

The following technical reports and other documents are hereby incorporated by reference in this EIR/EIS for the Cadiz Project:

- Cadiz Groundwater Storage and Dry-Year Supply Program, Draft Environmental Impact Report/Draft Environmental Impact Statement: Public Participation (Report No. 1161);

- Cadiz Groundwater Storage and Dry-Year Supply Program, Environmental Planning Technical Report: Project Feasibility and Facilities (Report No. 1162);

- Cadiz Groundwater Storage and Dry-Year Supply Program, Environmental Planning Technical Report: Groundwater Resources (Report No. 1163);

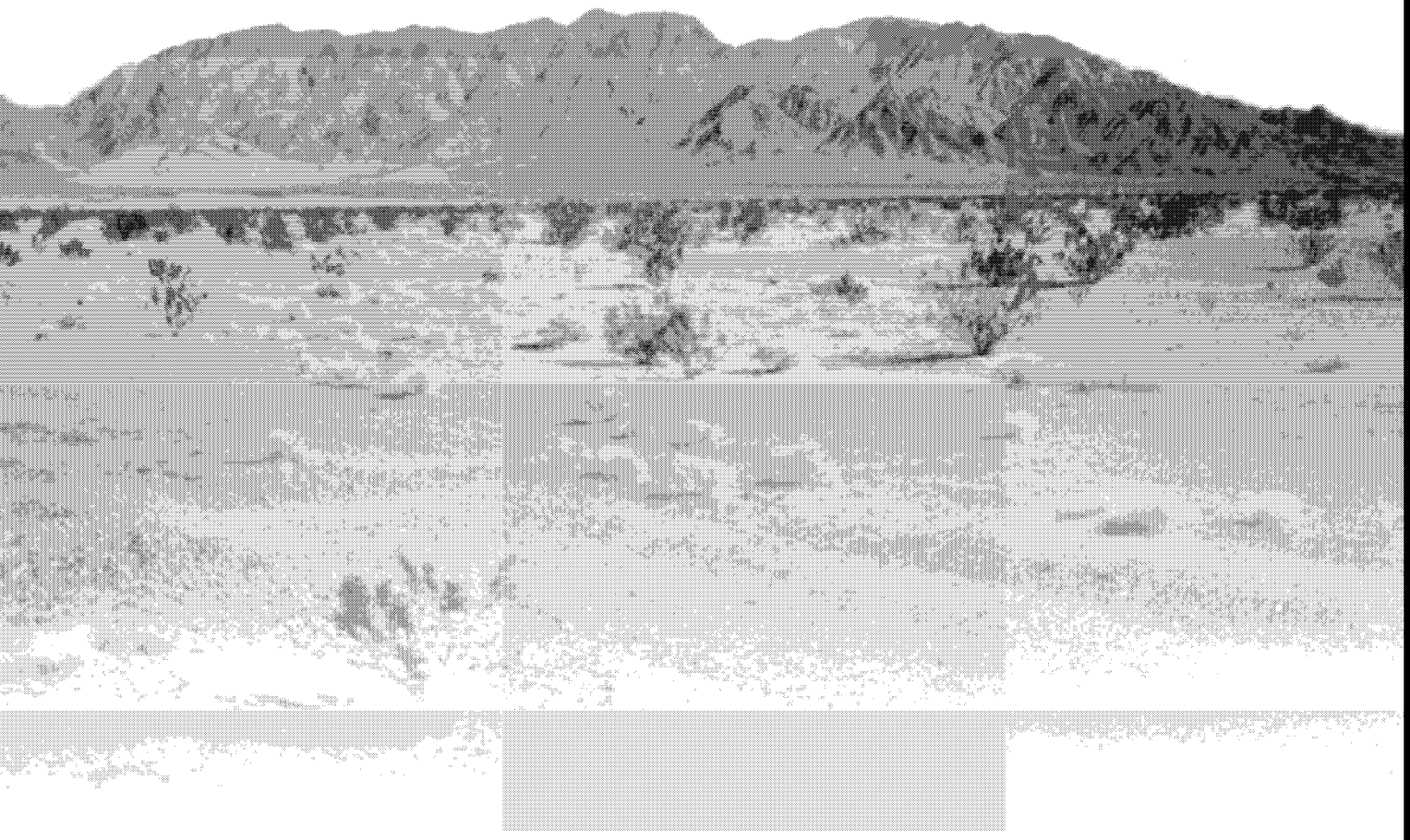
- Cadiz Groundwater Storage and Dry-Year Supply Program, Environmental Planning Technical Report: Biological Resources (Report No. 1164); and

- Cadiz Groundwater Storage and Dry-Year Supply Program, Environmental Planning Technical Report: Cultural Resources (Report No. 1165).

These reports are available for review at Metropolitan's office, 700 North Alameda, Los Angeles, California and at the BLM offices in Needles (101 West Spike's Road, Needles, CA) and Riverside (6221 Box Springs Boulevard, Riverside, CA).

SECTION 2.0

Assessment of Project Need and Purpose



SECTION 2.0
ASSESSMENT OF PROJECT NEED AND PURPOSE

2.1 GENERAL APPROACH TO NEEDS ASSESSMENT

Metropolitan assesses the need for future water supplies through a systematic and regularly updated analysis of water demands throughout its service area compared to water supplies available from a wide variety of sources. To quantify the need for supplies, Metropolitan uses official population projections and historical demand data, which are adjusted to reflect projected reductions in per capita demand resulting from implementation of water conservation measures. These minimum demands constitute the overall water supply need for Metropolitan's service area, shown on Figure 2-1.

Once demands are determined, Metropolitan evaluates the potential supplies available from all sources or "resource areas." The six major resource options evaluated are:

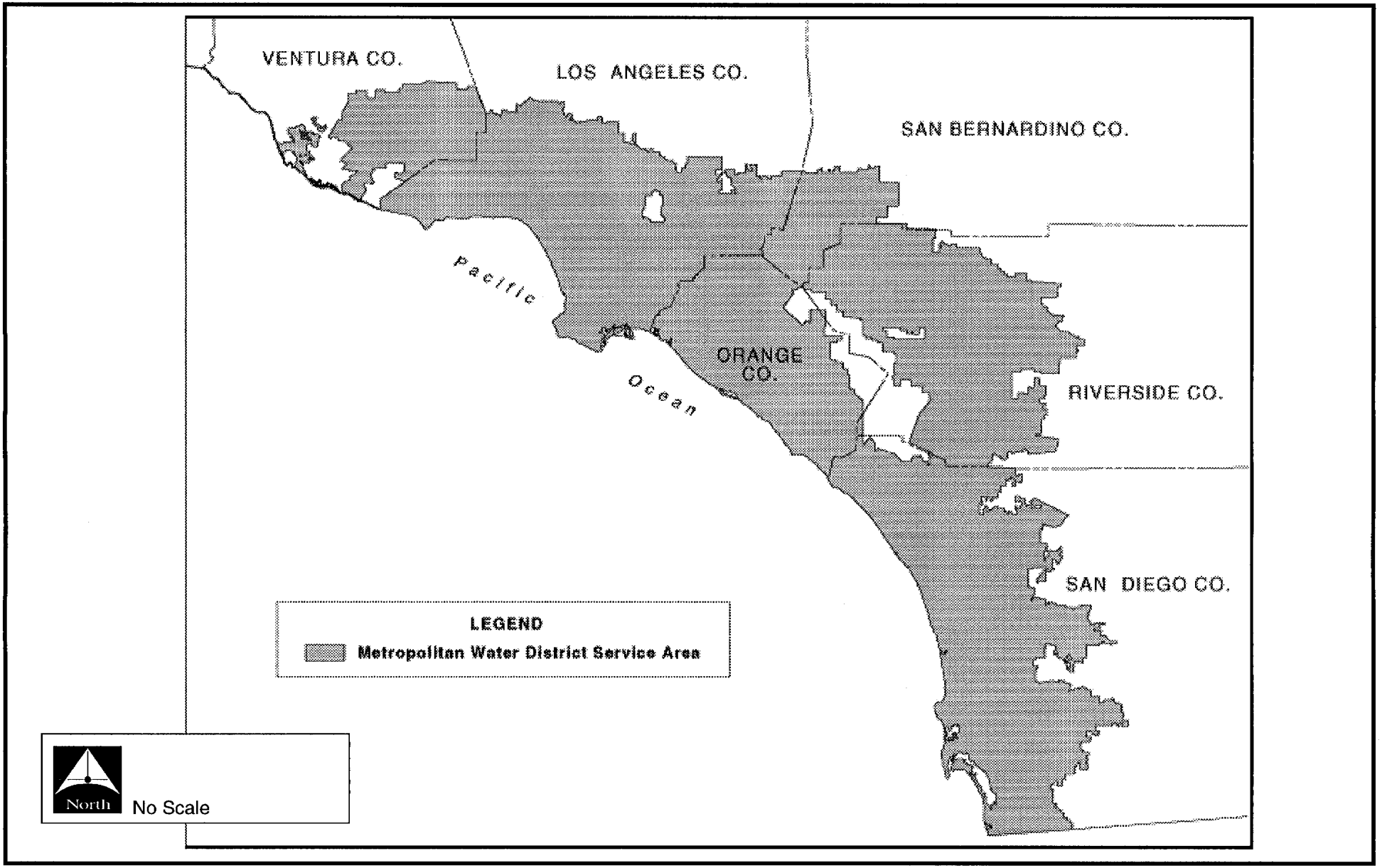
1. Water recycling and groundwater recovery;
2. Storage within the service area;
3. Central Valley transfers and groundwater storage;
4. State water project;
5. Ocean desalination; and
6. Colorado River.

Supply projections for the future are made based on historic data adjusted to reflect known trends. As an example, Metropolitan anticipates groundwater recovery and water recycling will yield about 500,000 acre-feet of supply in 2020. This projection is based on current levels of recycling, an analysis of yields from all currently proposed recycling projects, and an estimate of the potential yield from this resource area given general trends in the development of these programs.

This approach to analysis of supply leads to a general picture of future supplies, by type or resource area that includes three elements for each resource area:

a. Existing supplies;
b. Projected supplies from currently planned programs; and
c. Potential or "target" supplies from new programs.

Metropolitan then compares minimum demands to projected supplies from all areas. If this analysis shows a shortfall in supply, Metropolitan then determines how best to meet this need from the six resource areas listed earlier. In general, Metropolitan attempts to meet overall need in the most cost-effective manner feasible, by enhancing supplies from all feasible resource areas. The amount of supply that can be reasonably expected from each resource area is examined using a model which evaluates trends, potential programs and Metropolitan's ability to convey, distribute and blend supplies from each source to meet water supply and water quality objectives. Based on this



Source: Metropolitan Water District (1999).

Figure 2-1

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Metropolitan's Service Area

analysis, Metropolitan defines a "target" or "need" for new projects in each supply area.

Metropolitan's approach to planning for regional water supply reliability during dry years is based on implementation of a diverse range of resource investments and conservation measures. This approach is essential because: (1) a diversified approach helps ensure supply reliability and operational flexibility if supplies from any one source are temporarily disrupted; (2) diversification helps prevent overloading of any one element of the water conveyance and distribution system; and (3) distribution system capacity is optimally used if supply is derived from a variety of regions and sources. Meeting dry-year demands through 2020 therefore requires a diversity of sources in Metropolitan's service area and in Metropolitan's two major imported water supply areas, the Sacramento-San Joaquin Valley and the Colorado River.

Procurement of needed dry-year supply to meet 2020 dry-year demand that cannot be met by existing programs is, therefore, focused on determining supply targets and potential means of meeting these targets in six major resource option areas:

1. Water recycling and groundwater recovery;
2. Storage within the service area;
3. Central Valley transfers and groundwater storage;
4. State Water Project;
5. Ocean desalination; and
6. Colorado River.

2.2 DRY-YEAR WATER SUPPLY NEEDS

2.2.1 GENERAL

The rationing of water during the recent drought (1987-1992) underscores the necessity to improve Metropolitan's supply reliability, particularly in dry years. Metropolitan's approach to achieving dry-year supply reliability, outlined in the following paragraphs, is:

- Determining total dry-year demand for Metropolitan's service area;
- Identifying and quantifying existing supplies from all local and regional sources;
- Determining the need for additional supply;
- Evaluating resource options for procurement of this supply from all resource areas to determine appropriate targets for each resource area; and
- Identifying specific needs and objectives within each resource area.

In determining need and evaluating options for meeting that need, Metropolitan has focused on the period from 2000 to 2020, for which reliable, official projections of population growth and other demographic changes are available. Within this planning period, the need for dry-year supply enhancement and for diverse options to meet dry-year supply needs is evaluated in an integrated resources model as outlined below. Storage plays a significant role in meeting dry-year needs.

2.2.2 THE ROLE OF STORAGE

The role of storage in a water delivery system is to optimize existing resources by managing supply deliveries in order to provide assured water service, even during adverse and emergency circumstances. California's climate is characterized by alternating periods of wet and dry, with two-year drought periods occurring approximately once every six to eight years and extended drought, such as the 1987-1992 drought, occurring on a less frequent basis. Water supplies vary significantly from year to year as a result, and it is, therefore, essential for water agencies to proactively manage available supplies. In short, water supplies vary from greater abundance during wet years to reduced availability during dry years which may extend over several years. By developing new storage facilities, it is possible to reduce or avoid the effects of these natural events and the need for operating contingencies.

Adequate storage during periods of abundance is also needed to prevent and offset overdraft of local groundwater basins and surface storage during droughts. Southern California's groundwater basins were overdrawn by approximately 1.5 million acre-feet (maf) during the recent 1987-1992 drought. Several local surface water reservoirs, which capture runoff from adjacent watersheds and are operated by member agencies, were drawn down to approximately 50 to 65 percent full. If the drought had extended into the following year, increasingly severe shortages would have occurred. Therefore, it is vital to prepare for the next drought by developing additional storage programs.

Water storage programs are essential to water supply reliability for virtually all California water agencies, which rely on water stored during wet years for supply during dry years. For example, approximately 50 percent of the runoff in California's Central Valley is captured and stored in a system of reservoirs owned and operated by local, state and federal government agencies. Reservoirs on the Colorado River store approximately 60 maf and are an essential element of water supply programs for Arizona, Nevada and Southern California.

Currently, storage available to Metropolitan is inadequate to meet water needs in times of drought or emergency. Metropolitan has, therefore, pursued a program to enhance groundwater and surface storage capacity both within and outside its service area.

Metropolitan's commitment to storage as an element of a prudent water management strategy includes enhancement of groundwater and surface storage in Southern California, development of water banking programs in the San Joaquin Valley and enhancement of conveyance facilities. Metropolitan and its member agencies are also cooperating to enhance storage of water in groundwater basins in Metropolitan's service area to meet normal demands and to provide additional yield during periods of drought.

Enhancing groundwater storage is a critical element of this strategy because groundwater storage, when compared to surface storage alternatives, is relatively inexpensive, has fewer potential environmental impacts, and results in

significantly less evaporative losses. The use of groundwater storage reduces the need to draw on water supplies from environmentally sensitive areas such as the San Francisco Bay-Delta during drought periods. Metropolitan and its member agencies are actively pursuing the goal of enhancing groundwater storage throughout the Metropolitan service area, and local groundwater production capability in a dry year is anticipated to increase significantly as a result of these efforts. This enhanced yield will involve full use of virtually all useable groundwater storage capacity within the Metropolitan service area. Efforts to further enhance groundwater storage capacity must therefore be focused on areas outside the six-county Metropolitan service area, along the California Aqueduct in the San Joaquin Valley and/or the Colorado River Aqueduct between the Colorado River and the coastal plain of Southern California.

2.2.3 THE ROLE OF CONSERVATION

Conservation directly reduces per capita demand and thus reduces the need for dry-year supply enhancement. Metropolitan has assumed a leadership role in water management and is implementing a comprehensive package of conservation and water management programs to ensure its ability to meet current and projected demand in its service area under a full range of hydrologic conditions. The program includes implementation of:

- Enhanced water conservation; and
- Enhancement of existing supply through recycling and groundwater recovery.

These two elements of Metropolitan's overall water management program have already contributed significantly to reducing demand in all years. Metropolitan and its member agencies have contributed over $160 million to conservation programs involving retrofitting more than four million residential plumbing fixtures. The result of these and other programs described below has been a permanent reduction in demand of 480,000 acre-feet of water per year. The programs implemented by Metropolitan and its member agencies account for more than half of the water savings due to conservation in California.

2.2.4 THE ROLE OF TRANSFERS

Water transfers are also a major component of California's overall strategy for better management of available supplies. Water transfers involve changing the use of supplies in response to changing conditions. For example, farmers may install water conservation and water storage facilities which allow them to transfer part of the supplies they currently use to other users. During droughts, commercial, industrial, residential and certain agricultural users may be willing purchasers of transferred supplies because the consequences of rationing are not economically acceptable for such users. Transfers in drought years thus benefit the transferor by providing a higher economic return than could be gained by traditional use of the water and benefit the receiving party by enhancing water supply reliability or preventing an economic catastrophe that may otherwise result during a period of drought.

2.3 PROJECTION OF DRY-YEAR DEMAND: 2000-2020

2.3.1 GENERAL

Metropolitan's overall dry-year supply needs have been evaluated continuously in a series of studies beginning in 1988. These studies provide a flexible framework for the evaluation of Metropolitan's water transmission, storage and distribution system needs. As projects to meet defined needs are implemented and new potential projects are identified, they are factored into the analysis and needs are adjusted. In this way, Metropolitan's analysis of water supply and water quality reliability is constantly updated to reflect current and projected circumstances.

Estimates of dry-year demand are based on projections of water demands and groundwater replenishment needs, availability of existing supplies, blending of water resources to meet water quality standards, and the integrated operations of surface reservoirs and groundwater basins.

These studies currently show that Metropolitan needs to enhance its dry-year supplies through water storage and water transfers. In addition, they note that rapid population and water demand increases occurred in the 1980s and 1990s, despite significant reductions in per capita demand as a result of conservation programs, demographic shifts and land use changes. The most recent (1999) projections of dry-year demand have identified a minimum dry-year demand for Metropolitan's service area through 2020 of approximately 5.1 maf. The basis for this projection is detailed in the following sections.

2.3.2 SCAG, SANDAG AND DWR POPULATION PROJECTIONS

Metropolitan estimates its regional water demands based on the adopted population and growth plans of two regional government organizations: the Southern California Association of Governments (SCAG) and the San Diego Association of Governments (SANDAG). In addition, the California Department of Water Resources (DWR) projects statewide population and demographics as part of its process for projecting future water demands in California. Approximately every three years, SCAG and SANDAG convene elected officials from their respective areas and agree on population, housing, employment and land use (PHEL) objectives, along with a set of infrastructure plans needed to support those demographic objectives (SCAG 1997 and SANDAG 1997). The regional population, housing and jobs goals are allocated to various communities in such a way as to best meet jobs/housing balances, reduce vehicle miles traveled, and meet other social and resource goals. The SCAG and SANDAG adopted plans are used by virtually all regional agencies as the basis for regional planning for transportation, water and wastewater, compliance with federal air quality standards and related activities.

Metropolitan plans its water supply, storage, and delivery facilities to support the regional governments' adopted plans by matching its water demand forecasts to the SCAG and SANDAG goals. Since 1987, Metropolitan's water demand forecasting tool for this purpose has been the Institute for Water Resources-Municipal and Industrial Needs (IWR-MAIN) Water Use Forecasting System (United States Army Corps of Engineers (ACOE) 1987;

Planning and Management Consultants, Ltd. 1990a, 1990b, 1990c and 1991a). Metropolitan has adapted this system for use in Southern California as the MWD-MAIN System. MWD-MAIN projects future demands in the residential, commercial, industrial, public and other sectors. In projecting long-term water demands, the resulting MWD-MAIN system accounts for a wide variety of economic, demographic and climatic factors. Residential water demands reflect population, housing mix, household occupancy, housing values, weather conditions, price for water services and the implementation of conservation practices. Other urban water uses (such as irrigation of public parks and rights-of-way, fire-line use and system losses) are included in the public/unaccounted sector (Planning and Management Consultants Ltd. 1991a).

The population and water demand projections presented for Metropolitan's service area in Tables 2-1 and 2-2 are keyed to Metropolitan's member agencies shown on Figure 2-2. Table 2-1 shows the population projections for Metropolitan's service area. The greatest growth rates, in terms of percent increases, are projected to occur in San Bernardino and Riverside counties. The greatest numerical increases are projected to occur in developed areas such as Los Angeles and Orange counties.

The SCAG and SANDAG forecasts suggest that population in Metropolitan's service area will continue to represent approximately one-half of the state's total population. The SCAG and SANDAG projections indicate that population in the Metropolitan service area is expected to increase from 16.4 million in 1998 to approximately 19.1 million by 2010; an average of nearly 225,000 people per year. Population in 2020 is estimated at 21.3 million, an increase of similar magnitude but reflecting a lower percentage growth. These projections are higher than the 200,000 people per year annual growth observed through the 1970s to mid-1980s, but significantly lower than the 300,000 to 350,000 people per year annual growth of the late 1980s.

In addition to the SCAG and SANDAG demographic forecasts, the 1998 forecasts by DWR in its California Water Plan include population projections higher than the SCAG and SANDAG projections. Based on its higher population projections, DWR projects 2020 demand in excess of supply in both normal and drought years. The DWR projections for 2020 are several hundred thousand acre-feet higher than those used by Metropolitan.

The SCAG and SANDAG growth projections have historically under-estimated actual growth. In 1990, for example, SCAG and SANDAG projected average annual growth for the period from 1990 to 2010 at about 50,000 persons per year less than the actual growth so far. Forecasts of water demand and infrastructure requirements which are based on SCAG and SANDAG population projections have, therefore, historically also been conservative.

2.3.3 FORECASTS OF AGRICULTURAL WATER DEMAND

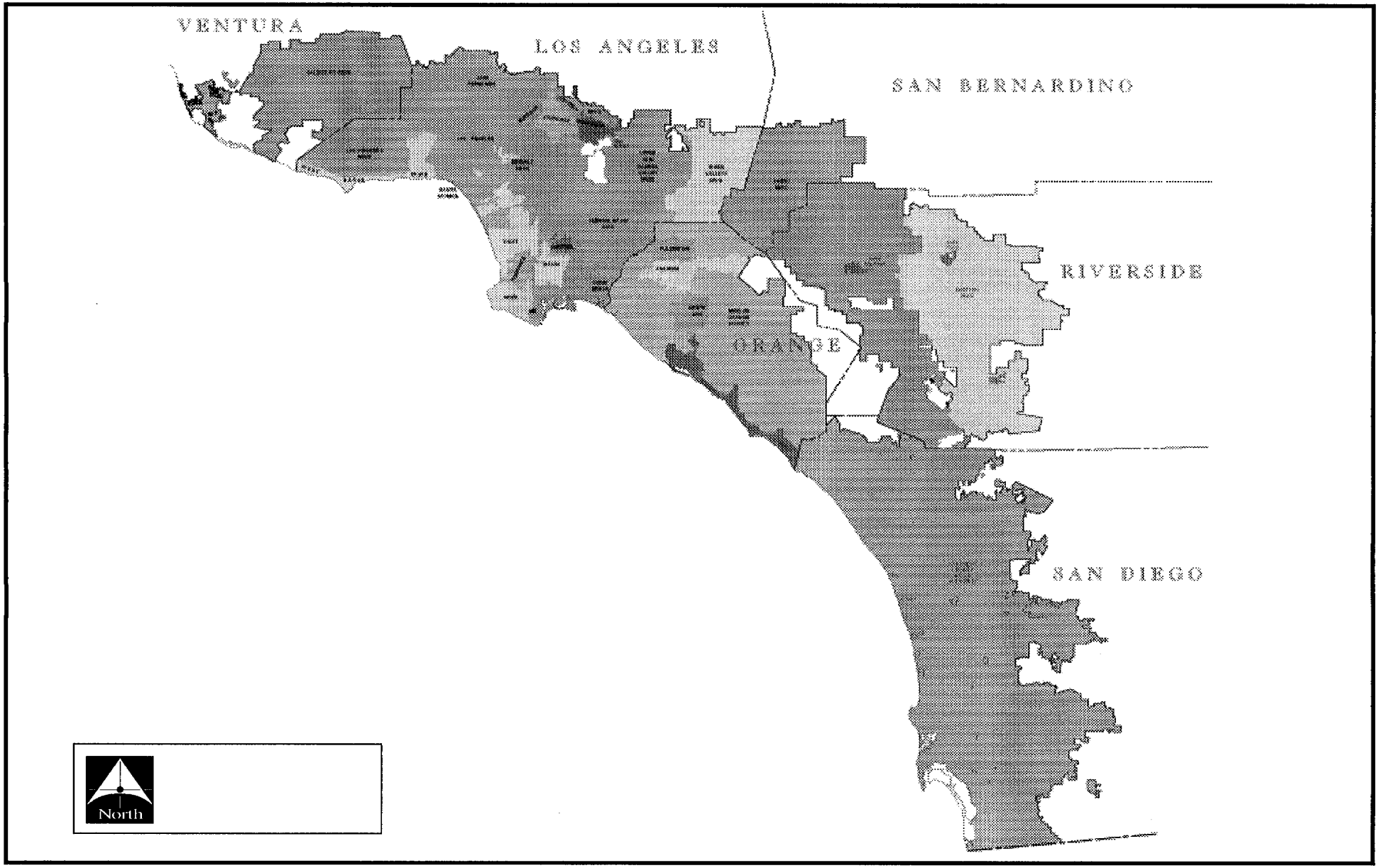
Metropolitan forecasts water demand based on current and projected per capita water demand in Metropolitan's member agencies, each of which has different

TABLE 2-1
PROJECTED POPULATION FOR THE METROPOLITAN SERVICE AREA

Agency	2000	2010	2020
Anaheim	345,000	395,700	423,900
Beverly Hills	40,500	41,700	43,000
Burbank	102,100	110,500	124,500
Calleguas	488,800	531,500	603,400
Central	1,524,100	1,601,500	1,721,200
Coastal	240,000	257,800	267,300
Compton	87,900	92,300	99,100
Eastern	525,300	785,600	1,020,600
Foothill	100,200	113,500	135,800
Fullerton	124,100	130,900	134,800
Glendale	183,400	194,500	213,100
Inland Empire	694,300	862,600	1,045,900
Las Virgenes	65,300	76,000	87,900
Long Beach	453,300	481,500	525,400
Los Angeles	3,826,700	4,268,900	4,847,000
MWDOC	1,828,800	1,984,500	2,073,800
Pasadena	139,700	151,400	171,000
San Diego	2,743,900	3,195,100	3,641,200
San Fernando	23,800	25,300	27,200
San Marino	13,300	13,600	14,000
Santa Ana	323,700	335,900	342,900
Santa Monica	91,900	94,700	98,000
Three Valleys	524,600	566,200	617,500
Torrance	130,700	134,000	138,900
Upper San Gabriel	863,300	922,700	997,600
West Basin	830,300	866,400	917,300
Western	669,200	832,300	979,700
MWD TOTAL	**16,984,200**	**19,066,600**	**21,312,000**

TABLE 2-2
PROJECTED DRY-YEAR RETAIL DEMAND IN METROPOLITAN'S SERVICE AREA
(ACRE-FEET)

Agency	2000	2010	2020
Anaheim	80,140	91,300	102,000
Beverly Hills	14,560	15,200	15,900
Burbank	25,930	30,400	33,600
Calleguas	135,900	149,300	168,900
Central Basin	271,160	288,200	309,500
Coastal	55,630	62,400	64,700
Compton	10,490	11,400	12,600
Eastern	213,290	281,500	338,800
Foothill	20,090	23,00	26,500
Fullerton	33,990	35,300	36,500
Glendale	32,820	35,500	38,800
Inland Empire	232,030	282,000	335,200
Las Virgenes	27,920	33,200	37,600
Long Beach	77,500	83,900	91,100
Los Angeles	680,600	748,600	833,900
MWDOC	481,400	534,100	572,400
Pasadena	39,500	42,800	47,000
San Diego	688,000	767,700	839,200
San Fernando	3,800	4,100	4,500
San Marino	7,150	7,400	7,700
Santa Ana	53,600	56,400	60,800
Santa Monica	15,700	16,400	18,000
Three Valleys	150,100	161,000	175,500
Torrance	33,600	36,400	40,700
Upper San Gabriel	200,000	218,000	232,800
West Basin	203,700	229,700	248,800
Western	318,300	352,800	384,000
Total	**4,106,900**	**4,598,000**	**5,082,000**



Source: Metropolitan Water District (1999).

Figure 2-2

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Metropolitan Member Agencies

climate, demographic, economic and development characteristics. In general, per capita demand is significantly higher in hot inland valleys. In addition, water use is affected by:

Trends in Household Characteristics

SCAG and SANDAG project that the number of households in the Metropolitan service area will increase from 5,290,000 in 1997 to 7,072,000 by 2020. However, the average number of persons per household was 2.97 in 1997 and is expected to increase to 3.05 in 2005 before falling to 2.96 in 2020, reflecting changing trends in family size and composition. More recent projections confirm these trends.

Industrial and Commercial Employment Projections

The 1997 SCAG and SANDAG projections estimated industrial employment to increase from 1,279,000 to 1,328,000 between 1997 and 2020. Commercial and institutional (government and services) employment was projected to increase much more rapidly, from 5,890,000 to 9,145,000 during the same period. Employment increases will be greater in commercial sectors than in industrial, especially in restaurants, hotels and tourism; hospitals and health care services; and schools, colleges and educational providers.

Geographic Growth Trends and Water Use within the Micro-Climates of Southern California

Historically, water use per household has been higher in the hotter, drier inland areas than in the colder, wetter coastal areas. Average per capita residential use ranges from 97 gallons per person per day (gpcd) on the coastal fringe to 123 gpcd on the coastal plains to 164 gpcd in the inland areas. An increasing percentage of the region's single-family dwelling units is expected to occur in inland areas, due to the greater availability and affordability of land, compared to coastal locations.

Type of Residence and Associated Trends in Indoor and Outdoor Uses

There are differences in water use for single- and multi-family residences, with single-family per capita residential use generally involving more outdoor use than multi-family residential use. Per capita use for residents in multi-family units is typically lower. Both SCAG and SANDAG have projected an increase in the percent of families living in multi-family units by 2020.

Seasonal Trends in Water Use

On average, base level use accounts for about 70 percent of total annual municipal and industrial use of water in Metropolitan's service area. During the period from April through October, water use increases, primarily due to greater use of water for irrigation during the dry summer months. This use above base level accounts for the remaining 30 percent of total annual use.

Water Pricing and Household Income

Water price and household income interact in predictable ways and these relationships are factored into Metropolitan's calculations of water demand. Higher incomes increase demand because consumers with greater discretionary income tend to acquire water using

appliances and larger housing lots, and increase irrigation of lawns and gardens. Recent (1999) projections suggest that real incomes will outpace growth in the price of water, resulting in an increase in per capita demand.

SCAG and SANDAG monitor trends in these factors, and they are incorporated into Metropolitan's water use forecasting model. The result is a water use projection that reflects projected changes in the key factors affecting municipal and industrial water use.

2.3.4 CURRENT AND PROJECTED CONSERVATION PROGRAMS

Metropolitan adjusts its demand projections to reflect existing and projected water savings. In addition to the water conservation programs described here, water recycling programs and other water conversation related programs are described in Section 2.4.4. A number of conservation programs are being aggressively pursued and implemented by Metropolitan and its member agencies. Several programs, including showerhead and toilet retrofitting, have been implemented region-wide since 1991. Metropolitan and its member agencies have contributed over $190 million to conservation programs which have involved retrofitting 1.2 million low-flow toilets and 3.2 million low-flow showerheads. The result of these and other programs described below has been a permanent reduction in demand of 560,000 acre-feet per year.

Current Programs

Long-term conservation efforts act to reduce or offset per capita water demand. Metropolitan promotes water conservation practices through pricing incentives that encourage efficient use of water in its service area; public information, education and major media campaigns; and financial incentives to retrofit residential and commercial buildings and industrial sites with water-conserving fixtures and to promote efficient irrigation practices.

Conservation Credits Program

At present, the primary vehicle for implementing water conservation projects in the Metropolitan service area is the Conservation Credits Program. Under this program, Metropolitan provides a financial incentive to its member agencies for the implementation of cost-effective conservation projects that have a demonstrated ability to save water. Metropolitan's incentive is based on the lesser of $154 per acre-foot of water saved over the life of the program or one-half the cost of the proposed program, whichever is less.

Public Information and Education Program

The primary element of Metropolitan's public information and education programs focuses on two goals:

1. Educating consumers on the benefits of water conservation; and

2. Providing consumers with information on how to conserve water.

The program is divided into six specific areas of concentration including: written publications, education programs, efficient landscaping programs and mass media campaigns. In recent years, Metropolitan

has made a substantial effort to enhance the effectiveness of public information campaigns promoting water conservation. Demonstrated results of these programs have allowed Metropolitan to further design and enhance mass media campaigns urging water conservation.

Research Program

Research efforts have focused on the best methods to implement residential water audits, residential leak detection, retrofit distribution and low-flow shower-head surveys by examining the implementation modes of these programs, their cost-effectiveness and consumer receptivity.

Projected Programs

Metropolitan has undertaken a number of studies regarding the effectiveness of additional conservation actions and has participated in the development of a statewide urban conservation plan, commonly referred to as Best Management Practices or BMPs. BMPs have served as the standard for water conservation throughout the state for almost 10 years and are nationally recognized. BMPs rely on the use of proven technologies to reduce water use, including an ambitious program to continue retrofitting residential, commercial, industrial and government facilities with water-saving devices for showers and toilets. The conservation plan also includes changes to the plumbing code to ensure that best available technology is applied to all new construction.

Under the BMP process, participating urban water agencies have implemented proven water conservation measures and developed and implemented new measures as they become feasible. In return for this commitment, environmental and public interest groups participating in the BMP process have generally agreed that BMP implementation provides the best available methods for water conservation implementation. It was also agreed that the State Water Resources Control Board should only use reliable estimates of conservation savings that have been developed through the BMP process. The primary vehicle for implementation of these practices is Metropolitan's Conservation Credits Program.

In addition to those BMPs already in implementation, there are a number of potential BMPs which must be shown to be technically and economically feasible, and socially acceptable, before a major commitment of resources for their implementation can be made. For those BMPs with limited performance data, Metropolitan has developed pilot programs which include technical and financial assistance to member agencies and sub-agencies, designed to evaluate and quantify performance characteristics for specific best management practices. The programs implemented to date have resulted in a net reduction in per capita demand of approximately 13 percent, compared to projected demand without their implementation.

Residential Retrofit Program

The indoor residential plumbing retrofit program is designed to reduce domestic water use. It involves replacing existing high-volume showerheads with more efficiently designed showerheads which limit the flow rate to less than 2.5 gallons per minute. It also involves retrofit of existing toilets with ultra-low flush toilets

to further reduce the volume of water used inside the residence.

Home Audit Program

The home water audit program is an evaluation of a homeowner's outdoor and indoor water use by a trained professional. Empirical data indicate a certain fraction of households account for disproportionate amounts of total residential water use in a given community. The home water audit savings are achieved by installing indoor retrofit devices, finding and repairing leaks, and by educating homeowners on efficient interior water use and exterior irrigation practices.

Leak Detection Program

The distribution system audits and leak detection program involves a thorough examination of the accuracy of water agency records and distribution system flow control equipment including pipes, meters, valves, hydrants and other system elements. The result of the water audit is used to financially justify the development and implementation of a leak detection and repair plan. Unaccounted water use may include authorized unmetered uses such as fire fighting, sewer flushing and street cleaning, and unauthorized uses include leakage, major breaks, illegal connections and under-registration of meters.

Landscape Water Audit Program

The landscape water audit program involves careful evaluation of water requirements and actual water use on large landscaped areas, including commercial/ industrial sites, parks, cemeteries and golf courses. It is designed to assist landscape managers in making more efficient use of water by correcting problems with irrigation systems and devising efficient irrigation schedules. Metropolitan will develop financial incentives and provide training for member agencies. Landscape requirements for new commercial, industrial and multi-family complexes are designed to promote the appropriate use of plants and turf in the landscape where appropriate, and advanced irrigation control systems and methods of irrigation. It is estimated that it would take five years for all the cities and counties in the service area to adopt and implement landscape ordinances into their building permit approval processes. Metropolitan will provide staff assistance to local agencies that implement this practice and will work on legislation in support of landscaping ordinances.

Code Enforcement

Since 1992, California plumbing code has required that low-flow showerheads and 1.6 gallon-per-flush toilets be used in all new or remodeled buildings. Because water savings from this measure can be expected only if builders comply with the law, Metropolitan has assisted its member agencies and sub-agencies in providing adequate enforcement of this law. The goal of this BMP is to achieve 95 percent or higher compliance in new construction and industrial sites with water-conserving fixtures.

Conservation Effectiveness

In addition to existing conservation, Metropolitan projects 500,000 acre-feet in new conservation savings by 2020. New programs will be developed to accomplish the remaining projected reduction (164,000 acre-feet per year). The

extension of existing programs and the implementation of new programs will result in a reduction in average per capita water usage in Metropolitan's service area from 220 gpcd to 192 gpcd, a reduction of 13 percent. These results will be achieved despite a shift in population growth from the cooler coastal plain to hotter and drier inland valleys. Because rationing is not a permanent measure and can have significant economic and social costs and impacts, rationing is not a feature of Metropolitan's program of BMPs and would be implemented only in periods of extreme water shortages.

2.3.5 MUNICIPAL, INDUSTRIAL AND AGRICULTURAL DEMANDS

Because Metropolitan's demand projections are adjusted to reflect not only current water savings from conservation programs, but also to reflect projected savings from even more progressive programs in the future, demand calculations are considered to be minimum projections of demand.

To further define projected water demands, Metropolitan uses an adjusted water demand model developed by the ACOE Institute of Water Resources (ACOE-IWR). This econometric model was first developed in the early 1960s and was extensively updated for the ACOE in the 1980s (ACOE 1987). Metropolitan has adjusted this model by calibrating it to Metropolitan's service area.

In projecting long-term water demands, the resulting MWD-MAIN system accounts for a wide variety of economic, demographic and climatic factors. Residential water demands reflect population, housing mix, household occupancy, housing values, weather conditions, price for water services and the implementation of conservation practices. Other urban water uses (such as irrigation of public parks and rights-of-way, fire-line use and system losses) are included in the public/unaccounted sector (Planning and Management Consultants Ltd. 1991a).

Agricultural water use is a relatively small part of total water use in Metropolitan's service area. It currently accounts for about 10 percent of total service area demands, and is projected to decline over time as agricultural lands are converted to urban uses. The projections are based on Metropolitan studies of historic trends, discussions with member agencies, and detailed area studies in some regions.

2.3.6 TOTAL DRY-YEAR DEMAND IN THE METROPOLITAN SERVICE AREA

Based on these analyses, baseline dry-year retail demand projections for 2010 and 2020, adjusted to reflect projected conservation savings, are 4,598,000 acre-feet and 5,082,000 acre-feet respectively (Table 2-2). In addition, if supplies are available, there will be an additional wholesale demand for supplies to replenish in-service area groundwater supplies with imported water.

2.4 EXISTING DRY-YEAR SUPPLY FROM ALL SOURCES

2.4.1 GENERAL

The first step in determining the need for additional dry-year supplies is to identify and project supply from existing sources and programs. In determining the supply

currently available to meet dry-year demands, Metropolitan projects dry-year supplies from all currently available sources, using historical data and data related to existing and projected law and regulation to estimate firm yield from each of the following sources:

1. Metropolitan's State Water Project contract entitlements from northern California, as permitted by the State Water Resources Control Board (SWRCB);

2. Metropolitan's Colorado River Compact allocation and other existing Colorado River programs; and

3. Other programs, including:

    a. Potential water transfers between agricultural water districts in the Colorado River Resource Area or the Central Valley Resource Area and Metropolitan;

    b. Desalinated water from projects in Metropolitan's service area or from desalination of agricultural drainage water in the Central Valley Resource Area and/or the Colorado River Resource Area;

    c. Storage in the service area; and

    d. Water recycling and groundwater recovery.

2.4.2 METROPOLITAN'S EXISTING STATE WATER PROJECT CONTRACT ENTITLEMENTS

Metropolitan obtains imported water supplies from the California Aqueduct, a facility of the State Water Project operated by the Department of Water Resources. State Water Project entitlements, as well as agricultural transfer or exchange water, are conveyed to Metropolitan through the California Aqueduct.

For the State Water Project, dependable (or dry-year) supply is defined as the average annual supply which could be expected if there were a recurrence of the hydrologic conditions that occurred during the critical seven-year drought from 1928 to 1934. Metropolitan's portion of the State Water Project's current dependable supply is about 1.14 maf per year. However, should a repeat of critical period drought occur, water supplies could be substantially less than the seven-year average; thus dependable supplies would be reduced. During the six-year drought from 1987 to 1992, dependable supplies were found to be lower than projected. As a result, the definition of the State Water Project dependable supply is being reevaluated.

In addition, the SWRCB, as a part of its hearings on the San Francisco Bay/Sacramento-San Joaquin Delta, is developing terms and conditions for the export of water from the Delta, which could change the present amount of water available to the State Water Project and other users of this resource.

Since 1987, when the SWRCB began hearings to review the existing standards and to adopt new standards protecting the beneficial uses of water from the Delta and San Francisco Bay, efforts to enhance water supply reliability, water quality (in-stream water quality and water supply water quality), ecosystem restoration and levee stability have been underway. This effort began under the SWRCB, and has

continued under the State-Federal CALFED Bay-Delta Program. One significant result of the SWRCB process was the 1994 Bay-Delta Accord, an interim plan for protecting Bay-Delta resources and ensuring reliable water supplies and water quality. Metropolitan was a leader in this effort and in the establishment of the CALFED Bay-Delta process.

The outcome of the CALFED Bay-Delta Program and future regulatory requirements under state and/or federal endangered species laws and regulations is uncertain. To the extent that reduction in exports from the Delta area or increased reservoir releases are considered, new water rights decisions would be required from the SWRCB, which would reduce the amount of water for State Water Project contractors, including Metropolitan.

Although Metropolitan is looking forward to resolution of dry-year State Water Project water supply problems in the long term, current dry-year supplies available to Metropolitan from the State Water Project are projected to be 450,000 acre-feet per year.

2.4.3 EXISTING COLORADO RIVER CONTRACT ALLOCATIONS

Metropolitan's entitlement to water from the Colorado River is governed primarily by four factors:

1. A 1931 agreement establishing delivery priorities among various California water users;

2. Its 1930, 1931, 1946 and 1987 contracts with the United States for delivery of Colorado River Water;

3. 1964, 1979 and 1984 United States Supreme Court decrees (Arizona v. California); and

4. The United States Secretary of the Interior's criteria for coordinated long-range operation of Colorado River reservoirs (operating criteria).

In addition to these factors, Metropolitan and others are participating in the development of a "Lower Colorado River Multi-Species Conservation Plan" (LCR-MSCP). While the outcome of the LCR-MSCP and future regulatory requirements under state and/or federal endangered species laws and regulations is uncertain, it is assumed for planning purposes that all the Cadiz Project alternatives considered here would be consistent with, and would contribute to, the objectives of the LCR-MSCP.

Historically, Metropolitan's delivery contracts with the United States Department of the Interior have allowed diversion of 1.2 maf per year, and an additional 180,000 acre-feet per year of surplus water when available. With commencement of operation of the Central Arizona Project in 1985, Metropolitan's ability to divert water on a dependable (dry-year) basis was reduced to 550,000 acre-feet per year. Arizona and Nevada are also increasing their use of Colorado River water in all years, potentially resulting in a reduction in the amount of water available for use in California under all conditions. Metropolitan's delivery priority for supplies to California is also last, and is for 550,000 acre-feet.

In 1988, Metropolitan entered into a water conservation agreement with the Imperial Irrigation District (IID), another user of Colorado River water. Under this agreement, Metropolitan funds specified conservation projects in the IID service area in return for which Metropolitan is entitled to divert the water conserved. When the conservation projects are fully implemented, Metropolitan would be entitled to divert approximately 106,000 acre-feet per year. This would increase Metropolitan's dependable supplies from the Colorado River to 656,000 acre-feet per year.

2.4.4 OTHER EXISTING PROGRAMS TO MEET WATER SUPPLY AND WATER QUALITY OBJECTIVES

In addition to yield from Metropolitan's contract allocations from the State Water Project and the Colorado River, dry-year demand is offset by a number of existing programs that provide reliable short-term supply during dry periods, but are not a part of normal-year supplies. They include water recycling, groundwater recovery, in-service area storage and Central Valley transfers and storage. As outlined below, these existing programs are projected to add about 840,000 acre-feet of firm supply by 2020.

Water Recycling and Groundwater Recovery

Recycled water has been used in Metropolitan's service area for decades, and over 50 percent of all water recycling in California occurs in Metropolitan's service area. Recycled water and groundwater recovery programs fall into three categories as described in the following sections.

Direct Use of Recycled (Treated) Water

This form of water recycling involves treating wastewater and conveying it in separate distribution systems for uses such as irrigation of golf courses and parkland, and industrial uses such as power plant cooling. At present, direct application of recycled water is limited to such non-potable uses by California Department of Health Services regulations.

Groundwater Replenishment

Recycled water can also be used to replenish groundwater basins and to control salt-water intrusion along Southern California's coastal plain. These uses enhance the overall water supply available during all years by increasing the availability of groundwater supplies.

Groundwater Desalination

Groundwater with high levels of total dissolved solids (TDS) is generally not suitable for domestic or agricultural use, and also has limited industrial applications. Groundwater with TDS levels in the range of 2,000 milligrams per liter (mg/L) can, however, be desalinated at a cost well below that of ocean-water, which has TDS levels of over 10,000 mg/L. Groundwater desalination is not currently a major component of water supply in Southern California, but it is anticipated to become a more important component in the future.

Combined, brackish groundwater desalination and water recycling have increased existing in-service area water production by 230,000 acre-feet per year. Water recycling and brackish groundwater desalination provide permanent benefits and help to meet demand in all year types.

In-Service Area Surface Storage

Under the Monterey Agreement, which governs use of State Water Project supplies and facilities, a portion of storage in the DWR reservoirs at Lake Castaic and Lake Perris is dedicated to meeting dry-year needs. Groundwater storage programs implemented cooperatively by Metro-politan and its member agencies supplement this surface storage. In addition, Metropolitan has existing storage at Lake Mathews and Lake Skinner. Total projected in-basin storage, shown on Table 2-3, is approximately 1,761,200 acre-feet. However, 400,000 acre-feet of Eastside Reservoir storage is dedicated to emergency use, leaving 400,200 acre-feet of storage capacity dedicated to drought storage. Total in-service area drought storage is, therefore, approximately 1,361,200 acre-feet. Assuming a three-year drought period and some loss of storage capacity due to evaporation during the drought period, annual dry-year yield from existing storage is approximately 390,000 acre-feet.

Central Valley Transfers and Groundwater Storage

Metropolitan has actively pursued voluntary water transfer and storage programs in the Central Valley and has implemented two storage programs, the Semitropic and Arvin-Edison dry-year water banking programs. Under these programs, Metropolitan contributes to the development of groundwater banking facilities and conveys State Water Project and other available water supplies to these banking sites. As of 1999, total storage in these two groundwater banks was

TABLE 2-3
EXISTING IN-SERVICE AREA SURFACE STORAGE AVAILABLE TO METROPOLITAN AND MEMBER AGENCIES (acre-feet)

Reservoir	Total Storage	Dead Storage	Storage Allocated to Others	Storage Available
Pyramid	171,200	4,800	5,300	161,100
Castaic	323,700	18,600	11,400	293,800
Elderberry Forebay	28,200	200	0	28,000
Silverwood	75,000	4,000	24,900	46,100
Lake Perris	124,000	3,500	0	120,000
Lake Mathews	182,000	3,500	0	178,500
Lake Skinner	44,000	200	0	43,800
Eastside	800,000	0	0	800,000
New SDCWA Reservoir	90,000	0	0	90,000
Total	**1,838,000**	**35,300**	**41,600**	**1,761,200**

approximately 550,000 acre-feet, with an anticipated dry-year yield of 140,000 acre-feet.

Existing Local Dry Year Supplies

Local water supplies consist of local groundwater, local surface water, recycled water, recovered groundwater and Department of Water and Power DWP water imported by the City of Los Angeles via the Los Angeles Aqueduct.

Local Groundwater Supplies

Local groundwater production constitutes about 90 percent of the natural local water supply in Southern California. Groundwater basins are replenished through a combination of natural percolation, temporary retention in flood control reservoirs, and diversion into groundwater spreading basins. The major groundwater basins located in Metropolitan's service area are shown in Figure 2-3, and operated by local agencies. The dependability of supply from this source is affected by several factors, one of which is contamination of groundwater basins. Efforts to solve contamination problems in several large groundwater basins are underway and will result in enhanced supply reliability in the future. From 1980 to 1996, groundwater production in Metropolitan's service area varied from a low of 1.1 maf in 1993 to a high of 1.4 maf in 1996.

Metropolitan has an on-going Groundwater Recovery Program that provides its member agencies with incentives to recover and treat contaminated groundwater. This program will expand dependable local water supplies by developing otherwise unusable contaminated supplies for use in conjunction with imported supplies.

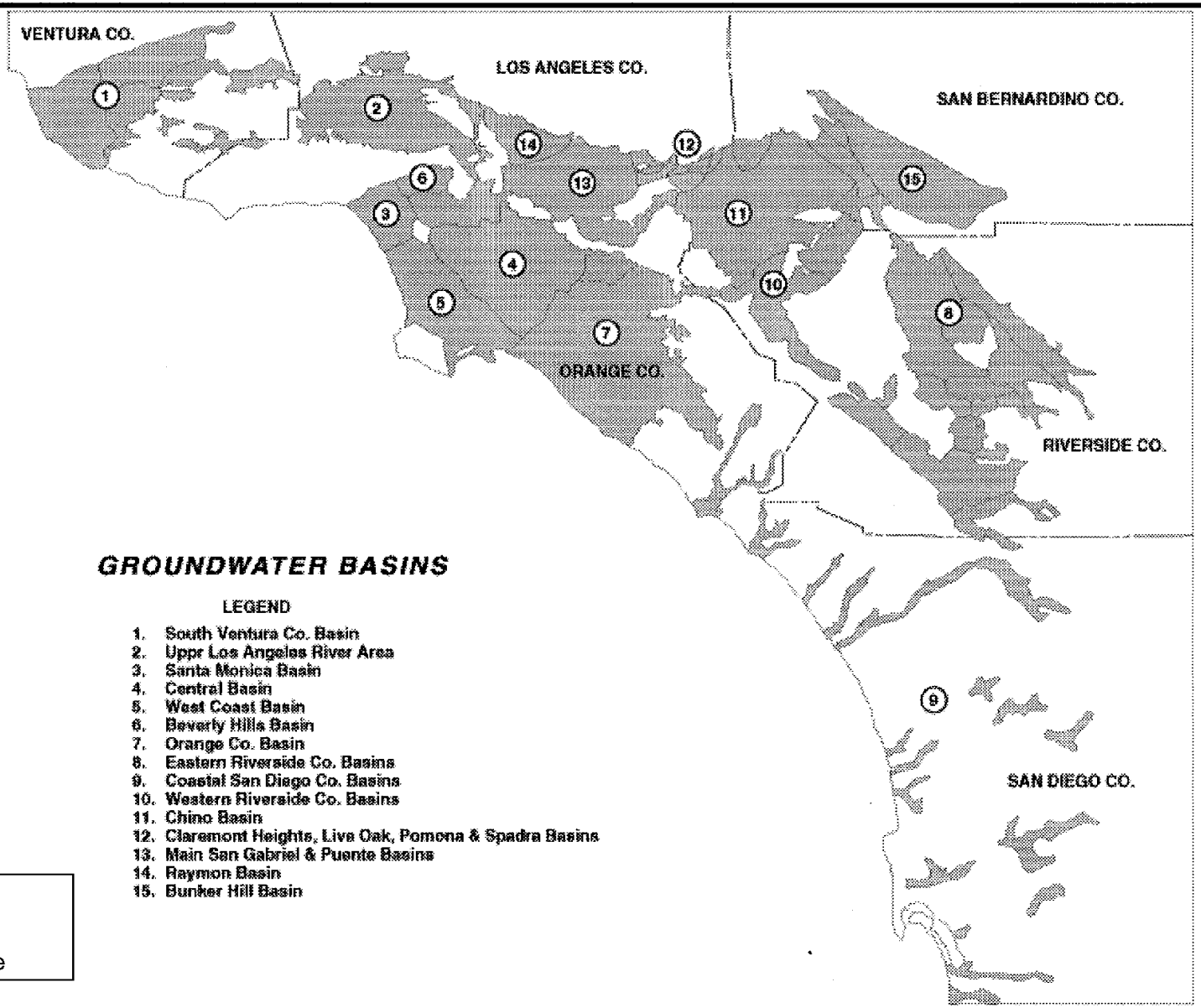
As a result of enhanced groundwater management, reliable yield from local groundwater basins is projected to increase from 1.27 maf to about 1.31 maf by 2010 and 1.34 maf in 2020.

Local Surface Water Production

Local agencies in the Southern California coastal plain maintain a number of surface reservoirs in local watersheds. From 1980 to 1996, yield from these reservoirs ranged from a low of 75,000 acre-feet in 1990 to a high of 207,000 acre-feet in 1984 (following the 1983 El Niño year). Reliable dry-year supply is assumed to be approximately 76,500 acre-feet.

Los Angeles Aqueduct Supply

Since 1914, the DWP has imported water supplies from the watershed of the Eastern Sierra Nevada Mountains via the Los Angeles Aqueduct. From 1980 to 1996, the annual supply from this source ranged from 106,000 acre-feet to over 518,000 acre-feet. Currently, reliable dry-year supply is estimated at about 215,000 acre-feet. This supply estimate reflects resolution of environmental disputes in the Mono Lake and Owens Valley areas, as well as the yield anticipated from a long term groundwater management program in the Owens Valley.



Source: Metropolitan (1999).

Figure 2-3

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Major Groundwater Basins Within Metropolitan's Service Area

2.4.5 TOTAL PROJECTED 2020 DRY-YEAR SUPPLY FROM EXISTING PROGRAMS

As Table 2-4 shows, the projected total dry-year yield from all existing sources, based on full implementation of water management programs through the year 2020, is approximately 3,494,000 acre-feet.

TABLE 2-4
EXISTING DRY-YEAR SUPPLIES IN 2020
(acre-feet)

Source	Yield
Metropolitan State Water Project	450,000
Metropolitan Colorado River Aqueduct	656,000
In-Service Area Storage	390,000
Groundwater Recovery	230,000
Central Valley Banking	140,000
Local Groundwater	1,336,500
Local Surface water	76,500
Los Angeles Aqueduct	215,000
Total Projected Supply	**3,494,000**

2.5 METROPOLITAN'S INTEGRATED PROGRAM TO MEET 2020 DRY-YEAR DEMANDS

In November 1997, Metropolitan initiated a process to secure supplemental water supplies and regional storage to meet dry-year demands. This process reflects the broad, statewide acceptance of the role of storage and transfers as a primary focus of water management programs to meet urban demands in dry years. The process involved establishment of overall targets for six resource areas:

1. Water recycling and groundwater recovery;
2. Storage within the service area;
3. Central Valley transfers and groundwater storage;
4. State Water Project;
5. Ocean Desalination; and
6. Colorado River.

As noted earlier, the targets for each resource area are based on an integrated model that takes into account:

1. Potential supplies;
2. Potential storage capacity; and
3. Available conveyance capacity for delivery of supplies to Metropolitan.

Potential supply sources in the six resource areas were identified independently by Metropolitan and through proposals from the public and private entities.

Based on the concurrent analysis of supply availability and storage and conveyance capacity, the integrated resource model provided data which allowed targets to be set for each major resource option. Once potential supply sources were identified and the qualifications of the potential providers were assured, each potential source was evaluated to determine: (1) regional need and economic value; (2) financial, legal and regulatory feasibility; and (3) potential for implementation.

Metropolitan then initiated a public review process to solicit and evaluate specific proposals for projects to meet resource procurement targets in each major resource option area. Proposals were received from both public and private entities. A committee composed of Metropolitan Board members and member agency General Managers conducted a series of publicly noticed and advertised meetings. A technical review panel of independent experts advised the committee as to the technical feasibility of individual proposals. The committee evaluated all proposals received and made advisory recommendations to the Metropolitan Board of Directors. Some proposals were determined to be infeasible because of costs or hydrologic, geotechnical or engineering issues, and were eliminated from further consideration. Proposals that were determined to be potentially feasible were carried forward for more detailed evaluation. At a future date, additional proposals may be solicited or developed if the potentially feasible options are inadequate to meet the target for each resource option area or are determined to be infeasible during detailed studies.

This integrated approach to resource procurement to meet dry-year demand in 2020 has resulted in development of quantitative targets for each of the resource option areas and more detailed evaluation of specific projects in each area. The specific proposals received for each major resource option preliminarily indicate that it would be feasible to meet overall targets, and provide a basis for projections of the potential dry-year supply from each resource option area. It is important to note that each resource option area represents a distinct source of potential dry-year supply and that meeting the overall quantitative targets for all resource option areas would be necessary to meet the projected dry-year demand in 2020.

2.5.1 PROJECTED DRY-YEAR YIELDS FOR NON-COLORADO RIVER RESOURCE AREAS

Targets for Water Recycling and Groundwater Recovery

Existing recycling and groundwater recovery programs are currently producing 230,000 acre-feet per year. Yield from these existing programs would rise to 375,000 acre-feet per year by 2020. In 1998, Metropolitan executed a Request for Proposals under its Local Resources Program to develop 53,000 acre-feet of new project yield. Based on proposals submitted, Metropolitan anticipates that this objective could be met in the near future and that the yield from this program would be approximately 428,000 acre-feet by 2010. Metropolitan has established a target of 500,000 acre-feet from the program by 2020, or an additional yield of 125,000 acre-feet compared to projected yield from existing programs.

Targets for Local Groundwater Storage

In addition to the 390,000 acre-feet of annual yield from dry-year storage currently available, the North Las Posas Basin groundwater storage project is scheduled to be completed by 2005. This project would add 210,000 acre-feet in storage with an annual yield of 70,000 acre-feet. Finally, four projects are currently under study (Raymond Basin - in planning and development, Orange County Basin - specific proposals being

studied, Chino Basin - in planning and development, Central/West Basin - studies underway), which in combination are anticipated to yield 450,000 acre-feet storage with an annual yield of 150,000 acre-feet.

The net effect of these programs would be to add 660,000 acre-feet of dry-year storage to Metropolitan's current storage capacity. Prudent use of this storage would involve delivery over a three-year period, with an annual dry-year yield of about 220,000 acre-feet.

Targets for Central Valley Transfers and Groundwater Storage

For the first decade of the 21st century, Metropolitan has established a target of 180,000 acre-feet of new dry-year yield from Central Valley transfers and groundwater storage programs. The total of 180,000 acre-feet per year in new dry-year yield is projected to come from expansion of existing Central Valley storage and transfer programs. All these programs would, if implemented, occur south of the Delta, thus further enhancing their water supply reliability.

Targets for State Water Project Programs

In April 1992, the State of California outlined a comprehensive plan to meet the water needs of urban, agricultural and environmental interests. It was recognized that there was a need to implement several currently planned State Water Project programs, and complete the environmental documentation for selection of a comprehensive Delta solution, as well as provide for the reallocation of State Water Project supplies through voluntary transfers. Of the 1992 proposed programs, only one, the Kern Water Bank (KWB), has been implemented. The remaining programs (South Delta Water Management Program (SDWMP); off-stream storage facilities in either the Sacramento or San Joaquin Valleys; and a Delta conveyance facility) are under consideration as part of the CALFED Bay-Delta process. Off-stream storage and Delta conveyance are still in the preliminary stages of planning and were not assumed to be in place in analysis of reliable water supplies from the State Water Project.

By 2000, the final phase of the KWB Fan Element will be operational, providing significant additional water storage capacity south of the Delta. The projected schedule for construction and operation of other facilities is currently undefined.

In addition, existing state policy also calls for water marketing to play a more important role in meeting California water needs. The viability of using market forces to voluntarily reallocate water supplies was demonstrated in 1991 when the Governor's Water Bank (91-Bank) acquired a gross amount of 820,800 acre-feet for critical needs including those of urban areas and agriculture.

It is difficult to predict the net increase in supply available to Metropolitan that would result from implementation of many potential supply enhancement and management programs. For this needs analysis, it has been assumed that the programs described above would be implemented by 2020, with an increase in State Water Project yield of 200,000 acre-feet per year in a dry year.

Targets for Ocean Desalination

Ocean desalination is a potentially long term source of reliable water supply that would also enhance water quality in Metropolitan's service area, and it is under study at this time. Implementation of large-scale ocean desalination projects would depend on the cost of energy, the cost of facilities and development of appropriate methods for disposal of highly saline brine. Advances in desalination technology and efficiency are needed before large-scale desalination can be an economically viable alternative to other Metropolitan programs. There are significant environmental issues which must be addressed related to disposal of highly saline brine from the desalination process. Even assuming that technological issues could be resolved in the relatively near future, the planning, design and construction of desalination facilities will require considerable time. As a result, although desalination is currently under study, significant yield from ocean desalination is not anticipated until sometime following 2020.

Summary of Demand Versus Non-Colorado River Resource Area Supplies

In summary, if all non-Colorado River Resource Area supply reliability enhancement programs outlined above are successfully implemented by 2020, the net effect will be to increase dry-year supply in 2020 by approximately 870,000 acre-feet as shown in Table 2-5.

TABLE 2-5
PROJECTED NEW 2020
DRY-YEAR SUPPLY PROGRAM
(acre-feet)

Resource Option	Dry-Year Supply
Water Recycling and Groundwater Recovery	270,000
In-Service Area Storage	220,000
Central Valley Transfers and Groundwater Storage	180,000
State Water Project Programs	200,000
Ocean Desalination	--
Projected Non-Colorado River Aqueduct Resource Area Supply	**870,000**

2.5.2 NEEDS ANALYSIS FOR THE COLORADO RIVER RESOURCE AREA

Metropolitan evaluated the need for additional Colorado River resources assuming that new supplies of 870,000 acre-feet would be obtained from other sources. As illustrated in Table 2-6, a residual need of 718,000 acre-feet remains for dry-year supplies in the Colorado River Resource Area.

TABLE 2-6
PROJECTED COLORADO RIVER
RESOURCE AREA 2020 DRY-YEAR
NEEDS (acre-feet)

Resource Option	Dry-Year Supply
Projected Dry-Year Demand (Table 2-2)	5,082,000
Existing Dry-Year Supplies (Table 2-4)	3,494,000
Projected Non-Colorado River Aqueduct Resource Area Dry-Year Supply (Table 2-5)	870,000
Remaining Dry-Year Requirement	**718,000**

To evaluate the quantity of additional supplies to be provided from the Colorado River Resource area, an analysis of the Colorado River Aqueduct was undertaken. This analysis demonstrated that the annual conveyance capacity of the Colorado River Aqueduct is approximately 1.25 maf, and current and planned programs have a dry-year yield of 656,000 acre-feet. Therefore, there is significant unused dry-year conveyance capacity in the Colorado River Aqueduct. Because supply from the Colorado River is the lowest cost imported supply available to Metropolitan, it is also beneficial to utilize Colorado River Aqueduct supplies to the extent feasible.

Full utilization of the Colorado River Aqueduct during dry years would also meet Metropolitan's need for operational flexibility in use of other facilities. For example, it would ensure that maximum conveyance capacity would be available in the California Aqueduct to import supplies from the State Water Project, from transfers and from Central Valley banking.

Based on these considerations, Metropolitan established a target for the Colorado River Aqueduct of 594,000 acre-feet of additional dry-year yield, which would (1) minimize the capital and operational cost of new programs, and (2) reduce the need for, and impacts associated with, new facilities.

Current Projects on the Colorado River Aqueduct

In 1997, Metropolitan initiated a planning process to identify potential projects which, collectively, might meet the 594,000 acre-foot per year target for dry-year supply on the Colorado River Aqueduct. Three projects are currently in various stages of implementation and are anticipated to be operational before 2020.

San Diego County Water Authority - Imperial Irrigation District Transfer

The San Diego County Water Authority (SDCWA), a Metropolitan member agency, has negotiated a water transfer which would provide to up 200,000 acre-feet per year of new yield to the service area.

All-American and Coachella Canals Lining Projects

Under this program, Metropolitan would fund a conservation program which would consist of constructing a 23-mile concrete-lined canal parallel to the existing earthen All-American Canal and Coachella Canal. This program would yield 74,000 acre-feet per year, water which is currently lost through seepage (52,600 acre-feet from lining the All-American Canal and 21,500 acre-feet from lining the Coachella Canal). Metropolitan would have rights to the conserved water for a period of 55 years with an option to renew the program for an additional 55 years.

Hayfield Valley Water Storage Program

Metropolitan has recently initiated testing of the Hayfield Valley Water Storage Program, a groundwater banking program utilizing an aquifer adjacent to the Metropolitan Julian Hinds Pumping Plant on the Colorado River Aqueduct. This program would involve storage of up to 1.0 maf of wet-year supply from the

Colorado River and would provide dry-year yield of approximately 150,000 acre-feet per year during an extended drought.

2.6 REMAINING COLORADO RIVER RESOURCE AREA DRY-YEAR NEED

If all the proposed Colorado River Resource Area supply reliability enhancement programs outlined above are successfully implemented by 2020, the net effect would be to increase dry-year supply in 2020 by 424,000 acre-feet leaving a residual need in the Colorado River Resource Area of 170,000 acre-feet as shown in Table 2-7.

TABLE 2-7
COLORADO RIVER RESOURCE AREA
DRY-YEAR NEED
(acre-feet)

Target for dry-year supply on the Colorado River Aqueduct	594,000
SDCWA-IID Transfer	130,000-200,000
All American and Coachella canals lining projects	74,000
Hayfield Valley Water Storage Program	150,000
Cadiz Groundwater Storage and Dry-Year Supply	150,000
Remaining Colorado River Resource Area Dry-Year Need	**20,000**

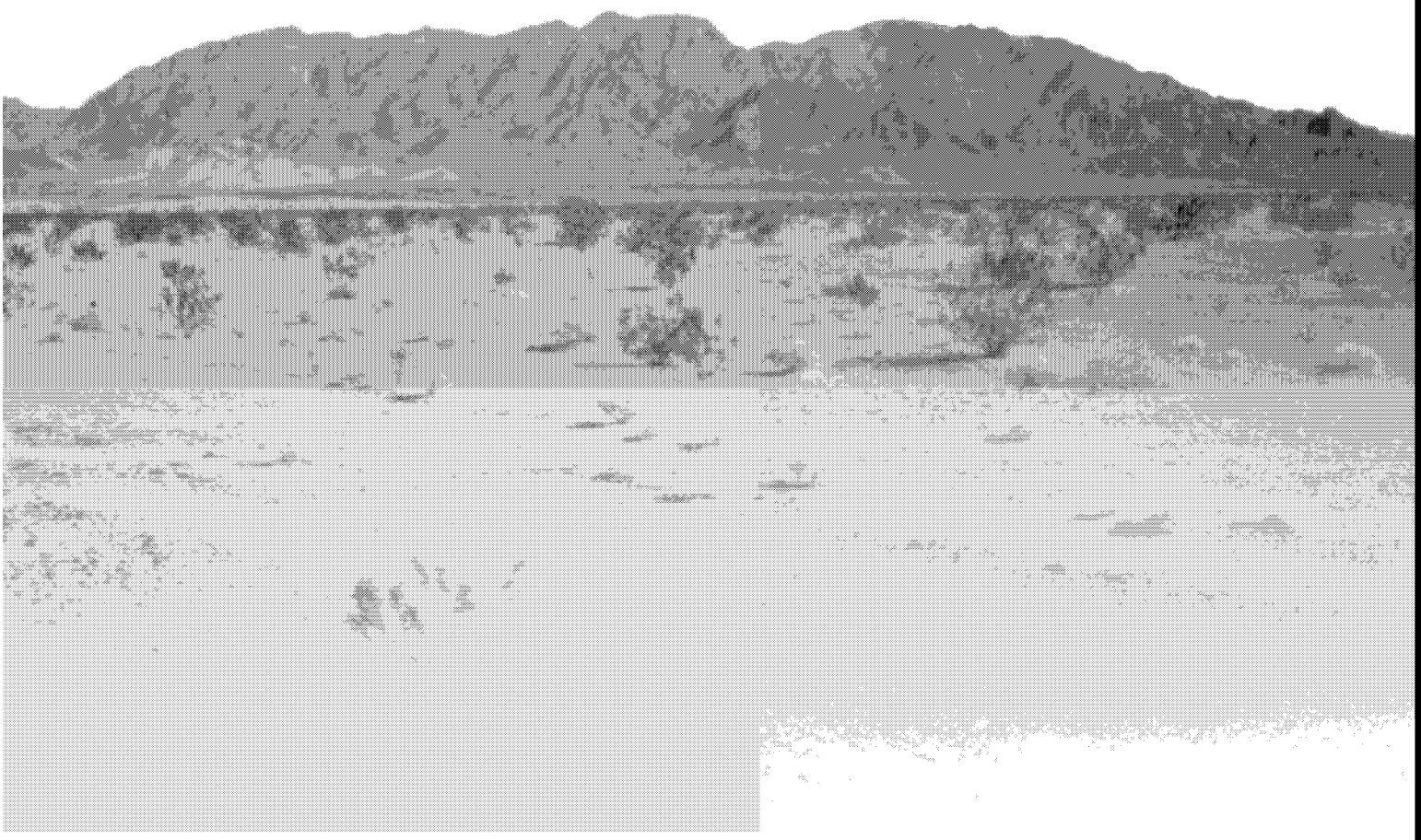
2.7 SUMMARY OF NEEDS ANALYSIS

In summary, the objective of the Cadiz Project is to allow Metropolitan to store Colorado River water during wet years when supplies are available and deliver this stored water to Metropolitan's service area during dry-years. In addition, the Cadiz Project would involve the transfer of indigenous groundwater in the Cadiz-Fenner aquifer system to further supplement Metropolitan's dry-year supplies and improve water quality.

The need for the Cadiz Project is based on current and projected needs (regional population and demographic projections for Southern California made by SCAG, SANDAG and DWR). Based on these official projections and accounting for the effects of aggressive water conservation programs in Metropolitan's service area, Metropolitan has determined that dry-year water demand in 2020 will exceed supply by approximately 1.5 maf. Meeting this need will require programs in a number of resource areas, and Metropolitan has established a dry-year target of 594,000 acre-feet for the Colorado River Aqueduct resource area. Existing Colorado River projects are anticipated to meet all but 170,000 acre-feet of this target. The Cadiz Project would meet 150,000 acre-feet of this deficit in the Colorado River resource area, leaving a deficit of approximately 20,000 acre-feet.

SECTION 3.0

Formulation and Evaluation of Alternatives



SECTION 3.0
FORMULATION AND EVALUATION OF ALTERNATIVES

3.1 INTRODUCTION

This section of the EIR/EIS describes the process leading to the selection and initial evaluation of a wide range of alternatives, leading to selection and detailed analysis of four Cadiz Project alternatives considered in the EIR/EIR. This section explains and documents the planning process leading to alternative selection and the role of technical and environmental considerations and public concerns in this process.

As discussed in Section 2 (Assessment of Project Need and Purpose), a number of potential projects would be utilized to meet the 594,000 acre feet dry-year supply requirement in the Colorado River resource area.

The formulation and evaluation of potential alternatives was conducted in a series of increasingly detailed studies, beginning with evaluation of 13 potential alternatives for supplying water in the Colorado River resource area, and ending with evaluation of basic design elements of the Cadiz Project. The fundamental steps in this process were:

1. Identification of potential alternatives for meeting dry-year supply needs on the Colorado River Aqueduct;

2. Screening to identify feasible alternatives that could meet the project objectives; and

3. Formulation and evaluation of project alternatives.

The formulation effort was focused on proposals received by Metropolitan from numerous public agencies and private entities. These were formulated to a level adequate to allow an evaluation for technical feasibility and potential for major environmental impacts. This initial screening-level evaluation was focused on basic issues of site feasibility; primarily addressing hydrogeological, construction and environmental issues. Based on this level of analysis, two feasible sites for meeting groundwater storage and transfer objectives were identified. An analysis of operational scenarios suggested that both the Cadiz Project and the Hayfield Groundwater Storage Project would be required. As noted in Section 2, the Hayfield Project was evaluated in a separate CEQA document and is currently in early stages of implementation.

Having determined that a water storage and transfer project could be feasible at Cadiz, and that none of the other sites evaluated other than Hayfield would be feasible due to hydrogeologic, construction or environmental concerns, as discussed later in this section, the next step was to evaluate alternative configurations for the Cadiz Project. This analysis included:

1. Evaluation of nine storage and transfer operational scenarios;

2. Evaluation of alternative sites for the Project spreading basins and wellfield;

3. Evaluation of alternative sites for connecting water conveyance facilities to the Colorado River Aqueduct; and

4. Evaluation of alternative alignments and designs for facilities to convey water from the Colorado River Aqueduct to the Project spreading basins and Project wellfield and from the Project wellfield to the Colorado River Aqueduct.

This progressively more detailed alternative formulation and evaluation process was intended to ensure that a wide range of alternatives was considered and evaluated objectively.

The results of these screening and evaluation processes for meeting needs and objectives of the operation of the Colorado River Aqueduct are discussed in detail below.

3.2 PROJECT BACKGROUND

The process which led to the formulation of the Cadiz Project alternatives was initiated in November 1997 when Metropolitan established a process to secure supplemental water supplies and regional storage to meet the needs identified by its analysis of dry-year supply and demand through 2020. As outlined in Section 2, Metropolitan has identified a need for approximately 320,000 acre-feet per year of dry-year supply from the Colorado River Aqueduct, in addition to the supplies anticipated from cooperative projects with Coachella Valley Water District and Imperial Irrigation District, and from the San Diego County Water Authority proposed transfer project with the Imperial Irrigation District. As described in Section 2, this need exists even if all projected dry-year supply programs in Metropolitan's service area and other resource areas are implemented.

The initial phase of alternative formulation and evaluation was focused on a number of proposals. In addition, based on early reconnaissance of groundwater basins near or adjacent to the Colorado River Aqueduct, Metropolitan independently identified two groundwater basins that were added to the list of potential areas for groundwater conjunctive-use projects. Metropolitan's intent was to determine whether its supply and storage needs could be met through these voluntary transactions. If the needed dry-year supply could be met through implementation of one or more of these projects, further project formulation would be unnecessary.

In addition, two proposals were received involving transfers of water from the States of Arizona and Washington that would have required proponents to resolve significant water rights issues. Consideration of these proposals was deferred until the proponents could resolve those water rights issues.

3.3 PROJECT OBJECTIVES

To ensure that all potential alternatives would be evaluated on a consistent basis, quantitative project objectives were developed, consistent with Metropolitan's policy of seeking to meet water supply and water quality needs in a manner consistent with protection of the environment. The objectives were:

1. Storage of up to 1.5 maf of Colorado River water

   Sustained withdrawals of 100,000 acre-feet per year over a period of up to six consecutive years and would require storage of 1.5 maf over the term of the project.

2. Capacity to put or withdraw up to 100,000 acre-feet of water in a given year

   The ability to recharge and withdraw supplies at this rate (or higher) is essential to ensure (1) that supplies available during a wet-year could be recharged during the year and (2) that dry-year needs could be met on a timely basis.

3. Potential for dry-year yield of 100,000 acre-feet per year

   The potential of the project to provide an additional and sustainable source of yield in a dry-year would make it feasible to use the project as a source of supply to meet demand in the Metropolitan service area.

4. Potential to produce water quality benefits

   Water from the Colorado River generally has high levels of total dissolved solids. Projects with a potential for enhancing water quality would be beneficial to Metropolitan operations.

5. Acceptable levels of environmental impacts

   Projects with high levels of impact would violate Metropolitan's commitment to act in an environmentally responsible manner.

3.4 STEP ONE: IDENTIFICATION OF POTENTIAL ALTERNATIVES

3.4.1 GENERAL

As a part of the preparation of this EIR/EIS, 13 potential alternatives were identified for consideration and evaluated. Ten were groundwater storage and conjunctive-use projects, one was a transfer project, and two involved desalting of agricultural drainage water. These alternatives for meeting supplemental water supply and water quality objectives are briefly described below.

3.4.2 GROUNDWATER PROJECTS

1. Arizona Banking (Groundwater Storage) Project

The State of Arizona created the Arizona Water Banking Authority to provide offstream storage for surplus supplies from its 2.8 maf Colorado River water entitlement. The storage goal for the Arizona Banking Project over the period from 2000 to 2030 is 14.0 maf of Colorado River water, which would otherwise be declared surplus and be made available to other water users. Under this project, Metropolitan would contract with Arizona

to store surplus Colorado River water along the Central Arizona Project between Lake Havasu and Phoenix. In dry-years, Arizona would then utilize stored water and would exchange surface storage (stored in Lake Havasu) to Metropolitan. Fees from the sale of exchanged water would fund development of this groundwater banking project. A small-scale demonstration project was implemented, and 89,000 acre-feet of water were stored.

2. Cadiz Valley Groundwater Storage Project

The Cadiz Valley is a northwest to southeast trending valley about 60 miles long which drains to Cadiz and Bristol dry lakes. Fenner Valley is a northeast to southwest trending valley that intersects Cadiz Valley at a gap (Fenner Gap) located between the Marble and Ship mountains.

Like most of the valleys studied, the alluvial sediments of the valley are underlain by granites and metamorphic rocks, forming a rock-bounded basin overlain with sands and gravels several hundred feet thick. Groundwater lies between approximately 140 and 220 feet below the surface in the proposed project area.

Most of the natural recharge in the Project area originates as precipitation in the Fenner Valley drainage, where high (7,500 foot) mountains receive in excess of 12 inches of average annual precipitation. There is, therefore, a significant groundwater flow through the Fenner Gap area. Additional significant precipitation occurs in the Granite Mountains (elevation 6,500 feet), which receive about 10 inches in average annual precipitation. These relatively high precipitation and groundwater recharge rates result in average annual natural recharge to the Project area of approximately 30,000 acre-feet.

Land use in the area is primarily open space and agriculture. There are existing salt mining operations at Bristol and Cadiz dry lakes. The Burlington Northern & Santa Fe (BNSF) rail line crosses through the Cadiz Project area south of the Ship Mountains. The Arizona and California Railroad Company (ARZC) line branches off the BNSF within the project area and trends southeastward toward Parker, Arizona.

A groundwater storage project in the Cadiz-Fenner area would involve use of the aquifer system at the junction of the Cadiz and Fenner valleys, approximately 35 miles northwest of Metropolitan's existing Iron Mountain Pumping Plant on the Colorado River Aqueduct. The Project would include construction of water spreading basins and a wellfield in the Cadiz Valley, a canal and/or pipeline from the Colorado River Aqueduct to the spreading basins, power supply and distribution facilities, and construction of supplemental pumping plant(s), depending on the type of conveyance facilities constructed.

The Cadiz Project area has the capacity to store approximately 1.0 maf of imported water. Studies indicated that indigenous groundwater is moderately low in TDS, ranging from approximately 270 to 420 mg/L in concentration.

The Cadiz Valley lies between the Sheephole Mountains and Old Woman Mountains wilderness areas. The Cadiz

Dunes Wilderness Area and the Kilbeck Hills lie in the middle of the Project area. It is likely that construction activities and above-ground facilities would be visible from trails in these wilderness areas. Low levels of desert tortoise activity have been documented in the valley, and there is bighorn sheep habitat in the mountains adjacent to the proposed project area.

3. Hayfield Valley Groundwater Storage Project

Use of the Hayfield Valley for water storage was first evaluated in the 1930s, when an attempt to create a surface storage reservoir on the Colorado River Aqueduct was conducted. Porous soils made it difficult to maintain surface storage, as stored water rapidly drained into the groundwater basin beneath the dry lake bed of Hayfield Lake. The proposed project would involve delivery of approximately 150,000 acre-feet per year to this groundwater basin via the Colorado River Aqueduct, storage of up to 1.0 maf in the basin, and recovery of approximately 150,000 acre-feet per year during dry-years. Metropolitan owns a large part of this valley and competing uses of its resources would therefore be minimal. Indigenous groundwater quality is moderate, with TDS levels in the 270 to 460 mg/L range, or about 30 percent lower than average levels in the Colorado River Aqueduct.

The Hayfield Valley site was determined to be a feasible site, and was studied extensively following initial evaluation. Environmental documentation was completed for this site in early 1999 and the project has been initiated.

4. Palen Valley Groundwater Storage Project

The Palen Valley, a component of the larger Chuckwalla Valley Drainage Basin, is located about five miles east of the Colorado River Aqueduct, which runs north-south along the eastern edge of the valley. The Valley lies between the Coxcomb Mountains on the west and the Granite and Palen mountains on the east. Elevations in these mountains reach approximately 4,500 feet, and precipitation and runoff are correspondingly low.

Hydrogeological investigations of the Palen Valley were generally conducted in conjunction with investigations of the Upper Chuckwalla Valley, and results are relatively consistent. The Palen Valley is underlain by granitic and metamorphic rocks, with overlying alluvial deposits approximately 1,000 to 1,200 feet deep. Several studies have recorded clay layers which could act as confining layers for groundwater recharge and withdrawal.

Data on groundwater levels for the Palen Valley generally dates to the late 1950s, when tests showed that depth to groundwater ranged from 13 to 325 feet. Preliminary studies indicate that Palen Valley has less than 300,000 acre-feet of storage capacity available. Indigenous water quality varies from moderate (520 mg/L TDS) to highly saline (12,300 mg/L TDS), with a majority of the recorded data indicating TDS levels in excess of 700 mg/L. Other mineral constituents have generally been consistently below Environmental Protection Agency Maximum Containment Levels (EPA MCLs).

Palen Valley lies adjacent to Joshua Tree National Park. Construction activities and permanent facilities would be visible from some parts of this park. Desert tortoise are documented in the area. The area is also within a north-south wildlife migration corridor.

A project at this site would involve discharge of water from the Colorado River Aqueduct to adjacent spreading basins and construction of a wellfield, pipeline and pumping station to convey stored supplies back to the Colorado River Aqueduct during dry years.

5. Pinto Valley Groundwater Storage Project

Located within Joshua Tree National Park, the Pinto Basin is a 20-mile long basin surrounded by mountains and draining at its east end through a gap between the Eagle and Coxcomb mountains. Both surface and subsurface groundwater flows pass through this gap into the Upper Chuckwalla Valley.

Like most other valleys in the region, the Pinto Basin is underlain by granitic and metamorphic rock and overlain by sand, gravel, and clay-rich alluvium approximately 200 to 300 feet thick. Based on previous studies, the large groundwater basin in this area is capable of storing up to 1.5 maf. A Metropolitan test well just north of the gap between the Eagle and Coxcomb mountains produced adequate flows of low TDS water 400 mg/L), and other water quality studies have indicated that indigenous water quality is moderate (ranging from approximately 314 to 580 mg/L TDS).

A project in Pinto Valley would involve conveyance of supplies from the Colorado River Aqueduct 15 miles west into the Pinto Valley, via a pipeline/canal, to 300 to 400 acres of spreading basins, a wellfield and pumping station.

Land use in the Pinto Valley is limited to public uses of the parklands, and construction could adversely affect these uses for several years. Above-ground project facilities would be visible from the Park's trail system and would constitute an inconsistent feature in the landscape.

Joshua Tree National Park is habitat for both bighorn sheep and desert tortoise, and a project in the Pinto Basin would adversely affect protected habitats of both species, as well as established wildlife migration corridors.

6. Rice Valley Groundwater Storage Project

The Rice Valley is the first large, topographically enclosed alluvial valley west of the Colorado River adjacent to the Colorado River Aqueduct. The valley is bounded on the north by the Turtle Mountains, on the east by the Riverside and West Riverside mountains, and on the south by the Little Maria and Big Maria mountains. Elevations in this watershed are generally less than 3,000 feet and precipitation is accordingly low.

Hydrogeological investigations of the valley have generally been limited to the area near Rice Township. These and other investigations suggest the valley is underlain by granitic and metamorphic rocks. The basement complex is overlain

by sand, gravel and clay-rich alluvium. Confining layers of clay have been found in several studies, and suggest that recharge and withdrawal of groundwater could be limited. Storage capacity was estimated at 125,000 acre-feet. United States Geological Survey (USGS) test well data from 1910 to 1972 suggest that depth to groundwater ranges from about 140 feet to over 450 feet. Groundwater flow is generally believed to be to the east and southeast, and may spill into the Colorado River's groundwater regime via Vidal Valley and between the Riverside and Big Maria mountains. Therefore, there is some potential for loss of storage to the Colorado River.

Groundwater quality has been recorded at five wells, with the most recent test conducted in 1956. Indigenous groundwater quality is generally poor, with TDS levels ranging from 662 mg/L to over 2,600 mg/L, but tests of other mineral constituents do not reveal contaminant levels in excess of EPA MCLs. These tests, however, predate modern testing techniques and are, therefore, potentially unreliable.

Land use in Rice Valley is primarily open space and agricultural. The BNSF rail line runs north-south along the eastern edge of the valley between the Big Maria and Little Maria mountains. Rice Valley is documented habitat for the desert tortoise and bighorn sheep.

A project in Rice Valley would involve delivery of supplies to a small (125,000 acre-feet) groundwater basin 10 miles south of the Colorado River Aqueduct, via a pipeline to a spreading basin and wellfield.

7. Shavers Valley Groundwater Storage Project

The Shavers Valley is located approximately 10 miles north of the Salton Sea and three miles from the Colorado River Aqueduct. The valley is bordered on the north by the Cottonwood Mountains, on the southeast by the Orocopia Mountains and on the southwest by the Mecca Hills. Initial geological investigations show that the valley is underlain by unconsolidated shales, sandstones and gravels. Elevations in Shavers Valley range from 1,000 to 2,000 feet. Less than 10 miles away, the Salton Sea is at an elevation of less than 100 feet above mean seal level above (amsl), creating a very high drainage gradient.

The valley has potential to store up to 350,000 acre-feet of imported water and the indigenous groundwater with TDS ranging from approximately 350 to 550 mg/L.

The valley is currently unused and vacant and there would be few competing interests for the valley's resources.

The fundamental hydrogeological issue addressed in evaluation of this valley was the ability of the valley to provide long term storage of imported supplies.

Shavers Valley is located due south of Joshua Tree National Park and has been identified as a potential north-south wildlife migration route to the Orocopia Mountains by the Coachella Mountains Conservancy. Desert tortoise occur in this valley. Because of this site's proximity to Joshua Tree National Park, spreading basins, conveyance facilities and power lines would be visible from parts of the

mountains on the southern boundary of the Park, as well as from Interstate 10 (I-10). Conveyance facilities to and from the spreading basins would require construction under I-10.

8. Upper Chuckwalla Valley Groundwater Storage Project

The Upper Chuckwalla Basin is located north of Desert Center. Several side valleys drain to this wide valley (over 10 miles at its southern end), including Hayfield Valley on the west and Pinto and Palen valleys on the north.

The valley, 14 miles long and 10 miles wide, is bounded on the east by the Coxcomb Mountains and on the west by the Eagle Mountains. Elevations in these mountains are generally below 4,000 feet.

Like many of the valleys studied, the Upper Chuckwalla Valley is underlain by granitic and metamorphic rocks, with sand and gravel alluvial deposits approximately 1,000 feet in depth. Initial borings indicated few clay layers, but hydrogeological studies in adjacent valleys raise the possibility that additional clay layers may be present and that these could act as confining layers for groundwater recharge and withdrawal.

Based on studies in 1994, the Upper Chuckwalla Valley was considered to be hydraulically connected to the Colorado River and the valley is included within the Colorado River Aquifer. At approximately 235 feet in elevation, a bedrock ridge may separate the groundwater basin from the Colorado River and, therefore, water stored below this elevation would probably not flow out of the basin to the Colorado River.

There have been a number of groundwater quality studies in the Upper Chuckwalla Valley since 1931. Depth to groundwater has ranged from 13 feet to over 630 feet. Based primarily on studies in 1961 involving 15 wells, indigenous groundwater quality is variable, with TDS levels ranging from 270 mg/L to over 1,310 mg/L. A majority of measurements have been in the 400 mg/L to 900 mg.L range. Several constituents exceed EPA MCLs, including nitrates and fluoride.

This proposal would involve storage of up to 1.0 maf in the Chuckwalla Valley immediately south of the Colorado River Aqueduct. Water would be delivered to spreading basins directly from the Colorado River Aqueduct. A wellfield and conveyance pipeline approximately five miles in length would be constructed to return stored water to the Colorado River Aqueduct.

The Upper Chuckwalla Valley lies immediately adjacent to Joshua Tree National Park. Construction activities and permanent facilities would be visible from trails in this area.

9. Vidal Valley Groundwater Storage Project

Vidal Valley is located eight miles from the Colorado River Aqueduct adjacent to the Colorado River downstream from Lake Havasu. This triangular-shaped valley is bounded by the Whipple Mountains on the north, the Turtle Mountains on the northwest, and the Riverside Mountains on the south. The Parker Valley of the Colorado River forms the southeastern boundary of Vidal Valley.

This large valley, 25 miles long and 12 miles wide, ranges in elevation from 2,000 feet to 400 feet at the Colorado River. The geology of this valley differs from that of other valleys studied. Three distinct layers of sedimentary deposits overlie the granitic and metamorphic basement rock formations. On the surface, there is a layer of sand and gravel alluvial sediments. Beneath this recent alluvium, there is a layer of fine sand, silt and clay of marine origin. These dense marine sediments overlie a sequence of sands and fanglomerates with occasional interlayed volcanic flows.

Indigenous groundwater in the valley is found both above and below the layer of marine sediments, but the marine layer restricts the connection between these two parts of the groundwater aquifer system. The marine layer would effectively block recharge to the larger, confined, groundwater aquifer below it. Both surface and groundwater drainage are directed to the Colorado River. The valley's groundwater has relatively high TDS levels at 397 to 2,864 mg/L.

Land use in the area is generally open space and agriculture. There are parts of the Colorado River Indian Reservation on the westside of the Colorado River, at the boundary of the valley.

Like other areas studied, the Vidal Valley is documented habitat for the desert tortoise.

10. Ward Valley Groundwater Storage Project

The Ward Valley watershed covers an area of approximately 600 square miles and extends northward from Danby Dry Lake more than 40 miles to the vicinity of I-10. The valley is bordered on the west by the Old Woman Mountains and on the east by the Turtle Mountains. The highest peaks in the Old Woman Mountains reach elevations greater than 5,300 feet. Peaks in the Turtle Mountains reach elevations greater than 4,300 feet.

The BLM owns most of the land in Ward Valley, and accordingly, there has been very little development in the area. The high-capacity powerline and access road that serves Metropolitan's Iron Mountain Pumping Plant runs north-south through the length of the valley. A low-level radioactive waste storage facility has been proposed for the northern end of Ward Valley, however its status is uncertain at this time.

There are designated wilderness areas in both the Old Woman and Turtle mountains, and construction activities in Ward Valley could potentially be visible from these areas. Portions of these mountain ranges are also habitat for bighorn sheep. The United States Fish and Wildlife Service has designated Ward Valley as Critical Habitat for desert tortoise.

A storage project in Ward Valley would involve construction of spreading basins and a wellfield in the southern portion of the valley, approximately 5 to 10 miles north of Danby Dry Lake. These facilities would be constructed a sufficient distance from the dry lake to avoid the saline groundwater that occurs at the lake margin. This portion of the valley is characterized by a thick section of alluvial sediments (sand and gravel) which overlie a basement complex of granite and metamorphic rock. These alluvial

sediments form the principal aquifer system in the area. TDS is estimated to be in the range of 400 to 600 mg/L.

A conveyance pipeline approximately 15 miles in length would be required to connect the Project spreading basins and Project wellfield to the forebay of the Iron Mountains Pumping Plant. An alternative alignment, approximately 20 miles in length, would be required to connect these facilities to the Colorado River Aqueduct southeast of the proposed site.

3.4.3 TRANSFER PROJECT

Cadiz Valley Dry-Year Transfer Project

In addition to providing potential groundwater storage for wet-year supplies on the Colorado River Aqueduct, indigenous groundwater in the Cadiz Valley could also be transferred to Metropolitan in dry-years through a transfer project. Transfers of indigenous groundwater have potential to help reduce average TDS levels in Colorado River Aqueduct supplies, especially in dry-years. Indigenous water has TDS levels ranging from approximately 270 to 420 mg/L, which is less than average levels in Colorado River water.

3.4.4 DESALTING PROJECTS

Construction and operation of a desalination facility capable of meeting seasonal and long term storage deficits would be one way to meet the dry-year water needs on the Colorado River Aqueduct. One source of water for desalination in the Colorado River Aqueduct basin would be agricultural drainage in the Coachella Valley.

Desalination of agricultural drainage in the Coachella Valley was initially proposed as two separate projects: Desalination of Whitewater River Agricultural Drainage and Desalination of Alamo River Agricultural Drainage. Both these rivers flow east across the agricultural lands of the Coachella Valley to the Salton Sea, contributing to the increasing salt load in this 35-mile long lake. Together, the two rivers collect up to 700,000 acre-feet of agricultural drainage per year, with minimum annual combined drainage of 450,000 acre-feet. Facilities to desalt this combined minimum annual flow would yield approximately 340,000 acre-feet of water per year.

Facilities would include two desalting plants, 55 miles of canal, 23 miles of pipeline, and four pumping stations to lift desalted water a total of 2,525 feet to the Colorado River Aqueduct. In addition, desalting operations would require facilities to dispose of waste water from the desalting operation. The potential benefits of desalting agricultural drainage include about 340,000 acre-feet yield of very high quality water (very low TDS), available in all years. Desalination would not only meet the dry-year supply need on the Colorado River Aqueduct, but would help to meet normal-year water quality needs on the Colorado River Aqueduct. The proposed (combined) desalination project would have a start up date between 2010 and 2015 and would have an indefinite term.

Desalination would involve disposal of approximately 80,000 acre-feet of highly saline brine per year. Disposal alternatives range from disposal in a brine evaporation area to pumping brine via pipeline south to the Sea of Cortez or west over the Coastal

Range to the Pacific Ocean. All these disposal alternatives would involve significant but as yet unquantified environmental impacts.

3.5 STEP TWO: SCREENING OF POTENTIAL ALTERNATIVES

3.5.1 GENERAL

The fundamental purpose of the screening process was to identify: (1) alternative sites for storage/transfer projects and/or (2) alternative approaches to meeting dry-year needs in the Colorado River Aqueduct region. Screening evaluations were intended to narrow the range of alternatives to those with potentially acceptable levels of costs and environmental impacts and, therefore, limit detailed analysis to storage sites, transfer programs and/or other approaches which are technically feasible and economical while minimizing potential environmental impacts. Specific criteria for screening evaluation were that alternatives carried forward for detailed analysis should:

1. Meet objectives for dry-year water storage and withdrawal;

2. Meet water quality objectives;

3. Be operational prior to 2005 - 2010 when dry-year needs are projected to exceed available supplies;

4. Have acceptable levels of construction difficulty, and long term maintenance (ground stability, corrosion); and

5. Be feasible from an environmental perspective, with levels of potential environmental impacts that could be mitigated to acceptable levels.

The screening evaluation was an objective and efficient way to reduce the number of storage sites and other programs carried forward for detailed analysis.

To provide an objective basis for screening alternatives, a Steering Committee, comprised of Metropolitan Board members and member agency General Managers, was formed. This committee established the above criteria to evaluate proposals.

Metropolitan also conducted reconnaissance-level studies of potential alternatives. These studies included extensive review of literature on each of the proposed projects.

Data from these studies, including data on environmental impacts or conflicts with regional environmental goals, were then used to screen less feasible alternatives from detailed consideration. When this was completed, screening for technical feasibility was conducted by a multi-disciplinary Technical Review Committee consisting of recognized experts in the fields of (a) geology and hydrology, (b) constructability and implementation cost, and (c) financial and economic analysis.

In addition to these technical analyses, Metropolitan conducted its own unit cost analysis. This analysis estimated the real cost of projects with different characteristics based on analysis of when costs are incurred and benefits are received. For example, costs of transfers may be incurred in the same years that the benefits are received. The costs of storage projects are, in contrast, often incurred prior to

benefits being received. Under this real cost approach, the deferred revenue from the capital expended early in such projects is taken into account when comparing storage and transfer projects.

Metropolitan evaluated unit costs relative to benefits using probable water supply and demand scenarios that forecast, for example, when supplies would be stored and when they would be recovered from a typical groundwater storage project. The results of different scenarios can then be compared to determine which alternatives have the lowest cost under expected conditions.

3.5.2 ENVIRONMENTAL CONSIDERATIONS

The initial screening focused primarily on technical feasibility issues. At the initial screening level, and in the absence of detailed environmental data that would allow site-specific analysis, the primary environmental issue addressed was conflicts with known environmental resources. Of primary importance in this evaluation was the Desert Tortoise Recovery Plan (USFWS June 1994). One alternative, the Pinto Valley Groundwater Storage Project, was located in a National Park. The other storage and transfer alternatives considered in the screening analysis were all considered to have potential adverse impacts to desert tortoise. Other key environmental issues addressed at this stage of evaluation were potential for impacts to wildlife migration corridors and impacts to adjacent public uses of park lands and wilderness areas.

Therefore, the initial screening focused on technical and economic feasibility, environmental criteria and the potential for conflicts with the goals and objectives of the National Park Service and wilderness areas.

3.5.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Based on the screening analysis, ten alternatives were eliminated from further consideration and environmental analysis because of multiple technical feasibility issues and/or environmental concerns. One alternative, Pinto Valley, was eliminated entirely on the basis of environmental concerns. The two alternatives for desalination of agricultural drainage were eliminated on the basis of significant technical concerns and unresolved environmental and water rights issues. The sites or programs carried forward for more detailed consideration were those determined to best meet feasibility, cost and environmental criteria.

1) Arizona Banking Groundwater Storage Project

This alternative was not carried forward for further analysis because the State of Arizona withdrew its proposal to Metropolitan. Therefore, the status of Southern California's participation in the Arizona Banking Project is considered uncertain at this time.

2) Palen Valley Groundwater Storage Project

The Palen Valley site is close to the Colorado River Aqueduct and, therefore, would require minimal construction. Project costs would be low to moderate.

However, parts of this valley are immediately adjacent to Joshua Tree National Park and documentation exists that this valley may provide habitat for desert tortoise. Extensive spreading basins in this valley could have an unacceptable level of impact on this species. A wildlife migration corridor would also be affected.

The Palen Valley's extremely poor indigenous water quality, which varies from moderate (520 mg/L TDS) to highly saline (12,300 mg/L TDS), does not meet critical water quality screening criteria. Groundwater in the Palen Valley also contains fluorides and nitrates. In addition, the site's potential yield and storage capacity were below target levels. Use of this site for storage of Colorado River water would not provide the needed yield or maintain current levels of Colorado River water quality.

These adverse environmental and water quality conditions offset the potentially low project cost at a Palen Valley site, and it was not carried forward for more detailed consideration.

3) Pinto Valley Groundwater Storage Project

Pinto Valley was determined to be a highly favorable site from the perspective of storage capacity and indigenous water quality. Construction costs would be low and would involve a relatively short conveyance facility. The valley has high storage capacity, and a wellhead located in the Eagle Mountains-Coxcomb Mountains gap would intercept groundwater migrating downstream in an efficient manner.

Although the Pinto Valley would otherwise meet all the initial screening criteria, a project at this site would have significant conflicts with existing National Park uses and environmental values. In addition, recent university surveys have determined that the Pinto Valley has high densities of desert tortoise and a unique herpetological community with a number of rare species. These impacts represent an unacceptable adverse environmental impact and the Pinto Valley site was not carried forward for detailed analysis.

4) Rice Valley Groundwater Storage Project

The Rice Valley site was eliminated from consideration early in the evaluation process due to the low potential for additional imported water storage capacity and extremely poor water quality.

5) Shavers Valley Groundwater Storage Project

The Shavers Valley site has several significant potential advantages. First, it is close to the Colorado River Aqueduct, and spreading grounds and wells would need to be only about three miles from the aqueduct, thereby reducing costs associated with pipeline or canal construction. Long term operation and maintenance costs would also be substantially lower than for many of the other alternatives. Construction under I-10, a major east-west artery, would pose some difficulties, but these were not considered unacceptable from the point of project feasibility.

However, the Shavers Valley proposal was eliminated from detailed analysis for a number of reasons. First, Shavers

Valley provides low storage potential and high potential for groundwater to migrate from the valley. The unconsolidated shales, sandstones and gravels that underlie this valley will not contain groundwater within the confines of the valley. This, combined with a steep gradient trending towards the Salton Sea to the south, would limit the effectiveness of long term storage in the valley. Although Shavers Valley could provide cost-effective short term storage, its usefulness as a long-term storage site is limited.

6) Upper Chuckwalla Valley Groundwater Storage Project

Upper Chuckwalla Valley provides numerous advantages due to its proximity to the Colorado River Aqueduct. The site is immediately adjacent to the Colorado River Aqueduct and conveyance facilities would be minimal. The basin is large, with capacity to store an additional 1.0 maf.

However, surrounded by Joshua Tree National Park, the Upper Chuckwalla Valley site would have potentially unacceptable levels of environmental impacts, including land use conflicts related to the Park and adjacent wilderness areas and impacts to desert tortoise habitat. Recent studies have indicated that this area has high densities of desert tortoise.

The proposed groundwater storage project in Upper Chuckwalla Valley also fails to meet critical water quality criteria, with TDS levels in excess of 900 mg/L from some test wells in the area. The former Eagle Mountain Site could also contribute to water quality degradation in the future. The result of these problems could be significant degradation of Colorado River water quality.

For both environmental and water quality reasons, the Upper Chuckwalla Valley alternative was eliminated from consideration.

7) Vidal Valley Groundwater Storage Project

The Colorado River Aqueduct bisects the Vidal Valley and thus construction of facilities would pose no significant difficulties or involve high costs. However, the feasibility of long-term storage is limited due to the low capacity of the upper groundwater aquifer and the inability of groundwater to penetrate the basin's marine sediment layer to reach the larger lower aquifer.

In addition, there is significant potential for stored groundwater to be lost from the basin to the Colorado River, reducing the net yield of the project and raising costs on a unit basis. Finally, poor water quality also made this site inappropriate for more detailed consideration.

8) Ward Valley Groundwater Storage Project

Evaluation of the Ward Valley Groundwater Storage Project focused primarily on environmental and engineering considerations, since available hydrogeological data are not sufficient to fully assess the site at this time. Based on available information, storage capacity in the southern portion of Ward Valley may meet project criteria. Water quality was estimated to range from

approximately 400 to 600 mg/L TDS. However, infiltration rates for spreading basins and well yields in the southern portion of the valley are not known.

Potential advantages of the site are offset by engineering difficulties, involving both construction and operation and maintenance. Metropolitan's Iron Mountain Pumping Plant would be the preferred site for linking a conveyance pipeline from the spreading basin and wellfield facilities to the Colorado River Aqueduct. Therefore, any direct alignment would require construction across the corrosive soils and shallow brine of Danby Dry Lake. Approximately five miles of this 15-mile alignment would be within the Danby Dry Lake depression. Such an alignment would also result in high operation and maintenance costs. An alternative alignment, which would link the spreading basin and wellfield facilities to the Colorado River Aqueduct southeast of the site, could potentially avoid corrosive soils in the vicinity of the dry lake. However, such an alignment would require approximately 20 miles of pipeline and necessitate construction of a supplementary pumping plant and related power transmission facilities at the aqueduct.

During withdrawal operations from the Ward Valley Project, approximately 40,000 acre-feet per year would be available for export. The individual pumps on the Colorado River Aqueduct are sized to move approximately 150,000 acre-feet per year each, thus creating a mismatch between the Ward Valley Project and the Colorado River Aqueduct.

Environmental issues were also identified during the screening evaluation. The site is located within designated critical habitat for the desert tortoise. The probable spreading basin sites would be located within Critical Habitat for the desert tortoise and would be adjacent to designated wilderness areas and visible from these areas, and would interrupt north-south wildlife movement.

For both operational and environmental reasons, the Ward Valley alternative was eliminated from consideration.

9) Desalination of Agricultural Drainage in the Coachella Valley

Desalination of agricultural drainage in the Coachella Valley was evaluated and determined to have significant potential water supply and water quality benefits. Consideration of desalination would require significant coordination with the on-going program for restoration of the Salton Sea, resolution of brine disposal issues and improvements in technology which would lower costs per acre-foot of yield. Assuming that such issues could be resolved in the near future, full-scale desalination could not be implemented prior to 2010, and implementation by 2010 could be affected by a number of issues, including environmental issues and issues related to resolution of California's Colorado River allocations. In addition, estimated desalination costs were approximately two to four times the cost per acre-foot for other alternatives. Desalination also utilizes large amounts of energy and requires large land areas, potentially resulting in both local and

regional environmental impacts. For these reasons, desalination of agricultural drainage was not carried forward as an alternative for meeting dry-year storage options.

Metropolitan and others will, however, continue to study desalination of agricultural drainage and ocean seawater as a means of meeting both water supply reliability and water quality needs. The implementation of such projects will, to a large extent, depend on resolution of brine disposal issues and technological advances that lower construction and long-term operation and maintenance costs.

3.5.4 ALTERNATIVES CARRIED FORWARD FOR DETAILED ANALYSIS

Three alternatives were carried forward for project-level formulation and evaluation, for the reasons outlined below.

1) Cadiz Valley Groundwater Storage Project

The Cadiz Valley site has several significant advantages. First, all the lands needed for the spreading basins and wellfield are owned by a single entity, Cadiz Inc. There are relatively few construction difficulties due to the remoteness of the project area and the availability of multiple options for conveyance systems which avoid construction in dunes or highly corrosive dry lake beds. Few, if any, unacceptable social impacts would be anticipated.

This proposed 50-year storage project has the potential to meet approximately one-third to one-half of the Colorado River Aqueduct need for supplemental supplies in 2020, and has adequate storage capacity to meet needs during a long term drought. Available data on indigenous groundwater supplies indicate that TDS levels are low to moderate and would enhance water quality in the Colorado River Aqueduct for this constituent. Indigenous groundwater quality must be monitored for other water quality constituents and demonstrated to be adequate before the project can be implemented. As the local project proponent, Cadiz Inc. has both established water rights and property rights to ensure the implementation of the project, and has the financial and technical support needed to perform its obligations under a cooperative project agreement.

Environmental impacts from a project at the Cadiz site were also not considered unacceptable during screening. The valley is not designated as critical habitat for the desert tortoise. Construction could temporarily impact bighorn sheep movement, but permanent impacts would not occur, assuming construction of an underground pipeline.

For these reasons, the Cadiz Valley groundwater storage project was carried forward for more detailed analysis.

2) Cadiz Valley Dry-Year Transfer Project

Studies and records of groundwater use and groundwater levels in the Cadiz Valley indicate that the basin has a sustainable yield of approximately 30,000 acre-feet per year. A groundwater transfer project, in combination with a storage project, would therefore meet the identified Colorado River Aqueduct Phase I screening criteria for dry-year supply in 2020.

3) Hayfield Valley Groundwater Storage Project

The Hayfield Project was carried forward for detailed evaluation because it meets all the initial screening criteria. Of particular note is Metropolitan's ownership and protection of a majority of the land in the valley, thereby providing protection against future groundwater contamination. Delivery of Colorado River water to the basin is also minimal in cost, requiring only a spillway to be constructed for release of water from the Colorado River Aqueduct. The Hayfield Project has the potential to meet approximately one-third to one-half of the identified need for supplemental supply in the Colorado River Aqueduct. The environmental effects of the Hayfield Project have been analyzed in a separate document and the Hayfield Project is currently being implemented.

3.6 STEP THREE: FORMULATION AND EVALUATION OF PROJECT-LEVEL ALTERNATIVES

3.6.1 GENERAL

Formulation and evaluation of detailed alternatives were addressed in the preparation of this EIR/EIS in a phased manner. Phase 1 was the consideration of various combinations of water storage and transfer opportunities (operational scenarios); and Phase 2 consisted of analysis of site-specific alternatives. By undertaking this phased approach, the size of project components became established and issues such as siting of conveyance facilities and spreading basins could be addressed.

3.6.2 PHASE 1 – ALTERNATIVE OPERATIONAL SCENARIOS

As part of the preparation of this EIR/EIS, nine representative operational scenarios shown in Table 3-1 were considered to determine the feasible range of water storage and water transfers scenarios. Because all the operational scenarios required the construction of water conveyance, extraction and pumping facilities, the primary differences would be:

1. Program yield and cost per unit of yield; and

2. The potential for groundwater resources impacts.

Program Yield and Cost per Unit of Yield

The majority of project costs are associated with water conveyance and extraction facilities. The cost of spreading basins is a relatively minor element of these total costs. Unit costs for combination storage and transfer operational scenarios involve an optimal net dry-year supply greater than 2.6 maf depending on the availability of Colorado River water, for storage, and the natural recharge of the basin over the 50-year term of the project.

Impacts to Groundwater Resources

Impacts to groundwater resources could affect the ability of a program to meet water quality objectives and also raise regulatory concerns regarding potential impacts to other users of groundwater in

TABLE 3-1
OPERATIONAL SCENARIOS CONSIDERED

Operational Scenario	Volume of Net Storage and Indigenous Water Transfer (maf)		Scheduling Considerations
	Storage Element	Transfer Element	
1	1.1	1.5	Storage in first half of program; extractions throughout program.
2	1.1	1.5	Storage and extraction in sequence with limited hold time.
3	1.6	1.7	Transfers in later years of project.
4	0.8	2.0	Early storage, long hold time, and later extraction.
5	2.3	1.3	Storage and extraction in sequence.
6	1.2	1.4	All storage and extraction in first half of program.
7	1.1	3.5	Storage and extraction in sequence.
8	0.0	1.5	All transfers as needed with no storage element.
9	2.3	0.0	All storage with no transfer element.

the basin. Potential impacts include: (1) lowering of groundwater levels and subsequent subsidence and associated ground instability; and (2) effects of raising groundwater levels and water quality.

The aquifer system has an estimated annual recharge of approximately 30,000 acre-feet per year, with most of this recharge originating in the Fenner Basin. Groundwater levels would be relatively stable as long as net groundwater extractions are less than or equal to this natural recharge rate. Extractions in excess of the natural recharge rate may increase the potential for subsidence and adverse impacts to water quality.

Groundwater quality impacts could occur if highly saline groundwater underlying Bristol Dry Lake were to migrate east into Cadiz Valley. If extractions of water for transfer purposes create a significant depression in the groundwater levels under the wellfield, this saline groundwater could flow down gradient towards this depression. Migration of this saline water would have adverse impacts on water quality in the wellfield and other areas.

In addition, introduction of Colorado River water has potential to impact indigenous water quality because of comparatively higher TDS levels and the presence of perchlorate. Infiltrating water in spreading basins would also leach salts from the soil and carry these salts into the indigenous groundwater. However, based on a long-term pilot spreading basin test by Geoscience (1999), such leaching would create only temporary and localized impacts to groundwater quality. Mixing of Colorado River water with indigenous groundwater would also be localized under the recharge basins and wellfield, and a majority of the mixed water would be returned to the Colorado River Aqueduct during extraction operations.

Low nitrate levels in Colorado River water would benefit indigenous water quality, which has higher nitrate concentrations. The net effect of storage operations on indigenous water quality would therefore not be significant.

As Table 3-2 indicates, as a result of this analysis, three operating scenarios were rejected. Scenario 7 was rejected for both cost and environmental reasons. The higher net yield under this scenario would require the construction of additional capital facilities, thus increasing costs.

These net yields would require the transfer of indigenous groundwater in amounts that significantly exceed the estimated, sustainable natural recharge rate of the groundwater basin.

Scenarios 8 and 9 were rejected for cost reasons. The lower net yields under these operating scenarios would result in a high unit cost.

Combinations of storage and transfer are justifiable from a unit cost perspective for programs with a net dry-year supply greater than 2.6 maf depending on the availability of Colorado River water, for storage or to meet future demands, and the natural recharge of the basin over the 50-year term of the project.

Impacts to groundwater resources and subsidence are minimized for combination programs when this yield includes transfers approximately equal to or less than sustainable natural recharge rates of the groundwater basin.

3.7 PHASE 2 – SITE- SPECIFIC PROJECT ALTERNATIVES

As noted above, the second phase of alternative formulation for the Cadiz Project considered in the preparation of this EIS/EIR involved the formulation and evaluation of various Cadiz Project facility configurations:

TABLE 3-2
SUMMARY EVALUATION STORAGE/TRANSFER ALTERNATIVE OPERATIONAL SCENARIOS

Operational Scenario	Storage Element	Transfer Element	Evaluation Criteria (1)	
			Cost Effective	Groundwater Resource Impacts
1	1.1	1.5	Positive	Positive
2	1.1	1.5	Positive	Positive
3	1.6	1.7	Positive	Positive
4	0.8	2.0	Positive	Positive
5	2.3	1.3	Positive	Positive
6	1.2	1.4	Positive	Positive
7	1.1	3.5	Negative	Negative
8	0.0	1.5	Negative	Positive
9	2.3	0.0	Negative	Positive

(1) Negative – indicates the operational scenario is not cost effective or has the potential to create significant groundwater impacts.
Positive – indicates the operational scenario is cost effective or does not have as high a potential to create significant impacts with mitigation.

To minimize the complexity of alternative formulation and evaluation, an initial effort was made to identify elements of the proposed Project that would be common to all site-specific facilities alternatives. This effort was initially focused on evaluation of potential sites for spreading basins and the wellfield and on identifying feasible sites for the connection of conveyance facilities to the Colorado River Aqueduct. The effect of this preliminary analysis was to define the feasible end points of the needed conveyance facilities and, therefore, focus the remaining analysis on conveyance alignments.

Once the common elements for all alternatives (with the exception of the No Project Alternative) were established, detailed comparison of alternatives focused on formulation and evaluation of conveyance facilities.

3.7.1 SITING OF PROJECT SPREADING BASINS AND WELLFIELD

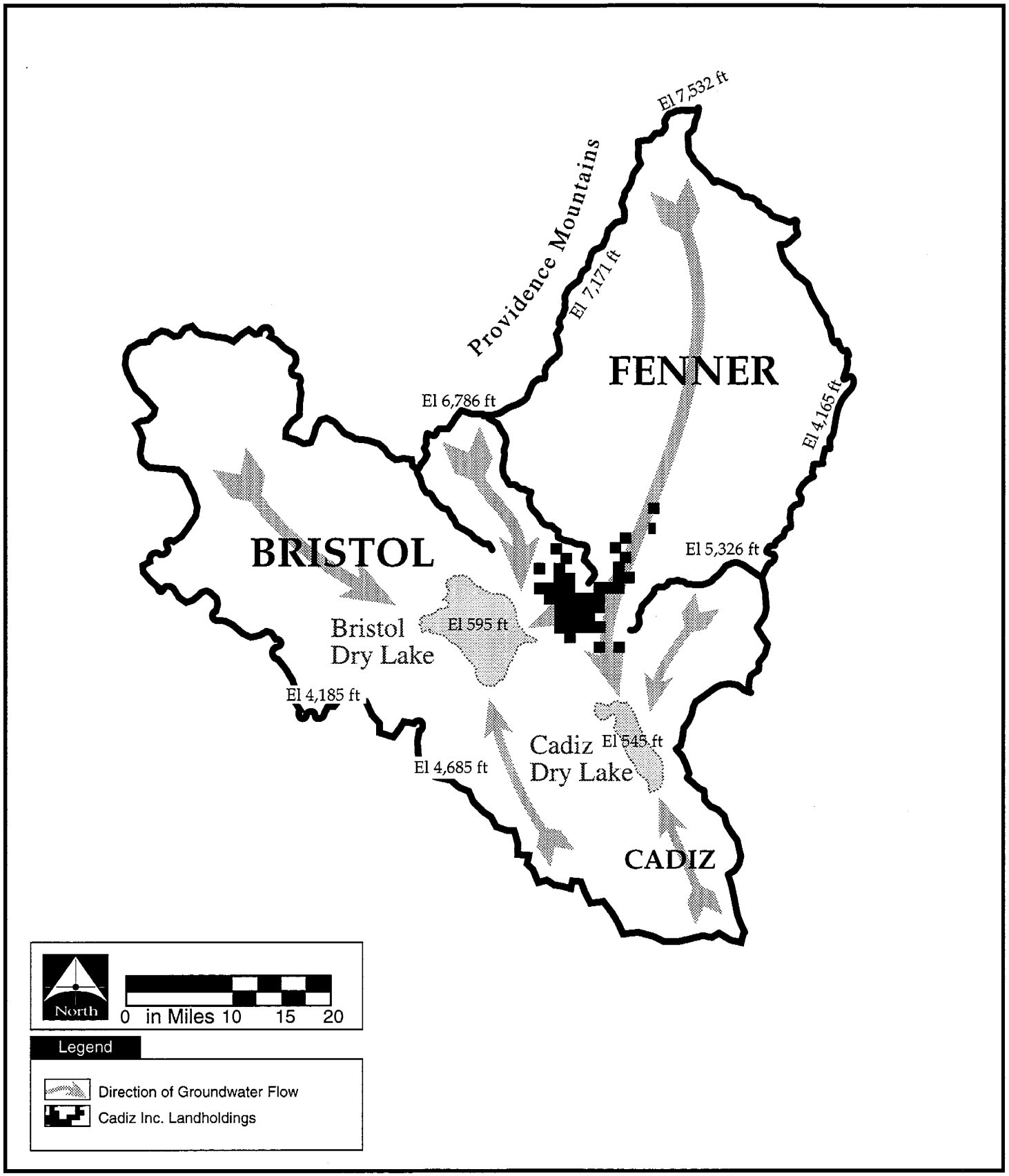
The locations of the Bristol, Cadiz and Fenner valleys are shown on Figure 3-1. Spreading basins in the upper reaches of Fenner Valley were initially considered but were rejected because they would be constructed on relatively steep slopes, would require more grading and cause more habitat disturbance than spreading basins constructed further south in the Fenner Gap area. Spreading basins south of Fenner Gap were precluded by the highly saline groundwater underlying Bristol and Cadiz dry lakes and the potential for this water to migrate into the Project wellfield during extraction operations. Hydrogeologists recommended that to avoid such interaction, the spreading basins and wellfield be located as shown on Figures 3-2 and 3-3. This configuration would place the spreading basins in an area of high soil permeability and provide for "mounding" of the groundwater stored upslope from Bristol and Cadiz dry lakes. Placement of the wellfield in the general area of the spreading basins, on Cadiz Inc. landholdings, was also recommended.

The intent of these siting considerations would be to reduce lateral movement of water toward the saline groundwater at Bristol and Cadiz dry lakes during recharge and to minimize lateral movement of water from the dry lake towards the wellfield during withdrawal operation. This was selected as the most feasible site for these facilities based on the need to minimize habitat loss due to construction, the need to optimize percolation rates, and the need to maintain water quality in the storage and extraction areas. The siting also places the wellfield and the spreading basins entirely on privately owned land. This minimizes the potential for loss of wildlife habitat as a result of project construction based on the existing agricultural production on this site.

1. Groundwater spreading basins;

2. Wellfields; and

3. Siting and configuration of conveyance facilities (pipelines, canals, pumping plants and power lines).

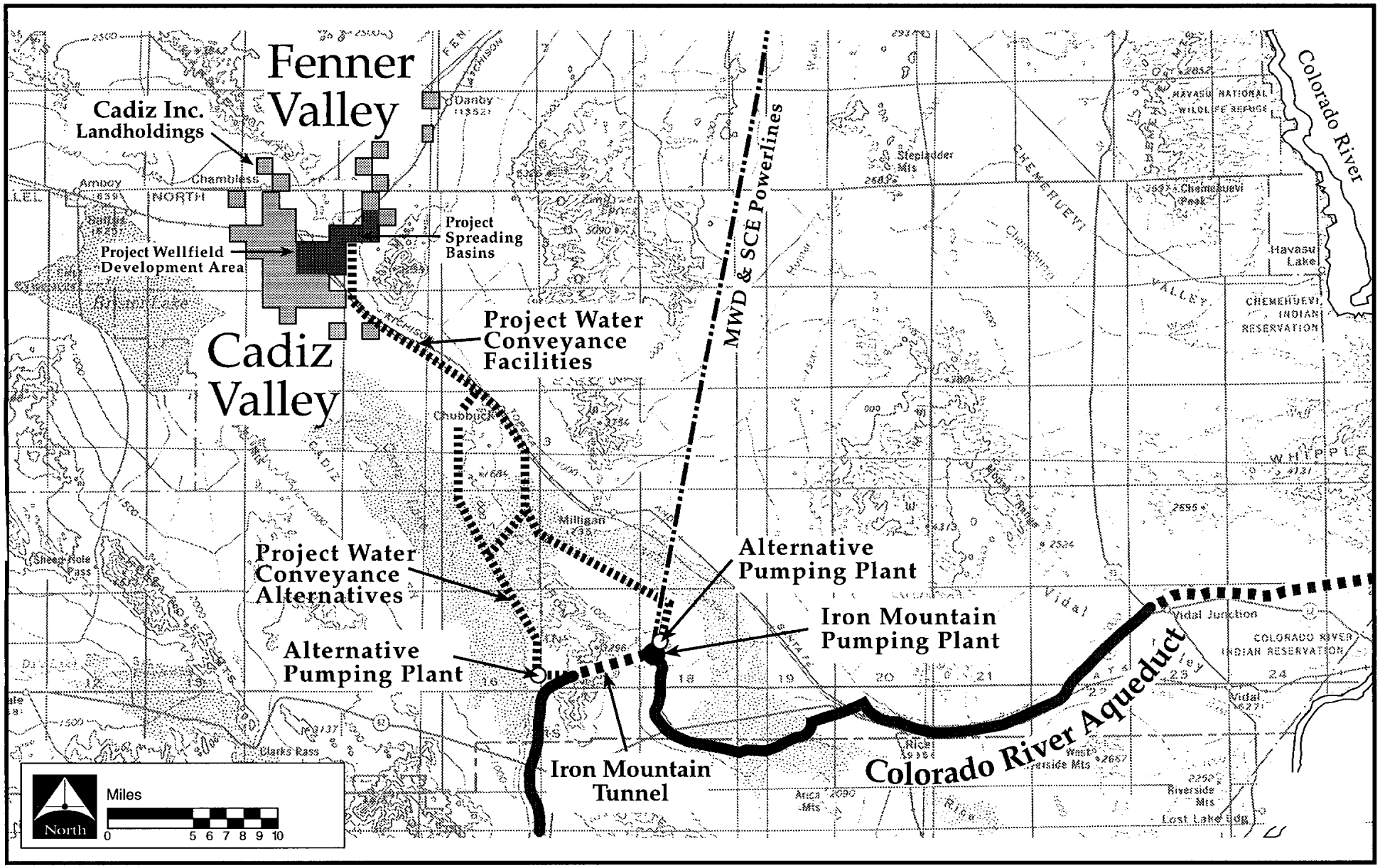


Source: Geoscience Support Services Inc. (1999).

Figure 3-1

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Bristol, Cadiz and Fenner Watersheds



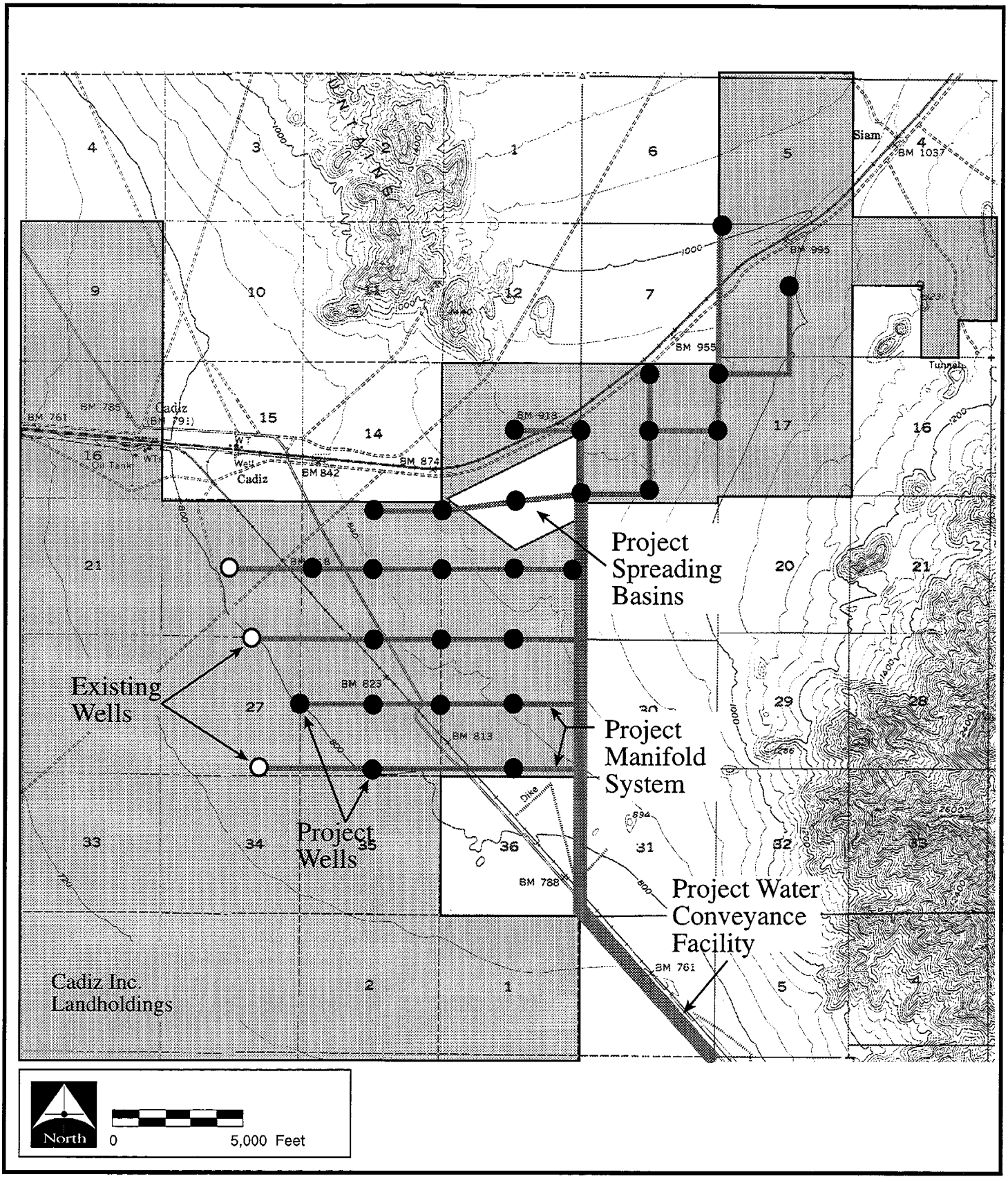
Source: Metropolitan (1999).

Figure 3-2

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Generalized Location of the Cadiz Project Facilities



Source: P&D Consultants, Inc. (1999).

Figure 3-3

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Proposed Wellfield and Manifold System

3.7.2 SITING OF PUMPING STATIONS

Siting of primary pumping stations was based on two primary factors: proximity to the Colorado River Aqueduct and distance from the Fenner Gap. As Figure 3-4 shows, the Colorado River Aqueduct is closest to the Fenner Gap at the Iron Mountain Tunnel portals. The ability to minimize the distance for construction of a water conveyance facility, together with use of existing capital improvements, operations and maintenance resources, would reduce the cost of constructing, maintaining and operating a Cadiz Project conveyance facility and could potentially minimize the potential for environmental impacts associated with it. For these reasons, pumping station siting was limited to two sites, one near the west portal of the Iron Mountain Tunnel and one near the existing Iron Mountain Pumping Plant.

3.7.3 SCREENING-LEVEL ALTERNATIVES CONSIDERED

General

Having established the feasible endpoints of the Cadiz Project, the next phase of detailed alternative formulation was to identify feasible alignments for water conveyance facilities (pipelines, canals and combinations of pipeline and canal). Alignments and design for water conveyance facilities were constrained by regional topography and soils. The water conveyance facilities must cross several areas of steep topography and must be constructed in alternating sand and rock for the remainder of their lengths.

Initial Screening of Conveyance Facility Types and Alignments

Metropolitan and its technical consultants conducted a preliminary screening of 17 potential water conveyance facility alternatives for the Cadiz Project. The development of the water conveyance facility alternatives for the Cadiz Project focused on three main corridors:

a. An eastern corridor beginning at the Iron Mountain Pumping Plant and running northwest near Danby Dry Lake.

b. A western corridor beginning at the west end of the Iron Mountain Tunnel and running northwest through the Cadiz Valley.

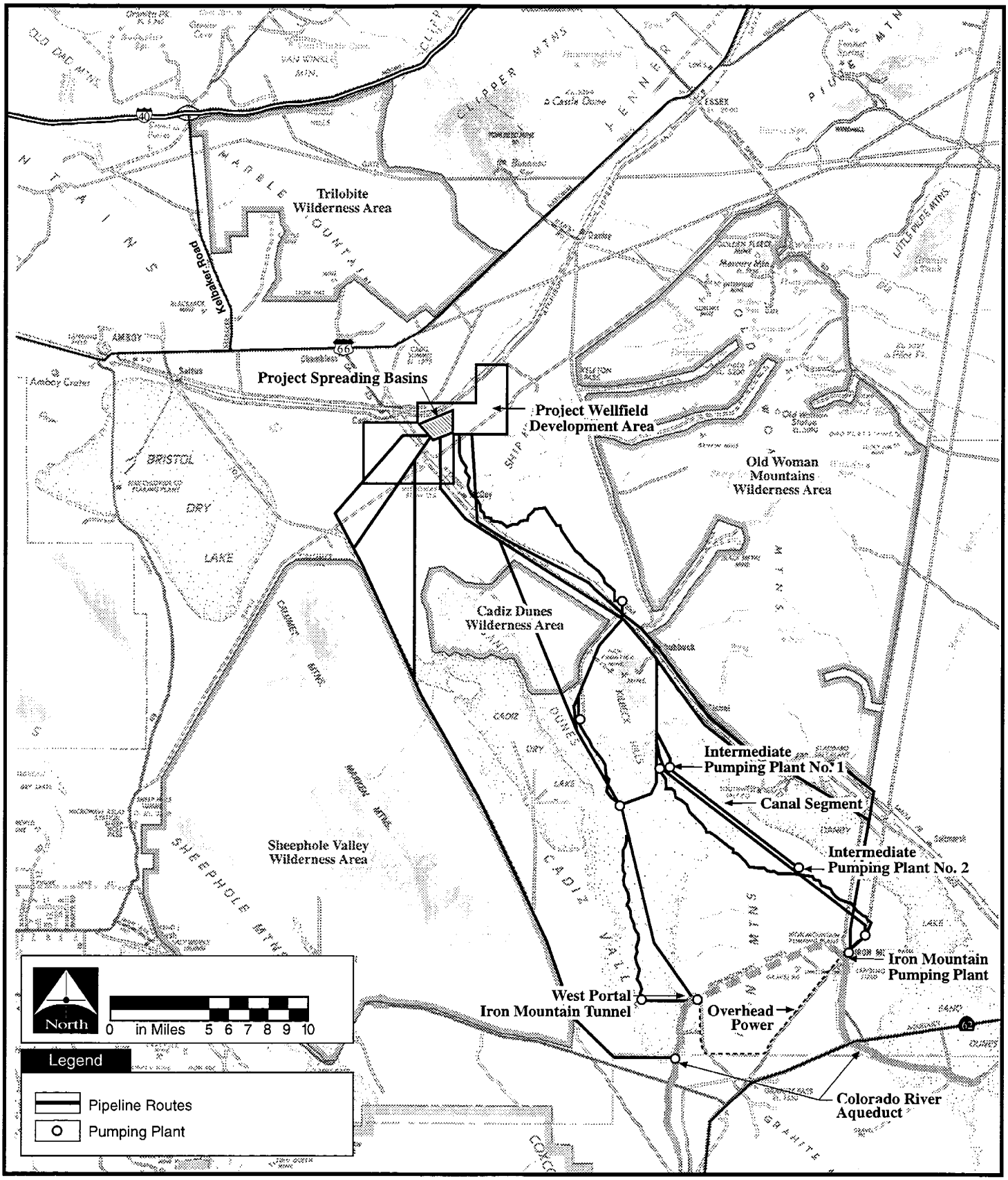
c. A central or combination corridor beginning in the south along the western corridor alignment west portal and then crossing east to join the eastern alignment north of the Kilbeck Hills.

Within these three corridors, 17 screening-level alternatives were formulated and evaluated to arrive at a short list of practicable alignment alternatives described in Table 3-3 and shown on Figure 3-4. Many of the 17 alternatives shared common individual segments.

All alternatives end at the Project spreading basins on Cadiz Inc. property located in the Fenner Gap. The primary differences among alternatives are alignment and whether the water conveyance facility would be pipe, canal or a combination of pipe and canal.

TABLE 3-3
SEVENTEEN CONVEYANCE ALTERNATIVES
GIVEN SCREENING-LEVEL EVALUATION

Alternative (Refer to Figure 3-5)	Segments, North to South (Figure 3-5)	Rational for Elimination Summary
E-1. Eastern Alternative	E-1	Carried forward.
W-4. Western Alternative	E-1, W-4	Carried forward.
C-1. Combination Alternative	E-1, C-1, W-4	Carried forward.
E-6. Eastern/Canal 1 Canal follows 820-foot contour along Iron Mountain	E-1, E-6	Canal construction would involve dewatering and associated environmental impacts; canal would block wildlife migration corridor.
E-5. Eastern/Canal 2 Canal follows 755-foot contour along Iron Mountain	E-1, E-5	Carried forward.
E-7. Eastern/Canal 3 2-way canal conveyance, including canal on 755-foot contour along Iron Mountains	E-7, E-1, E-5	Canal construction would involve dewatering and associated environmental impacts; canal would block two wildlife migration corridors.
E-9. Eastern/Canal 4 2-way canal conveyance, including canal on 820-foot contour along Iron Mountains	E-7, E-1, E-6	Canal would block two wildlife migration corridors.
E-8. All Canal Alternative	E-7, E-8	Canal would completely block east-west wildlife migration; high cost.
E-4. Eastern Pipeline and Tunnel through Iron Mountains	E-1, E-4	Higher cost than Eastern Alternative; similar levels of environmental impacts.
E-2. Eastern Pipeline across Danby Lake and along Cadiz Road	E-2, E-3, E-2, E-4	Requires dewatering across Danby Dry Lake with associated environmental impacts; high cost, greater construction length along ARZC railroad; high corrosion potential across Danby Dry Lake.
E-3. Eastern Pipeline along ARZC Railroad	E-2, E-3, E-2, E-4	Requires dewatering across Danby Dry Lake with associated environmental impacts; high cost, greatest construction length along ARZC railroad; high corrosion potential across Danby Dry Lake.
W-1. Western Pipeline, along west side of Cadiz Valley	W-1	Virtually all of alignment is adjacent to wilderness areas.
W-2. Western Pipeline along western side of Cadiz Valley; cross-valley segment to reach wellfields	W-3, W-1	Most of alignment is adjacent to wilderness areas, construction in dune sands.
W-3. Western Pipeline, through agricultural reserve	W-2, W-1	Impacts agricultural reserve as well as wilderness area.
W-5. Western Pipeline through Cadiz Wilderness	E-1, W-5, W-4	Avoids Sheephole Valley Wilderness Area but crosses Cadiz Dunes Wilderness Area with associated environmental impacts; difficult construction in dunes.
W-6. Western Pipeline/Canal, along west of Kilbeck Hills	E-1, W-4, W-6	Southern canal section blocks wildlife movement; high costs.
W-7. Combination Pipeline/Canal between Kilbeck Hills and Iron Mountains	E-1, C-1, W-6	Southern canal section blocks wildlife movement; high costs.



Source: P&D Consultants, Inc. (1999).

Figure 3-4

Cadiz Groundwater Storage & Dry-Year Supply Program
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Screening - Level Water Conveyance Alternatives

The screening evaluation of alternatives included consideration of environmental impacts, impacts to property and structures, agriculture and utility conflicts, road and railroad crossings, drainage course crossings, construction and maintenance access, geologic hazards and construction staging areas.

The 17 screening-level alternatives were evaluated in a technical workshop to determine which should be carried forward for further analysis. The pipeline, pipeline/canal and all canal alternatives were evaluated based on three criteria: total length, operation and maintenance (O&M), and environmental impact. Cost issues were deferred to the final evaluation of the alternatives. A formalized rating system was established to provide a logical basis for comparing the non-economic criteria. The following technical objectives were targeted:

a. Total Length

The longer the alternative, the more likelihood of increased costs, construction issues, O&M concerns, environmental impacts and aesthetic considerations. Therefore, shorter alternatives were determined to be preferable.

b. Operations and Maintenance

O&M considerations include impacts on O&M staff and general ease of operations and maintenance. O&M issues associated with canals, as opposed to buried pipelines, include cleaning requirements to keep brush, tumbleweeds and sand from entering this exposed water conveyance facility. Also, the canal options include intermediate pumping stations, which create additional O&M requirements. Corrosion is also an O&M consideration with buried pipeline. The West and Combination alternatives include new facilities at the west portal of the Iron Mountain Tunnel that require full time O&M. This location is a remote site, with access over unimproved roads.

c. Environmental Impact

Several key environmental concerns were addressed. First, construction in dry lakebeds, such as Danby and Cadiz dry lakes, would involve work where groundwater levels were within several feet of the ground surface. Excavation would therefore involve dewatering of the pipeline or canal, resulting in discharge of high-salinity groundwater. Second, construction along the western edge of the Cadiz Valley would be adjacent to the Sheephole Mountains Wilderness Area. Third, construction through the Cadiz Dunes Wilderness Area would adversely affect sensitive habitat. Finally, open canals pose physical barriers to animals, including the desert tortoise, bighorn sheep and other species. Canals have greater visual impact than buried pipelines as permanent disturbances of the desert surface. Also, canals require crossings for natural drainage and runoff collection berms to direct runoff to the drainage crossings. Thus, all-pipeline alternatives were generally determined to be preferable to canal alternatives.

3.7.4 RESULTS OF INITIAL SCREENING-LEVEL OF ALTERNATIVES EVALUATION

General

The 17 screening-level alternatives were evaluated for the three factors outlined above and then screened for more detailed analyses. Numerous conveyance facility alternatives were eliminated on the basis of environmental impacts, primarily impacts associated with construction in or adjacent to designated wilderness areas and impacts associated with dewatering of excavation areas crossing the dry lakes. Several pipeline/canal alternatives were eliminated because canal segments would block migration of bighorn sheep, and movement of desert tortoise and other wildlife species. Technical considerations eliminated several pipeline-only alternatives. Key technical considerations were the potential for pipeline corrosion and the potential for impacts to the BNSF railroad.

Therefore, this screening indicated that all-pipeline alternatives would generally be preferred to alternatives including canal segments on both technical and environmental grounds. Detailed alternative formulation and evaluation was therefore focused on all-pipeline alternatives, with only one pipeline-canal alternative (Eastern/Canal Alternative) included in the final array of alternatives. The alternatives carried forward for detailed consideration were:

a. Eastern Alternative
b. Western Alternative
c. Combination Alternative
d. Eastern/Canal Alternative
e. No Project

Based on the initial formulation considerations outlined above, all alternatives except for the No Project Alternative would include spreading basins and a wellfield in the Fenner Gap part of the Cadiz Project area. The operational scenarios for all alternatives would be the same. All alternatives carried forward for detailed consideration would begin at the Iron Mountain Pumping Plant or the west portal of the Iron Mountain Tunnel and end at the spreading basin/wellfield located on Cadiz Inc. landholdings in the Fenner Gap.

3.7.5 DETAILED EVALUATION OF PROJECT-LEVEL ALTERNATIVES

General

Studies of the four alternatives and their appurtenant facilities were performed to evaluate each alternative's potential impact to the environment. These studies developed information which was then used to evaluate the alternatives.

Based on this information, the relative impacts and benefits of the four alternatives were evaluated using 27 separate parameters that permit quantitative evaluation of the practicability and environmental/social impacts of each alternative as shown in Table 3-4. The evaluation parameters were selected because they met the following tests:

TABLE 3-4
EVALUATION CRITERIA FOR THE
PROJECT ALTERNATIVES

Criteria	Units of Measurement	Criteria Weight
Practicability Measures (50% of Total Weight)		
Project cost	Dollars	0.091
On-line date	Months beyond target date	0.082
Risk to existing infrastructure	Miles adjacent to existing infrastructure	0.073
Proximity to salt playas	Miles within delineated dry lakes	0.064
Construction within sand dunes	Miles within sand dunes	0.055
Construction/maintenance access	Miles from road or railroad	0.045
Internal pipeline pressure	Feed (elevation) of head	0.036
Arroyo wash crossings	Number of crossings	0.027
Construction in rock	Miles with delineated rock structures	0.018
Right-of-way acquisition	Miles within private ownership	0.009
Environmental/Social Impacts Measures (50% of Total Weight)		
Desert tortoise	Number of signs per alternative	0.053
Wildlife corridors crossed	Miles of designated corridors blocked	0.048
Wilderness area compatibility	Miles of alternative adjacent to wilderness area	0.048
Air quality	Tons of No_x and PM_{10} emissions during construction	0.044
Mojave fringe-toed lizard habitat	Miles of suitable habitat crossed	0.041
Cultural/ethnographic resources, including historic and pre-historic resources, ethnographic concerns and paleontological resources	Number of sites/issues affected	0.038
Mojave wash scrub habitat	Acres affected	0.035
Aesthetic affects	Miles of alternative visible from wilderness areas	0.032
Desert dunes and sand fields habitat	Acres affected	0.029
Business/mining claim affects	Number of mining claims affected	0.026
Ordnance and explosive waste	Potential for encountering	0.023
Mojave creosote bush scrub habitat	Acres affected	0.020
Energy use (construction and operation)	KWh/day, gal/day for storage operations	0.018
Noise	Amount of blasting per alternative	0.009
Common chuckwalla habitat	Number of signs per alternative	0.009
Ribbed cryptantha	Est. number of plants affected	0.009
Traffic/disruption of access	Est. hours cumulative delay	0.009
Borrego milketch	Est. number of plants affected	0.009

a. Importance

Each parameter represents an important characteristic of the four alternatives. A characteristic could affect either project practicability or the nature and extent of environmental impacts associated with construction and operation of the alternatives.

b. Quantitative Measurement

All 27 parameters are measurable using field data, allowing alternatives to be compared objectively. Decision-makers and the public therefore have a concrete basis for evaluation and selection of the Project-level alternatives.

c. Redundancy

Each of the 27 parameters was selected because it measures a discrete characteristic of the Cadiz Project. The parameters avoid the potential for double counting and the inadvertent bias that this may introduce into decision-making processes.

Criteria for Evaluation of Project-Level Alternatives

Practicability Measures

Based on engineering, geotechnical and hydrologic analyses, ten parameters were selected as the basis for comparing the practicality of the alternatives.

a. Project Cost

Overall implementation costs are important to Metropolitan's customers. Metropolitan is committed to holding costs of its supplies to the lowest levels consistent with maintaining high water quality and system reliability. Overall costs can be measured in terms of capital costs and amortized over the term of the project.

b. On-Line Date

The availability of surplus supplies on the Colorado River Aqueduct is anticipated to decline in the future as Arizona and Nevada take a greater percentage of their allocations. Also, a greater percentage of supply would be dedicated to meeting normal-year needs as demand grows as projected, as discussed earlier in Section 2. It is, therefore, beneficial to bring storage elements of the project on line as rapidly as possible. A target completion date is December 2000. Delays beyond this completion date could have an adverse impact on project benefits.

c. Risk to Existing Infrastructure

Although it is unlikely that construction and operation of the Cadiz Project would pose a risk to adjacent infrastructure, this risk would be directly proportional to the distance of the project from existing infrastructure. The potential risk can be quantified by the number of miles of each alternative parallel to existing infrastructure (roads, utilities and railroad lines).

d. Proximity to Salt Playas

The soils of salt playas are highly corrosive and require high levels of maintenance. Avoidance of these areas reduces operation and maintenance requirements and operation and maintenance activity along the alternative.

A measure to evaluate salt playas is the length of alternative crossing mapped dry lakebeds.

e. Construction Within Sand Dunes

Unstable sands in dune fields pose problems related to construction difficulty, safety and long-term maintenance. These problems are directly proportional to the length of each alternative within sand dune areas.

f. Construction/Maintenance Access

Access to remote construction sites would be difficult and time-consuming. Hauling materials to remote construction sites is a particular problem. Alternatives within reasonable proximity to roads or railroads are preferred. This can be measured in terms of the number of miles an alternative parallels an existing road or railroad.

g. Internal Pipeline Pressure

Alternatives which require greater lift of water, and therefore greater pipeline pressure rating, also require additional measures to ensure against failure. In addition, higher pipeline pressures affect operation and maintenance of the pumping plant. The maximum calculated internal pipeline pressure (head) is a measure of this factor.

h. Arroyo Wash Crossings

Conveyance facilities which crosses desert washes are subject to potential damage from erosive flows during floods. Potential problems are directly proportional to the number of drainage crossings per alternative.

i. Construction in Rock

Construction in hardrock (crystalline) is difficult, slow and a potential safety hazard. The difficulties are directly proportional to the number of miles of construction in rock. These issues are a concern for the pipeline, canal and power distribution facilities.

j. Right-of-Way Acquisition

Acquisition of rights-of-way can affect construction schedule and cost, and adds uncertainty to the design and construction process. These problems are directly proportional to the number of miles of each alternative in private ownership.

Environmental/Social Measures

Several important factors were not used in this phase of the comparison of alternatives, including the potential for the project to create new access to the desert and adjacent mountain areas. This criterion, while important from the perspective of overall impacts, was considered the same for all four alternatives. Given that the level of new access would be identical for all project-level alternatives, this type of criterion would have no impact on the relative merit of the alternatives.

a. Desert Tortoise

Virtually all the Project area is considered to be potential desert tortoise habitat, but the actual occurrence of tortoises differs for each alternative alignment. The number of signs of such occurrences identified during field surveys is a

measure of the potential for the Project to involve take of this endangered species.

b. Wildlife Movement Corridors Crossed

Wildlife movement corridors could be affected by destruction of habitat or physical obstruction by Project facilities. These impacts could affect wildlife species by making habitat areas unavailable for use or by interfering with essential behaviors.

c. Wilderness Area Compatibility

Construction adjacent to a wilderness area may have adverse impacts on wildlife and visitors to wilderness areas as a result of vehicular traffic and construction activity. All of these issues are proportional to the length of each alternative parallel to existing wilderness areas.

d. Air Quality

The proposed Project is located in an area which does not currently comply with air quality standards. Air quality may be adversely affected during construction, primarily as a result of emissions from construction equipment and creation of dust. These can be measured in terms of estimated tons of pollutants emitted, using NO_x (nitrates from burning of fuel) and PM_{10} (a measure of fine dust) as indicators of overall pollution.

e. Mojave Fringe-Toed Lizard Habitat

This species may be impacted directly or indirectly by Project construction. The total acres of its habitat affected is a measure of the total potential for each alternative to have such adverse impacts.

f. Cultural/Ethnographic Resources

The region has a number of cultural resources sites, impacts to which can be evaluated based on the number of sites, by type and significance of site. Type of site includes consideration, by alternative, of ethnographic issues.

In addition, the Project could unearth (disturb) fossil resources during construction. While this would allow the excavation and study of such fossils, it could also impact the integrity of sites that could be otherwise studied more systematically in the future.

g. Mojave Wash Scrub Habitat

This is an important habitat, providing a relatively complex structure in an intermittently flooded environment for a wide variety of species. These impacts can be estimated by the number of times an alternative crosses such habitat.

h. Aesthetic Affects

The Cadiz Project area is located in a region remote from population concentrations. The pipeline and overhead power lines could potentially be observed by people using adjacent wilderness areas. For these people, seeking to escape the trappings of urban development, a view of water conveyance and overhead power distribution facilities could result in an adverse impact. This impact is directly proportional to the miles of these facilities visible from a wilderness area.

i. Desert Dune and Desert Sand Fields Habitat

Impacts to this habitat can be measured in acres affected by construction.

j. Business/Mining Claim Affects

There is potential that access to mining claims could be temporarily blocked by construction and that the permanent Project right-of-way may affect some aspects of such mining claims. The number of such claims per alignment is a useful estimator of these potential problems.

k. Ordnance and Explosive Waste

The general region encompassing the Cadiz Project area has been used as a military training area and there are areas containing unexploded ordnance. This poses a safety threat to construction workers and operation and maintenance personnel. This threat is assumed to be proportional to the total acreage of known target zones crossed by each alternative.

l. Mojave Creosote Bush Scrub Habitat

Impacts to this habitat can be measured in acres affected by construction.

m. Energy Use (Construction and Operation)

Consumption of energy can be calculated for each alternative alignment based on projected equipment use during construction and by estimated electrical power demands of each conveyance facility. The measurement for ongong Project energy use is the projected daily power consumption during storage operations.

n. Noise

Blasting during construction could create short-term disturbance to people and wildlife. This impact can be measured in terms of the number of days of anticipated blasting for each alternative.

o. Common Chuckwalla Habitat

Potential for impacts to this species can be estimated by the number of sign of the species observed during field studies of each alternative. Such signs are considered an indicator of relative use of the habitat.

p. Ribbed Cryptantha Impacts

Impacts to this rare plant can be estimated based on the number of plants observed during field studies of each alternative.

q. Traffic/Disruption of Access

Each alternative has the potential to cause some construction-related delays in traffic. These can be estimated based on construction routes and construction schedules, combined with analysis of access problems. This analysis would provide an estimate of total hours of delay caused by construction of each Project alternative.

Borrego Milkvetch

Impacts to this rare plant can be estimated based on the number of plants observed during field studies of each alternative.

TABLE 3-5
PROJECT-LEVEL ALTERNATIVE ANALYSIS
(LISTED IN ORDER OF WEIGHT IN RANKING OF ALTERNATIVES)

Criteria	Units of Measurement	Project-Level Alternative			
		Eastern	Western	Combination	East/Canal
Practicability Measures					
Project cost	$ (millions)	150	150	153	165
On-line date	Months beyond target date	0	0	5	5
Risk to infrastructure	Miles adjacent to existing infrastructure	14	11	14	11
Proximity to salt playas	Miles within delineated dry-lakes	14	10	6	15
Construction within sand dunes	Miles within sand dunes	6	14	13	6
Construction maintenance access	Miles away from road or railroad	2	6	6	2
Internal pipeline pressure	Feet (elevation) of head	580	650	655	460
Arroyo wash crossings	Number of crossings	25	25	20	25
Construction in rock	Miles within delineated rock structures	3	3	3	3
Right-of-way acquisition	Miles within private ownership	1.5	2.5	2.25	1.5
Environmental Measures					
Desert tortoise	Scat Active burrows Old burrows	11 1 1	11 6 4	11 6 5	11 1 1
Wildlife corridors crossed	Miles of corridors blocked	0	0	0	0.17
Wilderness area compatibility	Miles of alternative adjacent to wilderness areas	7.35	7.65	7.35	7.35
Air quality	Tons NO_x and PM_{10} emissions during construction	49,564	56,248	56,053	84,692
Mojave fringe-toed lizard habitat	Miles of suitable habitat crossed	5.5	7.7	2.7	5.5
Cultural/ethnographic Resources	Historic/pre-historic ethnographic sites/issues Paleontological resources	4 - -	1 - -	4 - -	4 - -
Mojave wash scrub habitat	Acres affected Temporary Permanent	 11.5 2.2	 12.3 2.7	 13.2 2.8	 11.0 2.7
Aesthetics affects	Miles of alternative visible from wilderness areas	34	33	34	34
Desert dunes and sand fields habitat	Acres Affected Temporary Permanent	 148.7 16.5	 169.9 18.9	 177.8 19.8	 130.0 35.2
Business/mining claims affects	Number of mining claims affected	1	1	1	1
Ordnance and explosives waste	Potential for encountering	Medium	Medium	Medium	Medium
Mojave creosote bush scrub habitat	Acres affected Temporary Permanent	 634.0 465.2	 650.7 492.8	 883.7 518.7	 595.9 505.0
Energy use (construction and operation)	KWh/day, gal/day	187,500	178,600	187,500	129,400
Noise	Amount of blasting	Low	Low	Low	Low
Common chuckwalla habitat	Number of signs	1	2	3	1
Ribbed cryptantha	Est. number of plants affected	306	261	270	306
Traffic/disruption of access	Estimated hours of cumulative delay	100	0	100	100
Borrego milkvetch	Estimated number of plants affected	0	0	0	0

Weighting of Criteria

The above parameters were weighted to reflect their relative importance in overall decision making for this project. Weighting was based on two factors:

a. Importance of the Parameters

This judgment was based on the potential for each parameter to affect the practicability of the project and/or the acceptability of the project to the public.

b. Usefulness of Parameters in Comparison of Alternatives

Parameters were given a higher weight if they described project characteristics which were significantly different from alternative to alternative.

Highly weighted parameters were both important and represented areas where the various alternatives were significantly different.

3.7.6 RESULTS OF PROJECT-LEVEL ALTERNATIVES EVALUATION

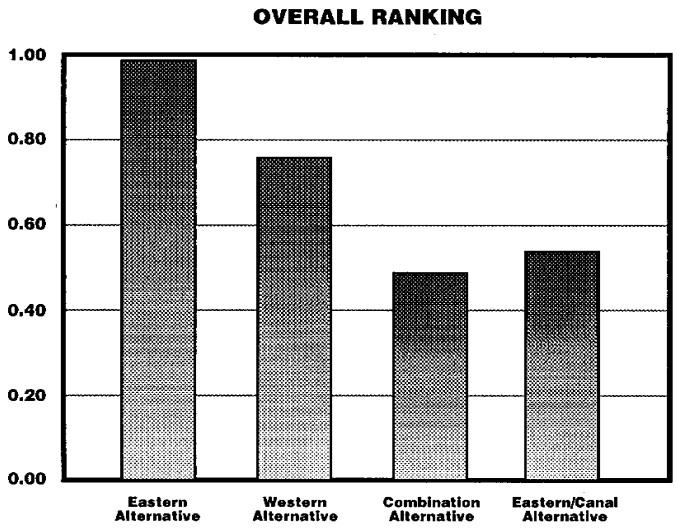
General

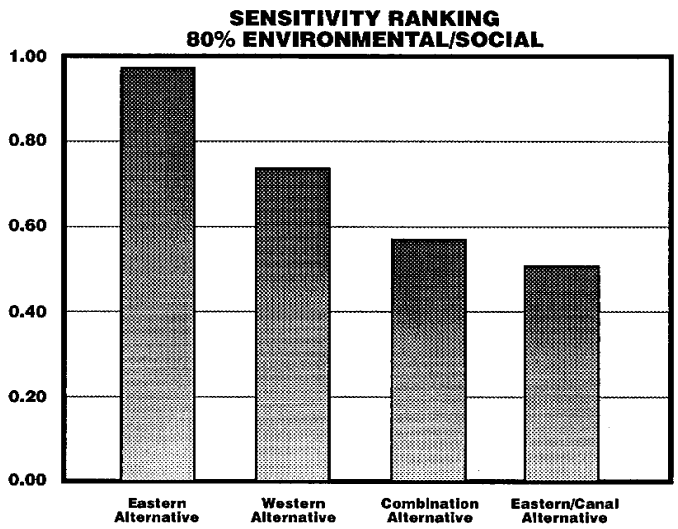
Data from field studies for the 27 quantitative measures used in evaluation of the project-level alternatives are summarized on Table 3-5. To rank the four project-level alternatives, these data were entered into a model that first developed a relative "score" for each alternative for each measure, with the score based on the difference between the lowest and highest raw scores on a measure. If all four alternatives had the same raw score on a measure, they were all assigned the same score (a score of 0.0 which eliminates the effect of the measure on alternative evaluation). The rankings thus reflect the relative difference between the alternatives on each measure. The worst score on a measure was then assigned a value of 0.0 and fractional values above this baseline were calculated to reflect the difference in raw score and the weight given to the measure. Where differences are relatively small, such as for acres of Mojave fringe-toed lizard habitat impacted or wilderness area compatibility, the effect of this approach is to assign relatively similar fractional values to all alternatives. Where there are major differences between alternatives, the fractional ranking reflects these differences.

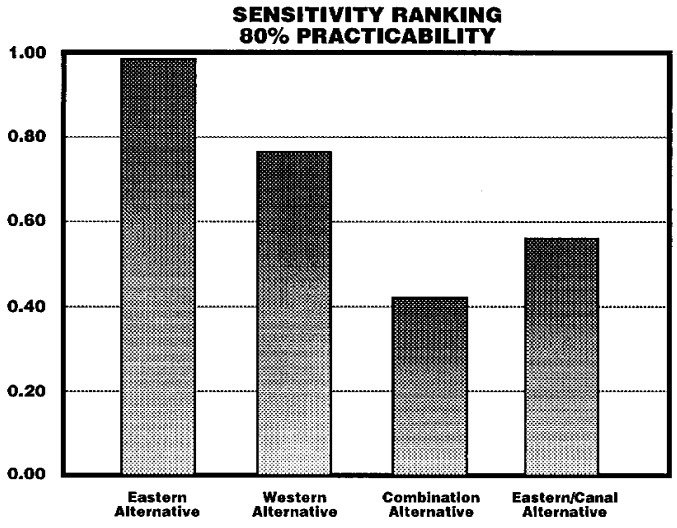
This proportional ranking on a common scale for each measure makes it possible for the results to be entered into a model that (1) accounts for the relative weight given to each measure and (2) then sums the weighted rankings for each alternative for all measures.

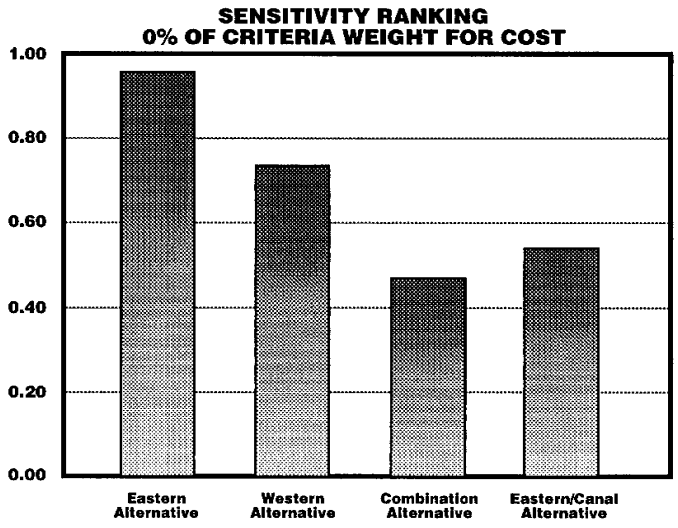
In this way, disparate data sets can be converted into a single score for comparison of alternatives. These overall scores are further normalized to a scale of 0.0 to 1.0 by dividing all overall scores by the highest (best) overall score.

The data on Table 3-5 and Figure 3-5 demonstrate that the four project level alternatives differ most on several measures. First, they differ significantly on four practicality measures, construction completion, risk to infrastructure, construction within sand dunes and construction-maintenance access. The Eastern Alternative has the best raw score on three of these measures, and this is









Source: Metropolitan Water District of Southern California (1999).

Figure 3-5

Cadiz Groundwater Storage & Dry-Year Supply Program

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Relative Ranking of Alternatives

reflected in its overall ranking for practicality as shown on Table 3-6. Second, they differ significantly on desert tortoise effects, on wildlife corridors where any impact is considered significant and on total acres of temporary and permanent habitat impacts. Again, the Eastern Alternative scores high on all these measures. The alternatives do not vary significantly on many of the other measures considered, and the effective weight of these measures with high variation among alternatives is therefore great.

Based on this evaluation, the conclusion of this analysis can be summarized as follows:

- The disadvantages of canals are considerable. They have higher costs than pipeline segments, they block wildlife movement and they have higher habitat impacts. Thus, although the Eastern/Canal Alternative shares some of the advantages of the Eastern Alternative, it has a lower overall ranking because of these disadvantages.

- The Western and Combination alternatives receive a number of low scores on both practicality and environmental impact measures, and they have no significant advantages on high priority measures. The result is a low overall ranking for both of these alternatives.

These conclusions are detailed below.

Practicability Scores

The Eastern Alternative is the shortest pipeline, has the fewest secondary facilities (added transmission lines, secondary pumping stations) and has the best construction access of the alternatives. It also has the fewest miles of construction in dunes and desert sands, low risk to existing infrastructure and the best construction access. These features

TABLE 3-6
RELATIVE RANKING OF ALTERNATIVES

	Overall	Practicability Measures	Environmental and Social Measures
Eastern Alternative	0.99	0.51	0.48
Western Alternative	0.75	0.38	0.36
Combination Alternative	0.49	0.19	0.31
Eastern/Canal Alternative	0.54	0.29	0.25

	Alternative Sensitivity Analysis		
	80% of Criteria Weight for Practicability	80% of Criteria Weight for Environmental/Social	0% of Criteria Weight for Cost
Eastern Alternative	0.99	0.97	0.99
Western Alternative	0.76	0.73	0.73
Combination Alternative	0.42	0.57	0.47
Eastern/Canal Alternative	0.56	0.51	0.54

help it achieve the lowest construction cost, about $8 million less than the Eastern/Canal Alternative, and the best score for completion schedule.

The Western Alternative scores low on essential construction difficulty criteria such as construction in desert dunes and desert sands and construction access. As a result, costs are also marginally higher and there is a greater risk of failing to meet completion schedule criteria.

The Combination Alternative has lowest scores on five practicality criteria, including project cost. Cost and completion schedule, however, are the primary factors which cause its low practicability score. In addition, it scores low on a number of factors such as proximity to salt playas and arroyo wash crossings, albeit marginally lower.

The Eastern/Canal Alternative, while it shares many of the advantages of the Eastern Alternative, scores low on schedule and cost because the canal section requires two secondary pumping stations and adds to the construction schedule.

Environmental and Social Impact Scores

The Eastern Alternative has the highest net score on the 17 environmental/ socioeconomic criteria, primarily based on its low impacts to the desert tortoise. The Western and Combination Alternatives have high desert tortoise impacts as a result of the southern power transmission line. The Combination Alternative has higher habitat impacts. The Eastern/Canal Alternative has higher impacts on corridor movement and lower scores on a number of other criteria.

Sensitivity Analyses

Purpose of Sensitivity Analyses

To determine whether the weighting of criteria introduced a significant bias into the analysis of conveyance alternatives, the overall weighting of practicability and environmental/social parameters was varied and scores recalculated. Three sensitivity analyses were conducted, as outlined below.

a. Increase Overall Weight for Practicability Parameters

This sensitivity test involved increasing the weight of the practicability parameters as a group from 50 percent to 80 percent, with a corresponding decrease in the weight given to environmental/social impact parameters as a group to 20 percent.

b. Increase the Overall Weight for Environmental/Social Impacts Parameters

This sensitivity test involved increasing the weight of the environmental/social impact parameters as a group from 50 percent to 80 percent, with a corresponding decrease in the weight given to practicability parameters as a group to 20 percent.

c. Reduce the Weight of the Cost Parameter

To determine whether the high weight given to project costs was affecting overall evaluation, the weight of this

parameter was reduced to zero. The weight given to all other parameters was then increased proportionally to equal 1.0.

Results of Sensitivity Analyses

Because the Eastern Alignment scores well for both practicality and environmental impacts, increasing the weight of practicability measures or the weight of environmental/social impact measures does little to change the overall rankings of the four alternatives. The Eastern Alternative remains the preferred alternative and the environmentally preferred alternative under both sensitivity tests. Note in Table 3-6 and Figure 3-5 that the ranking for the Combination Alternative is affected by changing these weights. When practicality is emphasized, this alternative's total ranking decreases. When environmental/social impacts are emphasized, the Combination Alternative's ranking increases. These changes are not significant to change the overall ordering of the alternatives.

Decreasing the weight of the cost measure has virtually no impact on overall rankings of the alternatives because anticipated Project costs vary by less than ten percent ($150 to $165 million) among the alternatives.

It is clear, then that the overall rankings of the alternatives are not sensitive to changes in the weight given to each category of measures, or to the highest weighted practicality measure. In addition, because the Eastern Alternative scores well on many of the other high priority measures, it is highly unlikely that changing the weight on these measures would alter the overall rankings.

3.8 SELECTION OF THE ENVIRONMENTALLY PREFERRED ALTERNATIVE

The primary criteria for selection of the environmentally preferred alternative were impacts to desert tortoise and wildlife corridors, and wilderness area compatibility. These were the three highest-weighted evaluation criteria. These were addressed individually and overall rankings of the alternatives are discussed below.

3.8.1 IMPACTS TO DESERT TORTOISE

Desert tortoise might be found near any of the Cadiz Project alternatives. A total of eight tortoise burrows and numerous other (15 to 16) signs were found in the Western and Combination alternatives, respectively, particularly along the powerlines between Iron Mountain Pumping Plant and the Cadiz Pumping Plant. Only four burrows and 11 other signs were found along the Eastern Alternative. The Eastern/Canal Alternative would, however, have significantly higher impacts on desert tortoise because an open canal section, would be constructed through this species habitat at the southeast corner of the Iron Mountains. This fenced canal section would draw predators to the area and block movement of desert tortoise, big horn sheep and other wildlife across a movement corridor.

3.8.2 IMPACTS TO WILDLIFE CORRIDORS

The Western and Combination alternatives cross a 10-mile wide wildlife movement corridor between the Iron Mountains and

the Calumet Mountains. In contrast, the Eastern Alternative crosses a similar wildlife movement corridor from the Old Woman Mountain area to the Iron Mountains, but the length of crossing is only five miles. Both short-term construction impacts to wildlife movement and long-term impacts as a result of routine inspection and maintenance of pipelines and power lines would therefore be lower for the Eastern Alternative. In addition, the Eastern/Canal Alternative would effectively sever the movement corridor between the Iron Mountains and the Old Woman Mountain Wilderness Area, with potentially significant long-term implications for wildlife.

3.8.3 WILDERNESS AREA COMPATIBILITY

Although all alternatives would probably be visible from nearby wilderness areas during construction, and power distribution lines would be visible from many areas in the long term for all alternatives, the Eastern Alignment has the lowest potential for conflicts with these areas. All alternatives include approximately five miles of construction adjacent to the northeastern boundary of the Cadiz Dunes Wilderness Area. In addition, the Eastern Alternative and Combination alternatives lie within three miles of the Old Woman Mountains Wilderness Area for a one mile segment, but are otherwise relatively distant from designated wilderness areas. In contrast, the Western Alternative has a three-mile segment along the eastern boundary of the Cadiz Dunes Wilderness Area. The Eastern/Canal Alternative would be a visible intrusion into the landscape, visible from the Iron Mountains, the valley floor and the Old Woman Mountains Wilderness Area.

3.8.4 OTHER ENVIRONMENTAL IMPACTS

As Tables 3-5 and 3-6 indicate, the Eastern Alternative has relatively lower combined impacts (higher scores) in most other environmental, social and cultural resources categories than the other alternatives. Given the Eastern Alignment's low level of impacts to all three critical environmental criteria, and no offsetting high impacts on other criteria, the Eastern Alternative was therefore designated the environmentally preferred alternative. The No Project Alternative is not the environmentally preferred alternative because, while it would minimize project area environmental and social impacts, it would generate its own adverse environmental and social impacts. This is because it would result in water supply deficits and rationing during future droughts. Rationing has adverse short-term impacts on the environment associated with potential groundwater over-drafting within Metropolitan's service area, resulting in lowering of groundwater levels and salinity intrusions. Rationing would affect agricultural production and land use and impact landscaping at public parks and recreation areas due to reduced irrigation. Significant short-term economic impacts are also associated with rationing.

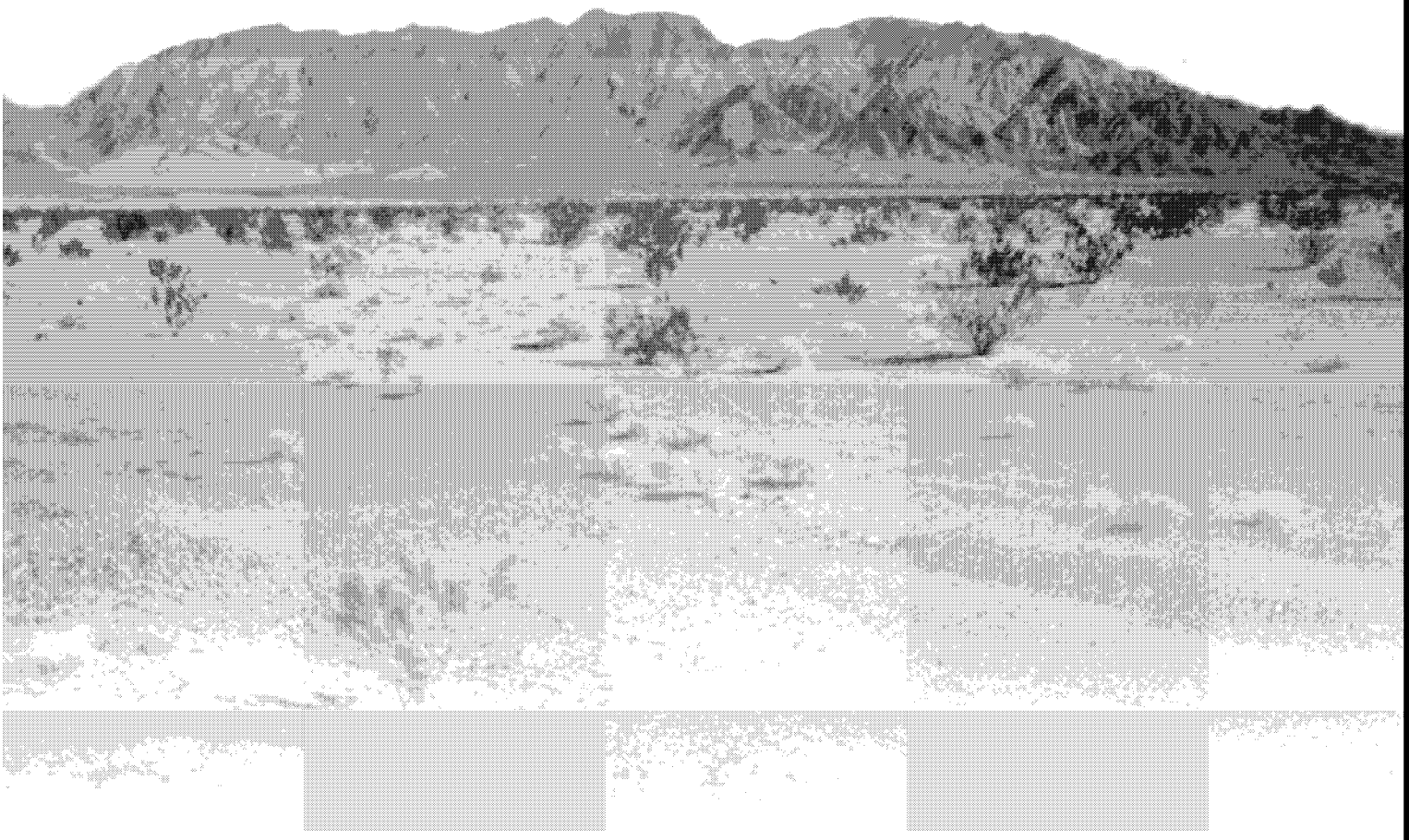
3.9 SELECTION OF THE PREFERRED ALTERNATIVE

The preferred alternative is the alternative which best optimizes practicability and environmental impacts; that is, which has relatively high practicability combined with acceptable levels of impact.

As Tables 3-5 and 3-6 suggest, the environmentally preferred Eastern Alternative also has the highest practicability score, and this score is not affected by changing the overall weight given to practicability and environmental/social scores as shown on Figure 3-5. The Eastern Alternative, therefore, would be preferred for practicability and low environmental impacts. It was therefore designated as the preferred alternative.

SECTION 4.0

Description of Project Alternatives



SECTION 4
DESCRIPTION OF THE PROJECT ALTERNATIVES

4.1 INTRODUCTION

As discussed in Section 2, the need and purpose for the Cadiz Project have been determined only after implementing extensive Best Management Practices (BMPs) including water conservation, water recycling, groundwater conjunctive use, water transfers and other related water management measures. The Cadiz Project was sized with consideration of Colorado River watershed hydrology, aquifer system safe yield, storage potential, Colorado River Aqueduct operating constraints, potential impacts to adjacent interests, water quality considerations and demands for supplemental water. The resulting need for the Cadiz Project was determined to be approximately: 1) 150,000 acre-feet of extraction capacity per year; 2) a storage capacity of up to 1 maf at any one time, per year; and 3) a net yield of about 2.6 maf to 3.6 maf, depending on the natural recharge of the basin over the 50-year term of the Cadiz Project.

The formulation and screening of the Cadiz Project alternatives considered in this EIR/EIS are discussed in Section 3. The following paragraphs describe in detail the Cadiz Project alternatives evaluated in this EIR/EIS, in addition to the No Project Alternative.

The Federal actions necessary for implementation of the Cadiz Project include the following:

- The Cadiz Project would need an amendment of the California Desert Conservation Plan (CDCA Plan) for an exception to the utility corridor requirement. This proposed amendment of the CDCA Plan is a planning action by the BLM and involves a separate decision by the BLM from that required for the proposed issuance of right-of-way easement for the Cadiz Project. An exception to the CDCA Plan is needed to allow a utility corridor for water conveyance and power distribution facilities. The corridor would extend from the Iron Mountain Pumping Plant along the approved water conveyance facilities alignment to the Project spreading basins.

- Grants of right-of-way for construction and operation of the water conveyance facility and power distribution facility. A temporary 200-foot wide right-of-way would be necessary for construction activities, and a permanent 80-foot wide right-of-way (or 120-foot along a canal section) would be necessary for operations and maintenance activities. The permanent right-of-way would be within the limits of the construction temporary right-of-way.

Metropolitan would also obtain the right-of-way around each well in the Project wellfield, a 40-foot wide corridor centered over the alignment of the wellfield piping, and a permanent easement for the Project spreading basins. These permanent easements would be granted to Metropolitan by Cadiz Inc.

The Cadiz Project consists of facilities in four general areas, as follows:

- Project spreading basins;
- Water conveyance and power distribution facilities between the Colorado River Aqueduct and the project spreading basins;
- Pumping plants to pump water from the Colorado River Aqueduct through the water conveyance facility to the Project spreading basins and
- Project wellfield in the Fenner Gap to extract water from the groundwater aquifer system and pump it back to the Colorado River Aqueduct.

Detailed descriptions of the alternatives are provided in this section, in the following order:

- Eastern Alternative.
- Western Alternative.
- Combination Alternative.
- Eastern/Canal Alternative.
- No Project Alternative.

The four Cadiz Project alternatives are shown on Figure 4-1. The alternatives, their appurtenances, and proposed operation and maintenance are discussed in detail in the following paragraphs. In addition, discussions of the hydraulic characteristics, right-of-way requirements, feasibility, capital costs and anticipated construction activities, manpower requirements and construction schedules are included in this section.

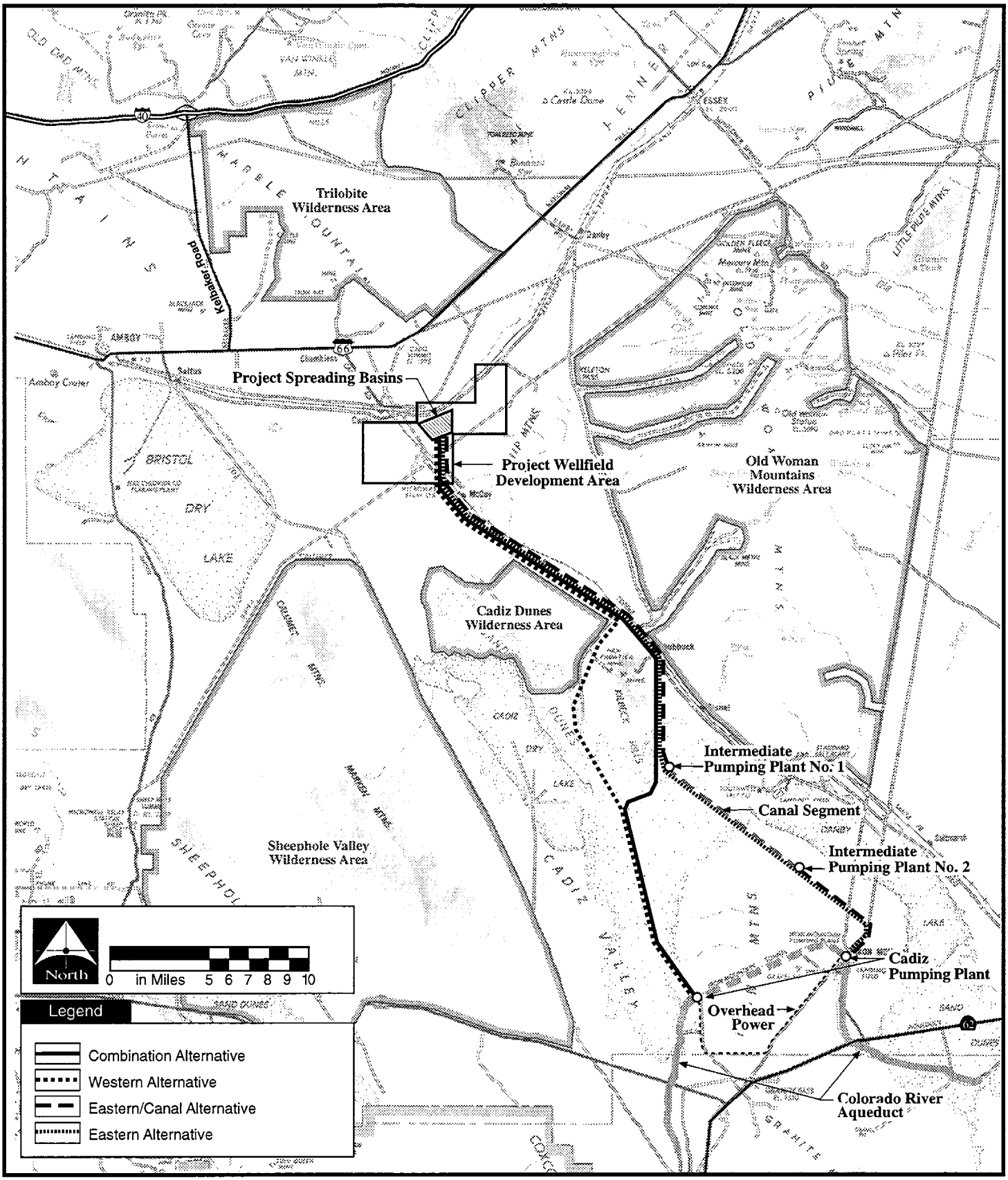
4.2 EASTERN ALTERNATIVE

4.2.1 GENERAL DESCRIPTION

As shown in Figure 4-2, the Eastern Alternative begins at the Project spreading basins in the Fenner Gap area, approximately three miles north of unimproved Cadiz-Rice Road. The water conveyance facilities route proceeds due south for three miles, then parallels Cadiz-Rice Road and the Arizona California Railroad Company (ARZC) rail lines in a southeasterly direction toward abandoned Chubbuck Station. Southeast of abandoned Chubbuck Station, the water conveyance facilities turn south, generally following the 820-foot contour for approximately three miles around the west side of Danby Dry Lake. The water conveyance facilities then turn southeast, still generally following the 820-foot contour, between the south side of Danby Dry Lake and along the Iron Mountains for approximately ten miles until crossing Metropolitan's existing power transmission right-of-way. The water conveyance facilities continue around the east side of the Iron Mountains where they connect to an unimproved road. The water conveyance facilities parallel the unimproved road, enter the Iron Mountain Pumping Plant site, and discharge into the existing Iron Mountain Pumping Plant forebay. The total length of the Eastern Alternative is approximately 34.6 miles.

4.2.2 HYDRAULIC CHARACTERISTICS

A hydraulic profile of the Eastern Alternative is shown on Figure 4-3. The Cadiz Project analysis is based on a nominal design flow of 200 to 250 cubic feet per second (cfs). Figure 4-3 indicates the elevation to which water must be pumped in order to overcome friction losses in the water conveyance facilities. Factors that affect system hydraulics include flow rate, size and cross section of the water conveyance facilities, length, and the type of material used.

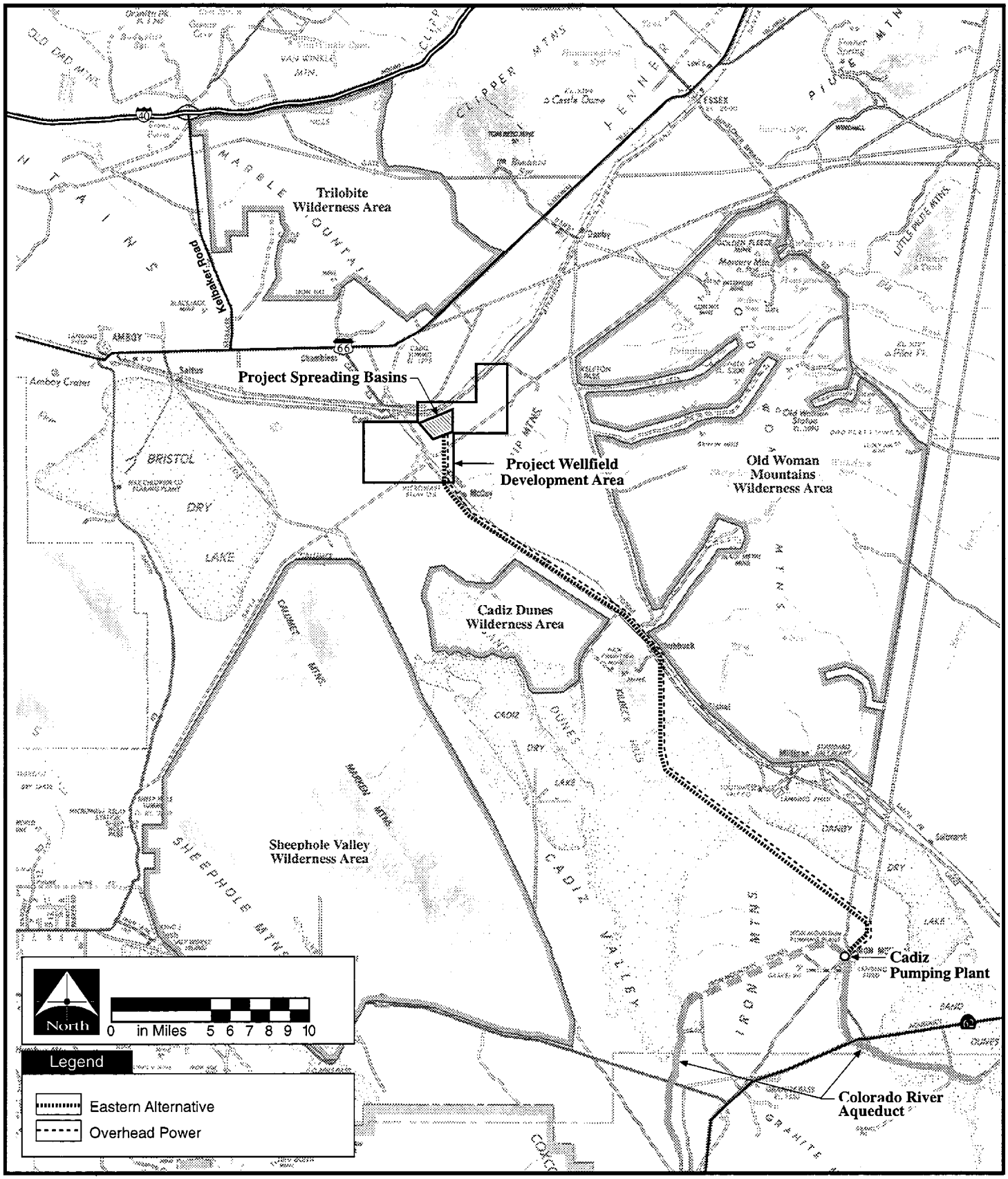


Source: P&D Consultants, Inc. (1999).

Figure 4-1

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

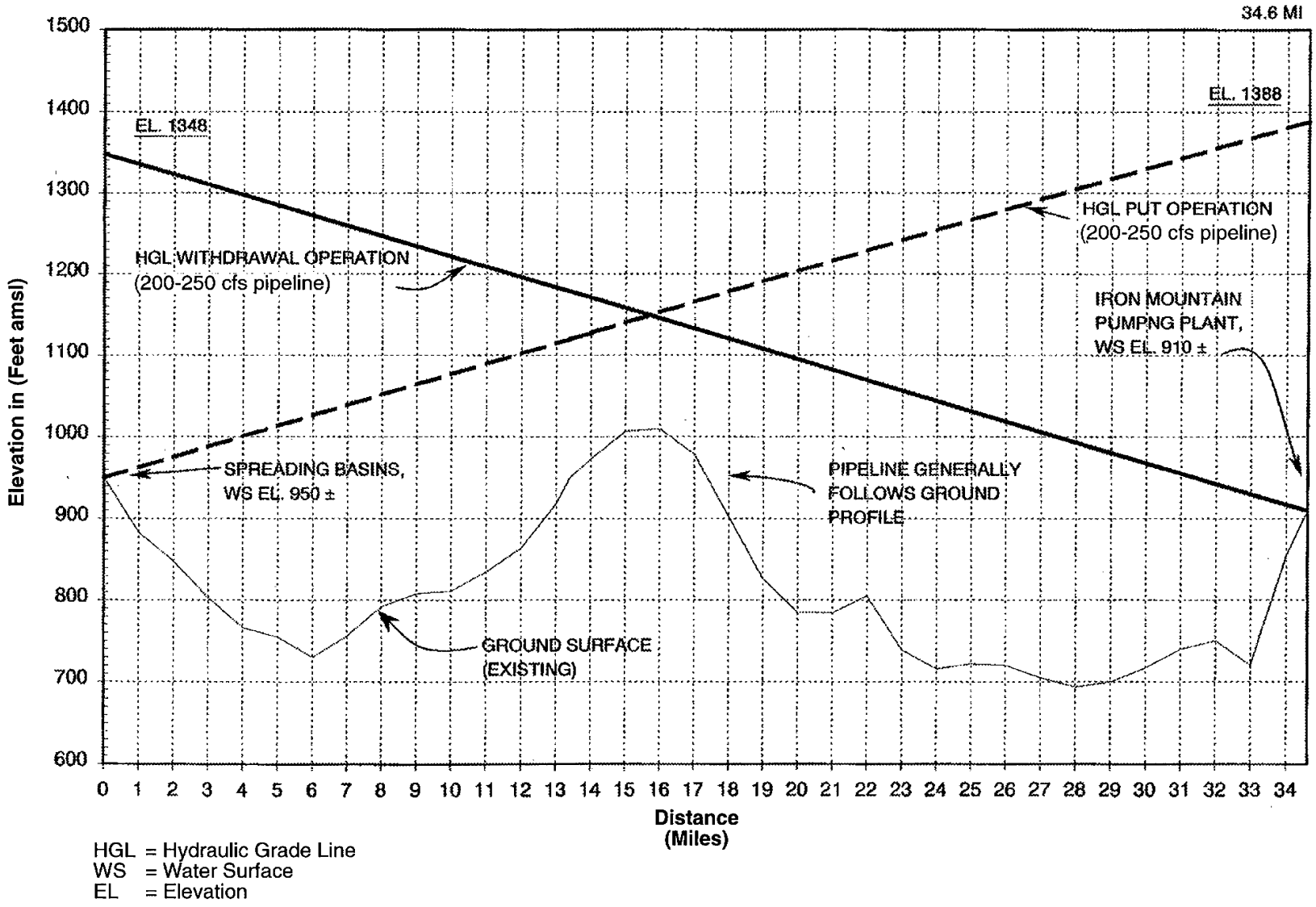


Source: P&D Consultants, Inc.

Figure 4-2

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Eastern Alternative



Source: Black and Veatch (1999).

Figure 4-3

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Eastern Alternative Hydraulic Profile

As indicated, during spreading cycles, the maximum hydraulic grade line elevation of 1,388 feet is experienced at the Cadiz Pumping Plant. The maximum pipeline pressure during spreading cycles occurs near mile 27 of the pipeline, where the pressure is 250 pounds per square inch (psi). During withdrawal cycles, the maximum hydraulic grade line elevation is at the wellfield site, at an elevation of 1,348 feet. The maximum conveyance facility pressure during withdrawal cycles occurs near mile 5, where the pressure is 235 psi.

4.2.3 CONSTRUCTION ACTIVITIES

The major construction equipment expected to be used for the Eastern Alternative is listed by type and number in this section. Table 4-1 summarizes equipment needed for trench excavation, pipe placement, backfill, appurtenant facility construction and erection of structures for the Eastern Alternative.

TABLE 4-1
CONSTRUCTION EQUIPMENT REQUIRED FOR THE EASTERN ALTERNATIVE

Description	Number
1.5 cy Loader-Backhoe	4
¾ ton Pickup Truck	24
1 cy Backhoe	4
Flatbed Truck w/ Crane	4
Crane	4
3 cy Hydraulic Backhoe	4
End Dump Truck, 12 cy	4
35 ton Crane (RT)	4
Tractor/Lowboy Hauling Rig	4
Tamping Spade	8
Hand Held Vibrator Plate	8
3 cy Rubber Tire Loader	4
Highway Water Truck	8
Vibrator Compactor	4
Forklift, 7.5 ton	4
Truck Mounted Vertical Auger Drill	4
Generator	12
Concrete Truck	Varies
Bedding Hopper/Conveyor Systems	4
Trench Shield	4
Z-bar Shoring	4
Truck Crane	4
Pile Hammer, Diesel	4
Pile Leads	4

The types and quantities of equipment are approximate and intended only for estimating construction related impacts. Actual equipment types and quantity may vary.

Water Conveyance Facilities Construction

Construction of the water conveyance facilities would be conducted in segments and would include trench excavation, utility preservation and/or relocation, pipe placement, backfill, appurtenant construction and restoration along the entire pipeline route. The pipeline would be buried, with a minimum earth cover of three feet. Where the facilities cross drainages, the depth of cover might be up to ten feet, and scour protection for the pipeline would be provided.

While the lengths of the individual construction segments would be comparable, productivity would be controlled by the trench type and construction corridor width, restrictions in construction operations and difficulties in construction of railroad or arroyo crossings. The rail line crossings would either be bore and jack or conventional tunnel with ribs and lagging or linear plate. All tunnel construction would require a bore pit and a receiving pit. For the Cadiz Project, an area of 150 feet by 100 feet is estimated to be sufficient for the bore pit and a surrounding construction activities. The receiving pit would likely be a shored excavation area of 20 feet by 12 feet.

The type of trench excavation for the pipeline would depend on several factors, including available construction space, soil/rock materials in the trench, groundwater level and allowable cut slope. Prior to a more detailed inspection, aerial photographs of the alternatives were used

to establish the preliminary right-of-way availability for each alternative. General assumptions were made about the soil/rock material type, extent of groundwater infiltration and special facilities, such as utility crossings. Special crossing items at arroyos, rail lines and road crossings would require additional special trench types. In the event that rock material is encountered, blasting might be used during trench excavation.

Trenching operations would depend on the trench type and the construction method selected by the contractor. Where necessary, trench shields or soldier piles and timber lagging could be used. Soldier piles could be driven in advance of the pipe heading and the lagging could be installed as the trench excavation progresses. In unrestricted working areas and with a crane used to install pipe, an average of eight to ten sections per day could be installed. Pipe sections would likely be 40 or 48 feet in length. In restricted work areas such as shored trench, where a crane must place the pipe in the trench, the average installation rate would be approximately half the rate in unrestricted work areas. Overall, the average length of time that any one area along the pipeline would be disturbed is anticipated to be three months.

It is anticipated that the excavated material would be used for pipe bedding. Water may have to be added to the excavated material to obtain proper compaction around the pipe. Using excavated materials for pipe bedding would eliminate the need to transport bedding materials from local rock quarries.

Throughout construction, the top three to four inches of topsoil would be stockpiled and cleared and grubbed vegetation would be mulched and set aside with the topsoil. At the completion of construction of each segment of the pipeline, the stockpiled topsoil and mulch would be re-spread over the re-contoured permanent right-of-way.

The surface would be re-contoured to preserve the original runoff pattern. Topsoil and mulch would be stockpiled for a maximum of three months prior to respreading.

The length of pipe sections transported would be determined by the existing weight limits on roads and highways but would not exceed 48 feet. Transportation of the pipe sections is a primary consideration since most public roads and highways have load restrictions of approximately 45 tons. Caltrans has indicated that, under a repetitive hauling permit, the absolute maximum load width permitted is 14 feet. In any event, all the required permits to haul pipe on public roads would be obtained. An alternative method for pipe delivery would be to transport pipe sections by rail lines in the Project area.

In addition, the general area of Chubbuck Station (CA-SBR-3283H) outside the construction limits would be identified on the Project specifications and maps as an Environmentally Restricted Area (ERA) in consultation with the Project archeologist. The area and the work limits would be flagged and construction activity would not be allowed within this ERA. The construction corridor would be narrowed to a maximum of 40 feet for approximately 1.25 miles adjacent to this site, in consultation with the Project archaeologist.

The general area of the Patton Camp (AE-CAD-13H) outside the construction limits would be identified on the Project specifications and maps as an ERA in consultation with the Project archaeologist. The area and the work limits would be flagged and construction activity would not be allowed within this ERA. The construction corridor in the immediate vicinity of this site would be limited to that area west of the ARZC rail lines and east of the All American Pipeline and focused, to the extent possible, on areas previously distributed by construction.

Cadiz Pumping Plant Construction

The Cadiz Pumping Plant would be built adjacent to the existing Iron Mountain Pumping Plant on land owned by Metropolitan. Construction equipment anticipated to be used is shown in Table 4-2. A staging area would likely be located on Metropolitan's property between the existing electrical substation and this proposed pumping plant.

Construction of the Cadiz Pumping Plant would involve site preparation. This first phase would involve clearing the building site of objectionable surface materials and obstacles to construction (stripping vegetation and initial grading). Minimum site work would be anticipated. Additional construction activities for the pumping plant would include trench and structure excavation; above-grade building; pipe; pump and valve installation; appurtenant construction and feature restoration around the entire pumping plant.

TABLE 4-2
CADIZ PUMPING PLANT
CONSTRUCTION EQUIPMENT

Description	Number
Grader	1
Dozer	1
Hydraulic Backhoe, 1.0 cy	1
¾ Pickup Truck	8
End Dump Truck, 12 cy	2
Crane	1
Gas Welding Machine	2
Tractor/Lowboy Hauling Rig	1
Concrete Mixer	2
Hand Held Vibrator Plate	4
3 cy Rubber Tire Loader	2
Highway Water Truck	1
Compressor	2
Trench Shield	1
Z-bar Shoring	1
Vibrator Compactor	2
Truck Mounted Vertical Auger Drill	1
Pile Hammer, Diesel	1
Pile Leads	1
Front End Loader	1
Roller	1
Generator	2
Concrete Truck	Varies

The types and quantities of equipment are approximate and intended only for estimating construction related impacts. Actual equipment types and quantity may vary.

A second phase of excavation would be required for the foundation of the facility, underground structures and buried utilities. Part of the excavated material would be stockpiled on site for backfill and site grading; the remainder would be disposed of or stockpiled on the pumping plant site.

Buildings would be erected to house the motors, pumps, communications and control rooms. The structure would likely have a split-faced block exterior. All below-grade and at least part of some above-ground structures would be constructed from cast-in-place reinforced concrete.

The Cadiz Pumping Plant would be constructed in a previously disturbed area and at a maximum distance from the historic structures in this complex. In addition, the Cadiz Pumping Plant would be designed and constructed in a style compatible with the existing architecture of the Iron Mountain Pumping Plant complex, and consistent with the Secretary of the Interior's *Standards and Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings* (1995), in consultation with the Project archaeologist. The design would be compatible with, but distinctive from, the existing historic buildings. The new design would be contemporary and would reference design motifs from the historic buildings. It would also be compatible in terms of mass (dimensions and scale), material (building composition), relationship of solids to voids (roof lines and window placement) and overall color. The predominant building composition at the Iron Mountain Pumping Plant structures includes poured and formed concrete walls (some with stucco exteriors) and low, gabble-hipped roofs, finished in red-colored tile.

After completion of the construction of the Cadiz Pumping Plant, excavated areas would be backfilled and stockpiled material would be graded to a finish grade.

4.2.4 CONSTRUCTION SCHEDULE

Elements included in the Cadiz Project construction schedule are the pumping plant, water conveyance facility, power distribution facilities, Project spreading basins and Project wellfield. Each of these items requires a unique time frame for construction. In all, the facilities required to store water would be completed by the winter of 2000/2001.

4.2.5 RIGHT-OF-WAY REQUIREMENTS

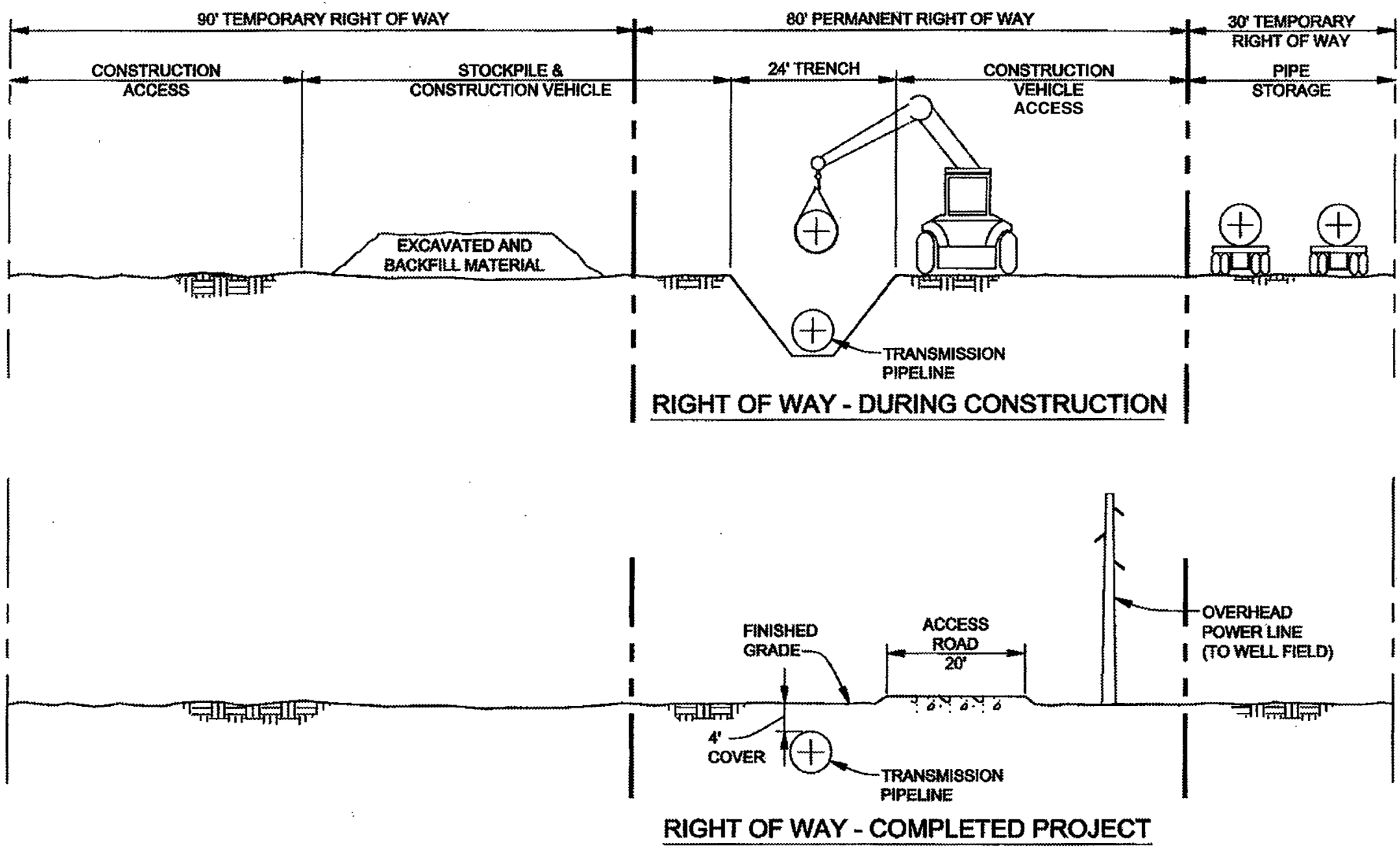
Temporary and permanent rights-of-way would be required to construct and operate the Eastern Alternative water conveyance and power distribution facilities. The other Project facilities under the Eastern Alternative would be located on properties owned by Metropolitan or Cadiz Inc. and would not require temporary or permanent rights-of-way.

Temporary construction easements would be required to construct the water conveyance and power distribution facilities. An estimated 200-foot wide right-of-way would be necessary during construction. The Eastern Alternative facilities would be contained in a permanent right-of-way 80 feet in width, that would allow access for operation and maintenance. A typical cross section for water conveyance facility construction is shown on Figure 4-4.

The Eastern Alternative is estimated to require 503 acres of temporary construction easement and 336 acres of permanent right-of-way.

4.2.6 FEASIBILITY CAPITAL COST

The cost estimates for the Eastern Alternative shown in Table 4-3 include, but are not limited to, costs for engineering design, construction, administration, conveyance facility land acquisition and environmental mitigation. These costs include a contingency.



Source: Black & Veatch (1999).

Figure 4-4

Typical Cross Section for Water Conveyance Facilities Construction and Operations

TABLE 4-3
EASTERN ALTERNATIVE
ESTIMATED CONSTRUCTION COST
(1999 $)

Item	Estimated Cost
Cadiz Pumping Plant	$11,173,000
Conveyance/Power Facilities	$86,358,000
Spreading Basins	$3,513,000
Wellfield Facilities	$30,672,000
Land/Mitigation/Erosion Control	$2,204,000
Eng, Legal, Admin	$15,824,000
Total Project Cost	**$149,744,000**

4.3 WESTERN ALTERNATIVE

4.3.1 GENERAL DESCRIPTION

As shown on Figure 4-5, the Western Alternative begins at the Project spreading basins in the Fenner Gap area, approximately three miles north of unimproved Cadiz-Rice Road. The water conveyance facilities route proceeds due south for three miles, then parallels Cadiz-Rice Road and the ARZC rail line in a southeasterly direction to a point located due north of the Kilbeck Hills. At this point, the water conveyance facilities turn south-southwest, skirting the western slopes of the of the Kilbeck Hills and the Iron Mountains for approximately 20 miles, at which point it joins the Colorado River Aqueduct at the west portal of the Iron Mountain Tunnel. The total length of the Western Alternative would be approximately 33.3 miles.

4.3.2 HYDRAULIC CHARACTERISTICS

A hydraulic profile of the Western Alternative is shown on Figure 4-6. The Cadiz Project analysis is based on a nominal design flow of 200 to 250 cfs. Figure 4-6 indicates the elevation to which water must be pumped in order to overcome friction losses in the conveyance system. Factors that affect system hydraulics include flow rate, size and cross section of water conveyance facilities, length, and the type of material used for the water conveyance facilities.

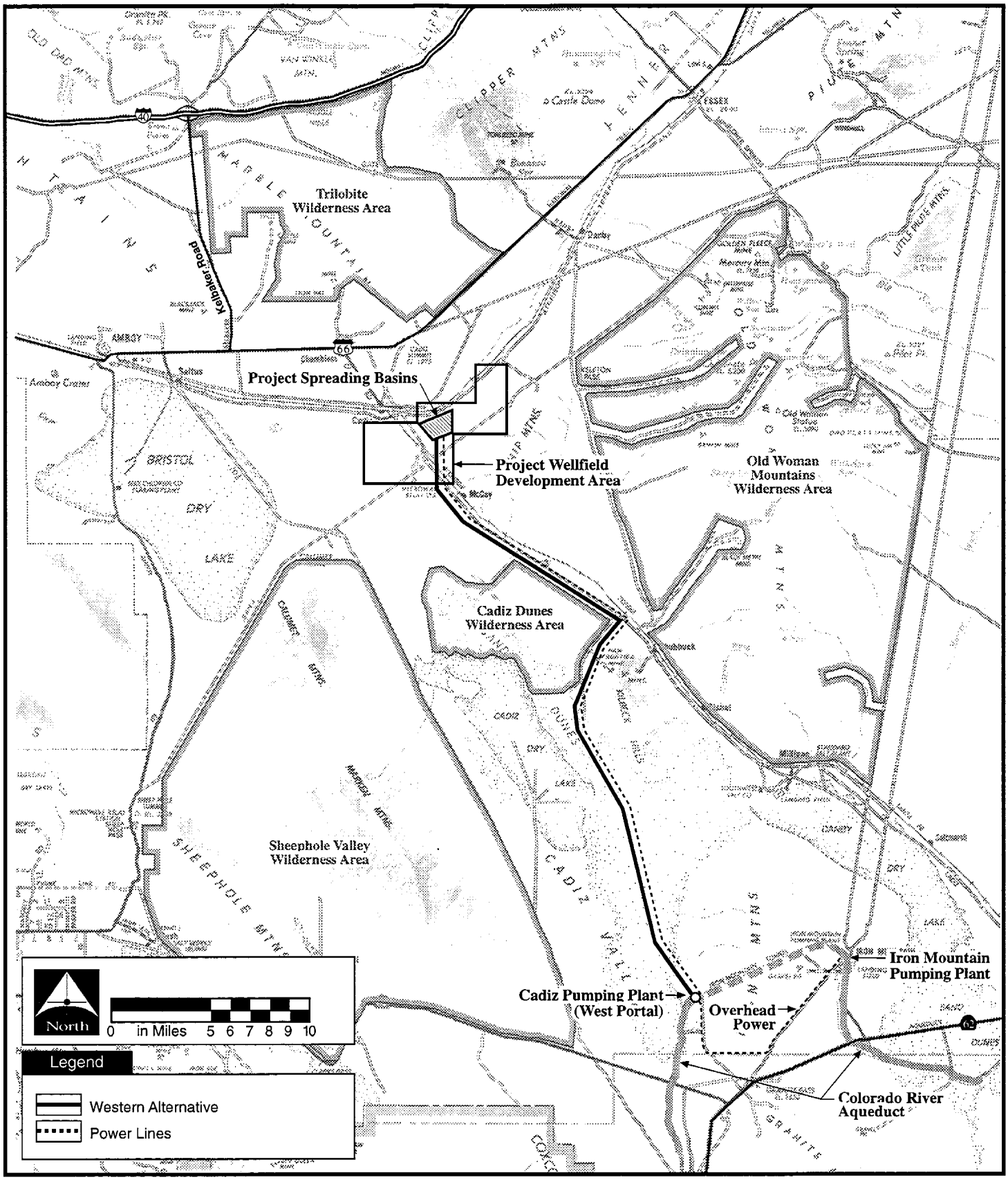
As indicated, during spreading cycles, the maximum hydraulic grade line elevation of 1,372 feet is experienced at the Cadiz Pumping Plant. The maximum pipeline pressure during spreading cycles occurs at mile 21 of the pipeline, where the pressure is 235 psi. During withdrawal, the maximum hydraulic grade-line elevation is at the Project wellfield, at an elevation of 1,442 feet. The maximum conveyance facility pressure during withdrawal cycles occurs at mile 5, where the pressure is 275 psi.

4.3.3 CONSTRUCTION ACTIVITIES

The major construction equipment that would be expected to be used for the Western Alternative is listed by type and number in Table 4-4. This table summarizes equipment needed for trench excavation, pipe placement, backfill, appurtenant facility construction and erection of structures.

Water Conveyance Facilities Construction

Construction of the water conveyance facilities would be conducted in segments and would include trench excavation, utility preservation and/or relocation, pipe placement, backfill, appurtenant construction and restoration along the entire pipeline route. The pipeline would be buried with a minimum earth cover of three feet. Where the facilities cross

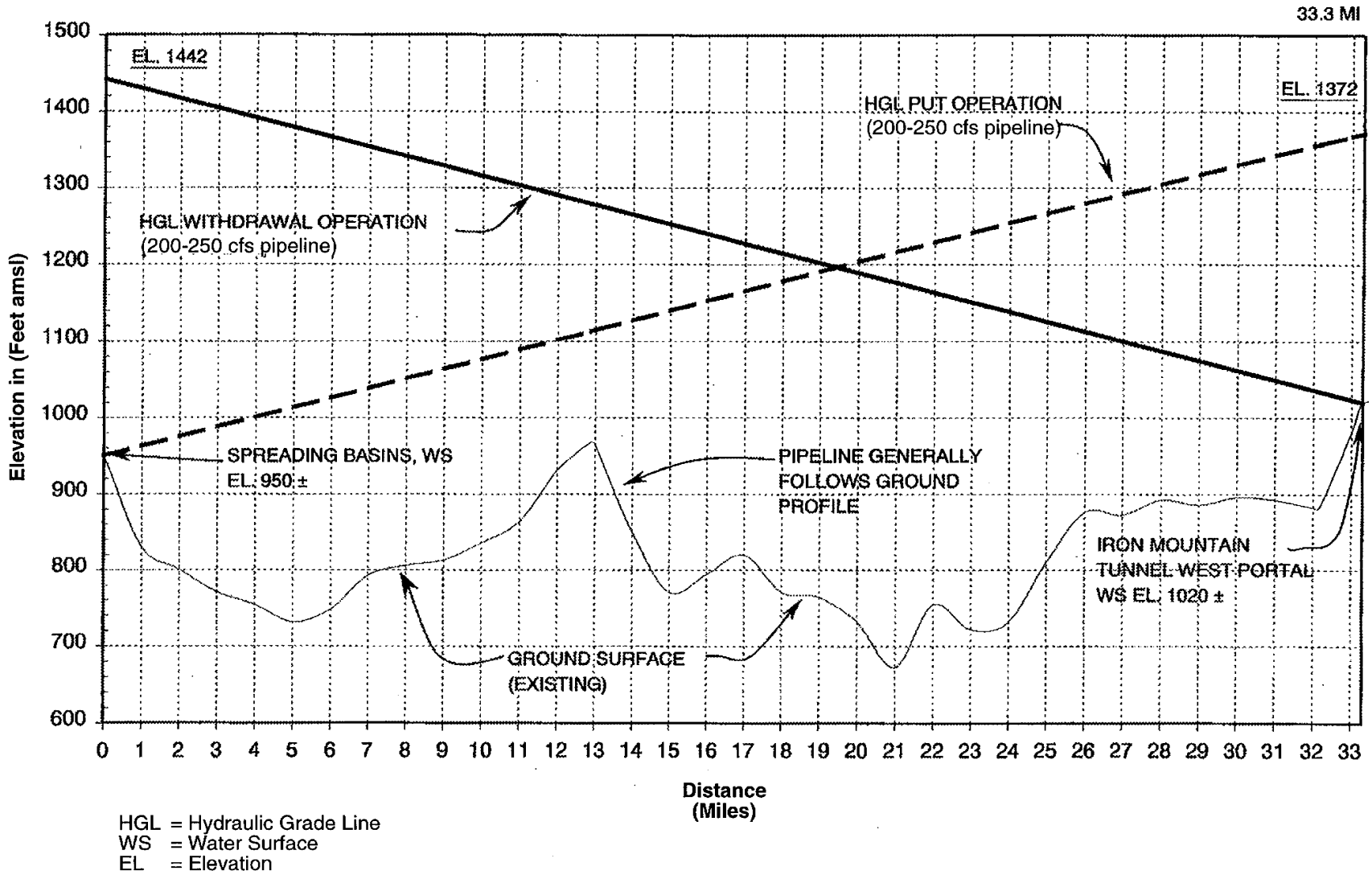


Source: P&D Consultants, Inc. (1999).

Figure 4-5

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Western Alternative



Source: Black and Veatch (1999).

Figure 4-6

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Western Alternative Hydraulic Profile

TABLE 4-4
WESTERN ALTERNATIVE
CONSTRUCTION EQUIPMENT

Description	Number
1.5 cy Loader-Backhoe	4
¾ ton Pickup Truck	24
1 cy Backhoe	4
Flatbed Truck w/ Crane	4
Crane	4
3 cy Hydraulic Backhoe	4
End Dump Truck, 12 cy	4
35 ton Crane (RT)	4
Tractor/Lowboy Hauling Rig	4
Tamping Spade	8
Hand Held Vibrator Plate	8
3 cy Rubber Tire Loader	4
Highway Water Truck	8
Vibrator Compactor	4
Forklift, 7.5 ton	4
Truck Mounted Vertical Auger Drill	4
Generator	12
Concrete Truck	Varies
Bedding Hopper/Conveyor Systems	4
Trench Shield	4
Z-bar Shoring	4
Truck Crane	4
Pile Hammer, Diesel	4
Pile Leads	4

The types and quantities of equipment are approximate and intended only for estimating construction related impacts. Actual equipment types and quantity may vary.

drainages, the depth of cover might be up to ten feet, and scour protection for the pipeline would be provided.

While the lengths of the individual construction segments would be comparable, productivity would be controlled by the trench type and construction corridor width, restrictions in construction operations and difficulties in construction of railroad or arroyo crossings. The rail line crossings would either be bore and jack or conventional tunnel with ribs and lagging or linear plate. All tunnel construction would require a bore pit and a receiving pit. For the Cadiz Project, an area of 150 feet by 100 feet is estimated to be sufficient for the bore pit and surrounding construction activities. The receiving pit would likely be a shored excavation area 20 feet by 12 feet.

The type of trench excavation for the pipeline would depend on several factors, including available construction space, soil/rock material in the trench, groundwater level and allowable cut slope. Prior to a more detailed inspection, aerial photographs of the alternatives were used to establish the preliminary right-of-way availability for each alternative. General assumptions were made about the soil/rock material type and extent of groundwater infiltration and special facilities, such as utility crossings. Special crossing items at arroyos, railroads and road crossings would require additional special trench types. In the event that rock material is encountered, blasting might be used during trench excavation.

Trenching operations would depend on the trench type and the construction method selected by the contractor. Where necessary, trench shields or soldier piles and timber lagging could be used. Soldier piles could be driven in advance of the pipe heading and the lagging could be installed as the trench excavation progresses. In unrestricted working areas and with a crane used to install pipe, an average of eight to ten sections per day could be installed. Pipe sections would likely be 40 or 48 feet in length. In restricted work areas such as shored trench, where a crane must place the pipe in the trench, the average installation rate would be approximately half the rate in unrestricted work areas. Overall, the average length of time that any one area along the pipeline would be disturbed is anticipated to be three months.

It is anticipated that the excavated material would be used for pipe embedment. Water may have to be added to the excavated material to obtain proper compaction around the pipe. Using excavated materials for pipe embedment would eliminate the need to transport bedding materials from local rock quarries.

Throughout construction, the top three to four inches of topsoil would be stockpiled and cleared, and grubbed vegetation would be mulched and set aside with the topsoil. At the completion of construction of each segment of the pipeline, the stockpiled topsoil and mulch would be re-spread over the recontoured permanent right-of-way. The surface would be re-contoured to preserve the original runoff pattern. Topsoil and mulch would be stockpiled for a maximum of three months prior to respreading.

The length of pipe sections transported would be determined by the existing weight limits on roads and highways but would not exceed 48 feet. Transportation of the pipe sections is a primary consideration since most public roads and highways have load restrictions of approximately 45 tons. Caltrans has indicated that under a repetitive hauling permit the absolute maximum width permitted is 14 feet. In any event, all the required permits to haul pipe on public roads would be obtained. An alternative method for pipe delivery would be to transport pipe sections by rail lines in the Project area.

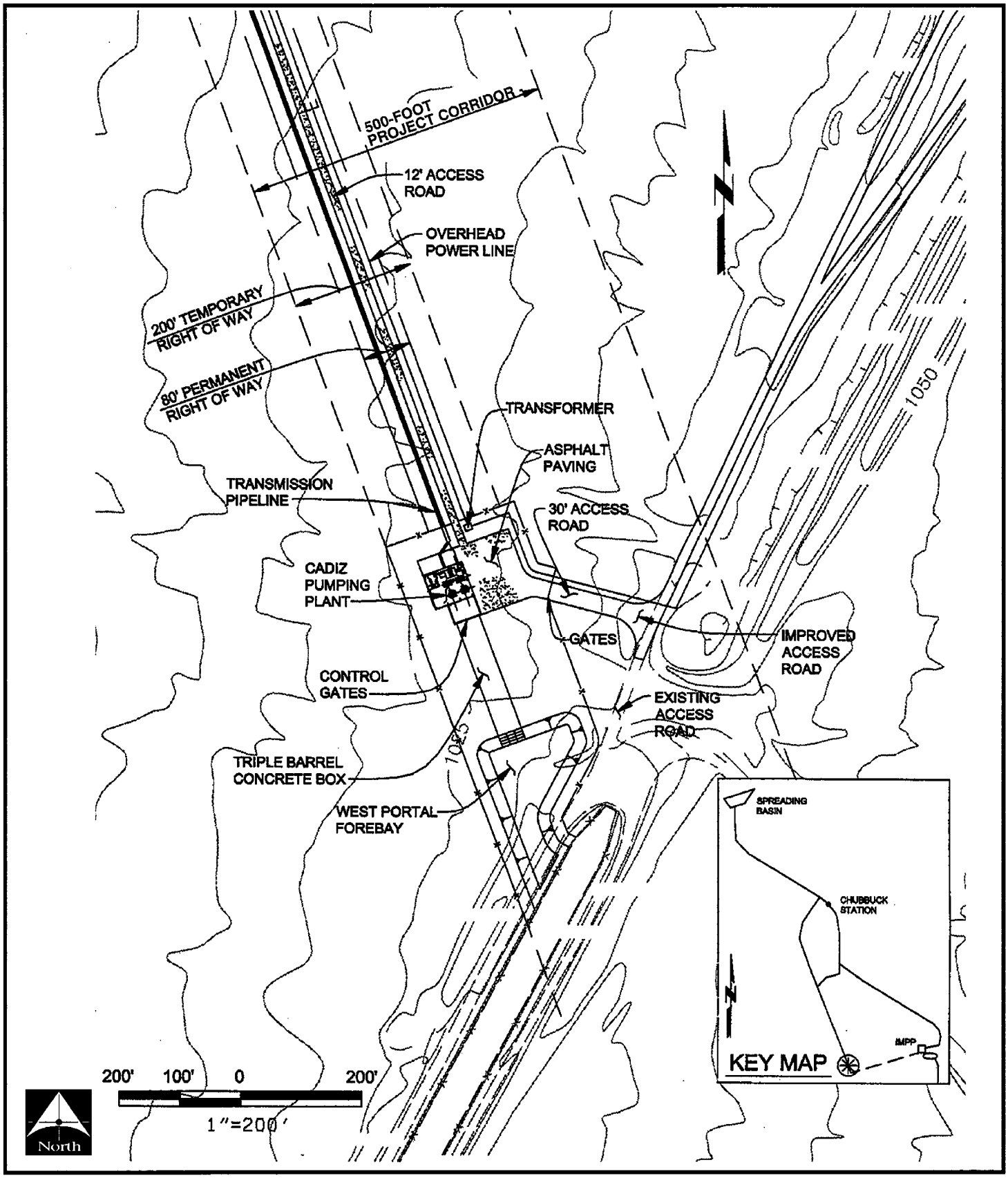
Cadiz Pumping Plant (West Portal)

The Cadiz Pumping Plant (West Portal) would be built at the west portal of the Iron Mountain Tunnel. Construction equipment anticipated to be used in installing this pumping plant is shown in Table 4-5. The staging area for construction of the Cadiz Pumping Plant (West Portal) and the Western Alternative would be parallel to the 200-foot wide construction right-of-way. Figure 4-7 shows the Cadiz Pumping Plant (West Portal) site plan and the location of the staging area. An alternative staging area may be available at the tunnel tailings area south of the Iron Mountain Tunnel, which would provide approximately 7.5 acres of storage area. The construction staging area would provide space for storage of materials, pipe, equipment and vehicles needed for construction. It is assumed that the construction trailers would be located at this site. Access to this site would be provided via an existing unimproved road that connects the staging area to Highway 62.

TABLE 4-5
CONSTRUCTION EQUIPMENT
CADIZ PUMPING PLANT (WEST PORTAL)

Description	Number
Grader	1
Dozer	1
Hydraulic Backhoe, 1.0 cy	1
¾ Pickup Truck	8
End Dump Truck, 12 cy	2
Crane	1
Gas Welding Machine	2
Tractor/Lowboy Hauling Rig	1
Concrete Mixer	2
Hand Held Vibrator Plate	4
3 cy Rubber Tire Loader	2
Highway Water Truck	1
Compressor	2
Trench Shield	1
Z-bar Shoring	1
Vibrator Compactor	2
Truck Mounted Vertical Auger Drill	1
Pile Hammer, Diesel	1
Pile Leads	1
Front End Loader	1
Roller	1
Generator	2
Concrete Truck	Varies

The types and quantities of equipment are approximate and intended only for estimating construction related impacts. Actual equipment types and quantity may vary.



Source: Black and Veatch (1999).

Figure 4-7

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Cadiz Pumping Plant (West Portal)

Construction of the Cadiz Pumping Plant (West Portal) would involve site preparation. This phase involves clearing the building site of surface materials and obstacles to construction (stripping vegetation and initial grading). Minimum site work is anticipated because the Cadiz Pumping Plant (West Portal) would be built on vacant land.

A second phase of excavation would be required for the foundation of the facility, underground structures and buried utilities. Part of the excavated material would be stockpiled on site for backfill and site grading; the remainder would be disposed of or stockpiled on the pumping plant site.

Additional construction activities for the pumping plant include site clearing, trench and structure excavation, pipe, pump and valve installation, appurtenant construction and feature restoration around the entire pump station.

Buildings would be erected to house the motors, pumps, communications and control rooms. The superstructure would likely have a split-faced block exterior. All below-grade and at least part of some above-ground structures would be constructed from cast-in-place reinforced concrete.

After completion of these structures, excavated areas would be backfilled, and stockpiled material would be graded to a finish grade.

4.3.4 CONSTRUCTION SCHEDULE

Elements included in the Cadiz Project construction schedule are the pumping plant, water conveyance facilities, power distribution facilities, spreading basins and wellfield. Each of these items would require a unique time frame for construction. In all, the facilities required to store water would be completed by the winter of 2000/2001.

4.3.5 RIGHT-OF-WAY REQUIREMENTS

Temporary and permanent rights-of-way would be required to construct and operate the Western Alternative water conveyance and power distribution facilities. The other Project facilities under the Western Alternative would be located on properties owned by Metropolitan or Cadiz Inc. and would not require temporary or permanent rights-of-way.

Temporary construction easements would be required to construct the water conveyance and power distribution facilities. An estimated 200-foot wide right-of-way would be necessary during construction. The permanent facilities would be contained in a permanent right-of-way, 80 feet in width, which would allow access for operation and maintenance. A typical cross section for conveyance facility construction was shown earlier on Figure 4-4.

The Western Alternative is estimated to require 484 acres of temporary construction easement and 323 acres permanent right-of-way.

4.3.6 FEASIBILITY CAPITAL COST

The cost estimates for the Western Alternative shown in Table 4-6 include, but are not limited to, costs for engineering design, construction, administration, land conveyance facility acquisition and environmental mitigation. These costs include contingency.

TABLE 4-6
WESTERN ALTERNATIVE
ESTIMATED CONSTRUCTION COST
(1999 $)

Item	Estimated Cost
Cadiz Pumping Plant	$11,515,000
Conveyance Power Facility	$84,684,000
Spreading Basins	$3,513,000
Wellfield Facilities	$30,672,000
Land/Mitigation/Erosion Control	$3,797,000
Eng, Legal, Admin	$15,663,000
Total Project Cost	**$149,844,000**

4.4 COMBINATION ALTERNATIVE

4.4.1 GENERAL DESCRIPTION

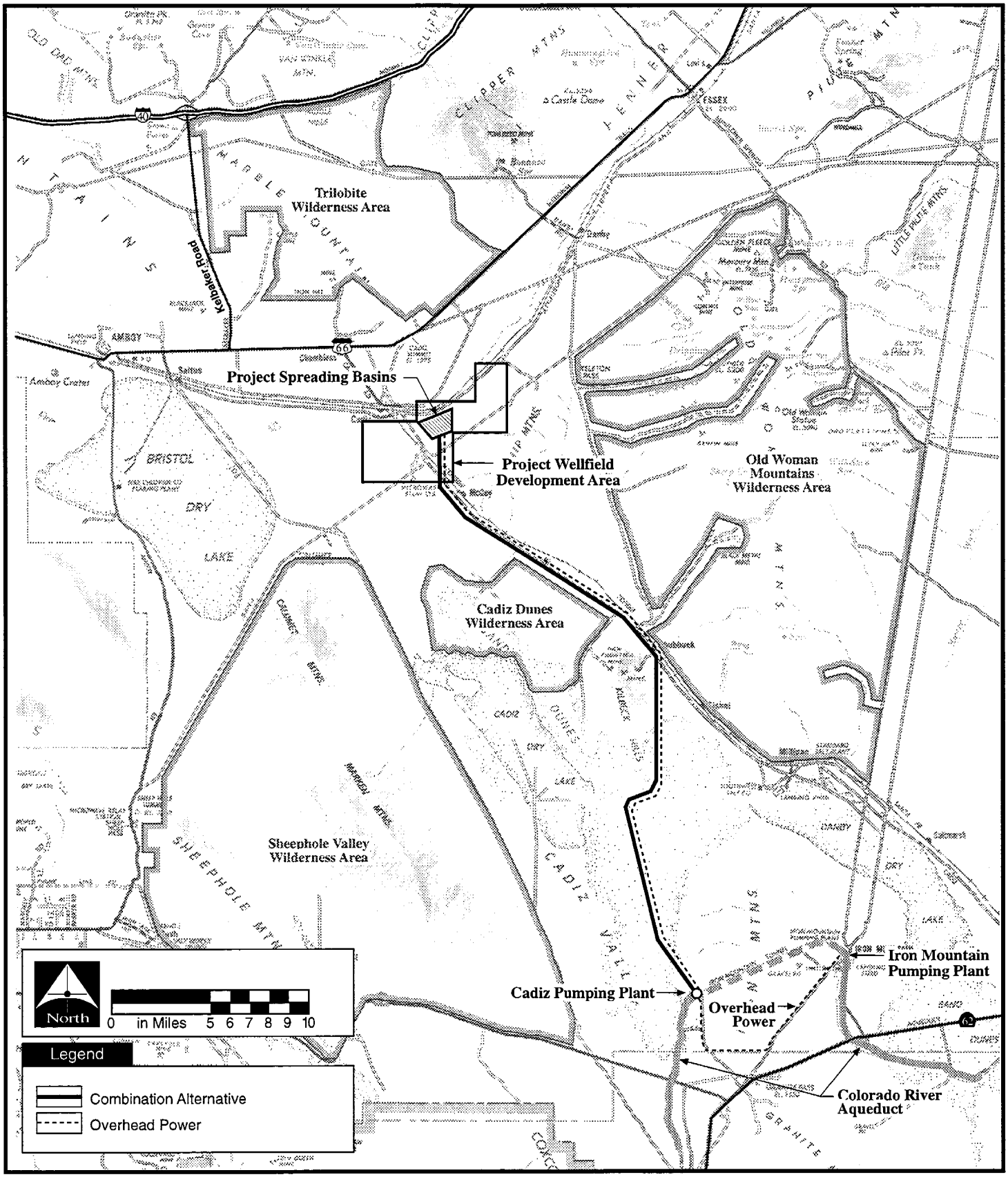
As shown on Figure 4-8, the Combination Alternative route begins at the Project spreading basins in the Fenner Gap area approximately three miles north of unimproved Cadiz-Rice Road. The water conveyance facilities route proceeds due south for three miles, then parallels Cadiz-Rice Road and the ARZC rail line in a southeasterly direction towards the abandoned Chubbuck Station. Southeast of the abandoned Chubbuck Station, the water conveyance facilities turn south, skirting the eastern slopes of the Kilbeck Hills for approximately six miles. At the saddle between the Kilbeck Hills and the Iron Mountains, the Combination Alternative turns southwest for a distance of approximately two miles. There, the alignment takes a southeasterly heading, skirting the western slopes of the Iron Mountains for about 11 miles until it discharges into the Colorado River Aqueduct at the west portal of the Iron Mountain Tunnel. The total length of the Combination Alternative would be approximately 34.0 miles.

4.4.2 HYDRAULIC CHARACTERISTICS

A hydraulic profile of the Combination Alternative is shown on Figure 4-9. The Cadiz Project analysis is based on a nominal design flow of 200 to 250 cfs. Figure 4-9 indicates the elevation to which water must be pumped in order to overcome friction losses in the water conveyance facilities. Factors that affect system hydraulics include flow rate, size and cross section conveyance facilities, length, and the type of material used for the conveyance facilities. As indicated, during spreading cycles, the maximum hydraulic grade line elevation of 1,382 feet is experienced at the Cadiz Pumping Plant. The maximum pipeline pressure during spreading cycles occurs at mile 24 of the pipeline, where the pressure is 235 psi. During withdrawal cycles, the maximum hydraulic grade-line elevation is at the wellfield site, at an elevation of 1,450 feet. The maximum water conveyance facilities pressure during withdrawal cycles occurs at mile 5 of the pipeline, where the pressure is 285 psi.

4.4.3 CONSTRUCTION ACTIVITIES

The major construction equipment expected to be used for the Combination Alternative is listed by type and number in Table 4-7. This table summarizes equipment needed for trench excavation, pipe placement, backfill, appurtenant facility construction and erection of structures.

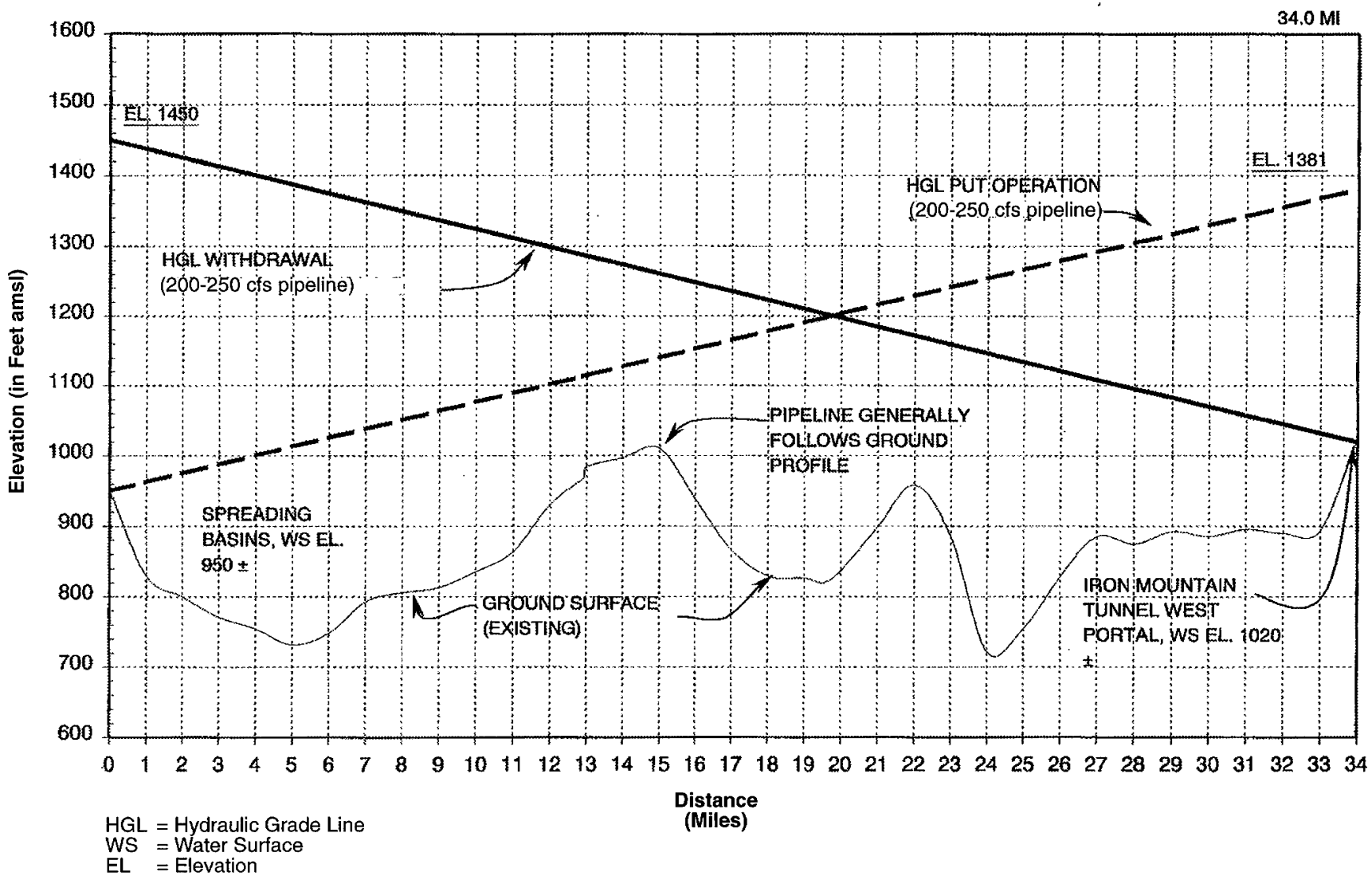


Source: P&D Consultants, Inc. (1999).

Figure 4-8

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Combination Alternative



Source: Black and Veatch (1999).

Figure 4-9

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Combination Alternative Hydraulic Profile

TABLE 4-7
COMBINATION ALTERNATIVE
CONSTRUCTION EQUIPMENT

Description	Number
1.5 cy Loader-Backhoe	4
¾ ton Pickup Truck	24
1 cy Backhoe	4
Flatbed Truck w/ Crane	4
Crane	4
3 cy Hydraulic Backhoe	4
End Dump Truck, 12 cy	4
35 ton Crane (RT)	4
Tractor/Lowboy Hauling Rig	4
Tamping Spade	8
Hand Held Vibrator Plate	8
3 cy Rubber Tire Loader	4
Highway Water Truck	8
Vibrator Compactor	4
Forklift, 7.5 ton	4
Truck Mounted Vertical Auger Drill	4
Generator	12
Concrete Truck	Varies
Bedding Hopper/Conveyor Systems	4
Trench Shield	4
Z-bar Shoring	4
Truck Crane	4
Pile Hammer, Diesel	4
Pile Leads	4

The types and quantities of equipment are approximate and intended only for estimating construction related impacts. Actual equipment types and quantity may vary.

Water Conveyance Facilities Construction

Construction of the water conveyance facilities would be conducted in segments and would include trench excavation, utility preservation and/or relocation, pipe placement, backfill, appurtenant construction, and restoration along the entire pipeline route. The pipeline would be buried, with a minimum earth cover of three feet. Where the facilities cross drainages, the depth of cover might be up to ten feet, and scour protection for the pipeline would be provided.

While the lengths of the individual construction segments would be comparable, productivity would be controlled by the trench type and construction corridor width, restrictions in construction operations and difficulties in construction of rail line or arroyo crossings. The rail line crossings would either be bore and jack or conventional tunnel with ribs and lagging or linear plate. All tunnel construction would require a bore pit and a receiving pit. For the Cadiz Project, an area of 150 feet by 100 feet is estimated to be sufficient for the bore pit and surrounding construction activities. The receiving pit would likely be a shored excavation area 20 feet by 12 feet.

The type of trench excavation for the pipeline would depend on several factors, including available construction space, soil/rock material in the trench groundwater level and allowable cut slope. Prior to a more detailed inspection, aerial photographs of the alternatives were used to establish the preliminary right-of-way availability for each alternative. General assumptions were made about the soil/rock material type, extent of groundwater infiltration and special facilities, such as utility crossings. Special crossing items at arroyos, rail lines and road crossings would require additional special trench types. In the event that rock material is encountered, blasting might be used during trench excavation.

Trenching operations would depend on the trench type and the construction method selected by the contractor. Where necessary, trench shields or soldier piles and timber lagging could be used. Soldier piles could be driven in advance of the pipe heading and the lagging could be installed as the trench excavation progresses. In unrestricted working areas where a crane is used to install pipe, an average of eight to ten sections per day could be installed. Pipe sections would likely be 40 feet or 48 feet in length. In

restricted work areas such as shored trench, where a crane must place the pipe in the trench, the average installation rate would be approximately half the rate in unrestricted work areas. Overall, the average length of time that any one area along the water conveyance facilities would be disturbed is anticipated to be three months.

It would be anticipated that the excavated material would be used for pipe embedment. Water may have to be added to the excavated material to obtain proper compaction around the pipe. Using excavated materials for pipe embedment would eliminate the need to transport bedding materials from local rock quarries. Throughout construction, the top three to four inches of topsoil would be stockpiled and cleared and grubbed vegetation would be mulched and set aside with the topsoil. At the completion of construction of each segment of the pipeline, the stockpiled topsoil would be re-spread over the recontoured permanent right-of-way. The surface would be re-contoured to preserve the original runoff pattern. Topsoil and mulch would be stockpiled for a maximum of three months prior to respreading.

The length of pipe sections transported would be determined by the existing weight limits on roads and highways but would not exceed 48 feet. Transportation of the pipe sections is a significant factor since most public roads and highways have load restrictions of approximately 45 tons. Caltrans has indicated that, under a repetitive hauling permit, the absolute maximum load width permitted is 14 feet. In any event, all the required permits to haul pipe on public roads would be obtained. An alternative method for pipe delivery would be to transport pipe sections by rail lines in the Project area.

In addition, the general area of Chubbuck Station (CA-SBR-3283H) outside the construction limits would be identified on the project specifications and maps as an ERA in consultation with the Project archaeologist. The area and the work limits would be flagged and construction activity would not be allowed within this ERA. The construction corridor would be narrowed to a maximum of 40 feet for approximately 1.25 miles adjacent to this site, in consultation with the Project archaeologist.

The general area of the Patton Camp (AE-CAD-13H) outside the construction limits would also be identified on the Project specifications and maps as an ERA in consultation with the Project archaeologist. The area and the work limits would be flagged and construction activity would not be allowed within this ERA. The construction corridor in the immediate vicinity of this site would be limited to that area west of the railroad and east of the All American Pipeline and focused, to the extent possible, on areas previously disturbed by construction.

Cadiz Pumping Plant (West Portal) Construction

The Cadiz Pumping Plant (West Portal) would be built at the west portal of the Iron Mountain Tunnel on land owned by Metropolitan. Construction equipment used for installing the pumping plant would be the same as used for the Western Alternative, as shown in Table 4-8.

TABLE 4-8
CADIZ PUMPING PLANT (WEST PORTAL)
CONSTRUCTION EQUIPMENT

Description	Number
Grader	1
Dozer	1
Hydraulic Backhoe, 1.0 cy	1
¾ Pickup Truck	8
End Dump Truck, 12 cy	2
Crane	1
Gas Welding Machine	2
Tractor/Lowboy Hauling Rig	1
Concrete Mixer	2
Hand Held Vibrator Plate	4
3 cy Rubber Tire Loader	2
Highway Water Truck	1
Compressor	2
Trench Shield	1
Z-bar Shoring	1
Vibrator Compactor	2
Truck Mounted Vertical Auger Drill	1
Pile Hammer, Diesel	1
Pile Leads	1
Front End Loader	1
Roller	1
Generator	2
Concrete Truck	Varies

The types and quantities of equipment are approximate and intended only for estimating construction related impacts. Actual equipment types and quantity may vary.

Construction of the pump station would involve site preparation. This first phase would involve clearing the building site of surface materials and obstacles to construction (stripping vegetation and initial grading). Minimum site work is anticipated.

A second phase of excavation would be required for foundation of the facility, underground structures and buried utilities. Part of the excavated material would be stockpiled on site for backfill and site grading; the remainder would be disposed of or stockpiled on the pumping plant site.

Additional construction activities for the pump station include trench and structure excavation, above-grade building, pipe, pump and valve installation appurtenant construction and feature restoration around the entire pump station.

Buildings would be erected to house the motors, pumps, communications and control rooms. The superstructure would likely have a split-faced block exterior. All below-grade and at least part of some above-ground structures would be constructed from cast-in-place reinforced concrete.

After completion of these structures, excavated areas would be backfilled and stockpiled material would be graded to a finish grade.

4.4.4 CONSTRUCTION SCHEDULE

Elements included in the Cadiz Project construction schedule are the pumping plant, water conveyance facilities, power distribution systems facilities, Project spreading basins and Project wellfield. Each of these items requires a unique time frame for construction. In all, the facilities required to store water would be completed by the spring of 2000/2001.

4.4.5 RIGHT OF WAY REQUIREMENTS

Temporary and permanent rights-of-way would be required to construct and operate the Combination Alternative water conveyance and power distribution facilities. The other Project facilities would be located on properties owned by Metropolitan or Cadiz Inc. and would not require temporary or permanent rights-of-way.

Temporary construction easements would be required to construct the conveyance and power transmission facilities. An estimated 200-foot wide right-of-way would be necessary during the construction period. The Cadiz Project facilities would be contained in a permanent right-of-way 80 feet in width, which would allow access for operation and maintenance. A typical cross section for the water conveyance facilities construction was shown earlier on Figure 4-4.

The Combination Alternative is estimated to require 495 acres of temporary construction easement and 330 acres of permanent right-of-way.

4.4.6 FEASIBILITY CAPITAL COST

The cost estimates for the Combination Alternative shown in Table 4-9 include, but are not limited to, costs for engineering design, construction, administration, conveyance facility land acquisition and environmental mitigation. These costs include contingency.

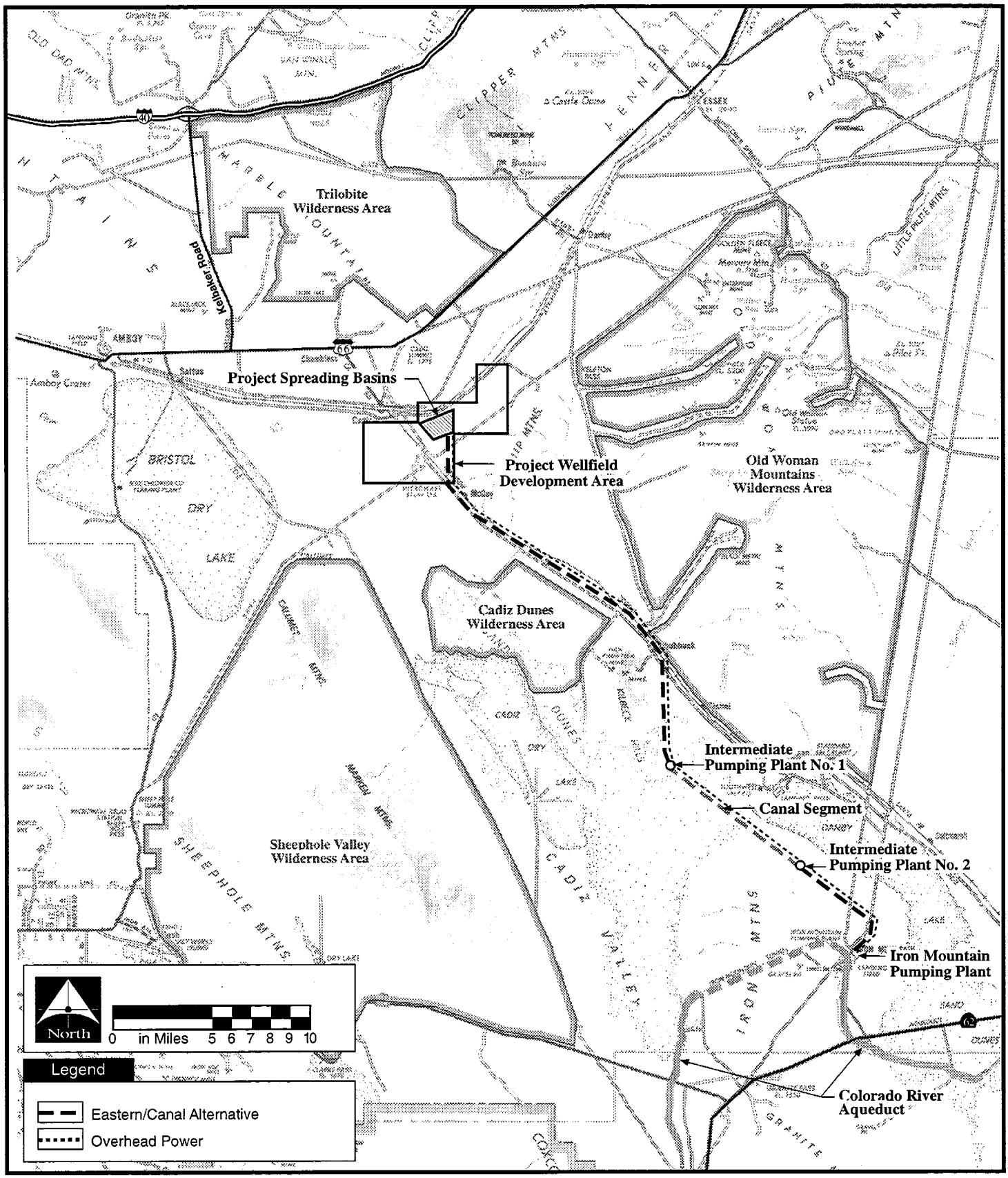
TABLE 4-9
COMBINATION ALTERNATIVE
ESTIMATED CONSTRUCTION COST
(1999 $)

Item	Estimated Cost
Cadiz Pumping Plant	$11,515,000
Conveyance Power Facility	$86,368,000
Spreading Basins	$3,513,000
Wellfield Facilities	$30,672,000
Land/Mitigation/Erosion Control	$4,587,000
Eng, Legal, Admin	$15,866,000
Total Project Cost	**$152,521,000**

4.5 EASTERN/CANAL ALTERNATIVE

4.5.1 GENERAL DESCRIPTION

As shown of Figure 4-10, the Eastern/Canal Alternative begins at the Project spreading basins in the Fenner Gap area approximately three miles north of unimproved Cadiz-Rice Road. The water conveyance facilities route proceeds due south for three miles, then parallels Cadiz-Rice Road and the ARZC rail line in a southeasterly direction towards the abandoned Chubbuck Station. Southeast of the abandoned Chubbuck Station, the water conveyance facilities turn south, generally following the 820-foot contour of Danby Dry Lake for approximately four miles. The water conveyance facilities then transition from an underground pipeline to a canal section and turn southeast, following the 755-foot contour, for approximately eight miles along the Iron Mountains. The canal section transitions back into an underground pipeline section while maintaining a southeasterly heading, and crosses Metropolitan's existing power transmission right-of-way. The water conveyance facilities continue around the east side of the Iron Mountains where they connect to an unimproved road. From this point, the water conveyance facilities parallel the unimproved road and enter the Iron Mountain Pumping Plant site, where they discharge into the existing Iron Mountain Pumping Plant forebay. The total length of the Eastern/Canal Alternative would be approximately 34.6 miles.



Source: P&D Consultants, Inc.

Figure 4-10

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Eastern/Canal Alternative

4.5.2 HYDRAULIC CHARACTERISTICS

A hydraulic profile of the Eastern/Canal Alternative is shown on Figure 4-11. The Cadiz Project analysis for the pipeline sections is based on a nominal design flow of 200 to 250 cfs. The analysis for the canal section was based on an 8-foot base width concrete-lined trapezoidal channel with 1.5:1 side slopes. Figure 4-11 indicates the elevation to which water must be pumped in order to overcome friction losses in the conveyance system. Factors that affect system hydraulics include flow rate, size and cross section of the water conveyance facilities, length, and the type of material used for the conveyance facilities. As indicated, during spreading cycles, the maximum hydraulic grade line elevation of 1,216 feet is experienced at the Intermediate Pumping Plant No. 1. The maximum pipeline pressure during spreading cycles occurs at mile 21 of the pipeline, where the pressure is 200 psi. During withdrawal cycles, the maximum hydraulic grade-line elevation occurs at the wellfield site, at an elevation of 1,200 feet. The maximum conveyance facility pressure during withdrawal occurs at approximately mile 5 of the pipeline, where the pressure is 170 psi.

4.5.3 CONSTRUCTION ACTIVITIES

The major construction equipment expected to be used for the Eastern/Canal Alternative is listed by type and number in Table 4-10. This table summarizes equipment needed for trench excavation, pipe placement, canal lining, backfill, appurtenant facility construction and erection of structures.

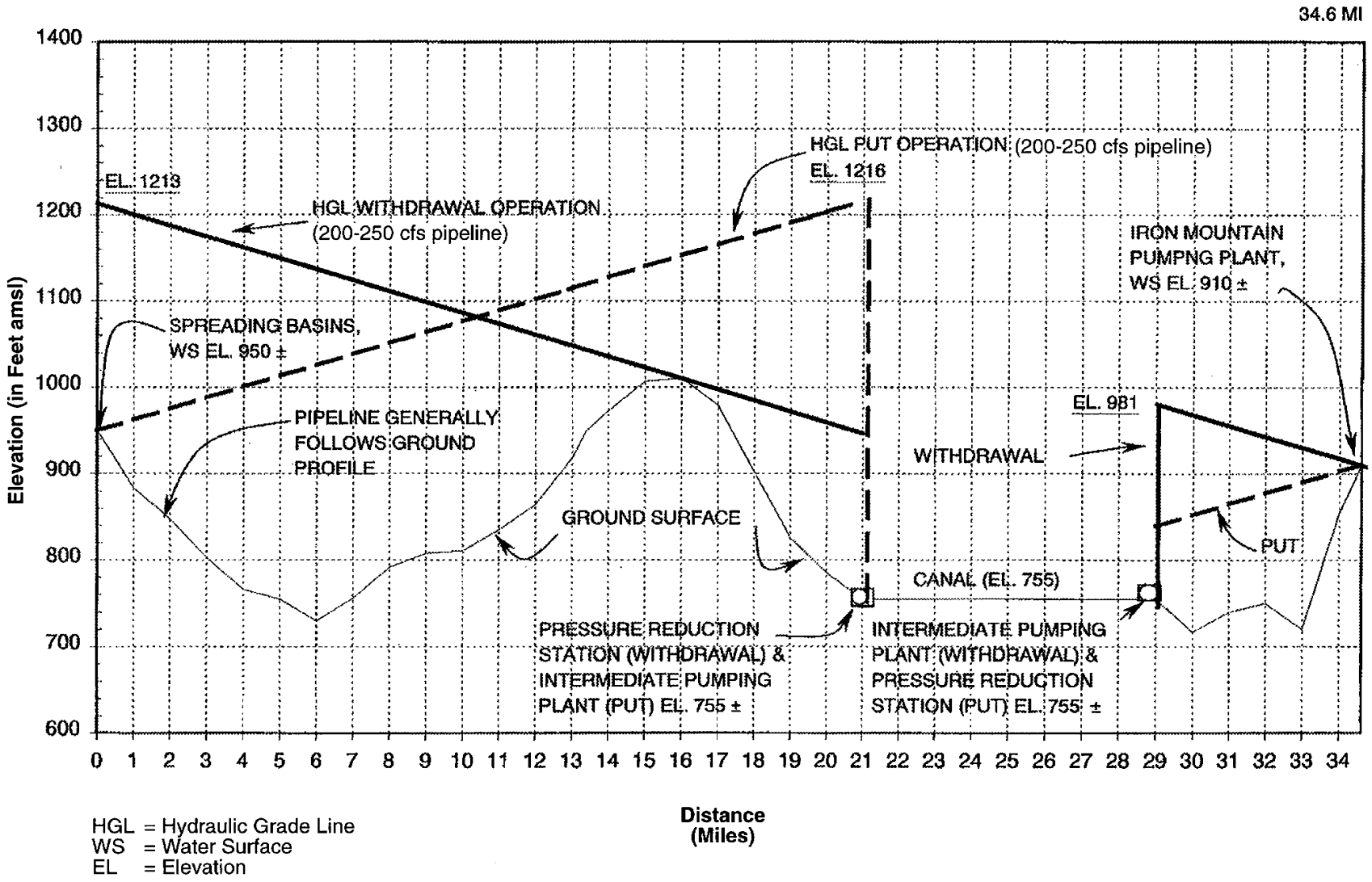
TABLE 4-10
EASTERN/CANAL ALTERNATIVE
CONSTRUCTION EQUIPMENT

Description	Number
1.5 cy Loader-Backhoe	8
¾ ton Pickup Truck	32
1 cy Backhoe	4
Flatbed Truck w/ Crane	8
Crane	12
3 cy Hydraulic Backhoe	8
End Dump Truck, 12 cy	4
Tractor/Lowboy Hauling Rig	8
Tamping Spade	12
Hand Held Vibrator Plate	12
3 cy Rubber Tire Loader	16
Highway Water Truck	16
Vibrator Compactor	4
Forklift, 7.5 ton	4
Truck Mounted Vertical Auger Drill	4
Generator	12
Concrete Truck	12
Bedding Hopper/Conveyor System	8
Trench Shield	4
Z-Bar Shoring	4
Truck Cane	4
Pile Hammer, Diesel	4
Pile Leads	4
Dozer	4
Scraper	4
Sheep-foot Compactor	4

The types and quantities of equipment are approximate and intended only for estimating construction related impacts. Actual equipment types and quantity may vary.

Water Conveyance Facilities Construction

Construction of the water conveyance facilities would be conducted in segments and would include trench and canal excavation, utility preservation and/or relocation, pipe and siphon placement, canal lining, backfill, appurtenant construction and restoration along the entire conveyance facility route. Pipeline segments would be buried, with a minimum earth cover of three feet. Where the pipeline crosses drainages, the depth of cover might be up to ten feet, and scour



Source: Black and Veatch (1999).

Figure 4-11

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Eastern/Canal Alternative Hydraulic Profile

protection for the pipeline would be provided. Canal segments would follow the ground profile, with earthen berms on either side of the canal. Drainage crossings would pass over the canal.

While the lengths of the individual construction segments would be comparable, productivity would be controlled by the trench type, canal excavation and construction corridor width, restrictions in construction operations; and difficulties in construction of railroad or arroyo crossings. The rail line crossings would either be bore and jack or conventional tunnel with ribs and lagging or linear plate. All tunnel construction would require a bore pit and a receiving pit. For the Cadiz Project, an area of 150 feet by 100 feet is estimated to be sufficient for the bore pit and surrounding construction activities. The receiving pit would likely be a shored excavation area 20 feet by 12 feet.

The type of trench and canal excavation for the pipeline would depend on several factors, including available construction space, soil/rock material in the trench, groundwater level and allowable cut slope. Prior to a more detailed inspection, aerial photographs of the alternatives were used to establish the preliminary right-of-way availability for each alternative. General assumptions were made about the soil/rock material type, extent of groundwater infiltration and special facilities, such as utility crossings. Special crossing items at arroyos, rail lines and road crossings would require additional special trench types. In the event that rock material is encountered, blasting might be used during trench excavation.

Trenching operations would depend on the trench type and the construction method selected by the contractor. Where necessary, trench shields or soldier piles and timber lagging could be used. Soldier piles could be driven in advance of the pipe heading and the lagging could be installed as the trench excavation progresses. In unrestricted working areas and with a crane used to install pipe, an average of eight to ten sections per day could be installed. Pipe sections would likely be 40 or 48 feet in length. In restricted work areas such as shored trench, where a crane must place the pipe in the trench after delivery by the pipemobile, the average installation rate would be approximately half the rate in unrestricted work areas. Overall, the average length of time that any one area along the pipeline would be disturbed is anticipated to be three months.

It is anticipated that the excavated material would be used for pipe embedment. Water may have to be added to the excavated material to obtain proper compaction around the pipe. Using excavated materials for pipe embedment would eliminate the need to transport bedding materials from local rock quarries.

Throughout construction, the top three to four inches of topsoil would be stockpiled, and cleared and grubbed vegetation would be mulched and set aside with the topsoil. At the completion of construction of each segment of the pipeline, the stockpiled topsoil would be re-spread over the re-contoured permanent right-of-way. The surface would be re-contoured to preserve the original runoff pattern. Topsoil and mulch would be stockpiled for a maximum of three months prior to respreading.

The length of pipe sections transported would be determined by the existing weight limits on roads and highways but would not exceed 48 feet. Transportation of the pipe sections is a significant factor since most public roads and highways have load restrictions of approximately 45 tons. Caltrans has indicated that under a repetitive hauling permit, the absolute maximum load width permitted is 14 feet. In any event, all the required permits to haul pipe on public roads would be obtained. An alternative method for pipe delivery would be to transport pipe sections by rail lines in the project area.

In addition, the general area of Chubbuck Station (CA-SBR-3283H) outside the construction limits would be identified on the Project specifications and maps as an ERA in consultation with the Project archaeologist. The area and the work limits would be flagged and construction activity would not be allowed within this ERA. The construction corridor would be narrowed to a maximum of 40 feet for approximately 1.25 miles adjacent to this site, in consultation with the project archaeologist.

The general area of the Patton Camp (AE-CAD-13H) outside the construction limits would also be identified on the Project specifications and maps as an ERA in consultation with the project archaeologist. The area and the work limits would be flagged and construction activity would not be allowed within this ERA. The construction corridor in the immediate vicinity of this site would be limited to that area west of the railroad and east of the All American Pipeline and focused, to the extent possible, on areas previously disturbed by construction.

Intermediate Pumping Plant No. 1 Construction

Intermediate Pumping Plant No. 1 would be built at mile 21 on the Eastern/Canal Alternative. Construction equipment that would be used in installing this pumping plant is shown in Table 4-11.

TABLE 4- 11
INTERMEDIATE PUMPING PLANT NO. 1
CONSTRUCTION EQUIPMENT

Description	Number
Grader	1
Dozer	1
Hydraulic Backhoe, 1.0 cy	1
¾ Pickup Truck	8
End Dump Truck, 12 cy	2
Crane	1
Gas Welding Machine	2
Tractor/Lowboy Hauling Rig	1
Concrete Mixer	2
Hand Held Vibrator Plate	4
3 cy Rubber Tire Loader	2
Highway Water Truck	1
Compressor	2
Trench Shield	1
Z-bar Shoring	1
Vibrator Compactor	2
Truck Mounted Vertical Auger Drill	1
Pile Hammer, Diesel	1
Pile Leads	1
Front End Loader	1
Roller	1
Generator	2
Concrete Truck	Varies

The types and quantities of equipment are approximate and intended only for estimating construction related impacts. Actual equipment types and quantity may vary.

Construction of this pumping plant would involve site preparation. This phase involves clearing the building site of objectionable surface materials and obstacles to construction (stripping

vegetation and initial grading). Additional construction activities for the pumping plant include trench and structure excavation, above-grade building, pipe, pump and valve installation, appurtenant construction and feature restoration around the entire pump station.

A second phase of excavation would be required for foundation of the facility, underground structures and buried utilities. Part of the excavated material would be stockpiled on site for backfill and site grading; the remainder would be disposed of or stockpiled on the pumping plant site.

Buildings would be erected to house the motors, pumps, communications and control rooms. The superstructure would likely have a split-faced block exterior. All below-grade and at least part of some above-ground structures would be constructed from cast-in-place reinforced concrete.

After completion of these structures, excavated areas would be backfilled, and stockpiled material would be graded to a finish grade.

Intermediate Pumping Plant No. 2

Intermediate Pumping Plant No. 2 would be built at mile 29 on the Eastern/Canal Alternative. Construction equipment anticipated to be used in installing the structure is shown in Table 4-12.

Construction of this pumping plant would involve the same building methods as the previously described for the Intermediate Pumping Plant No. 1.

TABLE 4-12
INTERMEDIATE PUMPING PLANT NO. 2
CONSTRUCTION EQUIPMENT

Description	Number
Grader	1
Dozer	1
Hydraulic Backhoe, 1.0 cy	1
¾ Pickup Truck	8
End Dump Truck, 12 cy	2
Crane	1
Gas Welding Machine	2
Tractor/Lowboy Hauling Rig	1
Concrete Mixer	2
Hand Held Vibrator Plate	4
3 cy Rubber Tire Loader	2
Highway Water Truck	1
Compressor	2
Trench Shield	1
Z-bar Shoring	1
Vibrator Compactor	2
Truck Mounted Vertical Auger Drill	1
Pile Hammer, Diesel	1
Pile Leads	1
Front End Loader	1
Roller	1
Generator	2
Concrete Truck	Varies

The types and quantities of equipment are approximate and intended only for estimating construction related impacts. Actual equipment types and quantity may vary.

4.5.4 CONSTRUCTION SCHEDULE

Elements included in the Cadiz Project construction schedule are the pumping plant, water conveyance facilities, power distribution facilities, Project spreading basins and Project wellfield. Each of these items requires a unique time frame for construction. In all, the facilities required to store water would be completed by the spring of 2001.

4.5.5 RIGHT-OF-WAY REQUIREMENTS

Temporary and permanent rights-of-way would be required to construct and operate the Eastern/Canal Alternative water conveyance and power distribution facilities, Intermediate Pumping Plant No. 1 and Intermediate Pumping Plant No. 2. The other facilities under the Eastern/Canal Alternative are located on properties owned by Metropolitan and Cadiz Inc. and would not require temporary or permanent rights-of-way.

Temporary construction easements would be required to construct the water conveyance and power distribution facilities. An estimated 200-foot wide corridor would be necessary during the construction period. The pipeline facilities would be contained in a permanent right-of-way, 80 feet in width, which would allow access for operation and maintenance. The canal segment would be contained within a 120-foot wide permanent right-of-way. A typical cross section for pipeline construction was shown earlier on Figure 4-4. A typical cross section for canal construction is shown on Figure 4-12.

Intermediate Pumping Plant No. 1 would be sited at mile 21 of the alignment, and would require approximately 1.5 acres of permanent right-of-way. Intermediate Pumping Plant No. 2 at mile 29 would require 1.5 acres of permanent right-of-way. Figure 4-13 illustrates the site plan and associated right-of-way requirements for Intermediate Pumping Plant No. 1, and Figure 4-14 shows the detailed site plan for Intermediate Pumping Plant No. 1. The site plan and detail for Intermediate Pumping Plant No. 2 would be comparable.

The Eastern/Canal Alternative is estimated to require 525 acres of temporary construction easement, and 350 acres of permanent right-of-way.

4.5.6 FEASIBILITY CAPITAL COST

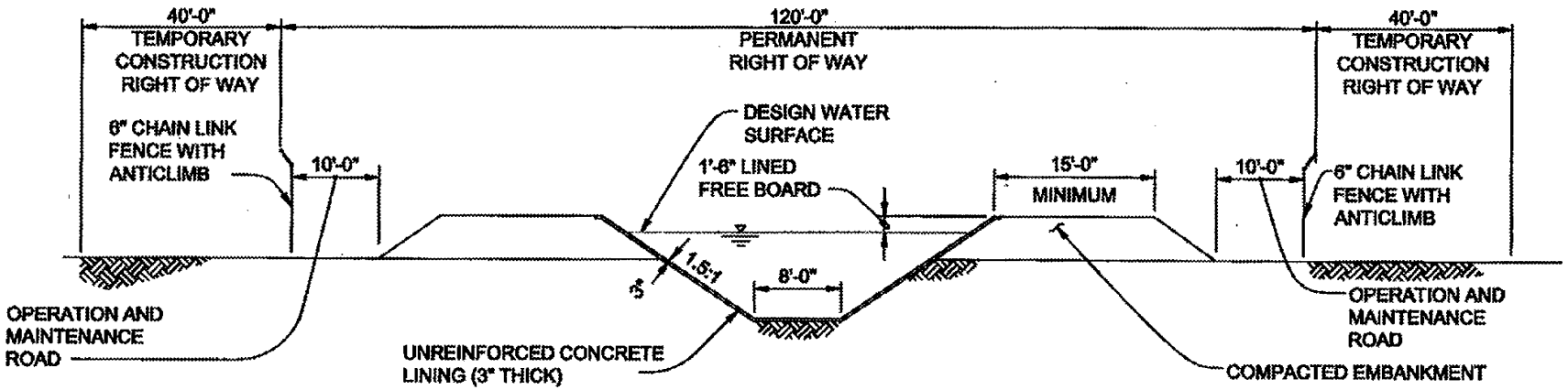
The cost estimates for the Eastern/Canal Alternative shown in Table 4-13 include, but are not limited to, costs for engineering design, construction, administration, water conveyance, power distribution facilities and environmental mitigation. These costs include a contingency.

TABLE 4-13
EASTERN/CANAL ALTERNATIVE
ESTIMATED CONSTRUCTION COST
(1999 $)

Item	Estimated Cost
Intermediate Pumping Plant No. 1	$11,447,000
Intermediate Pumping Plant No. 2	$11,011,000
Conveyance/Power Facilities	$84,962,000
Spreading Basins	$3,513,000
Wellfield Facilities	$30,672,000
Land/Mitigation/Erosion Control	$6,500,000
Eng, Legal, Admin	$17,010,000
Total Project Cost	**$165,115,000**

4.6 CHARACTERISTICS COMMON TO ALL ALTERNATIVES

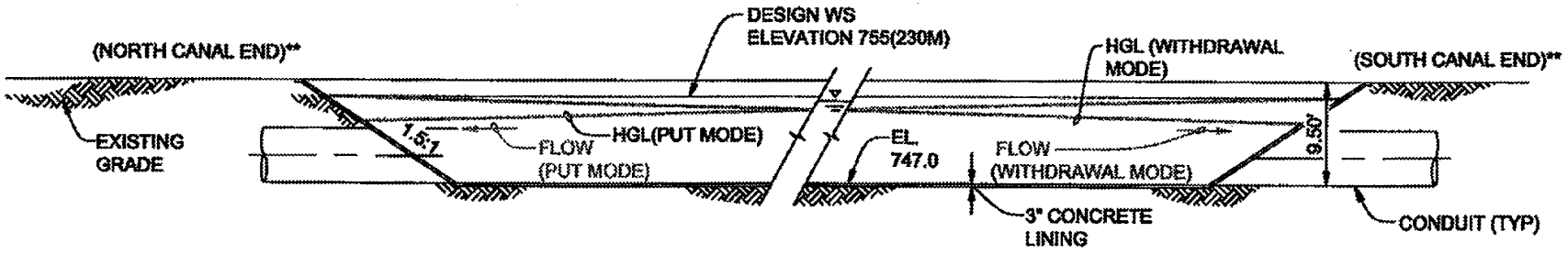
Certain Cadiz Project components are common to all the alternatives. These are the Project spreading basins, wellfield, wellfield power facilities, certain staging areas, power distribution facilities, pipeline appurtenant features, and instrumentation and control systems. These common Cadiz Project components are discussed below.



HGL = Hydraulic Grade Line
WS = Water Surface
EL = Elevations

CANAL SECTION

NTS



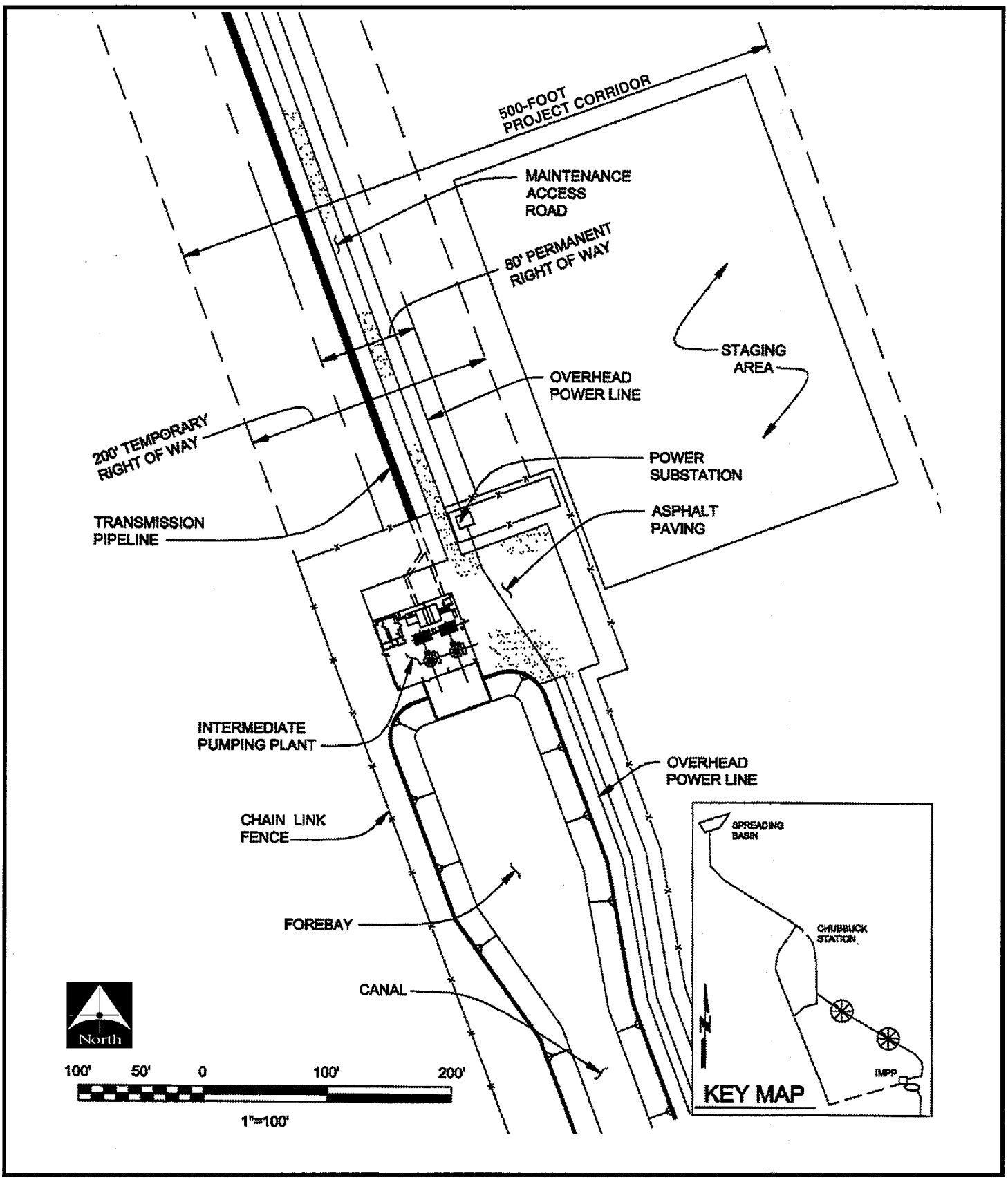
** PUMPING PLANTS NOT SHOWN.

Source: Black and Veatch (1999).

Figure 4-12

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Typical Cross Section for Canal Construction



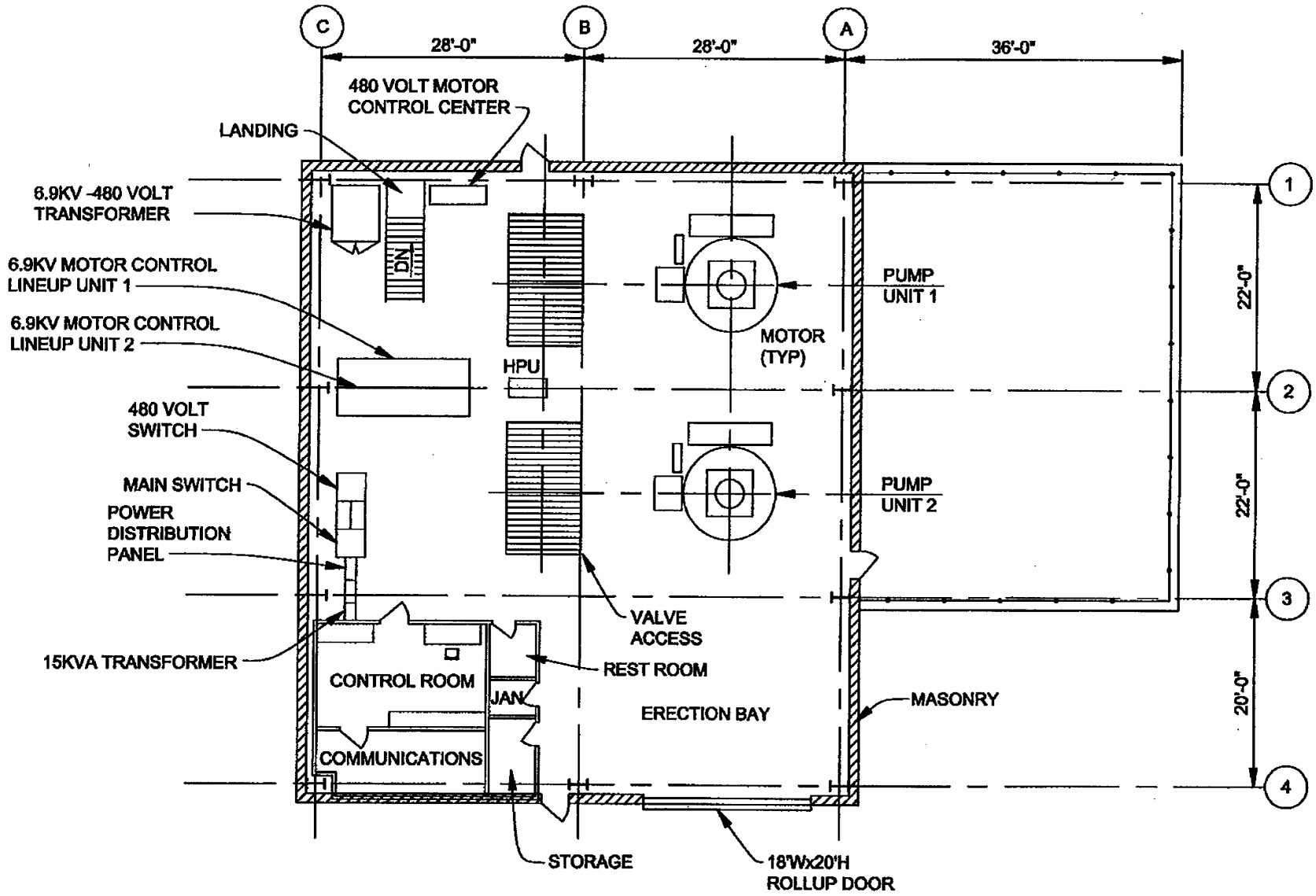
Source: Black and Veatch (1999).

Figure 4-13

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Intermediate Pumping Plant No. 1



Source: Black and Veatch (1999).

Figure 4-14

Intermediate Pumping Plant No. 1 Detail

4.6.1 PROJECT SPREADING BASINS

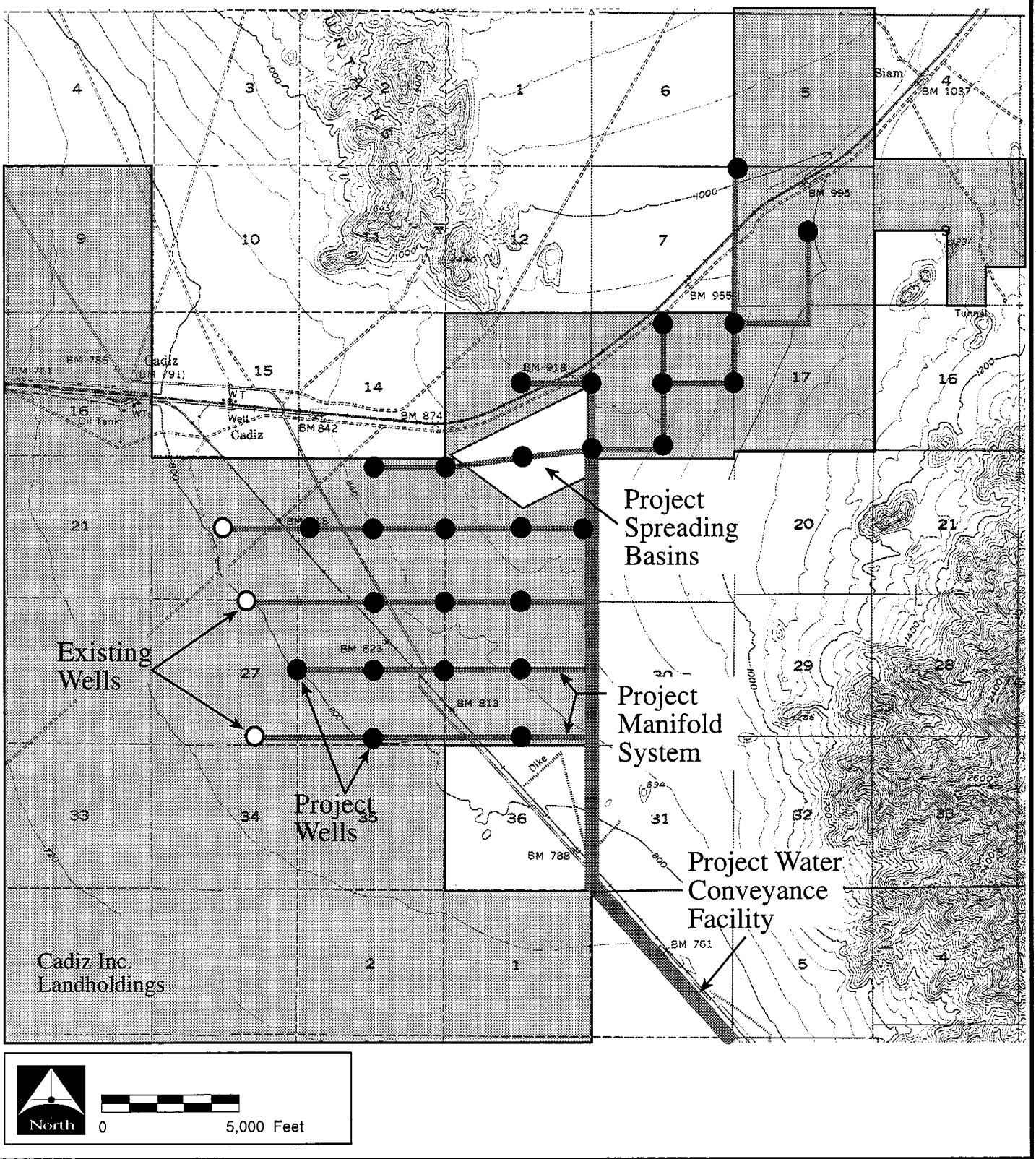
The Project spreading basins would encompass a total area of 390 acres, with about 330 acres of usable recharge area. The Project spreading basins would use a parallel train approach in which water could be diverted to each train through slide gate-operated control structures. Water would flow by gravity through all the basins in each train. Figure 4-15 shows a site plan of the Project spreading basins. Each basin would range in size from about 10 to 15 acres. Approximately 40 cells would be constructed. Individual basins would be about 400 feet wide and range from 1,700 to 2,100 feet long.

The invert of each basin would be level and each successive basin in the train would drop in elevation consistent with the slope of the existing ground surface. Individual basins would be approximately 3.2 feet lower in elevation than the upstream basin. The basins would be constructed with earthen berms using from 3:1 to 6:1 (horizontal:vertical) side slopes. The outside levees might be protected with riprap to control potential erosion. Interior berms might be protected with riprap or geotextile fabric to prevent erosion from wave action. The berm top would be 16 feet wide to allow equipment access for periodic maintenance of the basins. Typical cross sections of the spreading basins are shown on Figures 4-16 and 4-17. The maximum water depth in each basin cell would be 3.5 feet. Freeboard for the earthen berms would be between 1.5 to 2.5 feet.

Structures associated with the Project spreading basins include control structures, inlet structures, flow control structures and overflow structures. Control structures would control and divert water from the transmission pipeline to the inlet structure of each train. The control structure would consist of a reinforced concrete box approximately nine feet square and 16 feet deep. The structure would house two 72-inch slide gates that would be used to control flow into the basins. A typical control structure is shown on Figure 4-18.

Basin inlet structures would carry water from the control structures and discharge to the basin cells. Basin inlet structures would consist of a reinforced concrete foundation, horizontal and vertical discharge piping, and a steel framed trash grating. The top of the discharge pipe would be approximately 0.5 feet above the maximum basin water level and would spill on to a concrete slab surrounded by riprap. A typical inlet structure is shown on Figure 4-19.

Flow control structures would be used to cascade flow from upstream basin cells to downstream basin cells. The flow control structures would consist of a reinforced concrete structure with wingwalls, weir guides and supports, weir boards, piping, handrails and riprap at the inlet and outlet. The weir boards would be removable to allow operation of the basins at various water depths. A typical flow control structure would be used as an overflow device in the last basin cell of each train. This overflow structure would provide for berm integrity by preventing the berms from being overtopped by excess flow to the basins (Figure 4-20).

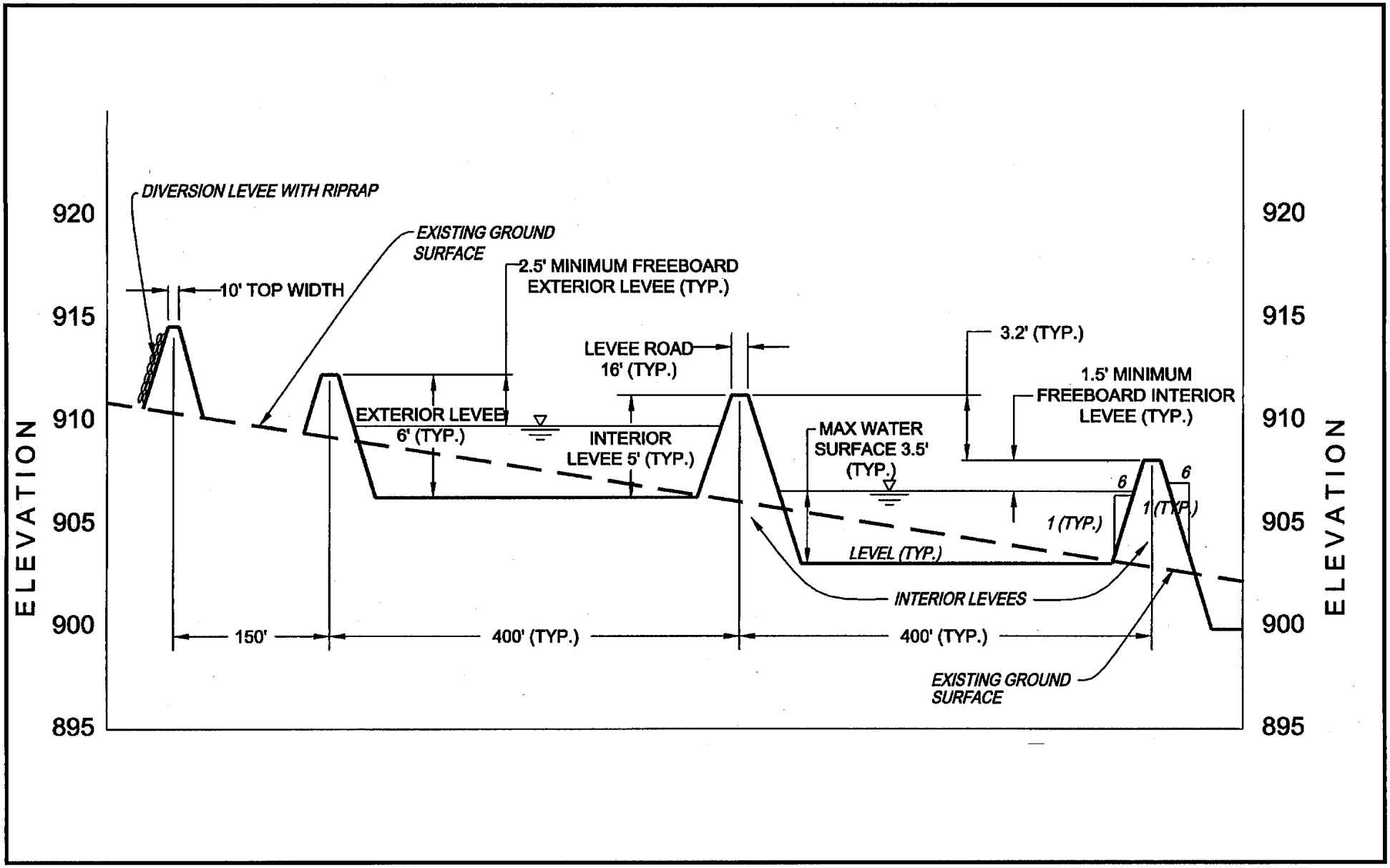


Source: P&D Consultants, Inc. (1999).

Figure 4-15

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Proposed Wellfield and Manifold System

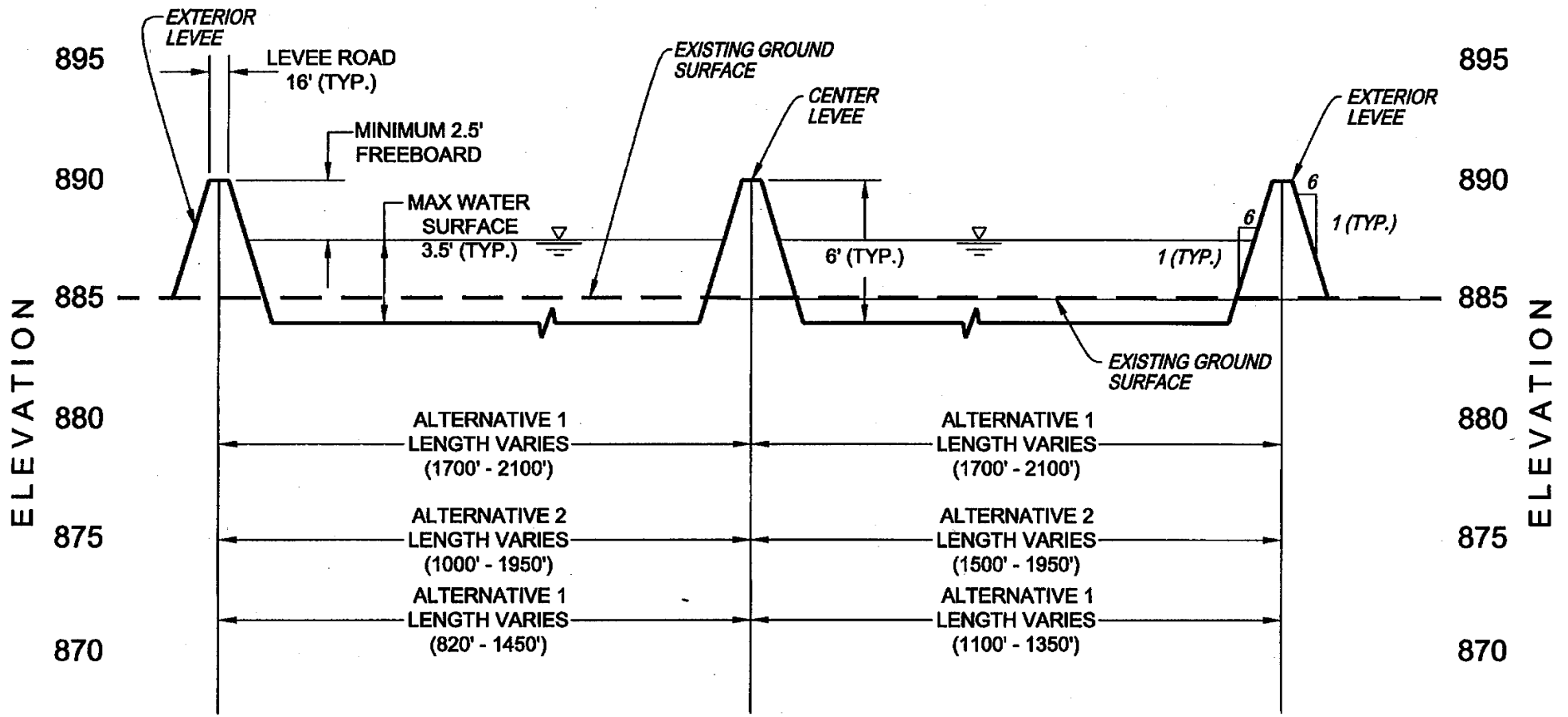


Source: Kennedy / Jenks Consultants (1999).

Figure 4-16

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Project Spreading Basins Profile



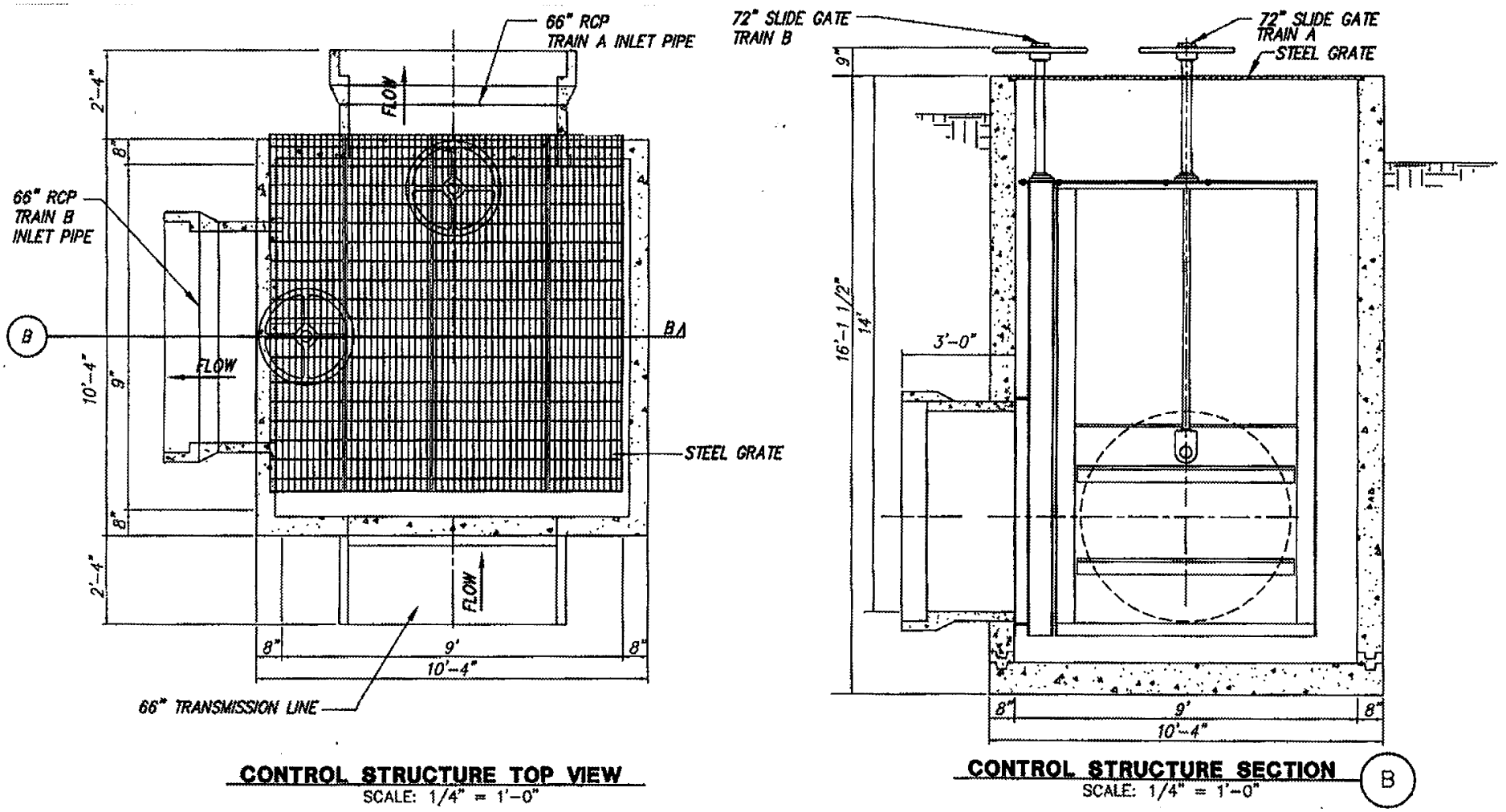
Source: Kennedy / Jenks Consultants (1999).

Figure 4-17

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Project Spreading Basins Profile

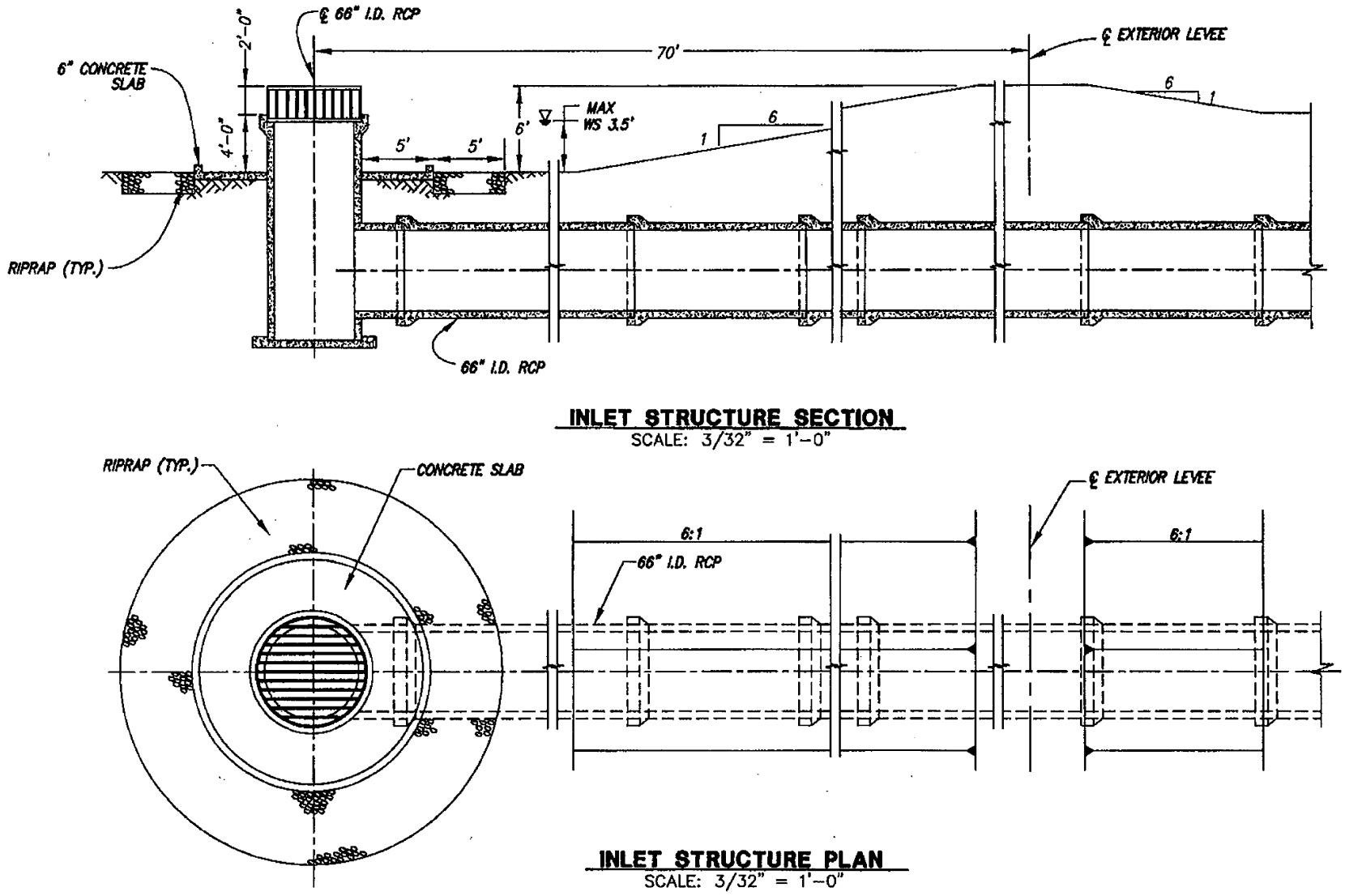


Source: Black and Veatch (1999).

Figure 4-18

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Typical Project Spreading Basin Control Stucture

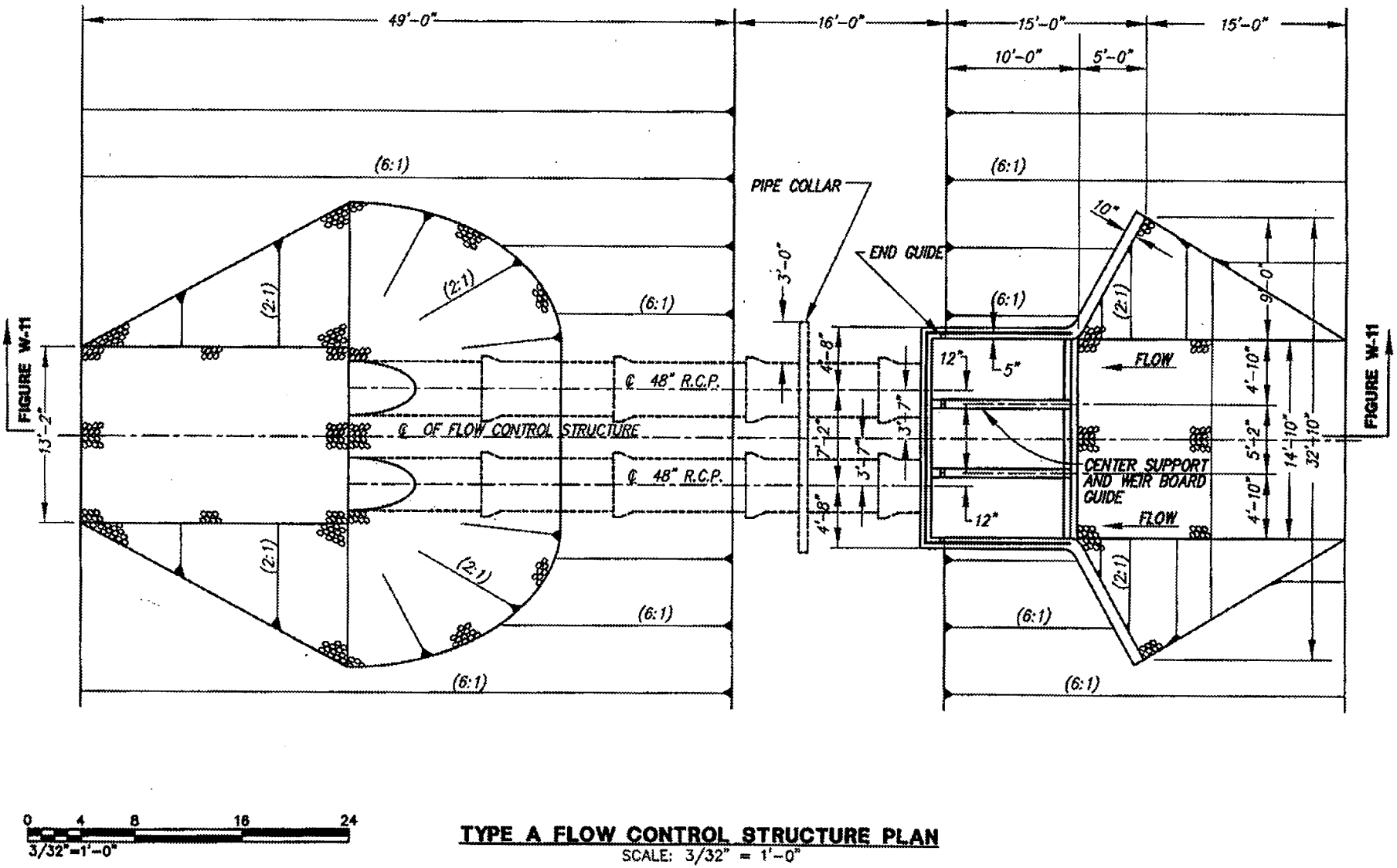


Source: Black and Veatch (1999).

Figure 4-19

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Typical Project Spreading Basin Inlet Structure



Source: Black and Veatch (1999).

Figure 4-20

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Typical Project Spreading Basin Flow Control Structure

The overflow structure would discharge to the area surrounding the Project spreading basins, and any discharged water would percolate into the ground until the incoming flow stops.

Virtually all construction-related activities would take place on the site of the spreading basin facilities. The only substantial off-site activities would be those associated with the delivery of ready-mixed concrete, other construction materials and process material equipment to the site.

It is the intent of the Project spreading basin design to have balanced cut and fill over the entire basin area. Construction activities for the Project spreading basins would include site preparation, clearing and grubbing, excavation, embankment or berm construction, utility preservation and/or relocation, pipe placement, backfill, gate and valve installation, and appurtenant construction.

Construction equipment used to complete the Project spreading basins is shown in Table 4-14.

The Project spreading basins would be constructed by excavating native material and placing and compacting the soil to form berms. Riprap might be placed on the interior and exterior berm faces with a loader. The interior berm face might alternately be protected by a geotextile fabric that would be placed using a loader and manual labor. A backhoe would excavate trenches for underground piping, valves and related substructures. Underground piping, valves and related substructures would be placed, and the excavation would be backfilled with native material and compacted to final grade. Mechanical equipment, such as gate valves, miscellaneous metalwork and piping, would be set with a crane.

TABLE 4-14
CONSTRUCTION EQUIPMENT REQUIRED FOR THE PROJECT SPREADING BASINS

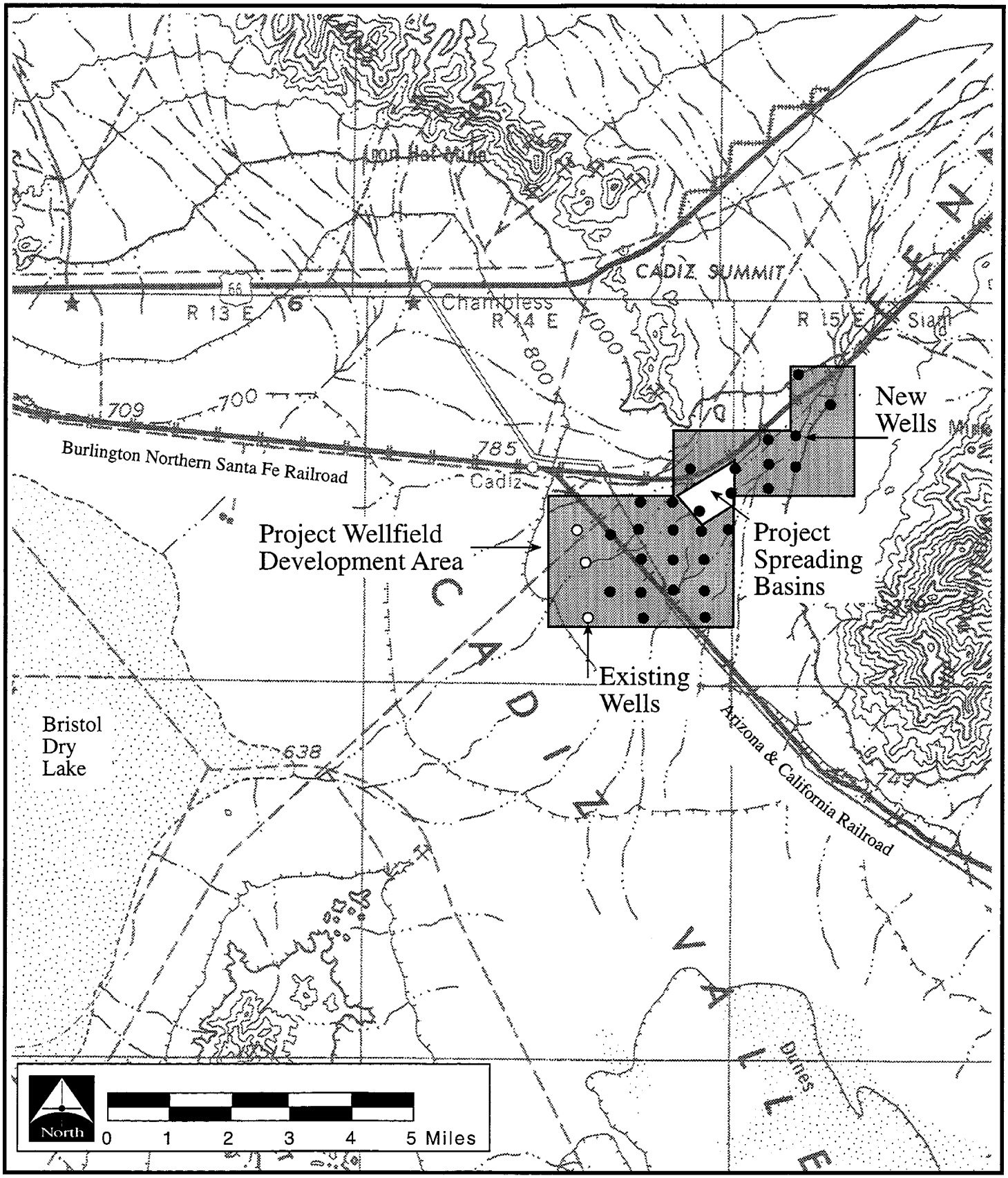
Description	Number
Grader	1
Dozer	1
Scraper	1
Compactor (Sheep-foot)	1
Concrete Mixer	1
Crane	1
End Dump Truck, 12 cy	2
Concrete Truck	Varies
Tractor/Lowboy Hauling Rig	1
3 cy Rubber Tire Loader	1
Highway Water Truck	2
Trench Shield	1
Z-bar Shoring	1
Front End Loader	1
Roller	1
¾ ton Pickup Truck	4
1 cy Backhoe	1

The types and quantities of equipment are approximate and intended only for estimating construction related impacts. Actual equipment types and quantity may vary.

The Project spreading basins would be located on Cadiz Inc. landholdings, and would not require any temporary or permanent rights-of-way.

4.6.2 PROJECT WELLFIELD

A Project wellfield, comprised of approximately 30 wells, would be constructed to recover stored Colorado River water and indigenous groundwater. The Project wellfield would be located in the vicinity of the Fenner Gap on Cadiz Inc. landholding. A preliminary site plan for the Project wellfield and Project spreading basins is shown on Figure 4-21.



Source: GEOSCIENCE Support Services Inc. (1999).

Figure 4-21

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Project Wellfield Spreading Basin Site Plan

The Project wellfield would include three existing agricultural irrigation wells which would be upgraded to meet the Cadiz Project requirements. Each new well would have a 16-20 inch diameter casing and provide a design capacity of about 6.7-8.3 cfs per well, for a nominal wellfield design capacity of 200-250 cfs. Motors used to operate the wells would range from 1,000 to 1,250 horsepower, and would be electrically powered using power supplied through Metropolitan's existing Colorado River Aqueduct power transmission system.

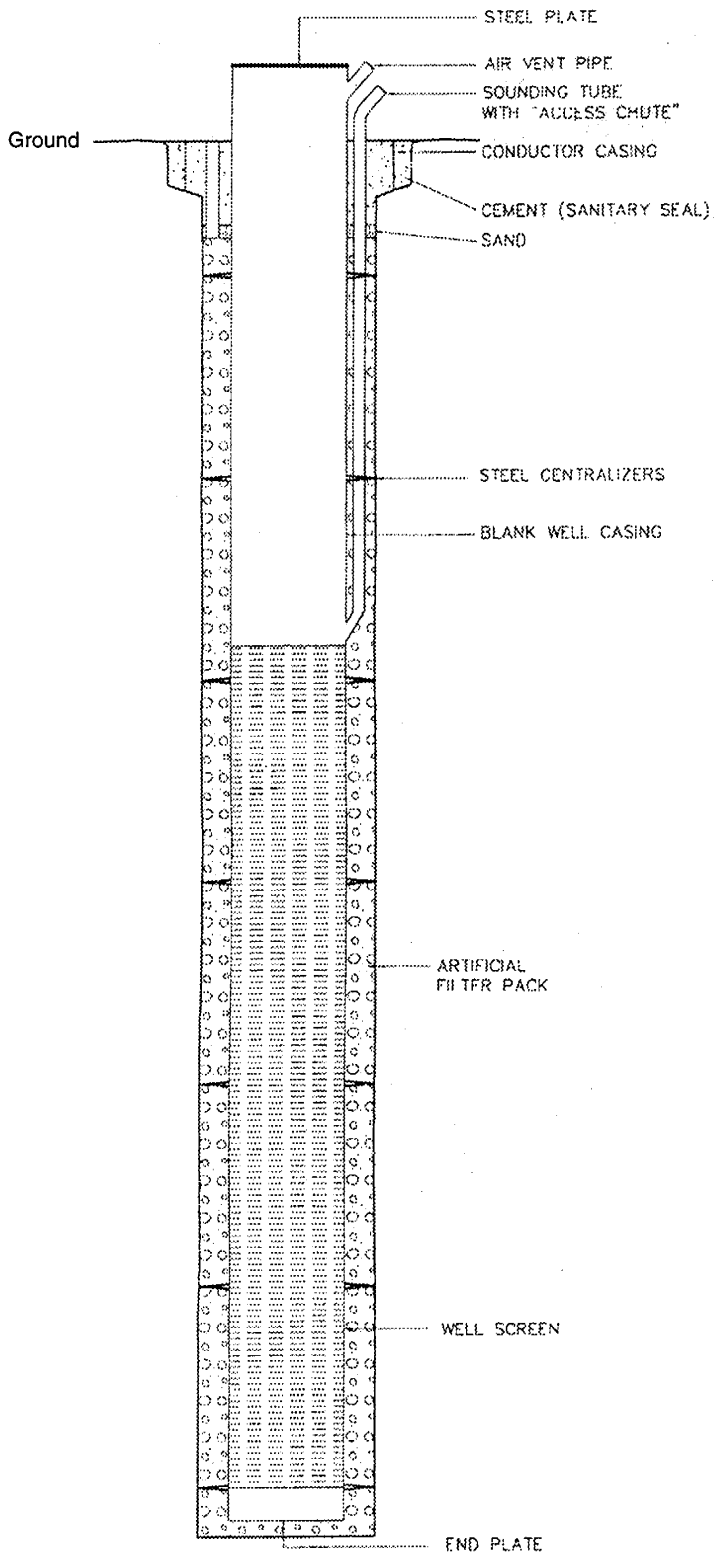
Construction of the Project wellfield would involve site preparation; clearing and grubbing; well drilling; utility preservation and/or relocation; pipe placement; backfill; pump, motor and valve installation; and appurtenant construction. Most of the construction-related activities and installation would take place on the site of the Project wellfield. The only substantial off-site activities would be those associated with transporting construction materials and appurtenances, and process equipment to the site.

Well drilling would be accomplished with drill rigs using the reverse rotary drill method. A pilot borehole, approximately 36-inches in diameter, would be drilled to a depth of approximately 30 feet and conductor casing would be cemented in-place. The borehole would then be extended to depth, up to 1,000 feet deep, using a bore diameter of 28 to 32 inches. The drilling operation would be continuous, 24 hours per day. A crane would then lower the well casing into the borehole. The annular space between the well casing and borehole would be filled with a specified mixture of soil and rock, called a filter pack, to ensure that fine-grained material from the formation surrounding the well is not pumped through the well during operation. A concrete seal would be placed at the top 50 feet of the annular space to provide a sanitary seal for the well. Figure 4-22 illustrates a typical well cross section.

The well pump bowls and driveshaft would be lowered into the well casing using a crane, and would then be aligned to ensure proper operation of the well. The electrical drive motor would be mounted on the wellhead, and appurtenant equipment, including flow meter, discharge piping, isolation valves and controls, would be installed. Plan and profile views of a typical well are shown on Figure 4-23.

A backhoe would excavate pipe trenches for the Project wellfield distribution piping that would carry water to the transmission pipeline leading to the Colorado River Aqueduct. A crane would be used to lower pipe segments into the trench. The pipe trench would be backfilled by a loader, and the backfill compacted to ensure pipe integrity. A separate trench would be excavated to install the Project wellfield monitoring and control systems. The monitoring and control systems would allow remote operation to be controlled from the Iron Mountain Pumping Plant. A schematic diagram of the monitoring and control system is shown on Figure 4-24.

Construction equipment used to complete the wellfield is shown in Table 4-15.

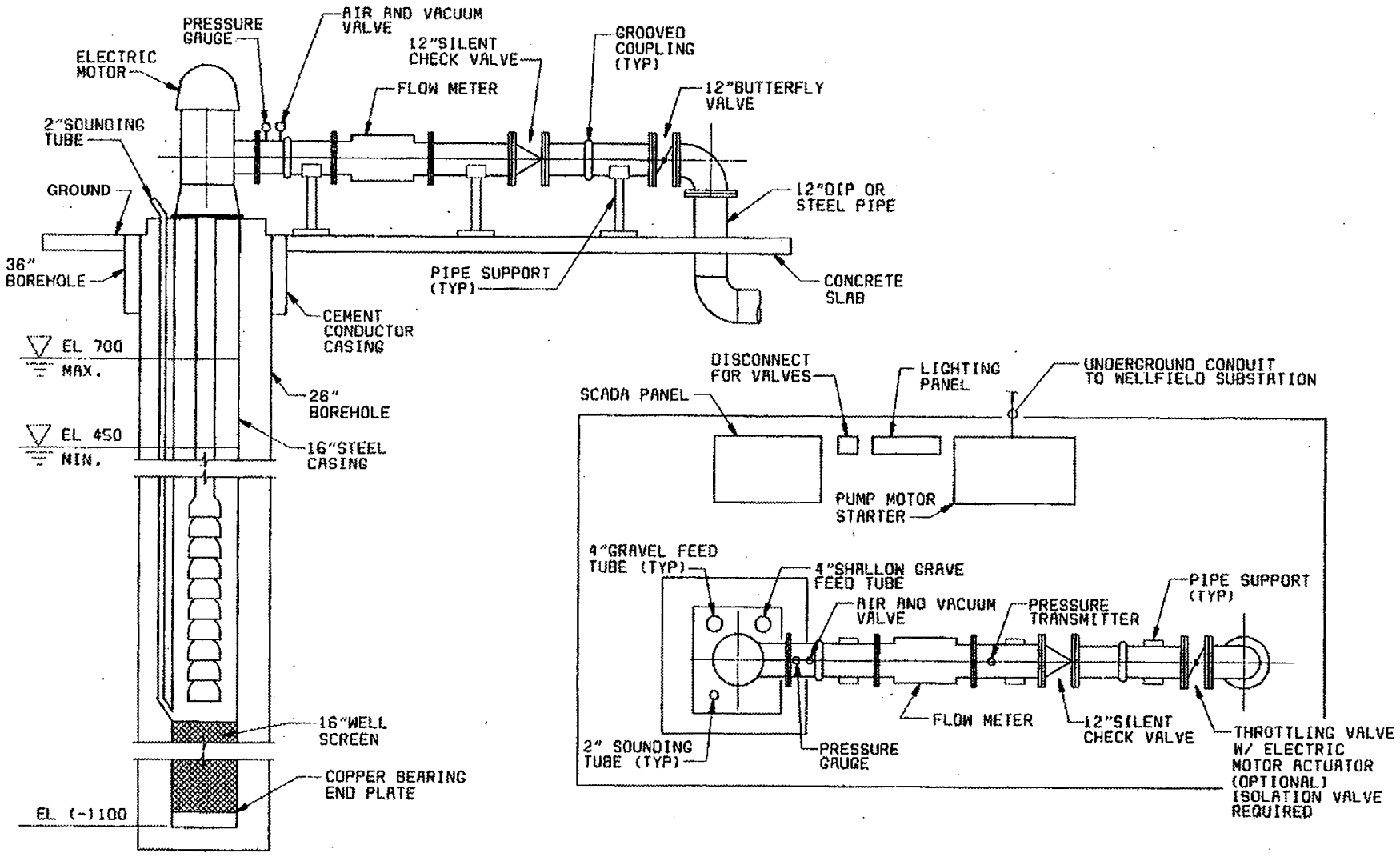


Source: Black and Veatch (1999).

Figure 4-22

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Typical Well Cross Section



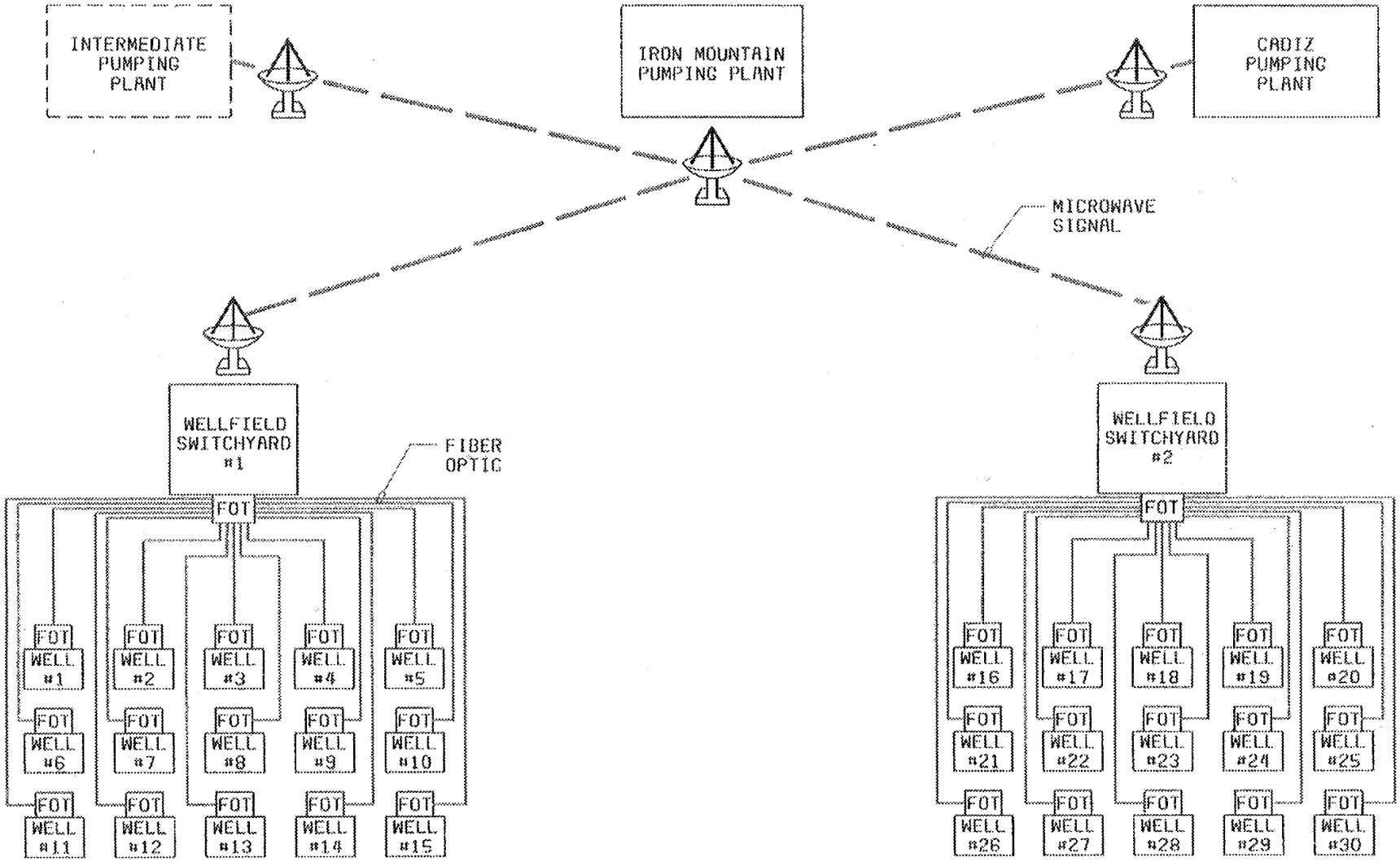
Source: Black and Veatch (1999).

Figure 4-23

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Typical Well Plan and Profile



Source: Black and Veatch (1999).

Figure 4-24

TABLE 4-15
CONSTRUCTION EQUIPMENT REQUIRED FOR THE PROJECT WELLFIELD

Description	Number
Grader	1
Dozer	1
¾ Ton Pickup Truck	6
End Dump Truck, 12 cy	2
Crane	2
Air Compressor	2
Tractor/Lowboy Hauling Rig	2
3 cy Rubber Tire Loader	1
Highway Water Truck	1
Truck Crane	1
Concrete Truck	Varies
Well Driller	4

The types and quantities of equipment are approximate and intended only for estimating construction related impacts. Actual equipment types and quantity may vary.

4.6.3 PROJECT WELLFIELD POWER SUPPLY AND DISTRIBUTION

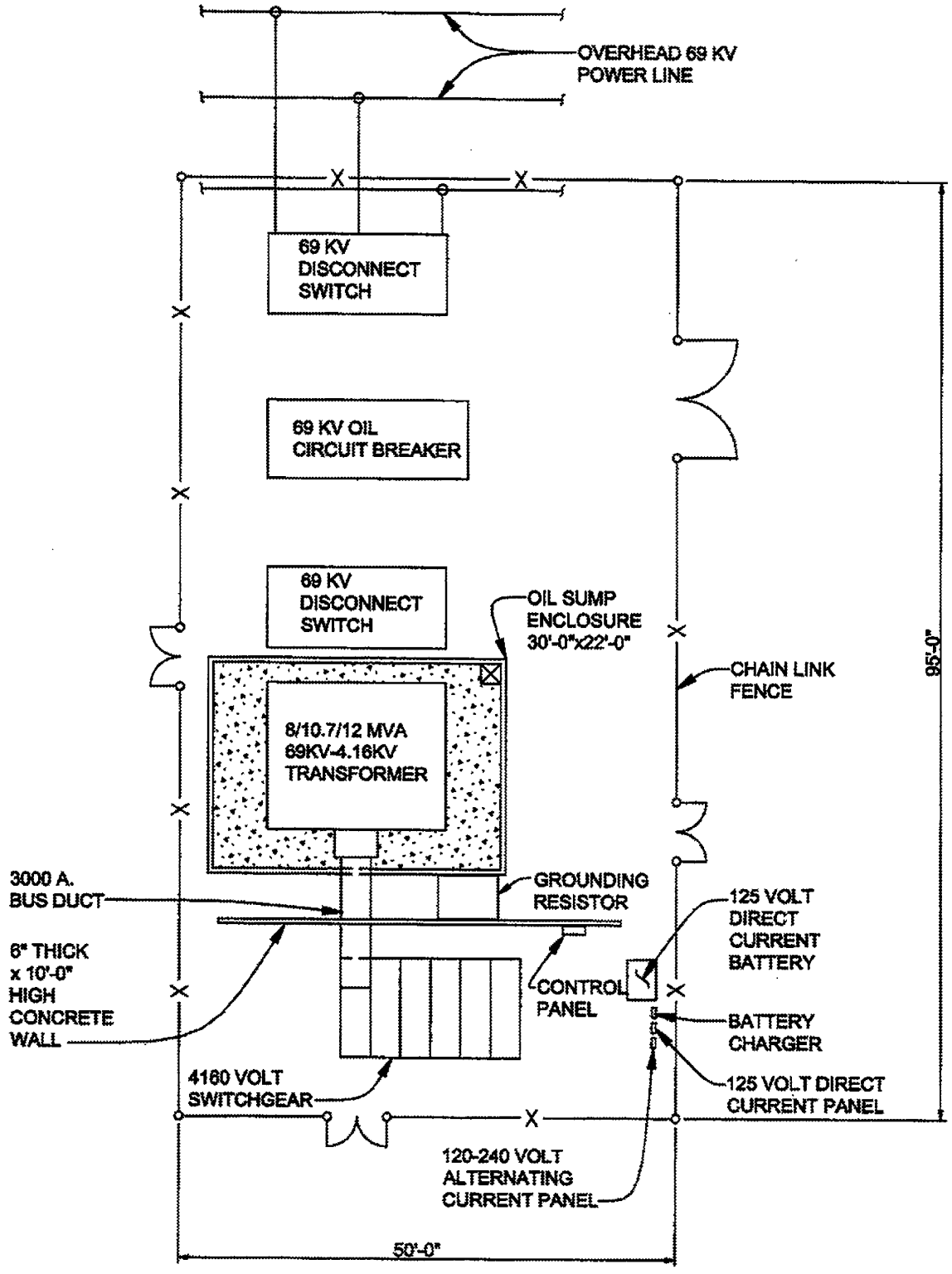
Power would be supplied to the Project wellfield via a 69kV overhead transmission line from the existing Iron Mountain Pumping Plant switchyard. Two switchyards would be equipped with a 69 kV circuit breaker, a 69/4.16kV transformer and a switchgear lineup containing a 3000 ampere rated main circuit breaker and five 1200 ampere rated circuit breakers which would distribute power to the Project wellfield. A site plan for a typical wellfield substation is shown on Figure 4-25. Each well site would be supplied with a 4.16kV starter which would have an oversized control power transformer to supply power to the site.

Construction of the Project wellfield power supply and distribution facilities would occur concurrently with the construction of the Project wellfield. Pads would be graded for the two switchyards. Concrete foundations would be placed on grade by concrete trucks. Large equipment would then be set on the foundations by a crane.

Power to individual wells could be supplied overhead or underground. If overhead, power poles would be installed in the wellfield area. A vertical auger would drill holes where poles would be placed. A small crane would lower poles into the ground. Conductors would be strung on the poles by lineman in a bucket-lift pulling wire from a reel truck. If the power is routed underground, a backhoe would excavate a trench from the switchyard to each well. Conduit to house conductors would be placed in the trench, and cement slurry would be placed around the conduit. The trench would be backfilled and conductors would be pulled through the conduit from a reel truck.

4.6.4 POWER DISTRIBUTION FACILITIES

Power distribution facilities for the Project wellfield would parallel the water conveyance facilities between the Colorado River Aqueduct and the Fenner Gap area. To power the Project wellfield, a 69 kV power distribution system would be required. The power poles would be placed within the permanent right-of-way obtained for the water conveyance facilities. Poles would be 50 - 60 feet in length, with 43 - 52 feet above ground. Each pole would carry three conductors and provide a minimum conductor ground clearance of 23 feet at maximum conductor sag. A typical power pole installation is shown on Figure 4-26.

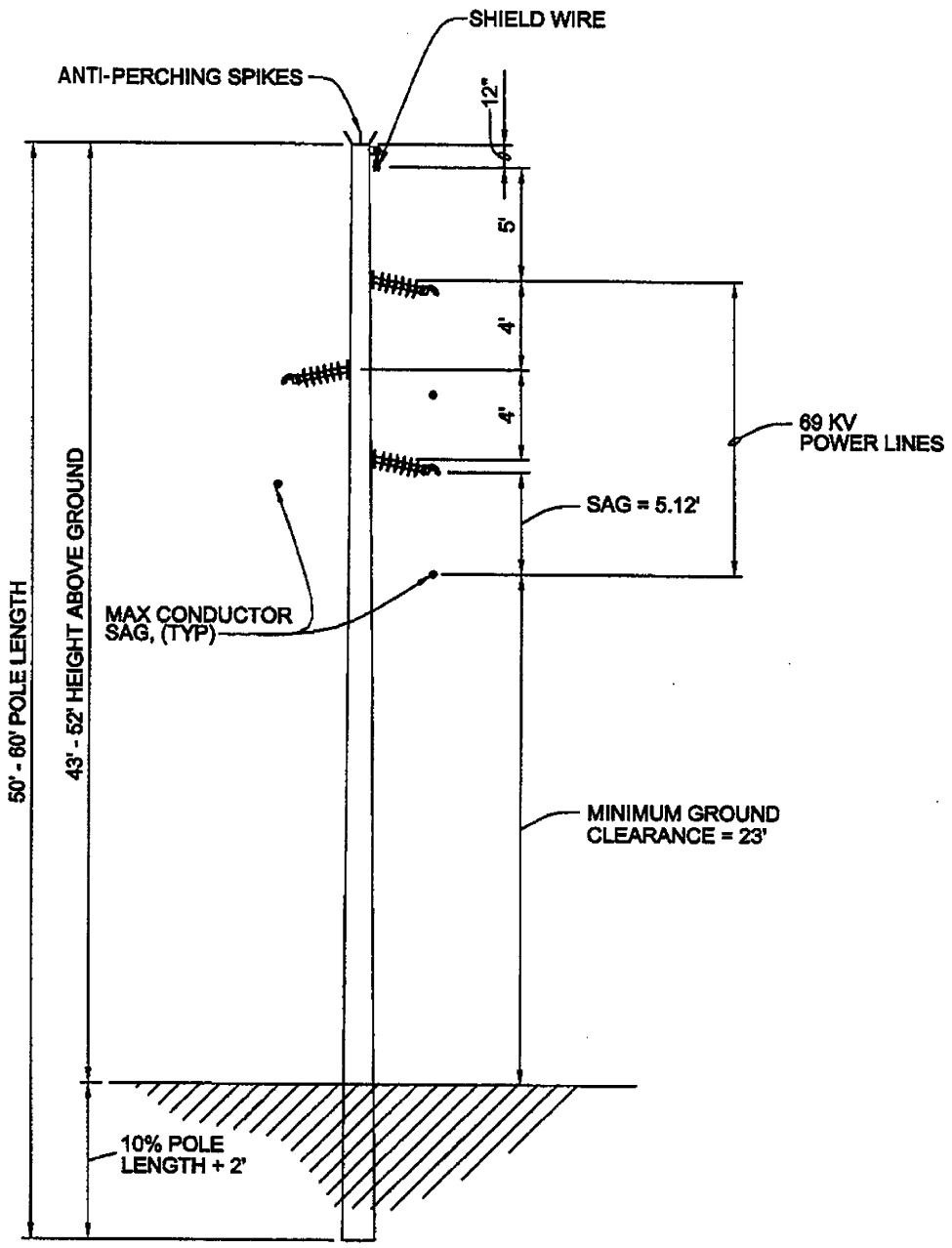


Source: Black and Veatch (1999).

Figure 4-25

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Typical Project Wellfield Substation



NOTE:

1. POLES MAY BE WOOD, CONCRETE OR METAL.
2. INSULATORS ARE ANGLED DOWNWARD TO PREVENT NESTING / PERCHING BY PREDATORY BIRDS.
3. SPIKES ARE INSTALLED AT TOP OF POLE TO PREVENT NESTING / PERCHING BY PREDATORY BIRDS.

Source: Black and Veatch (1999).

Figure 4-26

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Typical 69kV Power Pole

If the Eastern/Canal Alternative is implemented, an additional power supply line would be strung on the existing power poles from Iron Mountain Pumping Plant to the Intermediate Pumping Plants. This line would be 6.9 kV and would be installed on the same pole as the 69 kV line. The pole would be slightly taller to allow for the three additional conductors required for this Alternative.

Construction of the power line would occur concurrently with the water conveyance facility installation.

4.6.5 POWER SUPPLY FACILITIES

The existing 230kV switchrack at Iron Mountain Pumping Plant would be extended to provide two additional bays as shown on Figure 4-27. One bay would be for the new 69kV substation serving the overhead line to the wellfield and the other bay would be for the new pumping plant substation. Each bay would consist of a transformer, circuit breaker and disconnect switches. Overhead conductors would connect the switchrack extension to the new substations, with each one located in proximity to the switchrack. The pumping plant substation would be located southeast of the existing switchrack and would consist of a line termination structure and a 230kV/69kV transformer. Cables would connect directly to the low side of the transformer and would run underground to the pumping plant.

4.6.6 STAGING AREAS

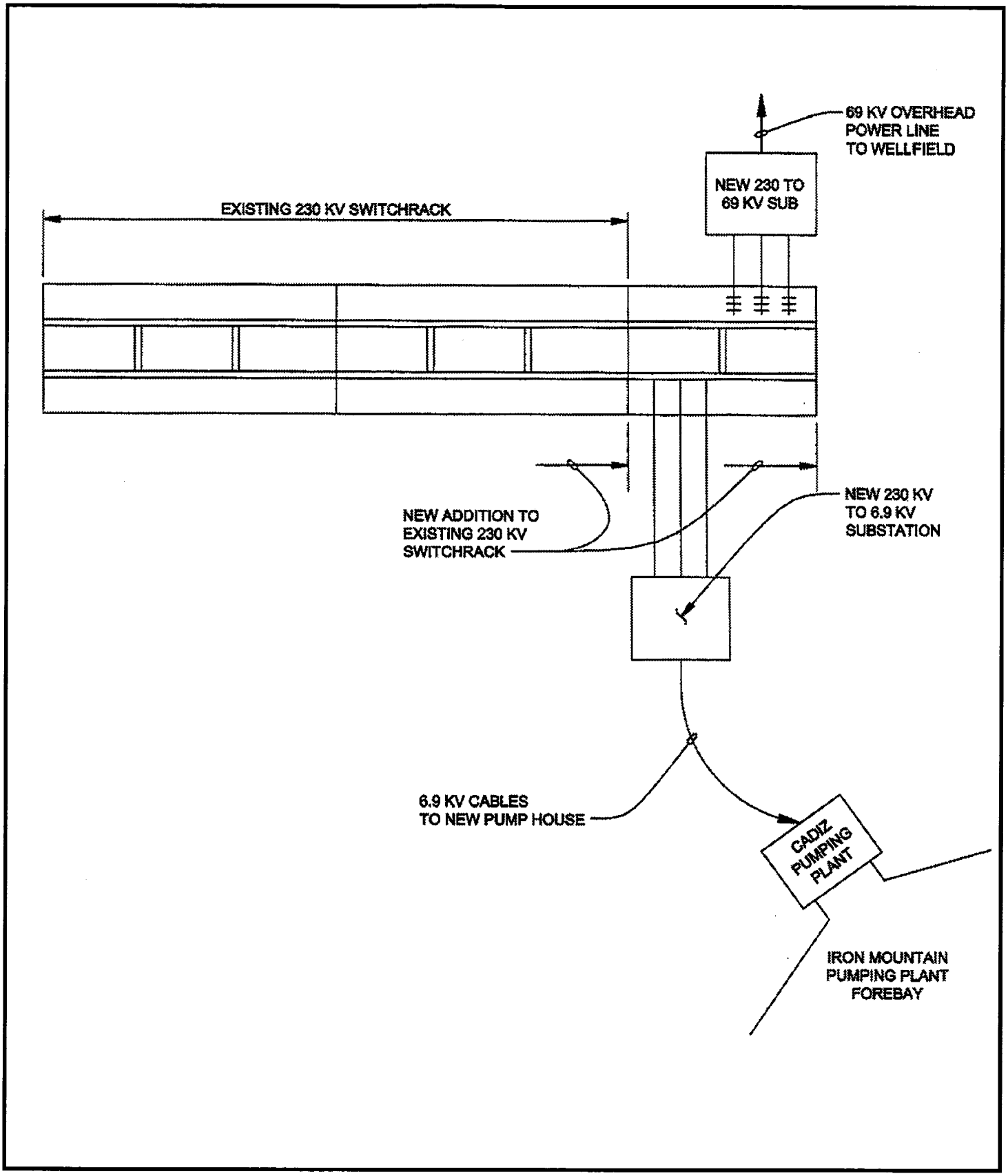
A staging area or areas would be prepared for the temporary storage of equipment and materials needed during construction of the Cadiz Project. Preparation of these staging areas would consist of crushing vegetation in place or blading the site in a manner that would allow native vegetation to recover from rootstock. The location of the storage areas would depend on which alternative was selected. The discussion below describes where these temporary staging areas would be located.

Wellfield Staging Area

A construction staging area for the construction of the Project wellfield and the northern segment of the water conveyance facilities would be contained within the 390 acre area used for the Project spreading basins. The construction staging area would provide space for material storage, pipe, equipment and vehicles needed for construction. Temporary construction trailers would also be housed on the site. Access to the staging area would be from Cadiz-Rice Road.

Intermediate Staging Area

An intermediate staging area for equipment and material storage and construction trailers would be located between Cadiz-Rice Road and the AZRC rail line. The location of this staging area is shown on Figure 4-28. Pipe sections, bedding material, reinforced steel, valves, a 5,000 to 10,000 gallon water storage tank and miscellaneous supplies would be stored at this staging area. This triangular shaped tract of land is approximately 1,500 feet long by 300 feet wide, providing nearly five acres for a construction staging area. Existing drainages define the west and east limits of this staging area site. The area is north and east of the Killbeck Hills. Equipment and materials would probably be delivered to this staging area from Cadiz rather than from the Iron Mountain Pumping Plant.



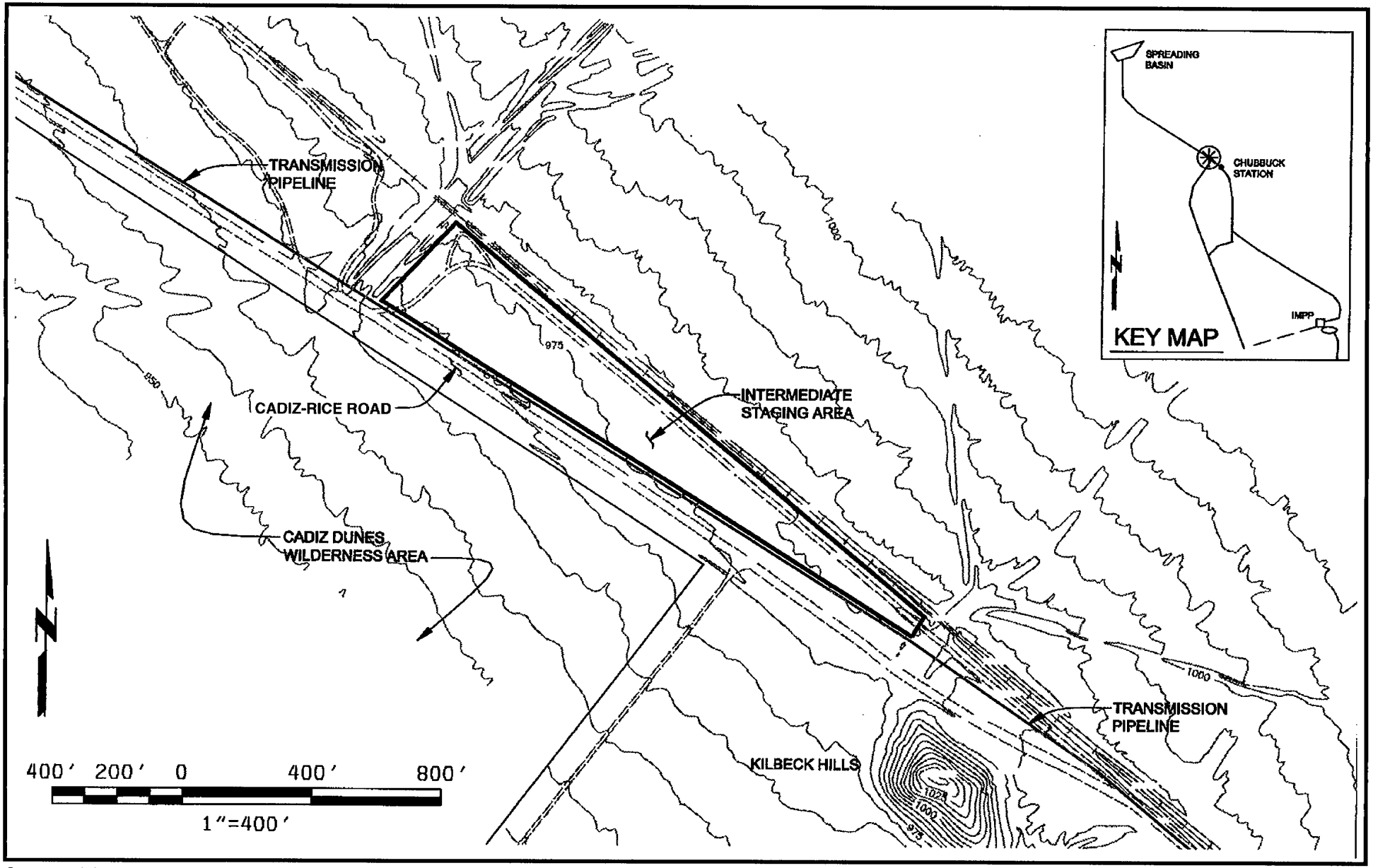
Source: Black and Veatch (1999).

Figure 4-27

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Electric Facilities at Iron Mountian Pumping Plant



Source: Black and Veatch (1999).

Figure 4-28

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Intermediate Staging Area

Access to this staging area would be from Cadiz-Rice Road. Although this staging area is adjacent to rail lines and material could be shipped by rail to the site, preliminary discussions with pipe suppliers indicate that pipe would be transported to the job site on trucks.

West Portal Staging Area

The staging area for construction of the Cadiz Pumping Plant (West Portal) and the West and Combination alternatives would parallel the 200-foot wide construction right-of way. Figure 4-29 shows the location of this staging area. An alternative staging area may be available at the tunnel tailings area south of the Iron Mountain Tunnel which could provide approximately 7.5 acres of storage.

This construction staging area would provide space for storage of materials, pipe, equipment and vehicles needed for construction. Construction trailers would presumably be located at this site. Access to this site would be provided via an existing unimproved road approximately five miles long that connects the staging area to Highway 62 as shown on Figure 4-30.

Cadiz Pumping Plant Staging Area

It is anticipated that a staging area for the Cadiz Pumping Plant and Eastern Alternative would be located south of the Eastern Alternative. A staging area of five to seven acres is anticipated at this site, as shown on Figure 4-31. Access to the staging area would be along the existing unimproved road east of the Colorado River Aqueduct.

Alternative staging areas may be available at several disturbed areas east and south of the existing Colorado River Aqueduct forebay. The staging area for the Cadiz Pumping Plant would likely be located between the existing electric substation and the Cadiz Pumping Plant.

Intermediate Pumping Plant

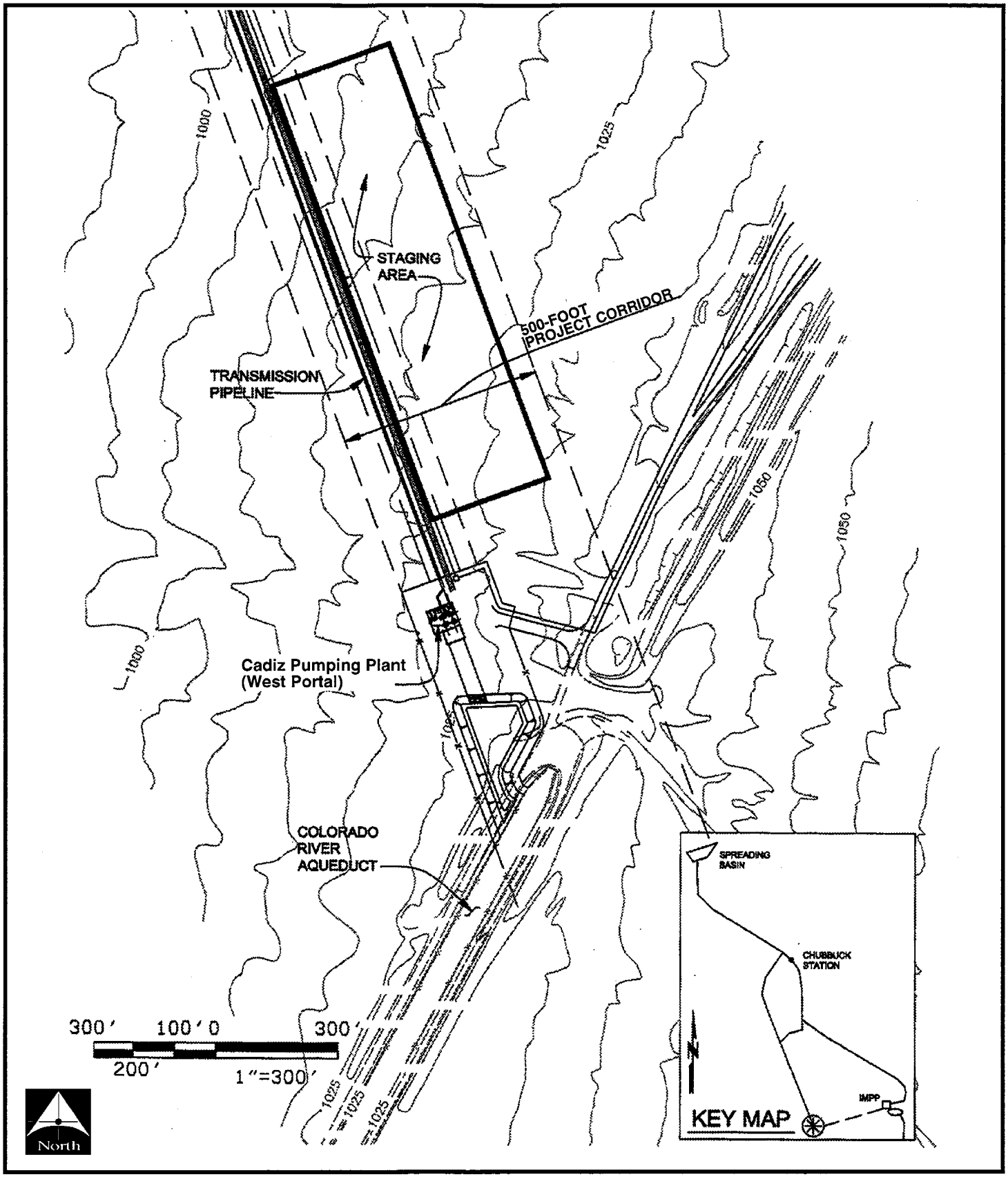
The staging area for construction of the Intermediate Pumping Plant would be parallel to the 200-foot wide construction right-of-way. Figure 4-28 shows the location of this staging area. This staging area would provide space for storage of construction materials, pipe, equipment and vehicles. Construction trailers would presumably be located at this site. Access to this site would be provided by the existing unimproved road east of the Colorado River Aqueduct and within the construction easement for the Eastern Alternative.

4.6.7 APPURTENANCES

The use of appurtenant features in the delivery system would facilitate its operation by allowing routine inspection, maintenance and repair, or by shutting off water flow. The appurtenances described below and shown on Figure 4-32 are applicable to each Cadiz Project alternative.

Blowoff Valves

Blowoff valves would be used to drain water from the water conveyance facilities to facilitate inspection and repair from the inside of the pipeline, and would be located at selected low points on the pipeline



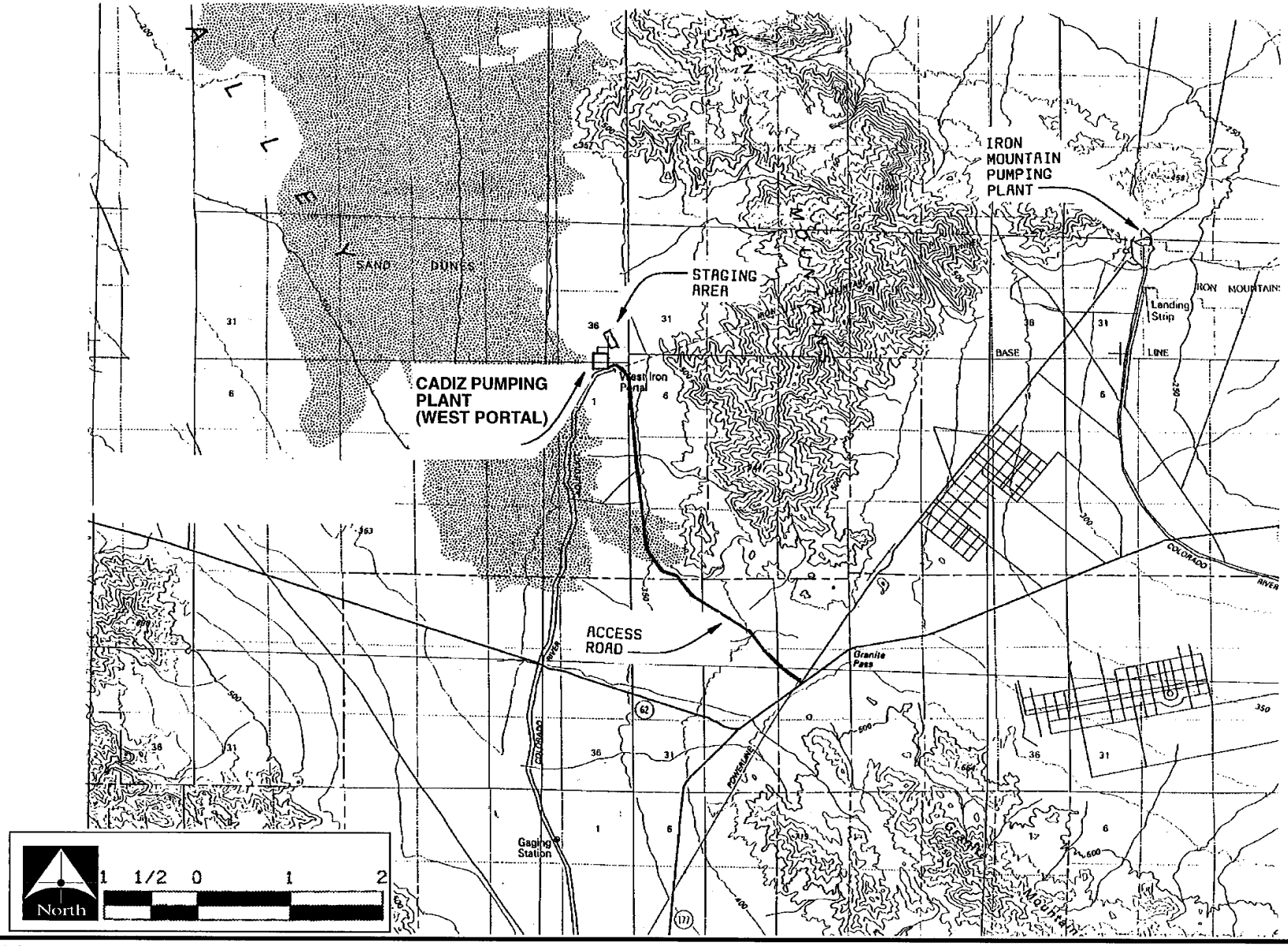
Source: Black and Veatch (1999).

Figure 4-29

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Cadiz Pumping Plant (West Portal) Staging Area

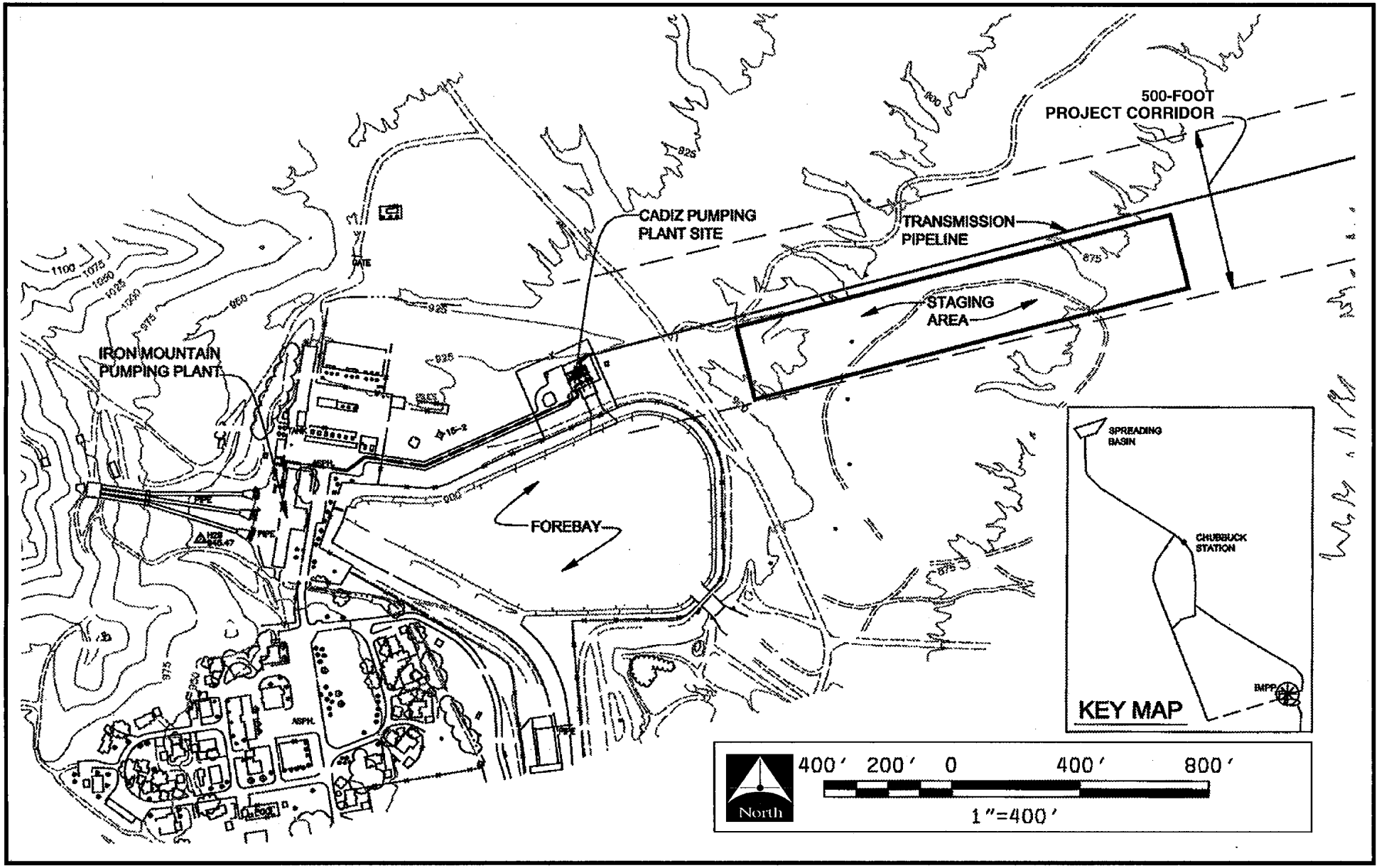


Source: Black and Veatch (1999).

Figure 4-30

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Cadiz Pumping Plant Access Road



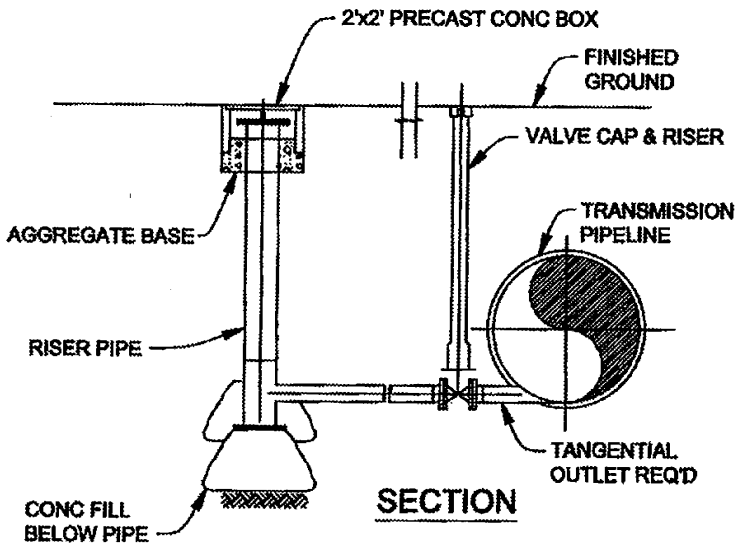
Source: Black and Veatch (1999).

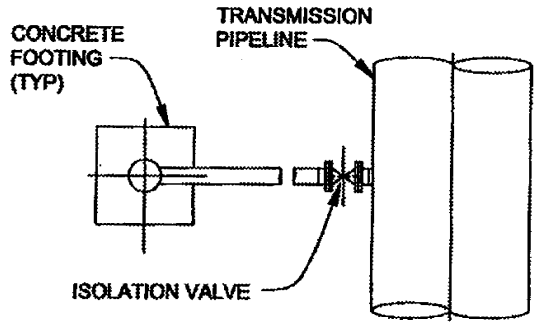
Figure 4-31

Cadiz Groundwater Storage & Dry-Year Supply Program

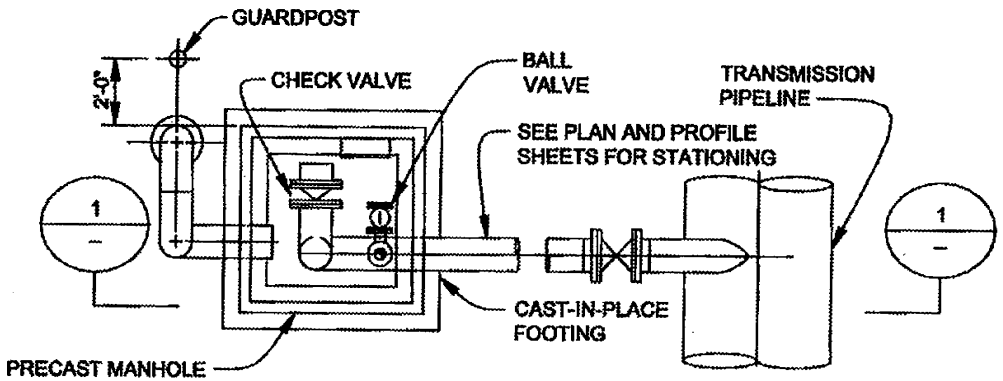
EIR/EIS

Cadiz Pumping Plant Staging Area

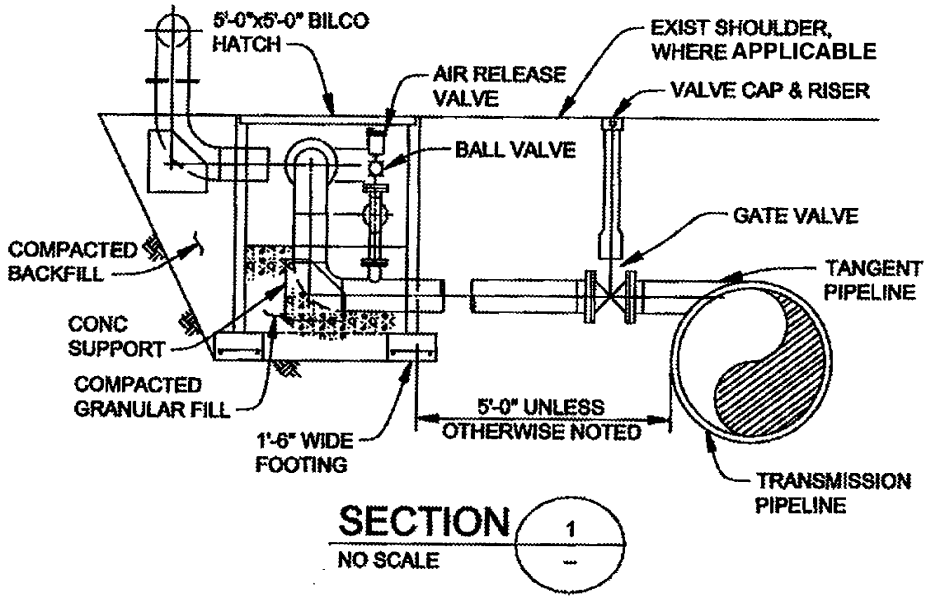




TYPICAL BLOWOFF DETAIL
NO SCALE



AIR AND VACUUM RELIEF MANHOLE DETAIL
NO SCALE



Source: Black and Veatch (1999).

Figure 4-32

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Typical Appurtenant Facilities

alignment. The final blowoff valve locations, sizes and types will be determined during detailed final design. A typical blowoff installation would consist of a pipe connected perpendicular to the transmission pipeline, a valve and valve operator to control flow from the transmission pipeline, and a pipe riser to deliver flow from the transmission pipeline.

Air Release/Vacuum Relief Valve Assemblies

When operating, the pipeline is intended to flow full and under pressure. However, air or mixtures of water and air could also flow through the pipeline. Air and vacuum valve assemblies are intended to ventilate air from the pipeline. On initial filling of the pipeline with water, air would be released through the air and vacuum valves.

Combination air and vacuum valves would be provided to exhaust small volumes of air from the pipeline under pressure and allow air into the pipeline when it is drained. Air and vacuum valve assemblies would be provided at high points in the pipeline and on the downward sloping side of line valves. These valves may be located in structures either below or above grade. Final locations will be determined during detailed design.

Access Manholes

Access manholes would be provided along the pipeline to allow for internal inspection and maintenance of the pipeline.

The manholes would typically be 24-inch flanged tees buried or contained within a concrete structure. They would be placed at approximately 1,500-foot intervals and would be denoted by permanent marker posts along the right-of-way. The metal or concrete marker posts would be approximately three feet high. Access manholes would be located close to valves and low points as well as at intermediate locations along the pipeline.

4.6.8 INSTRUMENTATION AND CONTROL SYSTEM

A control and monitoring system for the Project would monitor the well levels, flow data and pump status information. Monitoring sensors would be located at project pumping plant facilities and wellfield substations. Each wellfield substation would gather data from 15 remote input/output drops located at each of the 30 well sites. The system would communicate via microwave. Fiber optic cable would be used for communications from each of the wellfield substations to the individual well sites.

The system would provide on/off initiates to the wells to maintain constant flow. Facilities at the Iron Mountain Pumping flow. Each well site would be provided with a flow meter and pressure sensor on the discharge of the well pump, and a level meter to indicate the level of water in the well. Well monitoring systems would provide information on the well level, flow rate, high and low levels, status of the pump and status of the motor.

The system would be integrated with the existing Supervisory Control and Data Acquisition (SCADA) system currently used for Colorado River Aqueduct operations.

4.7 OPERATIONS AND MAINTENANCE

4.7.1 SPREADING BASINS

The water conveyance facilities would terminate at the Project spreading basins and would discharge Colorado River water for percolation into the ground for storage and future use by Metropolitan. The Project spreading basins would consist of multiple cells into which Colorado River water could be selectively discharged.

The Project spreading basins would be monitored remotely to confirm performance in percolating water into the underground aquifer. As percolation rates decline, operations personnel would redirect Colorado River water discharge to new spreading basin cells. The spreading basins would be located on Cadiz Inc. landholdings. A maintenance road would be constructed around the perimeter of the spreading basins which would facilitate access for inspection and maintenance. Routine inspection would be performed weekly and would consist of two maintenance personnel inspecting the facilities. Routine maintenance would include periodic cleaning of debris from off-line cells of the spreading basin interior. Fine-grained sediment would be removed from the bottom of the spreading basins using heavy equipment. All inspection and maintenance activities would be performed within the permanent Cadiz Project right-of-way.

4.7.2 PROJECT WELLFIELD FACILITIES

The Project wellfield facilities would draw water from underground storage into the transmission conduit for discharge to the Colorado River Aqueduct for use by Metropolitan. The Project wellfield facilities would include the wells, the well pumps and electric motors, the electrical power switchyards, the individual well discharge piping and control valves, collector piping and all appurtenant facilities.

The Project wellfield facilities would be controlled and monitored remotely to maintain the water delivery rate at the Colorado River Aqueduct consistent with desired parameters. The wellfield facilities would all be located on Cadiz Inc. landholdings. A maintenance road would be constructed to provide access to each Project wellfield site and the collector pipelines. Routine inspection performed weekly would consist of two maintenance personnel inspecting each well site. Other components of the Project wellfield would be inspected on about a monthly basis. All inspection and maintenance activities would be performed within the permanent Cadiz Project right-of-way.

In addition, the boundary of the rock alignment feature (AE-CAD-8H) would be identified on all project specifications and maps as an ERA, in consultation with the Project archeologist. The ERA would be flagged prior to any construction activity within 1,000 feet of this site. No construction activity would be allowed within this ERA.

4.7.3 WATER CONVEYANCE FACILITIES

Cadiz Pumping Plant

The Cadiz Pumping Plant would take water from the Colorado River Aqueduct and provide sufficient hydraulic head to deliver the water via the transmission

conduit to the Project spreading basins for storage in the aquifer system. The Cadiz Pumping Plant would consist of an above ground structure housing vertical turbine, electric motor driven pumping units.

The Cadiz Pumping Plant would be located on land owned by Metropolitan and would be provided with an access road for inspection and maintenance. A supervisor and one operator would be on duty during the normal daily operation of this facility. Routine inspection would be performed daily during periods of pumping plant operation. The individual pumping units would be inspected on an approximately annual basis.

Intermediate Pumping Plants

Intermediate Pumping Plants would be required for the Eastern/Canal Alternative only. The intermediate pumping plants would take water from a canal segment and lift it to the adjacent pipeline segment. Each intermediate pumping plant would consist of an above ground structure housing vertical turbine, electric motor driven pumping units.

The Intermediate Pumping Plants would be within dedicated right-of-way and would be provided with access roads for inspection and maintenance. A supervisor and one operator would be on duty during the normal daily operation of the facility. Routine inspection would also be performed daily during periods of pumping plant operation. The individual pumping units would be inspected on about an annual basis.

Water Conveyance Facilities

The water conveyance facilities would serve two functions: first, deliver Colorado River water from the Colorado River Aqueduct to the Project spreading basins for storage in the aquifer system; and second, deliver water from the Project wellfield back to the Colorado River Aqueduct for use by Metropolitan. The water conveyance facilities would consist of a concrete lined, open gravity flow canal with a bottom width of about eight feet, or a single barrel, pressurized pipeline with a nominal design flow of 200 to 250 cubic feet per second (cfs).

The water conveyance facilities would be within the dedicated permanent right-of-way and generally adjacent to the Cadiz Project maintenance road which would facilitate access for inspection and maintenance. Routine maintenance would be performed weekly and would consist of two maintenance personnel driving the right-of-way to inspect the above ground facilities. Approximately every five years, the pipeline segments would be drained and maintenance personnel would enter the pipeline and perform an inspection of the underground facilities. All appropriate safety procedures for access into a confined space would be followed. Canal segments would be drained on about an annual basis for inspection and cleaning.

Power Distribution Facilities

The electrical power supply for the Cadiz Project facilities including the Cadiz Pumping Plant, the Intermediate Pumping Plants (as required), the Project wellfield

facilities and the Project spreading basins would be supplied from a new power distribution line.

The power distribution line would be within the dedicated permanent right-of-way and generally adjacent to the Cadiz Project maintenance road which would facilitate access for inspection and maintenance. Routine inspection performed once each month would consist of two maintenance personnel driving the right-of-way to inspect the facilities. All inspection and maintenance activities would be performed from within the permanent Project right-of-way.

4.8 THE NO PROJECT ALTERNATIVE

The No Project Alternative evaluates the effects of not implementing the Cadiz Project. Discussion of Metropolitan's planning assumptions, system operations, and effects of the No Project Alternative is provided in the following sections.

4.8.1 PLANNING ASSUMPTIONS FOR THE NO PROJECT ALTERNATIVE

The No Project Alternative were evaluated to determine the supply deficit, through 2020, if the Cadiz Project were not implemented. This evaluation considered deficits that could occur, then addressed the probable local response to deficits and the potential impacts associated with that range of responses. In planning for the Cadiz Project, a number of assumptions were made regarding the conditions affecting supply and demand, as well as the water supply and distribution system. The assumptions for water demands and supplies were described earlier in Section 2.

The No Project Alternative assumes the existing delivery priorities for water would be maintained. Under this assumption, water would be delivered according to the following priorities:

- Municipal and industrial demands.
- Agricultural demands.
- Maintenance of seawater barrier.
- Enhanced groundwater replenishment.
- Seasonal in-lieu storage programs.
- Surface reservoir storage.

Under the No Project Alternative, the existing distribution system would include a range of operating options available to Metropolitan for minimizing system failures and unscheduled outages. As explained in detail in the following sections, the range of options would be defined by:

- Current operating procedures that provide for optimum system reliability.

- Operation to maximize deliveries, which would involve a substantial decrease in system reliability.

4.8.2 OPERATING OPTIONS EVALUATED

There are several options that could be implemented under the No Project Alternative, including continued overdrafting of groundwater basins, construction of desalination/purification facilities and not meeting demands in the service area. The potential impacts of the No Project Alternative are fully discussed in Section 5.

Continued Overdrafting of Groundwater Basins

Under the No Project Alternative, all existing facilities and all facilities for which environmental documentation has been certified would be operated to their fullest extents, allowing for preventive maintenance, rehabilitation and repairs. At all other times, the existing facilities would be operated at 90 percent of their maximum capacity on an as-needed basis. This would be consistent with current operations to assure system safety and reliability.

Groundwater Storage

With continued overdrafting, long-term storage deficits would be significant and the groundwater basins would have to be drawn down substantially. Such a level of overdrafting would not be sustainable; eventually it would adversely affect normal year production, further contributing to long-term adverse impacts. Overdrafting to meet needs under the No Project Alternative is, therefore, not considered feasible.

Conveyance and Storage Deficits

Without the Cadiz Project, Metropolitan's supply deficit would increase by additional approximately 150,000 acre-feet per year during dry years. These increased deficits would be the result of an inability to convey available supplies from the State Water Project and Colorado River Aqueduct to Metropolitan, DWR reservoirs and/or directly to Metropolitan member agencies.

Construction of Desalination/ Purification Facilities

Construction and operation of a desalination facility capable of meeting storage deficits is one option to meet supply needs in lieu of constructing and operating the Cadiz Project. Based on this increased supply deficit of approximately 150,000 acre-feet, a peak flow deficit condition of 400 acre-feet per day would be realized. At this deficit level, the required desalination plant capacity would have to be approximately 125 million gallons per day (MGD). The current technology for constructing a plant of this capacity would be to construct multiple modules of smaller capacity.

The optimal size of a reverse osmosis module using existing technology would be about 25-MGD, large enough to reduce redundancy of cost, yet small enough to maintain reliability, high yield and stay within the range of current technology. Meeting the estimated water needs using these criteria would require five modules at 25-MGD each. The capital cost of a 25-MGD reverse osmosis module is estimated at approximately $100 million. The total capital costs for a 125-MGD plant, including large diameter pipelines and high capacity pump stations, was estimated to be $500 million. This cost does not include the land requirements of approximately 125 acres, which, if located near the sea, would cost an estimated $1 million or more per acre. The annual operating costs of a seawater desalination plant, exclusive of capital repayment, would be about $1,500-1,800 per acre-foot, or $217 - 261 million in dry years. Pumping costs to convey the desalted

water to points of use would be about $195 per acre-foot, or about $28.3 million per year in dry years. In addition, the 125-MGD facility would require an electric power source of about 125 megawatts and an environmentally acceptable method of brine disposal.

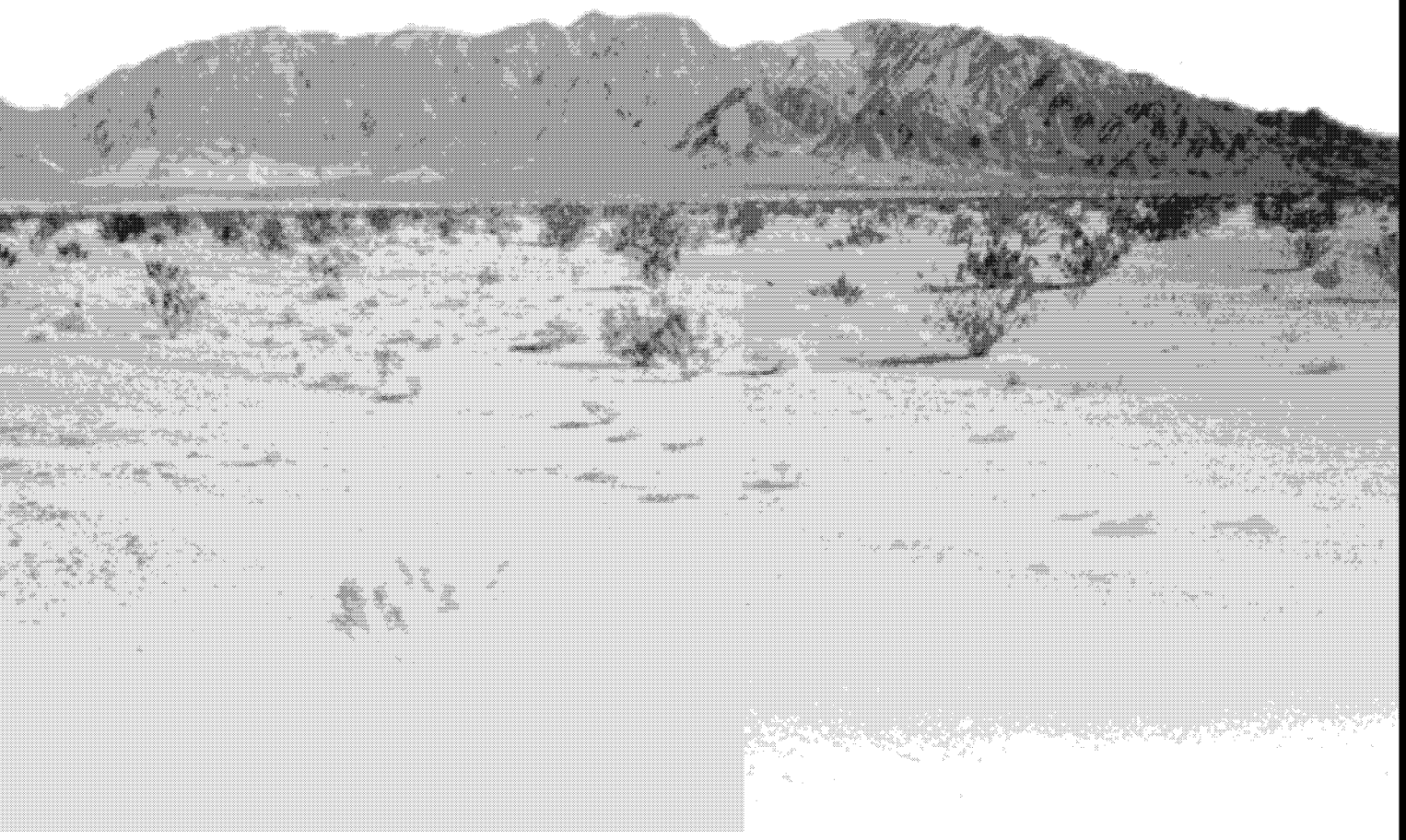
Desalination is considered a viable long-term approach to increasing supplies, but is not considered an appropriate solution to seasonal or long-term storage deficit problems at this time. Desalination to meet water requirements under the No Project Alternative is, therefore, not feasible.

4.8.3 MOST PROBABLE NO PROJECT SCENARIO

The most probable operations scenario under the No Project Alternative would involve efforts to maximize deliveries by operating at maximum capacity during periods of high demand and to replenish groundwater storage when possible. Under this scenario, scheduled outage time to rehabilitate aging equipment, make physical repairs and perform preventive maintenance would be deferred indefinitely. Over time, facility malfunctions and major outages would occur at a higher frequency. These major outages could result in potential overdraft of groundwater basins and sudden, high levels of rationing.

SECTION 5.0

Affected Environment, Impacts and Mitigation



5.1 AGRICULTURE

5.1.1 AFFECTED ENVIRONMENT

The areas surrounding and in the vicinity of the Cadiz Project site are generally undeveloped. The only agricultural cultivation in this area is restricted to the Cadiz Inc. agricultural operations located on the west side of the Project wellfield (at the north end of the Cadiz Project area). Approximately 1,600 acres of Cadiz Inc. landholdings are cultivated with table grapes, citrus and row crops acreage. A very small portion of this 1,600 acres, approximately six acres or less, would be used for the construction of the Project wellfield and water conveyance facilities.

Existing General Plan and Zoning Designations

The County of San Bernardino has land use planning jurisdiction over private and non-federal public lands in this area. The BLM has jurisdiction over federal public lands.

Most of the Cadiz Project area is designated in the San Bernardino County General Plan as Resource Conservation (RC), and 9,600 acres at the north end of the Cadiz Project area are designated as Agriculture (AG). The RC designation provides for open space and recreational uses, single family residences on very large parcels and similar compatible uses. The AG designation provides for commercial agricultural operations, agricultural support services, rural residential uses, open space and recreation uses, and similar and compatible uses.

The General Plan land use designations for the Cadiz Project area and the surrounding areas are shown on Figure 5.1-1. The Cadiz Inc. agricultural operations (approximately 1,600 acres) are within the AG designated area.

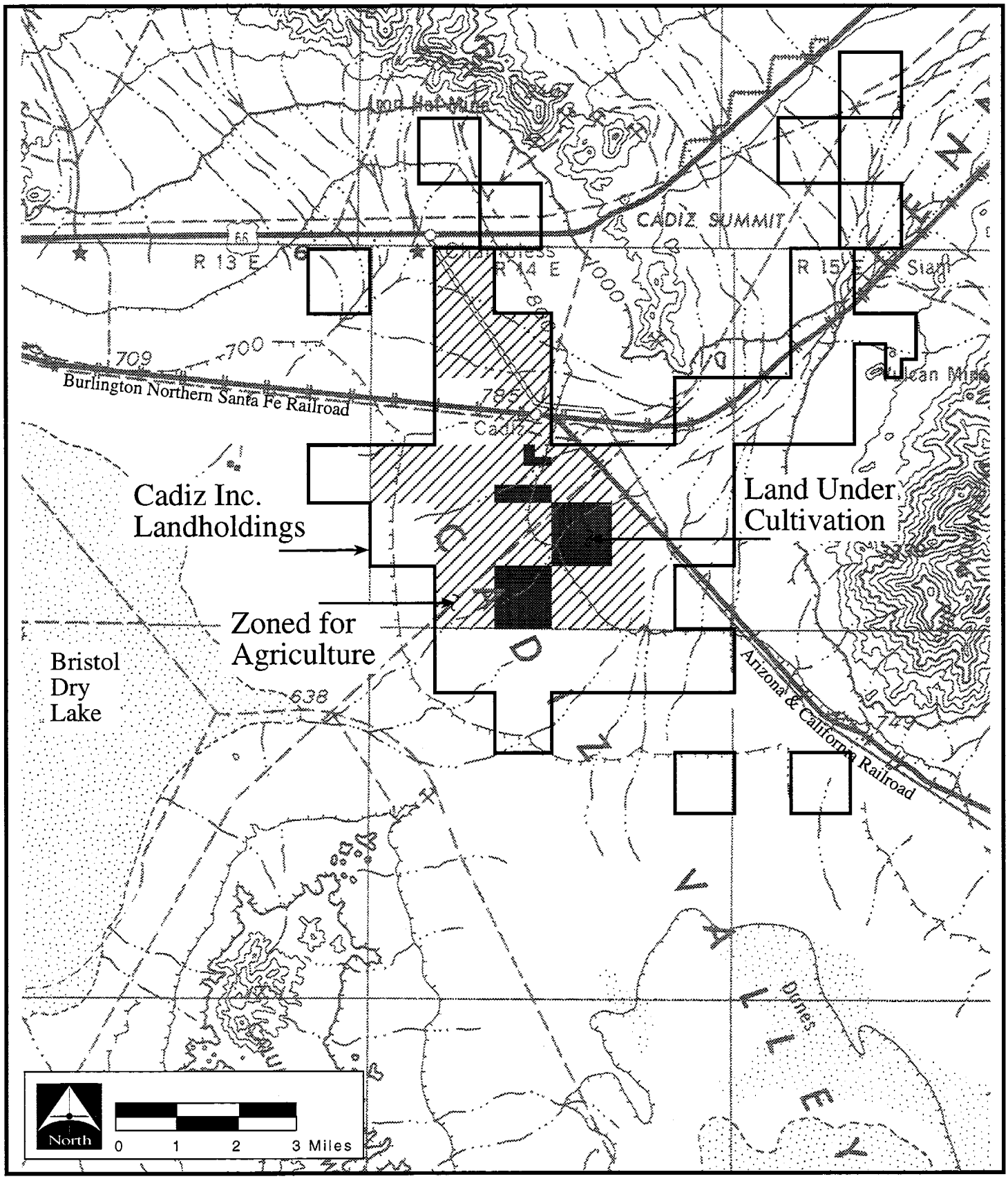
In 1993, the County of San Bernardino Board of Supervisors approved the Cadiz Valley Agricultural Development Project. This land use approval allows for the expansion of agricultural operations to encompass a total of 9,600 acres.

Future expansion of agriculture operations, if any, would be undertaken in compliance with the provisions of the Groundwater Monitoring and Management Program described later in Section 5.5 (Water Resources) and the Cadiz Valley Agricultural Development Final Environmental Impact Report (FEIR) Mitigation and Monitoring Compliance Program. Generally, changes in future agricultural production would be in response to market conditions such as changes in the demand for specific agricultural products at specific times of the year.

Existing Agricultural Operations

The majority of the Cadiz Project area is undeveloped with the exception of approximately 1,600 acres at the west side of the proposed Cadiz Project wellfield, which are the locations of the existing Cadiz Inc. agricultural operations. There are seven groundwater production wells that supply water for agricultural irrigation. All these wells are powered by diesel driven motors.

Figure 5.1-1 shows the location of Cadiz Inc. landholding, the County of San Bernardino AG land use designation and the Cadiz Inc. agricultural operations. Figure 5.1-2 shows the part of the Cadiz

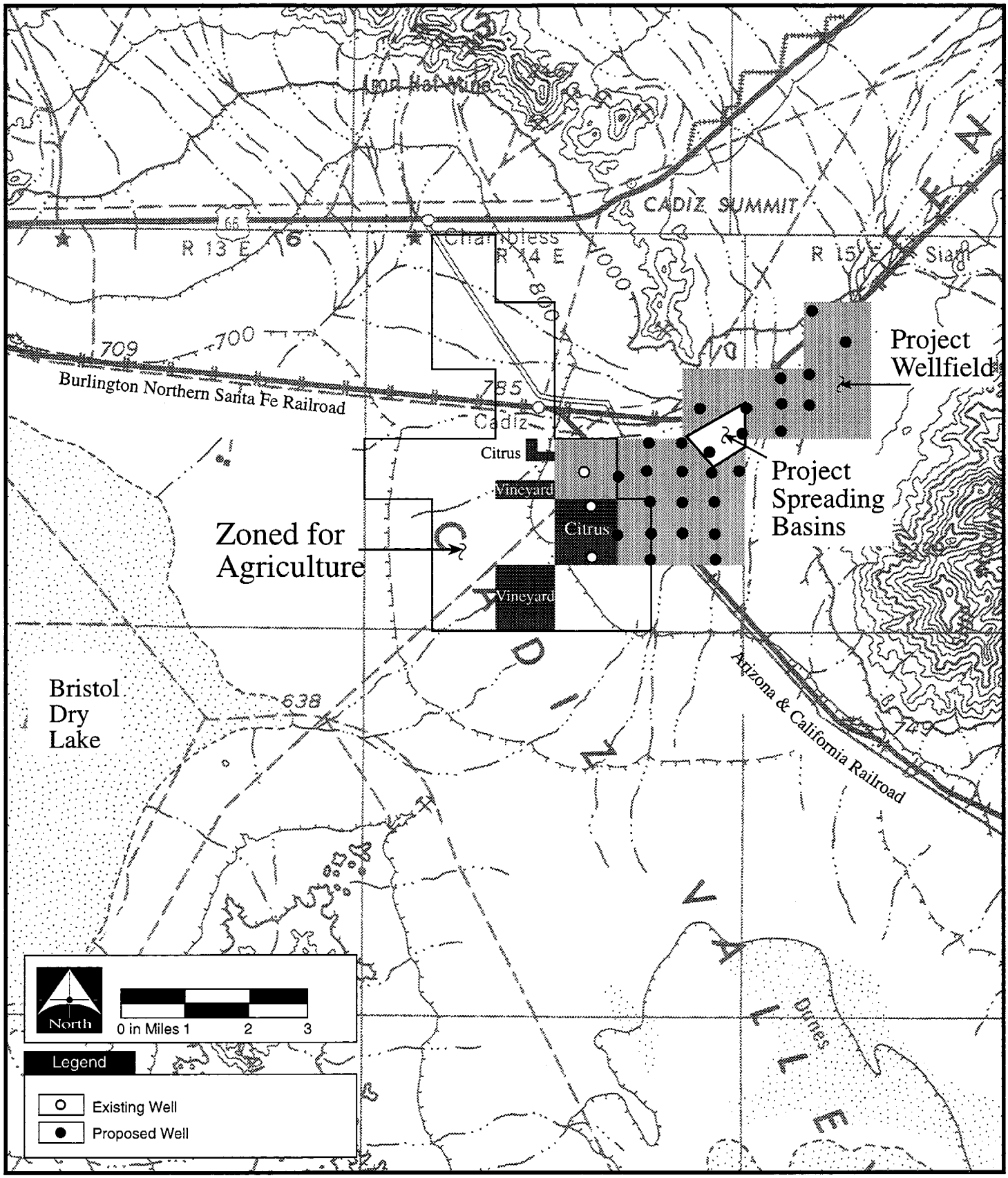


Source: Lilburn Consultants (1999).

Figure 5.1-1

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Land Zoned for Agriculture in the Project Area



Source: P&D Consultants (1999).

Figure 5.1-2

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Crops Cultivated on and Adjacent to the Project Site

Project area that is adjacent to and overlies the existing Cadiz Inc. agricultural operations.

The Cadiz Inc. agricultural operations are located within Sections 21, 27 and 33. The crops cultivated in these sections include citrus, grapes and cultivated acreage available for future row crop planting. Varieties being grown include Thompson seedless grapes, Red Flame seedless grapes, Lisbon and Eureka lemons, Royal Mandarin minneolas and Valencia oranges, as shown in Table 5.1-1.

TABLE 5.1-1
CURRENT AGRICULTURAL CULTIVATION ON THE PROJECT SITE

Variety/Crop	Acreage
Thompson Seedless	200
Flame Grapes	383
Research and Development	4
Lisbon and Eureka Lemons	280
Minneolas	27
Row Crops	572
Royal Mandarins	14
Valencia Oranges	120
TOTAL	**1600 acres**

Water from seven existing wells is supplied via pipeline to the Cadiz Inc. agricultural operations. An extensive irrigation system consisting of pipes and hoses delivers water directly to each individual plant or tree. All irrigation is water conserving. For example, grapes and row crops are irrigated with drip systems, and citrus trees are irrigated with microspray emitters.

Williamson Act Contract Lands

There are no Williamson Act contract lands in the Cadiz Project area.

Existing Soils

Because the United States Department of Agriculture Soil Conservation Service (SCS), now the Natural Resource Conservation Service (NRCS), has not mapped soils in the Cadiz Project area, no soils in the area are currently designated as agricultural soils. Therefore, none of the Cadiz Project area is designated as Prime Farmland, Unique Farmland or Farmland of Statewide Importance.

A soil study performed on part of the site in 1986 found the soils to be predominantly loamy sands and sandy loams. Shallow, naturally cemented soils known as caliche are not known to occur locally in the Cadiz Project area. The soils are alkaline with a pH between 8 and 9.

5.1.2 THRESHOLDS OF SIGNIFICANCE

A project will normally have a significant adverse impact related to agricultural resources if it results in:

- Conflicts with existing zoning for agricultural uses; or
- Other changes in the existing environment which due to their location or nature could result in the conversion of farmland to non-agricultural use.

5.1.3 METHODOLOGY

The potential impacts of the Cadiz Project were evaluated using the Cadiz Valley Development FEIR (1993) and photos and maps of the currently cultivated areas provided by Cadiz Inc. The California Agricultural Land Evaluation and Site

Assessment Model was not used to evaluate the relative value of agricultural land resources, as the soils in the Cadiz Project area have not been mapped.

5.1.4 IMPACTS

Eastern Alternative

Cadiz Inc. agricultural operations are adjacent to and overlay part of the Project wellfield located at the west end of the Cadiz Project area. The potential impacts on agricultural resources for the Cadiz Project build alternatives would be minimal. However, both short- and long-term impacts for the alternatives would occur due to the loss of approximately six acres of agricultural land for the permanent easements Metropolitan would obtain around each Cadiz Project well, Project wellfield pipe and manifolding. The potential loss of up to six acres of cultivated land is negligible compared to the 1,600 acre total Cadiz Inc. agricultural operations. Overall, the Eastern Alternative would not result in significant adverse impacts related to agricultural resources.

General Plan Land Use Designations

Under the Eastern Alternative, Project spreading basins would be constructed in Fenner Gap, between the Marble and Ship mountains, east of the Cadiz Inc. agriculture operations and approved A6 land use designation. The Project spreading basins, which would cover about 390 acres, would be approximately one mile northeast of the Cadiz agricultural operations as shown on Figure 5.1-2. The Project spreading basins would not impact Cadiz Inc. agricultural operations and would not result in conflict with the current General Plan land use designation of Resource Conservation. Refer also to Section 5.2 (Land Use).

Williamson Act Contracts

The Cadiz Project area and the surrounding areas are not under Williamson Act contracts. Therefore, the Eastern Alternative would not require the cancellation of any Williamson Act contracts.

Prime Farmland, Unique Farmland and Farmland of Statewide Importance

Soils in the Cadiz Project area are not designated as Prime Farmland, Unique Farmland or Farmland of Statewide Importance. Therefore, the Eastern Alternative would not impact these types of agricultural soils and would not result in significant adverse impacts related to the conversion of Prime Farmland, Unique Farmland or Farmland of Statewide Importance.

Cadiz Inc. Agricultural Operations

Impacts related to Cadiz Inc. agricultural operations could occur as a result of the upgrading of existing wells and construction of the Project wellfield (wells, pipes and manifolding). All new wells would be constructed outside the existing agricultural operations area. Three existing wells, located in Section 27, would be upgraded for use in the Cadiz Project. These wells are used for agricultural irrigation and are owned by Cadiz Inc.

The operation of the Cadiz Inc. agricultural operations wells and the Project wellfield wells would be subject to the requirements, conditions and restrictions of the Groundwater

Monitoring and Management Plan described later in Section 5.5 (Water Resources). The location, construction, and operation of the Project wellfield could impact agricultural operations, in both the short and long term.

The magnitude of these impacts in the short term would depend on the spacing between the cultivated crops in the different sections. The spacing between the rows of trees varies from section to section. In Section 27, the row spacing varies from 25 x 25 feet to 22 x 25 feet. In Section 21, the row spacing is 11 x 6.5 feet. The upgrading and construction and operation of the Project wellfield would displace up to six acres of cultivated agricultural lands. The construction and operation of electrical substations needed to power the Project wellfield would not displace or otherwise impact Cadiz Inc. agricultural operations.

Any potential, temporary loss of revenue for Cadiz Inc. due to the disruption of agricultural operations during construction is not considered significant and no mitigation is necessary.

Disruption of up to six acres of Cadiz Inc. agricultural operations may be necessary to accommodate construction of pipelines connecting to the wells. To minimize adverse effects, the alignments of the Project wellfield pipes would run outside of and along the edge of the cultivated sections to the extent feasible.

Metropolitan would obtain a permanent easement of 10,400 square feet around each Project well and a 40-foot wide easement centered over the alignment of the pipes, resulting in a total loss of approximately six acres from the upgrading of three existing wells, the construction of the new wells and the pipeline alignments. The loss of approximately six acres of cultivated agriculture for construction and operation of the Project wellfield would not be considered a long term significant adverse impact of the Cadiz Project as this loss would be minor in comparison to the total number of acres currently cultivated.

Construction and operation of the Project spreading basins would not affect Cadiz Inc. agricultural operations. Also, it would not impact the potential for future agricultural operations as these landholdings are not designated by the County of San Bernardino for agricultural uses. Therefore, no impact to agricultural land related to construction of the Project spreading basins would be anticipated.

The operation of the Cadiz Project would alternately result in the withdrawal or spreading of water. Currently, approximately 5,000 to 6,000 acre-feet of water is used on an annual basis to irrigate the Cadiz Inc. agricultural operations. As discussed in Section 5.5 (Water Resources) the withdrawal of Colorado River water and indigenous groundwater for use by Metropolitan is not anticipated to have a significant adverse impact on the availability of water for the existing Cadiz Inc. agricultural operations.

If the Eastern Alternative is implemented, indigenous groundwater resources together with stored Colorado River water would be used by both the Cadiz Inc. agricultural operations and the Cadiz Project. Oversight and management of the Cadiz Inc. agricultural operations water use and Cadiz Project water management and use would be subject to jurisdiction of the Groundwater Monitoring and Management Plan.

Western Alternative

The impacts of the Western Alternative on agricultural resources would be the same as the impacts under the Eastern Alternative.

Combination Alternative

The impacts of the Combination Alternative on agricultural resources would be the same as the impacts under the Eastern and Western alternatives.

Eastern/Canal Alternative

The impacts of the Eastern/Canal Alternative on agricultural resources would be the same as to the impacts under the Eastern, Western and Combination alternatives.

No Project Alternative

The No Project Alternative would not include the construction of any of the Cadiz Project alternatives and, therefore, would not result in the disruption of existing agricultural operations. There would be no impact on agricultural resources under this alternative.

5.1.5 MITIGATION MEASURES

The Cadiz Project impacts to agriculture are below a level of significance and no mitigation is necessary.

5.1.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Temporary disruption of agricultural land may be necessary to accommodate Project wellfield and pipeline construction. Metropolitan would obtain a permanent easement of up to six acres, to accommodate the wells and Project wellfield and pipeline alignments. The loss of up to six acres of cultivated agricultural land would not be a significant adverse impact.

5.2 LAND USE, PLANNING AND POLICIES

5.2.1 AFFECTED ENVIRONMENT

The Cadiz Project is located in the Cadiz and Fenner valleys, an unincorporated, remote area of San Bernardino County. The County is in the southeastern part of the State of California and borders the States of Arizona and Nevada. The southern and eastern regions of the county contain vast mountain and desert areas. Having a land mass of more than 20,000 square miles, San Bernardino County is the largest county in the contiguous 48 states. Metropolitan is the largest supplier of supplemental water supplies to San Bernardino County.

The Cadiz Valley spans from Historic State Route 66 south to State Route 62. The Cadiz Project wellfield and spreading basins would be located approximately 22 miles east of Amboy, 50 miles southwest of Needles and 45 miles northeast of Twentynine Palms.

Existing Land Use

Existing land uses in the Cadiz Valley consist mostly of desert conservation open space with limited agriculture, salt extraction, other mining, military uses, recreation, and electrical, gas and oil utility corridors. The site is accessible by rail and by a few designated roads. For the majority of the area, traveling off designated roads with any type of motor vehicle is not allowed due to the desert conservation measures applicable to the area. Land ownership is most commonly found in whole Sections (640 acre blocks) of land as shown on Figure 5.2-1.

Cadiz Inc. landholdings cover approximately 27,000 acres located at the northern end of the Cadiz Project area. Of this total, 9,600 acres of land are zoned for agricultural use and 1,600 acres are developed for agriculture.

At the southern end of the Cadiz Project area, Metropolitan's consolidated land ownership comprises the Iron Mountain Pumping Plant site, the land occupied by the Colorado River Aqueduct and an electrical power easement.

Historical users in the region include Mormon settlers, explorers, emigrants bound for more western areas in California and the United States military. Past construction projects include the Atchison, Santa Fe and Topeka Railroad now owned by either the Burlington Northern Santa Fe (BNSF) and Arizona and California Railroad Company (ARZC), and the Colorado River Aqueduct. During World War II, General Patton used the desert for tank maneuvers, testing of new equipment and training of military personnel.

Planned Development

The following paragraphs discuss proposed expansions of existing uses and new uses that may be developed in the area.

Cadiz Inc. Agricultural Operations

The Cadiz Inc. agricultural operations presently comprise approximately 1,600 acres of cultivated agricultural land, as described in Section 5.1. These agricultural operations are a part of Cadiz Inc. landholdings adjacent to and

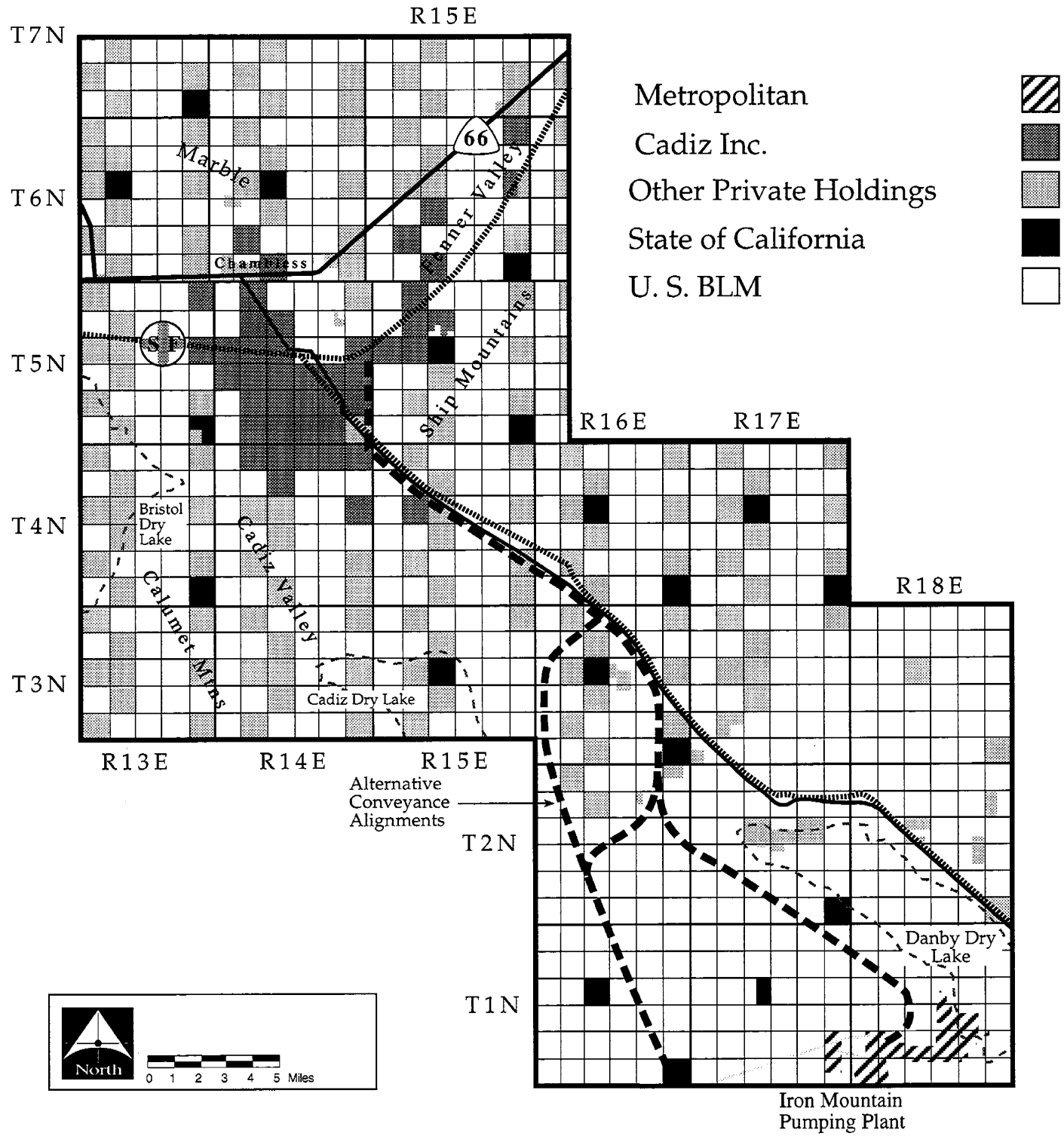


Figure 5.2-1

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Land Ownership in Relation to the Cadiz Project Facilities

overlying part of the Cadiz Project area. The Cadiz Inc agricultural operations are within the 9,600 acres of land designated by the County of San Bernardino as agricultural land use (AG).

In November 1993, the County of San Bernardino certified the FEIR and adopted corresponding land use approvals for this AG designation. Major components of the 1993 FEIR are the evaluation of increased use of groundwater, the potential for land surface subsidence and potential for impacts to water quality. The County of San Bernardino adoption of the FEIR Mitigation Monitoring and Compliance Program has resulted in the implementation of an ongoing groundwater monitoring program. Under the provisions of this program, water use, water quality and the potential for land subsidence are monitored. Annual reports are submitted to the County of San Bernardino.

Rail Cycle

Rail Cycle is a proposal by Waste Management, Inc. (WMI) for a Class III solid waste landfill which would receive waste transported by rail and truck from various counties and cities. The project site (preferred and proposed site), referred to in the EIR/EIS prepared for the landfill project as Bolo Station, is located near Bristol Lake, four miles east of Amboy. It would require 4,800 acres or 7 ½ Sections of land. Other alternatives studied included, but are not limited to, the Cadiz Valley Alternative and a Reduced Action Alternative.

The Bolo Station site consists of a checkerboard pattern of land ownership including the BNSF, Rail Cycle and the BLM. To facilitate the project, a land exchange between BLM and WMI would need to take place; as well as reclassification of the BLM lands obtained from Class L, designating sensitive natural, scenic, ecological and cultural resources, to Class M, designating more intensive uses. Refer to the discussion on the California Desert Conservation Area Plan (CDCA Plan) in the following subsection for further discussion of this land use designation.

The 4,800 acres required for the Rail Cycle project would consist of:

a) 2,100 acres for the landfill,
b) 300 acres for support facilities and
c) 2,470 acres as a buffer zone.

If permitted, the landfill would be authorized to receive up to 21,000 tons of waste per day. Waste would be transported to the landfill in 40- to 45-foot rail containers or by truck. The estimated operational life of the landfill would be between 60 and 100 years. The preliminary design plans show the landfill reaching a height of 400 feet. The visual barrier created by the landfill would be substantial and not in compliance with the desert open space policies. The Rail Cycle EIR/EIS listed the landfill's most significant environmental and unavoidable impacts as effects on groundwater, air quality and wildlife.

As a condition of Rail Cycle's approval, the County Board of Supervisors proposed a tax on the Rail Cycle project. State law requires that new taxes must be placed on the ballot and approved by 2/3 of the voters. Measure M was placed on the ballot in San Bernardino County in 1996. If Measure M had been approved, it would

have been implemented as a business license tax to be paid by Rail Cycle. However, Measure M was not approved by the voters of San Bernardino County.

The Rail Cycle project has been and continues to be the subject of civil and criminal litigation. More recently, Rail Cycle representatives have publicly stated they currently do not have plans to place Measure M or a similar initiative on the ballot again in the near future. Therefore, the future of Rail Cycle is unknown. Therefore, the Cadiz Project would not result in significant adverse impacts related to the Rail Cycle project. However, the Rail Cycle project could result in potential impacts on groundwater which would affect the Cadiz Project. Therefore, future planning for the Rail Cycle project would be required to consider potential impacts to groundwater and the Cadiz Project.

Applicable Land Use Plans and Policies

All Cadiz Project capital facilities, except the water conveyance and power distribution facilities, would be located on Cadiz Inc. landholdings or on land owned by Metropolitan. The Cadiz Project water conveyance and power distribution facilities would transect various landholdings, the majority of which are owned by the federal government. The regional agency with jurisdiction over how land in the Cadiz Project area is the County of San Bernardino.

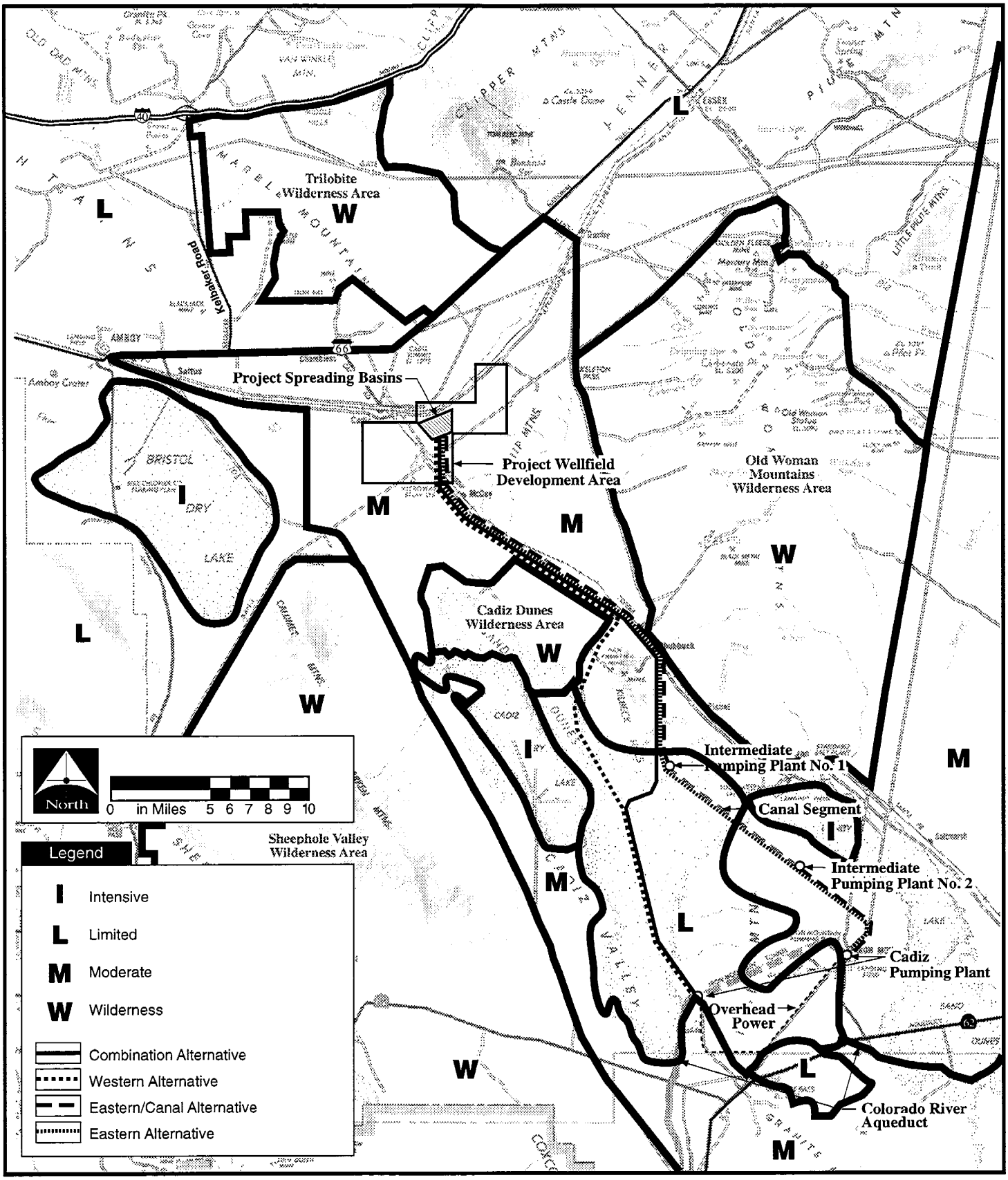
Bureau of Land Management

The BLM manages over 25 million acres of land for the purpose of desert and wilderness conservation. In 1976, Congress enacted the Federal Land Policy and Management Act, giving the BLM the direction to inventory and to prepare a comprehensive Land Use Management Plan (Plan) for public lands. The goal of this Plan is to provide for the use of the public lands and resources with a balance of preservation and conservation. The applicable Plan for the Cadiz Project area is the California Desert Conservation Area (CDCA) Plan. The CDCA Plan identifies economic, educational, scientific and recreational uses for this land which enhance, wherever possible, the environmental, cultural and aesthetic values of the desert and its future productivity. The Mojave Desert, including the Cadiz Valley, is in the CDCA Plan area and is subject to desert conservation criteria in that Plan.

California Desert Conservation Area Plan. The CDCA Plan was created in 1980 and has been amended numerous times. However, the goal of the CDCA Plan to provide for desert conservation has remained unchanged. According to the CDCA Plan, BLM-managed lands are divided into four multiple-use classifications. Each classification denotes the allowed uses and the degree of resource conservation to be implemented. The classes are:

a) Class C Controlled
b) Class L Limited
c) Class M Moderate
d) Class I Intensive

The Cadiz Project area is predominantly designated as Class M with same areas designated as Class L, as shown in Figure 5.2-2. This classification provides for a wide range of uses such as agriculture, roads, airport landing strips, installation of



Source: P&D Consultants, Inc. (1999).

Figure 5.2-1

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

BLM Multiple - Use Classes

a variety of new utility facilities, and livestock grazing and support facilities.

Multiple-Use Class L (Limited Use) protects sensitive, natural, scenic, ecological and cultural resource values. Public lands designated as Class L are managed to provide for generally lower-intensity, carefully controlled multiple use of resources, while ensuring that sensitive values are not significantly diminished.

CDCA Plan Elements. The CDCA Plan is divided into 12 Plan Elements which provide specific details of how sensitive cultural and natural resources should be balanced. Of the twelve elements, the Wildlife, Wilderness, Livestock Grazing, Recreation, Motorized Vehicle, Geology Energy Minerals, and Energy Production and Utility Corridors Elements are relevant to the Cadiz Project.

The CDCA Plan includes two maps listing areas of environmental concern: 1) Planned Management Areas for Fish and Wildlife; and 2) Sensitive, Rare, Threatened and Endangered Fish and Wildlife. The Wildlife Element identifies areas of sensitivity near the Cadiz Project area including the Cadiz Sand Dunes, and the Golden Eagle, Desert Bighorn Sheep and Desert Tortoise habitats. The CDCA Plan Vegetation Element has not recognized an area or region in the Cadiz Project area as an area of concern.

The Cadiz Project vicinity, four areas are designated as wilderness: the Trilobite, Cadiz Dunes, Old Woman Mountains and Sheephole Valley wilderness areas. In the Livestock Grazing Element, the majority of the Cadiz Project site and the surrounding area are listed as suitable for ephemeral grazing with a small part of the area listed as unsuitable for grazing.

The Recreation Element indicates that in the majority of the Cadiz Project area, recreational uses such as hiking, primitive camping, rock climbing, and wind sailing on approved dry lakes are allowed. In addition, one motorized event competitive route corridor transverses the Cadiz Project area. The Motorized Vehicle Access Element specifies that access to the Cadiz Project area is limited to existing dirt roads. Other routes of travel may only be approved on an individual basis by the BLM.

Based on the Geology Energy Minerals Element, there are areas in the Cadiz Project vicinity identified as potentially valuable for uranium and/or thorium extraction. In addition, saleable, leaseable and economic minerals have been identified near the Cadiz Project area in the CDCA Plan. The saleable minerals consist of sand, gravel and pumice. The leaseable minerals consist of sodium and may be found at Bristol, Cadiz and Danby dry lakes. The economic minerals consist of lithium, tungsten, gypsum, strontium and limestone. Refer to Section 5.9 (Energy and Mineral Resources) for additional discussion regarding these resources in the Cadiz Project area.

A goal of the Energy Production and Utility Corridor Element is to provide a network of joint-use planning corridors capable of meeting future utility, communication and energy needs. In the CDCA Plan, there are 16 separate designated planning corridors. One of these corridors traverses the Cadiz Project area. This corridor is occupied by two-

230 kV power lines and telephone pole lines. The All American and Questar pipelines also cross the Cadiz Project area, but not within utility corridors designated in the CDCA Plan.

Areas of Critical Environmental Concern. An important component of the CDCA Plan is the designation of Areas of Critical Environmental Concern (ACEC). These areas are unique or special and have features that set them apart from other areas in the desert. These features could be an unusual diversity of plant or animal life, unique geologic features or rare concentrations of remains of historic or prehistoric use and occupation. These areas are also identified by the BLM as areas that require special management attention.

In the vicinity of the Cadiz Project area there are two ACECs: Patton's Iron Mountain Divisional Camp, which is significant as a historic military camp site, and the Marble Mountain Fossil Bed which is significant for its paleontological values.

Northern and Eastern Colorado Desert Plan. The BLM, together with other federal, state, regional and local agencies and other affected interests, is preparing the Northern and Eastern Colorado Desert (NECO) Plan. When completed, the NECO Plan would revise, update and replace the CDCA Plan.

County of San Bernardino

Private lands in the region are regulated by the County of San Bernardino and most of the lands in the region are designated as Resource Conservation (RC) as shown earlier in Figure 5.1-1. A relatively small amount of land (9,600 acres) owned by Cadiz Inc. is designated in the General Plan as agriculture (AG). The County of San Bernardino Development Code Standards (May 21, 1998) and the General Plan (May 1999) were used for the analysis of land use and natural resources management policies within the County's jurisdiction.

Resource Conservation Land Use Designation. This land use designation generally provides for protection of natural and cultural resources through limitations on development. These limitations include requiring very large lot sizes with minimal development, resulting in large open spaces. Development allowed under this classification consists of:

a) Row, field, tree and nursery crop cultivation,

b) Single dwelling units,

c) Social care facility with six or fewer clients,

d) Animal raising and

e) Accessory uses.

According to the County of San Bernardino General Plan, the primary purpose of the RC designation is to encourage limited rural development that maximizes preservation of open space, watershed and wildlife habitat areas.

Agricultural Land Use Designation. The AG zoning designation allows the same uses as described above for the RC designation, however, with a greater density ratio.

Natural Resources (Water) Management Policies. Most of the developed areas in the County of San Bernardino rely on imported, supplemental water supplies to meet present demand. In recognition of these needs, County of San Bernardino General Plan policies encourages responsible water authorities to actively manage water resources, including:

- "Provide a balanced hydrological system in terms of withdrawal and replenishment of water from groundwater basins."

- "Continue and expand importation of water to sustain the existing population and projected growth; actively support the completion of the State Water Project, improvements in the Sacramento/ San Joaquin Delta and Colorado River Aqueduct System, and the use of water transfers and water marketing techniques."

- "Maximize the use of existing water resources through conservation programs and efficient groundwater and surface water management programs."

5.2.2 THRESHOLDS OF SIGNIFICANCE

Impacts of the Cadiz Project related to land use would be considered significant if they resulted in:

- Physical division of an established community;

- Conflict with any applicable land use plan, policy or regulation of an agency with jurisdiction over the project (including, but not limited to General Plan, Specific Plan or Zoning Ordinance) adopted for the purpose of avoiding or mitigating an environmental effect;

- Conflict with the CDCA Plan and the 12 Plan Elements as well as the ACEC Plan subsections as provided by the BLM; or

- Conflict with any applicable habitat conservation plan or natural community conservation plan.

5.2.3 METHODOLOGY

Each aspect of the Cadiz Project was evaluated on a detailed level. Because the Cadiz Project covers numerous miles of open terrain, the Project requires an evaluation by means of smaller scale subsections. Also, along the length of the Cadiz Project, the zoning, land use designations and environmental concerns change. Each of these concerns requires analysis on a smaller scale.

The methodology used to identify the Cadiz Project land use impacts was a comparison of known environmental concerns and land use designations depicted on existing mapping. Maps of the Cadiz Project were compared with map overlays provided by the BLM and the County. Existing mapping for environmental issues was available through maps of the 12 CDCA Plan Elements. Mapping for the land use designations was also provided by the BLM through their Multiple-Use Classification Map and in the County of San Bernardino General Plan. Not all environmental concerns have been mapped. Within the areas administered by

BLM, there are still vast areas where unmapped buried artifacts and minerals may occur.

Analysis of this mapping and related information show that all the Cadiz Project alignments avoid all the sensitive areas in the CDCA Plan and the Plan Elements.

5.2.4 IMPACTS

Eastern Alternative

Construction Impacts

Existing Land Uses. Construction of the Project wellfield for the Eastern Alternative would result in minor disturbance to the existing Cadiz Inc. agricultural operations as described earlier in Section 5.1.4. This impact would be limited to small areas and would be fully integrated with existing agricultural uses resulting in no significant adverse impact. The remainder of the Project wellfield, its associated electrical substations, the Project spreading basins and the northernmost end of the water conveyance facility and power transmission line would be constructed on vacant land that is a part of Cadiz Inc. landholdings. Consequently, no existing uses would be adversely affected on the remainder of the Cadiz Inc. holdings.

The pipelines connecting the extraction wells would cross the BNSF and ARZC rail lines at several locations. These crossings would be coordinated with the BNSF and ARZC. Pipe would be jacked or tunneled under the rail lines and no interruptions of service would be anticipated.

Other Project facilities for the Eastern Alternative, including most of the remainder of the water conveyance and power distribution facilities, would be constructed on undeveloped land, including federal lands administered by the BLM, state owned lands and privately owned lands. No existing land uses would be affected by construction on these lands. The water conveyance and power distribution facilities would, however, cross the ARZC rail line, the All American Pipeline and the Questar Pipeline. These crossings would be coordinated with the railroad and pipeline operators. Pipe would be jacked or tunneled under the rail line. Proper separation distance from the natural gas and crude oil pipelines would be maintained.

At some locations along the northern part of the alignment, the major transmission pipeline and electric transmission line are in close proximity to the Cadiz Dunes and Old Woman Mountains wilderness areas. However, no direct construction impacts to these resources would occur. Possible indirect construction effects are discussed later in Sections 5.11 (Noise) and 5.17 (Wilderness/Recreation).

The southernmost end of the water conveyance and power distribution facilities, the power substation and the pump station would be constructed on land owned by Metropolitan at the Iron Mountain Pumping Plant. Therefore, there would be no adverse impact on existing land uses for these facilities.

Plans and Policies. This section evaluates the impacts of the Eastern Alternative on existing BLM and County of San Bernardino plans and policies. Impacts on

growth management plans and policies are addressed in Sections 5.3 (Socioeconomics) and 6.0 (Growth Inducement).

BLM CDCA Plan. The Eastern Alternative does not intrude into any Wilderness Areas. It has specifically been configured to avoid them. Although parts of the Cadiz Project area are considered suitable for ephemeral grazing in the Plan's Livestock Grazing Element, none of the areas that would be traversed by the Project facilities are currently used for grazing, and due to the extremely arid nature of the land, they are not expected to be used for grazing in the future. Relative to the Recreation Element of the CDCA Plan, the area that would be traversed by the Cadiz Project facilities is seldom used for recreation, again due to its open, extremely arid character and distance from population centers. Some years ago, part of the Cadiz Project area was traversed by a motorcycle race route. This race has not been run for many years and there are no current applications to run it in the future. Recreational uses, including motorized vehicle use, are addressed later in Section 5.17 (Wilderness/Recreation).

The Motorized Vehicle Access Element limits motorized access to the area to existing dirt and paved roads. The Eastern Alternative would add new dirt roads in the form of project maintenance roads to the area. Metropolitan's intent is to limit access to these roads to their vehicles only and to prohibit their use by others. This issue is also addressed in Section 5.8 (Biological Resources). The Eastern Alternative would also temporarily delay traffic on Cadiz-Rice Road, since a flagman would be necessary to convey traffic in one direction at a time at Chubbuck. This would slightly, but not significantly, impede access to the area. Parts of the area are sources for various minerals as addressed in the Geology Energy Minerals Element of the CDCA Plan. Potential impacts to these resources are addressed in Section 5.9 (Energy and Mineral Resources).

Because there is no existing utility corridor along the Cadiz Project alternative alignments, the Cadiz Project would not be in conformance with the CDCA Plan. As a result, the proposed Cadiz Project would need an amendment of the CDCA Plan for an exception to the utility corridor requirement. This proposed amendment of the CDCA Plan is a planning action by the BLM and involves a decision by the BLM separate from the decision required for the proposed issuance of right-of-way easements. This designation is part of the Cadiz Project and is being considered by the BLM in conjunction with the proposed grant of temporary and permanent rights-of-way easements. Although there are two existing underground pipelines in the area (All American Pipeline and Questar Pipeline), they are not designated Energy Production and Utility Corridor Element in the CDCA Plan. The Eastern Alternative would also cross designated Utility Corridor E defined in the CDCA Plan. This corridor provides access for two 230-kV power lines and telephone pole lines. The latter is not considered to be a significant impact, since the Eastern Alternative is comprised of an underground pipeline at this location and the project's surface power transmission line can be configured to be compatible with the Corridor E facilities. With approval of the proposed amendment to the CDCA Plan for the Utility Corridor,

the Eastern Alternative would not result in any significant adverse impacts on the CDCA Plan.

Desert Plan Amendment Process

The BLM District Manager, Desert District may initiate an amendment to the CDCA Plan at any time. Individuals and public or private organizations may also submit written requests for CDCA Plan amendments to the District Manager for consideration. The District Manager must respond to such requests within 30 days, acknowledging receipt of the request and informing the applicant of the process to be followed in studying and deciding on the request. In the case of the Cadiz Project, the proposed change is an amendment to the established Planning Corridor designations and contingent corridors identified in the CDCA Plan. The amendment would add the alignment utilized for the water conveyance and power distribution facilities as a newly designated utility corridor.

The BLM classifies three general categories of CDCA Plan Amendments:

- **Category 1 -** An amendment that will not involve significant environmental impact or significant change in CDCA Plan designations, guidelines or elements.

- **Category 2 -** An amendment that will require significant changes in CDCA Plan designations, guidelines or elements and that is known to have a significant environmental impact.

- **Category 3 -** Changes that are submitted to accommodate a request for a specific use or activity that will require additional analysis and decision beyond the CDCA Plan Amendment decision process.

Categories 2 and 3 amendments that may have a significant effect on the environment are usually considered on an annual schedule. However, when the proposed CDCA Plan Amendment is a Category 3 amendment submitted to accommodate a specific activity, like the Cadiz Project, and that activity also requires additional analysis and decisions beyond the CDCA Plan Amendment decision process, exceptions may be granted. For the Cadiz Project, the additional consideration of a grant of right-of-way on certain BLM lands is required. In such cases, the BLM State Director may determine that the proposed project is of such significance to the public interest that deviation from the annual schedule is justified. Consequently, when government agencies such as Metropolitan submit applications for land and resource uses, BLM reviews the applications in light of the CDCA Plan's data and conclusions. When a proposal has merit, the BLM simultaneously considers the proposal and any necessary related CDCA Plan Amendment. In the case of Category 3 amendments, such as for the Cadiz Project, the process for amendment decisions as described in the CDCA Plan is as follows:

(a) Based on additional analysis, the Desert District Manager recommends an amendment to the State Director. If the State Director concurs, the District Manager makes a decision and a public notice of the amendment decision is given. This notice should clearly explain how the existing Plan is to be changed.

(b) Protests will be received for 30 days following the notice.

(c) An amendment may be approved after protests are resolved and at least 30 days after the notice.

For the Cadiz Project, notice of the proposed CDCA Plan amendment and a request for comments was published in the Federal Register and a newspaper of general circulation in the affected area. Notices were also sent to those on the CDCA Plan mailing list. This was done in conjunction with noticing for the Cadiz Project EIS. In the future, if the BLM chooses to hold an optional public hearing on its consideration of the CDCA Plan Amendment, the public and local government officials will be provided at least 30 days notice of the hearing.

Northern and Eastern Colorado Desert Plan. This Plan has not yet been completed and adopted. The Cadiz Project would be considered in this planning process, therefore, no significant adverse impacts to this Plan would occur as a result of the Eastern Alternative.

County of San Bernardino Plans and Policies. The Eastern Alternative would be a component of the regional infrastructure for water supply as well as a facility that can be deemed essential or desirable to the public convenience or welfare. It is therefore determined to be consistent with the additional uses allowed by the County of San Bernardino within the RC and AG land use designations. The Cadiz Project would be consistent with the primary purpose of the RC designation, since it will not encourage development in the area and has been designed to be consistent with the goals of preserving open space, watershed and wildlife habitat areas. The water conveyance facilities would be underground and the ground surface re-contoured to preserve existing drainage patterns. Therefore, no significant adverse impact on land use or land use designations would occur under the Eastern Alternative.

The Eastern Alternative would be consistent with the County of San Bernardino General Plan Natural Resources Management Policies. The Groundwater Monitoring and Management Plan included as part of the Cadiz Project would address the long term, balanced management of the groundwater resource. The Cadiz Project would assist Metropolitan in meeting dry-year water supply needs and therefore meet the County's goals of:

- "Continue and expand importation of water to sustain the existing population and projected growth; actively support the completion of the State Water Project, improvements in the Sacramento/San Joaquin Delta and Colorado River Aqueduct System, and the use of water transfers and water marketing techniques."

- "Maximize the use of existing water resources through conservation programs and efficient groundwater and surface water management programs."

No significant adverse impacts to the General Plan policies would occur under the Eastern Alternative.

Operations Impacts

The operations impact of the Eastern Alternative on land use would be negligible. Cadiz Inc. would accommodate the Project wellfield and the Project spreading basin operations within its existing landholdings, and would coordinate its water use within the Groundwater Monitoring and Management Plan. Cadiz Inc. would be able to expand its agricultural operations in coordination with, and within the limitations of, the Groundwater Monitoring and Management Plan on its existing undeveloped, agriculturally zoned landholdings.

Periodically, maintenance vehicles would visually survey the permanent easement for the water conveyance and power distribution facilities. With the designation of the easement as a utility corridor, utility maintenance activities would be allowed. Therefore, this activity would not result in a significant adverse impact relative to the CDCA Plan and its policies.

Western Alternative

The land use impacts of the Western Alternative are the same as for the Eastern Alternative with the following two exceptions:

1) The Western Alternative would not result in delays to traffic on Cadiz-Rice Road; and

2) In addition to running parallel, but not directly adjacent, to the northeast boundary of the Cadiz Dunes Wilderness Area along Cadiz-Rice Road, the Western Alternative would run parallel but not adjacent to the southeast boundary of the Cadiz Dunes Wilderness Area.

Combination Alternative

The land use impacts of the Combination Alternative are the same as for the Eastern Alternative.

Eastern/Canal Alternative

The land use impacts of the Eastern/Canal Alternative are the same as for the Eastern Alternative.

No Project Alternative

The No Project Alternative would have no direct land use impacts. It would also not conflict with the CDCA Plan or the County of San Bernardino General Plan.

5.2.5 MITIGATION MEASURES

Because amendment of the Energy Production and Utility Corridor Element of the CDCA Plan, to denote the location of Cadiz Water Storage and Dry-Year Supply Program water conveyance and power distribution facilities, is proposed as part of the Cadiz Project, no additional mitigation is necessary.

5.2.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

There will be no remaining adverse impacts if the Energy Production and Utility Corridor Element of the CDCA Plan is amended to include the Cadiz Project water conveyance and power distribution facilities.

5.3 SOCIOECONOMICS

5.3.1 AFFECTED ENVIRONMENT

Study Area Definition

Socioeconomic data were analyzed for the Cadiz Project site and the surrounding area and are described in the following paragraphs. The regional setting of the Cadiz Project area is shown on Figure 5.3-1.

The Cadiz Project site is the area that is directly affected by Cadiz Project construction and operation of Cadiz Project facilities such as the wellfield, spreading basins, pumping plants, power distribution facilities and water conveyance facilities.

The surrounding area consists of communities located in the Cadiz Project vicinity potentially influenced by socioeconomic effects of the Cadiz Project. The surrounding area includes the region that extends from Barstow, Ludlow and Twentynine Palms in the west to the City of Needles and the Colorado River to the east, and from Desert Center to the south and the community of Chambless to the north. The Southern California Association of Governments (SCAG) Regional Statistical Areas (RSAs) 33, 34 and 54 generally define this area.

Socioeconomic Characteristics

Population

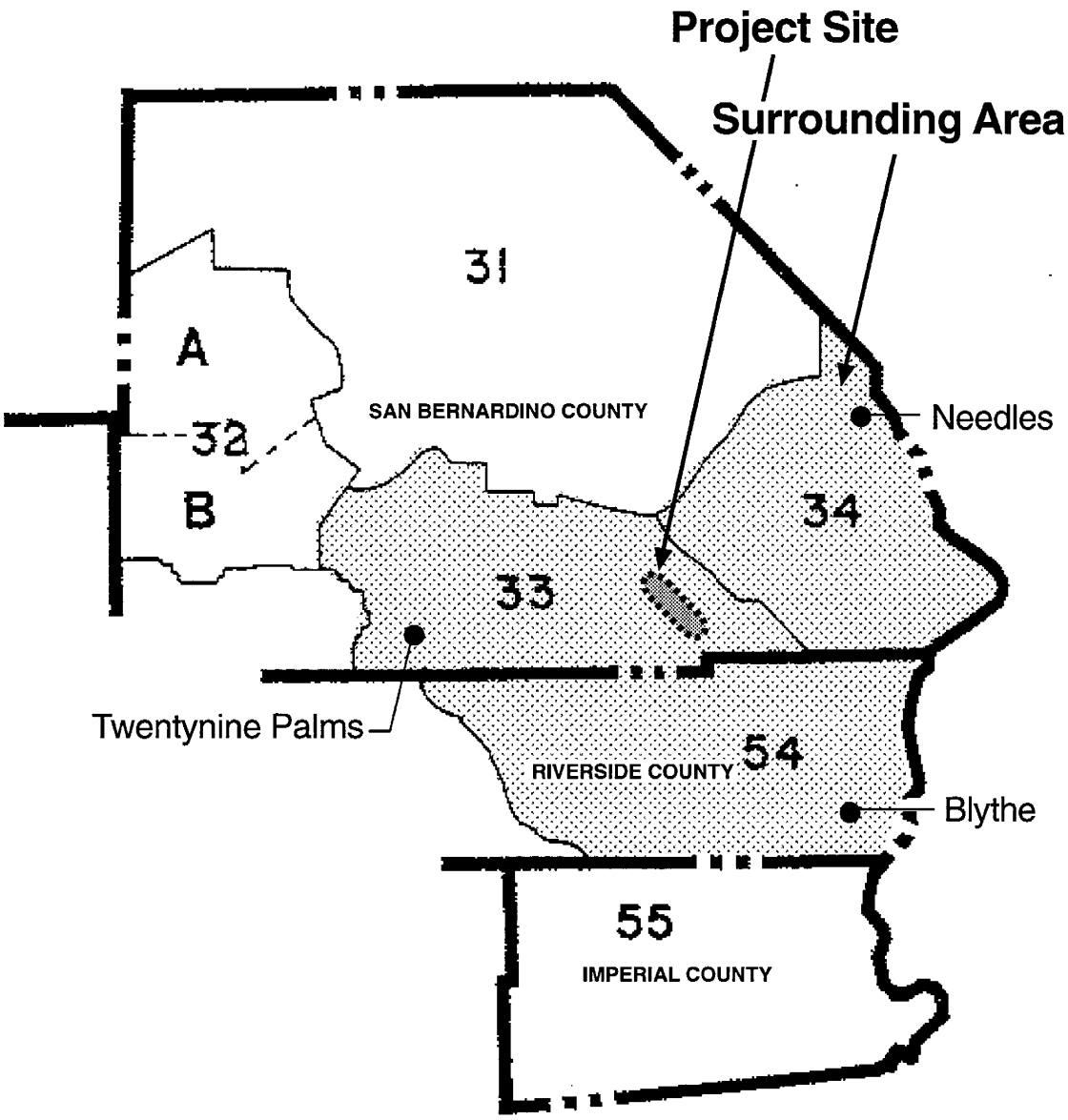
There is no population on the Cadiz Project site, and no population is projected to live on the site in the future as shown in Table 5.3-1.

TABLE 5.3-1
SOCIOECONOMIC TRENDS AND FORECASTS FOR THE CADIZ PROJECT AREA, SURROUNDING AREA AND REGION

	Total			Total Change		Average Annual Percent Change	
	1990	1998	2020	1990-1998	1998-2020	1990-1998	1998-2020
Population							
Project Site	0	0	0	0	0	0	0
Surrounding Area [1]	95,300	114,900	197,957	19,600	83,057	2.4%	2.5%
Region [2]	17,029,545	18,971,481	25,925,400	1,941,936	6,953,919	1.4%	1.4%
Households							
Project Site	0	0	0	0	0	0	0
Surrounding Area [1]	33,600	38,200	65,265	4,600	27,065	1.6%	2.5%
Region [2]	5,788,123	6,139,621	8,561,400	351,498	2,421,779	0.7%	1.5%
Employment							
Project Site	0	0	0	0	0	0	0
Surrounding Area [1]	17.500	21,500	41,029	4,000	19,529	2.6%	3.0%
Region [2]	8,092,600	8,387,178	12,111,700	294,578	3,724,522	0.4%	1.7%

[1] Includes SCAG RSAs 33,34 and 54.
[2] Includes Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura Counties.

Sources: 1990 SCAG and SANDAG.
1998 Estimates by P&D Environmental and California Department of Finance.
2020 SCAG and SANDAG Adopted Regional Growth Forecasts.



Source: 1982 SCAG Regional Growth Forecasts

Figure 5.3-1

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Project Site, Surrounding and Regional Areas

Population in the surrounding area totaled 95,300 in 1990. By 1998, population in the surrounding area had increased by almost 20,000 persons to 114,900, or 2.4 percent per year over the eight year period. According to SCAG forecasts, population in the surrounding area is anticipated to reach almost 200,000 persons by 2020, an increase of 83,000 over 1998 levels, or an average 2.5 percent per year increase.

Households

There are no residents on the Cadiz Project site and no residents are projected to live on the site in the future as shown in Table 5.3-1.

Households in the surrounding area totaled 33,600 in 1990. By 1998, households in the surrounding area had increased by 4,600 to 38,200, or 1.6 percent per year over the eight year period. According to SCAG forecasts, households in the surrounding area are anticipated to reach almost 65,300 by 2020, an increase of 27,000 over 1998 levels, or an average 2.5 percent per year increase.

Employment

There is no employment on the Cadiz Project site other than limited employment associated with the Cadiz Inc. agricultural operations and Metropolitan's Iron Mountain Pumping Plant. No employment, other than employment associated with the Cadiz Project, is projected to be present on the site in the future as shown in Table 5.3-1.

Employment in the surrounding area totaled 17,500 jobs in 1990. By 1998, employment in the surrounding area had increased by almost 4,000 jobs, to 21,500, or 2.6 percent per year over the eight year period. According to SCAG forecasts, employ-ment in the surrounding area is anticipated to reach over 41,000 jobs by 2020, an increase of 19,500 over 1998 levels, or an average 3.0 percent per year increase.

Labor Force and Unemployment

Except for Twentynine Palms, labor force and unemployment data are not reported for the surrounding area. However, 4,970 persons in Twentynine Palms were reported in the labor force in 1998[1] of which 430 or 8.7 percent were unemployed. This unemployment rate is higher than in the regional area, which was reported at 5.4 percent for the same period.[2]

Labor force participation rates are defined as the percent of persons in the labor force divided by the total population in the region. Assuming labor force participa-tion rates in the surrounding area are similar to those in the Riverside-San Bernardino County area as a whole, the civilian labor force in the surrounding area is estimated at 50,000. Assuming the unemployment rate in Twentynine Palms is similar to the overall rate in the surrounding area, then there were an estimated 4,400 unemployed persons in the labor force in 1998.

Housing Supply and Availability

Housing supply and vacancy rates are only reported for the incorporated cities in the surrounding area. According to

[1] California Employment Development Department, Labor Market Information, March 3, 1999.
[2] Ibid.

California Department of Finance,[3] in 1998, the three incorporated cities in the surrounding area, Blythe, Needles and Twentynine Palms, had over 2,300 vacant housing units out of a total housing stock of 14,000 units. This represents a 17 percent vacancy rate, as shown in Table 5.3-2. This vacancy rate is over twice the regional vacancy rate of 7.4 percent for the same period.

TABLE 5.3-2
HOUSING

City	Total Housing Units	Vacant Units	Percent Vacant
Blythe	4,609	451	9.8%
Needles	2,513	373	14.8%
Twentynine Palms	6,819	1,500	22.0%
Total	**13,941**	**2,324**	**16.7%**

Assuming the vacancy rate for incorporated cities in the surrounding area is indicative of the overall vacancy rate in the surrounding area, there were an estimated 7,600 vacant housing units in the surrounding area in 1998.

5.3.2 THRESHOLDS OF SIGNIFICANCE

The California Environmental Quality Act (CEQA) states that "...economic or social effects of a project shall not be treated as significant effects on the environment. An EIR may trace a chain of cause and effect from anticipated economic or social changes resulting from the project to physical changes caused in turn by the economic or social changes." Therefore, under CEQA, economic or social effects of a project are generally not considered significant unless they result in a change in the physical environmental or are directly caused by a change in the physical environment due to the project. However, the National Environmental Policy Act (NEPA) requires the assessment of economic and social effects regardless of whether they result in a change to the physical environment.

Therefore, a project would generally have a significant impact on the environment related to socioeconomics if it would:

- Induce substantial growth or concentration of population (either residents or employees);
- Displace a large number of people; or
- Disrupt or divide the physical arrangement of an established community.

Further, SCAG views significant impacts as those that would potentially:

- Result in population, housing and employment growth inconsistent with the level of growth projected under the 1998 Regional Transportation Plan (RTP).

5.3.3 METHODOLOGY

Potential impacts of the Cadiz Project alternatives were evaluated based on a comparison of the affected environment to anticipated socioeconomic changes that would occur under the Cadiz Project alternatives. These changes were evaluated based on the defined threshold of significance criteria to determine whether the potential socioeconomic impacts of the Cadiz Project alternatives would be significant.

[3] California Department of Finance, City/County Population and Housing Estimates, January 1, 1998.

5.3.4 IMPACTS

Eastern Alternative

Employment

The Eastern Alternative would generate short-term employment related to construction of the Project wellfield, Project spreading basins, water conveyance facilities, power distribution facilities and pumping facilities. The Eastern Alternative would also generate long-term employment opportunities related to the operations and maintenance of these facilities.

Construction Employment. According to estimates prepared for the Cadiz Project, construction of the various facilities could generate up to 1,233 jobs, as shown in Table 5.3-3.

TABLE 5.3-3
ESTIMATED CONSTRUCTION EMPLOYMENT FOR THE EASTERN ALTERNATIVE

Facility	Employees
Conveyance Facilities	400
Power Transmission Facilities	376
Pumping Facilities	160
Spreading Basins	120
Wellfield	177
Total Employment	**1,233**

The duration and timing of construction-related jobs would depend on the construction schedule developed by the individual contractors. Therefore, the number of construction-related jobs active at any point in time would most likely be less than the total number of potential jobs.

Employees for construction-related jobs would be expected to be drawn from the labor pool in the surrounding area and the greater San Bernardino/Riverside County area. Further, the short-term construction employment associated with the Eastern Alternative would represent a small share of the existing and projected employment base in the surrounding area. Therefore, short-term employment generated by the Eastern Alternative would not be considered a significant adverse impact under the criteria of inducing substantial growth or concentration of population (in this case, employee population).

Operational Employment. Operation and maintenance of the Eastern Alternative facilities would generate long-term employment opportunities. According to estimates prepared for the Cadiz Project, nine full- and part-time jobs would be supported by these activities, as shown in Table 5.3-4.

TABLE 5.3-4
ESTIMATED OPERATIONS EMPLOYMENT FOR THE EASTERN ALTERNATIVE

Facility	Employees
Central Pumping Plant	4
Spreading Basins	2
Conveyance Facilities	1
Wellfield	2
Total Employment	**9**

The long-term employment associated with the Eastern Alternative would represent an insignificant share of the existing and projected employment base in the surrounding area. Therefore, long-term employment generated by the Eastern Alternative is not considered a significant adverse impact under the criteria of inducing substantial growth or concentration of population (in this case employee population) in the area.

Resident Population

No housing would be developed as part of the Eastern Alternative. Therefore, the Eastern Alternative would not directly contribute to population or housing growth in the surrounding area.

Employees of the Eastern Alternative (either short term construction related or long-term operations and maintenance personnel) would be expected to be drawn from the labor pool in the surrounding area and the greater San Bernardino/ Riverside area. While there is a substantial unemployed labor pool in the surrounding area (estimated at 4,400 in 1998), some employees might be hired from outside the surrounding area and move to be near their jobs.

New employees and their families that would move into the surrounding area could indirectly contribute to population growth and demand for housing in the surrounding area. However, the scale of this potential additional population growth is insignificant relative to the existing and projected population in the surrounding area. Further, because there is a substantial amount of vacant housing in the surrounding area (estimated at 7,600 units in 1998), any demand for housing generated by employees under the Eastern Alternative could be absorbed by the existing housing supply. Therefore, the Eastern Alternative is not expected to result in significant adverse impacts related to population and housing.

The Eastern Alternative would be developed in an uninhabited area and would not displace any resident or business population and would not divide any established communities.

Consistency with Growth Projected Under the 1998 Regional Transportation Plan

The level of direct population or employment growth generated by the Eastern Alternative would be insignificant relative to the overall level of growth projected for the surrounding area. The Cadiz Project implements policies in the SCAG Regional Comprehensive Plan relating to more efficient use of existing water resources, policies which are reflected in the adopted regional growth forecasts.

Economic Benefits

While not a required CEQA topic, there are several important socioeconomic benefits that could be generated by Project construction activities. These potential benefits include increased short-term employment and income to businesses in the surrounding area, increased rental or sale income to homeowners in the surrounding area, and increased local tax revenues.

The first beneficial impact would be caused by expenditures for local goods and services by construction contractors. Project employees would also spend a portion of their incomes on local goods and services. These expenditures would become income for the local firms supplying the goods and services, potentially supporting additional jobs at these local firms for the duration of the construction period.

The second beneficial effect of the project would be generated from new employees that temporarily or permanently relocate to the area. These employees would be housed in new or existing rental or for-sale units, generating additional rental and

sales income to local homeowners and developers. The existing vacancy rate in the area can readily meet the need for this housing.

The first two effects would cause a third beneficial impact. Additional short-term expenditures for local goods and services, as well as increased rental and sales income for housing occupied by relocating employees would generate additional sales and property tax revenues to local jurisdictions. If some short-term employees chose to live in motel/hotel accommodations, there would also be some additional transient occupancy tax revenues to local jurisdictions.

Finally, this local spending by Project construction contractors and employees for goods, services and housing, becomes income to local individuals who supply the goods, services and housing. Then, part of these second-round incomes are also spent locally and become income for another set of individuals. This "multiplier" effect continues for several rounds of expenditures in the local economy, generating income and jobs for local residents.

While these short-term beneficial effects would be generated in the surrounding area by construction of the Cadiz Project, the level of benefit cannot be quantified until additional information is available on the potential level of expenditures for local goods and services by construction contractors, incomes that would be generated by the short-term jobs supported by Project construction, and the potential number of new employees that might relocate to the surrounding area on a short- or long-term basis.

Western Alternative

Employment

Like the Eastern Alternative, the Western Alternative would generate 1,233 short-term jobs related to construction of the Project wellfield, Project spreading basins, water conveyance facilities, power distribution facilities and pumping facilities. The Western Alternative would also generate the same long-term employment related to the operations and maintenance of these facilities as the Eastern Alternative. Nine new long-term jobs would be created.

As with the Eastern Alternative, the employees for the construction-related jobs under the Western Alternative would be expected to be drawn from the labor pool in the surrounding area and greater San Bernardino/Riverside County area. This short-term construction employment would represent a small share of the existing and projected employment base in the surrounding area. Therefore, similar to the Eastern Alternative, short-term employment generated by the Western Alternative would not be considered a significant adverse impact.

The long-term employment associated with the operation and maintenance of the Western Alternative would represent an insignificant share of the existing and projected employment base in the surrounding area. Like the Eastern Alternative, long-term employment generated by the Western Alternative would not be considered a significant adverse impact.

Resident Population

No housing would be developed as part of the Western Alternative. Therefore, like the Eastern Alternative, the Western Alternative would not directly contribute to population or housing growth in the surrounding area.

Employees for the Western Alternative (either short-term construction-related or long-term operations and maintenance personnel) would be expected to be drawn from the labor pool in the surrounding area and greater San Bernardino/Riverside County area.

While there is a substantial unemployed labor pool in the surrounding area (estimated at 4,400 in 1998), some employees might be hired from outside the surrounding area and move to be near their jobs. However, the scale of any potential additional population growth due to employees moving into the area would be insignificant relative to the existing and projected population in the surrounding area. Further, because there is a substantial amount of vacant housing units in the surrounding area (estimated at 7,600 in 1998), any additional demand for housing generated by employees of the Western Alternative could be absorbed by the existing housing supply. Therefore, as with the Eastern Alternative, the Western Alternative would not be expected to result in significant adverse impacts under the criteria of inducing substantial growth or concentration of population.

The Western Alternative would be developed in an uninhabited area and would not displace any resident or business population or divide any established communities.

Consistency With Growth Projected Under the 1998 Regional Transportation Plan

The level of direct population or employment growth generated by the Western Alternative would be insignificant relative to the level of overall level of growth projected for the surrounding area. This alternative implements policies in the SCAG Regional Comprehensive Plan relating to more efficient use of existing water resources, policies which are reflected in the adopted regional growth forecasts.

Economic Benefits

The short-term economic benefits of the Western Alternative would be the same as for the Eastern Alternative. The same "multiplier effect" and tax revenue benefits would arise from contractor and construction employee expenditures.

Combination Alternative

Employment

The Combination Alternative would generate the same 1,233 short-term jobs related to construction of the Project wellfield, Project spreading basins, water conveyance facilities, power distribution facilities and pumping facilities as the Eastern and Western alternatives. It would also generate the same nine jobs related to the operations and maintenance of these facilities.

Employees for the Combination Alternative (either short-term construction-related or long-term operations and maintenance personnel) would be expected to be drawn from the labor pool in the surrounding area and the greater

San Bernardino/Riverside County area. As with the Eastern and Western Alternatives, this employment represents a small share of the existing and projected employment base in the surrounding area. Therefore, short- and long-term employment generated by the Combination Alternative would not be considered a significant adverse impact.

Resident Population

No housing would be developed as part of the Combination Alternative. Therefore, the Combination Alternative would not directly contribute to population or housing growth in the surrounding area.

As with the Eastern and Western Alternatives, employees of the Combination Alternative (either short-term construction-related or long-term operations and maintenance personnel) would be expected to be drawn from the labor pool in the surrounding area and the greater San Bernardino/Riverside County area. While there is a substantial unemployed labor pool in the surrounding area (estimated at 4,400 in 1998), some employees might be hired from outside the surrounding area and move to be near their jobs. However, the scale of this potential additional population growth would be insignificant relative to the existing and projected population in the surrounding area. Further, because there is a substantial amount of vacant housing in the surrounding area (estimated at 7,600 units in 1998), any additional demand for housing generated by employees of the Combination Alternative could be absorbed by the existing housing supply. Therefore, the Combination Alternative would not be expected to result in significant adverse impacts under the criteria of inducing substantial growth or concentration of population in the surrounding area.

The Combination Alternative would be developed in an uninhabited area and would not displace any resident or business population or divide any established community.

Consistency with Growth Projected Under the 1998 Regional Transportation Plan

The level of direct population or employment growth generated by the Combination Alternative would be insignificant relative to the overall level of growth projected for the surrounding area and region. As noted above, this alternative implements policies in the SCAG Regional Comprehensive Plan relating to more efficient use of existing water resources, policies which are reflected in the adopted regional growth forecasts.

Economic Benefits

The short-term economic benefits of the Combination Alternative would be the same as for the Eastern and Western alternatives. The same "multiplier effect" and tax revenue benefits would arise from contractor and construction employee expenditures.

Eastern/Canal Alternative

Employment

The Eastern/Canal Alternative would generate more short-term construction employment than the Eastern, Western or Combination alternatives (1,413 versus 1,233), due to the need for an extra construction crew to erect Intermediate Pumping Plant No.1. It would also likely

generate one more long-term job than the other build alternatives.

As with the other alternatives, employees would be expected to come from the existing labor pool in the surrounding area and the greater San Bernardino/Riverside County area. This employment represents a small share of the employment base. Therefore both short- and long-term employment impacts under the Eastern/Canal Alternative would not be significant.

Resident Population

No housing would be developed as part of the Eastern/Canal Alternative. Therefore, this alternative would not directly contribute to population and housing growth in the surrounding area. Since labor is expected to be drawn largely from the existing labor supply, employment-related population growth is expected to be insignificant. There is also a substantial amount of vacant housing in the surrounding area that could absorb additional housing demand. Therefore, the Eastern/Canal Alternative would not result in significant adverse impacts under the criteria of inducing substantial growth or concentration of population in the surrounding area.

Consistency with Growth Projected Under the 1998 Regional Transportation Plan

The level of direct population or employment growth generated by the Eastern/Canal Alternative would be insignificant relative to the overall level of growth projected for the surrounding area and region. As noted above, the Cadiz Project implements policies contained in the SCAG Regional Comprehensive Plan relating to more efficient use of existing water resources policies which are reflected in the adopted regional growth forecasts.

Economic Benefits

Because of the larger number of construction employees (1,413 versus 1,233), the Eastern/Canal Alternative will have a larger short-term beneficial economic effect than the Eastern, Western and Combination Alternatives. The same type of "multiplier effect" and tax revenue benefits would occur under the Eastern/ Canal Alternative as for the Eastern, Western and Combination Alternatives, but the overall dollar value is expected to be greater.

No Project Alternative

The No Project Alternative would not require any construction and would not generate any long-term operations and maintenance employment. Therefore, the No Project Alternative would not induce any growth or concentration of population. The No Project Alternative would not require any construction and would not displace any resident or business population or divide any established community. The No Project Alternative would not result in any direct population or employment growth and would not impact the level of growth projected under the adopted 1998 Regional Transportation Plan.

5.3.5 MITIGATION MEASURES

No significant socioeconomic or growth inducing impacts would occur under the Eastern, Western, Combination or Eastern/Canal alternatives. Therefore, no mitigation is necessary.

5.3.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

No significant adverse socioeconomic or growth impacts are anticipated from any of the Cadiz Project alternatives.

5.4 TOPOGRAPHY, GEOLOGY, SEISMICITY AND SOILS

5.4.1 AFFECTED ENVIRONMENT

Project Area Topography

The topography of the Cadiz Project area is characterized by generally northwest to north-trending mountain ranges separated by broad intervening valleys with interior drainage. The elevations of the floors of Bristol Valley (Bristol Dry Lake), Cadiz Valley (Cadiz Dry Lake) and Ward Valley (Danby Dry Lake), are all at elevations between 500 and 600 feet above mean sea level. The highest elevation in the Iron Mountains, located at the southern end of the Project area, is 3,296 feet. The Kilbeck Hills, a northerly extension of the Iron Mountains, crest at approximately 1,684 feet. The maximum elevation in the Old Woman Mountains, located north of Danby Dry Lake and east of the Kilbeck Hills, is 5,326 feet. The maximum elevation in the Ship Mountains, located north of Cadiz Valley, is 3,239 feet. The Marble Mountains, located northwest of the Ship Mountains, reach an elevation of 3,842 feet. The topographic and geologic setting of the Cadiz Project area is shown in Figure 5.4-1.

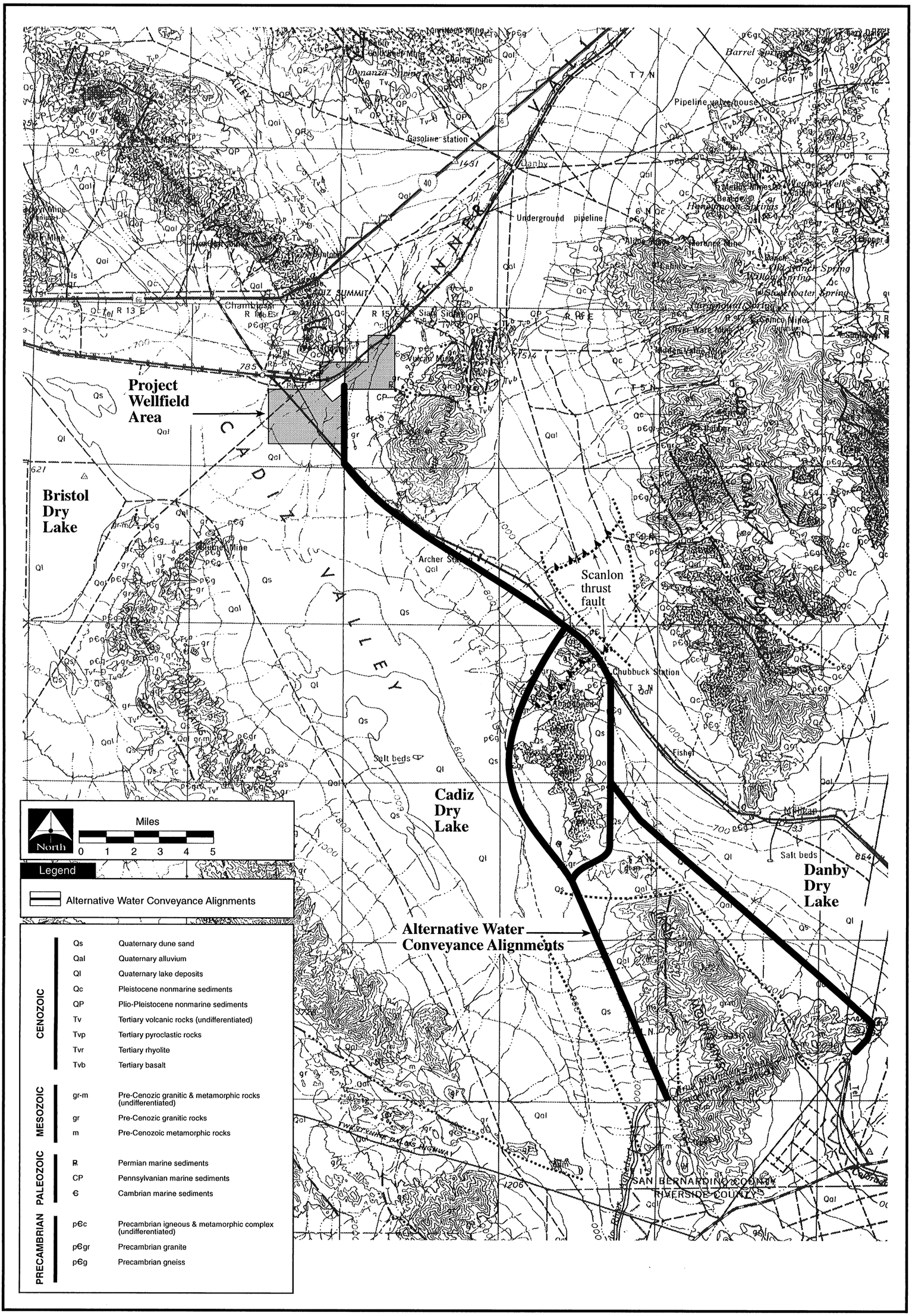
The Project spreading basins would be located in Fenner Gap, which is located between the Marble and Ship mountains. Fenner Gap is the site of both surface drainage and groundwater outflow from the Fenner Valley. Fenner Valley, which forms the principal watershed for the Project area, is a broad southwest-trending valley that drains an area of approximately 1,100 square miles.

The Project water conveyance alignments would originate either at the Iron Mountain Pumping Plant on the eastern flank of the Iron Mountains (Eastern and Eastern/Canal Alternatives), or at the western terminus of the Iron Mountain Tunnel (Western and Combination Alternatives). The pumping plant and tunnel are parts of Metropolitan's Colorado River Aqueduct. All alternatives would traverse gently sloping ground along the flanks of the Iron Mountains and Kilbeck Hills. Ground surface elevations along these alternatives range from approximately 900 to 1,000 feet. With minor local exceptions, the slope of the ground surface ranges from approximately one to six percent, (approximately 50 to 300 feet per mile).

Extending northwest from the north end of the Kilbeck Hills, a single water conveyance facility common to all Project alternatives would extend along the northeast margin of Cadiz Valley, adjacent to the ARZC line and to Cadiz-Rice Road. Near the north end of Cadiz Valley, the water conveyance facility would turn north toward the Project spreading basin site in Fenner Gap. Ground surface elevations along this reach of the alignment range from about 750 to 1,000 feet, with the surface sloping gently southwest toward Cadiz Valley at a slope of approximately one percent (50 feet per mile).

The Project wellfield would be centered on the Project spreading basin complex. Ground surface elevations in this area range from about 750 to 1,000 feet.

The ground surface in the vicinity of the Project wellfield and Project spreading basin site slopes gently toward the west and southwest at a slope of less than 50 feet per mile.



Source: Bishop (1963) and Howard & Others (1989).

Figure 5.4-1

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Geologic Map of the Project Area, Showing Alternative Water Conveyance Alignments

Project Area Geology

Figure 5.4-1 shows the water conveyance alignments for the Cadiz Project alternatives on a regional geologic base map prepared by the California Division of Mines and Geology (Bishop 1963) with more recent data mapped by the United States Geological Survey (Howard & others 1989). The geology summarized in Figure 5.4-1 is consistent with larger-scale (more detailed) geologic mapping available from a wide variety of sources, as referenced below.

The following discussion is intended to provide a general overview of regional stratigraphy and structure pertinent to the surface and groundwater hydrology of the Cadiz Project area and to the alternative alignments of the proposed conveyance facilities. A more detailed discussion of groundwater resources for the Cadiz Project area is provided in Section 5.5 (Water Resources).

The crystalline basement rocks exposed in the mountain ranges of the Cadiz Project area consist of Precambrian granitic and metamorphic rocks, which are overlain by a sequence of Paleozoic sediments. The Paleozoic section consists of indurated sandstones, shales, slates, limestones and dolomites which are depositional equivalents of sediments exposed on the Colorado Plateau, 100 miles to the east. These Paleozoic sediments have been faulted and folded by numerous periods of regional tectenism.

The basement complex and the overlying Paleozoic section were locally metamorphosed and intruded by granitic plutons during Mesozoic time. In the Old Woman Mountains, the Precambrian and Paleozoic section was also intensely deformed by ductile thrusting which accompanied the Mesozoic plutonism (Karlstrom and others 1993). Throughout the Cadiz Project area, the crystalline basement rocks form the boundaries of the groundwater aquifer system. The basement rocks are generally impermeable and, even where deeply weathered, typically yield only minor quantities of water to wells (Freiwald 1984).

The Paleozoic section is unconformably overlain by clastic sediments and interbedded volcanic rocks of Tertiary age. Mesozoic sediments have not been recognized in the Cadiz Project area. The Tertiary volcanic rocks consist of lava flows of basaltic to andesitic composition, and pyroclastic tuffs of rhyolitic to dacitic composition. The Tertiary sediments consist of conglomerate, fanglomerate, sandstone, siltstone, water-laid tuff and lake sediments, which form a composite section over 7,000 feet thick (Dibblee 1980) The Tertiary sediments and interlayered volcanic rocks are gently dipping, due to extensional normal faulting of mid- to late-Tertiary age. These sediments typically yield relatively small amounts water to wells (Moyle 1967).

The Quaternary and late-Tertiary alluvial fill in the basins is largely derived from the Precambrian basement complex, Paleozoic sediments and Tertiary volcanic rocks. Geophysical evidence indicates that this alluvial fill locally exceeds 3,500 feet in thickness beneath the Cadiz Project area (Maas 1994). These alluvial sediments form the principal aquifers in the Cadiz Project area.

The playa sediments underlying Bristol, Cadiz and Danby dry lakes consist of

brine-saturated clay, silt, fined-grained sand and evaporite deposits. The clastic sediments were deposited when stream flow and sheet flow from the surrounding alluvial fans reached the playas during major storm events (Gale 1951). The evaporite deposits formed from evaporation of surface water and from evaporation of groundwater which seeps onto the playas from the adjacent alluvial fans (Rosen 1989).

Bristol, Cadiz and Danby dry lakes have static groundwater levels at or near the playa surfaces (Moyle 1967; Rosen 1989). Sodium chloride and/or calcium chloride are currently being recovered from trenches and brine wells on all three of these playas. Thompson (1929), Gale (1951), Bassett and others (1959), Handford (1982) and Rosen (1989) concur that the principal recharge to the playas occurs as diffuse seepage of groundwater onto the playas from the adjacent alluvial fans.

Cadiz and Bristol dry lakes are locally bordered by active dunes formed by fine to medium-grained windblown sand. These Holocene deposits overlie older playa deposits of undifferentiated Quaternary age (Moyle 1967).

Amboy Crater, located near the western margin of Bristol Dry Lake, is a basaltic cinder cone and lava field believed to be as young as 6,000 years (Parker 1963; Hazlett 1992).

As shown on Figure 5.4-1, the alternative water conveyance alignments extend, with minor exceptions, across broad areas that are mapped as alluvium (Qal) and dune sand (Qs). The lakebed sediments (Ql), which are confined to the lower portions of the valleys, are not crossed by the water conveyance facilities.

It is estimated that groundwater levels along the water conveyance alignments vary from a few tens of feet to several hundred feet below the ground surface. As a result, groundwater is not anticipated to occur within construction excavations for the Cadiz Project.

Project Area Soils

According to *Soils of the Western United States* (Soil Conservation Service of the United States Department of Agriculture (USDA) 1964), the region of the alternative water conveyance facilities includes two soil types. Areas of low topographic relief are mapped as light colored, red, desert alluvial, sandy soils. The mountain slopes consist of alluvium, colluvium and residuum from granite, gneiss, quartzite and limestone formations.

A soil study performed on part of the Cadiz Project site (Western Ag Lab 1986) found the soils to be primarily loamy sands and sandy loams. Sandy soils were encountered at a few locations; no clay soils are known in the Cadiz Project area. The soils are alkaline, with pH between 8 and 9. Caliche, defined as soils with natural cementation, usually by calcium carbonate, occurs locally in the Cadiz Project area.

The USDA Natural Resources Conservation Service (formerly the Soil Conservation Service) classifies soils into four hydrologic groups based on infiltration rates obtained for bare soil after prolonged wetting. Their distribution in the Cadiz Project area is

shown on mapping by the BLM (1982). Those four soil groups are described as follows:

Group A Soils

Group A soils have a low runoff potential and high infiltration rate. These soils generally consist of deep, well-drained sands and gravels. USDA soil textures normally included in this group are sand, loamy sand and sandy loam. Soils in this group have an infiltration rate of more than 0.3 inch per hour. In the vicinity of the Cadiz Project area, most of the areas underlain by undifferentiated alluvium and dune sand are mapped as Group A soils. The soils underlying the Project spreading basins are also classified as Group A soils, as are most of the areas traversed by the alternative water conveyance facilities.

Group B Soils

Group B soils have a moderate runoff rate and moderate infiltration rate. These soils generally consist of moderately deep to deep, moderately well- to well-drained sandy loams with moderately fine to moderately coarse texture. These soils have an infiltration rate between 0.15 and 0.3 inch per hour. Group B soils are rare in the vicinity of the Cadiz Project area, and are not present in the areas of the water conveyance facilities or the Project spreading basins.

Group C Soils

Group C soils have a moderate runoff rate and slow infiltration rate. These soils generally consist of silty loam with a layer that impedes the downward flow of water or has a moderately fine to fine texture. The soils have an infiltration rate of 0.05 to 0.15 inch per hour. Group C soils in the Cadiz Project area occur in the lower part of the alluvial valleys, i.e., in the playa deposits of Bristol, Danby and Cadiz dry lakes.

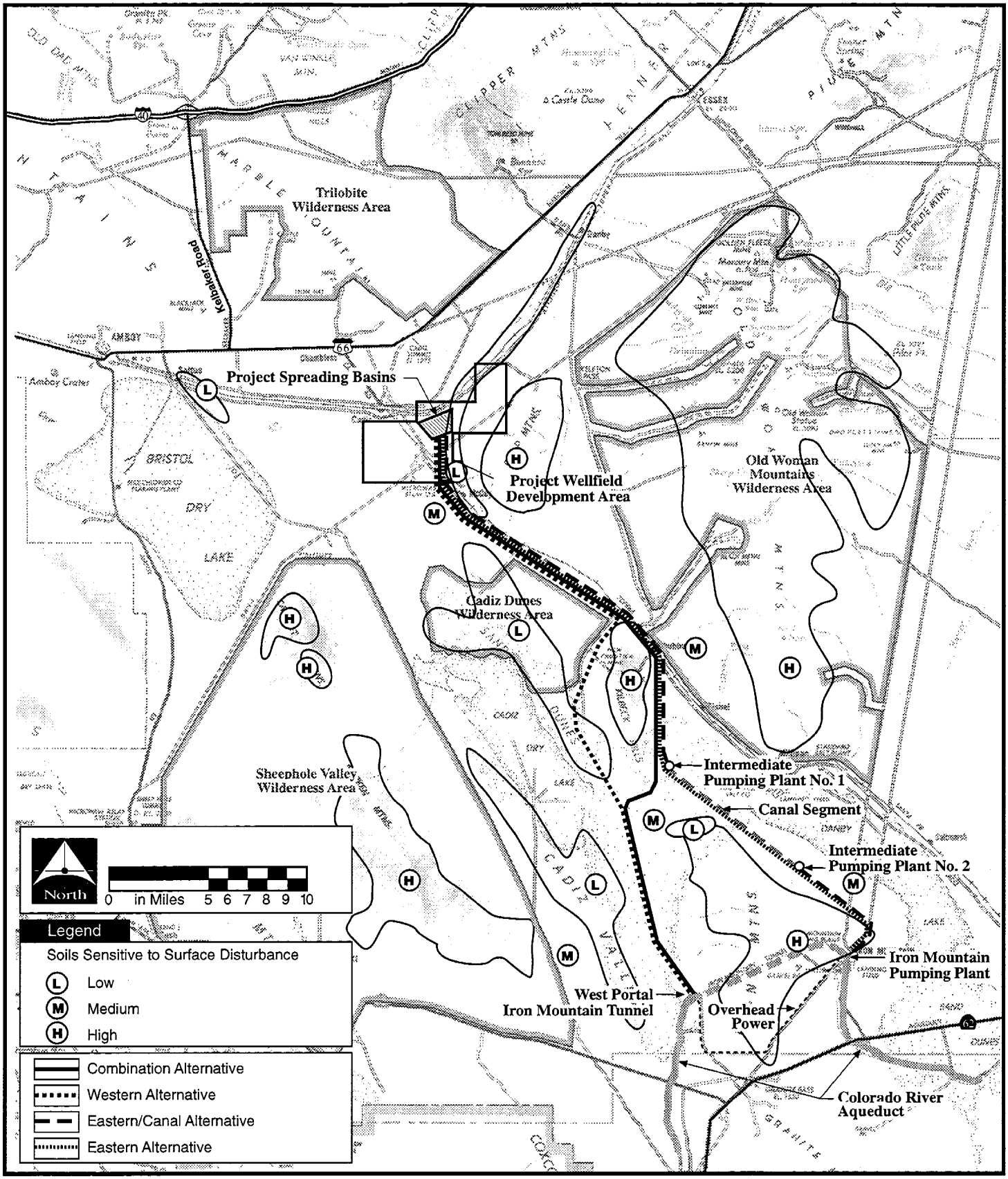
Group D Soils

Group D soils have a high runoff potential and very slow infiltration. These soils consist of clay with high swell potential, soils with a permanent high water table, soils with a clay pan or clay layer near the surface or shallow soils above nearly impervious material such as bedrock. Soil textures in this group include clay loam, silt loam, sandy clay, silty clay and clay. The soils have a very low infiltration rate, at 0.05 inch per hour. Group D soils in the Cadiz Project area are present in the areas mapped as bedrock, i.e., the Kilbeck Hills, and the Marble, Ship and Iron mountains.

Erosion and Sensitivity to Disturbance

Due to the sandy or loamy nature of the soil and the sparse vegetation in most of the Cadiz Project area, the soil is highly susceptible to wind erosion, particularly on the west side of the Iron Mountains. Signs of wind erosion, such as loss of soil around the bases of rooted bushes and the buildup of windblown soil along obstructions, are common.

According to mapping by the BLM (1982), the sensitivities of soils in the area to disturbance can be classified as high, medium or low, corresponding generally to mountainous areas with shallow bedrock, alluvium on the flanks of the mountain ranges, and playa/lakebed deposits, respectively. As shown on Figure 5.4-2, the water conveyance alignments primarily cross soils classified



Source: P&D Consultants, Inc.(1999).

Figure 5.4-2

Cadiz Groundwater Storage & Dry-Year Supply Program
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Sensitivity of Soils to Disturbance

as having medium sensitivity to disturbance, with local areas of low sensitivity. The alternative water conveyance alignments also cross the edges of areas of high sensitivity soils along the flanks of the Iron Mountains and Kilbeck Hills.

Project Area Faults and Seismicity

Regional Structural Setting

The Cadiz Project area is located at the eastern margin of the "eastern California shear zone" a broad seismically active region dominated by northwest trending right-lateral strike-slip faulting (Dokka & Travis 1990). Roughly a dozen fault zones showing evidence of Quaternary movement have been identified in and adjacent to Bristol, Cadiz and Fenner valleys (Howard & Miller 1992). These fault zones are believed to be related to the formation of these structural depressions. Figure 5.4-3 shows the generalized locations of these Quaternary fault zones.

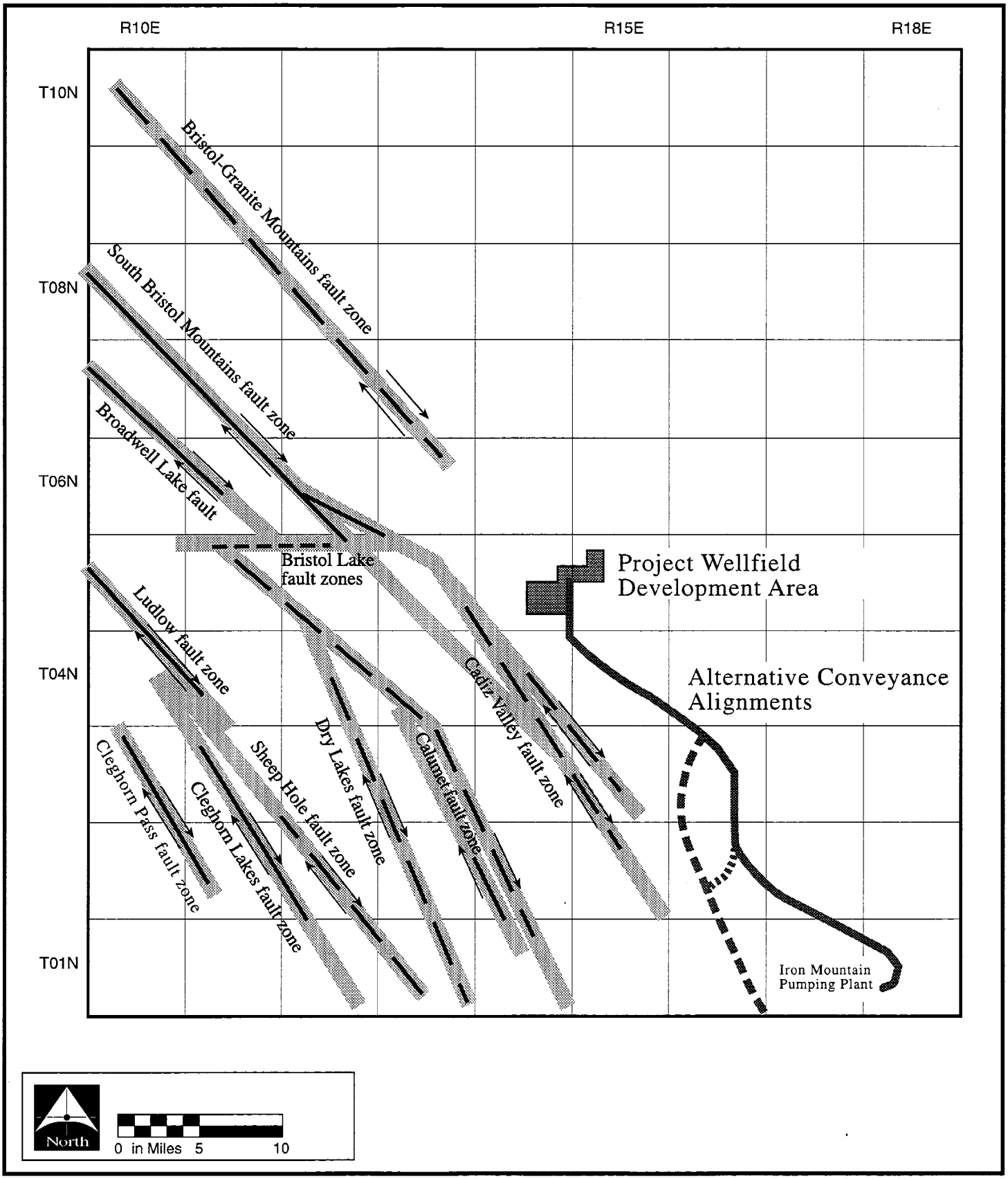
Cadiz Valley is underlain by two major northwest trending faults, inferred on the basis of gravity and magnetic data (Simpson & others 1984). This fault zone has a strike length of at least 25 miles, and may merge to the north and northwest with extensions of the Bristol-Granite Mountains and South Bristol Mountains fault zones (Howard & Miller 1992). Right-lateral slip along the Cadiz Valley fault zone of as much as 16 miles has been postulated on the basis of correlations of a distinctive Precambrian gneiss unit across the zone (Howard & Miller 1992). Slickenside surfaces, produced on rock by fault movement, and steeply dipping sediments recovered from cored drill holes beneath Cadiz Dry Lake, suggest that the fault zone displaces sediments of Pleistocene age (Bassett & others 1959).

Bristol Dry Lake is bordered by probable extensions of the Cadiz Valley and South Bristol Mountains fault zones to the east, and by probable extensions of the Broadwell Lake and Dry Lake fault zones to the west (Howard & Miller 1992). Geophysical data indicate this structural depression may exceed 6,000 feet in depth (Simpson & others 1984; Maas 1994). Drill cores recovered from depths of over 1,000 feet beneath Bristol Dry Lake suggest that subsidence of this basin began by Pliocene time and continues to the present (Rosen 1989).

Fenner Gap is a structural half-graben, formed by a system of northeast trending, northwest dipping normal faults as shown in Figures 5.4-4 and 5.4-5. Subsurface interpretation of the gap was assisted by a seismic reflection survey conducted by NORCAL Geophysical Consultants, Inc. (1997) along a portion of section A-A' as shown in these figures. This system of normal faults is also expressed in gravity and magnetic surveys and in surface outcrops for a length of approximately 15 miles.

Classifications of Fault Activity

Under the terms of the California Public Resources Code, an "active" fault is defined as one that has "had surface displacement within Holocene time (about the last 11,000 years)." A "potentially active" fault has been defined as one that shows evidence of surface displacement during Quaternary time (about the last 1.6 million years). These definitions are illustrated in Figure 5.4-6. The California Public Resources Code does not provide criteria for definition of "inactive" faults (Hart 1994).



Source: Howard & Miller (1992).

Figure 5.4-3

Cadiz Groundwater Storage & Dry-Year Supply Program
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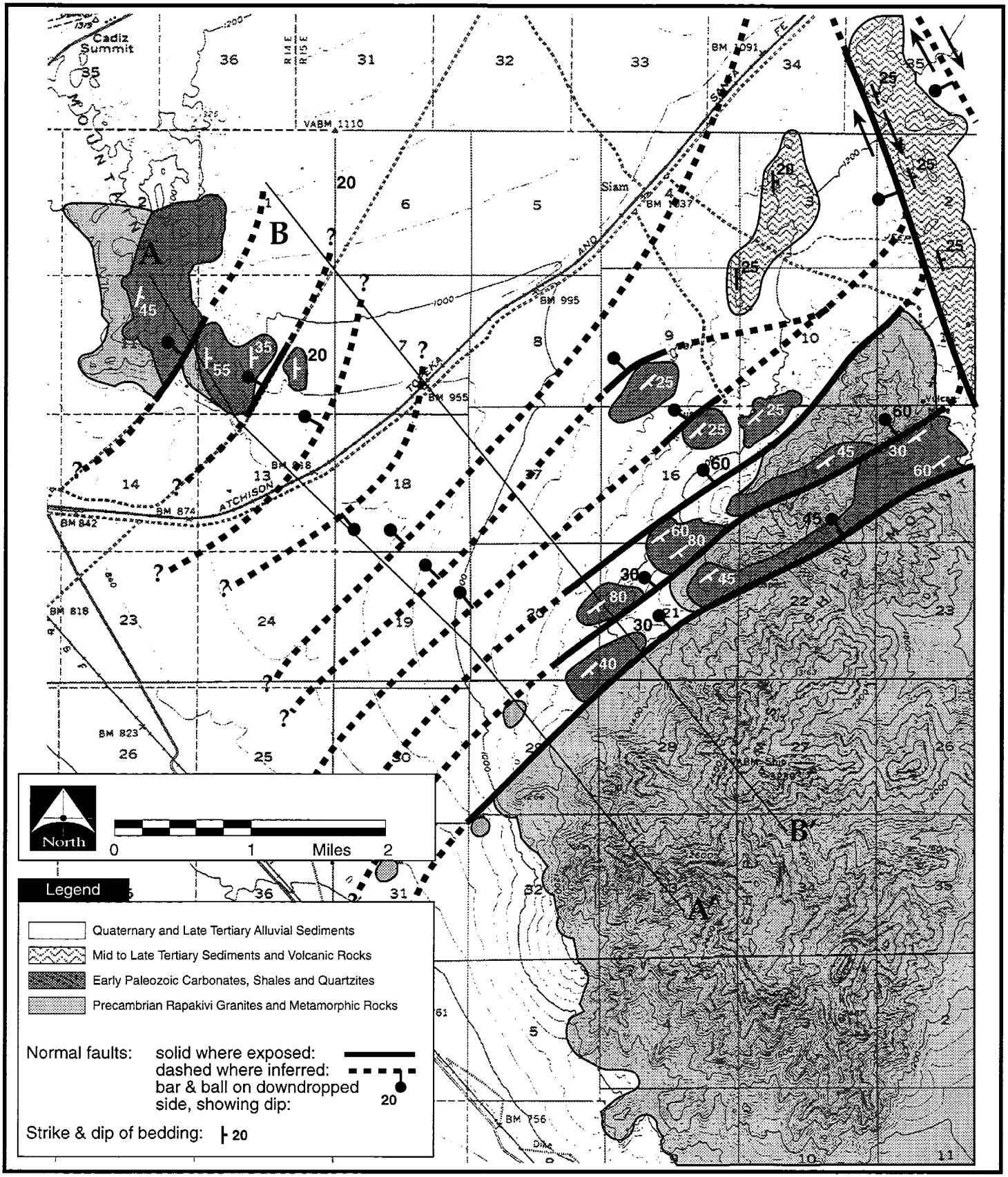
Quarternary Fault Zones in Relation to the Project Area



Source: Geoscience Support Services, Inc. (1999).

Figure 5.4-4

Cadiz Groundwater Storage & Dry-Year Supply Program

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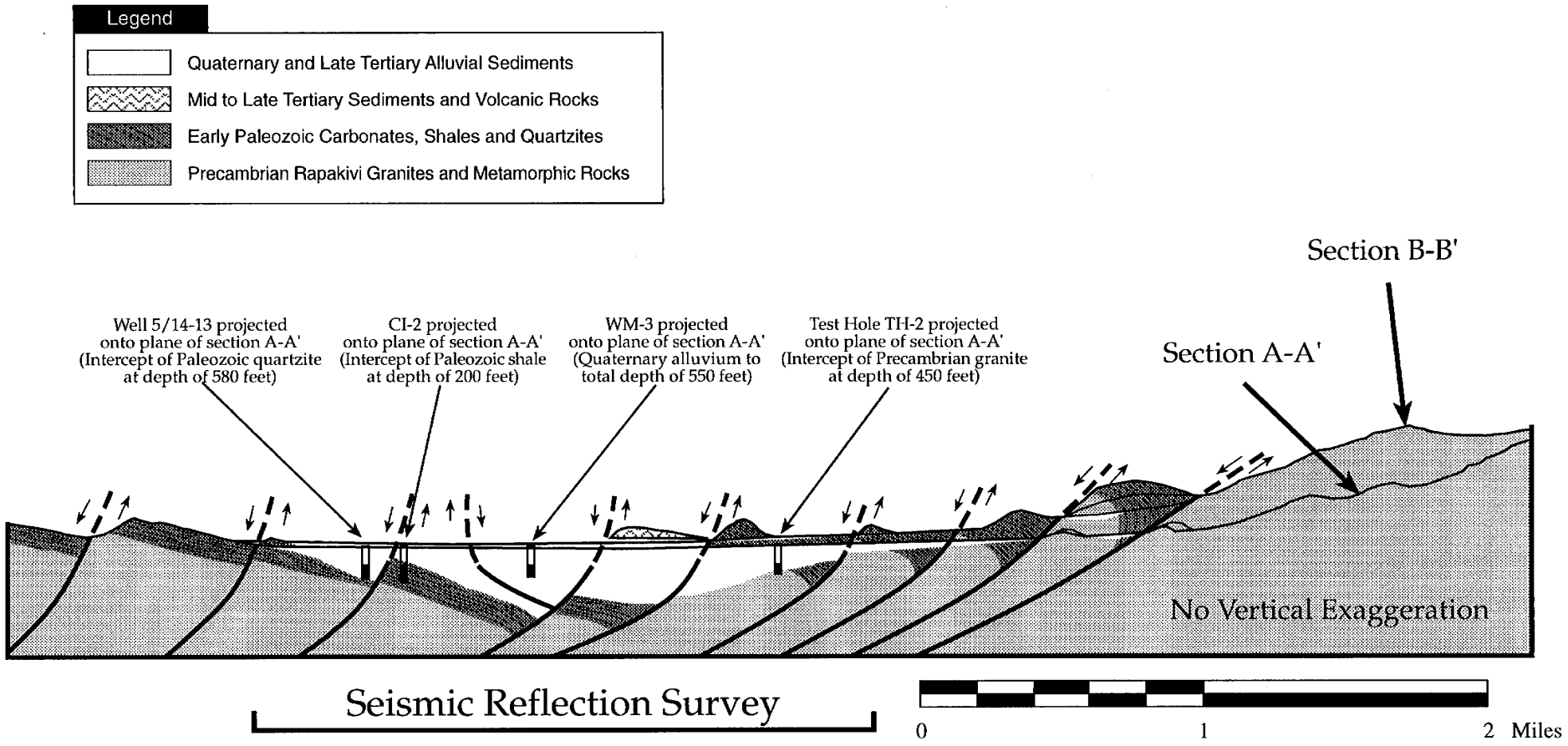
Generalized Geological Map of Fenner Gap



Source: Geoscience Support Services, Inc. (1999).

Figure 5.4-5

Cadiz Groundwater Storage & Dry-Year Supply Program

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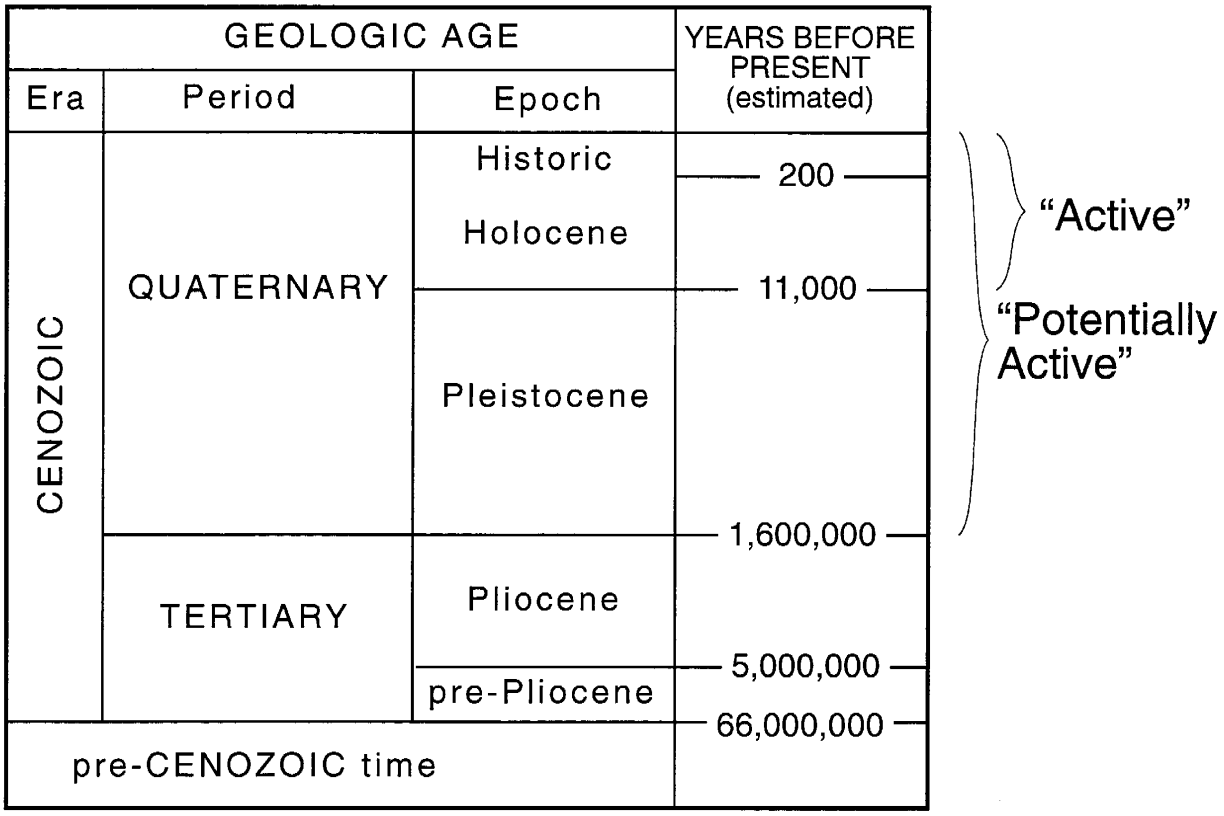
Simplified Cross-Section of Fenner Gap



Source: Hart (1994).

Figure 5.4-6

Definitions of Fault Activity

These fault definitions have been augmented with the new classifications of "sufficiently active" and "well-defined" faults. These two new terms constitute the present criteria used by the State Geologist in determining whether a given fault should be zoned under the Alquist-Priolo Act (Hart 1994). For the purpose of this discussion, the older classifications of "active" and "potentially active" have been used. No "active," "sufficiently active" or "well defined" faults have been identified in proximity to the Cadiz Project area.

Faults in the Project Area

The locations of the Cadiz Project water conveyance alignments with respect to regional geology were shown earlier on Figure 5.4-1. The locations of these alignments with respect to known Quaternary fault zones were shown earlier on Figure 5.4-3. The east and west flanks of the Iron Mountains are believed to be bounded by faults, but these faults are not known to displace Quaternary alluvium and they are, therefore, not considered to be either active or potentially active.

Two faults have been mapped as crossing the water conveyance alignments, as shown on Figure 5.4-1. One is a thrust fault, known as the Scanlon thrust fault, which underlies the Eastern, Combination and Eastern/Canal alternatives near Chubbuck Station. The other is an unnamed west-trending fault that crosses the Western Alternative south of the Kilbeck Hills.

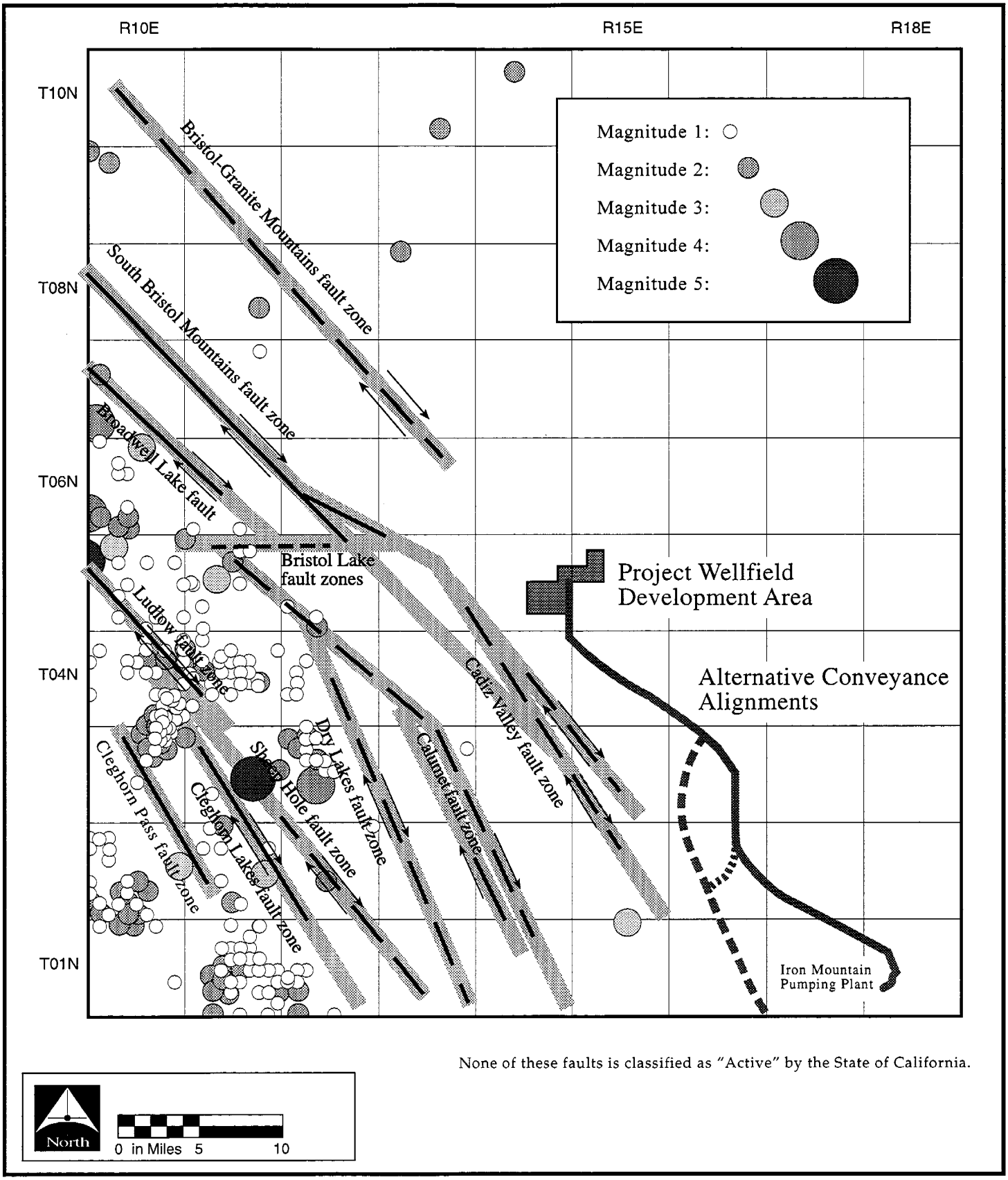
As mapped by Howard & others (1989) the Scanlon thrust fault juxtaposes Permian to Mississippian rocks (about 240 to 360 million years old) against Cambrian rocks (about 500 to 570 million years old). The Scanlon thrust fault is offset by younger northwest-trending faults, indicating that its movement predates normal faulting, typical of the Project area, that occurred during mid- to late-Tertiary time. Consequently, the Scanlon thrust fault is not considered to be active or potentially active.

The unnamed west-trending fault that crosses the Western Alternative south of the Kilbeck Hills is not exposed at the ground surface. This fault does not displace Quaternary alluvium and, therefore, is not considered to be either active or potentially active.

Other unmapped faults may be present beneath the alluvium in the Project area, but no surface expression of such faults is known. Faults that displace Quaternary alluvium are typically expressed by linear topographic escarpments or displaced drainage courses. However, such expressions are rapidly eroded and are, therefore, transient in nature. Therefore, older faults are difficult to trace across alluvial areas due to the lack of surface expression. Such faults are typically inferred on the basis of regional geologic mapping, drilling or geophysical surveys.

The system of normal faults which formed the half-graben of Fenner Gap displace and tilt volcanic rocks of mid- to late-Tertiary age, as shown in Figures 5.4-4 and 5.4-5. However, these faults do not displace Quaternary sediments and are, therefore, not considered to be either active or potentially active.

Very few earthquake epicenters have been recorded in the immediate region surrounding the Cadiz Project area. Figure 5.4-7 is a generalized map of fault zones near the Project area that are



None of these faults is classified as "Active" by the State of California.

Source: Advanced Geologic Exploration (1997) and Howard and Miller (1992).

Figure 5.4-7

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Recorded Earthquake Epicenters in Relation to Quaternary Fault Zones

inferred to have had movement during Quaternary time (within the past 1.6 million years). Superposed on this map are recorded earthquake epicenters recorded by the USGS (Advanced Geologic Exploration 1997). One minor earthquake of magnitude 3 has been recorded approximately six miles west of the Western Alternative. Although a relatively large amount of micro-seismic activity has been recorded in the western portion of the area shown on Figure 5.4-8, none of the faults in this area is presently classified as active.

Areas underlain by known, active faults are subject to special building restrictions under the Alquist-Priolo Earthquake Fault Hazards Zoning Act. The California Division of Mines and Geology (CDMG) is charged with the publication of maps, based on USGS 7.5-minute topographic quadrangle maps, showing known earthquake hazards. No official maps of earthquake fault zones have been published for any part of the Cadiz Project area. The nearest such maps that have been published are for parts of the Twentynine Palms area, approximately 40 miles southwest of the Cadiz Project site.

Future seismic activity in the Cadiz Project area would not be expected to have any impacts on the boundaries between individual groundwater basins or to create channels for movement of groundwater between basins.

Regional Seismicity

The principal seismic hazard in the Project area is the potential for ground shaking associated with large earthquakes on distant faults. Of these, the most important is the San Andreas fault zone, an active fault of regional significance located 65 miles southwest of the Cadiz Project area, well outside the area earlier shown on Figures 5.4-3 and 5.4-7. The timing of future large earthquakes on the San Andreas fault zone, which could cause strong ground shaking at the site, is unknown. However, considering that the average return interval for large to great (Magnitude 7 or greater) earthquakes on the south-central portion of the San Andreas fault zone is on the order of 140 years, and that the most recent such earthquake in this area occurred in 1837, the potential for strong, long duration ground shaking during the 50-year term of the Cadiz Project is evaluated as high.

The nearest other significant fault is the Ludlow fault zone, located 25 miles west of the Cadiz Project area (Howard & Miller 1992). The Ludlow fault zone is a major northwest trending structure, having a mapped length of over 50 miles. A portion of this strike length is shown on Figures 5.4-3 and 5.4-7. It is reported to have undergone a cumulative right lateral slip of over four miles. The Ludlow fault zone has displaced alluvium as young as late Pleistocene. In accordance with the definitions of the California Public Resources Code, this fault zone is considered to be potentially active. As shown in Figure 5.4-7, the Ludlow, Sheephole, Cleghorn Lakes and Cleghorn Pass fault zones appear to be associated with a relatively high amount of micro-seismic activity. However, none of these fault zones is classified as active, and none trends toward the Cadiz Project area.

In addition to the San Andreas fault zone, other regional fault zones that have been active in Holocene time (last 11,000 years) include the Bullion and Mesquite Lake fault zones. These faults are located 35 and 40 miles west of the Cadiz Project

area respectively, west of the area shown on Figures 5.4-3 and 5.4-7. The maximum probable earthquake magnitudes on these faults are estimated to be similar to those on the San Andreas fault zone (Magnitude 7.1), but the return interval for earthquakes on these faults is far greater, on the order of 5,000 years (Peterson and others, 1996). Therefore, the potential for a seismic event along these faults during the design life of the Cadiz Project is considered to be very low.

The Hector Mine Earthquake

The magnitude 7.1 Hector Mine earthquake of October 16, 1999 occurred on the Lavic Lake fault, a northwest-southeast trending zone located approximately 13 miles west of the Ludlow fault zone. The Hector Mine earthquake is reported to have triggered movement on the Bullion fault zone, which may be a southeastern extension of the Lavic Lake fault. Total surface rupture has been mapped for approximately 25 miles. Offset is estimated to be as much as 15 feet of right-lateral strike slip. This earthquake is considered to be one of the four largest to have occurred in Southern California this century.

The epicenter of the Hector Mine earthquake was located approximately 45 miles west of the Cadiz Project area, and the closest surface rupture was located approximately 35 miles southwest of the Cadiz Project area. Although the Cadiz Project is preliminarily estimated by the USGS to have been within the zone of 10% g (gravity) peak acceleration, no damage of any kind has been observed to any existing facilities in the area. These facilities include seven irrigation wells (several of which were operating at the time of the earthquake), production well PW-1 and the pilot spreading basin (one cell of which was in operation).

Site of Project Spreading Basins

Topography

The proposed location for the Project spreading basins is in Fenner Gap, located between the Marble and Ship mountains, as shown earlier in Figure 5.4-1. The site is located on alluvial fan deposits having a gentle slope toward the southwest of approximately one percent (50 feet/mile). Specific attention was given in the selection of this site to avoidance of major active washes which flow into and through Fenner Gap. Accordingly, the site will require relatively little protection from potential erosion during major storm events.

Geology and Soils

As described in greater detail later in Section 5.5 (Water Resources), the Quaternary alluvium at the Project spreading basin site was investigated by drilling seven shallow bore holes, eleven observation wells and a full-scale production well to test for the possible occurrence of continuous clay layers at depth. No clay layers were found as a result of this drilling. Such clay layers could impede the effectiveness of spreading imported Colorado River water at this site. The site was further tested by construction and operation of the pilot spreading basin, described later in Section 5.5 (Water Resources). The alluvium at the Project spreading basin site is locally underlain at depth by carbonate, quartzite and shale formations of Paleozoic age and granitic rock of Precambrian age.

According to mapping performed by the BLM (1982), the sensitivity of the soil to disturbance at the proposed site for the spreading basins is classified as moderate.

Faults and Seismicity

As described above, Fenner Gap is a structural half-graben, formed by a system of northeast trending, northwest dipping normal faults as shown earlier on Figures 5.4-4 and 5.4-5. The Paleozoic strata are steeply rotated between the faults, and dip at angles which range from approximately 25 to more than 80 degrees. These faults also displace and tilt volcanic rocks of mid- to late-Tertiary age to angles of approximately 25 degrees, indicating that some of the fault movement occurred after deposition of these volcanic rocks. However, none of these faults is known to displace Quaternary sediments, and accordingly, they are not considered to be either active or potentially active.

Site of Project Wellfield

Topography

The Project wellfield is located in Fenner Gap, between the Marble and Ship mountains, and on the broad alluvial fan down-gradient from the gap. The wellfield development area was shown earlier in Figure 5.4-1. This terrain is located on alluvial fan deposits having very gentle topography and a slope toward the southwest, which ranges between one and two percent (50 to 100 feet/mile). Specific well sites were selected to avoid major active washes, which flow through the area. Accordingly, the specific well sites will require relatively little protection from potential erosion during major storm events.

Geology and Soils

The Project wellfield will be located entirely on Quaternary alluvium, which has been tested by numerous bore holes, observation wells and by the long term pumping history of the seven irrigation wells operated by Cadiz Inc. The hydrological characteristics of the wellfield site are described in detail in Section 5.5 (Water Resources). The alluvium at the site is locally underlain at depth by carbonates, quartzite and shale of Paleozoic age and granitic rock of Precambrian age. Based on available geophysical data (including both gravity and seismic reflection surveys), the depth to bedrock underlying individual well sites ranges from approximately 800 feet to more than 3,000 feet.

According to mapping by the BLM (1982), the sensitivity of the soil to disturbance at the proposed site for the Project wellfield is classified as moderate.

Faults and Seismicity

As described above, Fenner Gap is a structural half-graben, formed by a system of northeast trending, northwest dipping normal faults as shown earlier in Figures 5.4-4 and 5.4-5. The Paleozoic strata are steeply rotated between the faults, and dip at angles which range from approximately 25 to more than 80 degrees. The faults also displace and tilt volcanic rocks of mid- to late-Tertiary age to angles of approximately 25 degrees, indicating that some of the fault movement occurred after deposition of these volcanic rocks. However, none of these faults is known to displace Quaternary sediments, and accordingly, they are not considered to be either active or potentially active.

Water Conveyance Facility Alignments

Eastern and Eastern/Canal Alternatives

Topography. The alignment of the Eastern and Eastern/Canal Alternatives originates at the Iron Mountain Pumping Plant and proceeds northeasterly around the southeast edge of the Iron Mountains. The alignment then proceeds northwest along the eastern flanks of the Iron Mountains and Kilbeck Hills (the western margin of the Danby Dry Lake depression) to Chubbuck Station on the ARZC line. From this point, the alignment proceeds northwesterly to a point west of the Ship Mountains, and then north to Fenner Gap and the Project spreading basins. This last segment of the water conveyance alignment is common to all alternatives.

Geology and Soils. The alignment of the Eastern and Eastern/Canal Alternatives traverses two geologic units: alluvium and dune sand. Dune sand is present near the south end of the alignment (where it curves northwesterly around the southeast portion of the Iron Mountains), approximately six miles northwest of this point (where the conveyance facilities come within one mile of the northwestern end of Danby Dry Lake), and three miles north of that point (where the alignment passes the east flank of the Kilbeck Hills). In all, approximately six miles of the 35-mile length of the Eastern Alternative traverses dune sand; the remainder is undifferentiated alluvium.

The Eastern and Eastern/Canal Alternatives originate in an area of high sensitivity to soil disturbance at the Iron Mountain Pumping Plant. From where the water conveyance facilities alignment turn from northeast to north in the area northeast of the Iron Mountain Pumping Plant, the balance of the alignment traverses soils of moderate sensitivity to disturbance.

Faults and Seismicity. The southern segment of the alignment for the Eastern and Eastern/Canal Alternatives parallels and is approximately one-half mile east of a fault located on the east side of the Iron Mountains as shown earlier on Figure 5.4-1. This fault, referred to as the Iron Mountains fault by Howard & Miller (1992), is reported to be of probable Pliocene age. Accordingly, it is not classified as either active or potentially active. Farther north, the Eastern Alternative crosses a projection of the Scanlon thrust fault, which is also not considered to be active or potentially active.

In the vicinity of Fenner Gap, the Eastern and Eastern/Canal Alternatives (along with the other alternative alignments) cross possible projections of the normal faults that formed the half-graben structure of Fenner Gap. However, as previously discussed, these faults are not known to displace Quaternary alluvium and are, accordingly, not considered to be either active or potentially active. Since the Eastern and Eastern/Canal alternatives generally parallel the overall northwest-southeast trend of the regional topography, it is considered unlikely that they cross any other significant fault zones.

Western Alternative

Topography. The alignment of the Western Alternative originates at the west end of the Iron Mountain Tunnel and proceeds north-northwesterly along the west side of the Iron Mountains and

Kilbeck Hills, gradually curving northeasterly to a point at the north end of the Kilbeck Hills, where it turns northwest along the ARZC line. From this point northward, the Western Alternative follows the alignment common to all four alternatives.

Geology and Soils. The Western Alternative traverses two geologic units: alluvium and dune sand. The alignment traverses dune sand from a point approximately two miles north of the Iron Mountain Tunnel to a point west of the central part of the Kilbeck Hills. In all, approximately 12 miles of the 35-mile length of the Western Alternative traverse dune sand; the remainder is undifferentiated alluvium.

The Western Alternative originates in an area of medium sensitivity to soil disturbance, and traverses areas of medium sensitivity to disturbance throughout its length, except west of the Kilbeck Hills where it traverses an area of low sensitivity for approximately four miles.

Faults and Seismicity. The southern reach of the Western Alternative parallels and is approximately one to two miles west of an unnamed north-trending fault that runs through the western flank of the Iron Mountains. The alignment also crosses an unnamed west-trending fault at the southern end of the Kilbeck Hills as shown earlier on Figure 5.4-1. Neither of these faults is mapped as displacing Quaternary alluvium and, accordingly, they are not considered to be either active or potentially active.

As described above, in the vicinity of Fenner Gap the common segment of all four alternatives crosses possible projections of the normal fault system that formed the half-graben structure of Fenner Gap. However, these faults are not known to displace Quaternary alluvium and are, accordingly, not considered to be either active or potentially active. Since the Western Alternative generally parallels the overall northwest-southeast trend of the regional topography, it is considered unlikely that it crosses any other significant fault zones.

Combination Alternative

Topography. The alignment of the Combination Alternative originates at the west end of the Iron Mountain Tunnel and proceeds north-northwesterly along the west side of the Iron Mountains, following the same alignment as the Western Alternative. However, south of the Kilbeck Hills, the Combination Alternative turns northeasterly through the gap between the Iron Mountains and Kilbeck Hills. It then proceeds northward along the alignment of the Eastern and Eastern/Canal Alternatives to a point along the ARZC line. From this point, the alignment follows the Eastern and Eastern/Canal Alternatives route northwesterly along the railroad line to a point west of the Ship Mountains, and then north to Fenner Gap and the Project spreading basin area.

Geology and Soils. The alignment of the Combination Alternative traverses two geologic units: alluvium and dune sand. The water conveyance facility alignment traverses dune sand from a point approximately two miles north of the Iron Mountain Tunnel to a point east of the central part of the Kilbeck Hills. In all, approximately 12 miles of the 35-mile length of the Combination Alternative are within undifferentiated alluvium. The

Combination Alternative traverses areas of medium soil sensitivity to disturbance throughout its length.

Faults and Seismicity. The southern segment of the Combination Alternative (also common to the Western Alternative) parallels and is approximately one to two miles west of an unnamed north-trending fault that runs through the western flank of the Iron Mountains. The alignment also crosses the unnamed west-trending fault at the southern end of the Kilbeck Hills. Neither of these faults is mapped as displacing Quaternary alluvium and, accordingly, they are not considered to be either active or potentially active.

As described above, in the vicinity of Fenner Gap the common segment of all four alternatives crosses possible projections of the normal fault system that formed the half-graben structure of Fenner Gap. These faults are not known to displace Quaternary alluvium and are, accordingly, not considered to be either active or potentially active. Since the Combination Alternative generally parallels the overall northwest-southeast trend of the regional topography, it is considered unlikely that it crosses any other significant fault zones.

5.4.2 THRESHOLDS OF SIGNIFICANCE

The proposed Cadiz Project facilities may be affected by the existing soil and geologic conditions along the proposed water conveyance alignments. For example, seismic shaking due to an earthquake on a nearby fault could cause structural damage to the water conveyance facilities, resulting in flooding and consequent erosion. The Cadiz Project may have the potential to affect the soil and other geologic formations within portions of the Project area. Examples of such potential impacts include soil erosion, land subsidence and changes in groundwater levels. These potential impacts are discussed in detail later in Section 5.5 (Water Resources).

Guidance for preparing the information contained in this section is provided by the California Division of Mines and Geology Note 46 (CDMG, 1975). This report, *Guidelines for Geologic/Seismic Considerations in Environmental Impact Reports*, provides a checklist of potential geologic problems that should be discussed in an EIR. According to Note 46, a project is considered to have a significant adverse impact if it would:

(a) Result in or expose people or structures to any of the following:

- **Earthquake Damage.** Fault movement, liquefaction, landslides, differential compaction/ seismic settlement, ground shaking, tsunami, seiche, seismically induced flooding;

- **Loss of Mineral Resources.** Loss of access, deposits covered by changed land use, zoning restrictions. These potential impacts are discussed later in Section 5.9 (Energy and Mineral Resources);

- **Waste Disposal Problems.** Change in groundwater levels (addressed in Section 5.5), disposal of excavated material, percolation of waste material;

- **Slope and/or Foundation Instability.** Landslides and

mudflows, unstable cut and fill slopes, collapsible and expansive soil, trench wall stability;

- **Erosion, Sedimentation, Flooding**. Erosion of graded areas, alteration of runoff, unprotected drainage ways, increased impervious surfaces;

- **Land Subsidence**. Due to extraction of groundwater, gas, oil, geothermal energy; hydro-compaction; and peat oxidation; and

- **Volcanic Hazards**. Lava flows, ash falls.

In addition, an impact of the Cadiz Project related to topography and landform was determined to be significant if it would:

(a) Remove or substantially alter a special or unique topographic feature on the site;

(b) Result in substantial landform alteration (cuts or fills more of 50 feet or more); and

(c) Conflict with Elements of the County General Plan and supporting documentation, specifically regarding special and unique topographic features.

5.4.3 METHODOLOGY

This analysis of potential impacts of the Cadiz Project related to topography, geology, seismicity and soils is based on a review of published and other available reports concerning the geology, soils, groundwater and seismicity of the Cadiz Project area. These reports are cited in the text and are listed in Section 14.0 (References).

5.4.4 IMPACTS

The design and construction of the Cadiz Project would conform to standard engineering and construction procedures (i.e. standard design requirements of Metropolitan and requirements of the Uniform Building Code).

Of the potential geologic impacts outlined above, the following do not apply to the Cadiz Project area and are not considered further in this document.

Landslides

The Project wellfield and Project spreading basins are located on gently sloping terrain. The four alternative water conveyance alignments also traverse areas of gently sloping topography. Cadiz Project construction would not involve significant alteration of land surface gradients. Therefore, construction of the Cadiz Project facilities would be unlikely to result in conditions that could trigger landslides. Although steeper slopes are present in mountainous areas, topographically higher than the alignments, the mountains consist largely of crystalline rocks that are not typically prone to landsliding. Further, no landslides have been documented in the mountains adjoining the Cadiz Project area. Strong ground shaking from earthquakes on nearby faults could cause rock instabilities (i.e. rock falls, rock toppling) in the mountainous areas. However, because the pipelines would be buried and the Cadiz Project facilities would be sufficiently distant from the mountainous areas, they are not considered to be at risk.

Sand Flow

The Project spreading basins could conceivably interrupt the movement of windblown sand and affect the formation of sand dunes such as those found adjacent to Cadiz and Danby dry lakes. However, the prevailing winds in the Cadiz Project area are westerly, and the Project spreading basins are located approximately six miles north of the sand dunes, at the northern and eastern margins of Cadiz Dry Lake. Consequently, the potential for impact to any sand dunes in or adjacent to the Cadiz Project area is very remote.

Tsunami/Seiche

Since the Cadiz Project area is located far from any oceans or permanent lakes, there is no potential for tsunamis or seiches in the Cadiz Project area.

Percolation of Waste Material

Since excavation for the Cadiz Project facilities will occur in natural soils only, and since the excavated material will be backfilled into the trenches or spread along the pipeline reaches and revegetated after construction, there is no potential for percolation of any environmentally harmful material from the excavated soils. Water that may be generated from possible dewatering operations would be disposed of by percolation and/or evaporation. Such water could also be used for moisture-conditioning of soils to be placed as trench backfill. In any event, water disposal, if needed, would be performed according to construction dewatering regulatory and permit requirements. As a result, any potential impact associated with disposal of waste water during construction is not considered significant.

Increased Impervious Surfaces

No construction of impervious surfaces of substantial size is proposed under the Cadiz Project alternatives. Only the small pump stations, small well sites and electrical substations involve impermeable surface coverage. Therefore, the impervious surfaces that would be constructed would be insufficient in size to significantly impact percolation of surface waters into the subsurface.

Volcanic Hazards

Amboy Crater, located 17 miles west of Fenner Gap, is a volcanic cinder cone that has been dated as less than 10,000 years old. No historic volcanic activity is known in the eastern Mojave Desert, and the likelihood of a volcanic eruption during the operational life of the Cadiz Project is very low. In the event that an eruption at, for example, Amboy Crater resulted in an ash fall at the Cadiz Project site, ash deposited in the Project spreading basins would be removed through normal basin maintenance and the buried pipelines would be unaffected.

The following discussion analyzes the potential geologic impacts that could occur from implementation of the Cadiz Project. This discussion is organized by Cadiz Project alternative alignment, with each type of impact addressed for each alternative.

Eastern and Eastern/Canal Alternatives

Topography

The Project spreading basins will be constructed along the natural surface gradient with the excavated soil used to construct the berms. No importation of soil or deep excavation of native material is expected. Therefore, no significant impacts to topography would occur under these alternatives.

Long-term effects on topography would occur if the Project wellfield or water conveyance facilities entailed excavation in areas of bedrock outcrops. However, construction of the Eastern or Eastern/ Canal Alternatives would not be expected to involve such excavation. Wellfield construction requires minor surface modification and no significant impacts to topography would occur.

Faults and Seismicity

The possibility exists that the Project spreading basins could be damaged in the event of a major earthquake on a nearby fault. Liquefaction, differential settlement and hydrocompaction are associated risks. However, any such damage would depend to a large degree on the magnitude of the event and the distance of the earthquake epicenter from the Cadiz Project area. No known active or potentially active faults underlie the Cadiz Project site. Rupture of the Project spreading basins during a seismic event could result in surface spillage of water, with the potential for localized flooding and erosion. This potential impact could occur only during spreading operations. Water would typically be only one to two feet deep and inflow to the basins would be shut off after a large magnitude event. As a result, impacts would be less than significant.

The Project wellfield and wellfield manifold pipeline could be damaged in the event of a major earthquake. If this should occur during wellfield operations, the wellfield operations would be shutdown for repairs. No significant impacts would occur.

The possibility also exists that the water conveyance facilities could be damaged in the event of a major earthquake. Liquefaction, differential settlement and ground movement are the anticipated risks, and pipelines are potentially susceptible to damage. Pipeline rupture during a seismic event could result in underground and surface spillage of water, with the potential for localized flooding, soil saturation and mudflows, depending on where a rupture occurred and the characteristics of the local geological formations. This potential could occur only during the spreading and withdrawal operations. Such operations would be suspended and facilities inspected after a large magnitude event. The pipeline will be designed to avoid and minimize the potential for these impacts. Therefore, no significant impacts would occur.

Liquefaction

Standards for the evaluation of hazards associated with seismically-induced soil liquefaction are provided by the CDMG (Special Publication 117, 1997). The soils in the Cadiz Project area, including sand and silt, include types potentially susceptible to liquefaction. However, indicators of a low potential for liquefaction include the presence of

bedrock near the surface and the occurrence of groundwater at a depth greater than 30 feet which is generally the case throughout the Cadiz Project area. Liquefaction could occur in the vicinity of the Project spreading basins in the event that groundwater mounding were to rise to within approximately 30 feet of the ground surface. This potential impact will be reduced to a less than significant level with implementation of mitigation measure G-2. Liquefaction is addressed in further detail later in Section 5.5 (Water Resources) and by mitigation measure WR-1, the Groundwater Management Plan.

Local areas of shallow groundwater may exist where the alignment of the water conveyance facilities for the Eastern and Eastern/Canal alternatives pass in close proximity to Danby Dry Lake. This is the only segment of the water conveyance facilities alignment that has a significant risk of liquefaction. Mitigation will reduce this risk to a level of insignificance.

Soils

Project Spreading Basins. No expansive soils have been observed in proximity to the Project spreading basin. However, the alluvial soils at this site are considered potentially susceptible to hydro-compaction. For this reason during construction of the pilot spreading basins, survey benchmarks were installed to identify and monitor any hydrocompaction that might occur as a result of the pilot test. To date, no hydrocompaction has been detected. Any hydrocompaction that may occur during operation of the Project spreading basins would be reduced to a level of insignificance by the appropriate design and construction of the spreading basins.

Project Wellfield. Soil impacts for the Project wellfield and manifold pipeline would be short term in nature, as the material excavated for the cut-and-cover trench would be suitable for backfilling the manifold trench, and would be replaced to cover the pipeline while maintaining the soil profiles. Short duration effects to disturbed soils are predicted and are described below. Excess materials from well drilling would be disposed of around each well.

Based on all available geological data, expansive soils are considered unlikely to be present in the vicinity of the Project wellfield and manifold pipeline. However, some soils in proximity to the wellfield and manifold may have a reasonably high potential of being susceptible to hydrocompaction if saturated by water. The risk that the wellfield or manifold pipeline could introduce water into this soil and trigger hydrocompaction is evaluated as low, and impacts would be less than significant.

Water Conveyance Facilities. Soil impacts for the water conveyance facilities for the Eastern and Eastern/ Canal alternatives would be short term in nature, as the material excavated for the cut-and-cover trench would be suitable for backfilling the trench, and would be replaced to cover the pipeline while maintaining the soil profiles. Short duration effects to disturbed soils are predicted as described below.

Along the water conveyance facility, approximately 181,000 cubic yards of excavated material would be spread over the permanent right-of-way, to a depth of

approximately four inches along the alignment. No soil disposal sites are anticipated for the other Cadiz Project facilities.

Since the water conveyance facilities for the Eastern and Eastern/Canal Alternatives cross two areas where rock could be encountered (i.e., areas are northeast of the Iron Mountain Pumping Plant and north of the Kilbeck Hills near Chubbuck Station), some ripping or blasting could be required.

Based on published and other available geologic and soil mapping, expansive soils are considered unlikely to be present along the water conveyance alignments. However, Project area soils have a reasonably high potential of being susceptible to hydrocompaction when saturated with water. Design phase investigations will identify whether or not there is a potential for hydrocompaction along the Eastern and Eastern/Canal alternatives and will identify appropriate design features to address this issue, if needed. In the case of the Eastern Alternative, because the water will be conveyed via pipeline, as opposed to conveyance by a canal, the potential for the Project pipeline to introduce water into the soil and trigger hydrocompaction is considered to be very low. For the Eastern/Canal Alternative, the potential for leakage into the underlying soil and the resulting risk of hydrocompaction is considered greater. Appropriate design and construction measures would be necessary, as required by mitigation measure G-3, described later in this section. Therefore, impacts would be less than significant.

Slope Stability

Project Spreading Basins. The Project spreading basins would be constructed with berms formed from material excavated from the adjacent basins. This is expected to result in balanced cut-and-fill over the entire spreading basin facility. This design objective has been tested in the pilot spreading basin test with excellent results. Although precautions would be required to minimize and mitigate erosion of the berms due to wave action in the basins during spreading operations, no permanent instabilities are anticipated due to the low angles of the slopes and the compaction of the berms during construction. Commonly accepted construction practices would mitigate the potential for impacts due to berm stability to a level of less than significant.

No permanent cut or fill slopes are planned for the project wellfield or pipeline conveyance facilities.

The Eastern/Canal Alternative would involve construction of a permanent excavation along the canal segment of the alignment. In this case, specific design studies and commonly accepted construction practices would mitigate the potential for stability impacts related to the canal excavation to a level of less than significant.

Erosion

Project Spreading Basins. Special attention would be given during design and construction of the Project spreading basin to mitigate any increased risk of soil erosion. No significant impacts would occur.

Project Wellfield. Grading for construction of the Project wellfield and manifold pipeline would be limited to the conveyance facility and adjacent access roads. After the manifold pipelines were installed, the trench would be backfilled with compacted fill, and excess soil from the pipeline trench would be placed as a thin compacted fill along the alignment. As a result, the disturbed soils would be left in a compacted, recontoured state, and would not be substantially more susceptible to erosion than existing native soils. Therefore, no significant impact would occur.

Water Conveyance Facilities. Grading for the water conveyance facilities for the Eastern and Eastern/Canal Alternatives would be limited to the pipe and canal excavation and an adjacent access road. After the pipe is installed, the trench would be backfilled with compacted fill, and excess soil from the pipeline trench would be moisture conditioned, as appropriate, and placed as a thin compacted fill along the alignment. As a result, the disturbed soils would be left in a compacted, recontoured state, and would not be substantially more susceptible to erosion than existing native soils. Therefore, no significant impact would occur.

Drainage and Flooding

Project Spreading Basins. The Project spreading basins have been specifically located to avoid all major natural drainages into and through Fenner Gap. Additional precautions would be taken during final design and construction to provide protection of the spreading basins from storm flow on minor drainages in the area. Accordingly, no significant erosion would result from construction or operation of the Project spreading basins.

Periodic flash flooding occurs in desert regions as the result of heavy rainfall in upland areas. Because the Project spreading basin facilities have been located outside of major drainages, any periodic flash flooding in the Project area would not result in significant impact.

Project Wellfield. Grading for the Project wellfield and manifold pipeline would not create new drainages. However, there is potential for erosion at locations where the manifold pipelines cross ephemeral streams, and erosion protection at such crossings may be required. Design studies will be performed to evaluate the potential need for erosion control.

Because the individual well sites would be above ground level and the manifold pipelines would have adequate burial, periodic flash flooding in the Cadiz Project area would not have a significant impact on these facilities.

Water Conveyance Facilities. Grading for the water conveyance facilities would not create new drainages. However, there is potential for erosion at locations where the water conveyance facility crosses ephemeral arroyos. Based on the depth of pipeline burial, erosion protection along existing arroyos may be required for the Eastern Alternative. Detailed design studies would be prepared in conjunction with final project design to evaluate the potential need for erosion protection of water conveyance facilities where the Eastern and Eastern/Canal alternatives cross arroyos.

Because the water conveyance facility would have adequate burial, periodic flash flooding in the Cadiz Project area would not create a potential impact. Design studies will be needed to evaluate the use of alternative structures where the Eastern and Eastern/Canal alternatives cross arroyos.

Sedimentation

Project Spreading Basins. The rate of natural sedimentation in proximity to the Project spreading basins is very slow and it is not expected to be substantially changed by construction or operation of the Project spreading basin facilities. Although the Project spreading basins would collect windblown dust and other debris over time, these materials would be removed during routine maintenance and spread in adjacent areas or on the basin berms. Therefore, the potential for accumulation of sedimentation would not result in a significant impact under these alternatives.

Project Wellfield. The rate of sedimentation in the vicinity of the Project wellfield and manifold pipeline is estimated to be slow and would not be substantially changed by Cadiz Project construction or operation. Therefore, no significant impact would occur.

Water Conveyance Facilities. The rate of sedimentation along the water conveyance facility is estimated to be slow and it is not anticipated to be substantially changed by Cadiz Project construction. Therefore, the potential for accumulation of sedimentation over the pipeline would not be an impact to the Cadiz Project.

Subsidence

Project Spreading Basins. Ground surface subsidence may occur as the result of the extraction of groundwater and is a potential concern in the Project area, if thick lenses of clay are dewatered. Due to the planned extraction of groundwater during Project withdrawal operations, subsidence does pose a potential concern for parts of the Project area in the immediate vicinity of the Project wellfield. Because no susceptible clay lenses would be dewatered during construction or operation of the Project spreading basins, subsidence would not be expected to occur as a result of spreading operations. This topic is addressed in greater detail later in Section 5.5 (Water Resources) and by mitigation measure WR-1, the Groundwater Management and Monitoring Plan.

Project Wellfield. Ground surface subsidence as the result of extraction of groundwater is a potential concern within portions of the Project wellfield, if thick lenses of clay are dewatered. Due to the planned extraction of groundwater during Project withdrawal operations, subsidence does pose a potential concern in the Project area. This risk is greatest in the western parts of the wellfield, were relatively fine-grained sediments occur at depth below the water table. This topic is addressed in greater detail in Section 5.5 (Water Resources), and by mitigation measure WR-1, the Groundwater Management and Monitoring Plan.

Water Conveyance Facilities. Soil subsidence as the result of large-scale withdrawal of groundwater is a potential

concern in desert areas, if thick lenses of clay are dewatered. Large-scale extraction of groundwater is not expected as part of the water conveyance facility construction and, accordingly, no risk of subsidence would occur under these alterantives.

Western Alternative

Topography

Project Spreading Basins and Project Wellfield. Similar to the Eastern and Eastern/Canal Alternatives, the impacts of the Project spreading basins and Project wellfield under the Western Alternative on topography would not be significant.

Water Conveyance Facilities. Long term effects on topography would occur if the Cadiz Project entailed excavation in areas of bedrock outcrops. However, the Western Alternative alignment for the water conveyance facility is not anticipated to involve such excavation. Therefore, no significant impacts to topography are anticipated.

Faults and Seismicity

The possibility exists that the Project spreading basins, Project wellfield and/or the water conveyance facility could be damaged in the event of a major earthquake. However, the Western Alternative does not have any geological characteristics that differ substantially from the Eastern Alternative as discussed earlier in Section 5.4.4. Accordingly, no differences in relative risk would occur.

Liquefaction

Project Spreading Basins and Project Wellfield. The Project spreading basins and Project wellfield, similar to the Eastern and Eastern/Canal Alternatives, are potentially susceptible to liquefaction. This potential impact will be reduced to a less than significant level with implementation of mitigation measure G-2. Liquefaction is discussed in more detail in Section 5.5 (Water Resources) and is addressed by mitigation measure WR-1, the Groundwater Management and Monitoring Plan.

Water Conveyance Facilities. Unlike the Eastern Alternative discussed earlier, the water conveyance facilities for the Western Alternative do not cross any geological terrain underlain by shallow groundwater. Therefore, the risk of liquefaction in the event of a major seismic event is not considered significant for the Western Alternative.

Soils

Project Spreading Basins and Project Wellfield. The soils impacts for the Project spreading basins and Project wellfield are the same for the Western Alternative as for the Eastern and Eastern/ Canal alternatives.

Water Conveyance Facilities. Soil impacts for the water conveyance facilities in the Western Alternative would be short-term, as the material excavated for the cut-and-cover trench would be suitable for backfilling the trench, and would be replaced to cover the pipeline while maintaining the soil profiles. Short-duration effects to disturbed soils are predicted. Except for a higher incidence of dune sand along the alignment of the Western Alternative, the Western Alternative does not differ substantially in any geological characteristics from the Eastern Alternative discussed earlier.

Since the Western Alternative water conveyance facility does not cross any bedrock outcrops, no blasting is anticipated at this time. However, the conveyance facility does cross one area, on the west side of the Kilbeck Hills, where harder than normal materials may be encountered. It is anticipated that standard excavation equipment would be able to excavate the trench in this area. However, some ripping and blasting may possibly be required.

Expansive and Compressible Soils

Project Spreading Basins and Project Wellfield. The Project spreading basins and Project wellfield for the Western Alternative are the same as for the Eastern and Eastern/Canal alternatives. Therefore, their potential impacts to and from expansive and compressible soils would be the same.

Water Conveyance Facilities. Based on published geologic and soil mapping, expansive soils are considered unlikely to be present along the water conveyance facility for the Western Alternative. The Western Alternative does not have any geological or soils characteristics that differ substantially from the Eastern Alternative discussed above.

Slopes and Trench Wall Stability

Project Spreading Basins and Project Wellfield. The impact of the Project spreading basins and Project wellfield on slopes would be the same for the Western Alternative as described earlier for the Eastern and Eastern/Canal alternatives.

Water Conveyance Facilities. No permanent cut slopes are planned for the water conveyance facilities, and fills placed to dispose of excess trench excavation materials would be thin, resulting in gentle slopes. Therefore, no potential slope stability hazards are anticipated for permanent slopes under the Western Alternative. Design studies would be needed to evaluate appropriate construction techniques within the dune sand portions of the alignment, as required by mitigation measure G-3 described later in this section.

Erosion

Project Spreading Basins and Project Wellfield. Erosion impacts for the Project spreading basins and Project wellfield under the Western Alternative would be the same as for the Eastern and Eastern/Canal alternatives.

Water Conveyance Facilities. Grading for the Western Alternative water conveyance facility would be limited to the pipeline trench and the adjacent access road. After the pipeline is installed, the trench would be backfilled with compacted fill, and excess soil from the pipeline trench would be moisture conditioned, as appropriate, and placed as a thin compacted fill along the alignment. As a result, the disturbed soils would be left in a compacted, recontoured state, and would not be substantially more susceptible to erosion than existing native soils.

Drainage and Flooding

Project Spreading Basins and Project Wellfield. The impact of the Project spreading basins and Project wellfield on drainage and flooding would be the same as for the Eastern and Eastern/Canal alternatives.

Water Conveyance Facilities. Grading for the water conveyance facility would not create new drainages. However, there is potential for erosion at locations where the pipeline alignment crosses ephemeral arroyos. Based on the depth of pipeline burial, erosion protection along existing arroyos may be required. Design studies will be needed to evaluate the potential need for erosion control where the conveyance facility crosses arroyos.

Periodic flash flooding occurs in desert regions as the result of heavy rainfall in upland areas. Because the pipeline would have adequate burial, periodic flash flooding in the Cadiz Project area would not create a potential impact under the Western Alternative.

Sedimentation

Project Spreading Basins and Project Wellfield. The impact of the Project spreading basins and the Project wellfield on sedimentation would be the same as for the Eastern and Eastern/Canal alternatives.

Water Conveyance Facilities. The rate of sedimentation along the water conveyance facility route is estimated to be slow, and is not anticipated to be significantly changed by Cadiz Project construction. Therefore, the potential for accumulation of sediment over the pipeline would not be an impact to the Western Alternative.

Subsidence

Project Spreading Basins and Project Wellfield. The impact of the Project spreading basins and Project wellfield on subsidence would be the same as for the Eastern and Eastern/Canal alternatives. As with these other alternatives, due to the planned extraction of groundwater during Cadiz Project operations, subsidence does pose a potential concern for parts of the Cadiz Project area underlying and surrounding the Project wellfield. This topic is addressed in Section 5.5 (Water Resources) and by mitigation measure WR-1, the Groundwater Management and Monitoring Plan.

Water Conveyance Facilities. As described earlier for the Eastern Alternative, no risk of subsidence would occur as a result of the water conveyance facility construction.

Combination Alternative

Topography

Project Spreading Basins and Project Wellfield. The impacts of the Project spreading basins and the Project wellfield for the Combination Alternative would be the same as for the Eastern, Eastern/Canal and Western alternatives.

Water Conveyance Facilities. Long-term effects on topography would occur if the water conveyance facilities entailed excavation in areas of bedrock outcrops. However, the Combination Alternative would not be expected to involve such excavation. Therefore, no significant impacts to topography would occur under the Combination Alternative.

Faults and Seismicity

The possibility exists that the Project spreading basins, Project wellfield and/or the water conveyance facility could be damaged in the event of a major earthquake. However, the Combination Alternative does not have any geological characteristics that differ substantially

from the other alternatives discussed above. Accordingly, no differences in relative risk are anticipated.

Liquefaction

Project Spreading Basins and Project Wellfield. Similar to the other three Alternatives discussed above, the Project spreading basins and Project wellfield would be potentially susceptible to liquefaction. This potential impact will be reduced to a less than significant level with implementation of mitigation measure G-2. Liquefaction is discussed in more detail in Section 5.5 (Water Resources) and by mitigation measure WR-1, the Groundwater Management and Monitoring Plan.

Water Conveyance Facilities. Unlike the Eastern Alternative discussed above, the water conveyance facility for the Combination Alternative would not cross any geological terrain underlain by shallow groundwater. Accordingly, the risk of liquefaction in the event of a major seismic event is not considered significant under the Combination Alternative.

Soils

Project Spreading Basins and Project Wellfield. The soils impacts for the Project spreading basins and Project wellfield would be the same for the Combination Alternative as for the Eastern, Eastern/Canal and Western alternatives.

Water Conveyance Facilities. Soil impacts for the water conveyance facility for the Combination Alternative would be short term, as the material excavated for the water conveyance facility would be suitable for backfilling the trench, and would be replaced to cover the pipeline while maintaining the soil profiles. Short-duration effects to disturbed soils are predicted. The Combination Alternative does not differ substantially in any geological characteristics from the three alternatives discussed above.

Expansive and Compressible Soils

Project Spreading Basins and Project Wellfield. The Project spreading basins and Project wellfield for the Combination Alternative would have the same impacts related to expansive and compressible soils as the Eastern, Eastern/Canal and Western alternatives.

Water Conveyance Facilities. Based on published geologic and soils mapping, expansive soils are considered unlikely to be present along the water conveyance facility for the Combination Alternative. This Alternative does not have any geological characteristics that differ substantially from the Alternatives discussed above.

Slope Stability

Project Spreading Basins and Project Wellfield. The impacts of the Project spreading basins and Project wellfield on slopes would be the same as for the Eastern, Eastern/Canal and Western alternatives.

Water Conveyance Facilities. No permanent cut slopes are planned for the water conveyance facility and fills placed to dispose of excess trench excavation materials would be thin, resulting in gentle slopes. Therefore, no potential slope stability hazards would occur for permanent slopes under the Combination Alternative.

Erosion

Project Spreading Basins and Project Wellfield. The impacts of the Project spreading basins and Project wellfield on erosion under the Combination Alternative would be the same as for the Eastern, Eastern/Canal and Western alternatives.

Water Conveyance Facilities. Grading for the Combination Alternative water conveyance facility would be limited to the pipeline trench and to an adjacent access road. After the pipeline was installed, the trench would be backfilled with compacted fill, and excess soil from the pipeline trench would be moisture conditioned, as appropriate, and placed as a thin compacted fill along the conveyance facility. As a result, the disturbed soils would be left in a compacted, recontoured state and would not be substantially more susceptible to erosion than existing native soils. Therefore, no significant impact would occur.

Drainage and Flooding

Project Spreading Basins and Project Wellfield. The impact of the Project spreading basins and Project wellfield on drainage and flooding would be the same for the Combination Alternative as for the Eastern, Eastern/Canal and Western alternatives.

Water Conveyance Facilities. Grading for Combination Alternative water conveyance facility construction would not create new drainages. However, there is potential for erosion at locations where the water conveyance facility crosses ephemeral arroyos. Based on the depth of pipeline burial, erosion protection along existing arroyos may be required. Design studies would be needed to evaluate the potential need for erosion protection where the water conveyance facility crosses arroyos.

Periodic flash flooding occurs in desert regions as the result of heavy rainfall in upland areas. Because the water conveyance facility would have adequate burial, periodic flash flooding in the Cadiz Project area would not create a significant impact under the Combination Alternative.

Sedimentation

Project Spreading Basins and Project Wellfield. The impact of the Project spreading basins and the Project wellfield on sedimentation would be the same as for the Eastern, Eastern/Canal and Western alternatives.

Water Conveyance Facilities. The rate of sedimentation along the water conveyance facility route is estimated to be slow and would not be significantly changed by Project construction. Therefore, the potential for accumulation of sediment over the conveyance facility would not be an impact to the Combination Alternative.

Subsidence

Project Spreading Basins and Project Wellfield. The impact of the Project spreading basins and Project wellfield on subsidence will be the same as for the Eastern, Eastern/Canal and Western alternatives. As with those alternatives, due to the planned extraction of groundwater during Cadiz Project operations, subsidence does pose a potential concern for portions of the Cadiz Project area underlying and surrounding

the Project wellfield. Subsidence is addressed in Section 5.5 (Water Resources) and by mitigation measure WR-1, the Groundwater Management and Monitoring Plan.

Water Conveyance Facilities. As described earlier for the Eastern and Eastern/Canal alternatives, no risk of subsidence would occur as a result of the water conveyance facility construction on the Combination Alternative.

No Project

Under the No Project Alternative, the land would be left in its natural state and no modifications would be made. The site would, therefore, continue to be subject to natural, baseline processes of erosion, flooding, drainage, liquefaction and other impacts discussed above.

5.4.5 MITIGATION MEASURES

G-1 Seismicity. Final Cadiz Project design will incorporate appropriate facilities and operational procedures to minimize potential impacts due to seismic events and water discharge due to earthquake-related damage. Design measures will include ensuring that all the structures associated with the Cadiz Project, including the water conveyance facility and wellfield manifold, be designed and constructed in compliance with current engineering practices including the Uniform Building Code and all applicable seismic engineering guidelines.

G-2 Liquefaction. Detailed final design studies will be prepared to document the actual soil conditions and groundwater depths along the water conveyance facility and wellfield manifold so that the liquefaction potential, if any, is documented and assure the final design is appropriate.

G-3 Slope and Foundation Instability. Commonly accepted design and construction practices, in accordance with applicable building codes and regulations, will be implemented to reduce potential impacts to non-significant levels. For example, where groundwater may be locally encountered along the pipeline alignment, commonly accepted construction dewatering methods (i.e. sumps, well points, shallow pumping wells) may be employed to temporarily lower water levels for ease of construction.

G-4 Erosion, Sedimentation and Flooding. Commonly accepted design and construction practices, in accordance with applicable building codes and regulations, will be implemented to reduce potential impacts to non-significant levels. For example, the conveyance pipeline and wellfield manifold pipelines would be buried at a depth sufficient to protect them from minor erosion that may occur. Also, backfill in the pipeline trench would be compacted and recontoured to mitigate the potential for increased rates of erosion along the pipeline easement.

5.4.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Seismicity. Appropriate design measures would minimize the potential impact to the Cadiz Project facilities from seismic events. Such impacts cannot be completely eliminated but they would be reduced to below a level of significance.

Liquefaction. Available information indicates that the potential for soil liquefaction along the alternative conveyance alignments is limited to a specific reach adjacent to Danby Dry Lake. Appropriate design measures would reduce this potential impact to below a level of significance.

Slope and Foundation Instability. Appropriate design and construction measures would reduce the potential impacts associated with instability to below a level of significance.

Erosion, Sedimentation and Flooding. Appropriate design and construction measures would decrease the potential impacts associated with these concerns to below a level of significance.

5.5 WATER RESOURCES

5.5.1 AFFECTED ENVIRONMENT

Cadiz Inc. currently owns more than 27,000 acres in the Cadiz and Fenner valleys as shown in Figure 5.5-1. To date, approximately 1,600 acres of this land have been developed for vineyards, citrus orchards and various types of row crops. Seven groundwater production wells were installed between 1984 and 1994 to provide irrigation for the agricultural operation.

Physiography and Topography

Watersheds in the vicinity of the Cadiz Project include Fenner Valley and the Bristol and Cadiz dry lake depressions. Watersheds surrounding the Fenner Valley and Bristol and Cadiz dry lake depressions drain away from the Cadiz Project area, as shown on Figure 5.5-1.

The Fenner Valley watershed includes all of Fenner Valley and approximately the southern third of Lanfair Valley. The boundaries of this watershed are defined by the Marble and Providence mountains on the west, the New York and Providence mountains on the north, the Piute Range on the northeast, and the Old Woman and Ship mountains on the east. The Clipper Mountains, which reach elevations of over 4,600 feet, occur entirely within the Fenner Valley watershed. Elevations within this watershed range from a high of approximately 7,500 feet in the New York Mountains to a low of around 900 feet in Fenner Gap. Fenner Gap, which forms the surface and groundwater drainage outlet of the Fenner Valley watershed, is located between the Marble and Ship mountains.

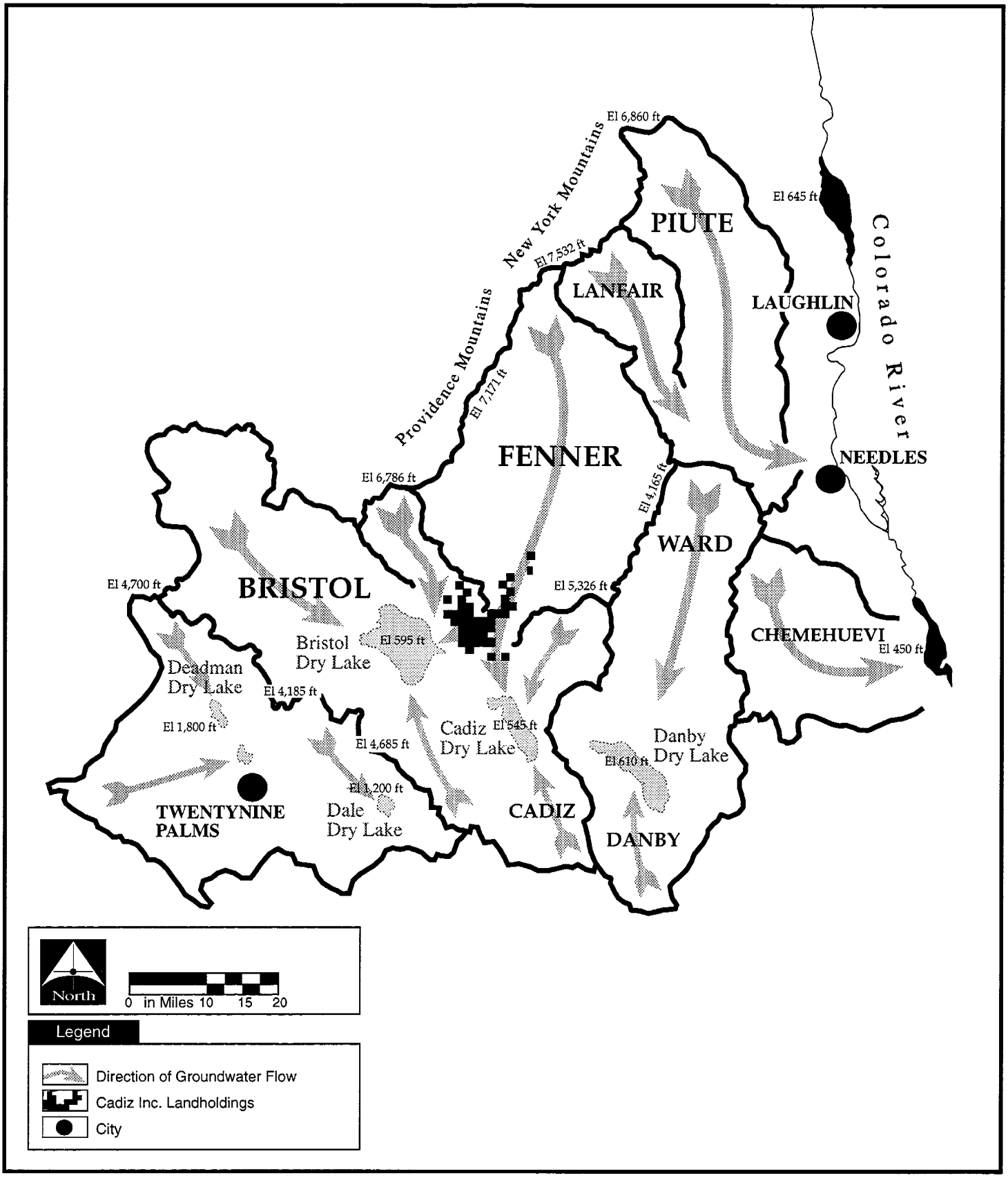
Immediately southwest of Fenner Valley and Fenner Gap are the Bristol and Cadiz dry lake depressions. Together they form a relatively continuous lowland that extends from near the town of Ludlow on the northwest to a topographic divide between the Coxcomb and Iron mountains on the southeast. These depressions are bounded on the southwest by the Bullion, Sheephole, Calumet and Coxcomb mountains, and on the northeast by the Bristol, Marble, Ship, Old Woman and Iron mountains. The Bristol and Cadiz depressions are separated only by a low topographic and surface drainage divide. Two dry lakes, Bristol to the northwest and Cadiz to the southeast, have formed at two low points (595 and 545 feet, respectively) on either side of this divide.

Climate

The eastern Mojave Desert is characterized by a desert climate with low annual precipitation, low humidity and relatively high temperatures. Winters are mild and summers are hot, with a relatively large range in daily temperatures. Temperature and precipitation vary greatly with altitude, with lower temperatures and higher quantities of precipitation in the higher elevations.

Regional Weather Patterns

The seasonal weather patterns of the eastern Mojave Desert region are primarily controlled by semi-permanent high and low pressure systems located over North America and the Pacific Ocean (Houghton & others 1975). During the summer months, a semi-permanent high pressure cell (the Pacific High), centered over the north Pacific about 1,600 miles



Source: Geoscience Support Services, Inc. (1999).

Figure 5.5-1

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Watersheds of the Eastern Mojave Desert

west of the California coast, diverts low-pressure, moisture-carrying weather systems north of California. The Pacific High contracts and moves southward during the winter months, allowing storms to cross California. Another semi-permanent high-pressure cell (the Great Basin High) is centered over southern Idaho during the winter months and deflects cold Canadian low-pressure weather cells to the east of the Cadiz Project area (Houghton & others 1975). During the summer months, a seasonal low-pressure weather cell (the California Low) develops over the Cadiz Project area as a result of intense surface heating (Houghton & others 1975).

Temperature

Air temperature in the eastern Mojave Desert region follows a normal pattern of high summer and low winter readings. Daily patterns are also typical, with temperatures dropping to an early morning low, climbing to a mid-afternoon high, before falling again to the next morning's low temperature (US Ecology 1989). Summers are hot and winters are mild. During the winter, the Great Basin High protects the region from cold Canadian air flows, typically keeping temperatures above freezing, except at the highest elevations. Average temperatures fall as elevation increases.

The average winter temperature for the eastern Mojave Desert region is between 50 and 55 degrees Fahrenheit (F), with the average daily maximum near 65 degrees F and the average daily minimum near 40 degrees F (US Ecology 1989). The highest temperatures occur during the summer months, when the average daily temperature is over 85 degrees F. Average daily maximum temperatures in the summer months are typically around 100 degrees F, although temperatures in excess of 120 degrees F are not unusual. Average daily minimum temperatures during the summer months are around 70 degrees F (US Ecology 1989). The daily temperature range (daily maximum minus daily minimum) is generally 20 to 30 degrees F. This range is greater during the summer months than during the winter months (Thompson 1929).

Precipitation

Most of the precipitation in the eastern Mojave Desert occurs during the winter months of November through March (Thompson 1929). However, the frequency and intensity of rainfall from year to year is unpredictable.

Winter rainfall occurs in events lasting several hours to a day or more. These winter events are typically the result of frontal weather conditions and rainfall during such events is more or less steady. In the higher mountains, snow frequently accumulates. An average of 20 to 30 frontal systems move through the region each winter (Houghton & others 1975; California Air Resources Board (CARB) 1975). However, most of these systems are relatively weak by the time they reach the Cadiz Project area (CARB 1975).

Evaporation Rates

Monthly pan evaporation rates at the Amboy weather station range from approximately five inches per month in December and January to more than 22 inches per month in July, with an average annual pan evaporation of 158 inches. Average monthly pan evaporation rates at

the Iron Mountain Pumping Plant range from approximately four inches per month in December to almost 17 inches per month in July, with an annual average of 119 inches.

Local Weather Patterns

More detailed information is available for local weather patterns. There are two weather stations located in proximity to the Project area. Amboy station is located on the margin of Bristol Dry Lake at an elevation of 625 feet. Mitchell Caverns station is located on the flank of the Providence Mountains just north of Clipper Valley, at an elevation of 4,330 feet.

Temperature

The average, maximum and minimum monthly temperatures for these weather stations are shown in Table 5.5-1. Because of the higher elevation of Mitchell Caverns (4,330 feet), the average annual temperature is around 60 degrees F. The floor of Fenner Valley ranges from approximately 1,000 to 3,500 feet, and for this reason the valley's average annual temperature is a few degrees higher than that of Lanfair Valley (Freiwald 1984). The average temperature at Amboy is slightly higher than that of Fenner Valley due to its lower elevation (625 feet).

TABLE 5.5-1
AVERAGE TEMPERATURE DATA

Station	Yearly Average	Maximum Monthly Average	Minimum Monthly Average
Amboy	71.8°F	94.4°F (July)	50.7°F (January)
Mitchell Caverns	62.6°F	82.1°F (July)	46.3°F (January)

Source: San Bernardino County Flood Control District – Hydrology Department

Precipitation

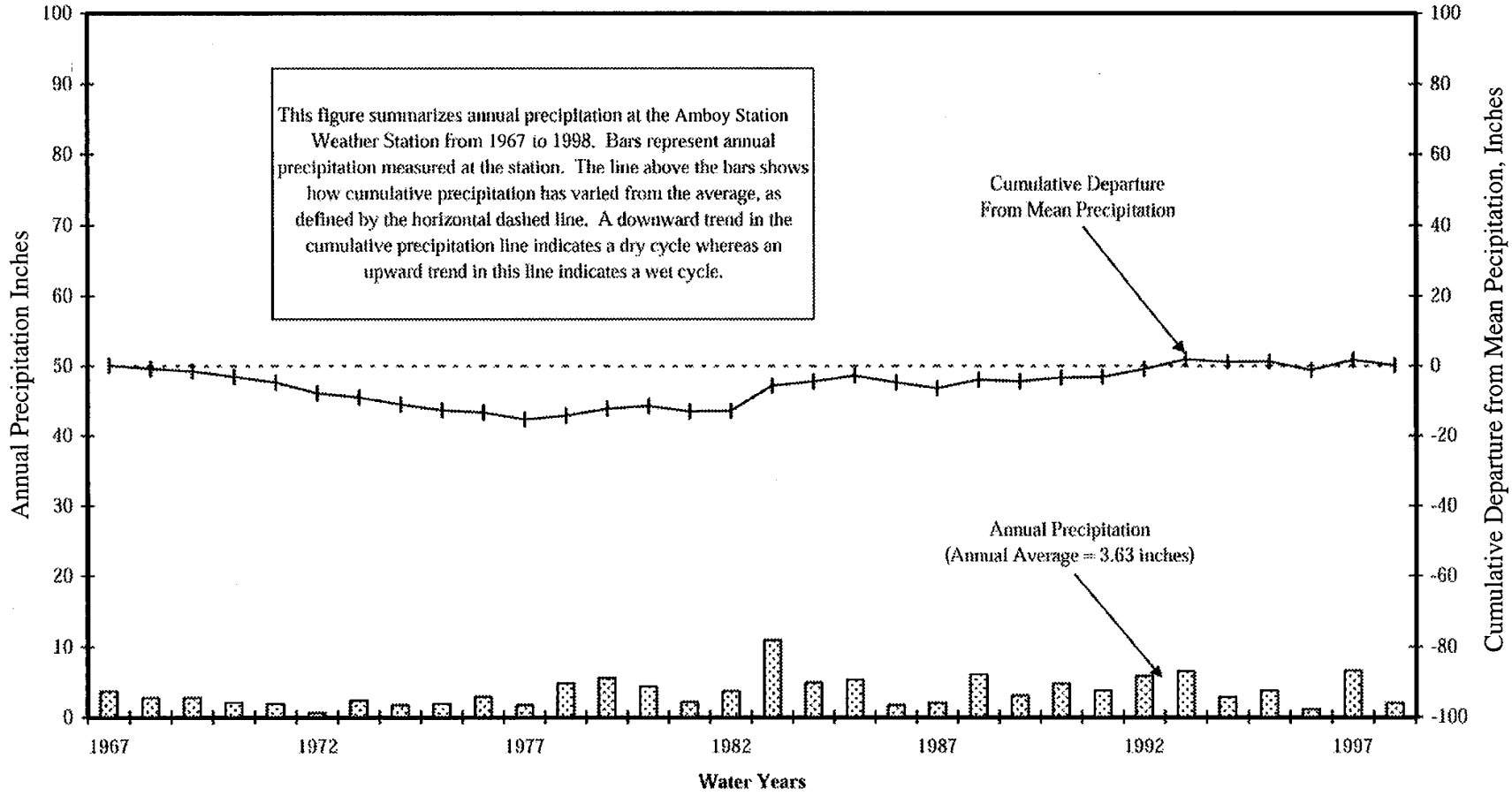
The amount of precipitation in the Bristol, Cadiz and Fenner valleys varies with differences in altitude as shown in Figures 5.5-2a, 5.5-2b and 5.5-3. Average annual precipitation ranges from approximately three inches on Cadiz and Bristol dry lakes (elevations of 545 to 595 feet) to over 12 inches in the Providence and New York mountains (elevations over 7,000 feet). However, most of the Cadiz Project area receives, on average, four to six inches of rain annually (DWR 1975; Freiwald 1984; Bedinger & others 1989).

From 1958 to 1998 there have been three cyclical variations in the precipitation pattern: (1) 1958-1977: a severe 20-year drought; (2) 1978 to 1993: a wet period; and (3) 1994 to 1998: an average period.

The number of precipitation events during each season varies with elevation; the higher elevations receive more events. Early summer and late fall are typically periods of little rainfall. Mid- to late-summer rainfall is characterized by localized thunderstorms, induced by the California Low (US Ecology 1989). In general, summer thunderstorms deliver minimal amounts of rain in intense bursts (Thompson 1929). Occasionally, these thunderstorms result in flash flooding in the valley areas (DWR 1979).

Humidity

The average annual daily relative humidity in the Cadiz Project area is less than 30 percent. Relative humidity is minimal and is often recorded below 10 percent during the hottest part of the day. Relative humidity occurs at its maximum in the early morning hours, when it ranges



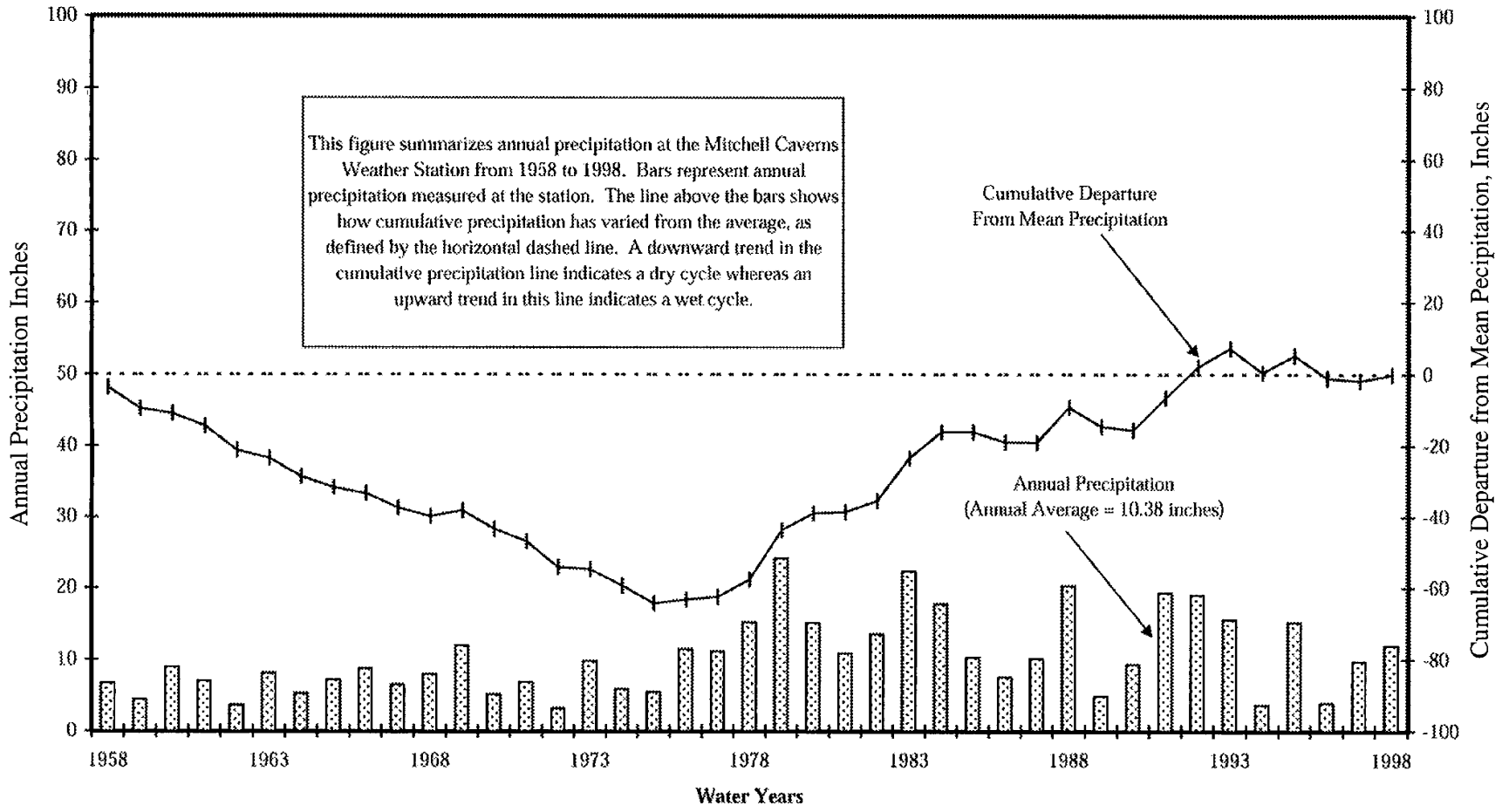
Source: San Bernardino County Flood Control District and EarthInfo Inc.

Figure 5.5-2a

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Annual Precipitation and Cumulative Departure from Mean Precipitation - Amboy Station



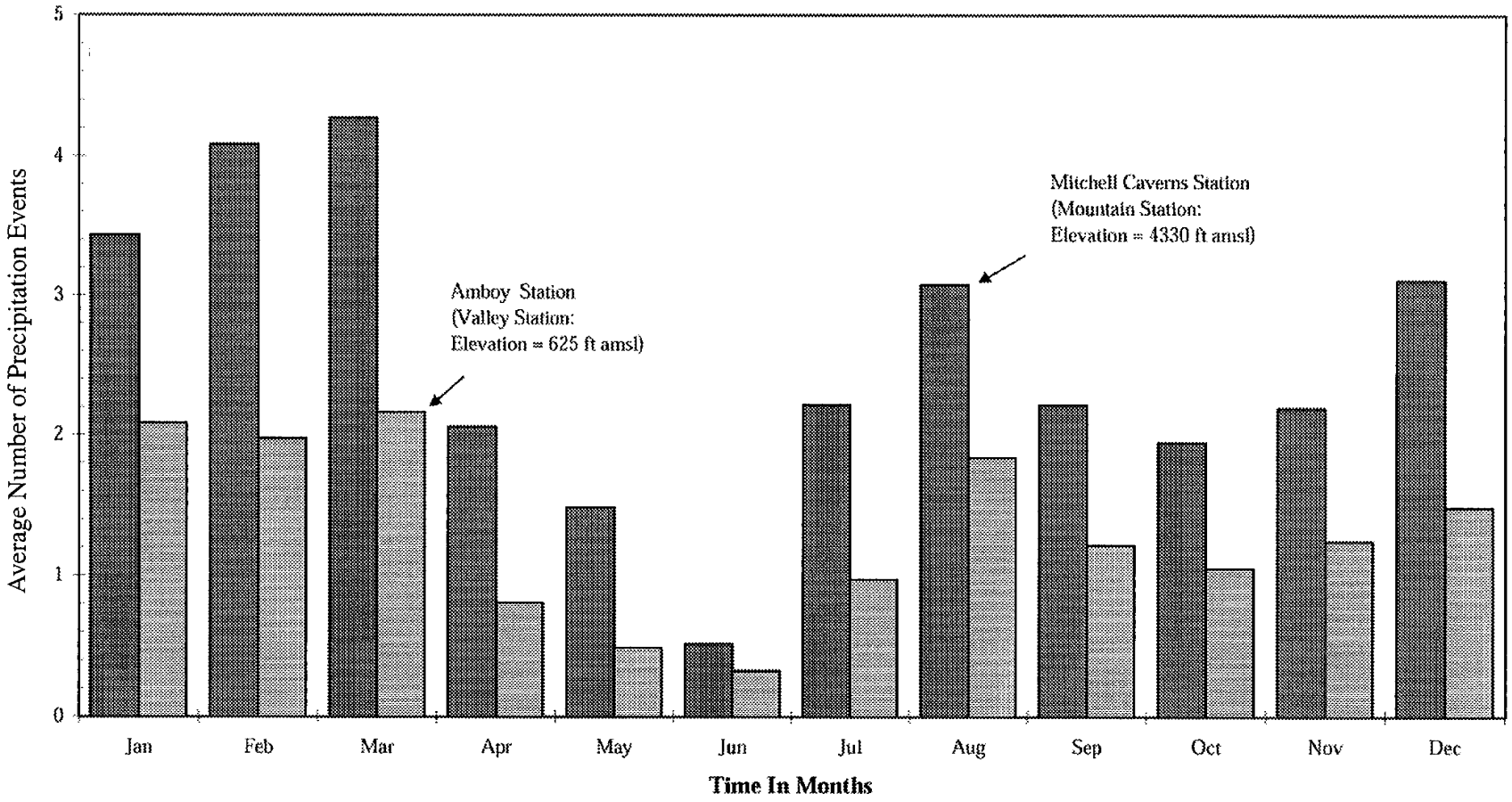
Source: San Bernardino County Flood Control District and EarthInfo Inc.

Figure 5.5-2b

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Annual Precipitation and Cumulative Departure from Mean Precipitation - Mitchell Caverns Station



Source: San Bernardino County Flood Control District

Figure 5.5-3

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Comparison of Precipitation Frequency Patterns-Mountainous and Valley Regions

from 30 to 50 percent (CARB 1975). The higher early morning relative humidity readings are largely due to the range in daily temperatures (Thompson 1929). No data are available as to the effects, if any, the Cadiz Inc. agricultural operations have had on microclimate humidity.

Wind Speed

The average annual low altitude wind speed in the Mojave Desert region is 8.1 miles per hour (mph) (US Ecology 1989), with the highest wind speeds recorded during the summer months (CARB 1975). The prevailing wind direction is from the west (Thompson 1929). During the spring, the wind is generally from the southwest; during the summer, from the south-southwest; during the fall, from the west; and during the winter, from the northwest (CARB 1984). Wind data measured in the Cadiz Project area at Fenner Gap between March and June 1999 recorded steady wind (not including gusts) of up to 30 mph as shown on Figure 5.5-4.

Evaporation Rates

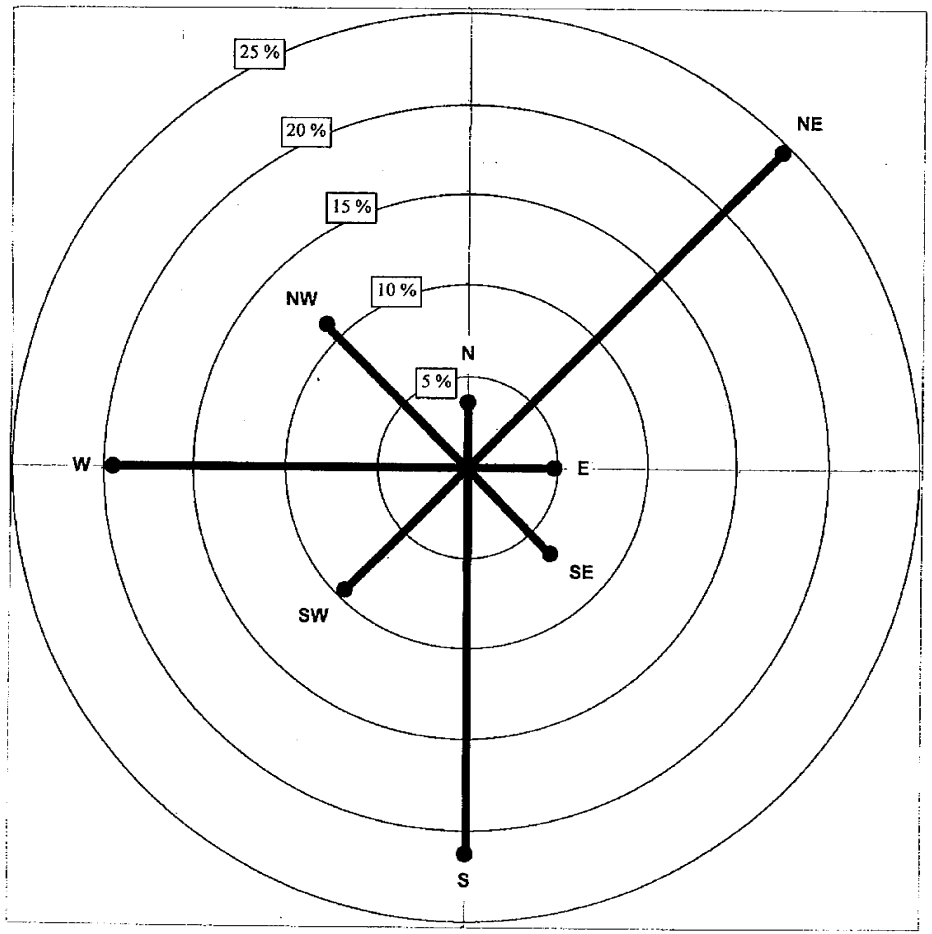
Relatively high temperatures, low humidity and frequent strong winds cause a high rate of evaporation in the Cadiz Project area (DWR 1979). Surface water evaporation, as measured using an evaporation pan, is highest in the valleys and lowest in the higher elevations. Measured monthly evaporation rates, using an evaporation pan located at the Project's pilot spreading basins in Fenner Gap, are illustrated in Figure 5.5-5. The measured evaporation rates in Fenner Gap are slightly lower than at Amboy.

Surface Water

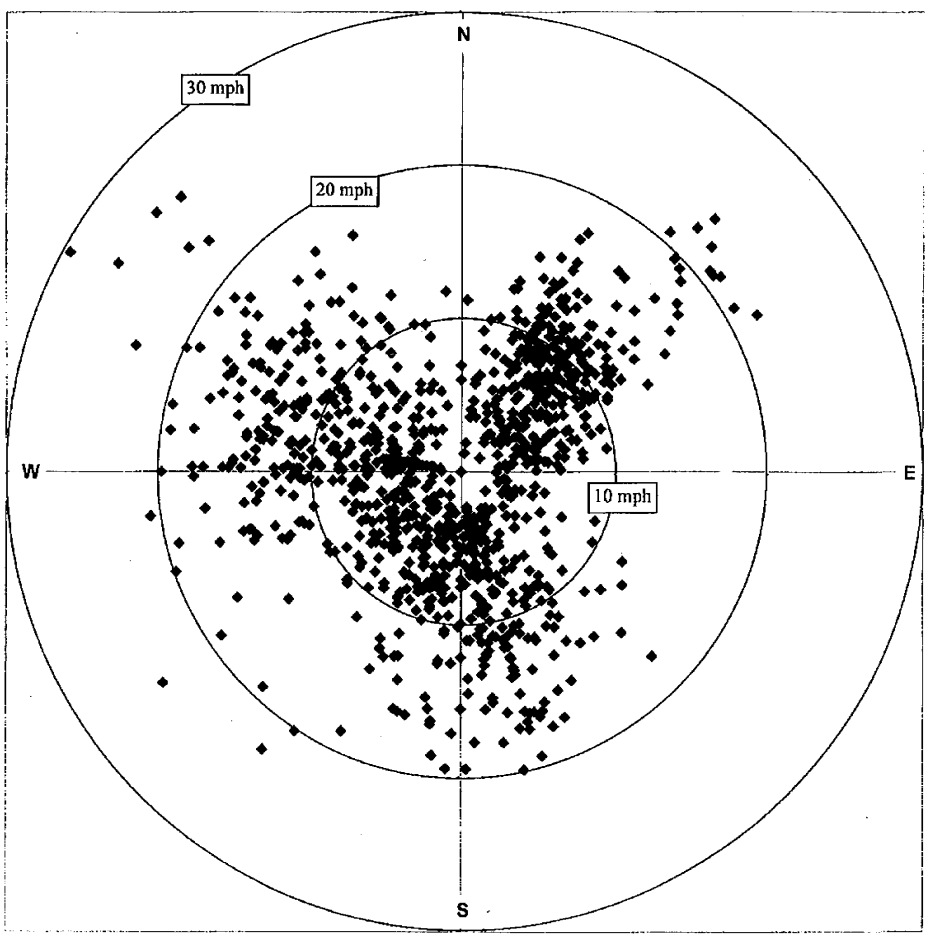
The Cadiz Project area lies within the Fenner, Bristol and Cadiz watersheds as shown in Figure 5.5-1. The specific boundaries of these watersheds have been determined from topographic maps, satellite images and field reconnaissance, and are in accordance with previous investigations of the area (Thompson 1929; Freiwald 1984). These regional watersheds form a closed drainage system. The topography and subsurface geology of the watersheds do not allow for surface or groundwater outflow (Thompson 1929; Bedinger & others 1989). Instead, all surface water drains to Bristol and Cadiz dry lakes. Within these watersheds, the only outlets for surface and groundwater are direct evaporation of precipitation, transpiration by vegetation, evaporation from the dry lake surfaces and groundwater pumping from wells (Shafer 1964).

In general, the amount of surface water flow is dictated by precipitation, geology and topography. Part of the precipitation falling in any watershed area is intercepted by vegetation and transpired. Another part of the precipitation wets and adheres to the soil before returning to the atmosphere through evaporation. In addition, some precipitation is temporarily stored in low spots on the surface of the ground. This is called "depression storage." The effects of vegetation transportation, evaporation and depression storage are combined to determine a volume of water that is referred to as "initial loss." If precipitation exceeds this initial loss, overland flow begins as water in low-lying areas collects and overflows

WIND FREQUENCY
(Percentage Of Time Wind Blew From Various Directions)
Cadiz Weather Station, Hourly Data, 1-Mar-99 through 15-Apr-99



WIND VELOCITY
(Source Direction And Speed Of Wind)
Cadiz Weather Station, Hourly Data, 1-Mar-99 through 15-Apr-99

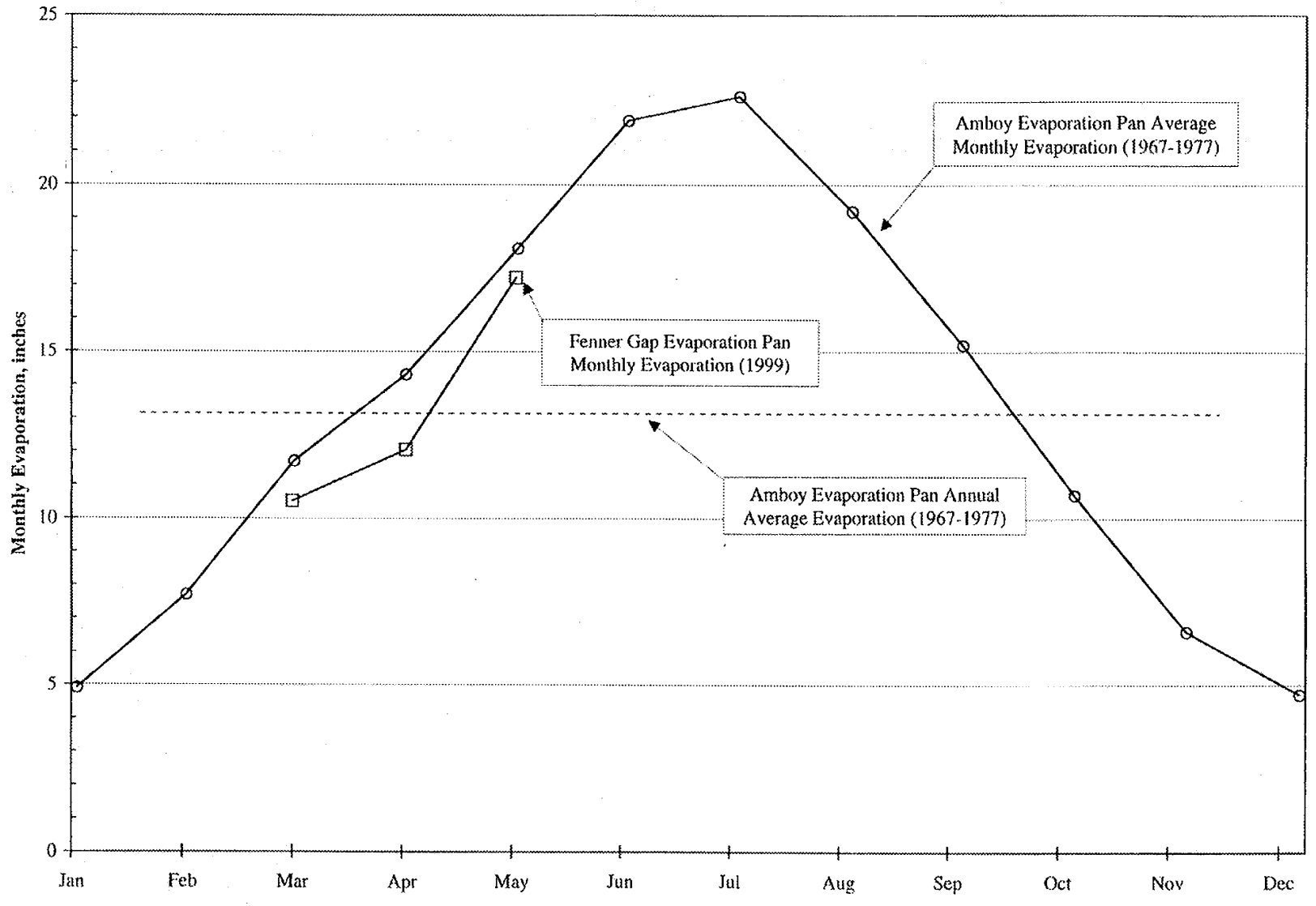


Source: Geoscience Support Services, Inc. (1999).

Figure 5.5-4

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Wind Data Analysis



Source: Geoscience Support Services, Inc. (1999).

Figure 5.5-5

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Average Monthly Evaporation

into small stream channels. The overland flow that eventually reaches a stream is called surface runoff.

Due to the desert climate of the Bristol, Cadiz and Fenner watersheds (with high daytime temperatures and low amounts of precipitation), surface water does not flow throughout the year (Freiwald 1984). As a result, there are no perennial streams in these watersheds. Ephemeral surface runoff from the Fenner Valley watershed flows through Fenner Gap toward Cadiz Dry Lake. Ephemeral surface runoff within the Bristol Depression, including runoff from Orange Blossom Wash, flows into Bristol Dry Lake. Schulyler Wash is the principal surface drainage in the Cadiz Project area. It flows from Fenner Valley through Fenner Gap to Cadiz Dry Lake.

The lake surfaces are normally dry, but flash flooding from major winter storms, sudden spring snow thaws and/or late summer thunderstorms (which are of high intensity and short duration) can result in occasional standing water (Bassett & others 1959; Koehler 1983; URS Consultants 1993).

Groundwater

Regional Overview

The mountain ranges which define the boundaries of the Bristol, Cadiz and Fenner watersheds are composed predominantly of impermeable granitic and metamorphic basement rock as described in Section 5.4. This impermeable basement defines the margins and bottoms of the aquifer systems (Freiwald 1984). Accordingly, these aquifer systems form contained areas from which groundwater cannot escape. Instead, groundwater flows slowly towards the low points of each respective watershed (i.e., Bristol and Cadiz dry lakes) where it slowly migrates upward, through capillary action, to the dry lake surface and evaporates (Bassett & others 1959; Handford 1982; Rosen 1989).

More permeable carbonate bedrock of Paleozoic age occurs locally within the boundaries of these watersheds (as in Fenner Gap). However, geologic mapping indicates that the distributions of such bedrock units are completely enclosed within the perimeter of these watersheds. Accordingly, these units do not form paths for groundwater flow outside of the Bristol, Cadiz and Fenner watersheds or for water from surrounding watersheds to migrate into the local groundwater system.

Infiltration of runoff generated by rain and snow in the surrounding hills and mountains is the primary source of recharge to the Bristol, Cadiz and Fenner groundwater system (Freiwald 1984). A significant percentage of infiltration from such runoff occurs in the sandy-bottomed washes that drain the mountainous regions of these watersheds (Izbicki & others 1997). In addition to showing the regional watersheds of the eastern Mojave Desert, Figure 5.5-1 shows the generalized directions of surface and groundwater flow in these watersheds.

Aquifer Systems

Based on available geologic and geophysical data, the principal geologic deposits in the Cadiz Project area that can store and transmit groundwater (i.e. aquifers) can be divided into three units: an upper alluvial aquifer, a lower alluvial

aquifer and a bedrock aquifer. Figure 5.5-6 presents a generalized cross-section of the aquifer system from the Fenner Gap portion of the Project area (to the northeast) across Bristol Dry Lake (to the southwest).

The upper aquifer consists mainly of more recently deposited Quaternary alluvial sediments, including stream-deposited sand and gravel with lesser amounts of silt (Moyle 1967; GEOSCIENCE 1999). The thickness of this aquifer varies from approximately 200 to 800 feet. To the west of Fenner Gap, the upper aquifer is separated from the lower aquifer system by discontinuous layers of silt and clay. The average thickness of the upper aquifer in Fenner Gap is approximately 500 feet (GEOSCIENCE 1999). Well PW-1, located in Fenner Gap, draws water from this upper aquifer and yields 3,000 gallons per minute with less than 20 feet of drawdown (GEOSCIENCE 1999).

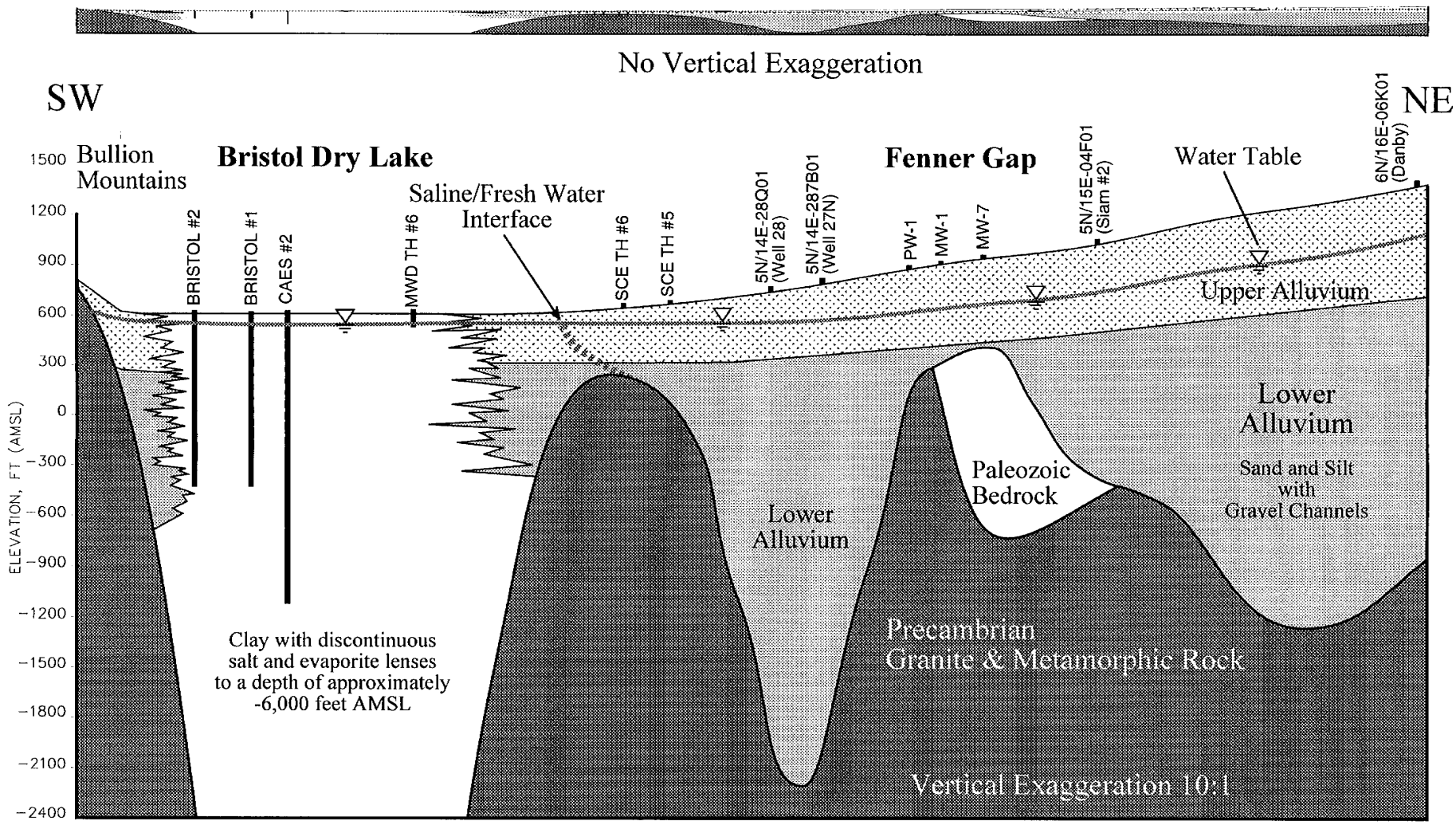
The lower alluvial aquifer consists of older sediments, including interbedded sand, gravel, silt and clay of late Tertiary to early Quaternary age. Where these materials extend below the water table, they yield water freely to wells but are generally less permeable than the upper aquifer sediments (Moyle 1967; GEOSCIENCE 1999). The maximum thickness of the lower aquifer is unknown, but may reach over 6,000 feet in the vicinity of Bristol Dry Lake (Maas 1994). The Cadiz Inc. agricultural wells draw water primarily from the lower alluvial aquifer and typically yield 1,000 to more than 2,000 gallons per minute.

Based on findings during recent drilling in Fenner Gap, carbonate bedrock of Paleozoic age, located beneath the alluvial aquifer, contains groundwater and is considered a third aquifer unit (GEOSCIENCE 1999). Groundwater movement and storage in this carbonate bedrock aquifer primarily occurs in secondary porosity (i.e. joints, faults and dissolution cavities that have developed in the rocks over time). The full extent, potential yield and storage capacity of this aquifer are not fully understood at this time.

As noted above, granite and metamorphic basement rock form the subsurface margins of the aquifer system in the Cadiz Project area. This basement rock is generally impermeable and typically yields only minor quantities of water to wells (Freiwald 1984).

Groundwater Flow

In general, groundwater within the watersheds flows in the same direction as the slope of the land surface (Viceroy Gold Corporation 1990; GEOSCIENCE 1999). In the Fenner watershed, groundwater generally flows southward from the New York and Providence mountains into the main part of Fenner Valley, and then southwest to Fenner Gap (Schafer 1964). In the Bristol and Cadiz watersheds, groundwater flows from Fenner Gap and the surrounding highlands toward the dry lakes. In Orange Blossom Wash, located between the Marble and Bristol mountains, groundwater flows generally southward from the Granite Mountains into Bristol Dry Lake. Figure 5.5-7 presents a contour map of groundwater elevations and flow directions in the vicinity of the Cadiz

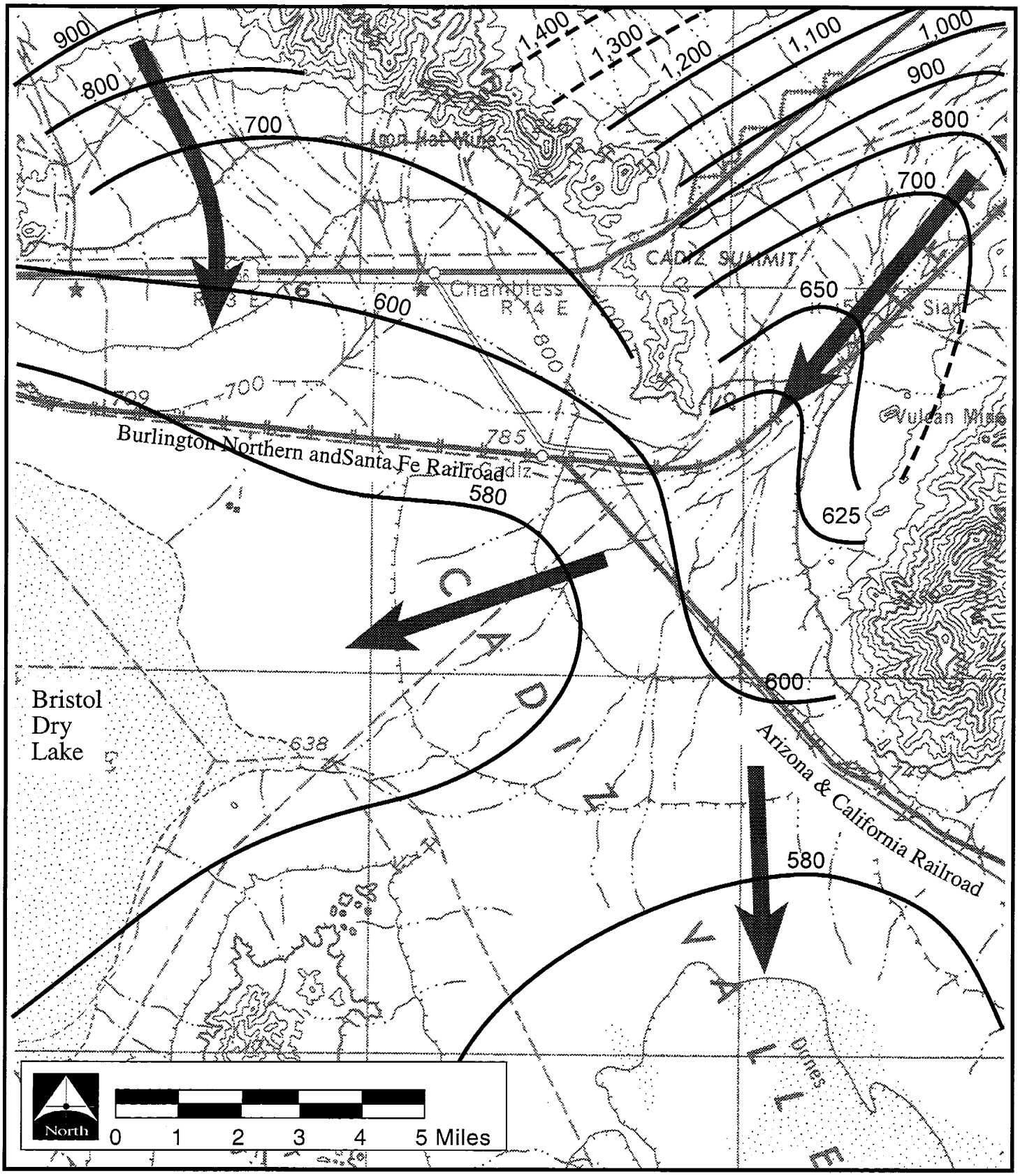


Source: GEOSCIENCE Support Services Inc. (1999).

Figure 5.5-6

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Generalized Aquifer Cross-Section from Fenner Valley to Bristol Dry Lake



Source: GEOSCIENCE Support Services Inc. (1999).

Figure 5.5-7

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Groundwater Elevation Contour Map for Fenner Gap Portion of the Project Area (Contours in Feet AMSL)

Project spreading basins and Project wellfield in the Fenner Gap part of the Cadiz Project area.

Groundwater moves through the upper aquifer within Fenner Gap at a rate of roughly one to two feet per day (GEOSCIENCE 1999). The velocity of groundwater flow in the upper aquifer is generally higher than that of the lower aquifer because the upper aquifer sediments are more permeable. However, specific groundwater flow rates in the lower aquifer have not yet been quantified in the Cadiz Project area.

Groundwater Recharge

Natural replenishment of the groundwater resources beneath the Bristol, Cadiz and Fenner watersheds occurs from both surface runoff and percolation of precipitation. The majority of the rainfall in the lower elevations is evaporated or taken up by plants before it enters the groundwater system. The primary sources of replenishment to the groundwater system are infiltration of precipitation at the higher elevations and surface water infiltration in the sandy-bottomed washes during major storm events.

Although some of this groundwater is tapped by vegetation near the range fronts, the majority moves slowly downgradient through Fenner Gap into the Bristol and Cadiz depressions, where it eventually discharges to Bristol and Cadiz dry lakes. Evaporation of groundwater from the dry lakes over the past several million years has resulted in thick deposits of salt (calcium chloride and sodium chloride) and brine-saturated, fine-grained sediments.

The occurrence of active groundwater replenishment in the Bristol, Cadiz and Fenner watersheds is supported by a variety of evidence. Such evidence includes: (1) the existence of a regionally consistent hydraulic gradient (slope to the water table) based on measurements from more than 50 wells and exploratory drill holes in the region; (2) isotopic evidence for a geologically "recent" (Holocene) age for the groundwater; and (3) stable groundwater elevations for wells located between Fenner Gap and the dry lakes, despite groundwater pumping by the Cadiz Inc. agricultural operations for more than 15 years.

Recent estimates of the average amount of recoverable water (surface runoff plus groundwater recharge) available to the Cadiz Project area range from approximately 15,000 to 37,000 acre-feet per year (GEOSCIENCE 1999). Based on a comprehensive program of exploratory drilling and testing in Fenner Gap, and extensive computer modeling of the groundwater hydrology of the area, the sustainable groundwater yield available to the Project wellfield is currently estimated to be approximately 30,000 acre-feet/year (GEOSCIENCE 1999).

Groundwater Discharge

The primary outlet, or discharge, of groundwater from the Bristol, Cadiz and Fenner watersheds is evaporation from Bristol and Cadiz dry lakes. The groundwater (brine) elevation beneath these dry lakes averages only a few feet below the lakebed surface (Bassett & others 1964; Moyle 1967; Rosen 1989).

Another source of groundwater discharge in the area is pumping. The total amount of groundwater pumped in the Bristol, Cadiz and Fenner watersheds has been minimal until the last decade. The Cadiz Inc. agricultural operations, the BNSF, various salt-producing companies operating on the dry lake beds and the few residents in the area are the primary groundwater users.

Between 1901 and 1947, approximately 2,365 acre-feet of groundwater, or an average of 50 acre-feet per year, was produced from Fenner Valley (Shafer 1964). Between 1948 and 1962 Shafer (1964) estimates that approximately four acre-feet per year were pumped from Fenner Valley. The sharp drop in production was attributed to a switch from steam to diesel powered engines on the railroad. Freiwald (1984) estimates that between 1954 and 1981, groundwater pumping in Fenner Valley remained constant at approximately seven to eight acre-feet per year. Using Freiwald's (1984) pumping rate estimate for 1954 through 1981, and assuming that this rate continued through 1998, the total volume of groundwater estimated to have been pumped from this valley since 1901 ranges from approximately 2,700 to 2,750 acre-feet.

Shafer (1964) reports that approximately 14,300 acre-feet of fresh water were pumped from the Bristol and Cadiz valleys from 1910 (when the first fresh water well was drilled) to 1964, or an average pumping rate of approximately 265 acre-feet per year. Assuming these historical pumping rates continued from 1964 through 1998 (not including the Cadiz Inc. agricultural operations), a total of approximately 9,000 additional acre-feet was pumped from these valleys during this time period. In addition, from 1983 through 1998, the Cadiz Inc. agricultural operations produced approximately 61,740 acre-feet of groundwater from its wellfield. Accordingly, the total amount of groundwater pumped from the Bristol and Cadiz valleys from 1910 through 1998 is approximately 85,000 acre-feet. No significant declines in groundwater levels in the area have resulted from this pumping.

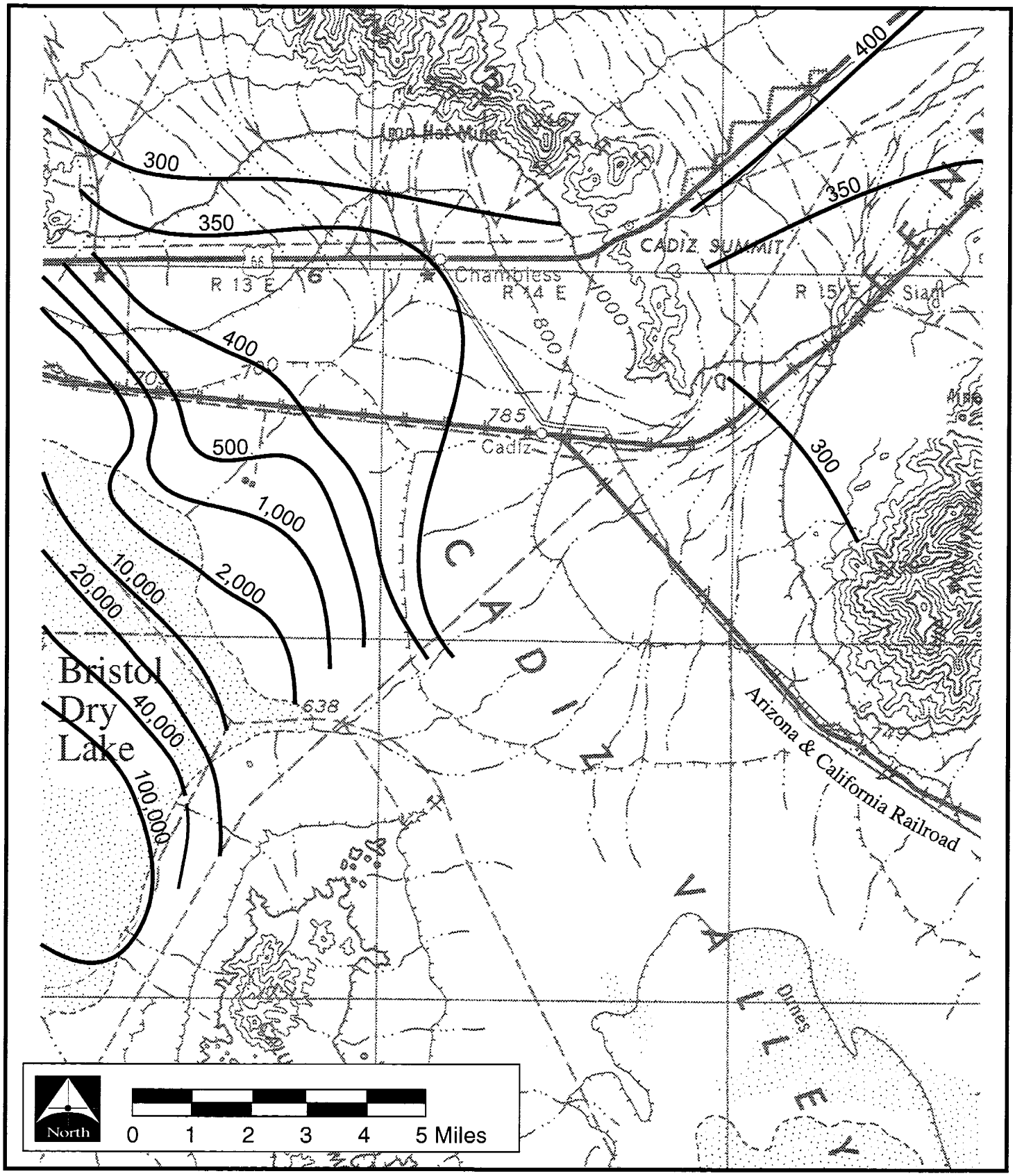
Yearly groundwater production for the Cadiz Inc. agricultural operations averaged 5,000-6,000 acre-feet per year from 1986 through 1998. Current estimates of production from the other groundwater users are not available for this EIR, but are estimated to total no more than 100 acre-feet per year.

Groundwater Storage

The amount of groundwater currently in storage in the aquifer system underlying the area of the proposed Project wellfield has been estimated to range from 3.65 to 6.69 million acre-feet (GEOSCIENCE 1999). This estimated storage range does not include groundwater with TDS concentrations greater than 1,000 mg/L or groundwater stored in the carbonate bedrock aquifer.

Groundwater Quality

With the exception of the areas underlying and immediately adjacent to Bristol and Cadiz dry lakes, the quality of the groundwater in the Fenner Gap part of the Cadiz Project area is relatively good. TDS concentrations are generally about 300 mg/L, as shown in Figure 5.5-8. The



Source: GEOSCIENCE Support Services Inc. (1999).

Figure 5.5-8

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Total Dissolved Solids in Groundwater in the Fenner Gap and Bristol Dry Lake Areas (Contours in mg/L)

TDS concentration in Fenner Valley groundwater is typically in the range of 300 to 400 mg/L.

At Bristol and Cadiz dry lakes, surface water and shallow groundwater evaporation has concentrated dissolved salts in the water, resulting in TDS concentrations as high as 298,000 mg/L (Schafer, 1964). The interface between low-TDS "fresh" groundwater and high-TDS "saline" groundwater underlying the dry lakes has been mapped on the basis of data from monitoring wells in the area (Shafer 1964; Rosen 1989).

The State of California guideline for drinking water is a maximum TDS of 1,000 mg/L. However, all groundwater having a TDS below 3,000 mg/L is considered by the State to be a potential domestic or municipal source of water supply.

5.5.2 THRESHOLDS OF SIGNIFICANCE

A project is normally considered to have a significant adverse impact on surface water flow, groundwater supply and groundwater quality if it results in:

- The violation of any drinking water quality standards or waste discharge requirements, including those in the California Regional Water Quality Control Board's Colorado River Basin Region.

- Substantial depletion of groundwater supplies or substantial interference with groundwater recharge, such that there would be a significant net deficit in aquifer volume or a lowering of the local groundwater table to the extent that existing nearby well production would not support existing land uses or planned uses for which permits have been granted.

- Substantial fluctuations in brine levels on nearby dry lakes resulting in reduced production at the salt-mining operations.

- Substantial alteration of the existing drainage pattern of a site or area, including the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation on- or off-site.

- Substantial increase of the rate or amount of surface runoff in a manner which would result in flooding on or off a site.

- Creation or contribution of runoff water that would exceed the capacity of existing or planned stormwater drainage systems or providing substantial additional sources of polluted runoff.

- Structures placed within a 100-year flood hazard area which would impede or redirect flood flows.

- Exposure of people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam.

- Inundation by a seiche, tsunami or mudflow.

5.5.3 METHODOLOGY

Preliminary studies by Metropolitan and Cadiz Inc. were conducted to assess the

feasibility of storing large quantities of Colorado River water beneath the Fenner Gap portion of the Cadiz Project area. These studies involved collecting extensive geologic, hydrologic and water quality data in the Cadiz Project area, not only to evaluate the feasibility of the Cadiz Project but also to evaluate the potential impacts that a large-scale storage program would have on existing environmental resources in the region. Potential geological/hydrological impacts evaluated include:

1. Ground structure instability, including possible land subsidence from lowering of groundwater levels, settlement from hydro-compaction and increased risk of liquefaction.

2. Water quality impacts from mixing Colorado River water with indigenous groundwater underlying the Project spreading basins and Project wellfield.

3. Water quantity impacts from storing and extracting Colorado River water and indigenous groundwater which might affect nearby wells and nearby salt mining operations.

4. Changes to the microclimate of Fenner Gap.

The studies used to evaluate these potential impacts included:

1. Collection of background data regarding the geology and hydrogeology of the groundwater aquifer system underlying the Cadiz Project area.

2. Collection of field data on the soil/rock types, groundwater levels, aquifer characteristics and water quality in the Cadiz Project area.

3. Construction and operation of an infiltration test using two 2.5-acre pilot spreading basins located within the area of the Cadiz Project spreading basins.

4. Development of detailed groundwater flow and solute transport models to help predict effects on local groundwater levels and groundwater quality from storing and extracting Colorado River water and indigenous groundwater.

5. Development of water quality mixing models (both computer and laboratory) to assess the effects of mixing Colorado River water with indigenous groundwater.

6. Development of a subsidence model to assess the potential for land surface subsidence in the vicinity of the Project wellfield.

Collection of Field Data

Seven shallow boreholes (BH-1 through BH-7) were drilled in the Fenner Gap part of the Cadiz Project area to assess soil types and variations in subsurface stratigraphy. With the exception of BH-1, which was drilled to approximately 330 feet below ground surface (bgs) and completed as a monitoring well (CI-1), the boreholes were drilled to approximately 100 feet bgs. The locations of these boreholes, as well as the associated

monitoring wells and pilot spreading basin, are shown in Figure 5.5-9.

Eleven groundwater monitoring wells were drilled and installed in the Fenner Gap part of the Cadiz Project area to monitor water levels and facilitate the collection of water quality data. Two of these wells (CI-2 and MW-7) were extended into the underlying bedrock to evaluate the aquifer characteristics of the bedrock formations.

Monitoring wells were installed in and adjacent to the pilot spreading basins to monitor groundwater level and water quality changes during the pilot test. Soil moisture sensors (i.e. gypsum blocks) were installed to monitor the vertical movement of infiltrating water through the unsaturated zone (vadose zone) beneath the pilot test basins.

A production well (PW-1) was drilled in Fenner Gap to a depth of 830 feet bgs to provide data on aquifer hydraulic properties and to serve as a source of water for the pilot spreading basin test. This production well also served as a test of the well design planned for the Project wellfield.

Pilot Spreading Basins

A pilot spreading basin test was performed to determine the feasibility of storing Colorado River water in, and later retrieving it from, the aquifer system underlying the Fenner Gap part of the Cadiz Project area. The pilot test program was also designed to assess the types and extent of environmental impacts that could potentially result from the Cadiz Project.

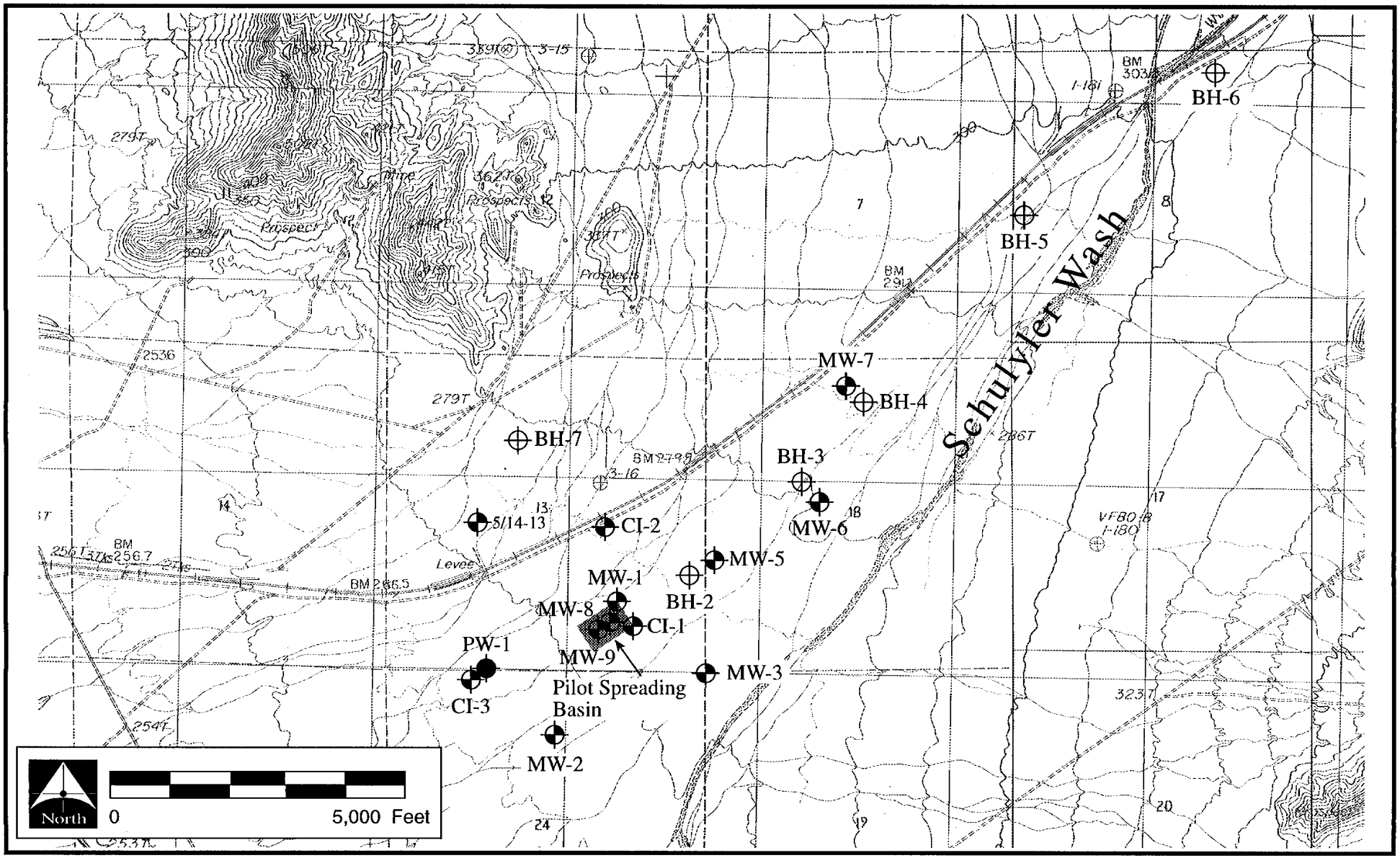
The pilot spreading basin consists of two 2.5 acre cells, designed to be filled independently or together, depending on the specific test objectives. The pilot basin is operated by pumping water from the production well (PW-1), via a temporary pipeline, into the designated cell. A schematic diagram of the pilot spreading basin test is presented in Figure 5.5-10. Spreading tests were performed to evaluate the infiltration rate of percolating water, to determine the dimensions of the resulting mound of elevated groundwater that forms as a result of surface spreading, and to monitor any changes to water quality during the spreading test. A weather station and an evaporation pan, located at the pilot spreading basin, collected data on wind speed and direction, precipitation, air temperature, relative humidity and evaporation rates.

Groundwater Flow Model

A groundwater flow model for the Project spreading basin complex and wellfield was prepared using the USGS's MODFLOW model (McDonald & others 1988). Employing data gained from background research and the field testing program, the MODFLOW model was used to: (1) predict water levels under various spreading and extraction scenarios; (2) predict if wellfield extractions would draw saline groundwater from Bristol and/or Cadiz dry lakes toward the Project wellfield; and (3) more precisely site production wells for the Cadiz Project.

Water Quality Mixing Model

Laboratory tests to evaluate the chemical effects of mixing Colorado River water with indigenous groundwater underlying



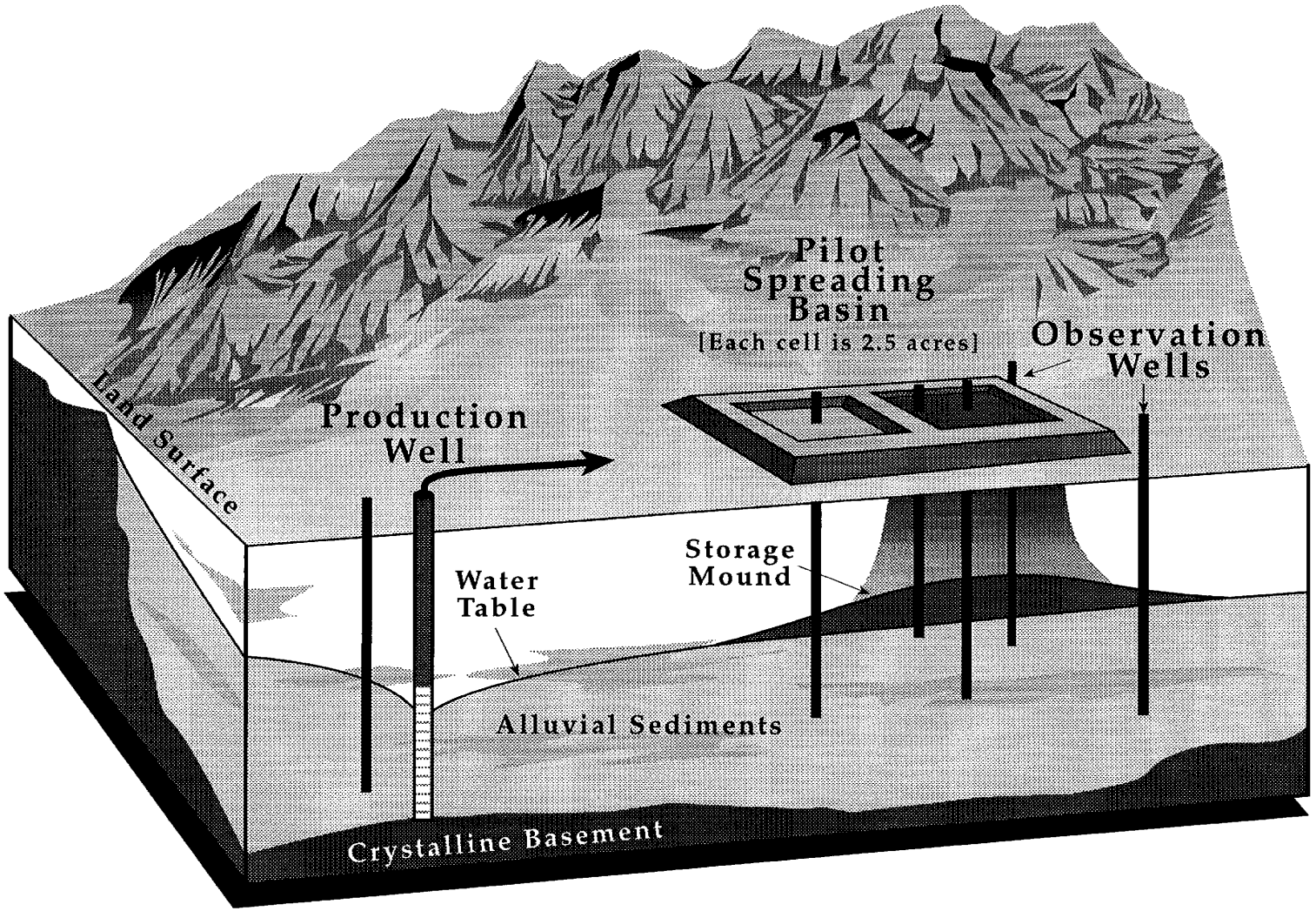
Source: Geoscience Support Services, Inc. (1999).

Figure 5.5-9

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Locations of Bore Holes, Monitoring Wells, Production Well and Pilot Spreading Basin in Fenner Gap



Source: Geoscience Support Services, Inc. (1999).

Figure 5.5-10

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Conceptual Diagram of the Spreading Basin Test

the Fenner Gap part of the Cadiz Project area were conducted by mixing various proportions of Colorado River water and indigenous water in a physical scale model of the aquifer system underlying the Fenner Gap part of the Cadiz Project area. The laboratory model takes into account various environmental factors, including the chemistry of the soil, the indigenous water temperature and potential biological impacts. The results of the physical model were verified using a computer model (PHREEQE C) designed to simulate the mixing of waters of different composition (Parkhurst & others 1980).

Operational Scenarios

A range of representative operating scenarios were described for the Cadiz Project's 50-year term of operations. These operating scenarios were based on long-term statistical data on Colorado River flow and projection of future needs in Metropolitan's service area. The range of variation in these storage and extraction scenarios was intended to define a range of probable Cadiz Project storage and extraction operations; and to provide a basis for designing Cadiz Project facilities and capacities.

These representative operating scenarios, when incorporated in the computer models, also provided a basis for predicting potential Cadiz Project-related changes in groundwater quality and groundwater levels, and the areal extent of potential impacts to the aquifer system.

The storage and extraction scenarios were coordinated with, and are consistent with, the operational basis for the Colorado River Aqueduct system. Accordingly, the scenarios are each designed to operate at constant flow rates equal to one pumping unit in the Colorado River Aqueduct pumping plants, or a nominal capacity of 200 to 250 cubic feet per second (cfs). If operated year-round with no down time for maintenance, the resulting capacity would be about 150,000 acre-feet per year.

The various storage and extraction scenarios were selected to provide a conservative analysis of potential impacts. These scenarios are shown in Table 5.5-2 and are described below.

Scenario 1

Scenario 1 cycles 1.1 million acre-feet of Colorado River water through the Cadiz Project facilities, and transfers 1.5 million acre-feet of indigenous groundwater to the Colorado River Aqueduct during the 50-year term of the Cadiz Project. This scenario emphasizes storage during the first half of the Project with extractions and transfers spread throughout the Project.

Scenario 2

Scenario 2 cycles 1.1 million acre-feet of Colorado River water through the Cadiz Project facilities, and transfers 1.5 million acre-feet of indigenous groundwater to the Colorado River Aqueduct during the 50-year term of the Cadiz Project. This scenario emphasizes storage and extraction taking place in sequence with little hold time for stored Colorado River water.

Scenario 3

Scenario 3 cycles 1.6 million acre-feet of Colorado River water through the Cadiz Project facilities, and transfers 1.7 million acre-feet of indigenous groundwater to the

TABLE 5.5-2
SUMMARY OF PROJECT OPERATIONAL SCENARIOS (IN THOUSANDS OF ACRE-FEET)

Year	Scenario 1		Scenario 2		Scenario 3		Scenario 4		Scenario 5		Scenario 6	
	Put [acre-ft]	Withdraw [acre-ft]	Put [acre-ft]	Withdraw [acre-ft]	Put [acre-ft]	Withdraw [acre-ft]	Put [acre-ft]	Withdraw [acre-ft]	Put [acre-ft]	Withdraw [acre-ft]	Put [acre-ft]	Withdraw [acre-ft]
1	100		100		100		100		145		145	
2	100		100		100		100		145		145	
3	100		100		100		100		145		145	
4	100		100		100		100		145		145	
5	100		100		100		100		145		145	
6									145		145	
7									145		145	
8									145		145	
9												-145
10		-145		-145		-145				-145		-145
11		-145		-145		-145				-145		-145
12		-145		-145		-145				-145		-145
13		-145		-145		-145				-145		-145
14		-145		-145		-145				-145		-145
15		-145		-145		-145				-145		-145
16	100		100		100			-145		-145		-145
17	100		100		100			-145	145			-145
18	100		100		100			-145	145			-145
19	100		100		100		100		145			-145
20	100		100		100		100			-145		-145
21	100		100		100		100			-145		-145
22										-145		-145
23										-145		-145
24		-145		-145		-145				-145		-145
25		-145		-145		-145				-145		-100
26		-145		-145		-145				-145		-100
27		-145		-145		-145		-145	145			-24
28		-145		-145		-145		-145		-145		
29		-145		-145		-145		-145		-145		
30								-145		-145		
31					100			-145		-145		
32					100					-145		
33					100					-145		
34		-145		-145	100					-145		
35		-145		-145	100					-97		
36		-145		-145				-145		-100		
37				-145		-145		-145		-145		
38						-145		-145		-90		
39						-145		-145	145			
40						-145		-145				
41		-145		-145		-145		-145				
42		-145		-145		-145						
43		-145		-145								
44									145			
45									145			
46						-145		-145		-145		
47						-145		-145		-116		
48						-145						
49						-145						
50						-145						
Put/ Withdraw Totals	1100	-2610	1100	-2755	1600	-3335	800	-2755	2320	-3593	1160	-2544
Transfer	-1510		-1655		-1735		-1955		-1273		-1384	

Colorado River Aqueduct. This scenario emphasizes long term transfer of indigenous groundwater.

Scenario 4

Scenario 4 cycles 0.8 million acre-feet of Colorado River water through the Cadiz Project facilities, and transfers 2.0 million acre-feet of indigenous groundwater to the Colorado River Aqueduct. This scenario emphasizes early storage (five years) followed by a long hold time (eight years) followed by extraction and transfer.

Scenario 5

Scenario 5 cycles 2.3 million acre-feet of Colorado River water through the Cadiz Project facilities, and transfers 1.3 million acre-feet of indigenous groundwater to the Colorado River Aqueduct. This scenario emphasizes high storage in the first half of the Project with extraction and transfer throughout the Project. This scenario allows little hold time between storage and extraction phases.

Scenario 6

Scenario 6 cycles 1.2 million acre-feet of Colorado River water through the Cadiz Project facilities, and transfers 1.4 million acre-feet of indigenous groundwater to the Colorado River Aqueduct. This scenario emphasizes early storage and extraction with no Project activity after year 27.

5.5.4 IMPACTS

During storage operations, the surface of the water table underlying the Cadiz Project spreading basins will rise (mound) in response to the infiltration of the imported Colorado River water. During extraction operations, a depression will form in the water table underlying the Cadiz Project wellfield. During storage operations, Colorado River water, which is of a different quality than local groundwater, will blend with indigenous groundwater.

Potential impacts to the Cadiz Project area and adjacent regions as a result of the Project operations include:

1. Ground structure instability, including possible land subsidence (from lowering of groundwater levels), settlement from hydro-compaction and liquefaction.

2. Water quality impacts from mixing Colorado River water with indigenous groundwater underlying the Project spreading basins and Project wellfield.

3. Water quantity impacts from storing and extracting Colorado River water and indigenous groundwater such that existing nearby well production would not support existing land uses and such that existing mining operations on Bristol and Cadiz dry lakes would be impaired by fluctuating water levels.

4. Changes to the microclimate of Fenner Gap.

Any potential impacts to groundwater quality or quantity in the Cadiz Project area are expected to be the results of specific storage and extraction operations, rather than the configuration of the facilities built for the Cadiz Project. Accordingly, no significant differences in impacts are anticipated for the Eastern,

Western or Combination Alternatives. However, under the Eastern/Canal Alternative, the potential impacts could be slightly greater than for the other alternatives. This is due to the greater topographic alteration required by the canal, and creation of an open additional water surface that would be subject to evaporative losses.

Potential Impacts to Nearby Communities

The communities nearest the Cadiz Project area are Chambless (six miles), Amboy (15 miles), Essex (20 miles) and the cities of Twentynine Palms (40 miles) and Needles (60 miles). The closest boundary of the Mojave National Preserve is located approximately 15 miles north of the Cadiz Project area.

The community of Chambless, located approximately six miles from Fenner Gap, is underlain by groundwater that is in hydraulic continuity with that of the Cadiz Project area. For this reason, potential for Cadiz Project storage and extraction operations to impact wells in the Chambless area is addressed in detail in the following paragraphs.

The community of Amboy, which is located north of Bristol Dry Lake, is separated from the Cadiz Project area by brine-saturated sediments and salt deposits underlying Bristol Dry Lake. Consequently, there is no potential for continuity of potable groundwater in the Cadiz Project area with groundwater beneath this community.

The community of Essex is located in Fenner Valley, approximately 20 miles up-gradient from the Project spreading basins and Project wellfield. Although there is continuity between the aquifer systems underlying the Cadiz Project area and Essex, all the wells in the Essex area are located far beyond, and up-gradient of, the maximum area of influence of Cadiz Project operations. As a result, there is no potential for the Cadiz Project to impact wells in the community of Essex.

Likewise, the closest boundaries of the Mojave National Preserve are located approximately 15 miles north of, and up-gradient from, the Project spreading basins and Project wellfield. Although there is continuity between the aquifer systems underlying the Cadiz Project area and some parts of the Mojave National Preserve, the Preserve is located far beyond, and up-gradient of, the maximum area of influence of Cadiz Project operations. There is, therefore, no potential for the Cadiz Project to impact groundwater underlying the Mojave National Preserve.

The Cadiz Project area is separated from groundwater in the Twentynine Palms area by at least thirty miles. Nearly eight miles of this distance is occupied by the brine-saturated sediments and salt deposits of Bristol Dry Lake which reach depths of more than 6,000 feet. Furthermore, the Cadiz Project area is separated from Twentynine Palms by crystalline basement rock exposed in the Bullion Mountains. The Bullion Mountains exceed 4,000 feet in elevation and are located on the southwest side of Bristol Dry Lake, creating a barrier to the transmission of groundwater. There is, accordingly, no potential for groundwater continuity or flow between the Cadiz Project area and Twentynine Palms.

Groundwater in the vicinity of Needles and the Colorado River is separated from the Cadiz Project area by 60 miles, including intervening mountain ranges of crystalline basement rock which reach elevations in excess of 5,000 feet. Similar to the case of groundwater in the Twentynine Palms area, there is no potential for groundwater continuity or flow between the Cadiz Project area and either the town of Needles or the Colorado River.

Ground Structure Instability

Land Subsidence Due To Groundwater Withdrawal

The potential for land surface subsidence due to groundwater withdrawal from the Project wellfield was evaluated using a one-dimensional simulation of aquifer system compaction originally developed by Helm (1975). Soil properties data obtained from the Fenner Gap area during recent field investigations and historical geophysical logs from wells operated by Cadiz Inc. agricultural operations were used as input for the model. Based on the potential storage and extraction scenarios summarized above, this model suggests that changes in land surface elevation due to subsidence could range from 1 to 22 inches within the area of the Project wellfield. Any such subsidence would occur gradually over time and would be dispersed laterally over an area of several miles. The greatest predicted lateral extent of subsidence would be confined to the immediate vicinity of the Project wellfield, as shown in Figure 5.5-11.

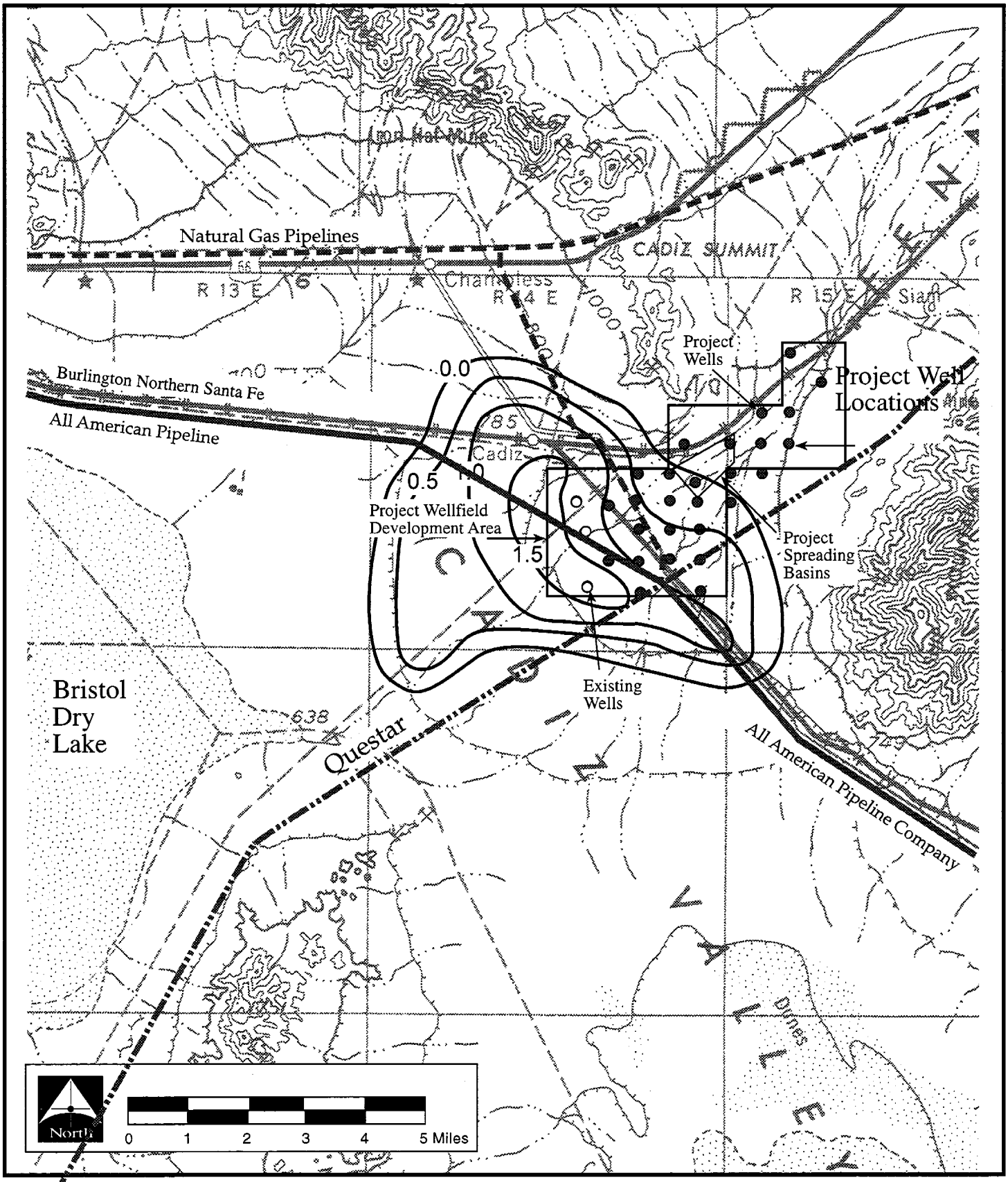
The area with the greatest potential for subsidence is in the western part of the Project wellfield in the vicinity of the Cadiz Inc. agricultural operations. This region contains the highest proportion of fine-grained sediments observed in the subsurface, below the water table. Although railroad lines owned and operated by BNSF and AZRC, and natural gas and crude oil pipelines operated by All American Pipeline L.P. and Questar cross part of this area, no significant impacts to these facilities due to subsidence would occur as a result of the Cadiz Project operations.

Hydrocompaction

Hydrocompaction refers to the settlement of near-surface sediments as a result of the saturation, displacement and consolidation of the mineral grains within the sediments. Hydrocompaction generally affects the upper 20 feet of sediments and does not usually exceed 12 inches in total vertical settlement. The part of the Cadiz Project area that could be affected by settlement due to hydrocompaction is limited to the area to be occupied by the Project spreading basins. No hydrocompaction impacts to railroad tracks, pipelines, local residents, agricultural operations or any other entity would occur.

Liquefaction

Liquefaction is the transformation of water-saturated granular material (usually sand or sand/silt mixtures) from a solid state to a liquid state as a result of increased pore water pressure during intense ground shaking, as from a major earthquake. When undergoing liquefaction, surface soils can be transformed into a state that will no longer support structures. Liquefaction is generally considered a risk where fine-grained



Source: GEOSCIENCE Support Services Inc. (1999).

Figure 5.5-11

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Maximum Projected Subsidence Due to Cadiz Project Operations (Contours in Feet)

sediments are saturated by groundwater to within 50 feet of the ground surface. The most shallow groundwater levels anticipated during the Cadiz Project storage operations would be approximately 80 feet below ground surface. Accordingly, no increased risk of liquefaction would occur as a result of storage operations. Thus, impacts due to liquefaction as a result of the Cadiz Project would not be significant.

Water Quality Impacts

Groundwater Quality Changes

Potential changes in groundwater quality may occur as a result of mixing Colorado River water with indigenous groundwater underlying the Project spreading basins. Such changes may include:

1. Transport of salts from unsaturated soil into the groundwater as a result of the infiltration of Colorado River water.

2. Increased TDS concentrations from mixing higher TDS Colorado River water with lower TDS indigenous groundwater.

3. Introduction of undesirable constituents, specifically perchlorate from Colorado River water into indigenous groundwater.

4. Dilution of undesirable constituents, specifically nitrate, in indigenous groundwater by introducing Colorado River water that has very low concentrations of these constituents.

Based on results obtained during operation of the pilot spreading basin and groundwater analyses from the nearby observation wells, the initial infiltration of Colorado River water during Project spreading operations is expected to dissolve salts in the upper parts of the unsaturated zone (vadose zone) and carry them downward to the water table (GEOSCIENCE 1999). According to the analysis, although this process would create some initially high TDS concentrations in the indigenous groundwater immediately below and adjacent to the spreading basins, the effect would be temporary and would not impact wells outside the Cadiz Project area.

The introduction of Colorado River water with TDS of approximately 600 mg/L into indigenous groundwater in TDS of approximately 300 mg/L in the Cadiz Project area would result in a TDS concentration that is between these values where the two waters mix. The zone of mixing would be limited to the area of groundwater mounding caused by the Cadiz Project spreading operations. Groundwater modeling indicates this area would not extend significantly outside the vicinity of the Project wellfield. Accordingly, wells owned by neighboring landowners in the community of Chambless are not expected to be impacted.

Any increased TDS that may occur in the Cadiz Project area would still meet drinking water standards. The higher TDS would not adversely effect the Cadiz Inc. agricultural operations, or any other groundwater uses in or adjacent to the Cadiz Project area.

Tables 5.5-3 and 5.5-4 summarize analysis of the movement of specific constituents to and from the Colorado River Aqueduct and the Cadiz Project area as a result of Project operations. This analysis is based on the hypothetical conveyance of two million acre-feet of indigenous groundwater to the Colorado River Aqueduct and storage of one million acre-feet of Colorado River water in the Cadiz Project area during the 50-year term of the Cadiz Project.

Assuming the conveyance of two million acre-feet of indigenous groundwater to the Colorado River Aqueduct, approximately 815,688 tons of salt would enter the Colorado River Aqueduct over the life of the Cadiz Project (59,107 tons/year). Likewise, assuming that one million acre-feet of Colorado River water were stored, approximately 1,015,532 tons of salt would be deposited in the aquifer system underlying the Project spreading basins over the life of the Cadiz Project (147,178 tons/year). Most of the salts that enter the aquifer system in the Cadiz Project area would be pumped back to the Colorado River Aqueduct during extraction operations.

No Colorado River water is anticipated to migrate to Bristol or Cadiz dry lakes during the term of the Cadiz Project. As a hypothetical scenario, however, because Colorado River water contains more sodium and calcium than the indigenous groundwater, any Colorado River water that migrated to the dry lakes and evaporated would contribute even more sodium and calcium to these dry lakes for the production of calcium chloride and sodium chloride. The availability of chloride in the brine underlying the dry lakes would facilitate production of these compounds, and be beneficial.

Perchlorate is the only undesirable constituent that has been identified in Colorado River water that may impact the water quality of the indigenous groundwater in the Cadiz Project area. Recent testing has detected this constituent in Colorado River water at concentrations ranging from non-detect to as high as nine micrograms/liter (µg/L). The current provisional State of California Department of Health Services maximum contaminant level for perchlorate is 18 µg/L. If perchlorate reached the water table, it would be diluted by the indigenous groundwater. If undesirable levels of perchlorate were detected in wells owned by nearby landowners, the mitigation measures identified later in Section 5.5.6 would be implemented. In addition, under the Groundwater Monitoring and Management Plan described in Section 5.5.6, the importation and spreading of Colorado River water could be curtailed in the event that any constituent level in the Colorado River water was determined to pose a threat to the indigenous groundwater. If one million acre-feet of Colorado River water were stored in the Cadiz Project area, approximately 12.2 tons of perchlorate would be deposited in the aquifer system. However, most of this perchlorate would be pumped back to the Colorado River Aqueduct during withdrawal operations.

Any increased perchlorate that may occur in the Cadiz Project area would still meet drinking water standards. The higher perchlorate would not adversely affect the Cadiz Inc. agricultural operations or any other groundwater uses in or adjacent

TABLE 5.5-3
MASS BALANCE FOR INDIGENOUS GROUNDWATER

	Annual Mass from the Cadiz Project (tons)	Total Mass from the Cadiz Project* (tons)
Perchlorate	0.000	0.000
Nitrate as NO_3	2,620	36,162
Arsenic	1.38	19.0
Bromide	25.61	353.5
Chloride	7,684	106,039
TDS	59,107	815,688

*Assumes conveyance of two million acre-feet of indigenous groundwater to the Colorado River Aqueduct (144,893 acre-feet per year times 13.8 years).

TABLE 5.5-4
MASS BALANCE FOR COLORADO RIVER WATER

	Annual Mass From Colorado River Water (tons)	Total Mass from Colorado River Water* (tons)
Perchlorate	1.77	12.2
Nitrate as NO_3	0.000	0.000
Arsenic	0.54	3.7
Bromide	13.79	95.2
Chloride	13,791	95,163
TDS	147,178	1,015,532

*Assumes storage of one million acre-feet in the Cadiz Project area (144,893 acre-feet per year times 6.9 years).

to the Cadiz Project area. Accordingly, the impact would be less than significant.

Mixing Colorado River water with indigenous groundwater would benefit indigenous groundwater quality through the dilution of naturally high concentrations of nitrate present in the indigenous groundwater. The concentration of nitrate (expressed as N03) found in the indigenous groundwater is generally in the range of 13 to 17 mg/L, which is well below the Maximum Contaminant Level (MCL) of 45 mg/L. Nitrate is generally not present in Colorado River water at concentrations greater than one mg/L. Therefore, the addition of low nitrate Colorado River water would improve the quality of the indigenous groundwater through mixing and dilution to lower nitrate concentrations.

Aquifer Characteristics Change

During spreading operations, the mixing of Colorado River water and indigenous groundwater could potentially result in the precipitation of minerals (primarily calcium carbonate) within the sediments that make up the aquifer system. Such

precipitation could, by decreasing the porosity of the aquifer, reduce its ability to yield groundwater to the Project wellfield. The results of extensive laboratory testing and computer modeling indicate this effect is highly unlikely. No significant impacts would occur.

Movement of the Saline Groundwater Interface

Extensive computer modeling was conducted on the movement of saline groundwater in the vicinity of Bristol and Cadiz dry lakes, resulting from Cadiz Project storage and withdrawal operations. This was necessary to determine if the Cadiz Project would affect existing salt mining operations on the dry lake beds. Mineral rights to some brine constituents are owned by the federal government and are leased to mining operations.

The location of the saline groundwater interface (defined by the 1,000 mg/L TDS concentration line) has been determined from recent groundwater analytical data for the Cadiz Inc. agricultural wells and monitoring wells, and from historical analytical data from other wells in the area as shown on Figure 5.5-8. The computer model used to determine saline water interface movement (MT3D) tracks the movement of TDS in the groundwater based on output from the groundwater flow model (MODFLOW).

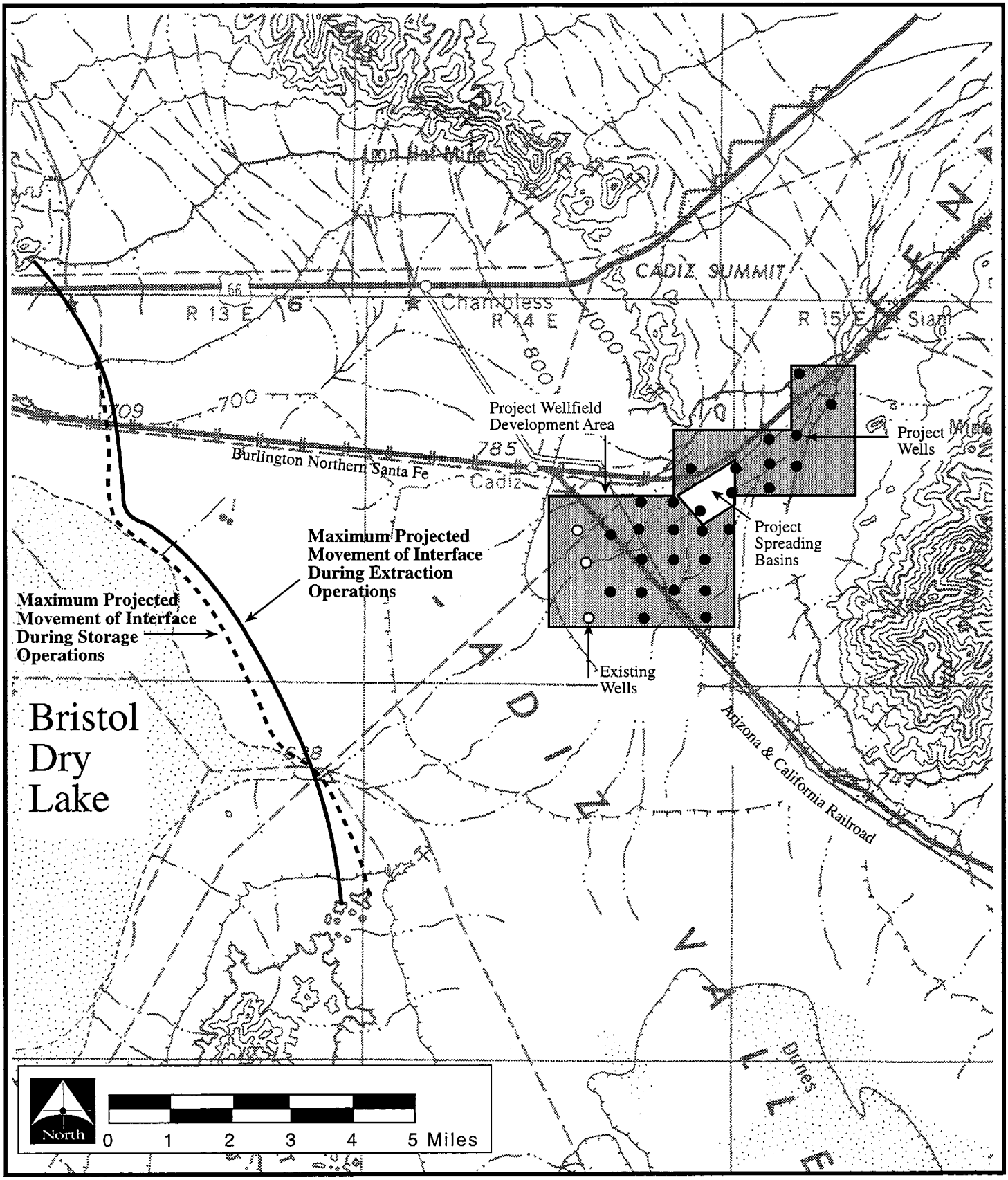
The modeling indicates that movement of the saline water/fresh water interface would be a maximum of approximately 2,000 feet away from the Project wellfield under the greatest storage scenarios, and approximately 2,000 feet toward the Project wellfield under the greatest withdrawal scenarios during the term of the Cadiz Project (Figure 5.5-12).

The minimal amount of movement of this interface toward the Project wellfield during extraction operations would not impact the salt mining operations on the dry lakes, the Cadiz Inc. agricultural wells or any other private groundwater users in proximity to the Cadiz Project area. The nearest production wells to the saline water/fresh water interface (owned by the Cadiz Inc. agricultural operation) are four miles away, well beyond the maximum predicted movement of the interface.

During storage of Colorado River water, the lateral extent of mounding during a maximum storage scenario, as predicted by the transport model, would not reach either Bristol Dry Lake or Cadiz Dry Lake. However, if Colorado River water were to reach these dry lakes, it would migrate upward to the dry lake surface and evaporate. The evaporation potential of the dry lakes is more than adequate to accommodate any such increased recharge. Therefore, dilution of brines would not occur and the salt mining operations would not be affected. Potential migration of stored Colorado River water during long hold periods would be managed by using the Project wellfield for periodic pumping and re-spreading of the extracted groundwater. Monitoring would be conducted as described in mitigation measure WR-1 later in Section 5.5.6, to ensure that there would be no significant effects.

Migration of Water from Other Areas

Migration of lower-quality groundwater into the Cadiz Project vicinity from



Source: GEOSCIENCE Support Services Inc. (1999).

Figure 5.5-12

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Maximum Projected Movement of Saline/Fresh Water Interface

adjacent regions is not likely to result from Project wellfield operations. With the exception of saline groundwater beneath and adjacent to the dry lakes, water quality is relatively consistent throughout the region. TDS concentrations in the Fenner Valley aquifer system are locally slightly higher than those found in the Fenner Gap part of the Cadiz Project area. However, the area of influence of the Project wellfield would not extend a substantial distance into Fenner Valley, and accordingly, the migration of groundwater from Fenner Valley into the Cadiz Project area would be minimal. Monitoring would be conducted as described by mitigation measure WR-1 provided later in Section 5.5.6, to ensure that there would be no significant effects.

Changes to Colorado River Aqueduct Water Quality

Potential changes to water quality in the Colorado River Aqueduct, through introduction of indigenous groundwater from the Cadiz Project area include: (1) reduction of TDS levels; (2) reduction of perchlorate concentration; (3) increase in bromide concentration; and (4) increase in arsenic concentration. Introduction of this water can provide water supply reliability and water quality benefits with regards to some constituents while some having water quality. Water introduced in the Colorado River Aqueduct must meet all drinking water quality regulations as well as provide a net overall benefit to Metropolitan. None of these changes is an adverse impact of the Cadiz Project.

Water Quantity Impacts

Water Level Changes

Ranges of groundwater mounding and depression, as predicted from groundwater modeling, are summarized Table 5.5-5 for the three areas depicted on Figure 5.5-13. The areas (A through C) are in the Project wellfield, at locations that reflect the maximum mound and depression (Area B) and the upgradient near-edge of the mound and depression (Areas A and C). These water level changes reflect the greatest water level fluctuations anticipated during the 50-year term of the Cadiz Project, and are the result of model output for storage, withdrawal and transfer Scenario 5 (average conditions with high storage) and Scenario 6 (dry period with early storage and withdrawal).

The model indicates that water levels directly beneath the Project spreading basins could rise to depths as shallow as approximately 80 feet bgs (approximately 190 feet above the natural water level of 270 feet bgs) when the highest volume of Colorado River Water is stored and the resulting groundwater mound has reached its peak. During maximum withdrawal operations, water levels could be as deep as approximately 470 feet bgs (200 feet below the natural water level).

Based on analysis and interpretation of field data and extensive computer modeling, the Cadiz Project storage and withdrawal operations would not significantly affect water levels directly beneath Bristol and Cadiz dry lakes.

TABLE 5.5-5
MAXIMUM AND MINIMUM GROUNDWATER LEVELS DURING THE 50-YEAR CADIZ PROJECT

Area	Current Groundwater Level		Maximum Rise in Groundwater Levels as Compared to Current Levels		Maximum Drawdown in Groundwater Levels as Compared to Current Levels	
	Depth to Groundwater [ft bgs]	Elevation [ft amsl]	Maximum Rise [ft]	Depth to Groundwater [ft]	Maximum Drawdown [ft]	Depth to Groundwater [ft]
A	294	695	88	206	116	410
B	274	613	193	81	189	463
C	201	582	116	85	143	344

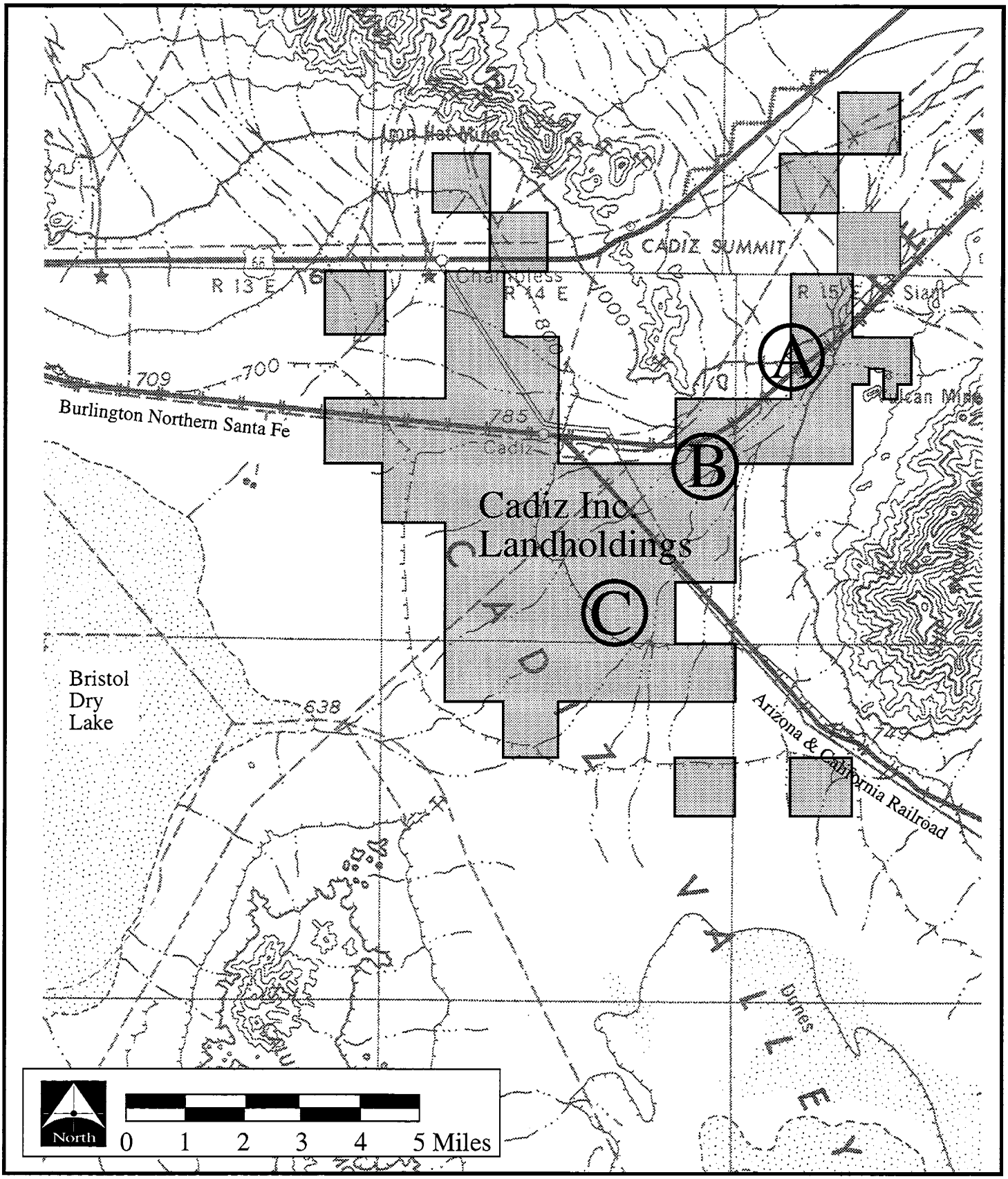
Model results indicate that existing salt mining operations will not be affected. However, as part of the Groundwater Management Plan, described later in Section 5.5.6, changes in water levels over the 50-year term of the Cadiz Project would be monitored to ensure that there would be no significant effects.

Groundwater Supply to Bristol and Cadiz Dry Lakes

A calibrated groundwater flow model was used to quantify the amount of groundwater underflow that would enter Bristol and Cadiz dry lakes at their margins, under natural conditions (without the Cadiz Project) and under two Cadiz Project operating scenarios that demonstrate the greatest range of this potential impact.

Natural groundwater underflow to Bristol Dry Lake, with no Cadiz Project, would be approximately 1,150,000 acre-feet over a 50-year period. With the Cadiz Project in operation, underflow to Bristol Dry Lake would increase during years 1 to 18 and decrease during years 18 to 50 under Scenario 6. Under Scenario 5, underflow would increase during years 1 to 25 and decrease during years 25 to 50. Over the term of the Cadiz Project, the range of cumulative change in underflow to Bristol Dry Lake (the difference between cumulative underflow without the Cadiz Project and cumulative underflow with the Cadiz Project) would be approximately 62,000 acre-feet (Scenario 5) to 174,000 acre-feet (Scenario 6). Corresponding changes in brine levels beneath this dry lake as a result of changes in underflow would range from approximately eight inches of rise to 10 inches of drawdown. Such a fluctuation in brine levels would have no impact on salt mining operations relying on brine trenches or brine wells on Bristol Dry Lake. The maximum projected change in underflow to Bristol Dry Lake and the approximate change in average brine elevation over the 50-year term of the Cadiz Project are shown on Figure 5.5-14.

Natural groundwater underflow to Cadiz Lake, without the Cadiz Project, would be approximately 1,300,000 acre-feet over a 50-year period. With the Cadiz Project in operation, underflow to Cadiz Dry Lake would increase during years 1 to 14 and decrease during years 14 to 50 under both Scenarios 5 and 6. Over the term of the Cadiz Project, the range of cumulative change in underflow to Cadiz Dry Lake (the difference between cumulative



Source: Gioscience Support Services, Inc. (1999).

Figure 5.5-13

Cadiz Groundwater Storage & Dry-Year Supply Program
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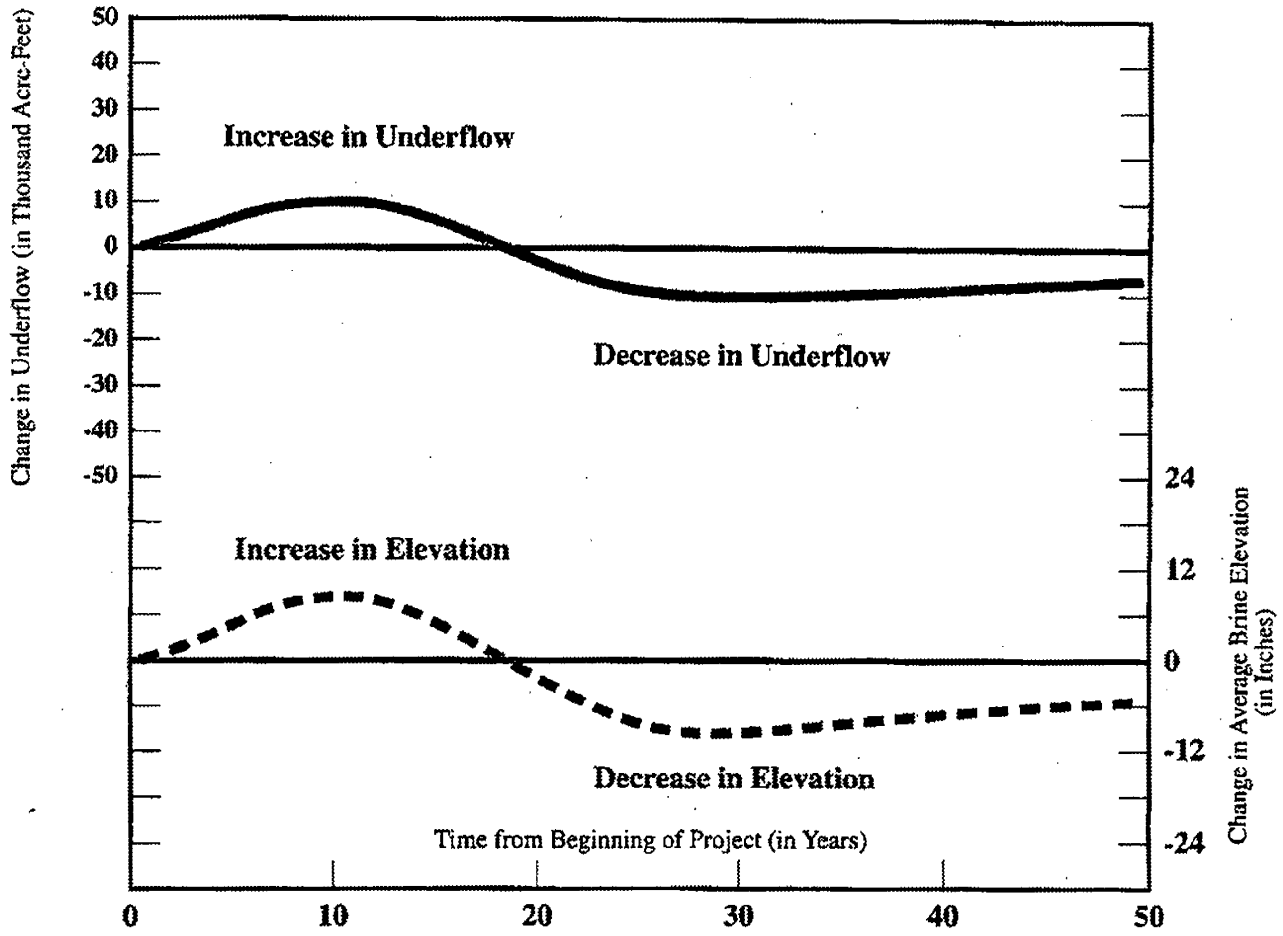
Area of Influence of Project Storage and Extraction Operations



Expressed as underflow in acre-feet and as the change in average brine elevation in inches.

Figure 5.5-14

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Maximum Change in Underflow to Bristol Dry Lake

underflow without the Cadiz Project and cumulative underflow with the Cadiz Project) would be approximately 340,000 acre-feet (Scenario 5) to 480,000 acre-feet (Scenario 6). Corresponding changes in brine levels beneath Cadiz Dry Lake as a result of changes in underflow would range from approximately 17 inches of rise to 25 inches of drawdown. Such a fluctuation in brine levels would have no impact on salt mining operations relying on brine trenches or brine wells on Cadiz Dry Lake. The maximum projected change in underflow to Cadiz Dry Lake and approximate change in average brine elevation over the 50-year term of the Cadiz Project are shown on Figure 5.5-15.

Springs and Phreatophytes

Several bedrock springs are located in the Clipper Mountains, approximately 12 miles north of Fenner Gap. These springs are not related to the water table conditions in the alluvial aquifer system, and they are located far beyond the area of influence of Cadiz Project operations. Accordingly, no impacts to these springs would occur. No other springs are known to exist in proximity to the Cadiz Project area.

Phreatophytic plants are those with deep roots, able to tap shallow groundwater. Because no native varieties of phreatophytes are known to exist in proximity to the Cadiz Project area, no adverse impacts would occur.

Neighboring Basins

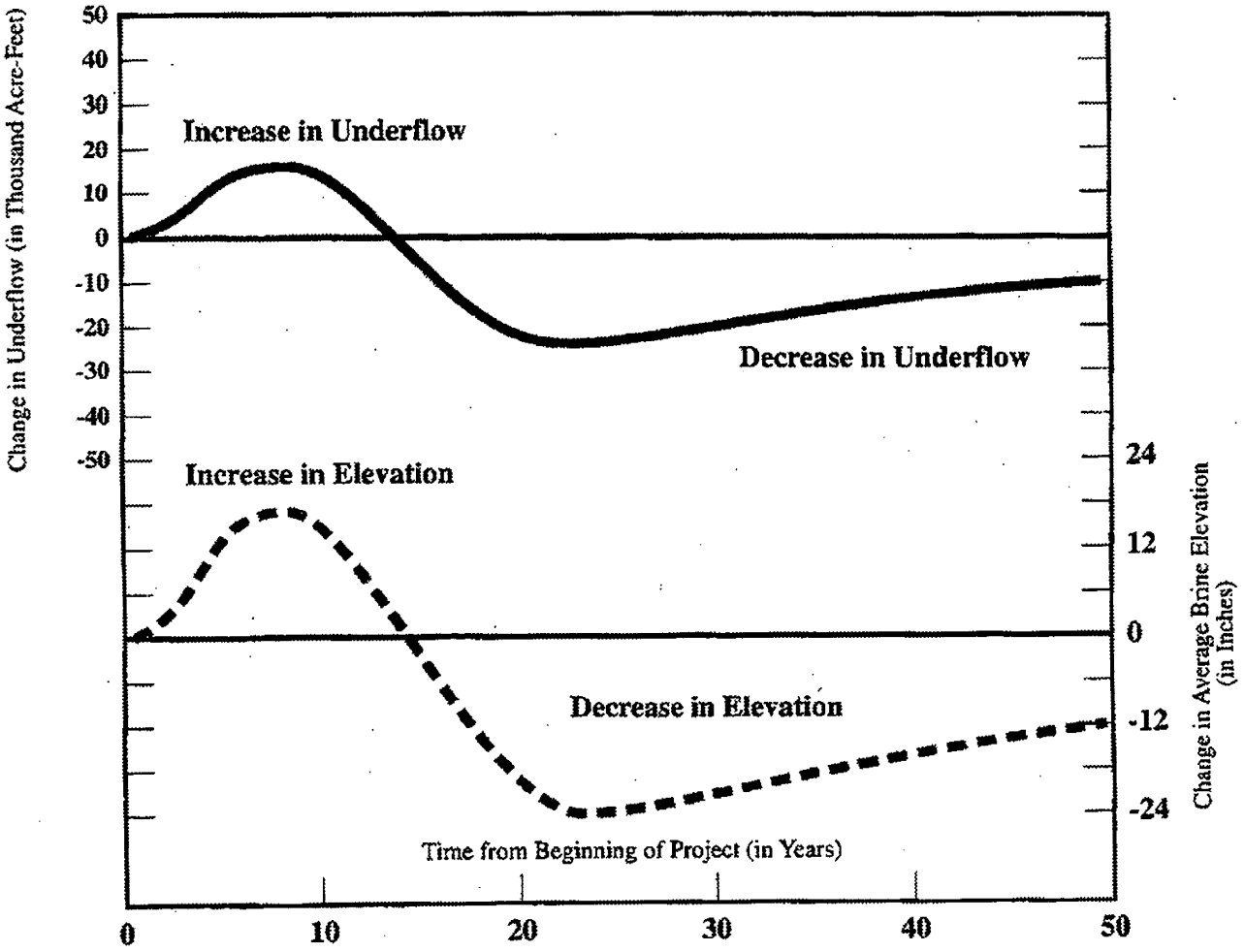
The anticipated area of influence of Cadiz Project operations, as determined by extensive field mapping and computer modeling, is confined entirely within the Bristol, Cadiz and Fenner watersheds as shown in Figure 5.5-1. As discussed in Section 5.4, the mountain ranges that form the boundaries of the aquifer system are composed predominantly of impermeable granitic and metamorphic basement rock. Accordingly, the aquifer system occurs within a contained, bowl-like area from which groundwater cannot escape. Storage and withdrawal operations in the Cadiz Project area would not effect water levels or the quantity of water in storage in the neighboring basins since these basins are not hydraulically connected.

Impact of Evaporation on Microclimate

Average annual evaporation pan measurements in the Amboy area, located approximately 15 miles west of the Project area, average 158 inches per year. Actual evaporation rates from a larger surface water body, such as the Project spreading basins, would be approximately 70 percent of the pan evaporation rate (Chow 1964).

Because the elevation of Fenner Gap is approximately 300 feet higher than that of Amboy, the annual evaporation is expected to be slightly lower. This has been verified with an evaporation pan located immediately adjacent to the pilot spreading basins in Fenner Gap. However, the record for this installation is relatively short-term, and the Amboy pan data have been employed here as a conservative estimate (Figure 5.5-5).

Based on the corrected surface water evaporation values obtained from the Amboy evaporation pan, the amount of water expected to evaporate from the Project spreading basins ranges from



Expressed as underflow in acre-feet and as the change in average brine elevation in inches.

Figure 5.5-15

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Maximum Change in Underflow to Cadiz Dry Lake

approximately 600 to 1,000 acre-feet per year over the 50-year term of the Cadiz Project. Evaporation would occur only during spreading operations. The maximum projected evaporation estimate is approximately three percent of the total volume of Colorado River water to be stored in the Cadiz Project area. For comparison, Lake Havasu, located on the Colorado River east of the Cadiz Project area, loses approximately 133,000 acre-feet of water each year to evaporation (DWR, 1979). This corresponds to a loss of approximately 22 percent of its total storage capacity every year.

The effect of evaporation from the Project spreading basins on the microclimate of Fenner Gap is expected to be minimal. The most aggressive Cadiz Project storage scenario involves spreading during only 17 of the 50 years of the Project based on anticipated availability of Colorado River water and other operational factors. Although minor spreading may be conducted during the storage periods to maintain the Project wellfield and Project spreading basins, the amount of time that Colorado River water would be susceptible to evaporation would be minor in comparison to the life of the Cadiz Project. Accordingly, the existing natural long term climatic conditions in Fenner Gap would not be adversely affected by the Cadiz Project.

5.5.5 MITIGATION MEASURES

WR-1 A comprehensive Groundwater Monitoring and Management Plan shall be prepared and implemented by Metropolitan to monitor, maintain and regulate all groundwater extraction and storage operations within the Project area, including the irrigation wellfield owned and operated by Cadiz Inc.

The Groundwater Monitoring and Management Plan shall include a comprehensive protocol for monitoring all potential adverse impacts due to Project operations and specific measures for mitigating significant adverse impact that are identified. The principal measures to be included in the Groundwater Monitoring and Management Plan are described below:

- Ground Structure Instability (subsidence, hydrocompaction and liquefaction);
- Water Quality Impacts (changes in surface and groundwater quality, and movement of the saline/freshwater interface);
- Water Quantity (groundwater levels and groundwater supply to Bristol and Cadiz dry lakes.

Ground Structure Instability (subsidence, hydrocompaction and liquefaction)

Because the potential for subsidence would be greatest within the Project wellfield itself (Figure 5.5-11), monitoring of this potential impact will be primarily focused in this area. Because the potential for hydrocompaction would be greatest within the vicinity of the Project spreading basins, monitoring of this potential impact will be focused on these facilities. The Project wellfield and spreading basins will be surveyed periodically by a State of California licensed land surveyor to detect subsidence and/or hydrocompaction.

Extensometers will be installed as necessary in selected wells to measure potential compaction of clays and other fine-grained sediments in the aquifer system. If these measures detect differential subsidence or fissuring or general subsidence, more than one foot per mile, an independent investigation will be initiated. Remedial actions would be implemented if the results of this investigation show:

1. Potential for damage to structures as a result of differential subsidence or fissuring;

2. General subsidence sufficient to alter natural drainage patterns or damage structures; or

3. Hydrocompaction that could not be corrected by standard engineering practices.

Remedial actions may include, but are not limited to, repair or replacement of impacted structures or wells and modification of the Project storage and/or extraction schedules.

Although groundwater levels are not anticipated to rise above 80 feet below the ground surface, selected wells in the region will be periodically logged to determine groundwater levels. Groundwater levels in the Project wellfield will also be monitored to detect conditions that could affect adjacent groundwater wells. If these surveys were to show groundwater levels less than 50 feet from the surface in the vicinity of the Project spreading basins, and this can be attributed to mounding as a result of Project operations, spreading operations would be modified until groundwater levels recede. Remedial action would only be implemented if tangible damage is predicted to occur as a result of liquefaction induced by operation of the Cadiz Project.

Water Quality Impacts (changes in surface and groundwater quality, and movement of the saline/freshwater interface)

Water quality will be monitored at selected wells within the Project wellfield and, with the owner's permission, in private and other public wells outside the Project wellfield. Monitoring will include wells in the area of the interface between saline and fresh water near the eastern boundary of Bristol Dry Lake and the northern boundary of Cadiz Dry Lake.

Groundwater samples will be analyzed for total dissolved solids, percholorate and, as needed, for other constituents as required by law and regulation. Field procedures will be in compliance with industry standards. If analyses were to indicate that groundwater chemistry had changed in a manner that would cause the water to be unsuitable for its present use, or otherwise cause tangible damage to the current water users, then remedial actions would be implemented. Depending on the type of effect that was identified, remedial actions may include, but are not limited to, wellhead treatment of impacted wells, blending impacted well water with another local source, modifying the pumping at impacted wells and construction of replacement wells.

Water Quantity (groundwater levels and groundwater supply to Bristol and Cadiz dry lakes)

Project wells and off-site wells (dedicated to monitoring) will be monitored at least annually to determine static water levels. If analyses of these data were to indicate that groundwater levels or well function have changed in a manner that adversely affects current uses, otherwise causes tangible damage to water users or causes the water to be unsuitable for its present use, and that these changes are attributed to the operation of the Cadiz Project, then remedial actions would be implemented. Remedial actions may include, but are not limited to, modification of the Project storage and/or withdrawal schedules and rehabilitation or replacement of impacted wells.

5.5.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Potential impacts to water resources include adverse changes to the quality and quantity of surface water and groundwater.

Surface water quality could be affected primarily during construction of the Cadiz Project facilities, including the wellfield, spreading basins, and water conveyance facilities. The Cadiz Project could introduce sediment and contaminants into surface waters. However, due to the general lack of surface water in the Project area, the ability to control erosion and sedimentation, existing regulation of the use of potential contaminants (fuel, oil, etc.), the ability to clean up accidental spills, and with the short construction activities, the risk of potential adverse impacts is not considered significant.

Potential water quantity impacts include adverse changes in the location of surface water flow. Such impacts could be created by construction of Cadiz Project facilities and continue through the term of the Cadiz Project. The Project will create small impermeable areas associated with the well heads and pumping plants. The spreading basins and water conveyance facilities will be earthen and will not change surface water characteristics appreciably.

The Project spreading basins (all alternatives) and the canal segment of the Eastern/Canal Alternative will require diversion of surface flows. Diverted flows would maintain existing volumes and return water to their existing paths downstream of Cadiz Project facilities. Consequently, the Cadiz Project is not anticipated to have a significant adverse impact on surface water quantity and will have only minor impacts due to the relocation of surface flow.

Groundwater quantity impacts will include potential reduction in flow and groundwater elevation changes. As discussed earlier, groundwater elevation can be managed through the Cadiz Project operation. As required under the Groundwater Monitoring and Management Plan (mitigation measure WR-1), groundwater elevations will be monitored and the Cadiz Project operations adjusted to avoid significant adverse impacts.

Potential groundwater quality impacts include the potential introduction of undesirable constituents from Colorado River water into the groundwater aquifer system and the potential introduction of undesirable constituents from the indigenous groundwater into the Colorado River Aqueduct. As discussed above, Cadiz Project operations will transfer undesirable constituents. However, this

transfer will not cause exceedance of any drinking water standards. Therefore, these impacts are less than significant.

5.6 AIR QUALITY

5.6.1 AFFECTED ENVIRONMENT

Existing Air Quality Data

The Cadiz Project is in the Mojave Desert Air Basin (MDAB) under the jurisdiction of the Mojave Desert Air Quality Management District (MDAQMD) as shown in Figure 5.6-1. The existing air quality conditions in the MDAB include air quality management planning activities, ambient air quality measurements, climatic conditions, sensitive receptors and existing emissions sources.

Non-Attainment Designations and Classification Status

The United States Environmental Protection Agency (USEPA) and the California Air Resources Board (CARB) have designated portions of the MDAQMD as nonattainment for a variety of pollutants, and some of those designations have an associated classification. An unclassified designation means that adequate data is not available. Table 5.6-1 shows the designations and classifications for criteria pollutants in the MDAQMD. The Cadiz Project area is in a nonattainment area for ozone (O_3) and particulate matter (PM_{10}).

The Cadiz Project is not in the Southwest Desert Modified Air Quality Management Area (AQMA), Searles Valley Planning Area or the Mojave Desert Planning Area. Therefore, the specific policies that apply to these special air quality management areas are not applicable in the Cadiz Project area.

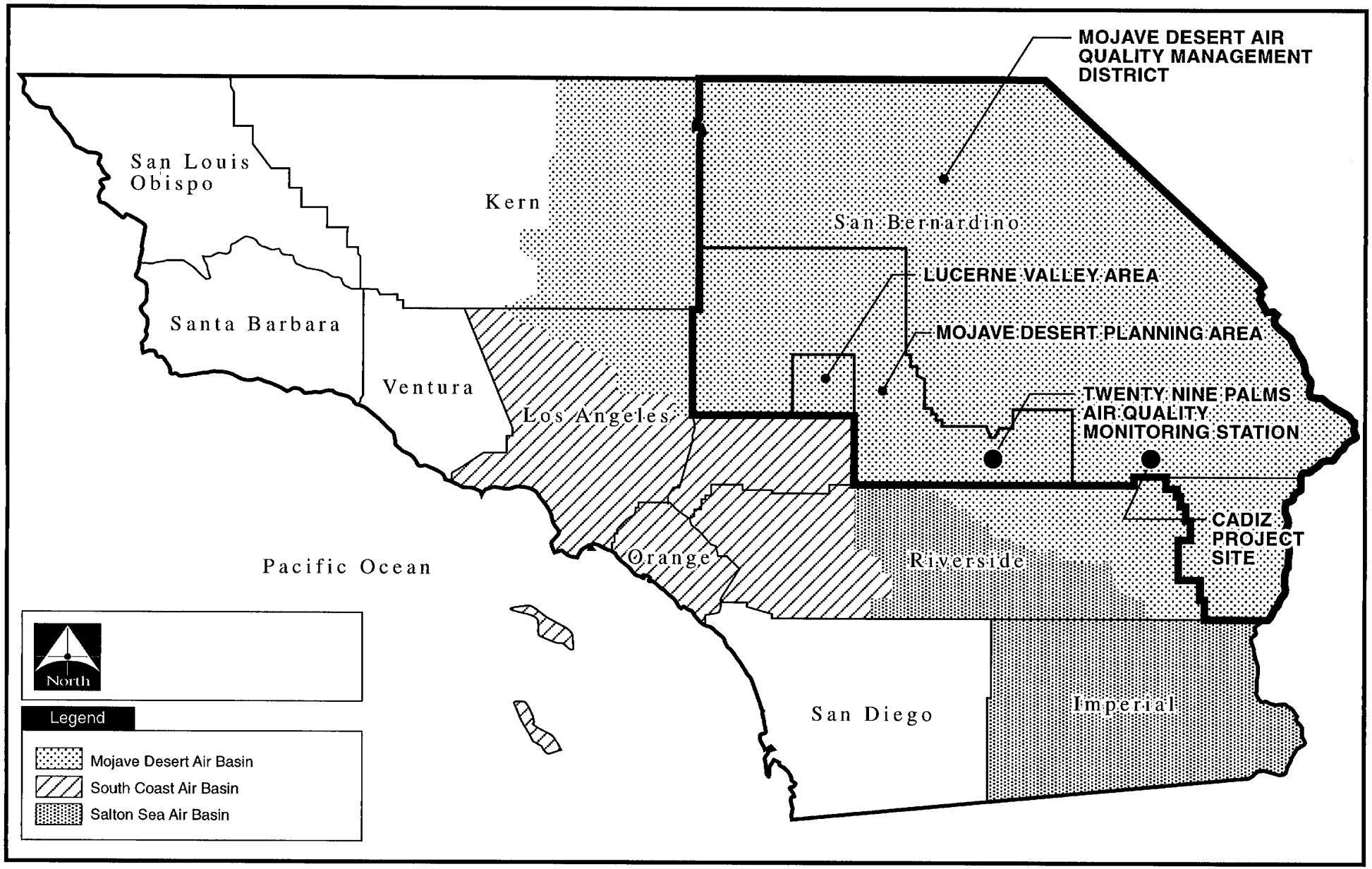
Measured Pollutant Levels

Table 5.6-2 shows the California and federal ambient air quality standards (AAQS), the concentrations of pollutants measured at the Twentynine Palms air quality monitoring station and the number of days that state and federal AAQS were exceeded. State standards for particulate matter were exceeded for one day in 1995. State and federal standards for O_3 were exceeded for several days each in 1995, 1996 and 1997.

Topography and Climate

The Cadiz Project is in the MDAB. The MDAB is an assemblage of mountain ranges interspersed with long broad valleys that often contain dry lakes. Many of the lower mountains which dot the vast terrain rise from 1,000 to 4,000 feet above the valley floor. Prevailing winds in the MDAB are out of the west and southwest. These prevailing winds are due to the proximity of the MDAB to coastal and central regions and the blocking nature of the Sierra Nevada Mountains to the north; air masses pushed onshore in Southern California by differential heating are channeled through the MDAB. The MDAB is separated from the Southern California coastal and central California Valley regions by mountains where highest elevation reaches approximately 10,000 feet and whose passes form the main channels for these air masses.

The Mojave Desert is bordered on the southwest by the San Bernardino Mountains, which are separated from the San Gabriel Mountains by the Cajon Pass (4,200 feet). A lesser channel, the Morongo Valley, lies between the San Bernardino Mountains and the Little San Bernardino Mountains.



Source: MDAQMD (1999).

Figure 5.6-1

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Mojave Desert Air Basin and Air Quality Management District

TABLE 5.6-1
DESIGNATIONS AND CLASSIFICATIONS FOR AIR QUALITY
IN THE MOJAVE DESERT AIR BASIN

Ambient Air Quality Standard	MDAQMD
One-Hour Ozone (Federal)	Nonattainment; classified Severe-17 (the part of the MCAQMD outside the Southeast Desert Modified AQMA is attainment).
Eight-Hour Ozone (Federal)	Unclassified.
Ozone (State)	Nonattainment; classified Moderate.
PM_{10} (Federal)	Nonattainment; classified Moderate (the part of the MDAQMD in Riverside County is attainment).
New PM_{10} (Federal)	Unclassified.
PM_{25} (Federal)	Unclassified.
PM_{10} (State)	Nonattainment.
Carbon Monoxide (State and Federal)	Attainment.
Nitrogen Dioxide (State and Federal)	Attainment.
Sulfur Dioxide (State and Federal)	Attainment.
Lead (State and Federal)	Attainment
Particulate Sulfate (State)	Attainment (Searles Valley Planning Area is nonattainment).
Hydrogen Sulfide (State)	Unclassified (Searles Valley Planning Area is nonattainment).
Visibility Reducing Particles (State)	Unclassified.

Source: MDAQMD CEQA and Federal Guidelines (1998).

The Palo Verde Valley part of the Mojave Desert lies in the low desert, at the east end of a series of valleys, most notably Coachella Valley, whose primary channel is the San Gorgonio Pass (2,300 feet) between the San Bernardino and San Jacinto Mountains.

During the summer, the MDAB is generally influenced by a Pacific subtropical high cell which sits off the coast and which inhibits cloud formation and encourages daytime solar heating. The MDAB is rarely influenced by cold air masses moving south from Canada and Alaska, as these frontal systems are weak and diffuse by the time the reach the desert.

Most desert moisture arrives from infrequent warm, moist and unstable air masses from the south. The MDAB averages between three and seven inches of precipitation per year with from 16 to 30 days with at least 0.01 inches of precipitation. The MDAB is classified as a dry-hot desert climate (BWh), with portions classified as dry-very hot desert (BWhh), to indicate at least three months have maximum average temperatures over 100.4° Fahrenheit (F).

TABLE 5.6-2
AIR QUALITY LEVELS MEASURED AT THE TWENTYNINE PALMS AMBIENT AIR MONITORING STATION

Pollutant	Avg. Time	CA Standard	Fed. Standard	Year	Max. or Mean Level	Days Std. Exceeded
Ozone (O_3)	1 hr.	0.09 ppm	0.12 ppm	1995	0.11	3 (state)
				1996	0.121	19 (state)
				1997	0.115	15 (state)
	8 hr.	--	0.08 ppm	1995	0.0939	3 (fed.)
				1996	0.1014	22 (fed.)
				1997	0.1046	14 (fed.)
Particulate Matter (PM_{10})	AGM	30 mg/m3	--	1995	11.9	0
				1996	20.2	0
				1997	14.9	0
	24 hr.	50 mg/m3	150 mg/m3	1995	85	1 (state)
				1996	47	0
				1997	30	0
	AAM	--	50 mg/m3	1995	9.9	0
				1996	22.5	0
				1997	16.6	0
Carbon Monoxide (CO)	8 hr.	9 ppm	9 ppm	1995	2.03	0
				1996	1.31	0
				1997	1.03	0
	1 hr.	20 ppm	35 ppm	1995	5	0
				1996	1.9	0
				1997	2	0
Nitrogen Dioxide (NO_2)	AAM	--	0.053 ppm	1995	0.00653	0
				1996	0.0062	0
				1997	0.00603	0
	1 hr.	0.25 ppm	--	1995	0.073	0
				1996	0.035	0
				1997	0.037	0
Sulfur Dioxide (SO_2)	AAM	--	0.030 ppm	1995	0.002	0
				1996	0.0011	0
				1997	0.0008	0
	24 hr.	0.04 ppm	0.14 ppm	1995	0.005	0
				1996	0.0037	0
				1997	0.002	0
	3 hr.	--	0.5 ppm	1995 to 1997	--	0
	1 hr.	0.25 ppm	--	1995	0.012	0
				1996	0.005	0
				1997	0.008	0

Source: California Air Resources Board, California Ambient Air Quality Data 1980-1997, compact disc.

Notes:
AGM = annual geometric mean
AAM = annual arithmetic mean
ppm = parts per million
mg/m3 = micrograms per cubic meter

The average rainfall in the proposed project area is four to six inches annually. The average wind speed in the Proposed Cadiz Project area is eight miles per hour and the prevailing wind direction is from the west. Refer to Section 5.5 (Water Resources) for a more detailed description of meteorological conditions in the Cadiz Project area.

Air Quality Management Plans

The MDAQMD Triennial Revision to the 1991 Air Quality Attainment Plan (AQAP) (1996) and the Southern California Association of Governments (SCAG) Regional Comprehensive Plan and Guide (1996) apply to the Cadiz Project area. Both these plans indicate that the main source of O_3 in the MDAB is O_3 transported by the wind from the South Coast Air Basin to the MDAB.

The Mojave Desert Planning Area PM_{10} Plan (1995) is a federal PM_{10} attainment plan for the Mojave Desert Area designed to satisfy the 1990 Federal Clean Air Act planning requirements. The MDAQMD has requested that the federal government change the PM_{10} status for the Cadiz Project area from nonattainment to unclassified because there is not adequate data to support the nonattainment status. There are no control measures in this Plan.

Sensitive Receptors

The Cadiz area, at the north end of the Cadiz Project, consists primarily of agricultural fields and a few residences farther to the north. The residences are the only sensitive receptors in the immediate vicinity of the Cadiz Project. These residences are located approximately five miles from the northwestern boundary of the Project spreading basins. For this EIR, sensitive air quality receptors are defined as residences, schools, play-grounds, child care centers, convalescent homes, retirement homes, rehabilitation centers and athletic facilities.

Existing Emissions Sources

Existing emissions sources in the vicinity of the proposed Cadiz Project include: diesel fuel burning emissions for operation of generators to run wells at Cadiz Ranch; emissions from vehicles traveling on paved roads (I-66, SR 62 and Iron Mountain Road); dust and vehicle emissions from vehicles traveling on unpaved roads (between SR 62 to Cadiz Dry Lake, between the north end of Iron Mountain Road to the AT&SF railroad alignment to the community of Cadiz); AT&SF railroad train emissions; and dust from high winds in the undeveloped desert, fallow agricultural fields near the community of Cadiz, and the Cadiz, Bristol and Danby dry lakes.

The major existing energy consumers in the Cadiz Project area are the Iron Mountain Pumping Plant and the wells used to irrigate Cadiz Inc. agricultural operations. There are seven irrigation wells which are currently powered by diesel engines. The pumps operating these wells use approximately 191,500 gallons per year of diesel fuel to power the irrigation wells. Refer to section 5.9 (Energy and Mineral Resources) for a more detailed discussion of current energy use.

5.6.2 THRESHOLDS OF SIGNIFICANCE

A project will normally have a significant adverse environmental impact on air quality if it results in:

- Air emissions that exceed any of the following MDAQMD standards or result in a substantial contribution to an existing or projected air quality violation:

  548 pounds daily of CO.
  137 pounds daily of NO_x.
  137 pounds daily of SO_2.
  137 pounds daily of VOC.
  82 pounds daily of PM_{10}.

  100 tons annually of CO.
  25 tons annually of NO_x.
  25 tons annually of SO_2.
  25 tons annually of VOC.
  15 tons annually of PM_{10}.

- A conflict with or obstruction of the implementation of the applicable Air Quality Management Plan.

- A cumulatively considerable net increase of any criteria pollutant for which the project region is in non-attainment under an applicable federal or state AAQS (including releasing emissions which exceed quantitative thresholds for ozone precursors).

- Delay in the timely attainment of any air quality standard or any required interim emission reductions or other milestones of any federal attainment plan.

- Exposure of sensitive receptors to substantial pollutant concentrations.

- The creation of objectionable odors affecting a substantial number of people.

5.6.3 METHODOLOGY

Based on MDAQMD's recommendation, the estimated emissions for the construction and operation of the Cadiz Project were calculated based on emissions factors in the 1993 South Coast Air Quality Management District (SCAQMD) CEQA Handbook. The Triennial Revision to the 1991 AQAP and the SCAG Regional Comprehensive Plan and Guide were reviewed for consistency with the proposed project. General Plan consistency of the proposed project is discussed in detail in Section 5.2 (Land Use).

5.6.4 IMPACTS

Construction Impacts

Table 5.6-3 summarizes the estimated temporary emissions for the construction of the build alternatives for the Cadiz Project. These emissions reflect the intensity of the effort to implement the Cadiz Project over the planned construction period. The summary table is based on the detailed emission calculations provided in Appendix C. Emissions were estimated for all construction activities including stationary equipment, mobile construction equipment/vehicles and vehicular traffic to and from the Cadiz Project site. Table 5.6-3 also shows the thresholds of significance for each pollutant and shows whether or not the Cadiz Project is anticipated to result in a significant adverse air quality impact without mitigation. Based on the identified impact thresholds, and due to the overall

Table 5.6-3
Summary of Estimated Construction Emissions

Alternatives /Emissions Sources	Estimated Pollutant Emissions									
	CO		ROC		NOx		SOx		PM_{10}	
	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)	(lbs/day)	(tons/yr)
Eastern Alternative										
Stationary Equipment	68.60	9.70	21.60	3.10	315.60	44.70	21.00	3.00	11.30	1.60
Mobile Equipment	10556.80	1606.20	777.00	116.10	5117.70	750.70	444.70	65.00	388.00	56.90
Vehicular	5476.8	722.07	331.4	43.5	1606.3	207.5	102.5	13.3	167.7	21.9
PM10 from Construction Site	--	--	--	--	--	--	--	--	458568.5	48481.4
Totals	**16102**	**2338**	**1130**	**163**	**7040**	**1003**	**568**	**81**	**459136**	**48562**
Thresholds of Significance	548	100	137	25	137	25	137	25	82	15
Level of Significance Before Mitigation	significant	significant	significant	significant	significant	significant	significant	significant	significant	significant
Western Alternative										
Stationary Equipment	68.60	9.70	21.60	3.10	315.60	44.70	21.00	3.00	11.30	1.60
Mobile Equipment	10556.80	1606.20	777.00	116.10	5117.70	750.70	444.70	65.00	388.00	56.90
Vehicular	5500.5	725.5	332.2	43.6	1611.6	208.2	102.9	13.3	168.3	22
PM10 from Construction Site	--	--	--	--	--	--	--	--	508359.2	55164.1
Totals	**16126**	**2341**	**1131**	**163**	**7045**	**1004**	**569**	**81**	**508927**	**55245**
Thresholds of Significance	548	100	137	25	137	25	137	25	82	15
Level of Significance Before Mitigation	significant	significant	significant	significant	significant	significant	significant	significant	significant	significant
Combination Alternative										
Stationary Equipment	68.60	9.70	21.60	3.10	315.60	44.70	21.00	3.00	11.30	1.60
Mobile Equipment	10556.80	1606.20	777.00	116.10	5117.70	750.70	444.70	65.00	388.00	56.90
Vehicular	5499.5	725.37	332.1	43.6	1611.4	208.2	102.9	13.3	168.3	22
PM10 from Construction Site	--	--	--	--	--	--	--	--	506798.7	54969.1
Totals	**16125**	**2341**	**1131**	**163**	**7045**	**1004**	**569**	**81**	**507366**	**55050**
Thresholds of Significance	548	100	137	25	137	25	137	25	82	15
Level of Significance Before Mitigation	significant	significant	significant	significant	significant	significant	significant	significant	significant	significant
Eastern/Canal Alternative										
Stationary Equipment	92.10	13.40	29.00	4.20	423.50	61.50	28.20	4.10	15.10	2.20
Mobile Equipment	12344.80	1871.10	964.10	143.60	6587.40	967.20	577.80	84.60	500.10	73.30
Vehicular	6737.5	898.7	450.1	59.3	1959.6	255.9	124.1	16.3	202	26.6
PM10 from Construction Site	--	--	--	--	--	--	--	--	716995	83305
Totals	**19174**	**2783**	**1443**	**207**	**8971**	**1285**	**730**	**105**	**717712**	**83407**
Thresholds of Significance	548	100	137	25	137	25	137	25	82	15
Level of Significance Before Mitigation	significant	significant	significant	significant	significant	significant	significant	significant	significant	significant

Notes:
Refer to detailed emissions tables in Appendix C (Air Quality).
The emissions were calculated using emission equations and factors in the 1993 SCAQMD CEQA Handbook.
The Transportation and Circulation chapter of this EIR is the source of the vehicular trip information.
The "Vehicular" emissions source includes emissions from haul trucks and autos, cement trucks within the alignment and delivery of equipment and materials.
The "Mobile Equipment" category includes emissions from construction vehicles within the alignment.

magnitude of the Cadiz Project, all short term temporary air emissions impacts would be significant for all the build alternatives.

Operations Impacts

Operations related air emissions from the build alternatives for the Cadiz Project are anticipated to result from the following activities: energy use by the pumping facility for pumping water in the spreading and withdrawal modes of operation, energy used by the control room, and emissions associated with the maintenance crew and wind erosion PM_{10} emissions from the spreading basins and access roads.

Energy

As discussed in Section 5.9 (Energy and Mineral Resources) and shown in Table 5.9-2, the peak demand for electricity for the operation of the Cadiz Project would be in the withdrawal mode. The Cadiz Project will use Metropolitan's existing power supply from the Colorado River Aqueduct. Pumps would be shut down along the Colorado River Aqueduct, simultaneously providing Colorado River Aqueduct, capacity and power supply for the Cadiz Project. Given this transfer of energy use from one Metropolitan operation to another, the Cadiz Project is not anticipated to result in a net increase in energy use for the operation of pumps and extraction wells. Therefore, the Cadiz Project would not result in significant air quality impacts related to pump and extraction well energy use during operation.

The existing Colorado River Aqueduct power supply will also be used to provide power to the pumping facility control room. The amount of electricity that will be used by the pumping facility control room is 411 kWh/day. This is a relatively small amount of electricity compared to the energy demand of the pumps. The control room energy use is estimated to generate 0.08 lbs. of CO per day, 0.004 lbs. per day of ROC, 0.5 lbs. per day of NO_x and SO_x and 0.02 lbs. per day of PM_{10}. These levels of pollutants are far below the daily and annual thresholds of significance. Therefore, the Cadiz Project would not result in a significant impact related to control room energy consumption during operations.

Maintenance Crew

During operations, the maintenance crew would generate emissions from vehicle fuel consumption, commuting to work and driving in the Cadiz Project area as well as PM_{10} emissions from driving on dirt roads. The maintenance crew consists of nine persons. Air emissions from this size of maintenance crew are estimated to be minimal and below a level of significance.

Project Spreading Basins

Vegetation that grows in the Project spreading basins will be cleared approximately once a year. The spreading basin berms will also be maintained approximately once a year. The Project spreading basins could be empty for periods of up to a year. The spreading basins, although denuded of vegetation, will be comprised of soil which is both mechanically compacted by grading activities and also by wetting during spreading activities. Current operation of the pilot spreading basins has not appeared to result in a noticeable increase in dust generation in the area. The PM_{10} emissions from the Project spreading

basins are estimated to be minimal because disturbance will be infrequent and the emissions from the undisturbed Project spreading basins are estimated to be similar to the surrounding undeveloped landscape.

Wind erosion emissions from the unpaved access roads on the Cadiz Project site are also anticipated to be similar to the existing wind erosion emissions from the surrounding undeveloped, sparsely vegetated landscape. Therefore, the Cadiz Project is anticipated to result in air quality impacts that are below a level of significance related to wind erosion of the Project spreading basins and access roads during operations.

During operations of the Project spreading basins, odor is unlikely to be created due to the rapid percolation of the Colorado River Aqueduct water.

Summary

The combined emissions from the energy use of the pumps and control room and the emissions associated with the maintenance crew, Project spreading basins and unpaved access roads are estimated to be minimal. Therefore, the Cadiz Project would not result in significant air quality impacts during operations.

Because the emissions from the Cadiz Project are estimated to be minimal during operations, the Cadiz Project would not result in significant adverse impacts during operations related to the following: air quality emissions standards; consistency with the AQAP and SCAG Regional Comprehensive Plan and Guide; clean air attainment delays; cumulative non-attainment criteria pollutants and sensitive receptors or odors.

Impacts Related to Air Quality Emissions Standards

The following is a discussion of the anticipated air quality impacts of the build alternatives for the Cadiz Project related to each threshold. The No Project Alternative is addressed separately.

The Eastern, Western, Combination and Eastern/Canal Alternatives are anticipated to result in significant adverse air quality impacts related to air quality emissions standards during construction for CO, ROC (VOC), NO_x, SO_x and PM_{10}, as shown in Table 5.6-3. Mitigation measures provided later in this section will substantially reduce this impact, but impacts would remain significant during construction.

Consistency with the AQAP and SCAG Regional Comprehensive Plan and Guide

SCAG participates in the approval process of the MDAQMD's air plans such as the Triennial Revision to the AQAP. However, the SCAG Regional Comprehensive Plan and Guide does not include any additional requirements to the MDAQMD's air plan. Therefore, the Cadiz Project will not result in a significant adverse air quality impact related to consistency with the SCAG Regional Comprehensive Plan and Guide.

Because the Cadiz Project is a new program, the Eastern, Western, Combination or Eastern/Canal Alternatives were not included in the Emissions Source Groups in the Triennial Revision to the AQAP. The Eastern,

Western, Combination or Eastern/Canal Alternatives would result in significant adverse emissions of CO, VOC, No_x, So_x and PM_{10} during construction, as described earlier, in excess of the levels estimated in the Triennial Revision to the AQAP. Therefore, each of these Alternatives would result in a significant adverse air quality impact related to a conflict with the Triennial Revision to the AQAP during construction. Mitigation measures provided later in this section will substantially reduce this impact, but not to a level of insignificance.

Clean Air Attainment Delays

The Eastern, Western, Combination and Eastern/Canal Alternatives are expected to result in contributions to delays in the timely attainment of air quality standards in the MDAQMD. The Cadiz Project is in an area currently designated as non-attainment for O_3 and particulate matter. During construction, each of the build alternatives is anticipated to result in levels of NO_x and VOC (O_3 precursors) and PM_{10} which are significant based on the MDAQMD thresholds. Therefore, the Eastern, Western, Combination and Eastern/Canal Alternatives would result in significant adverse impacts related to timely attainment of air quality standards during construction. Mitigation measures provided later in this section will substantially reduce this impact, but not to a level of insignificance.

Cumulative Non-Attainment Criteria Pollutants

The Cadiz Project is in an area currently designated as non-attainment for O_3 and particulate matter. During construction, the Eastern, Western, Combination and Eastern/Canal Alternatives would result in levels of NO_x and VOC (O_3 precursors) and PM_{10} which are significant based on the MDAQMD thresholds. Therefore, the Eastern, Western, Combination and Eastern/Canal Alternatives would result in a significant adverse impact during construction related to the non-attainment pollutants O_3 and particulate matter, in the MDAB. Mitigation measures provided later in this section will substantially reduce this impact, but not to a level of significance.

Sensitive Receptors

The project features under the Eastern, Western, Combination and Eastern/Canal Alternatives are not adjacent to any sensitive receptors. Therefore the Eastern, Western, Combination and Eastern/Canal Alternatives would not result in a significant air quality impact on sensitive receptors.

Odors

The Eastern, Western, Combination and Eastern/Canal Alternatives would not result in significant objectionable odors during construction because no odor causing activities will occur.

No Project Alternative

The No Project Alternative does not result in construction and operations emissions and therefore does not exceed emission standards, affect attainment of pollution standards or affect sensitive receptors. The No Project Alternative is consistent with attainment plans.

5.6.5 MITIGATION MEASURES

AQ-1 Construction activities shall be conducted in a manner that minimizes the amounts of exposed excavated soil during and at the end of work periods.

AQ-2 During construction and spreading basin maintenance, surplus excavated material will be disposed of in accordance with local ordinances and sound engineering practices.

AQ-3 During construction and spreading basin maintenance, water will be used on site and on equipment in the morning and evening, as necessary, to prevent the transport of silt onto public roads. Implementation of this measure is anticipated to result in a 34% reduction in PM_{10} emissions from graded areas based on the SCAQMD CEQA Handbook.

AQ-4 During construction, soil binders, watering or other dust control methods will be used on the site, unpaved haul roads and unpaved parking areas. Implementation of this measure is anticipated to result in a 30% reduction in PM_{10} emissions from graded areas based on the SCAQMD CEQA Handbook.

AQ-5 During construction, all application of non-toxic soil stabilizers will be conducted in accordance with manufacturer's specification to all inactive construction areas (previously graded areas inactive for ten days or more). Implementation of this measure is anticipated to result in a 30% reduction in PM_{10} emissions from graded areas based on the SCAQMD CEQA Handbook.

AQ-6 Construction equipment shall be maintained and properly tuned and operated in a manner so as to reduce peak emission levels.

AQ-7 Construction contractors shall provide rideshare or transit incentives for construction employees.

5.6.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

The Eastern, Western, Combination and Eastern/Canal Alternatives are each anticipated to result in significant adverse air quality impacts during construction related to air quality emissions standards, cumulative non-attainment criteria pollutants, and attainment plans and delays that cannot be mitigated to below a level of significance. The implementation of the mitigation measures shown above is not anticipated to reduce any of the emissions totals shown in Table 5-6.3 to below a level of significance. Because electric power for operations comes from Metropolitan's existing supply and is available due to a shift in use, operational impacts from energy use are not significant. Once a year spreading basin maintenance activities are infrequent and would not result in a significant PM_{10} impact.

5.7 TRANSPORTATION

5.7.1 AFFECTED ENVIRONMENT

Roads and Highways

Barstow, Desert Center, Morongo Valley, Needles, Parker and Twentynine Palms are communities that have been identified as the most likely places from which construction crew/employees, materials and equipment for the Cadiz Project would originate. Larger equipment would be expected to come from the Los Angeles area. This section examines the existing road network providing access to/from these places of origin to the Cadiz Project area during construction and, later, operation of the Cadiz Project. Figure 5.7-1 shows the regional location of the Cadiz Project and the highways and streets serving this area.

Regional access to the Cadiz Project area is provided by Interstate 40 (I-40) via National Trails Highway (old US 66) from the north, and I-10 via State Route (SR) 177 and SR 62 from the south. I-40 is a four-lane east-west freeway north of the Cadiz Project area, connecting to Barstow, approximately 100 miles west of the Cadiz Project area, and to Needles, approximately ninety miles east of the Cadiz Project area. I-10 is a four-lane, east-west freeway south of the Cadiz Project area providing regional access from the west (Los Angeles, Orange, San Bernardino and Riverside Counties) and the east (Phoenix). I-95 is a north-south interstate highway which provides a link between I-10 and I-40 east of the Cadiz Project area. I-95 connects to I-40 to the north at Parker Junction and to I-10 to the south at Vidal Junction. Vidal Junction is approximately 30 miles east of the Iron Mountain Pumping Plant and approximately 20 miles west of Parker.

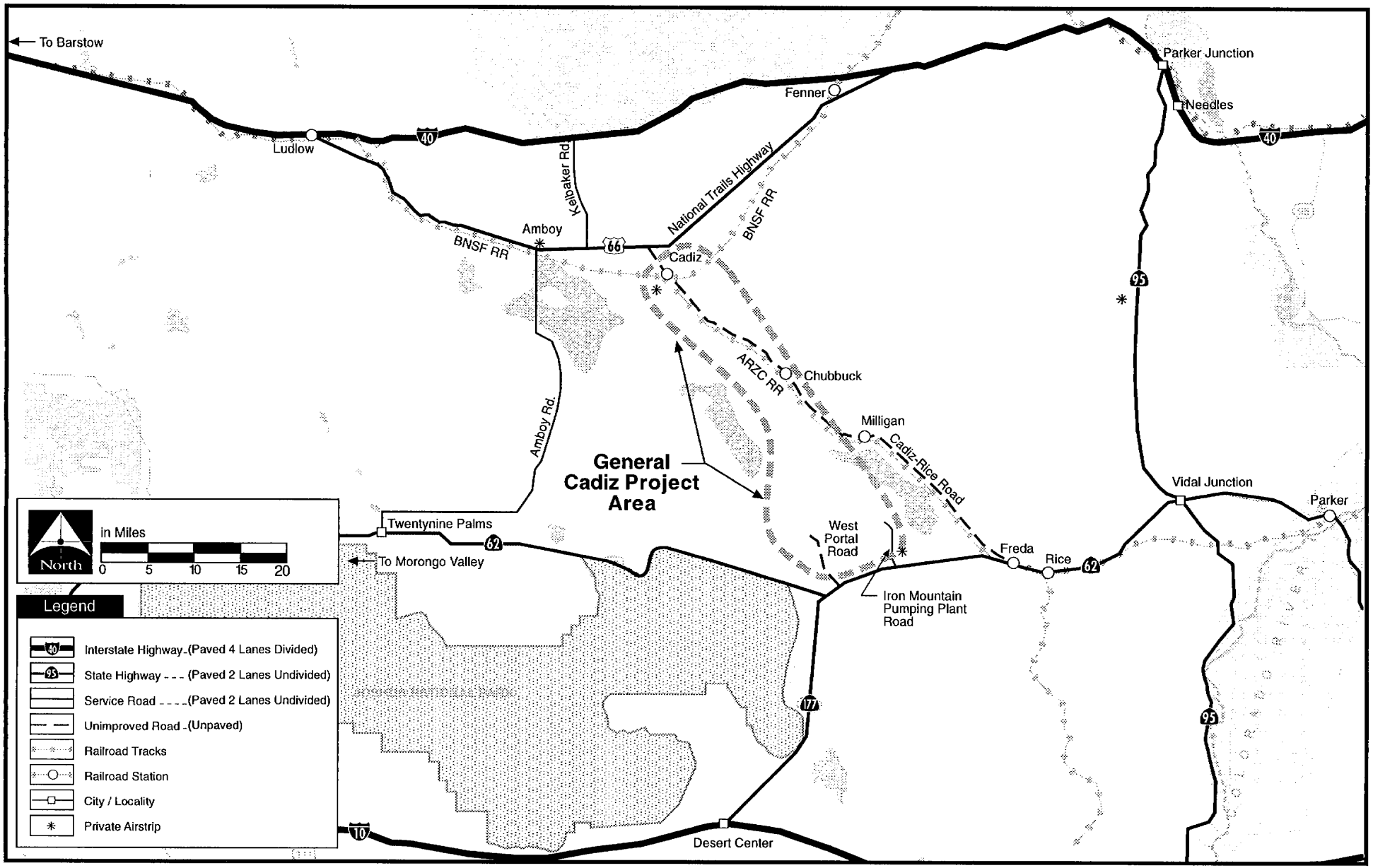
SR 62 is a two-lane highway that connects the Iron Mountain Pumping Plant to Twentynine Palms approximately 60 miles to the west and to Parker approximately 60 miles to the east. SR 177 is a two-lane north-south highway that connects to Desert Center at I-10 approximately thirty miles south of the Iron Mountain Pumping Plant. National Trails Highway is a two-lane highway which roughly follows a semi-elliptical alignment, with the west end connecting to I-40 at Ludlow 40, miles northwest of Cadiz, and the east end connecting to I-40 at Fenner approximately 30, miles northeast of the Cadiz Project area. Amboy Road is a two-lane paved road that connects the National Trails Highway at Amboy (approximately 15 miles west of Cadiz) to Twentynine Palms. Kelbaker Road is a two-lane north-south paved road connecting National Trails Highway to I-40.

The majority of the roads in the Cadiz Project area are unimproved and serve minimal traffic volumes. Along the easternmost edge of the Cadiz Project area, unimproved Cadiz-Rice Road runs northwesterly from SR 62 at Freda to National Trails Highway at Cadiz, generally following the alignment of the ARZC rail line. Cadiz-Rice Road currently carries approximately 10 trips per day.

Due to the limited road network in the area, access roads would be constructed within the Cadiz Project area.

Railroads

Current railroad transportation in the area consists of tracks operated by the BNSF and ARZC. The BNSF rail lines closely follow the east-west alignment of National Trails Highway. In the general vicinity of the



Source: P&D Consultants (1999).

Figure 5.7-1

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Transportation Network

Cadiz Project, these rail lines run through the following areas: Ludlow, Amboy, Cadiz and Needles. East of Needles, the rail lines continue into Arizona. The BNSF rail lines are main line facilities used for long distance and transcontinental shipments. Activity on these rail lines is frequent and cannot be disrupted.

At a BNSF siding located at Cadiz, the BNSF rail lines connect with the ARZC track. The ARZC track extends from Cadiz to Phoenix, Arizona.

In the Cadiz Project area, the ARZC track runs northwest/southeast, closely following the alignment of Cadiz-Rice Road. The ARZC has stations and/or operations at Cadiz, Milligan, Freda and Rice as shown on Figure 5.7-1. The ARZC schedules one train into the Cadiz area daily, except Saturday, to interchange cars with the BNSF system. Extra trains move in and out of the Cadiz area on an as needed basis, usually two to four times per week. Trains may be using the ARZC track at any time of day, depending on that day's scheduling.

In general, railroad cars have considerable weight when fully loaded. The rail lines are supported by a foundation consisting of rails, ties, gravel or rock bedding, and the existing desert soil. Temporarily raising or drawing-down static water levels underlying the Cadiz Project area, if not properly monitored and managed, could potentially impact rail lines in certain locations. For additional information on this subject, refer to Section 5.5 (Water Resources).

Airports

There are two private airstrips located in the Cadiz Project area. A private airstrip at the Iron Mountain Pumping Plant is used by Metropolitan staff and others visiting the Iron Mountain Pumping Plant. There is a private airstrip located at the Cadiz Inc. agricultural operations (at the north edge of the northernmost cultivated area). There is also a private airstrip located in the community of Amboy, approximately 12 miles west and north of the airstrip located at the Cadiz Inc. agricultural operations. The nearest general aviation airport is located in Twentynine Palms.

5.7.2 THRESHOLDS OF SIGNIFICANCE

The Cadiz Project would be considered to result in a significant adverse impact related to transportation if it results in:

- An increase in road traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., results in a substantial increase in the number of vehicle trips, the volume-to-capacity ratio on roads used by project traffic or congestion at intersections).

- An exceedance, either individually or cumulatively, of a level of service (LOS) standard established by the County Congestion Management Plan for designated roads or highways.

- Disruption of rail service due to construction activities or differential settlement attributable to fluctuations in groundwater levels.

- A change in air traffic patterns, including either a substantial increase in air traffic levels or a change in location that results in substantial safety risks.

- A substantial increase in road hazards due to a project design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment).

- Inadequate emergency access.

- Inadequate parking capacity.

- Conflicts with adopted policies, plans or programs supporting alternative modes of transportation.

5.7.3 METHODOLOGY

Short term construction traffic impacts largely depend on the schedule and intensity of construction activities. A construction schedule scenario was developed which is representative of the specific construction schedules for the Cadiz Project build alternatives. This schedule assumes construction would begin in 2000 and that construction of all Cadiz Project capital improvements would be completed in the winter of 2000/2001. The construction impacts discussed below are based on this schedule scenario.

For each Cadiz Project component, traffic volumes during construction were estimated by identifying the equipment, materials, and crew and employee requirements based on a typical construction activity schedule. Daily one-way trips and the frequency of trips were then determined from these requirements. Cadiz Project-related trips would be expected to occur at different frequencies: some trips would occur daily (e.g., crew trips, unless on-site crew housing is provided), other trips would occur at regular intervals during construction (e.g., delivery of materials), while still others would occur only prior to and after construction (e.g., transport of heavy equipment to/from the site). Most of the construction equipment would be expected to originate from the communities of Barstow, Desert Center, Morongo Valley, Needles, Parker and Twentynine Palms. However, large equipment would probably come from the Los Angeles area.

Based on input from potential materials suppliers and contractors, the traffic impact analysis assumes that materials and pipe for the Cadiz Project would be transported to the construction areas by truck. It is possible for all Cadiz Project build alternatives that some construction materials could be shipped to the area by rail. Any shipments would be by railcars added to existing trains on the BNSF and the ARZC rail lines. This possibility is also considered.

A typical day traffic estimate was assumed by considering only the trips that would occur daily and at regular intervals during construction. The typical day traffic estimate excludes construction equipment delivery, which occur before and after the construction period. Traffic that is expected to occur at regular intervals is assumed to be distributed over the duration of the construction. Furthermore, the typical day estimate assumes that construction activities would occur simultaneously, although they may be located at different segments and/or locations on the Cadiz Project site. Actual construction traffic would vary from these estimates depending on the adopted construction schedule; and would generally be lower than the typical day traffic if all construction activities are not conducted simultaneously.

To determine the potential construction traffic impacts under each Cadiz Project alternative, traffic estimates for all components were combined and distributed on the existing road network. This was performed using P&D's IMPAX program. P&D's proprietary IMPAX program for traffic impacts analysis was used to determine Cadiz Project-related traffic volumes on the road network based on the assumed distribution and routing of traffic.

Long term project impacts were assessed by estimating the amount of employee traffic that would be generated during operation and maintenance of the Cadiz Project. During operations, the number of employees needed to operate each Project component was estimated. From the estimated number of operations employees, operations-related employee traffic was estimated. Projected maintenance traffic was added to the operations employee traffic to indicate the amount of traffic generated by the Cadiz Project over the long term.

5.7.4 IMPACTS

This section describes the potential transportation impacts under each Cadiz Project alternative. The discussion for each Cadiz Project alternative considers potential construction impacts and potential long term operations impacts to the existing road network.

Appendix B provides detailed tables of the trip generation factors and calculations used for this analysis of the potential construction and operations related traffic impacts of the Cadiz Project alternatives.

Eastern Alternative

Construction Impacts

The potential short term construction impacts of the Eastern Alternative were assessed based on the total daily traffic simultaneously generated by all construction activities. The following analyses identify the daily traffic for each Cadiz Project component and the total traffic impact of the construction of the Eastern Alternative.

Construction Access Roads and Staging Areas. Due to the limited road network in the area providing access to the Cadiz Project site, access roads would be constructed at different locations. For the Project wellfield and Project spreading basins construction, access would be via existing paved and unpaved roads and within designated construction easements. An unpaved access road would also parallel the water conveyance facilities and power distribution facilities alignment for all Cadiz Project build alternatives. The unpaved access road would be used during construction. After the completion of construction, a 20-foot wide, unpaved access road would remain for long-term Cadiz Project operation and maintenance activities.

In addition, there would be three temporary staging areas under the Eastern Alternative. Each staging area would be approximately five acres in size. These staging areas would be used to provide storage for construction materials and equipment and an area for crew/employee parking and construction trailers. One staging area would be located at the north end of the Cadiz Project area near the Project

spreading basins. This staging area would be located on Cadiz Inc. landholdings. An intermediate staging area would be located adjacent to Cadiz-Rice Road, due north of Kilbeck Hills. This staging area would be located on federal lands bordered by Cadiz-Rice Road and the AZRC rail lines. A third staging area would be located at the Iron Mountain Pumping Plant between the existing Iron Mountain Pumping Plant electrical substation and the Cadiz Pumping Plant.

Traffic Impacts During Construction of the Project Spreading Basin. The Project spreading basin would be located on Cadiz Inc. landholdings. During construction of the Project spreading basin, traffic would be generated by construction vehicles, employee vehicles and transport of heavy equipment and construction materials to and from the site.

During any given work shift, approximately 60 workers and 40 pieces of heavy equipment would be required for construction of the Project spreading basin. The total number of workers and pieces of heavy equipment operating at one time would vary depending on the construction schedule developed by the individual Cadiz Project contractors, but are not expected to exceed the estimates given above.

It is assumed that the spreading basin would be constructed over a period of nine months. Two work shifts per day would be utilized, working six days a week.

Table 5.7-1 summarizes the estimated one-way trips for construction vehicles and crews for the construction of the Project spreading basins. As shown, the spreading basin construction would generate 127 one-way trips daily, consisting of 120 employee trips and 7 truck trips for equipment and materials delivery. Most of these trips are due to employee trips. This estimate assumes that employees drive alone to the construction site. These estimates represent a conservative methodology that assumes that the contractor would undertake all construction activities simultaneously. Actual traffic during construction would vary with the contractor's schedule, but would be lower than these traffic estimates.

Some equipment needed for construction of the Project spreading basins would originate from Desert Center, Morongo Valley and Twentynine Palms. Trucks transporting this equipment would be expected to use either Cadiz-Rice Road or make the loop around Amboy Road to reach the construction site. In addition, construction equipment would also originate from the Barstow and Needles areas. Trucks transporting this equipment would be expected to use Cadiz-Rice Road via I-40 and National Trails Highway. Large equipment would probably come from the Los Angeles area via I-40 and National Trails Highway.

Materials and crew/employees needed for Project spreading basins construction would be expected to come from the same communities and travel the same routes as described above. Virtually all the construction activities for the Project spreading basins would take place on-site. The only substantial off-site activities would be those associated with delivery of construction materials and process material equipment to the site. The design of the Project spreading basin is balanced in terms of the cut and fill of material. Therefore, no trips for delivery or removal of excess fill are assumed.

TABLE 5.7-1
SUMMARY OF TRAFFIC ESTIMATES DURING CONSTRUCTION

Staging Area/Facility	One-Way Daily Traffic Estimate		
	Employee Auto Trips	Truck Trips	Total Trips
Cadiz Inc. Site			
Conveyance System	100	29	129
Spreading Basin	120	7	127
Wellfield	177	5	182
Power Distribution	94	8	102
Subtotal	**391**	**49**	**540**
Intermediate Staging Area			
Conveyance System	200	58	258
Power Distribution	188	16	204
Subtotal	**388**	**74**	**462**
Iron Mountain Pumping Plant Site			
Conveyance System	100	29	129
Pumping Facility	160	7	167
Power Distribution	94	8	102
Subtotal	**354**	**44**	**398**
Project Total	**1,133**	**167**	**1,400**

[1] The traffic volume used for this analysis consists of all the daily traffic and the daily equivalent of traffic occurring at the regular intervals (e.g., materials delivery). It excludes traffic occurring before and after construction (e.g., delivery of heavy equipment).

[2] Refer to Appendix B for detailed tables of trip generation during construction of the Eastern Alternative.

Traffic Impacts During Construction of the Project Wellfield. The Project wellfield would be located on Cadiz Inc. landholdings. During construction of the Project wellfield, traffic would be generated by construction vehicles, employee vehicles and transport of heavy equipment, primarily well drilling rigs, to and from the Cadiz Project site.

During any given work shift, approximately 59 workers and 17 pieces of heavy equipment would be required during construction of the Project wellfield. The total number of workers and pieces of heavy equipment operating at one time would vary depending on the construction schedule developed by the individual Cadiz Project contractors, but are not expected to exceed the estimates given above.

It is assumed that the Project wellfield would be constructed over a two-year period. Three work shifts per day would be employed, working seven days a week.

Table 5.7-1 summarizes the estimated one-way trips of construction vehicles and crew needed for the construction of the Project wellfield. Wellfield construction would generate approximately 182 daily vehicle trips one-way consisting of 177 employee trips and 5 truck trips for equipment and materials delivery.

Most construction equipment, materials and crew/employees for the Project wellfield would be expected to originate from the same communities and travel via the same routes as described in the sub-section titled

"Traffic Impacts During Construction of the Project Spreading Basins," above.

Traffic Impacts During Construction of the Water Conveyance Facilities. During construction of the water conveyance facilities and parallel power lines, traffic would be generated by construction vehicles, employee vehicles and transport of heavy equipment to and from the construction staging areas.

During any given work shift, approximately 97 workers and 59 pieces of heavy equipment would be required for each of the four assumed construction teams. Many of the construction activities could be performed concurrently at multiple locations. Consequently, multiple crews may perform the same task at the same time, but at different locations along the alignment, or may perform different activities at the same place along the alignment at the same time. The total number of workers and pieces of heavy equipment operating at one time would vary depending on the construction schedule developed by the individual Cadiz Project contractors, but are not expected to exceed the estimates given above.

It is assumed that the conveyance facilities and parallel power lines would be constructed over a period of nine months. The conveyance facility construction team would consist of four crews per shift, each crew having 50 employees. Two shifts per day, and six work days per week would be utilized. The construction team for the power distribution would have the same arrangement, except that each crew would consist of 47 employees.

As previously noted, most of the construction equipment would be expected to originate from the communities of Barstow, Desert Center, Morongo Valley, Needles, Parker and Twentynine Palms, while large equipment would probably come from the Los Angeles area. Equipment bound for the Cadiz area and the intermediate staging area would most probably be trucked to these areas from Cadiz-Rice Road and National Trails Highway via SR 62, I-95 and I-40 and Amboy Road. Construction equipment destined for the Iron Mountain Pumping Plant staging area would use SR 62/SR 177 and the Iron Mountain Pumping Plant Road to reach that staging area.

The conveyance facility construction would generate approximately 129 one-way daily vehicle trips per crew, consisting of 100 employee auto trips, and 29 truck trips for equipment and materials. Each power distribution crew would generate approximately 102 one-way daily vehicle trips consisting of 94 employees auto trips and eight truck trips for equipment and materials.

During construction of the conveyance facility, traffic on existing roads that cross or are adjacent to construction access roads may be disrupted by construction vehicle crossings. However, these disruptions would be temporary. Mitigation measures provided later in this section would substantially reduce this impact. These measures include providing road safety personnel (flagmen) to control traffic through the construction area or providing detour routes.

In the vicinity of Chubbuck Station, the water conveyance facilities would be constructed within the existing disturbed area of Cadiz-Rice Road to avoid direct impacts on cultural resources in this area. As a result, one approximately 1,200-foot long segment of Cadiz-Rice Road would have a relatively narrow construction easement allowing for one-way traffic only on Cadiz-Rice Road during the construction of this segment of the water conveyance facility.

Vehicles would travel parallel to the pipeline trench through an area approximately 20 feet wide designated for both construction-related and local traffic. Construction vehicles would stop only to unload materials or equipment. Road safety personnel (flagmen) would control traffic through the construction zone. The maximum delay to local traffic is anticipated to be approximately 10 minutes.

Equipment would be brought to the Cadiz Project over existing paved roads and unmaintained dirt roads. Once on the Cadiz Project site, all construction traffic would travel on construction access roads to the staging and construction areas.

The length of pipe sections transported to the Cadiz Project area by truck would be determined by the existing weight and height limits on roads and highways but would not exceed 48 feet. Transportation of the pipe sections is an important factor since most public roads and highways have load restrictions of approximately 45 tons. Caltrans indicated that under a repetitive hauling permit, the absolute maximum width permitted is 14 feet. In any event, all required permits to haul pipe on public roads would be obtained. The pipe for the water conveyance facility would not require a special permit since each load would be less than 14 feet wide. Discussions with pipe suppliers have confirmed that all loads would be kept to allowable highway load standards. Therefore, the shipment of pipe by truck under the Eastern Alternative would not result in adverse impacts related to restrictions on public roads. No mitigation is necessary.

Traffic Impacts During Construction of the Cadiz Pumping Plant. The Cadiz Pumping Plant would be located at the Iron Mountain Pumping Plant. During construction of the Cadiz Pumping Plant, traffic would be generated by construction vehicles, employee vehicles and transport of heavy equipment and materials to and from the site.

During any given work shift, a maximum of 80 workers and 37 pieces of heavy equipment would be required on a daily basis during construction of the Cadiz Pumping Plant. The total number of workers and pieces of heavy equipment operating at one time would vary depending on the construction schedule developed by the individual Cadiz Project contractors, but are not expected to exceed the estimates given above.

It is assumed that the Cadiz Pumping Plant would be constructed over a 12-month period. A crew of 80 employees would work six days a week. There would be two work shifts per day.

The construction of the Cadiz Pumping Plant is expected to generate 167 one-way daily vehicle trips, consisting of 160 employee auto trips and 7 truck trips. This estimate assumes that each employee drive alone to the work site.

Most construction equipment materials and crew/employees for the Cadiz Pumping Plant would be expected to originate from the same communities and travel via the same routes as described earlier in the sub-section titled "Traffic Impacts During Construction of the Project Spreading Basins."

Overall Traffic Impacts During Construction. Table 5.7-1 summarizes the traffic generation impacts during construction of the different components of the Eastern Alternative in detail. As shown, the combined Cadiz Project components, if constructed simultaneously, would generate approximately 1,400 one-way vehicle trips on a typical day.

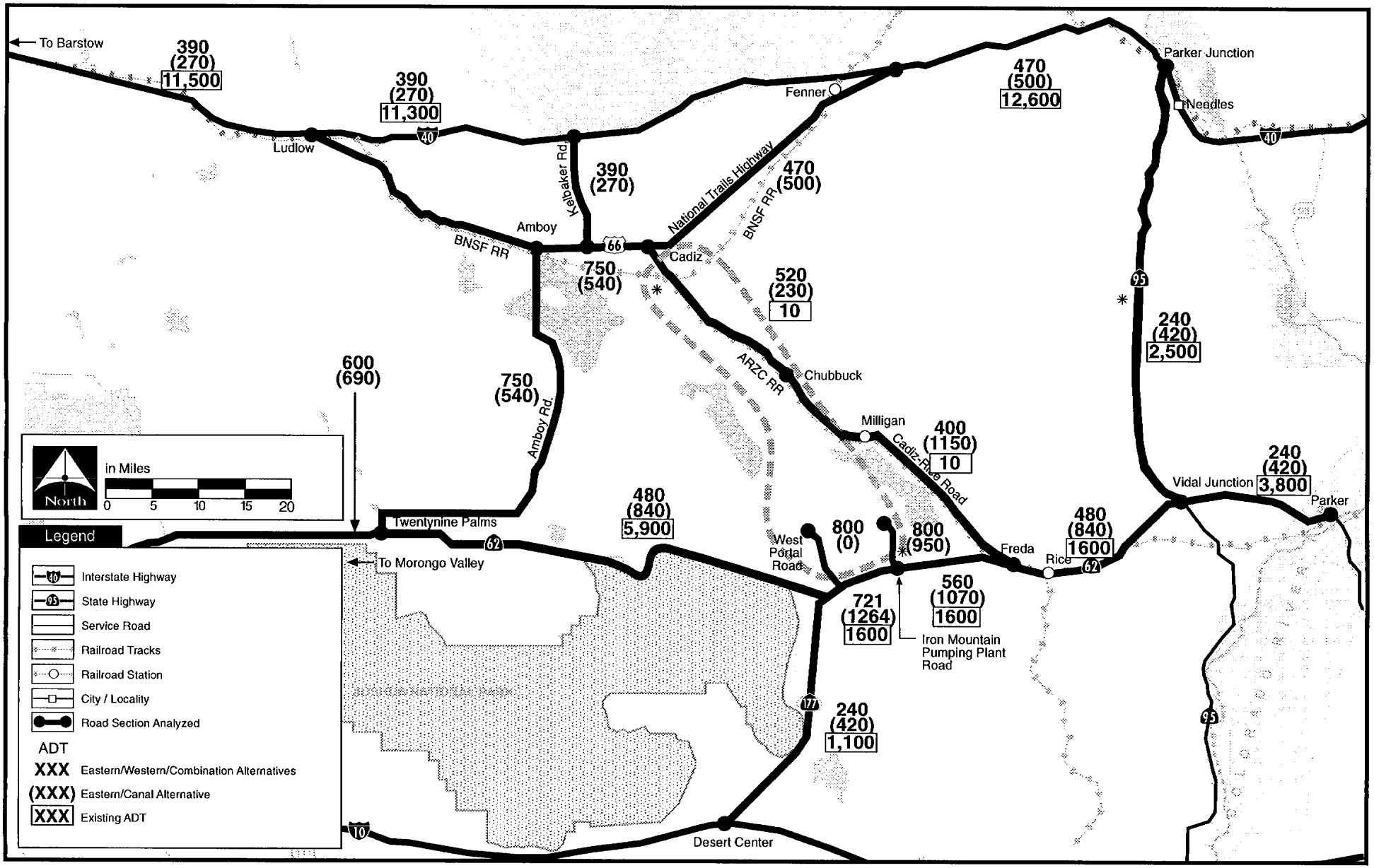
To determine the overall traffic impacts during construction, of the Eastern Alternative traffic generated by the construction of the different Cadiz Project components was distributed to the existing road network using P&D's IMPAX program.

Figure 5.7-2 shows the additional traffic on existing roads due to construction activities taking place simultaneously at different sites under the Eastern Alternative. The road segment most heavily impacted by construction traffic would be the Iron Mountain Pumping Plant Road. It is anticipated that this road segment would carry approximately 800 additional vehicles per day (two-way) as a result of construction of the Eastern Alternative. Approximately 700 of these trips would consist of crew traffic which would be expected to occur during the peak hour. Based on an ideal hourly capacity of approximately 1,500 vehicles per hour for a two-lane service road, construction traffic would use less than half of the existing road capacity on Iron Mountain Pumping Plant Road. This low level of capacity utilization would not be considered significant or adverse.

Cadiz-Rice Road between the Cadiz Project and Chubbuck Station would be expected to carry approximately 520 vehicles trips per day (two-way) during construction of the Eastern Alternative. Since Cadiz-Rice Road is currently unimproved with an existing traffic volume of approximately 10 trips per day, this would represent a substantial increase in traffic volumes on the road. However, construction traffic would use less than half of the existing road capacity. This low level of capacity utilization would not be considered significant or adverse. As previously noted, for a 1,200-foot long segment at the abandoned Chubbuck Station, through traffic would be limited to one-way traffic controlled by road safety personnel (flagman) during the period of time that segment of the conveyance facilities would be under construction.

To mitigate the impact of additional traffic on Cadiz-Rice Road, improvements would be made to better accommodate the estimated volume of construction traffic. Improvements would be limited to grading only, and would not include widening or paving of Cadiz-Rice Road. Mitigation measure T-4, described later in this section, provides for sufficient capacity to accommodate construction-related traffic impacts without resulting in significant adverse impacts on Cadiz-Rice Road.

Rail Transportation. It is possible that for all the Cadiz Project build alternatives that some construction materials could be shipped to the Cadiz Project area by rail line. Shipments would be anticipated to be



Source: P&D Consultants (1999).

Figure 5.7-2

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Project-Related Average Daily Traffic

added to existing trains on the BNSF and the ARZC rail lines. The magnitude of such shipments would not be anticipated to substantially increase the overall number of trains on the BNSF or ARZC rail lines. Therefore, impacts to rail traffic would be less than significant and no mitigation is necessary.

The Project spreading basins are located a sufficient distance from the BNSF and ARZC rail lines that these rail lines would not be impacted by the construction or operation of these Cadiz Project facilities.

The construction of the water conveyance facilities would require coordination with the ARZC and the BNSF. The water conveyance facilities head due south from the Project spreading basins and cross underneath the ARZC rail line. After crossing underneath the rail line, the conveyance facilities parallel the ARZC rail line in a southeasterly direction. The crossing of the water conveyance facilities beneath the rail line would need to be coordinated with the ARZC. Protection of the rail line and the rail operation needs to be considered for both the crossing and the construction of the parallel alignment.

Part of the Project wellfield manifold crosses under the BNSF rail lines and similar arrangements would have to be made with this entity. Construction at rail line crossings would be either by bore and jack or conventional tunnel with ribs and lagging or lineal plate. Under either method, normal railroad operations would not be disrupted. All construction operations at rail line crossings would be coordinated with the affected railroad companies.

Air Transportation. During construction of the Eastern Alternative, there would probably be a slight increase in air traffic at the two private airstrips adjacent to the Cadiz Project site due to travel by Cadiz Inc. and Metropolitan staff. This increase would be estimated to be less than two flights per week into each private airstrip. This slight, temporary increase would not result in any increased safety risks. No mitigation is necessary. The Amboy airstrip would not be affected since the Cadiz Inc. and Metropolitan airstrips could meet all the Cadiz Project needs for air access.

Operations Impacts

Vehicular Access and Emergency Traffic. Once completed, the long term operation and maintenance of the Eastern Alternative would not be expected to generate substantial vehicle trips. Traffic would consist of employee commuter, operations and maintenance trips. Employees operating the facilities would be expected to make daily commute trips to and from these facilities.

Existing Metropolitan personnel and additional personnel to be based at the Iron Mountain Pumping Plant would perform Cadiz Project operations and maintenance activities under the Eastern Alternative. Personnel would perform regular inspections and periodic maintenance on the water conveyance facilities, Project spreading basins and the Project wellfield. Fewer than 10 new employees would be needed for operations.

Weekly to monthly inspection trips of the water conveyance facilities, power distribution facilities, Project wellfield and Project spreading basins would be conducted during Cadiz Project operations. Special inspection trips would also be conducted after major storm events and

earthquakes. These infrequent inspection trips would not affect traffic operations on the study area roads.

Operation and maintenance traffic would follow the access roads maintained for this purpose. No long term adverse traffic impacts as a direct result of the Cadiz Project would occur.

The Cadiz Project may have a beneficial impact on emergency access routes by improving the existing road link between SR 62 and National Trails Highway; improving and maintaining segments of existing roads and constructing a new, permanent, limited access maintenance road within the water conveyance and power distribution facilities right-of-way. Although public access will be prohibited on this access road, it could be used by emergency vehicles to access remote areas near the pipeline or in event of a blockage on other north-south routes.

Operation of the Cadiz Project would entail either spreading, storage or withdrawal of water. During spreading operations, employees would operate and maintain the Project spreading basins. During withdrawal operations, the same employees would operate and maintain the Project wellfield. Appendix B provides detailed tables summarizing the personnel/crew needed to operate and maintain the Cadiz Project facilities in the spreading and withdrawal modes. During the storage mode, routine maintenance of Cadiz Project facilities would occur.

During spreading operations, a total of nine employees, consisting of one supervisor, five operators and three maintenance crew members, would be required to maintain Cadiz Project operations.

During the withdrawal mode, a total of nine employees would be required. A supervisor, one operator and two maintenance workers would be staffed at the Cadiz Pumping Plant. Two operators would work full-time in the Project wellfield, and one maintenance worker would be required for the water conveyance facilities. The Project spreading basins would be out of service in the withdrawal mode. Two workers would staff this facility for maintenance during storage and withdrawal modes.

Depending on the Cadiz Project operation (spreading, storage or withdrawal), the employees at the different Cadiz Project locations would vary. For both the storage and withdrawal operations, personnel would be stationed at the Iron Mountain Pumping Plant. For the storage operation, the remaining employees would be mainly stationed at the spreading basins. In the withdrawal operation, staff would be shifted to operation and maintenance of the Project wellfield. Daily maintenance and operation activities would require staff to travel to the appropriate site locations.

There would be two maintenance trucks on site under all the Project alternatives. The routes for these vehicles would be along the permanent access road along the water conveyance facility alignment, making an assumed one trip per day to a specific destination on the Cadiz Project site. With nine employees working at the active facility (Project spreading basins or Project wellfield), two employees at the inactive facility and two maintenance vehicle trips daily, daily maintenance and operation traffic would be estimated to be approximately 13 one-way vehicle trips daily for the Eastern Alternative. This volume is considered to be negligible and

would not cause significant adverse traffic impacts on regional roads and local access roads. No mitigation is necessary.

Rail Transportation. The operation of the Eastern Alternative may result in fluctuations in groundwater levels. To ensure that disruption of rail service due to differential settlement or liquefaction attributable to fluctuations in groundwater levels does not occur, a Groundwater Monitoring and Management Program will be established as part of the Project. The Groundwater Monitoring and Management Program incorporates monitoring practices and other measures necessary to ensure that risks to rail operations or other facilities do not occur, due to fluctuations in groundwater levels. Refer to Section 5.5 (Water Resources) for a more detailed discussion.

Air Transportation. The operation of the Eastern Alternative would not be expected to generate any regular air traffic into the private airstrips adjacent to the Project site. Some flights to the Metropolitan and/or Cadiz Inc. airstrips may be expected after major storm events and earthquakes. Air trips during these types of events are not expected to be substantial. No trips to the Amboy airstrip are expected. Therefore, the Eastern Alternative will not result in long term adverse impacts related to air transportation. No mitigation is necessary.

Western Alternative

Transportation impacts during construction and operation under the Western Alternative are expected to be similar in magnitude to those projected for the Eastern Alternative as shown earlier in Table 5.7-1. The difference is in the geographic pattern of vehicular traffic as a result of having the new pumping facility and pipeline alignment at the West Portal instead of the Iron Mountain Pumping Plant. These differences are discussed below.

Construction Impacts

Construction Access Roads and Staging Areas. As with the Eastern Alternative, a construction access road would be constructed for the Western Alternative within the designated construction easement from the Project spreading basins, the ARZC right-of-way and to unimproved Cadiz-Rice Road. The northern half of the water conveyance facility would be constructed adjacent to unimproved Cadiz-Rice Road.

Following the main transmission water conveyance facility alignment for the Western Alternative, an access road would also be constructed within the designated construction easement from Cadiz-Rice Road, just north of and along the west side of the Kilbeck Hills and along the west side of the Iron Mountains to the West Portal.

Similar to the Eastern Alternative, a staging area would be provided for the Western Alternative on the Cadiz Inc. landholding near the site of the Project spreading basins and Project wellfield, as well as at an intermediate location along Cadiz-Rice Road near the north edge of the Kilbeck Hills. A staging area for construction of the West Portal Pumping Plant and the southern segment of the main transmission pipeline alignment would be within the 200-foot wide construction right-of-way north of the Colorado River Aqueduct. An alternative staging area may be available at the tunnel tailings spoil area south of the Iron Mountain Tunnel which has approximately 7.5 acres of storage area. Access to either

area would be provided via five miles of existing unimproved road from SR 62.

Traffic Impacts during Construction of the Project Spreading Basins and Project Wellfield. The magnitude and pattern of traffic during the construction of the Project spreading basins and Project wellfield for the Western Alternative would be the same as described earlier for the Eastern Alternative.

Traffic Impacts During Construction of the Water Conveyance Facilities. The magnitude of traffic impacts during construction of the water conveyance facilities for the Western Alternative is expected to be the same as for the Eastern Alternative. However, unlike the Eastern Alternative, traffic bound for the West Portal staging area would be expected to use the new access road from the SR 62/SR 177 junction, instead of the Iron Mountain Pumping Plant Road.

Traffic Impacts During Construction of the West Portal Pumping Plant. The magnitude of traffic impacts during the construction of the West Portal Pumping Plant for the Western Alternative is expected to be the same as for the Eastern Alternative. However, unlike the Eastern Alternative, traffic bound for the West Portal staging area would be expected to use the access road from the SR 62/SR 177 junction, instead of the Iron Mountain Pumping Plant Road.

Overall Traffic Impacts During Construction. The level of construction traffic for the Western Alternative would be the same as for the Eastern Alternative. Therefore, the traffic impacts associated with the Western Alternative are considered to be similar to the impacts under Eastern Alternative, although the Western Alternative would not cause delays to traffic on Cadiz-Rice Road since it would not require construction through the Chubbuck area.

Rail Transportation. The construction impacts to rail transportation for the Western Alternative would be the same as for the Eastern Alternative and would, therefore, be less than significant. No mitigation is necessary.

Air Transportation. The construction impacts related to air transportation for the Western Alternative would be the same as for the Eastern Alternative and would, therefore, be less than significant. No mitigation is necessary.

Operations Impacts

The magnitude of long term traffic impacts during Project operations with the Western Alternative is expected to be the same as for the Eastern Alternative, except that the pumping plant at the West Portal would require slightly more staffing due to its remote location. However, the overall long term traffic impacts would be negligible, similar to the Eastern Alternative, because of the overall small number of employee and maintenance trips generated during project operations.

Vehicular Traffic and Emergency Access. As with the Eastern Alternative, the Western Alternative would have a beneficial impact on emergency access routes by improving and maintaining segments of existing roads and providing an alternate road link between SR 62 and National Trails Highway via the permanent maintenance road within the water conveyance facility right-of-way. Although

the maintenance road would be closed to public use, it could be used by emergency vehicles to access remote areas near the pipeline or in the event of blockage of other north-south routes.

Rail Transportation. The operation of the Western Alternative may result in fluctuations in groundwater levels. To ensure that disruption of rail service due to differential settlement or liquefaction attributable to fluctuations in groundwater levels does not occur, a Groundwater Monitoring and Management Program will be established as part of the Project. The Groundwater Monitoring and Management Program incorporates monitoring practices and other measures necessary to ensure that risks to rail operations or other facilities do not occur due to fluctuations in groundwater levels. Refer to Section 5.5 (Water Resources) for a more detailed discussion.

Air Transportation. The operation of the Western Alternative would not be expected to generate any regular air traffic into the private airstrips adjacent to the project site. Some flights to the Metropolitan and/or Cadiz Inc. airstrips may be expected after major storm events and earthquakes. Air trips during these types of events are not expected to be substantial. No trips to the Amboy airstrip are expected. Therefore, the Western Alternative would not result in long-term adverse impacts related to air transportation. No mitigation is necessary.

Combination Alternative

Traffic impacts during construction and operation of the Combination Alternative are expected to be similar in magnitude to those projected for the Eastern Alternative, as shown earlier in Table 5.7-1. The difference is in the geographic pattern of traffic as a result of having the new pumping facility at the West Portal instead of the Iron Mountain Pumping Plant. These differences are discussed below.

Construction Impacts

Construction Access Roads and Staging Areas. Like the Eastern Alternative, an access road would be constructed for the Combination Alternative from the Project spreading basins to the ARZC right-of-way and unimproved Cadiz-Rice Road. The pipeline would be constructed adjacent to unimproved Cadiz-Rice Road. South of Chubbuck Station, the construction access route would follow the pipeline alignment across the saddle between the Kilbeck Hills and along the west side of the Iron Mountains to the West Portal within the construction easement.

Similar to the Eastern Alternative, construction staging areas would be provided on the Cadiz Inc. landholdings near the Project spreading basins and Project wellfield, as well as at an intermediate area located at the most easterly corner of the Cadiz Dunes Wilderness Area. Similar to the Western Alternative, a five-acre staging area near the West Portal would be provided under the Combination Alternative. Access to the West Portal staging area would be provided by the existing unpaved access road from SR 62.

Project Spreading Basin, Project Wellfield, Water Conveyance Facilities and West Portal Pumping Facilities. The magnitude and pattern of traffic impacts during construction of the Project spreading basin, Project wellfield, water conveyance

facilities and pumping facilities under the Combination Alternative would be the same as for the Western Alternative.

Overall Traffic Impacts During Construction. The level of construction-related traffic impacts for the Combination Alternative would the same as shown earlier in Table 5.7-1 for the Eastern and Western alternatives. Therefore, the traffic impacts associated with the Combination Alternative are considered to be similar to the impacts for the Western Alternative.

Rail Transportation. The construction impacts to rail transportation for the Combination Alternative would be the same as for the Eastern and Western Alternatives. These impacts would be less than significant. No mitigation is necessary.

Air Transportation. The construction impacts related to air transportation for the Combination Alternative would be the same for the Eastern and Western Alternatives and would, therefore, be less than significant. No mitigation is necessary.

Operations Impacts

The magnitude and pattern of long term traffic impacts during Project operations and maintenance for the Combination Alternative are expected to be the same as for the Eastern and Western alternatives.

Vehicular Traffic and Emergency Access. As with the Eastern and Western alternatives, the Combination Alternative would have a beneficial impact on emergency access routes by improving and maintaining segments of existing roads and providing an alternate road link between SR 62 and National Trails Highway via the permanent maintenance road within the water conveyance facility right-of-way. Although this route would be closed to public use, it could be used by emergency vehicles to access remote areas near the pipeline or in the event of blockage of other north-south routes.

Rail Transportation. The operation impacts to rail transportation for the Combination Alternative would be the same as for the Eastern and Western alternatives.

Air Transportation. The operation of the Combination Alternative is not expected to generate any regular air traffic into the private airstrips adjacent to the project site. Some flights to the Metropolitan and/or Cadiz Inc. airstrips may be expected after major storm events and earthquakes. Air trips during these types of events are not expected to be substantial. No trips to Amboy airstrip are expected. Therefore, the Combination Alternative would not result in long term adverse impacts related to air transportation. No mitigation is necessary.

Eastern/Canal Alternative

Traffic impacts during construction and operation of the Eastern/Canal Alternative would be greater in magnitude than under any of the other build alternatives. This is because construction of an additional pump station is required and because canal construction involves more intensive construction work than pipeline construction. Operational impacts under the Eastern/Canal Alternative related to traffic would be nearly identical to the Eastern Alternative.

Construction Impacts

Construction Access Roads and Staging Areas. Like the Eastern Alternative, an

access road would be constructed for the Eastern/Canal Alternative within the construction easement from the Project spreading basin to the ARZC tracks and unimproved Cadiz-Rice Road. The construction access road would then run within the construction easement paralleling Cadiz-Rice Road to Chubbuck Station, where the same narrow construction zone as for the Eastern and Combination alternatives would be employed. From Chubbuck Station, similar to the Eastern Alternative, construction access would be provided within the construction easement, all the way south to the Iron Mountain Pumping Plant. The Eastern/Canal Alternative would use the same construction staging areas as the Eastern and Combination alternatives.

Overall Traffic Impacts During Construction. Traffic volumes generated by construction of the Eastern/Canal Alternative would be approximately 30 to 35 percent higher than for the Eastern Alternative. Up to 180 additional construction workers could be added to simultaneous construction activities for the Intermediate Pumping Plant and canal under this Alternative. The number and types of equipment needed for construction of the canal are also higher than that needed for construction of a similar segment of pipeline. Canal construction will require frequent delivery of concrete. Concrete for the Cadiz Project is expected to be produced at a temporary batch plant in a nearby construction zone, such as the staging area at Iron Mountain Pumping Plant. Materials would have to be brought to the batch plant to manufacture the concrete.

This Alternative would also result in one-way traffic operations at Chubbuck Station during construction, with delays to through traffic of up to 10 minutes. Traffic would be controlled by road safety personnel (flagmen) during the period of time that segment is under construction.

Similar to the Eastern Alternative, options exist to mitigate traffic impacts on Cadiz-Rice Road during construction. Mitigation measure T-4, described later in this section, provides for sufficient capacity to accommodate construction-related traffic impacts under the Eastern/Canal Alternative without resulting in significant adverse impacts.

Rail Transportation. The construction impacts to rail transportation for the Eastern/Canal Alternative would be the same as for the other build alternatives.

Air Transportation. During construction of the Eastern/Canal Alternative, there would probably be a slight increase in air traffic to the two private airstrips adjacent to the Project site due to travel by Cadiz Inc. and Metropolitan staff. This increase is estimated to be less that two flights per week into each private airstrip. This slight temporary increase would not result in any increased safety impacts. The Amboy airstrip would not be affected since the Cadiz Inc. and Metropolitan airstrips could meet all Cadiz Project needs for air access under the Eastern/Canal Alternative.

Operations Impacts

The magnitude of the long term traffic impacts during Project operations for the Eastern/Canal Alternative would be the same as for the Eastern Alternative, except that the canal segment may require the assignment of up to one more staff person. However, the overall long term traffic

impacts are expected to be negligible, similar to the Eastern Alternative, because of the small number of employee and maintenance trips generated during Cadiz Project operations.

Vehicular Traffic and Emergency Access. As with the Eastern Alternative, the Eastern/Canal Alternative would have a beneficial impact on emergency access routes by improving and maintaining segments of existing roads and providing an alternate road link between SR 62 and National Trails Highway via the permanent maintenance road within the water conveyance pipeline right-of-way. Although this route would be closed to the public, it could be used by emergency vehicles to access remote areas near the pipeline or in the event of blockage of other north-south routes.

Operating the Intermediate Pumping Plant would not require additional staff, since it can be run remotely from the Cadiz Pumping Plant and Iron Mountain Pumping Plant. Maintenance of the canal may require up to one additional staff person. The same people who would otherwise be involved in pipeline and pumping plant maintenance/ operations would be capable of maintaining the canal and operating the booster station. Therefore, the operations impacts due to traffic associated with the Eastern/Canal Alternative would be similar to the Eastern Alternative. No mitigation is necessary.

Rail Transportation. The operations impacts to rail transportation of the Eastern/Canal Alternative would be the same as for the Eastern, Western and Combination alternatives. The Groundwater Monitoring and Management Program incorporates monitoring practices and other measures necessary to ensure that risks to rail operations do not occur due to fluctuations in groundwater levels.

Air Transportation. The operation of the Eastern/Canal Alternative in not expected to generate any regular air traffic into the two private airstrips adjacent to the Project site. Some flights to the Metropolitan and/or Cadiz Inc. airstrips may be expected after major storm events or earthquakes. Air trips during these types of events are not expected to be substantial. No trips to the Amboy airstrip are expected. Therefore, the Eastern/Canal Alternative would not result in long term adverse impacts related to air transportation. No mitigation is necessary.

No Project Alternative

Under the No Project Alternative, traffic on existing roads is expected to remain the same as it is currently and would continue to grow at the normal rate experienced in the area. Therefore, the No Project Alternative would have no significant adverse traffic impacts.

The No Project Alternative would not result in any changes in existing rail services or facilities in the Cadiz Project area because it will not result in any Project-related construction or operations.

The No Project Alternative would not result in any changes in the existing agricultural and Metropolitan activities in this area. Therefore, it would not result in any changes in the use of local private airfields by either Metropolitan or Cadiz Inc. personnel.

5.7.5 MITIGATION MEASURES

Although the Cadiz Project would not result in significant short- or long-term adverse traffic impacts, measures to reduce the

potential for adverse temporary impacts associated with construction have been identified. These mitigation measures are intended to avoid or reduce short term temporary traffic impacts resulting from construction of the any of the build alternatives.

T-1 During construction, Metropolitan will coordinate with the local jurisdictions where construction of water conveyance facilities crossings will impact existing public roads.

T-2 During construction, Metropolitan will coordinate with all emergency services providers, both public and private, in the development of construction scheduling and detour plans to ensure adequate access and travel routes for emergency vehicles in and around all construction areas.

T-3 During all site preparation, grading and construction, Metropolitan will require the contractor to provide traffic assistance at all locations where construction access routes cross existing public roads. This assistance may include providing flagmen to control and direct traffic through and/or around construction areas; signing, flagging and/or placing cones at crossing areas; and/or the provision of detour routes, as needed, to ensure the safe flow of through traffic in and around construction areas.

T-4 Prior to any construction on Cadiz-Rice Road between SR 62 and Chubbuck, Metropolitan will require the Project contractor to provide increased surface transportation capacity in this area of active construction.

5.7.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Although the short- and long-term transportation impacts of the Cadiz Project are below a level of significance, mitigation measures have been identified to further reduce the potential for adverse temporary impacts during construction. Road levels of service would not be exceeded, rail service disruptions would be avoided, flagmen would be stationed along Cadiz-Rice Road to prevent safety hazards, existing access will be preserved and augmented, and adequate parking would be provided for workers in construction staging areas and/or easements. No significant impacts would occur.

5.8 BIOLOGICAL RESOURCES

5.8.1 AFFECTED ENVIRONMENT

This section describes the existing biological resources in the areas that may be affected by Project construction and operation. It provides a description of the plant and wildlife communities characteristic of these areas, including rare and unique species and habitats, and summarizes the plant community acreages in the areas of potential project impact. The relationship of potentially affected areas to surrounding habitat areas and wilderness areas is also provided. In addition, the presence of wildlife corridors and their relative importance are described.

A brief description of special interest species known to occur or that could occur on or in the general vicinity of the Project site is also provided. More detailed descriptions of plant communities and special interest plant and wildlife species are provided in the Cadiz Groundwater Storage and Dry-Year Supply Program Environmental Planning Technical Report: Biological Resources (Report No. 1164, November 1999).

Plant Communities

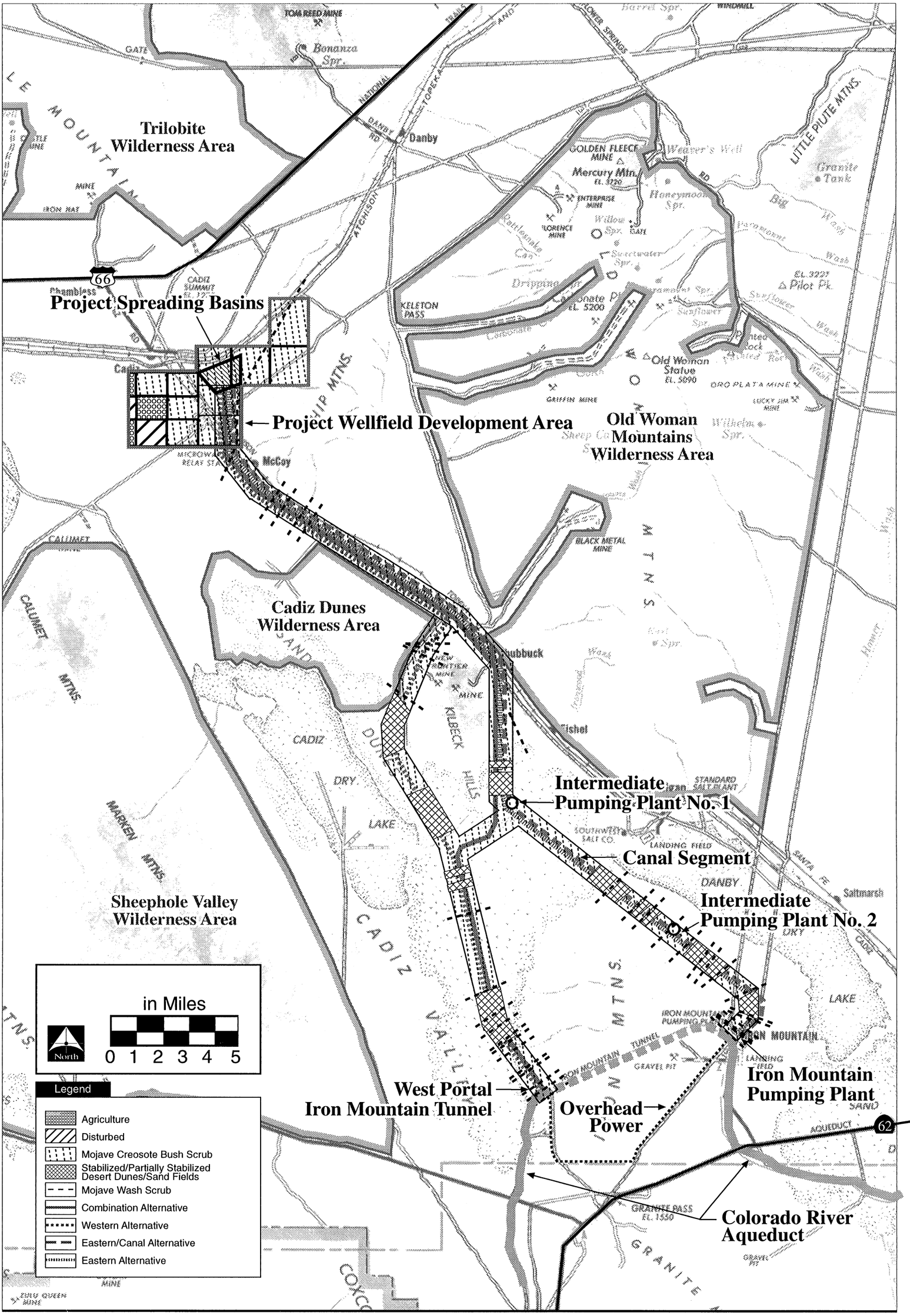
A plant community or vegetative association is "...an assemblage of interacting plant species characterized by the presence of one or more dominant species..." (Holland 1986, Ornduff 1974). General plant communities may exhibit localized variability in composition, as they do in the project area. The native and non-native plant communities identified in the area of the three Project alternatives include Mojave creosote bush scrub, Mojave wash scrub, stabilized and partially stabilized desert dunes, stabilized and partially stabilized desert sand fields, and agriculture. Each of these is described in detail in the Biological Resources Technical Report.

Plant community locations for each alternative are shown in Figure 5.8-1.

The following descriptions characterize the general locations, by the geographic features shown in Figure 5.8-1, of the native and non-native plant communities in the Project area for the three alternatives. The elevational range for the Eastern and Eastern/Canal alternatives is approximately 590 to 940 feet above mean sea level (amsl). The elevational range for the Western and Combination Alternatives is approximately 590 to 1,520 feet amsl.

Mojave Creosote Bush Scrub

Mojave creosote bush scrub is the dominant plant community associated with each Project alternative. It occurs throughout most of the Project area for the conveyance pipeline for each alternative, the proposed spreading basin area, the wellfield, the Cadiz Pumping Plant and the staging areas. On the Project site, this plant community is characterized by an open canopy of creosote bush (*Larrea tridentata*) and burrobush (*Ambrosia dumosa*), with a sparse understory of forget-me-not (*Cryptantha* spp.), woolly plantain (*Plantago ovata*) and Devil's lantern (*Oenothera deltoides*). Less common, but highly visible, species in this community on the Project site include silver cholla (*Opuntia echinocarpa*), pencil cholla (*Opuntia ramosissima*), brittlebush (*Encelia farinosa*) and desert milkweed (*Asclepias erosa*). In general, Mojave creosote bush scrub is more disturbed where the alignment parallels Cadiz-Rice Road and in the spreading basin and wellfield area.



Source: P&D Consultants, Inc. (1999).

Figure 5.8-1

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Plant Community Map

Biological soil crusts (cryptogamic soils) include a specialized community or microhabitat within Mojave creosote bush scrub. It contains bacteria, algae, lichens and mosses and acts as a living mulch by retaining soil moisture. It also discourages the growth of annuals and resists weeds, wind and water erosion. The distribution of biological soil crust ranges from sparse to dense; the extent of cover is similar for each alternative.

Mojave Wash Scrub

Mojave wash scrub occurs in washes in the project area for each alternative. These washes have coarse, sandy to gravelly bottoms and lack biological soil crusts. On the project site, the species characteristic of this plant community include smoke tree (*Psorothamnus spinosus*), cheesebush (*Hymenoclea salsola*), sweetbush (*Bebbia juncea*) and rayless encelia (*Encelia frutescens*). The quality of Mojave wash scrub is generally equivalent for each Project alternative. However, the density of smoke trees in the washes is greater for the Western and Combination alternatives than for the Eastern and Eastern/Canal alternatives. The most extensive and biologically diverse wash (Schulyler Wash) occurs in the wellfield area. This is the only wash on the Project site where catclaw (*Acacia greggii*) and desert willow (*Chilopsis linearis* ssp. *arcuata*) occur. Washes that do not contain tree-like vegetation were mapped as a different plant communty, Mojave creosote bush scrub. Numerous washes occur throughout the conveyance alignment for each Project alternative. A limited number of these washes supports tree-like vegetation (e.g., smoke tree) characteristic of this plant community. This plant community is considered threatened by the California Department of Fish and Game (CDFG) and is described in further detail in the discussion of Special Interest Species and Habitats, later in this section.

Stabilized and Partially Stabilized Desert Dunes and Desert Sand Fields

Stabilized and partially stabilized desert dunes and desert sand fields are the second most common plant community in the Project area. These two communities were combined due to the difficulty of distinguishing between them in the field. Desert dunes and sand fields have sandy substrates and accordingly do not form the biological soil crusts. These communities occur in all of the conveyance pipeline alignments, but not in the spreading basins or wellfield area. They occur east and west of the Kilbeck Hills and the Iron Mountains. These two communities form sand-influenced creosote bush scrub communities interspersed with Mojave creosote bush scrub. On the project site, these two communities have a slightly lower density of creosote bush than the Mojave creosote bush scrub community. Species characteristic of this community in the project area include big galletta (*Pleuraphis rigida*), Devil's lantern, burrobush, sandpaper plant (*Petalonyx thurberi*) and desert sand verbena (*Abronia villosa*). This plant community is considered threatened by the CDFG and is described in further detail in the discussion of Special Interest Species and Habitats, later in this section.

Agriculture Fields

Agricultural fields occur in the western portion of the Project wellfield. Agricultural areas where the wells and their associated pipelines will be located include plantings of grapes, oranges, minneolas and lemons.

Open Water

Open water is a Project-created habitat type that occurs at the north end of the Project. There are currently two pilot spreading basins comprising 2.5 acres each. These basins are being used to test and evaluate percolation rates and groundwater movement for Project planning purposes. If the Project is adopted, then these basins will be incorporated into the Project spreading basins. One of these areas had standing water in it at one point during field surveys in mid-May 1999. At other times, both of these basins have been dry. When these basins hold water, they have the potential to provide habitat for wildlife. However, if the Cadiz Project does not proceed, this area would be abandoned and no permanent open water would be present. Therefore, open water is not identified as an existing habitat later in Table 5.8-1.

Wildlife Communities

The following descriptions characterize the general locations, by the geographic features shown previously in Figure 5.8-1, of the wildlife communities in the Project area.

Due to the harsh environmental factors associated with desert ecosystems, only a relatively low diversity of native wildlife has adapted to these conditions. In addition, most forms of wildlife occupying desert ecosystems are generally sparsely distributed due to the scarcity of, and competition for, critical resources. Typically, wildlife species inhabiting desert regions are specifically adapted to conditions that would generally prohibit most wildlife use. However, two man-made habitats have been created in the Project area: agriculture and open-water. These habitats typically provide resources for a variety of wildlife that are often either non-native species, migratory species or species adapted to or tolerant of non-native vegetation and disturbed habitats, but may also meet specialized habitat or resource requirements of certain special interest wildlife species.

The plant community in the Project area that appears to support the greatest diversity and density of native wildlife is Mojave wash scrub. Due to the relatively greater diversity and more varied structure of vegetation typically occurring in these washes, this habitat is expected to provide superior cover and foraging resources for wildlife compared to other habitats in the Project area. Washes typically provide important habitat for resident, nesting birds and temporary waystations for migratory birds. Their banks are used by burrowing invertebrates, reptiles and mammals. The washes vary considerably in the extent and diversity of vegetation they support, and, therefore, in their significance to wildlife. Schulyler Wash, on the east side of the Project wellfields, is considered the most significant Mojave wash scrub habitat in the Project area in terms of wildlife habitat. Due to disturbance, many of the washes are of lower quality where the alignment parallels Cadiz-Rice Road. Generally, in areas away from human disturbance, the overall quality and importance of the Mojave wash scrub habitat to wildlife is considered approximately equivalent among all of the alternatives. Examples of wildlife species observed or expected in this habitat in the project area include zebra-tailed lizard (*Callisaurus draconoides*), mourning dove (*Zenaida macroura*), lesser nighthawk (*Chordeiles acutipennis*), Say's phoebe (*Sayornis saya*), verdin (*Auriparus flaviceps*), house finch (*Carpodacus mexicanus*), black-tailed jackrabbit (*Lepus californicus*), desert wood rat (*Neotoma*

lepida) and antelope ground squirrel (*Ammospermophilus leucurus*).

Mojave creosote bush scrub is predominant in the Project area, but this habitat supports lower densities and a lower diversity of wildlife species than Mojave wash scrub. Mojave creosote bush scrub varies in the structure and amount of available cover for wildlife. This habitat, with a variety of smaller shrub species and grasses, would support a more diverse wildlife community than habitats lacking this component. Examples of wildlife species observed or expected in the Mojave creosote bush scrub habitat in the Project area include western whiptail (*Cnemidophorus tigris*), side-blotched lizard (*Uta stansburiana*), greater roadrunner (*Geococcyx californianus*), horned lark (*Eremophila alpestris*), Costa's hummingbird (*Calypte costae*), cactus wren (*Campylorhynchus brunneicapillus*), black-throated sparrow (*Amphispiza bilineata*), round-tailed ground squirrel (*Spermophilus tereticaudus*), Merriam's kangaroo rat (*Dipodomys merriami*) and kit fox (*Vulpes macrotis*). Although the Mojave creosote bush scrub on the West Alternative was generally considered to have a greater diversity in comparison to this community in the other Project alternatives, these differences were not considered substantial in terms of wildlife habitat value.

The stabilized and partially stabilized desert dunes and desert sand fields generally supported the least diverse and smallest densities of wildlife in the Project area because these areas provided relatively limited resources for wildlife. This was especially true in areas with minimal vegetation. However, several highly specialized animals have adapted to this habitat. Examples of wildlife species observed or expected in desert dunes and sand field habitat include the desert horned lizard (*Phrynosoma platyrhinos*), sidewinder (*Crotalus cerastes*), long-nosed snake (*Rhinocheilus lecontei*) and desert kangaroo rat (*Dipodomys deserti).* Although there are some differences in the plant diversity and structure of this habitat within each of the alternatives, the differences between the alternatives were considered minimal in terms of value as wildlife habitat.

Special Interest Species and Habitats

Lists of special interest plant and wildlife species that were observed or were expected to occur in the Project area are provided in Tables 5.8-1 and 5.8-2. These tables also provide information regarding the presence of suitable habitat for these species in the Project area.

Special interest species are defined as those species that have been afforded special recognition by federal, state or local resource conservation agencies, organizations and/or jurisdictions, and include species listed as rare, threatened and endangered by resource conservation agencies. In some cases, unlisted species that are considered of special interest by the scientific community, local resource agencies, or knowledgeable experts are also included. The special status of these species is generally due to limited, declining and/or threatened population sizes. For the purposes of this EIR/EIS, special interest plant and wildlife species include those listed as threatened or endangered by the United States Fish and Wildlife Service (USFWS) or the CDFG, federal species of concern (FSC), California Species of Special Concern (CSC), CDFG Special Status Plants, BLM Special Plants and plants included in the California Native Plant Society's (CNPS) Inventory of Rare and Endangered Vascular Plants of California (1994).

TABLE 5.8-1
SPECIAL INTEREST PLANT SPECIES

Species	Status(a)	Suitable Habitat/ Soils (b)	Flowering Period	Occurrence
Cynanchum utahense Utah vine milkweed	CNPS 4	MCBS /dry, sandy, or gravelly	April-June	Absent. Plants not observed during 1999 surveys, but suitable habitat occurs within the Project area for all alternatives.
Matelea parvifolia Spearleaf	CNPS 2	MCBS /dry, rocky	March-May	Absent. Plants not observed during 1999 surveys. All alignments except the transmission line on the Western and Combination alternatives are below the elevational range of this plant.
Cryptantha costata Ribbed cryptantha	CNPS 4	MCBS /sandy	February-May	Occurs, common. Plants observed during 1999 surveys in areas of stabilized and windblown sand within the Project area for all alternatives.
Cryptantha holoptera Winged cryptantha	CNPS 4	MCBS /sandy to rocky	March-April	Absent. Plants not observed during 1999 surveys, but suitable habitat occurs within the project area for all alternatives.
Echinocereus engelmannii var. *howei* Howe's hedgehog cactus	FSC, CNPS 1B	MCBS	April-May	Absent. Plants not observed during 1999 surveys. All alignments except the transmission line on the Western and Combination alternatives are below the elevational range of this plant.
Escobaria vivipara var. *alversonii* Foxtail cactus	CNPS 1B	MCBS /sandy or rocky	May-June	Absent. Plants not observed during 1999 surveys, but suitable habitat occurs within the project area for all alternatives.
Ferocactus cylindraceus var. *cylindraceus* California barrel cactus	--	MCBS /gravelly, rocky, or sandy	May-June	Absent. Plants not observed during 1999 surveys, but suitable habitat occurs within the Project area for all alternatives.
Opuntia basilaris var. *brachyclada* Short-joint beavertail	FSC, CNPS 1B	MCBS	April-June	Absent. Plants not observed during 1999 surveys. All alignments except the transmission line on the Western and Combination alternatives are below the elevational range of this plant.
Astragalus insularis var. *harwoodii* Sand-flat locoweed	CNPS 2	DeDns	January-May	Absent. Plants not observed during 1999 surveys, but suitable habitat occurs within the Project area for all alternatives.
Astragalus lentiginosus var. *borreganus* Borrego milkvetch	CNPS 4	MCBS /sandy	February-May	Absent. Plants not observed during 1999 surveys, but suitable habitat occurs within the project area for all alternatives.

TABLE 5.8-1
SPECIAL INTEREST PLANT SPECIES

Species	Status(a)	Suitable Habitat/ Soils (b)	Flowering Period	Occurrence
Arctomecon merriamii White bear poppy	FSC, CNPS 1B	MCBS /rocky	April-May	Absent. Plants not observed during 1999 surveys. All alignments except the transmission line on the Western and Combination alternatives are below the elevational range of this plant.
Monardella robisonii Robison's monardella	FSC, CNPS 1B	--	April-October	Absent. Plants not observed during 1999 surveys, but suitable habitat occurs within area for all alternatives.
Salvia greatae Orocopia sage	FSC, CNPS 1B	MCBS /alluvial slopes	March-April	Absent. Plants not observed during 1999 surveys, but suitable habitat occurs within the Project area for all alternatives.
Sphaeralcea rusbyi var. *eremicola* Rusby's desert-mallow	FSC, CNPS 1B	MCBS	May-June	Absent. Plants not observed during 1999 surveys. The project site is below the elevational range of this plant.
Gilia maculata Little San Bernardino Mountains gilia	FSC, CNPS 1B	DeDns, MCBS	April-May	Absent. Plants not observed during 1999 surveys, but suitable habitat occurs within the Project area for all alternatives.
Linanthus arenicola Sand linanthus	CNPS 2	DeDns, MCBS /sandy	March-April	Absent. Plants not observed during 1999 surveys, but suitable habitat occurs within the Project area for all alternatives.
Colubrina californica Las animas colubrina	CNPS 4	MCBS	April-May	Absent. Plants not observed during 1999 surveys, but suitable habitat occurs within the Project area for all alternatives.
Penstemon albomarginatus White-margined beardtongue	FSC, CNPS 1B	DeDns (stabilized), MCBS /sandy	March-May	Absent. Plants not observed during 1999 surveys. The Project site is below the elevational range of this plant.
Penstemon stephensii Stephens's beardtongue	FSC, CNPS 1B	MCBS /carbonate, rocky	April-June	Absent. Plants not observed during 1999 surveys. The Project site is below the elevational range of this plant.
Castela emoryi Crucifixion thorn	CNPS 2	MCBS /dry, gravelly washes, slopes, plains	June-July	Absent. Plants not observed during 1999 surveys, but suitable habitat occurs within the Project area for all alternatives.
Physalis lobata Lobed ground-cherry	CNPS 2	MCBS /decomposed granitic	September-January	Absent. Plants not observed during 1999 surveys. However, the Project site is below the elevational range of this plant.

TABLE 5.8-1
SPECIAL INTEREST PLANT SPECIES

Species	Status(a)	Suitable Habitat/ Soils (b)	Flowering Period	Occurrence
*Androstephium breviflorum** Small-flowered androstephium	CNPS 2	MCBS	March-April	Absent. Plants not observed during 1999 surveys, but suitable habitat occurs within the Project area for all alternatives. CNDDB records indicate plants observed in 1995 approximately one mile north of Highway 62 and 1.5 mile west of the Colorado River Aqueduct. This location is outside of the Project alignments.

LEGEND

(a) Federal and California Native Plant Society (CNPS) Status Definitions:

FSC	Federal Species of Concern
CNPS List 1B	Plants rare, threatened or endangered in California and elsewhere
CNPS List 2	Plants rare, threatened or endangered in California, but more common elsewhere
CNPS List 4	Plants of limited distribution; a watch list

(b) Plant Community Abbreviations (for suitable habitat occurring on the project site):

MCBS	Mojave Creosote Bush Scrub
DeDns	Stabilized or partially stabilized desert dunes or desert sand fields

TABLE 5.8-2
SPECIAL INTEREST WILDLIFE SPECIES OBSERVED OR EXPECTED ON THE PROJECT SITE

Species	Status [a]	Suitable Habitat	Occurrence
Reptiles			
Desert tortoise *Gopherus agassizii*	FT, ST	Mojave creosote bush scrub, occasionally rocky areas	Sign observed along the transmission line on the Western and Combination Alternatives, the Eastern and Eastern/Canal Alternatives and along the common area for all Alternatives.
Common chuckwalla *Sauromalus obesus*	FSC	Rocky slopes	Sign observed along the transmission line on the Western and Combination Alternatives. Juvenile near Kilbeck Hills on Eastern, Eastern/Canal and Combination Alternatives.
Rosy boa *Lichanura trivirgata*	FSC	Rocky slopes	Absent, although suitable habitat occurs along the transmission line on the Western and Combination Alternatives and along Cadiz Road near the Ship Mountains.
Banded gila monster *Heloderma suspectum cinctum*	CSC	Mojave creosote bush scrub	Absent from all project alternatives.
Mojave fringe-toed lizard *Uma scoparia*	CSC	Stabilized or partially stabilized desert dunes or desert sand fields	Observed in sandy habitats in the project area for all alternatives, but not in spreading basin area or along the transmission line on the Western and Combination Alternatives.
Birds			
Northern harrier *Circus cyaneus*	CSC	Open habitats	Observed on the Western and Combination Alternatives.
Sharp-shinned hawk *Accipiter striatus*	CSC	Agriculture, Mojave wash scrub	Observed foraging over agriculture in the well field.
Cooper's hawk *Accipiter cooperii*	CSC	Agriculture, Mojave wash scrub	Absent, although suitable foraging habitat occurs along the conveyance pipeline alignments for all alternatives and agricultural areas in the well field.
Swainson's hawk *Buteo swainsoni*	ST	Agriculture, open habitats	Absent, although suitable foraging habitat occurs in the project area for all alternatives.
Ferruginous hawk *Buteo regalis*	FSC, CSC	Agriculture, open habitats	Observed foraging over agricultural areas in the well fields.
Golden eagle *Aquila chrysaetos*	CSC	Mojave creosote bush scrub, rocky cliffs	Observed foraging over the Western and Combination Alternatives.
Merlin *Falco columbarius*	CSC	Agriculture	Absent, although suitable foraging habitat occurs within the agricultural areas in the well fields.
Prairie falcon *Falco mexicanus*	CSC	Agriculture and rocky cliffs	Observed foraging over the Western Alternative, in the vicinity of the Iron Mountain Pumping Plant (Eastern and Eastern/Canal Alternatives) and in the common area for all alternatives.

TABLE 5.8-2
SPECIAL INTEREST WILDLIFE SPECIES OBSERVED OR EXPECTED ON THE PROJECT SITE

Species	Status [a]	Suitable Habitat	Occurrence
Mountain plover *Charadrius montanus*	FC	Agriculture	Absent. No suitable habitat within the project alternatives.
Western burrowing owl *Speotyto cunicularia hypugea*	CSC, FSC	Agriculture, open Mojave creosote bush scrub	Observed along Cadiz Road north of Chubbuck (all alternatives), on the Western Alternative for the conveyance pipeline and in the spreading basins.
Long-eared owl *Asio otus*	CSC	Mojave wash scrub	Observed on the Western and Combination Alternatives.
Black-tailed gnatcatcher *Polioptila melanura*	SA	Mojave creosote bush scrub, Mojave wash scrub	Observed in Mojave wash scrub at multiple locations on all project alternatives.
Crissal thrasher *Toxostoma crissale*	CSC	Mojave wash scrub	Absent. No suitable habitat occurs within the project alternatives.
LeConte's thrasher *Toxostoma lecontei*	CSC	Mojave creosote bush scrub, Mojave wash scrub	Observed primarily in Schulyler Wash at the northern end of the project and along the Western Alternative.
Loggerhead shrike *Lanius ludovicianus*	CSC, FSC	Open habitats	Observed along Cadiz Road north of Chubbuck (all alternatives) and in the vicinity of Schulyler Wash.
Yellow warbler *Dendroica petechia*	CSC	All habitats	Several migrants observed in washes on all project alternatives.
Mammals			
California leaf-nosed bat *Macrotus californicus*	FSC, CSC	Roosts in rock crevices, mines and buildings	None were observed on any project alternative.
Arizona myotis *Myotis occultus*	FSC, CSC	Roosts in crevices, mines, buildings, other miscellaneous habitat	None were observed on any project alternative.
Long-legged myotis *Myotis volans*	FSC	Roosts in crevices, mines, buildings, other miscellaneous habitat	None were observed on any project alternative.
Fringed myotis *Myotis thysanodes*	FSC, CSC	Roosts in crevices, mines, buildings, other miscellaneous habitat	None were observed on any project alternative.
Cave myotus *Myotis velifer*	FSC, CSC	Roosts in rock cliffs, crevices, mines and buildings	None were observed on any project alternative
Spotted bat *Euderma maculatum*	FSC, CSC	Roosts in rock crevices, mines and buildings	None were observed on any project alternative.
Townsend's big-eared bat *Chorynorhinus townsendii*	FSC, CSC	Roosts in rock crevices, mines and buildings	None were observed on any project alternative.

TABLE 5.8-2
SPECIAL INTEREST WILDLIFE SPECIES OBSERVED OR EXPECTED ON THE PROJECT SITE

Species	Status [a]	Suitable Habitat	Occurrence
Pallid bat *Antrozous pallidus*	CSC	Roosts in crevices, mines, buildings, other miscellaneous habitat	Night roost found in adjacent railroad trestle north of Kilbeck Hills on Eastern, Eastern/Canal and Combination Alternatives.
Pocketed free-tail bat *Nyctinomops femorosaccus*	CSC	Roosts in crevices, mines, buildings, other miscellaneous habitat	None were observed on any project alternative.
Big free-tail bat *Nyctinomops macrotis*	CSC	Roosts in rock cliffs, crevices, mines and buildings	None were observed on any project alternative.
Western mastiff bat *Eumops perotis*	FSC, CSC	Roosts in crevices, mines, buildings, other miscellaneous habitat	Foraging individuals were observed at Iron Mountain, Kilbeck Hills and near Ship Mountains (all alternatives).
American badger *Taxidea taxus*	CSC	Mojave creosote bush scrub, rocky slopes and Mojave wash scrub	Potential badger dens were observed along the Western Alternative. Suitable habitat occurs within the project alternatives.
Yuma mountain lion *Felus concolor browni*	FSC, CSC	Rocky slopes	Absent, although suitable habitat occurs within the project alternatives .
Nelson's bighorn sheep *Ovis canadensis nelsoni*	SA	Rocky slopes	Absent, although potentially suitable habitat occurs in the vicinity of the transmission line on the Western and Combination Alternatives.

[a.] Status Definitions

Federal

FE Federal Endangered
FT Federal Threatened
FSC Federal Species of Concern
FC Federal Candidate for Endangered or Threatened Listing

State

SE State Endangered
ST State Threatened
SA Special Animal (Fully Protected)
CSC California Species of Special Concern

Plant Species

Table 5.8-1 identifies the special interest plant species that occur or are expected to have the potential to occur in the Project area and for which surveys were conducted. Although previous surveys and review of the California Natural Diversity Data Base (CNDDB) records indicate that the area has supported sensitive species (Tierra Madre Consultants 1995 and 1998, Spaulding and Twitchell 1978, Scogin 1947), ribbed cryptantha (*Cryptantha costata*) was the only special interest plant species identified within the area of potential impact. This species was common in areas of windblown and stabilized sand for all Project alternatives.

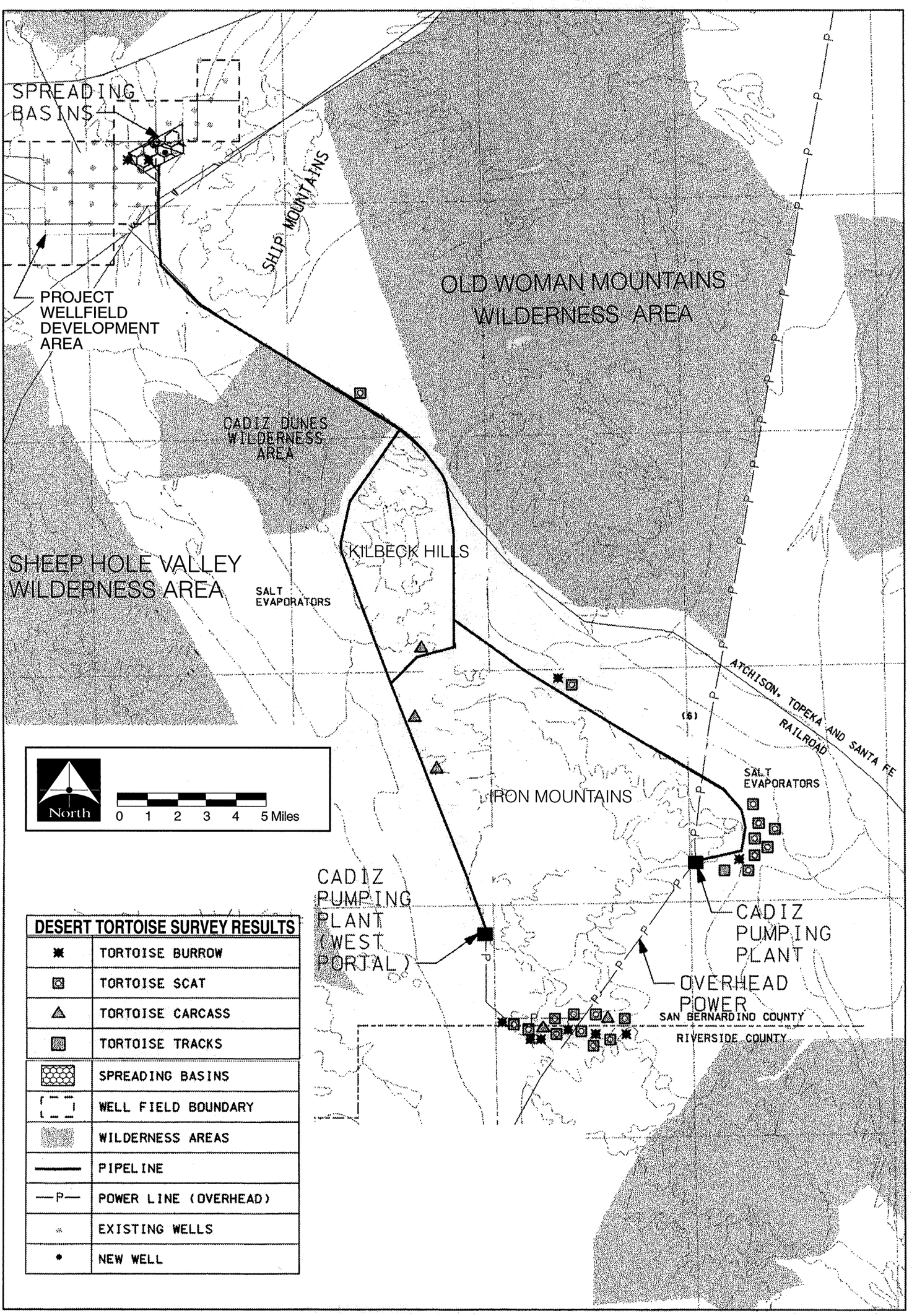
Although rainfall was low during the 1998 to 1999 season, the remainder of the special interest annual plant species shown in Table 5.8-1 have minimal or moderate likelihood to occur within Project construction and operations areas. Special interest perennial plant species not observed in the field are unlikely to occur.

Wildlife Species

Table 5.8-2, provided earlier, identifies the special interest wildlife species that were detected or were expected to potentially occur in the Project area and for which focused or general surveys were conducted. Species that were detected during the surveys include those actually observed as well as those determined to be present by other evidence such as vocalizations, scat, tracks and burrows. A total of fourteen special interest wildlife species were detected during the field surveys. These were desert tortoise (*Gopherus agassizii*), chuckwalla (*Sauromalus obesus*), Mojave fringe-toed lizard (*Uma scoparia*), northern harrier (*Circus cyaneus*), sharp-shinned hawk (*Accipiter striatus*), ferruginous hawk (*Buteo regalis*), golden eagle (*Aquila chrysaetos*), prairie falcon (*Falco mexicanus*), burrowing owl (*Speotyto cunicularia hypugea*), long-eared owl (*Asio otus*), black-tailed gnatcatcher (*Polioptila melanura*), LeConte's thrasher (*Toxostoma lecontei*), loggerhead shrike (*Lanius ludovicianus*) and yellow warbler (*Dendroica petechia*).

Desert tortoise sign was observed in very low densities on each of the Project alternatives, primarily in Mojave creosote bush scrub, as shown in Figure 5.8-2. However, this animal is relatively more common on the Western and Combination alternatives due to the greater abundance of sign located on the alignment for these Alternatives, than on the Eastern Alternative. Desert tortoise sign observed along the Eastern and Eastern/Canal alternatives included one active burrow and one cover site, one set of tracks and eleven scat. The majority of the sign for these Alternatives was located between 2,000 and 3,000 feet east of the Iron Mountain Pumping Plant. Six active burrows, four carcasses and eleven scat were observed in the Western Alternative. Six active burrows, five carcasses and eleven scat were observed on the Combination Alternative. The majority of the sign observed on the Western and Combination alternatives were along the transmission line.

Mojave fringe-toed lizards were observed on all project alternatives in areas of stabilized or partially stabilized desert dunes or desert sand fields. Forty-one fringe-toed lizards were located along the Western Alternative, with the majority of these in the vicinity of the Kilbeck Hills. Twelve were observed along the Combination Alternative, with the



Source: P&D Consultants, Inc. (1999).

Figure 5.8-2

Cadiz Groundwater Storage & Dry-Year Supply Program
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Desert Tortoise Sign Map

majority west of the Iron Mountains. Eighteen fringe-toed lizards were observed along the Eastern and Eastern/Canal alternatives, primarily east of the Iron Mountains.

Several special interest bird species were recorded in the Project alternatives during field surveys. One northern harrier was observed on the Eastern Alternative, near the southern end of the Kilbeck Hills. Two sharp-shinned hawks and two ferruginous hawks were observed over the agricultural property at the north end of the Project area. One adult golden eagle was observed along the west conveyance pipeline alignment, east of the Iron Mountains. Individual prairie falcons were also observed over the west conveyance pipeline alignment, west of the Iron Mountains, and on numerous occasions in the vicinity of the east portal, just east of the Iron Mountain Pumping Plant.

Burrowing owls were found at several locations within the Project alternatives, generally in areas of open Mojave creosote bush scrub. These include three in the spreading basins, five along Cadiz-Rice Road between Chubbuck and the vicinity of the Ship Mountains, and one on the west conveyance pipeline alignment, west of the Iron Mountains. One long-eared owl was observed in a wash containing smoke trees along the Western Alternative conveyance facility, west of the Iron Mountains.

Black-tailed gnatcatchers were observed in many locations within the Project alternatives, primarily in Mojave wash scrub habitat with substantial smoke tree populations. The largest numbers of gnatcatchers were found in Schulyler Wash, on the east side of the Project wellfield. LeConte's thrashers were observed during the field surveys on at least four locations. These included two locations in high quality Mojave wash scrub habitat (both in Schulyler Wash), one in Mojave creosote bush scrub habitat (spreading basins) and one in desert sand field habitat on the west side of the Kilbeck Hills.

Loggerhead shrikes were observed at several locations within the Project alternatives, in both Mojave creosote bush scrub and Mojave wash scrub. Shrikes were located along Cadiz-Rice Road in the vicinity of the Ship Mountains and south of Chubbuck, on the north side of the Kilbeck Hills, in two locations within Schulyler Wash and in the Project spreading basins. Yellow warblers were observed at several locations and on all of the project alternatives. This species was recorded only as a migrant, especially in areas with substantial Mojave wash scrub.

Special Interest Habitats

Special interest habitats or plant communities are either locally or regionally unique, relatively limited in distribution or are of particular value to wildlife species.

Special interest habitats in the Project area include Mojave wash scrub and stabilized or partially-stabilized desert dunes or desert sand fields. These plant communities are considered sensitive by the CDFG (Sawyer and Keeler-Wolf, 1995). Mojave wash scrub and stabilized and partially-stabilized desert sand fields each occupy 10,000 to 50,000 acres statewide and worldwide. Stabilized and partially stabilized desert dunes occupy 10,000 to 50,000 acres worldwide and 2,000 to 10,000 acres statewide.

Wildlife Movement Corridors

General Information on Wildlife Movement Corridors

Wildlife movement corridors are areas which link together suitable wildlife habitat. Movement corridors provide a means for wildlife to travel between these areas, which is often essential for their survival for the following reasons: (1) movement between habitats increases out-breeding, thereby increasing genetic fitness and reducing potential detrimental effects of in-breeding; (2) corridors provide escape routes for wildlife populations when they are threatened by fire, predators and/or human disturbance; and (3) wildlife movement corridors effectively increase the available home range of wildlife as they forage for food, water, mates and nesting space. This final reason is particularly important because corridors may allow the presence of animals that require larger areas that might not be available within the specific habitat islands.

Wildlife movement corridors vary greatly in their overall significance. Studies on wildlife movement corridors suggest that major drainages, canyon bottoms and ridgetops, as well as areas that provide important resources for wildlife, are the most important for wildlife movement. In general, two types of corridors exist. Regional corridors allow for movement between large, often widely separated areas. These may connect national forests, mountain ranges or other major wildlife use areas. Local wildlife corridors allow dispersion between smaller, generally more adjacent areas, such as between canyons or ridges, or between important resource areas.

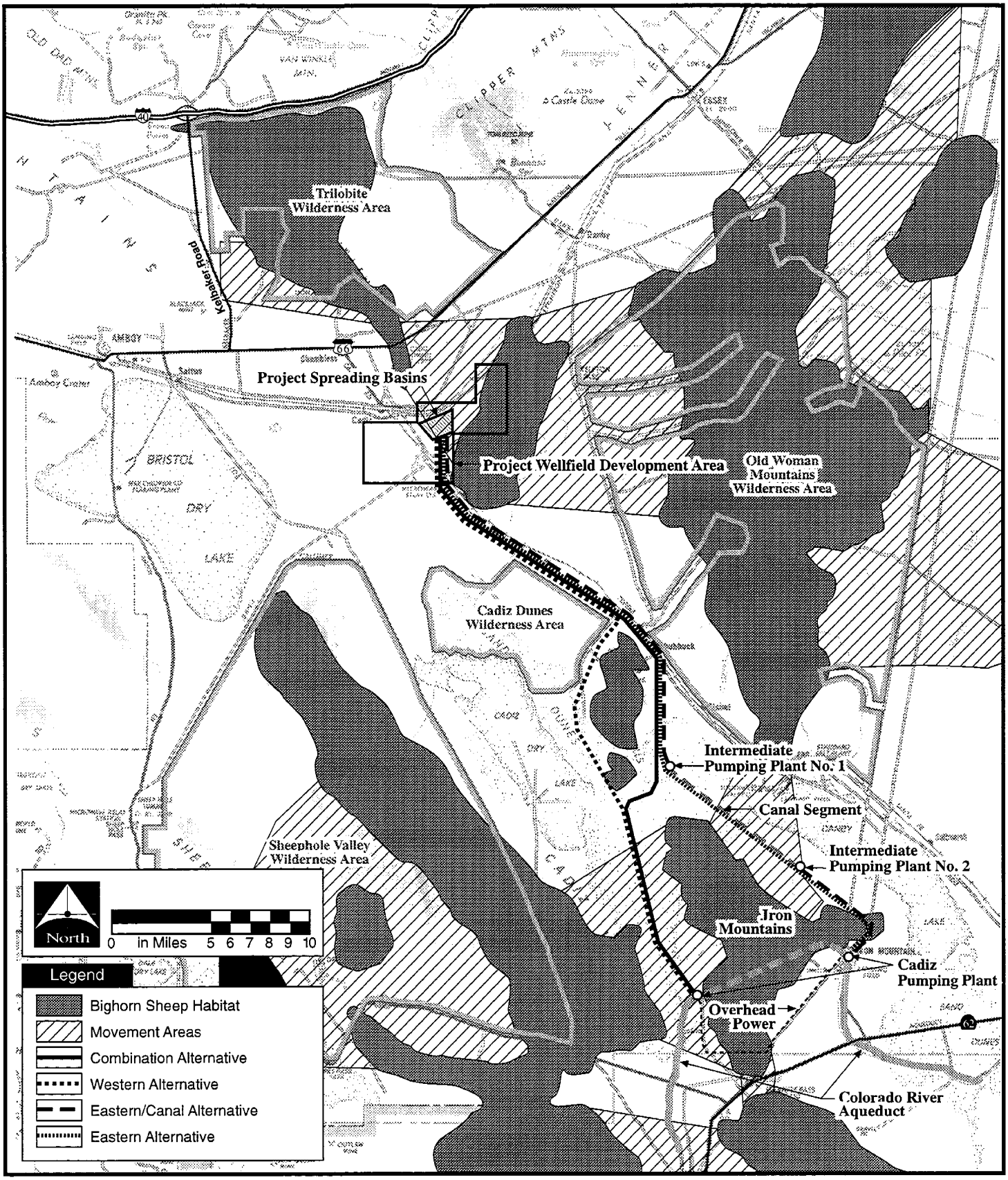
Schulyler Wash, which occurs southeast of the Project spreading basins, is a likely stopping point for these and other wildlife that may be travelling between the Marble and Ship mountains. A larger regional movement corridor connects the Ship Mountains to the Old Woman Mountains to the east. This corridor is outside of the Project area.

Wildlife Movement Corridors on the Project Site

The BLM has designated several regional wildlife movement corridors connecting occupied bighorn sheep habitat on the Project site or in the Project vicinity (Northern and Eastern Colorado Desert Planning Area Map, Figure 5.8-3). A movement corridor connecting occupied bighorn sheep habitat between the Marble Mountains and the Ship Mountains to the southeast traverses the Project spreading basin and wellfield areas. This corridor is bissected by the mainline of the BNSF, Historic Route 66 and other roads.

Another regional movement corridor connects occupied bighorn sheep habitat between the Old Woman Mountains and the Iron Mountains to the south. This corridor crosses Danby Dry Lake and the Eastern and Eastern/Canal alternatives. This corridor is bissected by the ARZC rail line and Cadiz Rice Road. A larger regional movement corridor connects the Iron Mountains and the Calumet Mountains to the west. This movement corridor crosses the Western and Combination alternatives. The power transmission line associated with the Western and Combination alternatives crosses suitable habitat at the southern edge of the Iron Mountains. However, evidence of sheep was not found during the survey of this area.

The Kilbeck Hills, located between the Eastern alternative, and the Western and



Source: Northeast Colorado Desert Plan (BLM) Modified by P&D Consultants, Inc. (1999).

Figure 5.8-3

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Wildlife Corridor Movement Map

Combination Alternatives water conveyance facilities alignments as shown on Figure 5.8-3, was not identified by the BLM as bighorn sheep habitat. No evidence of bighorn sheep in these hills was found, although there is suitable habitat for bighorn sheep in this area.

5.8.2. THRESHOLDS OF SIGNIFICANCE

A project will normally be determined to have a significant adverse environmental impact on biological resources if it results in a:

- Substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive or special status species in local or regional plans, policies or regulations, or by the USFWS or the CDFG.

- Substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies or regulations or by the USFWS or the CDFG.

- Substantial adverse effect on a federally protected wetland as defined by Section 404 of the Clean Water Act (including, but not limited to marsh, vernal pool, etc.) through direct removal, filling, hydrological interruption or other means.

- Substantial interference with the movement of any native resident or migratory fish or wildlife species, established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.

- Conflict with local policies or ordinances for protection of biological resources, including tree preservation policies or ordinances.

- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, BLM wildlife management plan or other approved local, regional, state habitat conservation plan or recovery plan.

5.8.3 METHODOLOGY

Biological resources in the Project area were documented using a variety of sources including review of aerial photographs; contacts with technical specialists familiar with the biological resources in the vicinity; review of prior documents (CMBC 1998; Lilburn Corp. 1994, 1995 and 1998; URS Consultants, Inc. 1993); review of the CNDDB (1999); CDFG List of Special-Status Reptiles; State and Federally Listed Endangered, Threatened and Rare Plants of California (1999); CDFG CNDDB Special Plant Lists (1999); BLM California Special Status Plant Species List (1996); and field surveys.

Habitat mapping was based on aerial photographs and field reconnaissance. Field reconnaissance was conducted in February through May 1999 for plants, birds and mammals. Reptiles were surveyed from March through June 1999. Survey protocol for the desert tortoise was conducted as follows: two transects were surveyed within each proposed 200-foot wide construction easement based on a staked centerline. Two additional transects were surveyed approximately 500 feet on either side of the centerline of the 200-foot wide easement. The spreading basin was surveyed using 30-foot transects and then additional surveys were conducted in the area of influence.

Four transects were surveyed for the power transmission alignment associated with the Western and the Combination alternatives. More detailed information on survey methodology is provided in the Cadiz Groundwater Storage and Dry-Year Supply Program, Environmental Planning Technical Report: Biological Resources (Report No. 1164, November 1999).

5.8.4 IMPACTS

Direct impacts involve the temporary or permanent physical loss of plant communities, wildlife habitat and special interest plant and wildlife species resulting from site preparation activities such as clearing, grubbing and grading. Direct impacts may also include habitat degradation, fragmentation or modification. Direct impacts would occur on plant communities, wildlife habitat, special interest species and special interest habitats as a result of implementation of the Cadiz Project.

Indirect impacts result from secondary changes to biological resources beyond the area of direct impacts. A 500-foot corridor was surveyed to identify indirect impacts of the 200-foot-wide conveyance facility construction right-of-way on biological resources.

Indirect impacts on plant communities include the potential for erosion, siltation and runoff into washes; soil and water contamination due to construction equipment fluid leakage; and increased susceptibility of adjacent, native habitats to invasion by non-native plant species. In addition, increased public access to areas of the desert that are currently relatively free from human disturbance, including the wilderness areas, was also considered an indirect impact. Fugitive dust created during Project construction settles on plants adjacent to the construction zone. This dust can at least temporarily result in reductions in plant photosynthesis, growth and reproduction. The growth of non-native plants leads to increased competition between native and non-native plants for available resources and decreased native species diversity in adjacent, native habitats.

Indirect impacts on wildlife species include the potential for noise, human intrusions into sensitive habitats, night-lighting, the introduction of non-native animals, increased raven population (a predator on young desert tortoise) and increased mortality of wildlife species displaced by construction due to competition for resources in adjacent areas. Local movement patterns for wildlife would be disrupted during construction.

Table 5.8-3 summarizes the temporary and permanent direct impacts on plant communities by Project component. For the 200-foot-wide construction right-of-way for the conveyance pipeline associated with all alternatives, temporary impacts are based on a 180-foot temporary impact width, while permanent impacts are based on a 20-foot permanent impact width, the width of the permanent maintenance road. For the 200-foot-wide construction right-of-way associated with the conveyance canal for the Eastern/Canal Alternative, temporary impacts are based on a 120-foot temporary impact width, while permanent impacts are based on an 80-foot permanent impact width (the width of the canal and permanent maintenance road). Impacts of the Project wellfield pipeline are based on a 20-foot temporary construction impact width and a 20-foot permanent impact width, the width of the permanent maintenance road. Impacts of the power distribution facility (Western and Combination Alternatives)

TABLE 5.8-3
PLANT COMMUNITY IMPACTS BY ALTERNATIVE

Plant Community Impacts Under the Eastern Alternative								
	Temporary Impacts (Acres)				Permanent Impacts (Acres)			
Project Component	Mojave Wash Scrub	Mojave Creosote Bush Scrub	Stabilized/Partially Stabilized Desert Dunes/Sand Fields	Agriculture	Mojave Wash Scrub	Mojave Creosote Bush Scrub	Stabilized/Partially Stabilized Desert Dunes/Sand Fields	Agriculture
Conveyance Pipeline	10.3	585.3	148.7	--	1.0	30.1	16.5	--
Cadiz Pumping Plant	--	1.7	--	--	--	1.2	--	--
Staging Areas	--	9.9	--	--	--	--	--	--
Spreading Basins	--	--	--	--	--	390.0	--	--
Wellfield Pipelines	1.2	37.1	--	1.5	1.2	37.1	--	1.5
Wells + Substations	--	--	--	--	--	6.8	--	0.7
TOTAL	**11.5**	**634.0**	**148.7**	**1.5**	**2.2**	**465.2**	**16.5**	**2.2**

Plant Community Impacts Under the Western Alternative								
	Temporary Impacts (Acres)				Permanent Impacts (Acres)			
Project Component	Mojave Wash Scrub	Mojave Creosote Bush Scrub	Stabilized/Partially Stabilized Desert Dunes/Sand Fields	Agriculture	Mojave Wash Scrub	Mojave Creosote Bush Scrub	Stabilized/Partially Stabilized Desert Dunes/Sand Fields	Agriculture
Conveyance Pipeline	11.0	550.5	169.9	--	1.1	26.2	18.9	--
West Portal	--	46.9	--	--	--	31.3	--	--
Cadiz Pumping Plant	0.1	1.6	--	--	0.4	1.4	--	--
Staging Areas	--	14.6	--	--	--	--	--	--
Spreading Basins	--	--	--	--	--	390.0	--	--
Wellfield Pipelines	1.2	37.1	--	1.5	1.2	37.1	--	1.5
Wells + Substations	--	--	--	--	--	6.8	--	0.7
TOTAL	**12.3**	**650.7**	**169.9**	**1.5**	**2.7**	**492.8**	**18.9**	**2.2**

TABLE 5.8-3
PLANT COMMUNITY IMPACTS BY ALTERNATIVE

Plant Community Impacts Under the Combination Alternative								
	Temporary Impacts (Acres)				Permanent Impacts (Acres)			
Project Component	Mojave Wash Scrub	Mojave Creosote Bush Scrub	Stabilized/Partially Stabilized Desert Dunes/Sand Fields	Agriculture	Mojave Wash Scrub	Mojave Creosote Bush Scrub	Stabilized/Partially Stabilized Desert Dunes/Sand Fields	Agriculture
Conveyance Pipeline	11.9	783.5	177.8	--	1.2	52.1	19.8	--
West Portal	--	46.9	--	--	--	31.3	--	--
Cadiz Pumping Plant	0.1	1.6	--	--	0.4	1.4	--	--
Staging Areas	--	14.6	--	--	--	--	--	--
Spreading Basins	--	--	--	--	--	390.0	--	--
Well Field Pipelines	1.2	37.1	--	1.5	1.2	37.1	--	1.5
Wells + Substations	--	--	--	--	--	6.8	--	0.7
TOTAL	**13.2**	**883.7**	**177.8**	**1.5**	**2.8**	**518.7**	**19.8**	**2.2**

Plant Community Impacts Under the Eastern/Canal Alternative								
	Temporary Impacts (Acres)				Permanent Impacts (Acres)			
Project Component	Mojave Wash Scrub	Mojave Creosote Bush Scrub	Stabilized/Partially Stabilized Desert Dunes/Sand Fields	Agriculture	Mojave Wash Scrub	Mojave Creosote Bush Scrub	Stabilized/Partially Stabilized Desert Dunes/Sand Fields	Agriculture
Conveyance Pipeline	9.8	545.6	130.0	--	1.5	69.9	35.2	--
Cadiz Pumping Plant	--	1.7	--	--	--	1.2	--	--
Staging Areas	--	11.5	--	--	--	--	--	--
Spreading Basins	--	--	--	--	--	390.0	--	--
Well Field Pipelines	1.2	37.1	--	1.5	1.2	37.1	--	1.5
Wells + Substations	--	--	--	--	--	6.8	--	0.7
TOTAL	**11.0**	**595.9**	**130.0**	**1.5**	**2.7**	**505.0**	**35.2**	**2.2**

were based on a 50-foot wide construction corridor with 20 feet of this remaining as a permanent impact.

Eastern Alternative

Impacts on Plant Communities and Wildlife Habitat

Direct Impacts on Plant Communities and Wildlife Habitat. Direct impacts resulting from the implementation of the Eastern Alternative, shown earlier in Table 5.8-3, include the removal of approximately 1,099 acres of Mojave creosote bush scrub (465 acres permanent impact), 13.7 acres of Mojave wash scrub (2.2 acres permanent impact), 165.2 acres of stabilized or partially stabilized desert dunes or desert sand fields (16.5 acres permanent impact), and 3.7 acres of agriculture (2.2 acres permanent impact). Permanent impacts are associated with features such as the spreading basins, maintenance roads, the Cadiz Pumping Plant and associated structures, and the wellfield. The remainder of these impacts are anticipated to be temporary because the plant communities can eventually reestablish themselves in the construction easement where no permanent structures are present. Temporary impacts are primarily a result of the disturbance associated with construction along the conveyance alignments.

Following the completion of construction, natural desert regeneration is anticipated to occur slowly, over a period of years. Seed germination and survival in the desert are rare events, especially for desert annuals. Significant rain events or years may result in abundant seed germination, especially for annual species, but these events may occur once every 10 to 50 years. In addition, the presence of a living, biological crust helps protect germinating seedlings. The absence of this crust following construction combined with the slow rate of crust formation will likely slow natural regeneration of desert plant species within the temporary easement. In addition, the absence of biological soil crusts may increase runoff and decrease infiltration.

The CDFG considers Mojave wash scrub and stabilized desert dunes/desert sand fields to be sensitive communities. Therefore, in accordance with the significance criteria (Section 5.8.2) direct impacts on Mojave wash scrub (13.7 acres) and stabilized or partially stabilized desert dunes or desert sand fields (165.2 acres) resulting from the implementation of the Eastern Alternative are expected to be potentially significant. Salvaging of topsoils, control of invasive weeds and access restriction (mitigation measures B-1 through B-4 described below), will help minimize direct impacts on these plant communities. Additionally, the Project is designed so that the conveyance pipeline will cross washes perpendicularly, thereby minimizing impacts to Mojave wash scrub.

Indirect Impacts on Plant Communities and Wildlife Habitat. Short-term indirect impacts resulting from the implementation of the Eastern Alternative are anticipated to include increased potential for site erosion, contamination by equipment fluids, potential loss of vegetation productivity associated with fugitive dust, and an increase in invasive/exotic vegetation, resulting in habitat degradation. In addition, indirect impacts on plant communities and wildlife habitat are anticipated every five to seven years due to maintenance activities associated with pipeline inspection, which would require the evacuation of water from the pipe through blowoff structures. Public access into native habitats is also an indirect impact of the Project. Mitigation measure

B-3 will minimize impacts from non-native plant species.

During construction, there may be an increase in site erosion. Once the vegetation is removed and the site is disturbed, erosion potential increases. If there is rainfall, uncompacted soils are subject to being transported into washes. This would result in increased siltation. Because the washes are ephemeral (water runs only during and after rainfall events), there is no permanent aquatic life in the washes, and erosion control measures would be incorporated as identified earlier in Section 5.4. Therefore, no significant impacts are anticipated due to an increase in site erosion.

Refueling and maintenance of equipment would result in the potential for spills of petrochemicals such as fuel and lubricants. All fuel and lubricant spills must be cleaned up in accordance with existing regulations. Because the quantity of fuels and lubricants are relatively small, the extent of disturbance would also be confined to a generally small area, the impacts to biological resources would generally not be significant. However, due to the sensitivity of the desert wash habitat and the potential for petrochemicals to be transported downstream in a rain event, impacts to the desert wash habitat from accidental spills would be adverse. However, due to the low likelihood of occurrence and existing regulations requiring clean up of hazardous materials spills, the limited extent of this potential impact would not be significant. Mitigation measure B-5, provided later in section 5.8.5, would reduce this impact to below a level of significance.

Dust levels are generally high in the desert because of the high winds and limited vegetative cover. Vegetation, therefore, is adapted to withstand some dust deposition that is washed off during rain events. Unless fugitive dust reaches a level that the plants could not photosynthesize, the impacts are likely to be adverse, but not significant. Air quality mitigation measures A-2 and A-4-7, provided earlier in Section 5.6, will reduce these potential adverse impacts on plant communities.

Blowoff structures will release water in the pipeline slowly (less than one cubic foot per second at peak flow), over a matter of days, and a majority of the water will percolate into the ground rapidly, thereby limiting the area of potential impact. Blowoff structures will be located at low points in the pipeline, where water would otherwise naturally collect. Because of the infrequent operation and limited area of effect, blowoff structure operations would not have a significant impact on native vegetation or wildlife communities.

Long-term indirect impacts under the Eastern Alternative are anticipated to include an increased susceptibility of adjacent, native habitats to invasion by non-native, weedy plant species, including mustard (*Brassica* sp.) and Russian thistle (*Salsola tragus*). These non-native species may have short-term competitive advantages over native species due to soil disturbance. Due to the highly invasive nature of these species, the adverse impacts of these species on the formation of native biological soil crusts and the slow recovery rates of desert plant communities, these temporary impacts are anticipated to be potentially significant. Weed control along the alignment (mitigation measure B-3, below) will also reduce these potential indirect impacts on plant communities and wildlife habitat to below a level of significance.

In addition, long-term indirect impacts of the Eastern Alternative are expected to

include an increase in public access to relatively undisturbed portions of the desert, including off-road vehicle use between the Iron Mountain Pumping Plant and Cadiz-Rice Road. These areas have been relatively free from human disturbance since General Patton used this area for military training in the 1940s and have good biological crust cover throughout most of this area. Impacts due to increased public access to these areas are anticipated to be potentially significant. Control of access to the pipeline alignment maintenance road with locked gates (mitigation measure B-4, below) will minimize long-term disturbance and reduce these potential indirect impacts on plant communities and wildlife habitat to below a level of significance.

Beneficial Impacts on Wildlife Species

The Project has the potential for beneficial impacts on some wildlife species. There will be short-term increases in water availability associated with the spreading basins. Water availability (particularly open water) is extremely limited in the desert environment. When water is pumped to the spreading basins, birds and bats may take advantage of the new water source. Because the spreading basin will be fenced, it would provide a limited benefit for mammals and reptiles that could not pass through or over the fence. This benefit is expected to be short-term and not significant.

Impacts on Special Interest Biological Resources

Direct Impacts on Special Interest Plant Species. The Eastern Alternative will result in direct adverse impacts on ribbed cryptantha, a CNPS List 4 plant. These impacts will involve the temporary removal of occupied and suitable habitat, and recovery of this species within the alignment will likely be slow. However, ribbed cryptantha occurs fairly commonly in areas of stabilized and windblown sand along and adjacent to the conveyance pipeline alignment south of where it parallels Cadiz-Rice Road and east of the Kilbeck Hills and the Iron Mountains.

Construction of the pipeline would result in the localized loss of individuals of a sensitive species, ribbed cryptantha. Although the field reconnaissance did not identify any other sensitive plant species, there is minimal-to-moderate potential for some of these species to be present in the area of impact. Because the Project would impact at least one sensitive plant species (ribbed crypthanta), the impacts are considered significant in accordance with the significance threshold (Section 5.8.2). Mitigation measures B-1 and B-3, which require salvaging of the topsoil and exotics control, respectively, would reduce this impact to below a level of significance.

Indirect Impacts on Special Interest Plant Species. Short-term indirect impacts may occur to special interest plant species located adjacent to the construction zone of the Eastern Alternative due to dust pollution, which could temporarily reduce their photosynthetic capabilities. As discussed previously in the Eastern Alternative Section, these impacts are not considered significant. Air quality mitigation measures (AQ-2, and AQ-4 through AQ-7) will reduce these potential adverse imparts on special interest plant species to below a level of significance.

Long-term indirect impacts may occur on special interest plant species located adjacent to the construction zone due to increased competition from non-native, weedy species that may have an increased abundance and cover following

construction. In addition, increased public access to areas adjacent to the final maintenance road for the Eastern Alternative may increase trampling and mortality of special interest plant species as a result of increase in foot traffic or off-road vehicle use. Topsoil salvaging and access control (mitigation measures B-1 and B-4, below) will reduce these potential indirect impacts on special interest plant species to below a level of significance.

Direct Impacts on Special Interest Wildlife Species. The Eastern Alternative is expected to result in direct adverse impacts on the following wildlife species: desert tortoise, Mojave fringe-toed lizard, chuckwalla, sharp-shinned hawk, ferruginous hawk, prairie falcon, western burrowing owl, black-tailed gnatcatcher, LeConte's thrasher, loggerhead shrike, yellow warbler, pallid bat, western mastiff bat and American badger. These impacts are related to the direct removal of occupied habitat as well as impacts on foraging habitat. These impacts on the special interest wildlife species observed or detected in the Project alternatives are described in the following sections.

Desert Tortoise. During site preparation activities for the Eastern Alternative, direct removal of habitat occupied, or potentially occupied, by the desert tortoise is expected. In addition, construction of the pipeline and related facilities may potentially result in injury or mortality of tortoises occurring within the Project site. Based on the surveys conducted by CMBC, tortoises were present in very low densities on all Project alternatives. On the Eastern Alternative, the majority of tortoise evidence was observed in an area approximately 2,000 to 3,000 feet east of the Iron Mountain Pumping Plant. Areas to the north, along this alternative, support few, and in most places, probably no, tortoises.

Although the desert tortoise occurs in very low densities within the Eastern Alternative, any impacts on this federal and state threatened species, or its habitat, are considered significant. Mitigation measures B-1 through B-4 and B-8 through B-31 will reduce these impacts on desert tortoise to below a level of significance.

Other Special Interest Wildlife Species. The Eastern Alternative is expected to result in the direct removal of occupied habitat for Mojave fringe-toed lizard, western burrowing owl, black-tailed gnatcatcher, LeConte's thrasher, loggerhead shrike and American badger. Based on field survey results, eighteen fringe-toed lizards were observed along the Eastern Alternative in areas of fine, windblown sand, primarily east of the Iron Mountains. Burrowing owls were found at four locations along the conveyance pipeline where the alignment parallels Cadiz-Rice Road, and at three locations in the spreading basins. Black-tailed gnatcatchers were observed in many of the washes within this Alternative, with the largest numbers occurring in Schulyler Wash, on the east side of the wellfields. LeConte's thrashers were observed in at least three locations, including two locations of Schulyler Wash, and one in the spreading basins. Loggerhead shrikes were observed at several locations within this Alternative, primarily along Cadiz-Rice Road (in the vicinity of the Ship Mountains and south of Chubbuck), and within Schulyler Wash. Numerous digs and enlarged ground squirrel burrows with characteristic American badger claw marks on the side walls were found in this Alternative, indicating the potential for direct impacts on this species. Impacts to western burrowing owl and

American badger are potentially significant. Mitigation measures B-6 and B-7 will reduce potential direct impacts on these species to below a level of significance. Impacts resulting from the Eastern Alternative on habitat occupied by the remainder of the above species were considered adverse but not significant due to: 1) the broad distribution of these species in the region; 2) the lack of any significant populations occurring in the impact area; 3) abundance of suitable habitat in the vicinity of the Project site; 4) the relatively short-term extent of the impacts; and 5) the relatively low sensitivity status of these species.

The Eastern Alternative is also expected to result in the removal of foraging habitat for sharp-shinned hawk, ferruginous hawk, prairie falcon, yellow warbler, pallid bat and western mastiff bat. With the exception of the prairie falcon, pallid bat and western mastiff bat, these species would be expected to occur as winter visitors or occasional migrants in the Project area. Although the falcon potentially occurs as a breeder in this area, no breeding habitat for this species will be impacted by this Alternative. Pallid bat and western mastiff bat make local, seasonal movements, and are not migratory. Because no breeding roosts were observed on this alternative, only impacts on foraging habitat for these species are expected. Impacts on foraging habitat for these species would not be considered significant due to: 1) the broad distribution of these species in the region; 2) the abundance of suitable habitat in the Project vicinity; and 3) the lack of any significant resources on this alternative that would be critical to the continued occurrence of these species in the area.

Due to the factors identified above, no other significant impacts are expected on other sensitive wildlife species that were recorded in the vicinity of this alternative, or that may potentially occur due to suitable habitat and distribution.

Indirect Impacts on Special Interest Wildlife Species. The Eastern Alternative may result in indirect impacts on desert tortoise and other special interest wildlife species. These effects are described below.

Desert Tortoise. The Eastern Alternative may result in adverse, but insignificant, indirect impacts on desert tortoise. Common ravens are well known predators on young tortoises. Ravens may potentially be attracted to the Project area due to trash left by workers, the presence of power poles or the presence of water in the spreading basins. The Project spreading basins are not expected to attract significantly greater raven populations, however, because water is already present in the agricultural areas in the vicinity of the project site, and a large raven population currently exists in this area (as recorded during field surveys in February 1999). Mitigation measures B-21 and B-24 will further reduce the likelihood of ravens being attracted to the Project area.

There is also the potential for mortality of tortoises associated with access to the proposed spreading basins and will reduce this impact to below a level of significance. Mitigation measure B-22 will provide tortoise exclusion fences around the basins. There is also the potential for increased mortality and habitat degradation from vehicles, and illegal collecting by unauthorized access into the Project area along pipeline maintenance roads. Mitigation measure B-4 will deter unauthorized public access into the Project area and will reduce this impact to below a level of significance.

Other Special Interest Wildlife Species. Indirect, short- and long-term impacts on other special interest species identified above may potentially occur as a result of: 1) startle effects related to noise and motion; 2) increased potential for site erosion; 3) habitat degradation from fugitive dust, siltation, invasion by non-native weedy plant species and contamination by equipment fluids; and 4) potential introduction of non-native wildlife species, which may compete with native species for limited resources. Due to the short-term nature and limited extent of these potential impacts, the indirect impacts on special interest species resulting from this Alternative would not be considered significant.

Impacts on Wildlife Movement. As a result of the conveyance pipeline and wellfield features of the Eastern Alternative, trenching and other construction-related activities may potentially result in short-term restrictions on wildlife movement. These impacts would be generally limited to the larger, relatively mobile mammal species such as bighorn sheep, coyote and fox. Movement corridors for bighorn sheep have been identified along the southern part of the Eastern Alternative pipeline, between the Iron Mountains on the west and the Old Woman Mountains on the east. Short-term impacts may also be expected on less mobile species, such as reptiles and smaller mammals, which would be related more to the potential for temporary disruption. Multiple pipeline construction sites will be used along the length of the alignment, with each site having 2,500 linear feet of pipeline (trench) under construction at any one time. Due to the limited duration and relatively limited extent of pipeline construction, the lack of natural features that would potentially concentrate movement through any particular area in the Project site, and the relatively low volume of wildlife movement expected in these areas, the potential impacts on wildlife movement are not considered significant.

The fencing proposed around the spreading basins at the north end of the Project may potentially result in a permanent impediment to wildlife movement (e.g., bighorn sheep) between the Marble Mountains to the northwest and the Ship Mountains to the east. These impacts would not be considered significant due to the reasons discussed above, as well as the substantial amount of open space remaining in the immediate vicinity of the basins. Other Project facilities, due to their smaller extent, would not be considered an impact on wildlife movement.

Western Alternative

Impacts on Plant Communities and Wildlife Habitat

Table 5.8-1, shown earlier, summarizes the temporary (short-term) and permanent (long-term) direct impacts on plant communities by Project component. For the water conveyance pipeline, temporary impacts are based on a 180-foot temporary impact width, while permanent impacts are based on a 20-foot permanent impact width, the width of the permanent maintenance road. Impacts of the southern transmission line are based on a 50- foot construction corridor (20-foot permanent impact). Impacts of the wellfield pipeline are based on a 20-foot temporary impact width and a 20-foot permanent impact width, the width of the permanent maintenance road.

Direct Impacts on Plant Communities and Wildlife Habitat. Direct impacts of the Western Alternative, not including the transmission line, are anticipated to include approximately 1,143.5 acres of Mojave

creosote bush scrub (492.8 acres permanent), 15 acres of Mojave wash scrub (2.7 acres permanent), 188.8 acres of stabilized or partially stabilized desert dunes or desert sand fields (18.9 acres permanent), and 3.7 acres of agriculture (2.2 acres permanent). Permanent impacts are associated with features such as the Project spreading basins, maintenance roads, the Cadiz Pumping Plant and associated structures, and the wellfield. The remainder of these impacts are anticipated to be temporary because the plant communities can re-establish themselves in the construction easement where no permanent structures are present. Temporary impacts are primarily a result of construction along the conveyance alignments.

As discussed for the Eastern Alternative, there are potentially significant impacts associated with the direct loss of native plant communities and associated wildlife habitat, increased erosion and siltation, fugitive dust and impacts to plant productivity, increased invasive and non-native species, habitat degradation from fueling or maintenance activities, access to native habitats that are not currently subject to indirect impacts from humans and impacts to desert tortoises. Mitigation measures B-1 through B-33 would also be required for this Alternative. Mitigation measures identified in Air Quality to reduce fugitive dust (AQ-2 and AQ-4 through AQ-7) and Topography to reduce erosion (G-4) would also be required under this Alternative. These mitigation measures would reduce these indirect impacts to below a level of significance.

Indirect Impacts on Plant Communities and Wildlife Habitat. In addition to those general impacts identified earlier, long-term indirect impacts of the Western Alternative are expected to include an increase in public access to relatively undisturbed portions of the desert. These impacts may be greater than for the Eastern Alternative because the Western Alternative has a greater extent of relatively inaccessible areas and a greater occurrence of sensitive habitats (desert dunes and sand fields, desert washes). Should the Western Alternative be constructed, it is expected that public access by off-road vehicles will increase in the areas between the northern terminus of the Colorado River Aqueduct near the West Portal and Cadiz-Rice Road near the Kilbeck Hills. Although there is already an access road adjacent to the Cadiz Dunes Wilderness Area, the addition of a second, more easily driveable access road near this wilderness area that may increase undesirable public entry. These impacts due to increased public access are anticipated to be potentially significant. Access control using locked gates (mitigation measure B-4, below), will reduce these potential indirect impacts on plant communities and wildlife habitat to below a level of significance.

Beneficial Impacts on Wildlife Species

Beneficial impacts of the Western Alternative on wildlife species would be the same as those discussed for the Eastern Alternative.

Impacts on Special Interest Biological Resources

Direct Impacts on Special Interest Plant Species. The Western Alternative will result in direct impacts on ribbed crypthantha, a CNPS List 4 plant. These impacts will involve the temporary removal of occupied and suitable habitat, and recovery of this species within the alignment will likely be slow. Numbers of individuals were not estimated for the determination of Project

impacts, because ribbed crypthantha occurs fairly commonly in areas of stabilized and windblown sand along and adjacent to the conveyance pipeline alignment west of the Kilbeck Hills and the Iron Mountains.

Construction of the pipeline would result in the localized loss of individuals of a sensitive species, ribbed crypthantha. Although the field reconnaissance did not identify any other sensitive plant species, there is minimal-to-moderate potential for some of these species to be present in the area of impact. Because the Project would impact at least one sensitive plant species (ribbed crypthantha) the impacts are considered potentially significant in accordance with the significance thresholds (Section 5.8.2). Mitigation measures B-1 and B-3, requiring salvaging of the topsoil and exotics control, respectively, would reduce this impact to below a level of significance.

Indirect Impacts on Special Interest Plant Species. Short-term indirect impacts may occur on special interest plant species located adjacent to the construction zone as a result of the Western Alternative due to dust pollution, which could temporarily reduce their photosynthetic capabilities. These indirect impacts are considered potentially adverse, but not significant. Air quality mitigation measures (AQ-2 and AQ-4 through AQ-7) will minimize these potential adverse impacts on plant communities.

Long-term indirect impacts may occur on special interest plant species adjacent to the construction zone due to increased competition with non-native, weedy species that may have an increased abundance and cover following construction. In addition, increased public access to the areas adjacent to the final maintenance road for the Western Alternative may increase trampling and mortality of special interest plant species via increases in foot traffic or off-road vehicle use. These impacts are anticipated to be potentially significant. Weed control and access control (mitigation measures B-3 and B-4, below) will reduce these potential indirect impacts on special interest plant species to below a level of significance.

Direct Impacts on Special Interest Wildlife Species. The Western Alternative is expected to result in direct adverse impacts on the following wildlife species: desert tortoise, Mojave fringe-toed lizard, chuckwalla, northern harrier, sharp-shinned hawk, ferruginous hawk, golden eagle, prairie falcon, western burrowing owl, long-eared owl, black-tailed gnatcatcher, LeConte's thrasher, loggerhead shrike, yellow warbler, western mastiff bat and American badger. These impacts are related to the direct removal of occupied habitat as well as impacts on foraging habitat. Impacts on the special interest wildlife species observed or detected in the Project alternatives are evaluated below.

Desert Tortoise. During site preparation activities for the Western Alternative, direct removal of habitat occupied, or potentially occupied, by the desert tortoise is expected. In addition, construction of the pipeline and related facilities may potentially result in injury or mortality of tortoises occurring within the Project site. Based on the surveys conducted by CMBC, tortoises were present in very low densities in all Project alternatives. In the Western Alternative, the majority of tortoise evidence was observed along the southern segment of the power distribution facilities. This area was considered by CMBC to support relatively more tortoises than any other portion of this Alternative. Areas to the north, along this

Alternative, were considered to support few, and in some places, probably no, tortoises.

Although the desert tortoise occurs in very low densities along most of the Western Alternative, any impacts on this federal and state threatened species, or its habitat, are potentially significant. Mitigation measures B-8 through B-31 will reduce these impacts on desert tortoise to below a level of significance.

Other Special Interest Wildlife Species. The Western Alternative is expected to result in the direct removal of occupied habitat for Mojave fringe-toed lizard, western burrowing owl, black-tailed gnatcatcher, LeConte's thrasher, loggerhead shrike and American badger. Based on field survey results, forty-one fringe-toed lizards were observed along the Western Alternative, west of the Iron Mountains and Kilbeck Hills in areas of fine, windblown sand. Burrowing owls were found at four locations along the conveyance pipeline west of the Iron Mountain and along Cadiz Road, and at three locations in the vicinity of the Project spreading basins. Black-tailed gnatcatchers were observed in washes within this Alternative along Cadiz Road, with the largest numbers occurring in Schulyler Wash, on the east side of the Project wellfield. LeConte's thrashers were observed in at least three locations, including two locations of Schulyler Wash and one in the vicinity of the Project spreading basins. Loggerhead shrikes were observed at several locations within this Alternative, along Cadiz Road (in the vicinity of the Ship Mountains), and within Schulyler Wash. Numerous digs and enlarged ground squirrel burrows with characteristic American badger claw marks on the side walls were found on this Alternative, indicating the potential for direct impacts on this species. More of these burrows were identified on this Alternative than on the Eastern and Eastern/Canal Alternatives. Impacts to western burrowing owl and American badger are potentially significant. Mitigation measures B-6 and B-7 will reduce potential direct impacts on these species to below a level of significance. Impacts resulting from the Western Alternative on habitat occupied by the remainder of the above species were considered adverse but not significant due to: 1) the broad distribution of these species in the region; 2) the lack of any significant populations occurring in the impact area; 3) the abundance of suitable habitat in the vicinity of the Project site; 4) the relatively short-term extent of the impacts; and 5) the relatively low-sensitivity status of these species.

The Western Alternative is also expected to result in the removal of foraging habitat for northern harrier, sharp-shinned hawk, ferruginous hawk, golden eagle, prairie falcon, long-eared owl, yellow warbler and western mastiff bat. With the exception of the prairie falcon, golden eagle and western mastiff bat, these species would be expected to occur as winter visitors or occasional migrants in the Project area. Although the falcon and eagle potentially occur as breeders in this area, no breeding habitat for these species will be impacted by this Alternative. Western mastiff bat makes local, seasonal movements, and is not migratory. Because no breeding roosts were observed on this Alternative, only impacts on foraging habitat for this species are expected. Impacts on foraging habitat for the above species would not be considered significant due to: 1) the broad distribution of these species in the region; 2) the abundance of suitable habitat in the Project vicinity; and 3) the lack of any significant resources in this Alternative that would be

critical to the continued occurrence of these species in the area.

Due to the factors identified above, no other significant impacts are expected on other sensitive wildlife species that may potentially occur in the Western Alternative due to suitable habitat and distribution.

Indirect Impacts on Special Interest Wildlife Species. As discussed for the Eastern Alternative, indirect impacts on desert tortoise resulting from implementation of the Western Alternative are potentially significant. Mitigation measures B-4, B-21, B-22 and B-25 will reduce indirect impacts on the tortoise to below a level of significance. Indirect impacts of the Western Alternative on other special interest wildlife species are not considered significant due to the short-term nature and limited extent of these potential impacts.

Impacts on Wildlife Movement. As discussed previously under the Eastern Alternative, impacts to wildlife movement due to implementation of the Western Alternative are not anticipated to result in significant impacts. This is because of the limited duration and relatively limited extent of conveyance pipeline construction, lack of natural features that would potentially concentrate movement through any particular area and the relatively low volume of wildlife movement in the area.

Combination Alternative

Impacts on Plant Communities and Wildlife Habitat

Direct impacts resulting from the implementation of the Combination Alternative, not including the southern segment of the power transmission line, are anticipated to include 1,402.4 acres of Mojave creosote bush scrub (518.7 acres permanent), 16 acres of Mojave wash scrub (2.8 acres permanent), 197.6 acres of stabilized or partially stabilized desert dunes or desert sand fields (19.8 acres permanent), and 3.7 acres of agriculture (2.2 acres permanent). Permanent impacts are associated with features such as the spreading basins, maintenance roads, the Cadiz Pumping Plant and associated structures, and the wellfield. The remainder of these impacts are anticipated to be temporary because the plant communities can re-establish themselves in the construction easement where no permanent structures are present. Temporary impacts are primarily a result of construction along the conveyance alignments.

As discussed for the Eastern Alternative, there are potentially significant impacts associated with the direct loss of native plant communities and associated wildlife habitat, including increased erosion and siltation; increased invasive and non-native species; habitat degradation from fueling or maintenance activities; access to native habitats that are not currently subject to indirect impacts from humans; and impacts to desert tortoises. Mitigation B-1 through B-33 would also be required for this Alternative which would reduce these impacts to below a level of significance.

In addition, long-term indirect impacts of the Combination Alternative are expected to include an increase in public access to areas of the desert. These impacts may be greater than those for the Eastern Alternative because the Combination Alternative has a greater extent of relatively inaccessible areas and a greater occurrence of sensitive habitats including desert dunes and sand fields, and desert washes. The Combination Alternative is expected to increase public access by off-road vehicle use of areas between the

northern terminus of the CRA near the west portal and Cadiz Road south of Chubbuck. These areas are more remote than those on the Eastern Alignment and have been relatively free from human disturbance since General Patton used this area for military training in the 1940s. These impacts due to increased public access to these areas are anticipated to be potentially significant and greater than for the Eastern Alignment. Access control using locked gates (mitigation measure B-4, below) will reduce these potential indirect impacts on plant communities and wildlife habitat to below a level of significance.

Impacts on Special Interest Biological Resources

Direct Impacts on Special Interest Plant Species. Construction of the Combination Alternative will result in direct impacts on ribbed cryptantha, a CNPS List 4 plant. These impacts will involve the temporary (short-term) removal of occupied and suitable habitat, although recovery of this species within the alignment will likely be slow. Numbers of individuals were not estimated for the determination of Project impacts because ribbed cryptantha occurs fairly commonly in areas of stabilized and windblown sand along the conveyance pipeline alignment west of the Kilbeck Hills and the Iron Mountains.

Construction of the pipeline would result in the loss of individuals of a sensitive species, ribbed crypthantha. Although the field reconnaissance did not identify any other sensitive plant species, there is a minimal-to-moderate potential for some of these species to be present in the area of impact. Because the Project would impact at least one sensitive plant species (ribbed crypthantha) the impacts are considered potentially significant in accordance with the significance thresholds (Section 5.8.2). Mitigation measures B-1 and B-3, requiring salvaging of the topsoil and exotics control, respectively, would reduce this impact to below a level of significance.

Indirect Impacts on Special Interest Plant Species. Short-term indirect impacts may occur on special interest plant species located adjacent to the construction zone as a result of the Combination Alternative due to dust pollution, which could temporarily reduce their photosynthetic capabilities. The production of fugitive dust may decrease plant photosynthesis and production of special interest plant species adjacent to the 200-foot construction corridor for this Alternative. Therefore, these indirect impacts are considered to be adverse. Air quality mitigation measures (AQ-2 and AQ-4 through AQ-7) will reduce these potential adverse impacts on plant communities to below a level of significance.

Long-term indirect impacts may occur on special interest plant species adjacent to the construction zone due to increased competition with non-native, weedy species that are anticipated to have an increased abundance and cover following construction. In addition, increased public access to the areas adjacent to the final maintenance road for the Combination Alternative may increase trampling and mortality of special interest plant species as a result of increases in foot traffic or off-road vehicle use. Weed control and access control using locked gates (mitigation measures B-3 and B-4, below) will reduce these potential indirect impacts on special interest plant species to below a level of significance.

Direct Impacts on Special Interest Wildlife Species. The Combination Alternative is expected to result in direct adverse impacts on the following wildlife species: desert

tortoise, Mojave fringe-toed lizard, chuckwalla, northern harrier, sharp-shinned hawk, ferruginous hawk, golden eagle, prairie falcon, western burrowing owl, long-eared owl, black-tailed gnatcatcher, LeConte's thrasher, loggerhead shrike, yellow warbler, pallid bat, western mastiff bat and American badger. These impacts are related to the direct removal of occupied habitat as well as impacts on foraging habitat. Impacts on the special interest wildlife species observed or detected in the Project alternatives are evaluated below.

Desert Tortoise. During site preparation activities for the Combination Alternative, direct removal of habitat occupied, or potentially occupied, by the desert tortoise is expected. In addition, construction of the pipeline and related facilities may potentially result in injury or mortality of tortoises occurring within the Project site. Based on the surveys conducted by CMBC, tortoises were present in very low densities in all project alternatives. In the Combination Alternative, the majority of tortoise evidence was observed along the southern transmission line. This area was considered by CMBC to support relatively more tortoises than any other portion of this Alternative. Areas to the north, along this Alternative, support few, and in most places, probably no, tortoises.

Although the desert tortoise occurs in very low densities along most of the Combination Alternative, any impacts on this federal and state threatened species, or its habitat, are considered potentially significant. Mitigation Measures B-1 through B-4 and B-8 through B-31 will reduce these impacts on desert tortoise to below a level of significance.

Other Special Interest Wildlife Species. The Combination Alternative is expected to result in the direct removal of occupied habitat for Mojave fringe-toed lizard, western burrowing owl, black-tailed gnatcatcher, LeConte's thrasher, loggerhead shrike and American badger. Based on field survey results, twelve fringe-toed lizards were observed within the Combination Alternative in areas of fine windblown sand, primarily west of the Iron Mountains. Burrowing owls were found at three locations along the conveyance pipeline, and at three locations in the spreading basins. Black-tailed gnatcatchers were observed in many of the washes within this Alternative, with the largest numbers occurring in Schulyler Wash, on the east side of the wellfields. LeConte's thrashers were observed in at least three locations, including two locations of Schulyler Wash and one in the vicinity of the Project spreading basins. Loggerhead shrikes were observed at several locations within this alternative, primarily along Cadiz Road in the vicinity of the Ship Mountains, and within Schulyler Wash. Numerous digs and enlarged ground squirrel burrows with characteristic American badger claw marks on the side walls were found in this Alternative, indicating the potential for direct impacts on this species. More of these burrows were identified on this Alternative than on the Eastern and Eastern/Canal Alternatives. Impacts to western burrowing owl and American badger are potentially significant. Mitigation measures B-6 and B-7 will reduce potential direct impacts on these species to below a level of significance. Impacts resulting from the Combination Alternative on habitat occupied by the remainder of the above species were considered adverse but not significant due

to: 1) the broad distribution of these species in the region; 2) the lack of any significant populations occurring in the impact area; 3) the abundance of suitable habitat in the vicinity of the Project site; 4) the relatively short-term extent of the impacts; and 5) the relatively low-sensitivity status of these species.

The Combination Alternative is also expected to result in the removal of foraging habitat for northern harrier, sharp-shinned hawk, ferruginous hawk, golden eagle, prairie falcon, long-eared owl, yellow warbler, pallid bat and western mastiff bat. With the exception of the prairie falcon, golden eagle, pallid bat and western mastiff bat, these species would be expected to occur only as winter visitors or occasional migrants in the Project area. Although the falcon and eagle potentially occur as breeders in this area, no breeding habitat for these species will be impacted by this Alternative. Pallid bat and western mastiff bat make local, seasonal movements, and are not migratory. Because no breeding roosts were observed in this alternative, only impacts on foraging habitat for these species are expected. Impacts on foraging habitat for these species would not be considered significant due to: 1) the broad distribution of these species in the region; 2) the abundance of suitable habitat in the Project vicinity; and 3) the lack of any significant resources in this Alternative that would be critical to the continued occurrence of these species in the area.

Due to the factors identified above, no other significant impacts are expected on other sensitive wildlife species that were recorded in the vicinity of this Alternative, or that may potentially occur due to suitable habitat and distribution.

Indirect Impacts on Special Interest Wildlife Species. As discussed for the Eastern Alternative, indirect impacts of the Combination Alternative on desert tortoise are potentially significant. Mitigation measures B-4, B-21, B-22 and B-25 will reduce indirect impacts on the tortoise to below a level of significance. Indirect impacts of this alternative on other special-interest wildlife species are not considered significant due to the short-term nature and limited extent of these potential impacts.

Impacts on Wildlife Movement. Due to the similarity of impacts between the Combination and Eastern alternatives on wildlife movement, refer to the discussion of impacts on wildlife movement provided earlier for the Eastern Alternative.

Eastern/Canal Alternative

Impacts on Plant Communities and Wildlife Habitat

The Eastern/Canal Alternative would follow the same conveyance alignment as the Eastern Alternative, but would include an approximately eight-mile long segment of open canal in the Danby Dry Lake area. This canal section would be an open cut similar to the Colorado River Aqueduct. The canal would cause greater permanent acreage losses of affected desert plant communities than the buried pipeline of the Eastern Alternative as shown earlier on Table 5.8-1.

Direct impacts to plant communities resulting from the implementation of the Eastern/Canal Alternative include removal of approximately 1,100.9 acres of Mojave creosote bush scrub (505 acres permanent impact), 13.7 acres of Mojave wash scrub (2.7 acres permanent impact), 165.2 acres of stabilized or partially stabilized desert dunes or desert sand fields (35.2 acres permanent

impact), and 3.7 acres of agriculture (2.2 acres permanent impact). Permanent impacts are associated with features such as the canal, spreading basins, maintenance roads, the Cadiz Pumping Plant and associated features, and the wellfield. The remainder of these impacts are anticipated to be temporary because the plant communities can re-establish themselves in the construction easement where no permanent structures are present. Temporary impacts are primarily a result of construction along the conveyance alignment.

As discussed for the Eastern Alternative, there are potentially significant impacts associated with the direct loss of native plant communities and associated wildlife habitat, increased erosion and siltation, increased invasive and non-native species, habitat degradation from fueling or maintenance activities, access to native habitats that are not currently subject to indirect impacts from humans and impacts to desert tortoises. Mitigation measures B-1 through B-33 would also be required for this alternative which would reduce these impacts to below a level of significance.

In addition to those general impacts identified earlier, long-term indirect impacts of the Eastern/Canal Alternative are expected to include an increase in public access to relatively undisturbed parts of the desert. The impacts of this Alternative are expected to be similar to those of the Eastern Alternative and are expected to be potentially significant. Access control using locked gates (mitigation measure B-4, below) will reduce these potential indirect impacts on plant communities and wildlife habitat to below a level of significance.

Impacts on Special Interest Biological Resources

Direct Impacts on Special Interest Plant Species. The Eastern/Canal Alternative is expected to result in direct impacts to ribbed cryptantha, a CNPS List 4 plant to a similar extent as the Eastern Alternative. Both alternatives would have the same temporary construction impacts, but additional permanent loss of habitat due to the canal footprint would result in somewhat greater permanent impacts to this species under Eastern/Canal Alternative. Mitigation measures B-1 and B-3, identified below, would reduce this impact to below a level of significance.

Indirect Impacts on Special Interest Plant Species. Long-term indirect impacts may occur on special interest plant species adjacent to the construction zone due to increased competition with non-native, weedy species that may have an increased abundance and cover following construction. In addition, increased public access to the areas adjacent to the final maintenance road for the Eastern/Canal Alternative may increase trampling and mortality of special interest plant species as a result of increases in foot traffic or off-road vehicle use. Soil salvaging and access control (mitigation measures B-1 and B-4) will reduce these potential indirect impacts on special interest plant species to below a level of significance.

Direct Impacts on Special Interest Wildlife Species. Implementation of the Eastern/Canal Alternative is expected to result in direct adverse impacts on the following wildlife species: desert tortoise,

Mojave fringe-toed lizard, chuckwalla, sharp-shinned hawk, ferruginous hawk, prairie falcon, western burrowing owl, black-tailed gnatcatcher, LeConte's thrasher, loggerhead shrike, yellow warbler, pallid bat, western mastiff bat and American badger. These impacts are related to the direct removal of occupied habitat as well as impacts on foraging habitat. Impacts on the special interest wildlife species observed or detected in the Project alternatives are evaluated below.

Desert Tortoise. The impacts of the Eastern/Canal Alternative on desert tortoise would include greater levels of impacts as the Eastern Alternative due to the presence of open water more of the time under this Alternative. In addition to these impacts, the canal portion of this alternative could block movement of tortoises in the vicinity of Danby Dry Lake. With appropriate fencing along the canal, tortoise mortality due to drowning is not expected. Mitigation measures B-1 through B-4 and B-8 through B-31 will reduce these impacts on desert tortoise to below a level of significance.

Other Special Interest Wildlife Species. The impacts of the Eastern/Canal Alternative are expected to be the same as for the Eastern Alternative as discussed earlier. Impacts of the Eastern/Canal Alternative on habitats utilized by special interest wildlife species are considered to be adverse, but not significant.

Indirect Impacts on Special Interest Wildlife Species. The Eastern/Canal Alternative may result in indirect impacts on desert tortoise and other special interest wildlife species. These effects are described below.

Desert Tortoise. The Eastern/Canal Alternative may result in indirect impacts on desert tortoise similar to those that would be caused by the Eastern Alternative discussed above. Ravens may potentially be attracted to the Project area due to trash left by workers, the presence of power poles or the presence of water in the spreading basins. The spreading basins are not expected to attract significantly greater raven populations, however, because water is already present in the agricultural areas in the vicinity of the Project site, and a large raven population currently exists in this area as recorded during field surveys in February 1999. Mitigation measures B-21 and B-25 reduce the likelihood of ravens being attracted to the Project area to below a level of significance.

There is also the potential for mortality of tortoises associated with access to the proposed spreading basins and the canal. Therefore, mitigation measure B-22 will provide tortoise exclusion fences around the basins and canal, if used. There is a potential for increased mortality and habitat degradation from vehicles and an increased potential for illegal collecting due to unauthorized access to the Project area along pipeline maintenance roads. Mitigation measure B-4 has been proposed to deter unauthorized public access into the Project area. These measures would reduce these impacts to below a level of significance.

Other Special Interest Wildlife Species. Indirect, short- and long-term impacts on other special interest species identified above may potentially occur as a result of: 1) startle effects related to noise and motion; 2) increased potential for site erosion; 3) habitat degradation from fugitive dust, siltation, invasion by non-native weedy plant species and contamination by equipment fluids; and 4) potential introduction of non-native wildlife species, which may compete with native species for limited resources. Due to the short-term nature and limited

extent of these potential impacts, however, the indirect impacts on special interest species resulting from this Alternative would not be considered significant.

Impacts on Wildlife Movement. The seven mile long canal segment of the Eastern/Canal Alternative would pose a substantial and permanent barrier to movement of desert tortoise, bighorn sheep, and other wildlife, and would be a potential source of mortality for all terrestrial species. The canal section is within a BLM designated bighorn sheep corridor and would potentially adversely impact movement of this species. Blocking of wildlife movement, combined with the threat of mortality to threatened and endangered species, as well as other wildlife, would be considered significant. Fencing the canal section would reduce the potential for direct mortality of terrestrial species. Siphons would be provided at major canal wash crossings and would reduce adverse impacts resulting from blocking of a designated wildlife corridor to below a level of significance.

Construction of the conveyance pipeline and wellfield features, including trenching and other construction-related activities, may potentially result in short-term restrictions on wildlife movement. Fencing of the spreading basins at the north end of the project may redirect bighorn sheep movement between the Marble Mountains to the northwest and the Ship Mountains to the east. These impacts would be the same as for the Eastern Alternative and are not considered significant.

No Project Alternative

Because the No Project Alternative will not involve construction or operation of any of the Project components, this Alternative will not result in any impacts on biological resources.

5.8.5 MITIGATION MEASURES

The Project alternatives would result in potentially significant, adverse impacts on Mojave wash scrub, stabilized and partially stabilized desert dunes and desert sand fields, and desert tortoise. Because the Project impacts are similar for each alternative, mitigation measures are provided below for all significant, adverse impacts on biological resources. Each alternative would involve implementation of these measures at a level appropriate for the alternative and would reduce impacts to below a level of significance.

The following mitigation measures are provided to reduce direct impacts on native plant communities and wildlife habitat to below a level of significance.

B-1 Topsoil will be salvaged by the contractor prior to construction and replaced following construction. The top 4 to 6 inches of topsoil, including all vegetative materials (shrubs, etc.) and biological soil crusts, where present, will be salvaged during construction and stockpiled prior to use of the site to help preserve the excavated native soil. Topsoil storage shall not exceed three months. Topsoil piles shall be kept dry and less than four feet high and dry. The vegetation removed from the construction zone by grubbing or blading will act as mulch and will be stored along with the topsoil. The subsoil removed during pipeline construction will be stored separately and replaced after the pipeline is in place. The upper two feet of backfilled subsoil will not

be compacted. At the completion of construction in a given area, the temporary impact area shall be recontoured to approximate pre-Project conditions and an estimated 4 to 6 inches of the topsoil and mulch will be spread over the subsoil, leaving a rough surface. A sheepsfoot roller will be used to roughen the soil surface, providing microhabitats for seeds to germinate and capturing available rainfall. The Plans and Specifications will specify topsoil storage locations and depths and necessary equipment.

B-2 During construction, to the extent practicable, the areas to be cleared of all vegetation and topsoil shall be restricted to the pipeline construction trench and permanent access road. For all other areas, vegetation shall be crushed in place while maintaining most of the roots intact.

The following mitigation measures are provided to reduce indirect impacts on native plant communities and wildlife habitat to below a level of significance.

Mitigation measure G-4 identified in Section 5.4.5 (Topography, Geology Seismicity and Soils) will reduce impacts from erosion on native plant communities.

Mitigation measures AQ-2 and AQ-4 through AQ-7 in Section 5.6.5 (Air Quality) will minimize potential adverse impacts on native plant communities due to fugitive dust.

B-3 Following the completion of construction of any portion of the project, and for two years thereafter, invasive non-native plants such as mustards (*Brassica* spp.), Russian thistle (*Salsola tragus*) and camel knapweed will be removed from the temporary impact area after summer and winter rains before these weed species can set seed.

B-4 After construction has been completed, Metropolitan shall discourage unauthorized access into the desert from any new access created by this project through such measures as barrier fences, boulders, topographic impediments (grading potential access points where vehicles will have difficulty gaining access) and signage.

B-5 No equipment shall be fueled in a wash. All fueling activities shall occur with adequate protection to provide the immediate clean-up of any accidentally spilled fuels. All maintenance (e.g., oil changes, repairs) shall take place in the designated staging areas. Provisions for the safe transport, storage and disposal of all materials shall be provided.

The following mitigation measure is provided to reduce potential direct impacts on western burrowing owl to below a level of significance.

B-6 Between the period of February and July prior to any site preparation, grading or clearing, focused surveys will be conducted for burrowing owls in areas of suitable habitat (Mojave wash scrub, Mojave creosote bush scrub) 100 feet on either side of the conveyance pipeline or associated facilities. These surveys, conducted by a qualified biologist familiar with the owl and its habitat, will determine

the location of burrowing owls, as well as the location and status of active burrows.

"Passive relocation" of owls will be conducted during the non-breeding season (approximately February through July) wherever active burrows are found in the construction easement or within 100 feet of the easement limits. Passive relocation would involve the elimination of owl roosting sites in the construction easement while the adult owls are away from their burrows, as well as the elimination of any other potentially suitable burrows within 100 feet of the construction easement. If owls are found at active nest sites within 100 feet of construction, these areas will be avoided until after the completion of nesting activities and at which time the young are determined by the biologist to be independent of the adults.

The following mitigation measure is provided to reduce potential direct impacts on American badger and desert kit fox to below a level of significance.

B-7 Occupied American badger and desert kit fox burrows will be identified during pre-construction surveys. Removal of these species from the construction corridor will be accomplished following consultation with the CDFG.

Mitigation Measures for Desert Tortoise Applicable During Construction of the Cadiz Project

The following mitigation measures are provided to reduce potential direct impacts on desert tortoise to below a level of significance. Upon completion of federal and State endangered species permitting, these measures may be refined or additional measures required.

B-8 Metropolitan shall designate a field contact representative (FCR) who will be responsible for overseeing compliance with protective stipulations for the desert tortoise during construction and for coordination of compliance with the BLM. The FCR must be on-site during all Project activities. The FCR shall have the authority to halt all Project construction activities that are in violation of the stipulations. The FCR shall have a copy of all stipulations when work is being conducted on the site. The FCR may be a crew chief or field supervisor, a project manager, any other employee of Metropolitan, or a contracted biologist.

B-9 All construction employees who work on the Cadiz Project facilities shall participate in a Metropolitan-sponsored education program. Metropolitan is responsible for ensuring that the education program is developed and presented prior to conducting activities. New employees shall receive formal approved training prior to working on the Cadiz Project facilities. The employee education program must be approved by the BLM, USFWS and CDFG prior to the presentation of the program. The program may consist of a class presented by a qualified biologist (BLM or contracted) or a video. The program shall cover the following topics at a minimum:

- Distribution of the desert tortoise.
- General behavior and ecology of the desert tortoise.
- Sensitivity of the desert tortoise to human activities.
- Legal protection for the desert tortoise.
- Penalties for violations of state or federal laws related to protected species.
- Reporting requirements.
- Project protective mitigation measures.

B-10 During construction, only biologists authorized by the USFWS, CDFG and the BLM shall handle desert tortoises.

B-11 During project construction, the area of disturbance shall be confined to the smallest practical area, considering topography, placement of facilities, location of burrows, public health and safety, and other limiting factors. Work area boundaries shall be delineated with flagging or other marking to minimize surface disturbance associated with vehicle straying. Special habitat features, such as burrows, identified by the qualified biologist shall be avoided to the extent possible. To the extent possible, previously disturbed areas within the Project site shall be used for the stockpiling of excavated materials, storage or equipment, location of office trailers, and parking of vehicles. Metropolitan, in consultation with the qualified biologist, shall ensure compliance with this measure.

B-12 Except when absolutely required by the Project and as explicitly stated in the project permit, employees must use established or proposed roads. Cross-country vehicle use is prohibited .

B-13 Desert tortoises may be handled only by the authorized biologist and only when necessary. In handling desert tortoises, the authorized biologist shall follow the techniques for handling desert tortoises contained in "Guidelines for Handling Desert Tortoises during Construction Projects" (Desert Tortoise Council 1994, as revised 1999).

B-14 The authorized biologist shall maintain a record of all desert tortoises handled. This information shall include for each tortoise:

1. The locations (narrative and maps) and dates of observations.

2. General condition and health, including injuries and state of healing and whether animals voided their bladders.

3. Location moved from and location moved to.

4. Diagnostic markings (i.e., identification numbers or marked lateral scutes).

5. Slide photograph of each handled desert tortoise.

B-15 No later than 90 days after completion of construction or termination of activities, the authorized biologist shall prepare a

report for the BLM. The report shall document the effectiveness and practicality of the mitigation measures, the number of tortoises excavated from burrows, the number of tortoises moved from the site, the number of desert tortoises killed or injured, and the specific information for each handled desert tortoise as described in measure B-14. The report may make recommendations for modifying the stipulations to enhance protection of the desert tortoise or to make it more workable. The report shall provide an estimate of the actual acreage (by habitat types) disturbed by various aspects of the operation.

B-16 Upon injuring, killing or finding an injured or dead desert tortoise, Metropolitan is to notify the USFWS, BLM, and CDFG within three days of the finding. Written notification must be made within three days of the finding, both to the Ventura USFWS office and to the USFWS's Division of Law Enforcement in Torrance. The information provided must include the date and time of the incident (if known), location of the carcass or injured animal, a photograph, cause of death, if known, and other pertinent information.

An injured tortoise shall be transported to a qualified veterinarian for treatment at the expense of Metropolitan. If an injured tortoise recovers, the Ventura USFWS office shall be contacted for final disposition of the animal.

B-17 During construction, vehicles shall not exceed 35 miles per hour between Cadiz-Rice Road and the Iron Mountain Pumping Plant.

B-18 Workers shall inspect for tortoises under a vehicle prior to moving the vehicle. Signage shall be designed and attached to each vehicle in the construction area. The intent of the signage will be to remind the driver to inspect the area prior to moving the vehicle. Signage may be placed on door handle, window, steering wheel or other visible location. If a desert tortoise is present, the authorized biologist shall be notified and shall move the tortoise from the construction site.

B-19 No dogs or other domesticated animals shall be allowed at the construction site in desert tortoise habitat.

B-20 Prior to filling any construction trench, the trench shall be inspected by the qualified biologist to ensure that no desert tortoise may have entered into the trench. If a desert tortoise is found, the authorized biologist shall move the tortoise to a safe location.

B-21 During construction, all trash and food items shall be promptly contained within closed, raven and wildlife-proof containers. These shall be regularly removed from the project site to an authorized site to reduce the attractiveness of the area for ravens and other predators of the desert tortoise.

B-22 A chain-link fence shall be constructed around the outside of the spreading basin facility immediately after construction on the facility (and

the canal, if used) has been completed (and the canal, if used). The depth that the fence will be buried below the surface approximately 12 inches.

B-23 After construction has been completed, Metropolitan shall discourage unauthorized access into the desert from any new access created by this project through such measures as barrier fences, boulders, topographic impediments (grading potential access points such that vehicles will have difficulty gaining access), and signage.

B-24 Power distribution facilities will be designed such that the cross members slope downward at an angle of approximately 45 degrees to minimize the potential for raven nesting.

B-25 A desert tortoise clearance survey shall be conducted no earlier than 30 days prior to any construction-related ground disturbance. Should a tortoise be identified, no disturbance shall occur within 20 feet or as specified by the qualified biologist until the tortoise is relocated in accordance with B-13. Should a burrow be identified, the burrow will need to be excavated in accordance with adopted protocol.

B-26 In conformance with the 1994 Desert Tortoise (Mojave Population) Recovery Plan and the 1991 document entitled "Compensation for the Desert Tortoise" approved by the Desert Tortoise Management Oversight Group, Metropolitan shall provide offsite property at a 1:1 ratio for impacts to desert tortoise habitats (Mojave wash scrub, Mojave creosote bush scrub, desert dunes/sandy fields) as identified in Table 5.8-3. This area shall be permanently protected and managed with emphasis for the protection and preservation of desert tortoise. Fee title to such mitigation property shall be conveyed to either the BLM or the CDFG for protection and management purposes.

Mitigation Measures for Desert Tortoise Applicable to Operations and Maintenance of the Cadiz Project

The following mitigation measures are provided to reduce potential direct impacts on desert tortoise to below a level of significance. Upon completion of federal and state permitting, these measures may be refined or additional measures required.

B-27 All operations and maintenance employees who inspect, maintain, repair, or otherwise visit the Cadiz Project conveyance pipeline, spreading basins, or well field shall participate in the Metropolitan-sponsored education program outlined in B-9 prior to conducting field work in the specified areas.

B-28 Operations and maintenance employees shall inspect under parked vehicles for tortoises prior to moving the vehicle. If a tortoise is present, the employee shall wait 15 minutes for the tortoise to move, and may move the vehicle thereafter if it can be done without harming the tortoise. If the tortoise does not move within 15 minutes and the vehicle cannot be moved without the tortoise, the operations and maintenance employees are authorized to pick up

the tortoise and move it out of the way while wearing latex gloves. Should such handling occur, Metropolitan shall notify BLM, USFWS and CDFG and shall indicate the date and location of such incident.

B-29 Upon injuring or killing a desert tortoise during operations and maintenance activities, Metropolitan will notify the USFWS, BLM and CDFG within three days of the finding. Written notification must be made within three days of the finding, both to the Ventura USFWS office and to the USFWS's Division of Law Enforcement in Torrance. The information provided must include the date and time of the incident (if known), location of the carcass or injured animal, a photograph, cause of death, if known, and other pertinent information.

An injured tortoise shall be transported by an authorized biologist to a qualified veterinarian for treatment at the expense of Metropolitan. If an injured tortoise recovers, the Ventura USFWS office shall be contacted for final disposition of the animal.

B-30 Prior to the first use of the blowoff valves to dewater the conveyance pipeline for routine maintenance purposes, the area in the vicinity of each valve to be so operated shall be surveyed for desert tortoise by an authorized biologist. The first operation of the blowoffs shall be monitored to evaluate the possible effects on desert tortoise and its habitat. The authorized biologist shall remove any tortoises present in affected areas that appear subject to possible harm from the operation of the blowoff valves, and shall promptly notify BLM, USFWS, and CDFG if any tortoise was relocated. Metropolitan shall submit a report to BLM, USFWS, and CDFG documenting the findings from the operation of the blowoffs. This report and subsequent coordination among Metropolitan, BLM, USFWS, and CDFG shall be used to determine the appropriate level and focus of survey and monitoring, if any, required for subsequent operation of each of the blowoff valves.

B-31 In the event of repair or modification of conveyance or wellfield pipelines that entail unearthing of substantial reaches of buried facilities, the repair/modification shall be treated as a construction activity and the following conservation measures shall apply: B-1, B-2, B-8 through B-16, B-18 through B-21, and B-25.

The following mitigation measures are provided to specifically address the CDFG's requirements for a Streambed Alteration Agreement pursuant to section 1601 of the California Fish and Game Code, and reduce impacts to wash habitat to below a level of significance.

B-32 Metropolitan shall mulch and stockpile vegetation grubbed from the pipeline construction right-of-way within washes along with the topsoil from those areas as discussed above in the project description. Grubbing and removal of vegetation and topsoil along the pipeline alignment shall be limited to the

approximately 50-foot-wide swath within the construction right-of-way that is needed for pipeline trenching and the permanent access road. Vegetation shall be crushed in place on other portions of the pipeline construction right-of-way. Following completion of construction of each portion of the pipeline, the area of temporary disturbance shall be recontoured to approximate pre-project conditions and the stockpiled topsoil and mulched vegetation randomly spread across the recontoured area. A sheep's foot shall then be rolled across the treated area. Mulched vegetation and topsoil shall be stockpiled for a maximum of three months prior to respreading.

B-33 Metropolitan shall provide offsite property that replaces impacted wash habitat at a 1:1 ratio. This shall be accomplished in conjunction with property acquired to compensate for impacts to desert tortoise habitat as identified in measure B-26, above.

5.8.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Eastern Alternative

The Eastern Alternative would not have any impact on a federally protected wetland, conflict with any local policies or ordinances for protection of biological species or conflict with any adopted biological management plan. Therefore, there are no significant unmitigated impacts associated with these thresholds of significance.

The Eastern Alternative would result in impacts to two plant community types designated as sensitive by the CDFG. These two plant community types, stabilized or partially stabilized desert dunes or desert sand fields and Mojave wash scrub, are designated as threatened by the CDFG. This designation is given when it is determined that only 10,000 to 50,000 acres of the plant community remain. Construction of the Eastern Alternative impacts 165.2 acres of stabilized or partially stabilized desert dunes or desert sand fields and 13.7 acres of Mojave wash scrub.

Permanent impacts of the Eastern Alternative are limited to 16.5 acres of stabilized or partially stabilized desert dunes or desert sand fields and 2.2 acres of Mojave wash scrub. Conservatively assuming that only 10,000 acres of each of these two plant community types exist, then the permanent impacts of the Eastern Alternative comprise 0.17 percent of the remaining stabilized or partially stabilized desert dunes or desert sand fields and 0.02 percent of the remaining Mojave wash scrub.

In addition to the permanent impacts disclosed above, are those additional temporary impacts that are expected within the construction easement. Temporary impacts to stabilized or partially stabilized desert dunes or desert sand fields are estimated at 165.2 acres. This represents a relatively small percentage impact of 1.65 percent to the remaining community type, assuming just 10,000 acres remain. Temporary impacts to Mojave wash scrub are estimated at 13.7 acres. This represents a small percentage impact of 0.14 percent of the remaining plant community type, again assuming that just 10,000 acres remain.

These permanent and temporary impacts associated with the Eastern Alternative do not comprise a substantial percentage of the remaining acreage of these community types. These impacts do not, therefore,

constitute "substantial" adverse impacts in terms of the threshold of significance. In addition, an extensive mitigation program is proposed to reduce the level of these insignificant impacts and is expected to enhance the recovery time for dependent flora and fauna. These mitigation components include the following:

- Construction worker training,
- Restricted/limited vegetation removal,
- Salvage of topsoil,
- Control of construction vehicle fueling/maintenance to prevent soil contamination
- Post construction replacement and re-contouring of topsoil,
- Post construction weed control,
- Access controls and
- Replacement acreage for temporary and permanent acreage losses of Mojave wash scrub and desert tortoise habitat at a 1:1 ratio.

These measures will reduce the insignificant, temporary impact to the sensitive plant communities and assist in their recovery. Moreover, when these mitigation measures are considered in conjunction with the fact that the permanently affected acreage is small in comparison to the amount of remaining acreage for the two sensitive plant communities, it is clear that the threshold of significance of a "substantial adverse effect" is not exceeded. Therefore, there would be no remaining significant adverse impacts to sensitive plant communities.

The habitats affected by the Cadiz Project provide limited habitat values for the desert tortoise as evidenced by only very limited sign of tortoise use. Notwithstanding the limited value to desert tortoise, extensive mitigation measures have been proposed to reduce the magnitude of impact to desert tortoise to below a level of significance. These measures include the above measures to restore tortoise habitat that is directly affected by the Eastern Alternative, including stockpiling, replacing and re-contouring topsoil, controlling weeds, access controls, etc. and others to reduce direct impacts to individual animals that may be found on the Cadiz Project site. To minimize the potential for incidental take of desert tortoise by the Cadiz Project, measures are included that require specific design features and actions by construction and operations and maintenance personnel as described earlier in this section. Mitigation measures also include replacement of desert tortoise habitat at a 1:1 ratio for both temporary and permanent acreage losses. With the implementation of these measures, impacts to the desert tortoise are reduced to below a level of significance. Impacts to other special interest species were not determined to be significant prior to mitigation as discussed in Section 5.8.4.

Western Alternative

The significance of impacts for the Western Alternative is generally the same as for the Eastern Alternative. No significant impacts would remain following mitigation. However, the Western Alternative results in slightly greater effects. It permanently impacts 18.8 acres of stabilized or partially stabilized desert dunes or desert sand fields and 2.7 acres of Mojave wash scrub, slightly more than the Eastern Alternative. In addition, the Western Alternative

temporarily impacts 188 acres of stabilized or partially stabilized desert dunes and desert sand fields and 15 acres of Mojave wash scrub. Like the Eastern Alternative, these impacts are not substantial relative to the total amounts of these plant communities that remain.

The temporary indirect impacts of the Western Alternative are greater due to its greater extent in areas that are now relatively inaccessible. Over the long term, even with access controls, it is expected that public access by off-road vehicles will increase in the areas between the West Portal and the Cadiz Dunes Wilderness Area due to its more remote location. Like the Eastern Alternative, impacts to the desert tortoise are mitigated to below a level of significance.

Combination Alternative

The significance of impacts for the Combination Alternative is generally the same as for the Eastern Alternative. No significant impacts would remain following mitigation. However, the Combination Alternative results in slightly greater effects than the Eastern or Western Alternatives. It permanently impacts 19.8 acres of stabilized or partially stabilized desert dunes or desert sand fields and 2.8 acres of Mojave wash scrub. The Combination Alternative temporarily impacts 197.6 acres of stabilized or partially stabilized desert dunes or desert sand fields and 16 acres of Mojave wash scrub. Similar to the Eastern and Western Alternatives, the amounts of affected plant communities are not substantial, relative to the acreage of the plant communities that remain and no significant impacts would remain after mitigation.

Like the Western Alternative, the Combination Alternative results in greater temporary impacts than the Eastern Alternative due to its greater extension in areas that are now relatively inaccessible. It also results in the same long term public access impacts as the Western Alternative. Like the Eastern and Western Alternatives, impacts to the desert tortoise would be mitigated to below a level of significance.

Eastern/Canal Alternative

The significance of impacts for the Eastern/Canal Alternative is generally the same as for the Eastern Alternative. No significant impacts would remain following mitigation. However, the Eastern/Canal Alternative has the most effects among the Cadiz Project Alternatives. It permanently impacts 35.2 acres of stabilized or partially stabilized desert dunes or desert sand fields and 2.7 acres of Mojave wash scrub. The Eastern/Canal Alternative temporarily impacts 165.2 acres of stabilized and partially stabilized desert dunes or desert sand fields and 13.7 acres of Mojave wash scrub. Similar to the Eastern, Western and Combination Alternatives, the impacts to these sensitive plant communities are not substantial relative to the remaining acreage of these resources.

In addition, the canal segment of the Eastern/Canal Alternative would cross an identified wildlife movement corridor and constrain the passage of animals between the Iron Mountains and Old Woman Mountains. Siphons would be provided at major washes along the canal, however, allowing for wildlife movement.

5.9 ENERGY AND MINERAL RESOURCES

5.9.1 AFFECTED ENVIRONMENT

This section describes the potential impacts on energy and mineral resources that could result from the Cadiz Project alternatives. Information for this section was obtained from Black and Veatch (1999), the California Division of Mines and Geology (CDMG 1999), BLM (1982 and 1999) and URS Greiner Woodward Clyde (1999).

There are three basic categories of mineral resources that are subject to claims on public lands and which are administered by the BLM: locatable, leasable and saleable. Locatable minerals include minerals such as calcium, lithium, gold, silver, lead, asbestos and mica. Leasable energy and mineral resources generally include oil, gas, oil shale, geothermal resources, potash, sodium, solid and semi-solid bitumen, bituminous rock, native asphalt, phosphate and coal. Saleable mineral resources generally include common varieties of sand, gravel, stone, pumice, cinders and clay.

Energy Use

The major existing energy consumers in the Cadiz Project area are the Iron Mountain Pumping Plant and the wells used to irrigate the Cadiz Inc. agricultural operations. There are seven irrigation wells which are currently powered by diesel engines. The pumps operating these wells use a total of approximately 191,500 gallons per year of diesel fuel.

The total existing annual electrical use for the entire Iron Mountain Pumping Plant and support facilities area is approximately 1,745,000 kilowatt-hours/year (1,745 megawatt-hours/year).

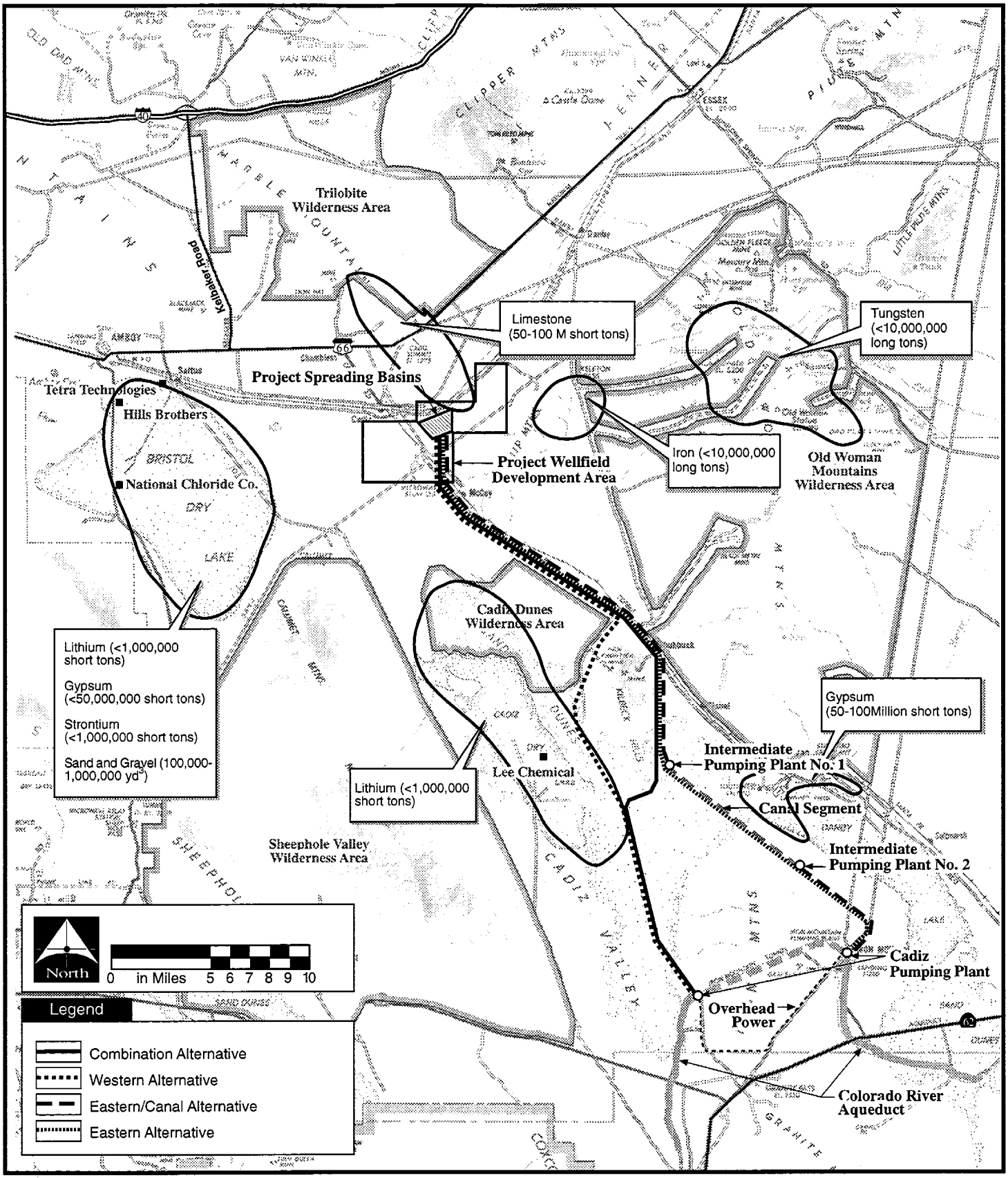
Natural gas is available for use at various locations throughout the Cadiz Project area. A six-inch natural gas pipeline owned by All American Pipeline, L.P. runs parallel to Cadiz-Rice Road and exclusively serves the pump and heater station for All American Pipeline, L.P.'s crude oil pipeline.

Mineral Resources

TETRA Technologies, Inc., Hills Brothers, National Chloride Company of America and Lee Chemical currently have liquid sodium and calcium chloride production operations on Bristol Dry Lake. National Chloride Company of America also has liquid chloride (food grade) production operations on Cadiz Dry Lake.

Based on a review of existing information, the BLM has developed a series of maps representing potential mineral resources within a wide area of southeastern California. The applicable portions of these BLM maps are shown in Figures 5.9-1 through 5.9-5. These figures also depict the locations of the Cadiz Project alternatives.

Figure 5.9-1 shows the locations of various economic mineral resources, as classified and located by the BLM. The potential economic resources nearest the Cadiz Project are lithium, limestone, iron, and gypsum. Lithium is identified as concentrated in the Cadiz Dry Lake, west of the water conveyance facilities. As shown on Figure 5.9-1, the Western Alternative trends along the east edge of Cadiz Dry Lake where there is a potential source of lithium. Other potential



Source: BLM (1982 and 1999).

Figure 5.9-1

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

mineral resources near the water conveyance facilities include a potential source of gypsum, about a mile east of the Cadiz Project area, at the northwest end of Danby Dry Lake; a potential source of iron, about five miles east of the north end of the Cadiz Project area; and a potential source of limestone, located to the north of the Cadiz Project area.

Figure 5.9-2 shows areas of potential locatable minerals, as identified by the BLM. As shown, most of the water conveyance facilities would cross lands that could not be classified, either due to insufficient data or because the known geology was considered unfavorable for most locatable minerals. As shown on Figure 5.9-2, part of the northern reach of all the water conveyance facilities alignments would cross an area classified as potentially containing locatable minerals, based on limited data.

The locations of potential leaseable minerals are shown on Figure 5.9-3. There are areas that would be crossed by the water conveyance facilities that are classified as prospectively valuable for sodium. As defined by the BLM, "prospectively valuable" indicates that geologic conditions are similar to other areas where minerals have been extracted. As shown on Figure 5.9-3, these areas are located within both Cadiz and Danby dry lakes.

Figure 5.9-4 shows areas identified by the BLM as having a potential for saleable minerals. As shown, the water conveyance facilities cross land that was either unclassified or was classified as having potential sand and gravel resources. Those areas identified as having the potential for saleable sand and gravel are identified as principally sand-covered planes, river washes, sand dunes and sand-covered alluvial fans.

Figure 5.9-5 shows areas identified for potential energy georesources in the Cadiz Project area. Although most of this area does not include identified energy georesources, there are areas identified as having potential uranium and thorium deposits. One area was identified as potentially valuable for oil and gas. These energy resources are based on aerial surveys and have not been field confirmed in this area.

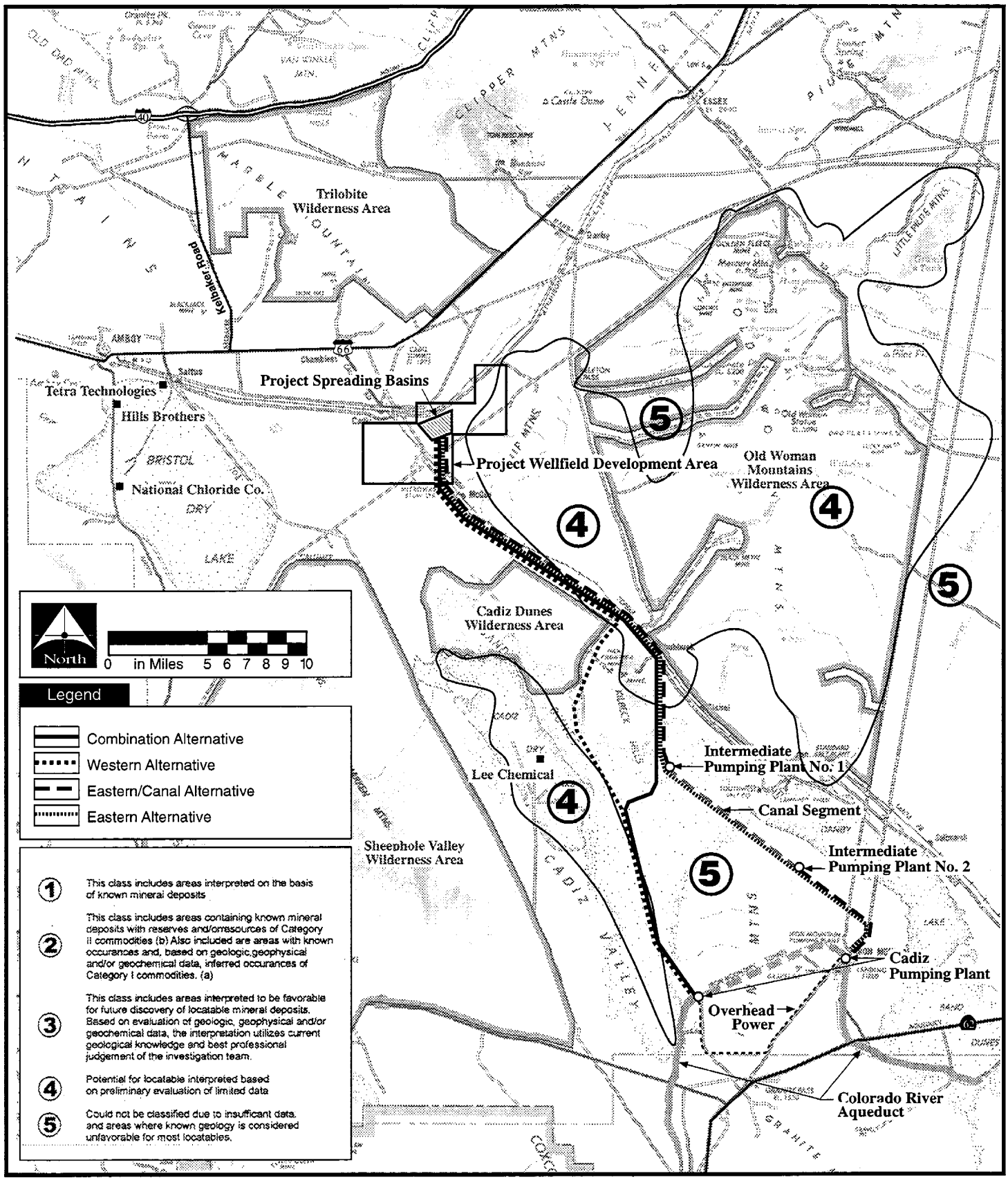
5.9.2 THRESHOLDS OF SIGNIFICANCE

The Cadiz Project would have a significant adverse impact related to energy and mineral resources if it would:

- Result in the loss of the availability of a known mineral resource that would be of value to the region and the residents of the state.
- Result in the loss of the availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan.
- Encourage activities which result in the use of large amounts of fuel, and energy.
- Use fuel, water or energy in a wasteful manner.

5.9.3 METHODOLOGY

The potential impacts of the Cadiz Project on energy and mineral resources were evaluated based on the Cadiz Valley Agricultural Development FEIR



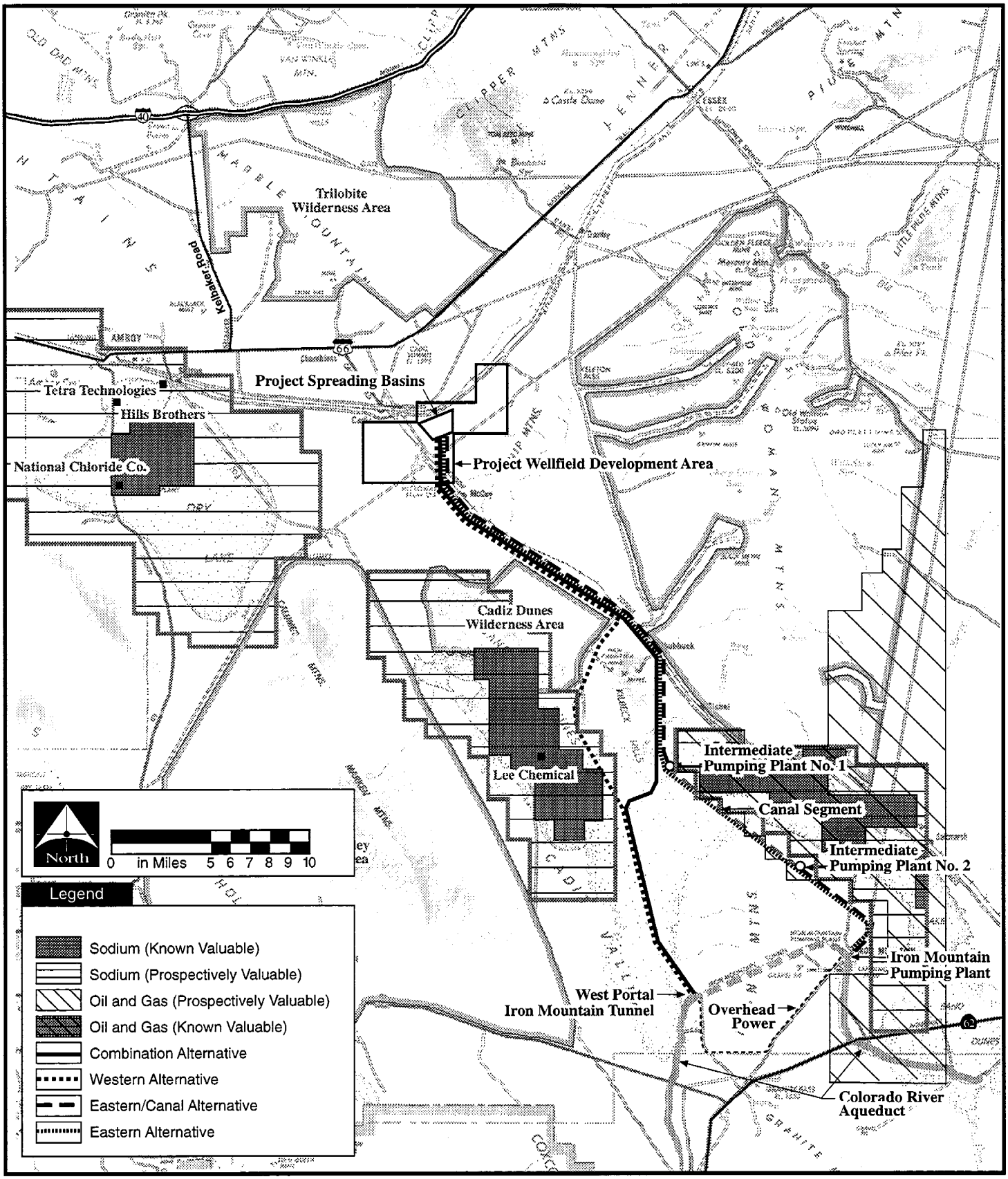
Source: BLM (1982 and 1999).

Figure 5.9-2

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Potential for Locatable Minerals



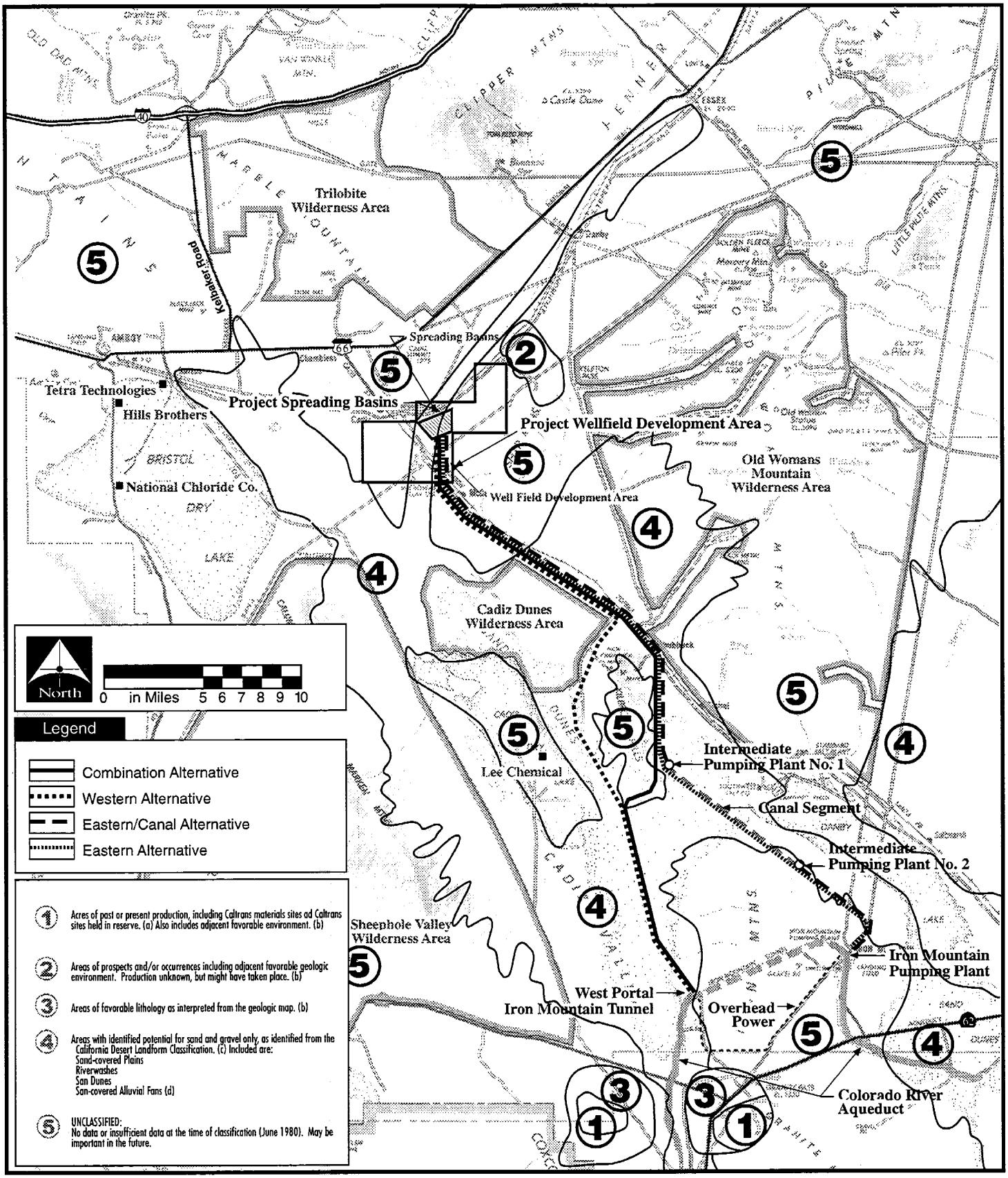
Source: BLM CDCA Plan (1980).

Figure 5.9-3

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Potential for Leasable Minerals



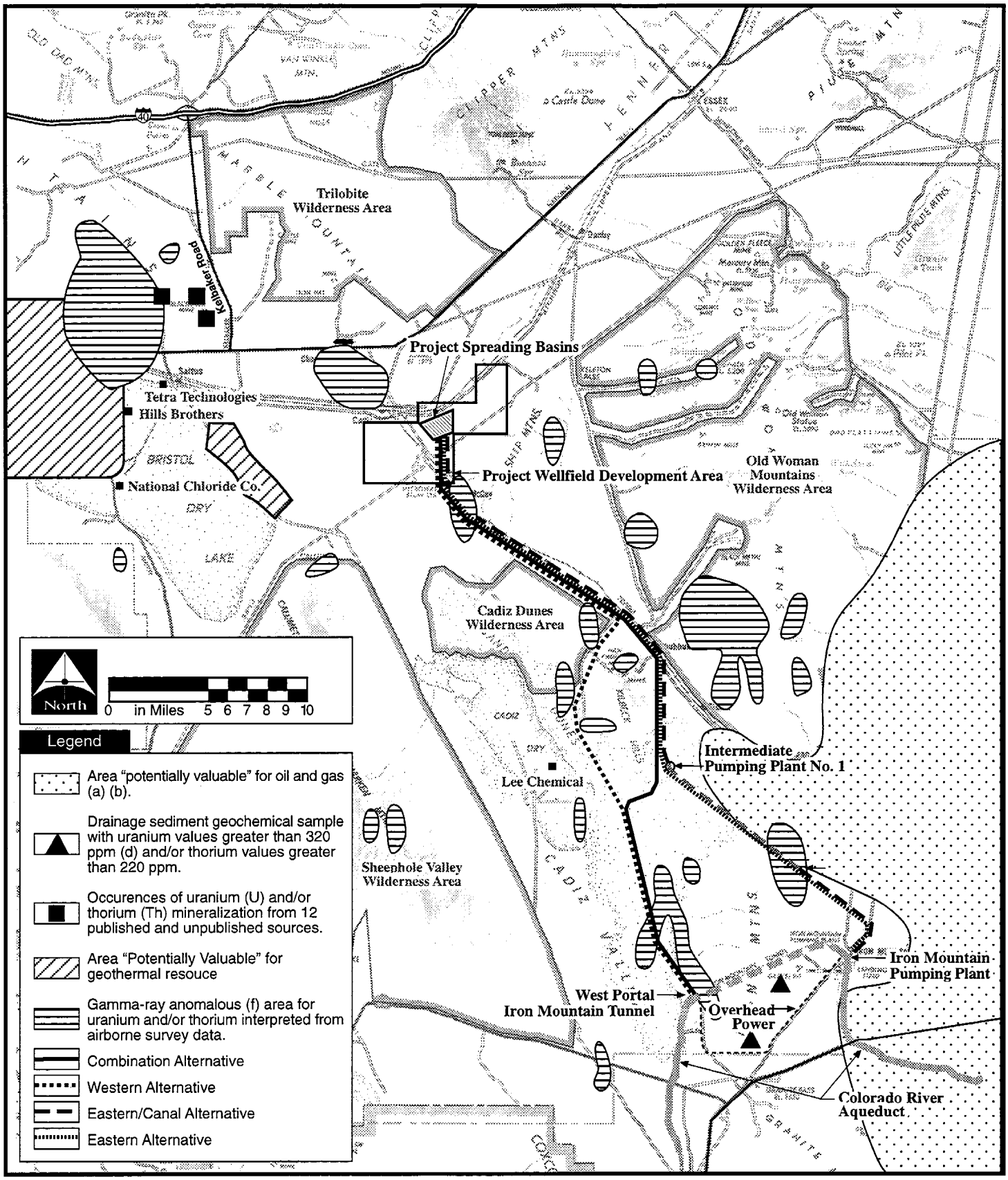
Source: URS Greiner Woodward Clyde (1999).

Figure 5.9-4

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Potential for Saleable Minerals



Source: BLM CDCA Plan (1980).

Figure 5.9-5

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Potential for Energy Geosources

(November 1993), mineral resource classification and location information from the Mineral Lands Classification for San Bernardino County (June 1999), CDMG (June 1999), URS Greiner Woodward Clyde (1999) and mineral resource maps from the BLM (June 1982 and 1999).

5.9.4 IMPACTS

Eastern and Eastern/Canal Alternatives

Mineral Resources

Construction Impacts. None of the existing active mineral extraction operations in the vicinity of the Cadiz Project area would be directly impacted by construction of the Eastern or Eastern/Canal alternatives.

As shown on Figures 5.9-1 through 5.9-5 and as summarized in Table 5.9-1, the Eastern and Eastern/Canal alternatives pass though or near areas with potential mineral resources. Limestone is documented for the area where a portion of the Project wellfield and Project spreading basins would be located. However, that potential is based on limited data and most locales are identified as only prospective at this time.

Construction of the Eastern or Eastern/ Canal alternatives would result in temporary access delays to areas along the water conveyance facilities, including areas identified for potential mineral resources. These temporary access delays would only occur if these areas were developed for mineral extraction and would be substantially mitigated based on implementation of measures T-1 and T-3, described earlier in Section 5.7 (Transportation). Construction of the Eastern and Eastern/Canal alternatives would not result in long term access limitations or delays to areas identified for potential mineral resources. No mitigation is necessary.

Operations Impacts. In the long term, mineral extraction may be somewhat restricted in the immediate vicinity of the water conveyance facilities, Project spreading basins, Project wellfield and other facilities in the permanent easement for the Eastern or Eastern/Canal alternatives. No existing active mineral extraction operations would be directly impacted by operations under the Eastern and Eastern/Canal alternatives. Groundwater storage and withdrawal associated with operation of the Cadiz Project could potentially affect the sodium and calcium chloride producers on Bristol or Cadiz dry lakes. This concern is addressed in Section 5.5 (Water Resources). The conclusion, described in more detail in that section, is that Cadiz Project operations would not impact the existing salt mining operations on either dry lake.

In the future, depending on the economic viability of the potential mineral resources in the general vicinity of the Cadiz Project area, extraction of identified minerals could be proposed. To protect the facilities that would be constructed in conjunction with the Eastern and Eastern/Canal alternatives, it may be necessary to restrict or prohibit recovery of certain resources within the permanent easement for these alternatives. In this event, Metropolitan would coordinate with the BLM, other property owners and/or the mining company, as appropriate, to ensure protection of the Cadiz Project facilities. Depending on the specific mineral resource extraction program proposed, Metropolitan may

TABLE 5.9-1
POTENTIAL MINERAL RESOURCES

Mineral Resource	Eastern and Eastern/ Canal Alternatives	Western Alternative	Combination Alternative
Economic Mineral Resources (Figure 5.9-1)	Limestone is documented for the area in the Project wellfield and Project spreading basins. Non-metallic gypsum is identified east of the water conveyance facilities.	Limestone is documented for the area of the Project wellfield and Project spreading basins. Lithium is documented in the dry lakes areas.	Limestone is documented for the area in the Project wellfield and Project spreading basins. Non-metallic gypsum is identified east of the water conveyance facilities.
Locatable Mineral Resources (Figure 5.9-2)	The Cadiz Project area is shown as either unclassified or with no documented resources of this type.	The Cadiz Project area is shown as either unclassified or with no documented resources of this type.	The Cadiz Project area is shown as either unclassified or with no documented resources of this type.
Leaseable Mineral Resources (Figure 5.9-3)	Sodium is identified for the area east of the water conveyance facilities.	Sodium is identified in the area west of the water conveyance facilities.	Sodium is identified for the area east and west of the water conveyance facilities.
Saleable Mineral Resources (Figure 5.9-4)	Substantial parts of the Cadiz Project area are shown as having potential for sand and gravel.	Substantial parts of the Cadiz Project area are shown as having potential for sand and gravel.	Substantial parts of the Cadiz Project area are shown as having potential for sand and gravel.
Energy Georesources (Figure 5.9-5)	The Cadiz Project area crossed by the southern segment of the water conveyance facilities is shown as having potential for uranium, thorium, oil and gas.	The Cadiz Project area crossed by the southwest segment of the water conveyance facilities is shown as having potential for uranium and thorium.	The Cadiz Project area crossed by the east and west segments of the water conveyance facilities is shown as having potential for uranium and thorium.

have to compensate the property owner for resources which cannot be extracted, in order to protect the pipeline and its facilities. These are not considered significant adverse impacts because the majority of these resources are identified only as potential or prospective at this time; there are no existing or proposed extraction activities affected; and future extraction activities can in all likelihood be conducted.

Fossil Fuels and Energy Resources

As shown in Table 5.9-2, short term fossil fuel consumption estimates for the Eastern and Eastern/Canal alternatives are based on the total fossil fuels used during construction of the capital facilities, divided by the number of construction days for each facility type: water conveyance facilities, pumping plant(s), Project wellfield, electrical substations (located in the Project wellfield), Project spreading basins, power distribution facilities, etc. As shown on Table 5.9-2, the daily demand for fossil fuels during construction is estimated at 4,054 gallons per day for the Eastern Alternative Table 5.9-2 also presents an estimate for the Eastern/Canal Alternative of 5,725 gallons per day. This estimate is higher than for the Eastern Alternative due to the need to construct two pumping plants, and a shorter construction schedule for the pipeline segment resulting in higher daily fuel use for that component. For both alternatives, this represents an increase from the existing consumption of fossil fuel in the Cadiz Project area, but is

TABLE 5.9-2
DAILY CONSUMPTION OF FOSSIL FUEL DURING CONSTRUCTION

	Fossil Fuel Consumption (gal/day)			
Description	Eastern Alternative	Western Alternative	Combination Alternative	Eastern/Canal Alternative
Water Conveyance Facility	2,698	2,428	2,428	2,840
Canal	-	-	-	1,101
Pumping Plant(s)	428	493	493	856
Spreading Basins	478	478	478	478
Wellfield	131	131	131	181
Power Distribution	319	397	397	319
Total	4,054	3,927	3,927	5,275

Source: Black and Veatch (1999).
Note: Average fuel use based on days of construction for each Cadiz Project component.

within the overall supply of fuel in the region and adequate supplies appear to be available in the foreseeable future. Therefore, the impacts of the Eastern and Eastern/Canal alternatives related to short term fossil fuel consumption would be below a level of significance.

There would be only limited demand for fossil fuels in the long term for maintenance and operation of the Cadiz Project facilities. This consists of demand for fuel for operation of two trucks that would be used for facility inspections. The total amount of fuel needed for this purpose is considered minimal. All other facilities would use electric power. Therefore, no long term adverse impacts related to fossil fuels related to the Cadiz Project would occur.

Electricity

The Eastern and Eastern/Canal alternatives would result in consumption of electricity during the construction phase for use by construction trailers and lighting at those locations where electric power service is currently available, such as at the Cadiz Inc. landholdings and the Iron Mountain Pumping Plant. Other needs for electric power during construction would be met using generators. Where power is available, this would represent only minor amounts of demand. Given the small demand, the construction impacts of the Cadiz Project related to electricity would not be anticipated to be significant. No mitigation is necessary.

For long-term operations, power would supplied to the Project wellfield via a 69 kV overhead transmission line from the from the Iron Mountain Pumping Plant switchyard. Three new substations located in the Project wellfield would be supplied with a 69 kV SF6 circuit breaker, a 20 MVA rated 69/4.16 kV transformer and switch gear which would contain a 3,000 ampere main circuit breaker.

The peak demand for electricity for the operation of the Eastern Alternative in the withdrawal mode is estimated at 454,000 kWh/day as shown in Table 5.9-3. In the storage mode it is 187,500 kWh/day. The increase in electrical demand compared to existing conditions is primarily due to operation of the Project wellfield, water conveyance facilities and energy distribution facilities. This energy supply would be drawn from Metropolitan's existing power supply on the Colorado River Aqueduct. Colorado River Aqueduct pumps located east of the Cadiz

TABLE 5.9-3
DAILY POWER CONSUMPTION IN kWh/Day

Operating Scenario	Eastern Alternative	Western Alternative	Combination Alternative	Eastern/Canal Alternative
Storage Mode	187,500	178,600	187,500	129,400
Withdrawal Mode	454,000	505,100	505,100	259,000

Project would be shut down to simultaneously allow for sufficient downstream capacity in the Colorado River Aqueduct to accommodate water from the Cadiz Project and provide power to operate the Project wellfield. Similarly, pumps to the west would be shut down to accommodate storage operations making power available to operate Cadiz Project pumping facilities. Therefore, no long-term operational impacts related to electricity would occur. No mitigation is necessary.

The peak demand for electricity for the operation of the Eastern/Canal Alternative in the withdrawal mode is estimated at 259,000 kWh/day as shown in Table 5.9-3. In the storage mode it is 129,400 kWh/day. As with the Eastern Alternative, the increase in electrical use would primarily be due to the operation of the Project wellfield, water conveyance facilities and energy distribution facilities. Similar to the Eastern Alternative, this energy supply would be drawn from Metropolitan's existing power supply on the Colorado River Aqueduct. Like the Eastern Alternative, pumps would be shut down along the Colorado River Aqueduct thereby simultaneously providing aqueduct capacity and power supply for the Cadiz Project.

Natural Gas

Natural gas would not be used during Project construction. Therefore, no adverse impacts associated with natural gas would occur under the Eastern or Eastern/Canal alternatives. No mitigation is necessary.

There would be no long-term use of natural gas for the Cadiz Project facilities under the Eastern or Eastern/Canal alternatives. Therefore, no adverse impacts under these alternatives related to natural gas would occur.

The use of natural gas to power the Project wellfield was investigated. This investigation was conducted in the interest of eliminating the need to run power lines from Metropolitan's existing power easement located south of these facilities. It was also done to determine if there would be any favorable cost differences in relying on natural gas versus electricity as a source of power for the Cadiz Project.

To operate the Cadiz Project facilities on natural gas, a new natural gas line would have to be constructed to connect to an existing line approximately six miles to the northwest of the Project Area. A new distribution system would also have to be constructed to deliver the natural gas to engine drives located at each well. When in use during withdrawal operations, the gas-fueled engine drives and gas supply system would require approximately thirty percent more maintenance personnel than needed for the electric power scenario. This is because gas drive systems typically require more maintenance to operate. Requirements for maintenance personnel are the same for both gas and

electric powered systems when the wells are not being operated.

When in operation, a natural gas-powered Project wellfield would consume 7,200 cubic feet per hour of natural gas, and would run twenty-four hours a day, seven days a week. Assuming it was operated for an entire year, the natural gas-powered system would consume approximately 1.8 billion cubic feet of natural gas. Comparing the cost to operate and amortize the capital cost of a gas driven system versus use of electric power, the gas system was found to cost almost twice as much, with a present worth cost differential in the tens of millions of dollars. Therefore, it was rejected as a cost-effective way of providing an energy source for the Project wellfield.

Western Alternative

Mineral Resources

Like the Eastern and Eastern/Canal alternatives, the Western Alternative will not adversely impact the existing salt mining operations on Bristol or Cadiz dry lakes. Section 5.5 (Water Resources) provides further discussion of this concern.

The nearest potential economic resource identified in the vicinity of the Western Alternative water conveyance facilities is locatable lithium, which is identified as occurring in Cadiz Dry Lake, west of the pipeline alignment. Known lithium deposits at this site are calculated to be less than one million short tons. As previously shown on Figure 5.9-1, the Western Alternative water conveyance facilities would trend along the east edge of the area mapped as a potential source of lithium. However, that potential is based on limited data and is identified as only prospective at this time. The potential construction impacts under the Western Alternative related to mineral resources would be similar to the impacts described for the Eastern and Eastern/Canal alternatives. For example, possible short-term access delays to potential mineral resource areas exist near the Cadiz Dry Lake and in the areas where the Project wellfield and Project spreading basins may occur. Mitigation measures T-1 and T-3, described earlier in Section 5.7, would mitigate these potential short-term access impacts to below a level of significance.

The operational related impacts on mineral resources under the Western Alternative would be similar to the potential long term impacts on mineral resources described earlier under the Eastern and Eastern/Canal alternatives. These impacts would not be significant and no mitigation is necessary.

Fossil Fuel and Energy Resources

The amount of fossil fuel anticipated to be used during construction of the Western Alternative is an estimated 3,927 gallons per day, similar to the 4,054 gallons per day used under the Eastern Alternative. Although this represents an increase from existing fossil fuel use in this area, this represents only a minor increase region-wide and would be expected to be within the overall supply of fossil fuel available in the region. Therefore, the impacts of the Western Alternative related to short term fossil fuel consumption would be below a level of significance. No mitigation is necessary.

Similar to the Eastern and Eastern/Canal Alternatives, the use of fossil fuels under the Western Alternative would be limited in the long-term. Therefore, no long-term

adverse impacts related to fossil fuels would occur under this alternative. No mitigation is necessary.

Electricity

The demand for electricity under the Western Alternative would be minor, consisting of providing power for construction trailers and lighting at Cadiz Inc. landholdings and the Iron Mountain Pumping Plant where power is currently available. Other needs for electric power during construction would be met using generators. Therefore, the construction of the Western Alternative would not result in short-term adverse impacts related to electricity. No mitigation is necessary.

The peak demand for electricity for the operation of the Western Alternative in the withdrawal mode is 505,100 kWh/day as shown in Table 5.9-3. In the storage mode it is 178,600 kWh/day. The amount of electricity that would be used for the Western Alternative is, therefore, slightly greater when compared to the demand for electricity under the Eastern Alternative. This increase could also be met using Metropolitan's available power supply. Therefore, the Western Alternative is not expected to result in adverse impacts related to electricity in the long term. No mitigation is necessary.

Impacts Related to Natural Gas

As with the Eastern and Eastern/Canal alternatives, natural gas would not be anticipated to be used for the construction or operation of the Cadiz Project facilities under the Western Alternative. Therefore, this alternative would not result in adverse impacts related to natural gas. No mitigation is necessary.

Combination Alternative

Mineral Resources

Like the Eastern, Eastern/Canal and Western alternatives, the Combination Alternative would not adversely impact the existing salt mining operations on Bristol and Cadiz dry lakes. Section 5.5 (Water Resources) provides further discussion of this concern.

The construction impacts under the Combination Alternative related to mineral resources would be similar to the impacts described for the Eastern, Eastern/Canal and Western alternatives related to short-term access delays to potential mineral resource areas in the area where the Project wellfield and Project spreading basins would be located. Mitigation measures T-1 and T-3, described earlier in Section 3.7, would mitigate these potential short-term access impacts to below a level of significance.

The operations-related impacts on mineral resources under the Combination Alternative would be similar to the potential long-term impacts on mineral resources described earlier under the Eastern, Eastern/Canal and Western alternatives. These impacts would not be significant and no mitigation is necessary.

Fossil Fuels and Energy Resources

The amount of fossil fuel anticipated to be used during construction of the Combination Alternative is estimated to be 3,297 gallons per day (Table 5.9-2), similar to the 4,054 gallons per day estimated for the Eastern Alternative. Although this represents an increase from existing fossil fuel use in this area, this represents only a minor increase region-wide and would be

expected to be within the overall supply of fossil fuel available in the region. Therefore, the impacts of the Combination Alternative related to short term fossil fuel consumption would be below a level of significance. No mitigation is necessary.

Similar to the Eastern, Eastern/Canal and Western alternatives, the use of fossil fuels under the Combination Alternative would be limited in the long-term. Therefore, no long term adverse impacts related to fossil fuels would occur under this alternative. No mitigation is necessary.

Electricity

The demand for electricity under the Combination Alternative during construction would be minor, for providing power for construction trailers and site lighting at Cadiz Inc. agricultural operations and the Iron Mountain Pumping Plant, where power is currently available. Other needs for electric power during construction would be met using generators. Therefore, the construction of the Combination Alternative would not result in short-term adverse impacts related to electricity. No mitigation is required.

The peak demand for electricity for the operation of the Combination Alternative in the withdrawal mode is 505,100 kWh/day. In the storage mode it is 187,500 kWh/day. Consequently, the amount of electricity anticipated to be used during operations under the Combination Alternative is higher than the electricity demand under the Eastern Alternative, as shown earlier in Table 5.9-3. This increase could be met using Metropolitan's available supply in the region and, therefore, the Combination Alternative would not result in adverse impacts related to electricity in the long-term. No mitigation is necessary.

Natural Gas

As with the other build alternatives, natural gas is not anticipated to be used for the construction or operation of the Cadiz Project facilities under the Combination Alternative. Therefore, this alternative would not result in adverse impacts related to natural gas. No mitigation is necessary.

No Project Alternative

The No Project Alternative would not include construction of any of the proposed Cadiz Project facilities. Therefore, the No Project Alternative would not result in any impacts on energy and mineral resources.

5.9.5 MITIGATION MEASURES

E–1 During construction, Metropolitan will maintain access into and out of any potentially affected mineral extraction operations authorized by the BLM and the County, to the greatest extent possible. If access cannot be provided, Metropolitan will compensate the owner of such operations for lost revenues directly resulting from temporary closure of the extraction operation during construction.

5.9.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Implementation of mitigation measure E-1 above would reduce the impacts of the Cadiz Project on energy and mineral resources to below a level of significance. Implementation of mitigation measure E-1

would ensure that mineral rights holders affected by the Cadiz Project would be compensated for any potential loss of mineral resources related to revenues and would ensure that access into and out of any active mineral extraction operation would be maintained during Cadiz Project construction.

5.10 HAZARDS AND HAZARDOUS MATERIALS

5.10.1 AFFECTED ENVIRONMENT

The Cadiz Project area is located in a remote, uninhabited part of the Cadiz and Fenner valleys. Several unimproved roads and branches of the BNSF and the ARZC traverse the Cadiz Project area. There are no residences, industrial facilities or gasoline service stations within the Cadiz Project area. Facilities at the Iron Mountain Pumping Plant include a forebay, pipelines and water conveyance facilities, a rail spur, 230Kv switch rack facilities, transformers, pump facilities and a bunk house.

Historic military use of this area has resulted in the widespread distribution of artifacts including unexploded ordnance. Agricultural uses in the Project vicinity include above-ground fuel storage tanks and pesticide storage areas.

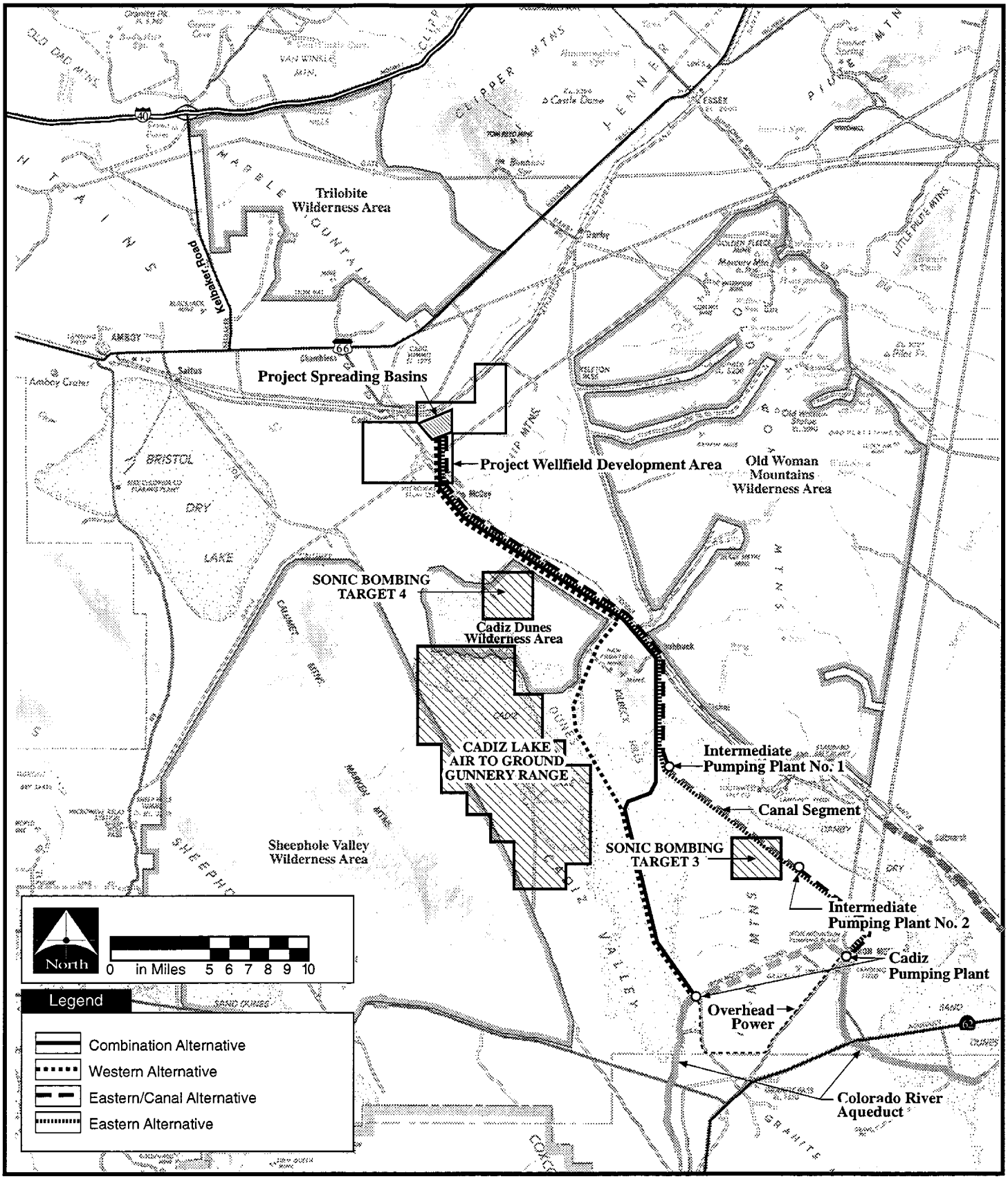
Agricultural Uses

Agricultural uses occupy approximately 1,600 acres in and adjacent to the northern part of the Cadiz Project area. As previously discussed in Section 5.1 (Agriculture), Cadiz Inc. agricultural operations are located within Sections 21, 27 and 33 of Township 5 North, Range 14 East of the San Bernardino Baseline and Meridian as shown earlier on Figures 5.1-1 and 5.1-2. Above-ground petroleum storage tanks and pesticide storage facilities in these areas support Cadiz Inc. agricultural operations.

The presence of fuel and pesticide storage facilities at or near the Cadiz Project area increases the risk of human exposure to potentially hazardous substances. Above-ground fuel storage tanks may leak petroleum products into the soil, where they could potentially migrate to water supplies. Pesticides may accumulate in the soil and, over time, also contaminate surface and groundwater supplies. However, a number of factors influence the potential hazards associated with these facilities. Soil conditions, depth to groundwater, irrigation practices, pest management practices, amount of storage capacity, relative proximity of hazards and protective containment measures all can reduce the potential for adverse effects associated with these existing uses.

Former Military Use

The Cadiz Project area is located within an area formerly used for military training. The Department of Defense (DoD) officially began using the area in during the 1940s with the acquisition of various tracts of land totaling of tens of thousands of acres. Collectively, these areas were known as the Desert Training Center (DTC) and, later, the California-Arizona Maneuver Area (CAMA). However, the area currently has no military identification. The former CAMA consisted of the Cadiz Lake Air to Ground Gunnery Range and Sonic Bombing Targets 1 through 10. Of these ten bombing targets, those nearest to, or within, the Cadiz Project area are the Gunnery Range and Sonic Bombing Targets 3 and 4, shown in Figure 5.10-1. Parts of the Cadiz Valley area were used by the Fourth Air Force stationed at March Field. The area was also used during World War II by General Patton's Armored Divisions for training in desert warfare, which involved the use of live ordnance.



Source: P&D Consultants, Inc. (1999).

Figure 5.10-1

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Gunnery Range and Sonic Bombing Targets 3 and 4

No known improvements to the area were made by the DoD. The lands within the CAMA were declared surplus in 1948 and a majority of the acreage was conveyed to the Department of Interior (DOI) in 1949.

Gunnery Range and Sonic Bombing Targets 3 and 4

The former Cadiz Lake Gunnery Range and Sonic Bombing Targets 3 and 4 were located within the boundaries of the DTC and CAMA. The Gunnery Range, consisting of approximately 29,440 acres; and Targets 3 and 4, each consisting of approximately 2,560 acres (four 640-acre sections), were officially acquired by the DoD in 1946 but may have been used as early as 1942. An ordnance sweep of these and other CAMA sites was conducted between 1948 and 1949 during which bursters, anti-tank fuses and mines, 100-pound bombs and metal scraps were recovered.

Surveys of these areas mainly consisted of visual assessments of the area to recover ordnance and explosive wastes from surficial soils. Therefore, ordnance and explosive wastes which may have penetrated more deeply into the ground would not have been recovered.

In 1992, the Department of the Army, through the ACOE, investigated all the Cadiz Lake bombing target sites, including the Gunnery Range and Targets 3 and 4, under the Defense Environmental Restoration Program (DERP), Formerly Used Defense Sites (FUDS) (10 USC 2701 et seq.). The ACOE Mandatory Center of Expertise (MCX) for Ordnance and Explosive Wastes made a determination that an ordnance debris removal project was required for these sites.

Since 1949, the ACOE, the Marine Corps at Twentynine Palms and the San Bernardino and Riverside County Sheriff's Departments have been called on to dispose of residuals from desert areas in eastern San Bernardino and Riverside Counties.

Other Hazardous Waste Issues

Ward Valley Low Level Radioactive Waste Disposal Facility

In 1991, the BLM and DOI prepared an EIS considering the environmental effects of transferring 1,000 acres of federally-owned land at Ward Valley to the State of California for siting a proposed Low Level Radioactive Waste (LLRW) disposal facility. The wastes would have come from nuclear power plants, laboratories and hospitals. The Ward Valley site is located approximately 40 miles north northeast of Cadiz Dry Lake and was chosen in part for its remote location and geologic stability.

Under consideration for more than a decade, the Ward Valley LLRW facility has been the subject of numerous and conflicting scientific studies and political debates. Studies subsequent to the release of the original EIS revealed that radioactive materials may be more mobile in the porous soils at the site than previously believed. The migration of radioactive materials through underground fissures to the Colorado River was considered by many experts to be unlikely, but not impossible. Another threat perceived by project opponents

was migration of water-borne radionuclides from the facility's unlined trenches into the potable groundwater located several hundred feet below the Project area. Information gathered from another similar facility in Beatty, Nevada indicated that radioactive tritium wastes there were not adequately contained.

In response to growing concerns over the safety of the site, the DOI requested additional testing and resisted transferring the site to the State for development. The State of California and the Ward Valley project proponent, U.S. Ecology, subsequently filed suit against the DOI in an effort to force conveyance of the land to the State.

In April 1999, the United States District Court ruled that the DOI was not required to transfer the land to the State. The ruling supported an earlier federal court ruling that blocked transfer of the land until the federal government determined the impact of facility on the desert tortoise, a federal endangered species. In June 1999, the Governor of California announced that the State would not appeal the Court's decision and other options for the disposal for radioactive waste would be explored.

5.10.2 THRESHOLDS OF SIGNIFICANCE

A project will normally have a significant adverse impact related to hazards and hazardous materials if it results in:

- A risk of accidental explosion or release of hazardous substances including, but not limited to, oil, pesticides, chemicals or radiation.
- A significant hazard to the public or the environment through the routine transport, use or disposal of hazardous materials.
- A significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.
- A safety hazard for people residing or working within the vicinity of a private airstrip.
- The inability to implement or physically interfere with the adoption of an emergency response plan or emergency evacuation plan.
- Exposure of people or structures to a significant risk of loss, injury or death involving wildland fires.
- A significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions associates with facility operations and/or maintenance.

5.10.3 METHODOLOGY

Information concerning potential hazards in or near the Cadiz Project area was compiled from existing documentation. No specific field surveys for potential hazards were conducted. However, field teams investigating other parameters did report finding military artifacts. Sources of information included interviews with BLM personnel and field subconsultants, newspaper articles, Cadiz Inc. and internet information posted by the BLM, ACOE, DoD and others.

5.10.4 IMPACTS

Eastern, Western, Combination and Eastern/Canal Alternatives

Construction Activities

Regardless of the selected alignment, construction of the Cadiz Project would require that equipment fuel, lubricants and other potentially hazardous materials be transported to and stored in the Cadiz Project area. It would be anticipated that one or more temporary, above-ground fuel storage tanks would be used throughout the Cadiz Project construction to service construction equipment. Because of the remote Project location, servicing and emergency repair of construction equipment may occur in the Cadiz Project area. Equipment servicing and repair could result in the generation of oily and hazardous wastes such as spent solvents, residual fuels, used oils and filters. These activities would be conducted consistent with existing hazardous waste and pollution regulations. Therefore, the potential impacts related to uncontrolled releases of hazardous substances into the environment would be below a level of significance.

There are no sensitive land uses within a one-quarter mile radius of the Cadiz Project area. Therefore, no adverse impacts on schools, daycare centers or centers for care of the elderly are anticipated. However, spills and leaks from fuel storage facilities, fueling activities and other hazardous waste streams could result in adverse impacts to construction workers and the environment.

Former Military Uses

Potential hazards to human health are associated with the presence of ordnance and explosive waste within the Cadiz Project area. The presence of ordnance and explosive wastes would pose the greatest risk during construction of the Cadiz Project when earth moving activities are likely to result in disturbance. Explosive materials may become more unstable over time, increasing the possibility of harm from residual wastes. Is it not possible to quantify the risk associated with ordnance and explosive wastes in the Cadiz Project area as the exact locations and nature of these wastes are not known. However, based on previous military uses and records indicating the discovery of ordnance and explosive wastes in the Cadiz Project area, it is possible that some ordnance and explosive wastes may be encountered during construction.

The presence of former ranges and bombing targets suggests that a greater concentration of ordnance and explosive wastes may exist at these locations but does not preclude the possibility that ordnance and explosive wastes may exist outside these areas. Therefore, construction of the water conveyance facilities, power distribution facilities, Project wellfield and Project spreading basins may result in significant adverse ordnance and explosive wastes hazards.

Other Hazards

Ward Valley Low Level Radioactive Waste Facility

In April 1999, the United States District Court ruled that the DOI was not required to transfer the land to the State for this planned facility. The ruling supported an earlier federal court ruling that blocked the transfer of the land until the federal government determined the impact of facility on the desert tortoise. Subsequent to the ruling on the transfer of the land, the DOI called for the State of California and all other interested parties to explore alternatives to the proposed Ward Valley land transfer. In June 1999, the Governor of California announced that the State would not appeal the Court's decision and other options for the disposal for radioactive waste would be explored. At this time, it does not appear to be likely that the facility will be constructed at the Ward Valley location.

In addition, the Ward Valley groundwater basin is geologically separate from the Cadiz Valley. If the Ward Valley LLRW were constructed at the proposed location, the possibility of groundwater contamination in the Cadiz Valley would have been extremely remote. Therefore, the potential impacts associated with radioactive waste disposal in the Ward Valley affecting groundwater storage at the Cadiz Project area would be below a level of significance.

Pipeline Failure

The Cadiz Project facilities would not traverse any known earthquake fault. However, disruption of the water conveyance facilities would be a remote possibility in the event of a catastrophic earthquake along the San Andreas fault or any other fault reach. In the unlikely event of conveyance facilities failure, for example rupture of an underground pipeline, temporary flooding in areas not specifically designed to convey large amounts of flowing water could incur extensive damage. Should this occur, the water between the failure point and the shut-off points (either the Iron Mountain Pumping Plant, the Cadiz Pumping Plant, the Intermediate Pumping Plants or the Project spreading basins) would continue to flow into the affected areas until that segment of the pipeline is sufficiently drained. Because of the remote location of the Cadiz Project, the potential for significant damage to private property is low. Depending on the location and severity of a failure of the water conveyance facilities, utility lines in the Cadiz Project vicinity could be adversely affected for an undetermined amount of time. These impacts would be reduced to below a level of significance with implementation of mitigation measures.

Aviation/Fire/Emergency Response

The Cadiz Project area is not located in the immediate vicinity or flight path of a major airport. Private airstrips are located at Amboy, at the Cadiz Inc. agricultural operations and at the Iron Mountain Pumping Plant. The Cadiz Project area is sparsely vegetated, making the likelihood of wildland fires very low. Emergency responses to remote parts of eastern San Bernardino County typically involve helicopter transport, which would not be hindered by Cadiz Project construction or operation. Therefore, potential impacts related to airport uses, wildland fires and

emergency response and evacuation plans would be below a level of significance.

Iron Mountain Pumping Plant Facilities

The existing facilities at the Iron Mountain Pumping Plant do not use substantial quantities of hazardous materials nor do they generate substantial quantities of hazardous wastes. In addition, the Cadiz Project facilities at the Iron Mountain Pumping Plant would not facilitate water contamination or increase the risks associated with hazardous materials use at the Iron Mountain Pumping Plant. Existing transformers at the Iron Mountain Pumping Plant do not use polychlorinated biphenyl (PCB) - containing cooling oils nor will these transformers be disrupted during project implementation. A new transformer would be added at the Iron Mountain Pumping Plant to accommodate the Cadiz Project. However, this new transformer would also use non-PCB-containing cooling oils. No new sources of hazardous wastes would be added to the Iron Mountain Pumping Plant as part of the Cadiz Project. Therefore, potential impacts related to new facilities at the Iron Mountain Pumping Plant would be below a level of significance.

Impacts Common to All Alternatives

Agricultural Uses

The petroleum storage tank nearest to the Cadiz Project area is a diesel fuel tank located at Well 22, approximately 2.5 miles southwest of the Project spreading basins. The tank is protected with a lined basin that provides secondary containment in the event of a leak or spill and prevents diesel fuel from entering the soil. New well pumps proposed as part of the Cadiz Project would be electrically powered and would not require fuel storage facilities. Because the existing fuel storage facilities are not in close proximity to the Project spreading basins and water conveyance facilities, and there are no new fuel storage facilities proposed, potential impacts related to groundwater contamination from fuel storage tanks would be below a level of significance.

There are no hazardous materials storage areas in the immediate vicinity of the Project spreading basins. Hazardous materials and pesticides are seldom used in connection with the Cadiz Inc. agricultural operations. Pesticide handling and application is performed by trained and certified employees of Cadiz Inc., and is conducted in accordance with Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and Occupational Safety and Health Administration (OSHA) regulations. Because of their limited and restricted use and location, potential impacts associated with the use of pesticides at the Cadiz Inc. agricultural operations southwest of the Project spreading basins would be below a level of significance.

No Project Alternative

Under the No Project Alternative, no excavation would be conducted in the Cadiz Dry Lake and no potential impacts related to ordnance and explosive wastes, hazardous materials storage or pipeline failure would occur. No mitigation requiring site investigation for ordnance and explosive wastes would be required. However, the threat posed by

ordnance and explosive wastes would remain for any future projects in the area.

5.10.5 MITIGATION MEASURES

The following mitigation measures are intended to reduce impacts associated with military ordnance, hazardous wastes and conveyance facilities failure:

HM-1 Prior to any earth moving activities, surveys shall be conducted for the purposes of locating potentially hazardous military ordnance within the Cadiz Project construction area. These surveys shall use methodologies capable of locating objects that may have been buried or penetrated the ground surface at depths to which excavation is proposed, with an appropriate margin of safety.

HM-2 No person other than a qualified explosive waste disposal technician shall handle suspected ordnance and explosive wastes during Project construction or operation.

HM-3 Should any ordnance and explosive wastes be discovered during construction or operation of the Cadiz Project, the person discovering the waste shall, without disturbing the suspect object, clearly mark the location and immediately notify the appropriate personnel. Work shall be diverted around the flagged area until the proper authorities have removed or otherwise eliminated the hazard.

HM-4 Metropolitan shall ensure that all temporary storage areas for motor vehicle fuels used for Project construction have an impermeable secondary containment system with a capacity of at least 100 percent of the total volume of the storage containers.

HM-5 Accumulated water within secondary containment areas exhibiting an oily sheen shall not be discharged directly into the environment. Oily residues shall be separated from the water prior to discharging or the water shall be collected in watertight containers and shipped off area for disposal as oily waste.

HM-6 Any hazardous wastes excavated during construction of the Cadiz Project will be disposed of in accordance with local regulations.

HM-7 The design of the water conveyance facilities pipeline shall include a leak detection system to alert the Iron Mountain Pumping Plant in the event of pipeline failure. The Cadiz Project shall be designed to allow the flow of water to be stopped from either end of the pipeline. Metropolitan shall establish emergency procedures to implement in the event of pipeline failure that minimize impacts to surrounding utilities and the environment.

5.10.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Implementation of mitigation measures HM-1 through HM-7 would substantially reduce potential impacts related to the possible presence of hazardous substances in the Cadiz Project area. However, methodologies used to detect ordnance and explosive wastes may not be 100 percent accurate. Therefore, some ordnance and explosive wastes may remain on the site following prescreening. Thus, the potential for hazards related to ordnance and explosive waste remains a significant adverse impact after mitigation.

5.11 NOISE

5.11.1 AFFECTED ENVIRONMENT

Noise Definitions

Noise is generally defined as unwanted sound. The standard unit of measurement of sound is the decibel (dB), which is based on a logarithmic scale. Because the human ear is not equally sensitive to sound at all frequencies, a frequency-dependent rating scale was developed to relate noise to human sensitivity. The A-weighted decibel scale (dBA) discriminates against very low and very high frequencies of the audible spectrum and is similar to the sensitivity of the human ear.

The range of the dBA scale extends from one dBA, defined as the threshold of hearing, to 140 dBA, defined as the threshold of pain. Everyday sounds normally range from very quiet, at about 30 dBA, to very loud at approximately 100 dBA. Each interval of 10 dBA indicates a ten-fold (logarithmic) sound energy increase that is perceived by the human ear as a doubling of the sound. For example, a noise of 15 dBA is heard as twice as loud as a sound of five dBA.

One commonly used scale in California for measuring noise levels and assessing land use compatibility is the Community Noise Equivalent Level (CNEL). The CNEL scale represents a time-weighted 24-hour average noise level. Weighting penalizes noise that occurs in the evening hours from 7:00 PM to 10:00 PM and the nighttime hours from 10:00 PM to 7:00 AM, by five and 10 dBA, respectively. These penalties reflect increased sensitivity to noise during those times of the day. Typical ambient noise levels for different types of land uses are shown in terms of the CNEL scale on Figure 5.11-1. As shown, rural and wilderness areas typically experience very low ambient noise levels, while land uses such as urban areas typically experience much higher ambient noise levels.

Noise levels drop off as the distance between the noise source and the receptor increases. For linear noise sources such as railroads and highways, noise levels drop off by approximately three dBA for each doubling of distance from the noise source. For example, a noise level of 65 CNEL at 50 feet from a road would drop to 62 dBA at 100 feet from the road. For stationary sources or mobile sources which are temporarily stationary, the drop would be six dBA for each doubling of distance from the noise source.

Existing Land Uses and Noise Sources

The Cadiz Project area is developed in an area of low and very low intensity land uses such as agriculture, mining, roads, railroads and public wilderness areas. Potentially noise-sensitive land uses in the Cadiz Project area are the Cadiz Dunes, Old Woman Mountains, Sheephole Valley and Trilobite Wilderness Areas. Other wilderness areas and Joshua Tree National Park are far enough from the Cadiz Project area that they would not be affected by Project-generated noise. The California Desert Conservation Area Plan (BLM 1980) identifies only one Area of Critical Environmental Concern (ACEC) in the vicinity, Patton's Iron Mountain Divisional Camp. This historical site is comprised of remnants of World War II-era training facilities.

There are no existing residential, church, school, hospital or other noise-sensitive land uses in the vicinity of the proposed Project. The nearest residential uses are

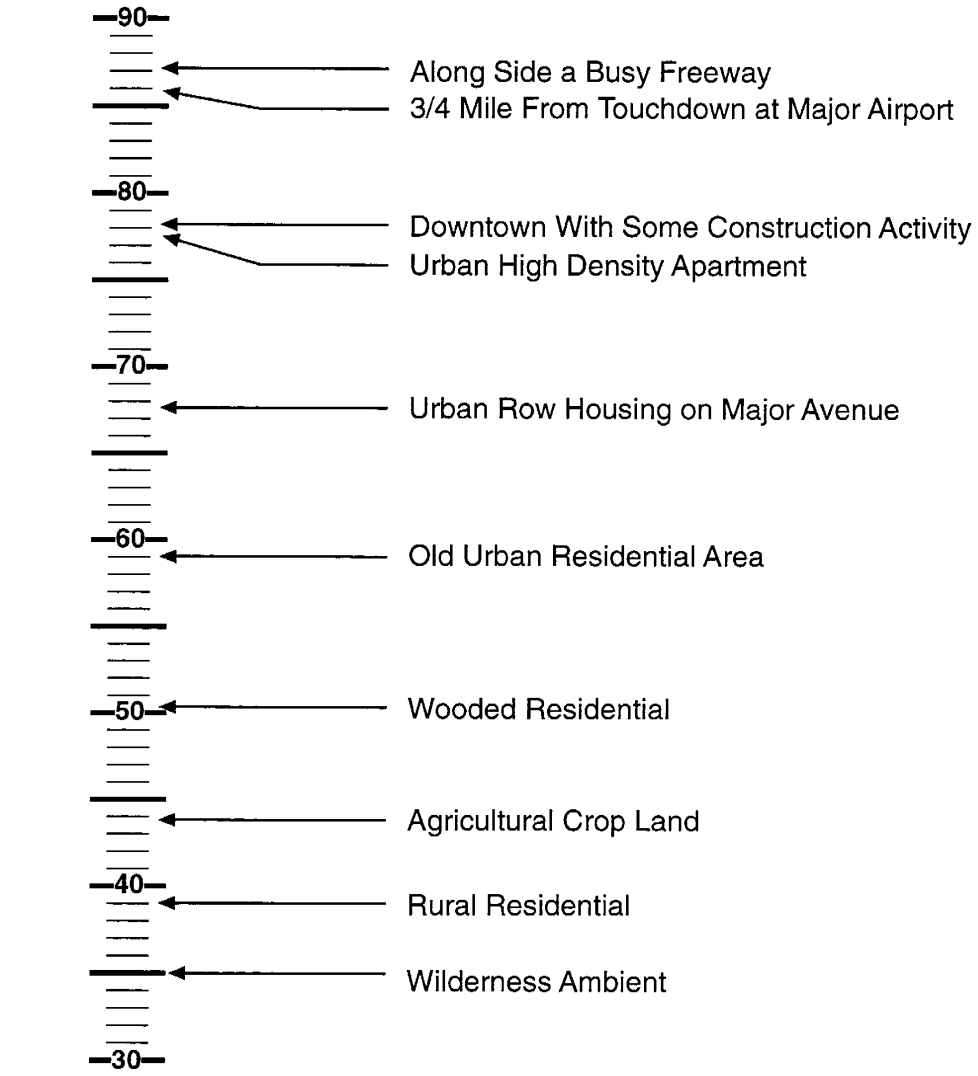


Figure 5.11-1

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Typical Ambient Noise Levels (in CNEL)

approximately five miles away. The San Bernardino County General Plan Land Use Map designates most of this area as Resource Conservation (RC), with 9,600 acres at Cadiz Inc. agricultural operations designated Agriculture (AG).

Given the remote location of the Cadiz Project area and the limitations of the RC land use designation, it is anticipated that few, if any, residential or other noise-sensitive uses would be constructed in this area in the future.

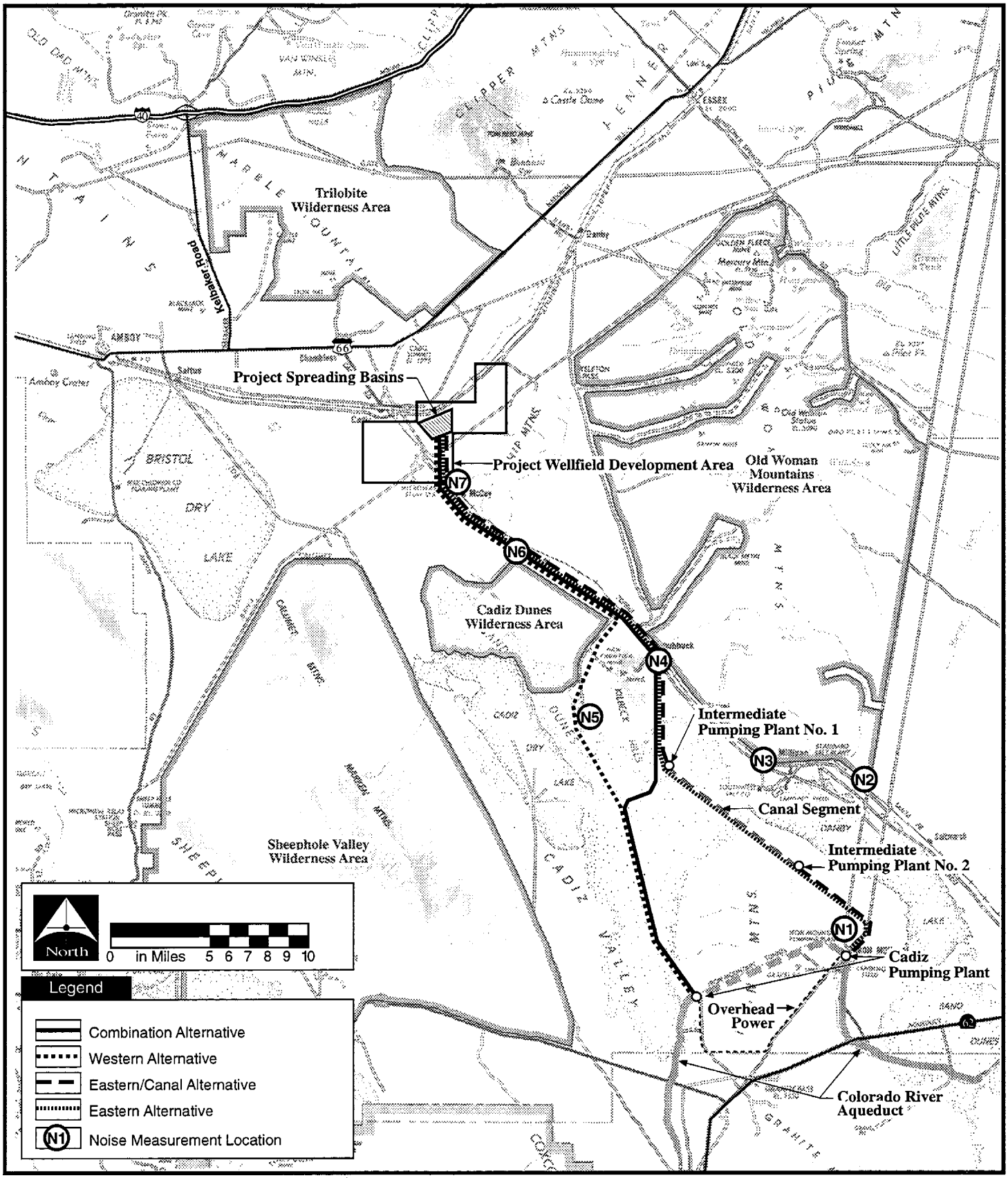
Existing noise sources in the Cadiz Project area include on- and off-road vehicles including cars, trucks, mining equipment, diesel generators and farm vehicles; trains; airplanes; and wind. In addition, military maneuvers and practice at the United States Marine Corps (USMC) Air Ground Combat Training Center northeast of Twentynine Palms include bombing, high-performance military aircraft exercises, and other combat training activities which create short-term, intermittent noise events which can be heard over a large area. The closest part of this Training Center is approximately 15 miles from the Cadiz Project area. The distance of the Training Center from the Cadiz Project area, combined with the noise-reducing effects of intervening topography, diminishes the noise associated with these military activities. Nonetheless, noise associated with bombing, high performance military aircraft and other very loud activities at the Training Center can be heard in the Cadiz Project area.

The County of San Bernardino General Plan Noise Element provides typical noise contour information for major highways. These contours were developed assuming an at-grade, six-lane highway in a 104-foot wide right of way, carrying nearly 60,000 vehicles per day, operating at 55 miles per hour. The vehicle mix assumes nearly 20 percent trucks. Based on these assumptions, the distances to various noise contours from the center line of this typical road are shown in Table 5.11-1.

Because roads in the Cadiz Project area generally have fewer lanes (two lanes or narrower), they are assumed to result in lower noise levels than the typical highway identified in the General Plan. Therefore, the typical contours shown in Table 5.11-1 would represent a worst case scenario of existing highway related noise levels in the Cadiz Project area.

The General Plan Noise Element also provides distances to noise contours for rail operations, assuming one 80-car freight train approximately 3,600 feet long. The contours associated with rail operations are also shown on Table 5.11-1.

Existing noise levels in the Cadiz Project area were measured using a Bruel & Kjaer Precision Integrating Sound Level Meter, type 2230. Measurements were collected at seven locations in the Cadiz Project area on August 5, 1999. Each location was monitored for a period of 15 minutes. The meter was calibrated as shown in the manufacturer's procedures prior to, during and after use in the field. Peak noise levels recorded in the Cadiz Project area resulted from truck traffic and wind. These locations are shown on Figure 5.11-2. Based on the measurements at these locations, average ambient noise conditions were found to generally be low and very low as shown in Table 5.11-2.



Source: P&D Consultants, Inc. (1999).

Figure 5.11-2

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Noise Measurement Locations

TABLE 5.11-1
TYPICAL DISTANCES TO NOISE CONTOURS

Noise Source	Distance (in feet) to Noise Contours				
	75 CNEL	70 CNEL	65 CNEL	60 CNEL	57 CNEL
Six-lane highway	120	278	560	1,000	1,325
Rail Freight	125	250	600	1,200	NA

NA = Not provided.
Sources: Figures II-6 and II-7 San Bernardino County General Plan Noise Element (Revised December 1993).

TABLE 5.11-2
EXISTING NOISE LEVELS

Monitoring Location (1)	Date/Time	Noise Level (L_{eq})	Comments
N1	August 5, 1999/10:05 AM	50.8 dBA	This area is affected by truck traffic to and from the salt beds.
N2	August 5, 199910:35 AM	31.9 dBA	No trains were recorded during the sound monitoring period.
N3	August 5, 1999/11:50 AM	33.4 dBA	No trains were recorded during the sound monitoring period.
N4	August 5, 1999/12:40 PM	38.8 dBA	No trains were recorded during the sound monitoring period.
N5	August 5, 1999/1:15 PM	41.4 dBA	No heavy vehicle activity in the vicinity of the salt beds was during the sound monitoring.
N6	August 5, 1999/2:00 PM	38.5 dBA	No trains were recorded during the sound monitoring period.
N7	August 5, 1999/2:25 PM	42.5 dBA	No trains were recorded during the sound monitoring period.

(1) See Figure 5.11-2 for monitoring locations N1 through N7.
Source: P&D Consultants, Inc. (August 1999).

5.11.2 THRESHOLDS OF SIGNIFICANCE

A project will normally have a significant adverse impact if it results in:

- Exposure of people to or the generation of noise levels in excess of standards established in the County General Plan or Noise Ordinance, or applicable noise levels of other agencies.
- Exposure of people to or the generation of excessive groundborne vibration or groundborne noise levels.
- A substantial increase in ambient noise levels in the project vicinity, above levels existing without the project.

- Exposure of people residing or working in the Cadiz Project area to excessive noise levels from a private airstrip.

Federal, state and local governments have established noise standards and guidelines for the protection of the public which generally focus on reducing noise at the source, such as automobiles, aircraft and mechanical equipment. Land use regulations with respect to noise/land use compatibility are generally the responsibility of local governments such as the County of San Bernardino. The County's Noise Element identifies interior and exterior standards for noise associated with mobile sources for new development. These standards, shown in Table 5.11-3, identify specific noise level standards for residential, commercial, institutional/public and open space uses. These noise standards refer to operational noise only, not temporary construction noise. The Cadiz Project would be considered to result in a significant adverse noise impact if its operations resulted in noise levels exceeding these defined standards for these specific land uses. These standards apply to ongoing or long term noise sources.

The California Desert Conservation Area Plan identifies specific guidelines associated with four classes of multiple use of BLM owned/managed lands. None of these guidelines relate to the generation of noise on or near BLM lands or the mitigation of noise-related impacts.

5.11.3 METHODOLOGY

Existing noise levels in the Cadiz Project area were identified based on measurements of existing noise levels in the area and on typical noise contours in the County General Plan for highway and railroad noise. Potential noise associated with the construction and operation of the Cadiz Project was assessed by comparing existing noise levels to future conditions with Cadiz Project noise levels.

5.11.4 IMPACTS

Eastern and Eastern/Canal Alternatives

Construction Impacts

Construction for the Eastern and Eastern/Canal alternatives would require nine months for the Project spreading basins and up to 12 months each for the water conveyance facilities, pump stations and the Project wellfield. During these construction periods, short term noise would be generated by construction equipment and vehicles and worker vehicles as described in the following sections. Noise would occur up to 24 hours a day, 7 days a week during construction. Most noise would occur during the daily 20 hour period when construction shifts are scheduled to work.

Construction Equipment. Construction of the Eastern and Eastern/Canal alternatives would result in the generation of short term noise associated with equipment operations, and vehicular traffic for employee trips, materials delivery and hauling. Typical construction equipment expected to be used for the construction of the water conveyance facilities, the power distribution facilities, the Project spreading basins, the Project wellfield and the pump facilities. Typical noise levels associated with these types of construction equipment are shown in Table 5.11-4. Noise levels for construction equipment without mitigation range from a low of 75 dBA for a pickup truck and 91 dBA for an excavating truck. As noted earlier, there would be a reduction

TABLE 5.11-3
INTERIOR/EXTERIOR NOISE LEVEL STANDARDS FOR MOBILE NOISE SOURCES

Land Uses		CNEL	
Categories	**Uses**	**Interior (1)**	**Exterior (2)**
Residential	Single and multi-family, duplex, mobile homes	45	60 (3)
Commercial	Hotel, motel, transient lodging	45	60 (3)
	Commercial retail, bank, restaurant	50	n/a
	Office building, research and development, professional office	45	65
	Amphitheater, concert hall, auditorium, movie theater	45	n/a
Institutional/Public	Hospital, nursing home, school classroom, church, library	45	65
Open Space	Park	n/a	65

Notes:

(1) Indoor environment excluding bathrooms, kitchens, toilets, closets and corridors.

(2) Outdoor environment limited to:
Private yard of single-family dwellings
Multi-family private patios or balconies
Mobile home parks
Hospital/office building patios
Park picnic areas
School playgrounds
Hotel and motel recreation areas

(3) An exterior noise level of up to 65 CNEL will be allowed provided exterior noise levels have been substantially mitigated through a reasonable application of the best available noise reduction technology, and interior noise exposure does not exceed 45 CNEL with windows and doors closed. Requiring that windows and doors remain closed to achieve an acceptable interior noise level will necessitate the use of air conditioning or mechanical ventilation.

(4) Source: San Bernardino County General Plan Noise Element (Revised December 1993).

TABLE 5.11-4
TYPICAL CONSTRUCTION EQUIPMENT NOISE LEVELS (dBA)

Equipment	Noise Levels (in dBA) at 50, 100 and 200 Feet					
	With No Noise Control			With Feasible Noise Control [1]		
	50 Feet	100 Feet	200 Feet	50 Feet	100 Feet	200 Feet
Lifting						
Heavy Lift Crane	88	82	76	75	69	63
Mid-Size Crane	83	77	71	75	69	63
Small Crane	80	74	68	75	69	63
Excavating						
Backhoe	85	79	73	75	69	63
Truck	91	85	79	75	69	63
Grader	85	79	73	75	69	63
General Construction						
Air Compressor	81	75	69	75	69	63
Pump	76	70	64	75	69	63
Pick-Up Truck	75	69	63	75	69	63
Miscellaneous [2]	86	80	74	75	69	63

Notes:

[1] Estimated levels obtainable with quieter procedures or machines, or by implementing noise control features that require no major redesign or extreme costs.

[2] Miscellaneous pneumatic tools.

Sources: United States Environmental Protection Agency, 1971. Noise from Construction Equipment and Operations, Building Equipment and Home Appliances, Office of Noise Abatement and Control, Washington, D.C.

in these noise levels of approximately six dBA per doubling of distance from the piece of equipment. For example, as shown in Table 5.11-4, the noise level of a midsize crane at 50 feet from the equipment would be 83 dBA. At 100 feet from the loader, the noise level would drop by six dBA, to 77 dBA.

Table 5.11-4 also shows the effects of equipment or operating modifications on reducing noise levels associated with construction equipment. These include mufflers on exhausts and use of acoustical enclosures. Intervening topography, acting as a barrier between a piece of equipment and a sensitive receptor, would further reduce noise levels.

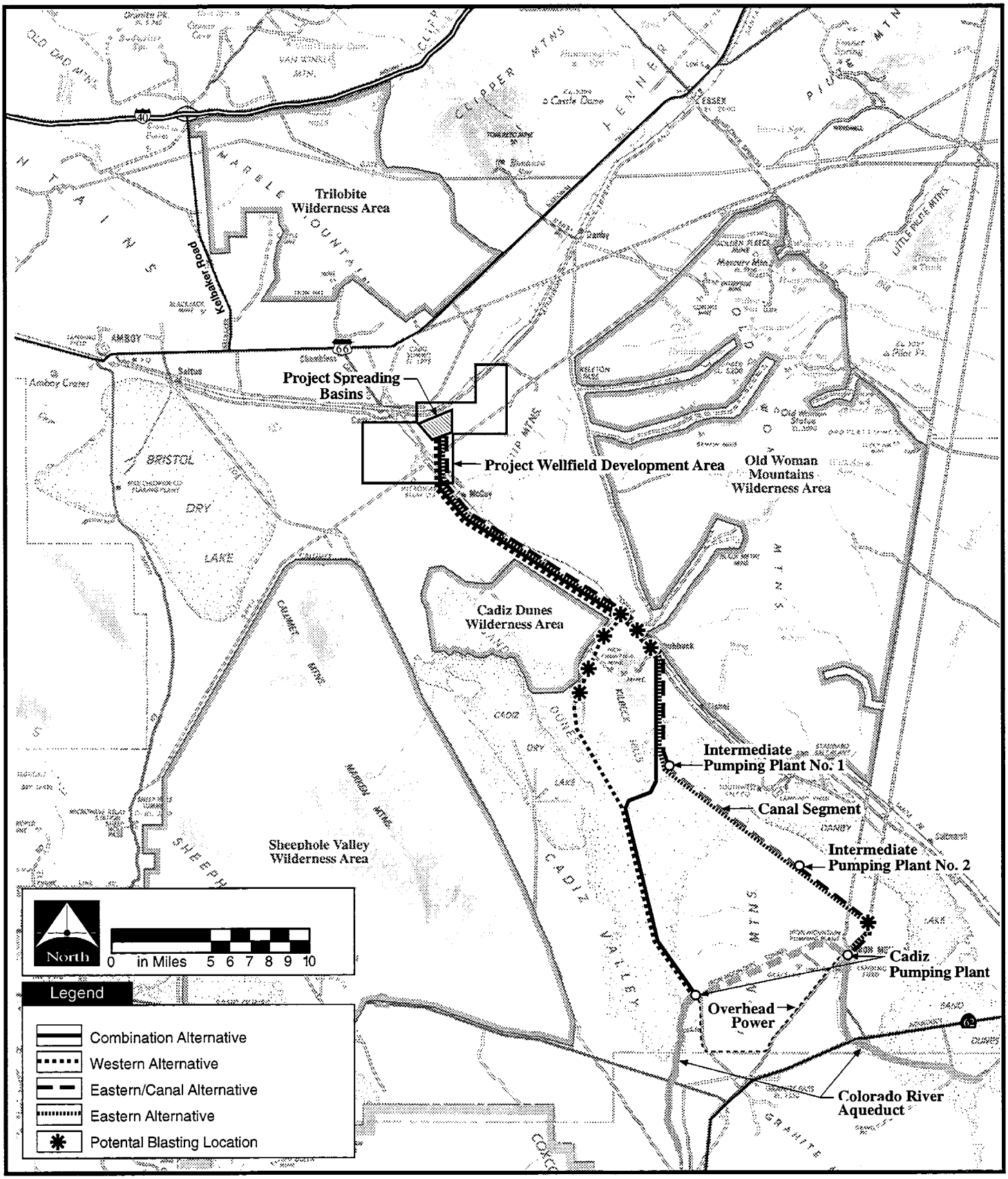
The potentially noise sensitive land uses in the general vicinity of the Cadiz Project area are the four wilderness areas. Of the four, the Cadiz Dunes Wilderness Area is closest to the construction easements for all alternatives. The wilderness area would be adjacent to the south side of the water conveyance facilities for a distance of approximately five miles. The Old Woman Mountains Wilderness Area would be located north of the water conveyance facilities. While the water conveyance facilities would not be directly adjacent to this wilderness area, it would run parallel and close enough for approximately three miles for consideration of potential noise impacts. The Sheephole Valley Wilderness Area would be southwest of the water

conveyance facilities. At its closest point, the water conveyance facilities would be within approximately eight miles of this wilderness area. The Trilobite Wilderness Area is located north of Cadiz Project area, with the closest boundary being approximately 3.5 miles from the Project spreading basins.

Therefore, depending on the equipment used and the actual distance from the equipment to the wilderness area, some parts of one or more of these wilderness areas may be subject to temporary noise during the construction period. This noise would predominantly be associated with the operation of bulldozers, backhoes and other excavation and earthmoving equipment. As shown in Table 5.11-4, noise levels of construction equipment with typical feasible noise controls at 100 feet from the noise source are approximately 69 dBA for a wide range of construction vehicles. At 200 feet from the noise source, noise levels are 63 dBA. It is unlikely that any visitors to the Cadiz Dunes or Old Woman Mountains wilderness areas would be any closer than 200 feet from the construction equipment under the Eastern and Eastern/Canal alternatives. The County of San Bernardino exterior noise standard for open space in general is 65 CNEL for operations. This standard does not, however, apply to temporary construction impacts. However, mitigation measure N-1, provided later in this section, would require Metropolitan's contractors to incorporate applicable noise controls on their equipment and in their construction activities. As a result, the use of typical feasible noise controls on construction equipment would reduce the short term construction noise impacts to below a level of significance. Nonetheless, for some visitors to these wilderness areas, the temporary noise generated during construction of the Eastern and Eastern/Canal alternatives could reduce the quality of their visitor experience, particularly visitors interested in quiet. This concern is also addressed in section 5.17 (Wilderness/Recreation).

Blasting. Based on preliminary engineering and soils studies for the Eastern and Eastern/Canal alternatives, blasting may be necessary during construction at up to three locations along the water conveyance facility alignment, as shown on Figure 5.11-3. This blasting could occur over a total of eight days during the excavation of the water conveyance facility trench in these areas and may result in short-term, intermittent noise levels which may be heard in the Cadiz Dunes wilderness area and potentially in parts of the Old Woman Mountains wilderness area. Because of the distance of this part of the water conveyance facility construction from the Sheephole Valley and Trilobite wilderness areas, it is not expected that blasting noise would be noticeable at those locations. Blasting noise from the area near the Iron Mountain Pumping Plant is shielded from the Sheephole Valley Wilderness Area by the Iron Mountains.

The intermittent noise associated with blasting could be controlled in a number of ways, which are specific to the rock and blasting conditions present in the excavation area. As described later in mitigation measure N-2, Metropolitan would require construction contractors to control and monitor noise levels during blasting events. This would substantially reduce the adverse blasting noise impacts under the Eastern and Eastern/Canal Alternatives to below a level of significance. Nonetheless, for some visitors to the wilderness areas, the audible



Source: Black & Veatch (1999).

Figure 5.11-3

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Potential Blasting Locations

blasting events associated with the Eastern and Eastern/Canal alternatives could reduce the quality of their visitor experience to this area.

Vehicular Traffic. During construction, truck trips on area roads would temporarily be generated to bring construction materials to the work areas and, very rarely, to haul excess material to appropriate locations. Construction workers would generate short-term trips on area roads traveling to and from the construction sites. As discussed earlier in Section 5.7 (Transportation), the Eastern and Eastern/Canal alternatives would generate a minor increase in traffic volumes on area roads and would likely not result in an appreciable change in the levels of noise associated with these roads. However, as shown earlier in Table 5.11-3, existing noise levels near the Cadiz Dunes Wilderness Area were 38.8 dBA at receptor N4 and 38.5 dBA at N6. Therefore, existing traffic volumes and the corresponding noise levels in this area are substantially below the levels estimated in the General Plan for typical roads. The additional traffic that would be added to these roads during construction of the Eastern and Eastern/Canal alternatives would not substantially change noise levels near these roads to the extent that it would approach or exceed the County's 65 CNEL exterior noise level. No mitigation is necessary. Therefore, the construction-related surface transportation would not result in significant adverse noise impacts on Cadiz Dunes Wilderness Area or any other wilderness areas under the Eastern and Eastern/Canal alternatives.

Trains. Pipe for the water conveyance facilities may be delivered to the Cadiz Project area by train on flatcars joined to existing trains on the BNSF and ARZC railroads. These train trips would result in distances to noise contours similar to the distances shown earlier in Table 5.11-1. The distance to the 65 CNEL contour shown in that table was 600 feet. Assuming the pipe would be delivered on railcars which are part of a another train, it is possible that small areas of Cadiz Dunes and/or Old Woman Mountain wilderness areas near Cadiz-Rice Road could fall within this 65 CNEL contour for the railroad. However, this would not be different than the existing train noise generated on this same track. Therefore, construction-related train traffic would not result in significant adverse noise impacts on the Cadiz Dunes, Old Woman Mountains or any other wilderness areas. No mitigation is necessary.

Exposure of Construction Workers to Noise. Construction workers working near heavy equipment may be subject to excessive levels of noise. However, construction personnel would be required to wear appropriate hearing protection, such as ear plugs or muffs, to reduce their exposure, consistent with federal and state worker safety requirements. Therefore, construction under the Eastern and Eastern/Canal alternatives would not be expected to result in significant adverse noise impacts on construction workers. No further mitigation is necessary.

Aircraft. As discussed earlier in Section 3.7 (Transportation), the Eastern and Eastern/Canal alternatives may result in a minor increase in the number of flights into and out of the private landing strips in the area, associated with Metropolitan or contractor personnel visiting the Cadiz Project. This is not expected to result in an adverse noise impact under the Eastern and Eastern/Canal alternatives because they would result in only a minor number of

aircraft operations which would be similar to existing operations at these landing strips. No mitigation is necessary.

Construction Noise Impact Summary. In summary, construction of the Eastern or Eastern/Canal alternatives would not be anticipated to result in significant adverse short term noise impacts. Although the construction is not expected to result in significant adverse noise impacts on sensitive land uses, measure N-1, provided later in this section, is included in the Cadiz Project to ensure that construction equipment would be properly muffled and operated consistent with manufacturer's requirements.

As noted earlier, construction of the Eastern or Eastern/Canal alternatives could result in approximately eight days of intermittent noise associated with blasting in the central and far south segments of the water conveyance facilities. Mitigation measure N-2, provided later in this section, would substantially reduce this construction-related noise impact under the Eastern and Eastern/Canal alternatives, to below a level of significance.

Operations Impacts

Facility Operations. During operations, water would be pumped from the Colorado River Aqueduct to the Project spreading basins or from the Project wellfield to the Colorado River Aqueduct. The water conveyance facilities would be underground so there would be no noise associated with water being transported in this pipe. Along the water conveyance facilities, there are valves that may be used during pipe maintenance to release water or take in air. Noise from the operation of these valves would be minimal and would occur very infrequently (less than once per year on average). At the pump station, the pumping equipment would be in an enclosed concrete structure with no significant noise impacts generated outside the pump station building. In the Project wellfield, each well would include an above ground electric pump motor, air and vacuum valve, and pressure gauge. This equipment would make only low levels of noise that would not be audible off the Project wellfield site. No mitigation is necessary.

Metropolitan would operate and maintain the Cadiz Project facilities in the long term. This would result in noise associated with truck trips to the areas being maintained or to deliver supplies, and associated with the physical operation and maintenance of the equipment, as well as noise from employee vehicles. However, these activities would occur intermittently, would require only a small staff and would not result in high levels of noise. No mitigation is necessary.

Raven Control. It may be necessary to include noisemakers around the perimeter of the Project spreading basins to keep ravens from being attracted to the Project spreading basins when they contain water. These noisemakers, which would operate during daylight hours only and only during periods when there is water in the Project spreading basins, would produce a popping/boom type noise approximately every one to two minutes. While this noise would not adversely impact the nearby Cadiz Dunes and Old Woman Mountains wilderness areas, or any residential uses because of the distances of these uses from the spreading basins, this would be a new noise source in the area. Because these noisemakers would only be operated during limited time periods and would not result in direct impacts on sensitive land uses, they

would not result in an adverse noise impact. No mitigation is necessary.

Aircraft. As discussed earlier in Section 3.7 (Transportation), the Eastern and Eastern/Canal alternatives may result in a minor increase in the number of flights into and out of the private landing strips in the area, associated with Metropolitan operations, maintenance and supervisory staff visiting the Cadiz Project. This would not result in an adverse noise impact under the Eastern or Eastern/Canal alternatives because it would result in only a minor number of aircraft operations which would be similar to existing operations at these landing strips. No mitigation is necessary.

Operational Noise Impact Summary. In summary, the long term operations of the Eastern or Eastern/Canal alternatives would not result in significant adverse noise-related impacts. No noise standards would be exceeded. No mitigation is necessary.

Western Alternative

Construction Impacts

Construction for the Western Alternative would require temporary construction periods similar to the periods described earlier for the Eastern and Eastern/Canal Alternatives. During these construction periods, short-term noise would be generated by construction equipment and vehicles, and worker vehicles for the Western Alternative; similar to the noise generation described earlier for the Eastern and Eastern/Canal alternatives.

Construction Equipment. Construction of the Western Alternative would result in the generation of short-term noise associated with equipment operations, and vehicular traffic for employee trips, materials delivery and hauling very similar to the Eastern Alternative. Typical construction equipment expected to be used for construction for the Western Alternative would be the same as shown earlier in Table 5.11-4.

The water conveyance facilities for the Western Alternative would be adjacent to the Cadiz Dunes wilderness area for a distance of approximately five miles. The Old Woman Mountains wilderness area is located to the north of the water conveyance facilities. While the water conveyance facilities would not be directly adjacent to the Old Woman Mountains wilderness area, they would run parallel and close enough for approximately two miles for consideration of potential noise impacts. The Sheephole Valley Wilderness Area is located southwest of the water conveyance facility alignment. At its closest point, the Western Alternative would be within approximately five miles from this wilderness area. The Trilobite Wilderness Area would be approximately 3.5 miles north of the Project spreading basins under the Western Alternative.

Therefore, depending on the equipment used and the actual distance from the equipment to the wilderness areas, some parts of one or more of these wilderness areas may be subject to temporary noise impacts during construction of the Western Alternative. As shown in Table 5.11-4, noise levels of construction equipment with typical feasible noise controls at 100 feet from the noise source are approximately 69 dBA for a wide range of construction vehicles. At 200 feet from the noise source, noise levels are 63 dBA. It is unlikely that any visitors to the Cadiz or Old Woman Mountains wilderness areas would be any closer than 200 feet from the construction equipment under the Western

Alternative. Mitigation measure N-1, later in this section, would require Metropolitan's contractors to incorporate applicable noise controls on their equipment and in their construction activities. Therefore, the use of typical feasible noise controls on construction equipment would reduce the short-term construction noise impacts on these sensitive uses to below a level of significance under the Western Alternative. Nonetheless, for some visitors to the Cadiz and Old Woman Mountains wilderness areas, the temporary noise generated during construction of the Western Alternative could reduce the quality of their visitor experience, particularly visitors interested in quiet.

Blasting. Based on preliminary engineering and soils studies for the Western Alternative, blasting may be necessary during construction at up to four locations along the water conveyance facility alignment, as shown earlier on Figure 5.11-3. This blasting could occur over a total of six days during the excavation of the water conveyance facility trench in this area, and may result in short-term, intermittent noise levels which may be noticeable in the Cadiz Dunes Wilderness Area and potentially in parts of the Old Woman Mountains Wilderness Area. Because of the distance of this part of the water conveyance facilities construction from the Sheephole Valley and Trilobite wilderness areas, blasting related noise would not be noticeable at these locations.

As described later in mitigation measure N-2, Metropolitan would require construction contractors to control and monitor noise levels during blasting events. This would substantially reduce the adverse blasting noise impacts under the Western Alternative, to below a level of significance. Nonetheless, for some visitors to the Cadiz Dunes and Old Woman Mountains wilderness areas, the blasting under the Western Alternative could reduce the quality of their visitor experience to this area.

Vehicular Traffic. During construction, truck and employee vehicle trips on area roads under the Western Alternative would be the same as under the Eastern and Eastern/Canal alternatives. This would be a minor increase in traffic volumes on area roads and would likely not result in an appreciable change in the levels of noise associated with these roads. As shown earlier in Table 5.11-3, existing noise levels near the Cadiz Dunes Wilderness Area were 41.4 dBA at receptor N5 and 38.5 dBA at N6. Therefore, existing traffic volumes and the corresponding noise levels in this area would be substantially below the levels estimated in the General Plan for typical roads. The additional traffic added to these roads during construction of the Western Alternative would not substantially change noise levels near these roads and would not approach or exceed the County's 65 dBA exterior noise level. No mitigation is necessary.

Trains. Pipe for the water conveyance facilities may be delivered to the Cadiz Project by train for the Western Alternative, resulting in train-related noise similar to the impacts discussed under the Eastern and Eastern/Canal alternatives. Therefore, it is possible that small areas of Cadiz Dunes and/or Old Woman Mountains wilderness areas, near Cadiz-Rice Road, could fall within the 65 CNEL contour for the railroad. However, this would not be substantially different than the existing train noise generated on this track in the same vicinity. Therefore, the construction-related train traffic for the

Western Alternative would not result in significant adverse noise impacts on Cadiz Dunes, Old Woman Mountains or any other wilderness areas.

Exposure of Construction Workers to Noise. Construction workers working near heavy equipment may be subject to excessive levels of noise. However, all construction personnel would be required to wear appropriate hearing protection, such as ear plugs or muffs, to reduce their exposure. Therefore, construction under the Western Alternative would not result in significant adverse noise impacts on construction workers. No mitigation is necessary.

Aircraft. As discussed earlier in Section 3.7 (Transportation), construction of the Western Alternative may result in a minor increase in the number of flights into and out of the private landing strips in the area, associated with Metropolitan or contractor personnel visiting the Cadiz Project site. This would not result in an adverse noise impact under the Western Alternative because it would result in only a minor number of aircraft operations, which would be similar to existing operations at these landing strips. No mitigation is necessary.

Construction Noise Impact Sumary. In summary, construction of the Western Alternative would not be anticipated to result in significant adverse short term noise impacts. Although the construction is not expected to result in significant adverse noise impacts on sensitive land uses, mitigation measure N-1, provided later in this Section, is included in the Project to require that construction equipment would be properly muffled and operated consistent with manufacturer's requirements.

As noted earlier, construction of the Western Alternative would result in approximately six days of intermittent noise associated with blasting in the central segment of the water conveyance facilities. Mitigation measure N-2, provided later in this Section, would substantially reduce this construction-related noise impact under the Western Alternative, to below a level of significance. No mitigation is necessary.

Operations Impacts

Facility Operations. During operations under the Western Alternative, water would be pumped from the Colorado River Aqueduct to Project spreading basins or from the Project wellfield to the Colorado River Aqueduct. The water conveyance facilities would be underground so there would be no noise associated with water being transported. Along the water conveyance facilities, there would be valves that may be used during pipe maintenance to release water or take in air. Noise from the operation of these valves would be minimal and occur very infrequently (less than once a year on average). At the pump station, the pumping equipment would be in an enclosed concrete structure with no significant noise impacts generated outside the pump station building. In the Project wellfield, each well would include an above ground electric pump motor, air and vacuum valve, and pressure gauge. This equipment would make only low levels of noise not expected to be audible off the Project wellfield site.

Metropolitan would operate and maintain the Cadiz Project facilities in the long term. This would result in noise associated with truck trips to reach areas being maintained or to deliver supplies, and associated with the physical operation and maintenance of

the equipment, as well as noise from employee vehicles. However, these activities would occur intermittently, would require only a small staff and would not result in high levels of noise. No mitigation is necessary.

Raven Control. Similar to the Eastern Alternative, noisemakers may be included around the perimeter of the spreading basin for the Western Alternative. The noisemakers would operate during daylight hours only during periods when there is water in the spreading basins and, similar to the Eastern Alternative, would not result in direct impacts on sensitive land uses. No mitigation is necessary.

Aircraft. As discussed earlier in Section 3.7 (Transportation), the Western Alternative may result in a minor increase in the number of flights into and out of the private landing strips in the area, associated with Metropolitan operations, maintenance and supervisory staff visiting the Cadiz Project. This is not expected to result in an adverse noise impact under the Western Alternative because it would result in only a minor number of aircraft operations which would be similar to existing operations at these landing strips. No mitigation is necessary.

Operational Noise Impact Summary. In summary, the long term operations of the Western Alternative would not result in significant adverse noise related impacts. No noise standards would be exceeded. No mitigation is necessary.

Combination Alternative

Construction Impacts

Construction for the Combination Alternative would require construction periods similar to the construction periods for the other alternatives. During these construction periods, short term noise would be generated by construction equipment and vehicles, and worker vehicles, similar to the noise generation described earlier for the other alternatives.

Construction Equipment. Construction of the Combination Alternative would result in the generation of short term noise associated with equipment operations, and vehicular traffic for employee trips, materials delivery and hauling similar to the Eastern and Western alternatives. Typical construction equipment expected to be used for construction under the Combination Alternative would be the same as shown earlier in Table 5.11-4.

Cadiz Dunes wilderness area is the closest noise sensitive receptor to the Combination Alternative. The water conveyance facilities under the Combination Alternative would be directly adjacent to the Cadiz Dunes Wilderness Area, for a distance of approximately five miles. The Old Woman Mountains Wilderness Area would be located to the north of the water conveyance facilities. While the water conveyance facilities would not be directly adjacent to the Old Woman Mountains Wilderness Area, they would run parallel and close enough for approximately three miles for consideration of potential noise impacts. The Sheephole Valley Wilderness

Area would be southwest of the water conveyance facilities. At its closest point, the Combination Alternative would be within approximately five miles of this wilderness area. The Trilobite Wilderness Area would be approximately 3.5 miles north of the Project spreading basins under the Combination Alternative.

Therefore, depending on the equipment used and the actual distance from the equipment to the wilderness areas, some parts of one or more of them may be subject to temporary noise during construction under the Combination Alternative. As shown in the earlier Table 5-11.4, noise levels of construction equipment with typical feasible noise controls at 100 feet from the noise source are approximately 69 dBA for a wide range of construction vehicles. At 200 feet from the noise source, noise levels are 63 dBA. It is unlikely that any visitors to the Cadiz or Old Woman Mountains wilderness areas would be any closer than 200 feet from the construction equipment under the Combination Alternative. Mitigation measure N-1, later in this Section, requires Metropolitan's contractors to incorporate applicable noise controls on their equipment and in their construction activities. Therefore, the use of typical feasible noise controls on construction equipment would reduce the short term construction noise impacts on these sensitive uses to below a level of significance for the Combination Alternative. Nonetheless, for some visitors to the Cadiz and Old Woman Mountains wilderness areas, the temporary noise generated during construction of the Combination Alternative could reduce the quality of their visitor experience, particularly visitors interested in quiet.

Blasting. Based on preliminary engineering and soils studies for the Combination Alternative, blasting may be necessary during construction at up to four locations along the water conveyance facility alignment, as shown earlier on Figure 5.11-3. This blasting could occur over a total of six days during the excavation of the water conveyance facility trench in this area and may result in short-term, intermittent noise levels which may be heard in the Cadiz Dunes Wilderness Area and potentially in parts of the Old Woman Mountains Wilderness Area. Because of the distance of this part of the water conveyance facilites construction from the Sheephole Valley and Trilobite wilderness areas, it is not expected that blasting related noise would be heard at these locations.

As described later in mitigation measure N-2, Metropolitan would require construction contractors to control and monitor noise levels during blasting. This would substantially reduce the adverse blasting noise impacts for the Combination Alternative, to below a level of significance. Nonetheless, for some visitors to the Cadiz Dunes and Old Woman Mountains Wilderness Areas, the blasting for the Combination Alternative could reduce the quality of their visitor experience to this area.

Vehicular Traffic. During construction, truck and employee vehicle trips on area roads would be the same as for the Eastern and Western alternatives. This would be a minor increase in traffic volumes on area roads and would likely not result in an appreciable change in the levels of noise associated with these roads. As shown earlier in Table 5.11-2, existing noise levels near the Cadiz Dunes Wilderness Area

were 41.4 dBA at receptor N5 and 38.5 dBA at N6. Therefore, existing traffic volumes and the corresponding noise levels in this area are substantially below the levels estimated in the General Plan for typical roads. The additional traffic added to these roads during construction of the Combination Alternative would not substantially change noise levels near these roads and would not approach or exceed the County's 65 dBA exterior noise level. No mitigation is necessary.

Trains. Pipe for the water conveyance facility may be delivered to the Cadiz Project area by train for the Combination Alternative, resulting in train related noise similar to the impacts described for the Eastern Alternative. Therefore, it is possible that small areas of Cadiz Dunes and/or Old Woman Mountains wilderness areas, near Cadiz Road, could fall within the 65 CNEL contour for the train tracks. However, this would not be different than the existing train noise generated on this track in the vicinity of these wilderness areas. Therefore, the construction related train traffic for the Combination Alternative would not result in significant adverse noise impacts on Cadiz Dunes and Old Woman Mountains wilderness areas. No mitigation is necessary.

Exposure of Construction Workers to Noise. Construction workers working near heavy equipment may be subject to excessive levels of noise. All construction personnel would be required to wear appropriate hearing protection, to reduce their exposure. Therefore, construction for the Combination Alternative would not be expected to result in significant adverse noise impacts on construction workers. No mitigation is necessary.

Aircraft. As discussed earlier in Section 3.7 (Transportation), the Combination Alternative may result in a minor increase in the number of flights into and out of the private landing strips in the area, associated with Metropolitan or contractor personnel visiting the Cadiz Project. This would not be expected to result in an adverse noise impact for the Combination Alternative because it would result in only a minor number of aircraft operations which would be similar to existing operations at these landing strips. No mitigation is necessary.

Construction Noise Impact Summary. In summary, construction of the Combination Alternative would not be anticipated to result in significant adverse short term noise impacts. Although the construction would not be expected to result in significant adverse noise impacts on sensitive land uses, mitigation measure N-1, provided later in this Section, is included in the Cadiz Project to require that construction equipment would be properly muffled and operated consistent with manufacturer's requirements.

As noted earlier, construction of the Combination Alternative would result in approximately six days of intermittent noise associated with blasting in the central part of the water conveyance facilities alignment. Mitigation measure N-2, provided later in this Section, would substantially reduce construction related noise impacts under the Combination Alternative, to below a level of significance. No further mitigation is necessary.

Operations Impacts

Facility Operations. During operations under the Combination Alternative, water would be pumped from the Colorado River Aqueduct to the Project spreading basins or from the Project wellfield to the Colorado River Aqueduct. The water conveyance facilities from the Project wellfield to the Colorado River Aqueduct would be underground so there would be no noise associated with water being transported. Along the water conveyance facilities there would be valves that may be used during maintenance to release water or take in air. Noise from the operation of these valves would be minimal and would occur very infrequently. At the Cadiz Pumping Plant, the pumping equipment would be in an enclosed concrete structure with no significant noise impacts generated outside the Cadiz Pumping Plant building. In the Project wellfield, each well would include an above ground electric pump motor, air and vacuum valve, and pressure gauge. This equipment would make only low levels of noise not expected to be audible off the Project wellfield site.

Metropolitan would operate and maintain the Cadiz facilities in the long term. This would result in noise associated with truck trips to reach areas being maintained or to deliver supplies, and associated with the physical operation and maintenance of the equipment, as well as noise for employee vehicles. However, these activities would occur intermittently and would not result in high levels of noise. No mitigation is necessary.

Raven Control. Similar to the Eastern and Western Alternatives, noisemakers may be included around the perimeter of the spreading basin for the Combination Alternative. The noisemakers would operate during daylight hours only during periods when there is water in the spreading basins and, similar to the Eastern and Western alternatives, would not result in direct impacts on sensitive land uses. No mitigation is necessary.

Aircraft. As discussed earlier in Section 3.7 (Transportation), the Combination Alternative may result in a minor increase in the number of flights into and out of the private landing strips in the area, associated with Metropolitan operations, maintenance and supervisory staff visiting the Cadiz Project site. This is not expected to result in an adverse noise impact under the Combination Alternative because it would result in only a minor number of aircraft operations which would be similar to existing operations at these landing strips. No mitigation is necessary.

Operational Noise Impact Summary. In summary, the long term operation and maintenance of the Combination Alternative would not result in significant adverse noise-related impacts. No noise standards would be exceeded. No mitigation is necessary.

No Project Alternative

The No Project Alternative would not result in any construction in the Cadiz Project area and would not result in any new, long-term, operations related noise generation in the Cadiz Project area. Therefore, the No Project Alternative would not result in any changes in ambient noise levels in the area. No mitigation is necessary.

5.11.5 MITIGATION MEASURES

As discussed earlier, noise control and muffling measures can substantially

reduce noise associated with construction. The following measures are incorporated in the Cadiz Project to address short-term construction noise.

N-1 During site preparation, grading, excavation and construction, Metropolitan will require all the construction contractors to incorporate feasible muffling and noise control devices into construction vehicles, equipment and construction methods and to maintain all construction vehicles and equipment in efficient operating condition.

N-2 Metropolitan will require all construction contractors to control and monitor noise during all blasting activities. The construction specifications will identify the locations where blasting may occur and measures the contractor must implement to control blasting-related noise. Depending on the specific blasting requirements and rock conditions at each blasting location, these measures may include the use of smaller, deeper charges; variable spacing of charges and/or phasing of charges.

The Eastern, Eastern/Canal, Western and Combination alternatives would not be anticipated to result in significant adverse noise impacts in the long-term. No mitigation is necessary for long-term operations and maintenance.

5.11.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Mitigation measure N-1, above, would reduce construction related noise to below a level of significance for all build alternatives. Mitigation measure N-2, above, would reduce construction related blasting noise to below a level of significance for all build alternatives.

The Eastern, Eastern/Canal, Western and Combination alternatives would not be anticipated to result in significant adverse noise impacts in the long-term.

5.12 PUBLIC SERVICES

5.12.1 AFFECTED ENVIRONMENT

This section describes potential impacts of the Cadiz Project related to public services. Information for this section was obtained from the applicable public service providers serving this part of San Bernardino County and the Cadiz Valley Agricultural Development Final EIR (1993).

Police and Law Enforcement Services

The San Bernardino County Sheriff's Department (SBCSD) provides police protection to the Cadiz Project area. The Cadiz Project area is under the jurisdiction of the SBCSD's Morongo Basin Station at 6527 White Feather Road, approximately 78 miles west of the Project site. This station has 82 Sheriff's personnel assigned, including 60 sworn personnel and 22 civilian employees. There are 17 patrol officers, two detectives and three sergeants assigned to the unincorporated county area. There are a minimum of two patrol officers per shift assigned to the 5,000 square miles of the unincorporated area in the Morongo Basin jurisdiction. The Cadiz Project area is patrolled on a random basis depending on the need for service. The estimated response time of a Sheriff's unit to the Cadiz Project area for non-emergency calls is approximately two hours and approximately one hour for emergency calls. Calls for police and law enforcement services in the Cadiz area average approximately ten calls annually.

The Cadiz Valley area is also patrolled by Rangers from the Needles Resource Area office of the BLM. Eight staff rangers regularly patrol a total of 8,600 square miles in the Needles Resource Area. As a result, patrols of the Cadiz Project area generally occur every few weeks. These rangers can typically respond to an emergency situation in 1.5 hours. These rangers have the same powers as the San Bernardino County Deputy Sheriff and are the federal law enforcement authorities in the Cadiz Valley area. Their primary responsibility is resource protection-oriented law enforcement.

The Cadiz Valley area is served by the Barstow office of the California Highway Patrol (CHP). The CHP does not regularly patrol the Cadiz Project area. However, they provide assistance on an on-call basis for accidents, emergencies, etc. The normal response time is approximately one and 1.5 hours. However, the CHP has been known to respond to emergencies in the Cadiz Project area in about one-half hour.

There is a Sheriff's Department Citizen on Patrol volunteer group in Cadiz. This unit consists of unarmed volunteers who patrol the Cadiz area in marked Citizen Patrol cars and report suspicious activities. This group does not take any law enforcement action. There is no set schedule for this volunteer unit. The volunteers patrol when they have free time.

The Cadiz Inc. agricultural operation employs one to two security personnel on a seasonal basis, depending on the number of workers in their seasonal housing facility.

Fire Protection Services

Fire protection services for the Cadiz Project area are provided by the San Bernardino County Fire Department (SBCFD), headquartered at 157 West Fifth Street in San Bernardino. The

nearest fire station to the Cadiz Project area is at Harvard, approximately 85 miles away. This station has a mutual aid agreement with the Wonder Valley fire station, which is approximately 40 miles from the Cadiz Project. The Harvard station has approximately 12 on-call firefighters and two fire managers. This station is equipped with one structure engine, a 750-gallon engine, a 500-gallon engine and a reserve 500-gallon engine.

The average response time to the project site is approximately one to 1.5 hours.

Schools

The Cadiz Project area is under the jurisdiction of the Needles Unified School District (NUSD) which provides elementary and secondary education. The nearest school to the Cadiz Project is the Essex Elementary School at 110715 Highway 66, located approximately 25 miles to the northeast. This school serves grades kindergarten through eight. Essex Elementary School has a capacity of approximately forty students. Currently, there are 13 students attending Essex Elementary School.

Needles High School, which serves grades 9 through 12, is east of the Cadiz Project. This high school has approximately 500 regular students. Bus transportation is available to Needles High School from Amboy, approximately 72 miles east of Needles.

Libraries

The San Bernardino County Public Library (SBCPL) provides library service to 18 cities and unincorporated areas in San Bernardino County. The closest branches of the SBCPL system are in Twentynine Palms, approximately 50 miles southwest of the Cadiz Project, and Needles, approximately 60 miles east of the Cadiz Project. The Twentynine Palms Library occupies 5,000 square feet and has 37,000 volumes. This library is open 52 hours a week.

The Needles Library is staffed by a full-time librarian, a library assistant and page help, and is open 48 hours a week. It occupies 5,568 square feet and has 30,000 volumes.

A bookmobile, which serves the Cadiz area, is headquartered at the Needles Library. This bookmobile visits the Cadiz area on a weekly basis and is staffed by two persons.

Medical Facilities

The nearest medical facilities to the Cadiz Project site are in Needles, approximately 60 miles to the east. The San Bernardino County Health Department's office in Needles operates a health clinic, providing tuberculosis screening, flu vaccines, family planning and child care services.

Medical aid and ambulance services to the Cadiz Project area are provided from Twentynine Palms or Needles, when needed. The Sheriff's Department helicopter, the CHP air ambulance or Mercy Air Service can provide assistance in the case of emergencies for transporting patients to the nearest medical facilities. Response time varies from fifteen minutes to one hour depending on mode.

5.12.2 THRESHOLDS OF SIGNIFICANCE

A project will normally have a significant adverse environmental impact on public

services including fire protection, police and law enforcement, emergency medical services, schools, parks, libraries, or other public facilities, if it will result in:

- Substantial adverse physical impacts associated with the provision of new or physically-altered governmental facilities.

- The need for new or physically-altered governmental facilities which would cause significant environmental impacts in order to maintain acceptable service ratios, response times or other performance objectives.

5.12.3 METHODOLOGY

The potential impacts of the Cadiz Project on public facilities were evaluated based on written correspondence with local public service agencies, information in the Cadiz Valley Agricultural Development Final EIR (1993) and various 1999 San Bernardino County public service studies. The correspondence with the public services and utilities written is provided in the Public Participation Report on file at Metropolitan.

5.12.4 IMPACTS

The Cadiz Project is located in an undeveloped area with minimal provision of existing public services. Although the project would bring in large amount of construction equipment and workers over the short term, only a few workers will be added during project operations. During construction, contractors would be responsible for construction site security and worker safety per state and federal safety regulations. Therefore, the Cadiz Project would have little or no impact on public services. Potential impacts on public services for the Cadiz Project alternatives would be short term and would occur only during construction of the Cadiz Project. The need to close Cadiz-Rice Road and/or limit access to vehicular traffic would result in similar impacts for each type of emergency response service and Cadiz Project alternative. However, under mitigation measures PS-1 and PS-2, provided later in this section, closures and/or delays would be coordinated with emergency service providers. Overall, there would be no significant short or long term increase in the demand for any public services directly resulting from the Cadiz Project.

Impacts of the Eastern and Eastern/ Canal Alternatives

Police and Law Enforcement Services

Potential impacts to police and law enforcement from proposed actions are typically expressed as an increased demand for these services and potential disruption of service due to restricted vehicular access during construction.

Construction of the Eastern or Eastern/Canal Alternative would not require additional police and law enforcement services in the Cadiz Project area. During construction, the potential short term impacts on police services would be related to the ability of the SBCSD to respond to emergency situations in the Cadiz Project area. Open trenches and/or temporary storage of construction materials and equipment on the Cadiz Project area could impede or prevent access for law enforcement vehicles through the site. However, these potential construction impacts would be considered temporary and, therefore, would not be anticipated to be significant.

Construction and traffic detour signs would be placed accordingly throughout the Cadiz Project area to reduce adverse impacts related to police/law enforcement services access to and through this area during construction.

Safety related issues could be a potential impact during non-construction hours. However, construction may occur up to 24 hours/day and 7 days/week. Mitigation measure PS-3, provided later in this Section, requires that construction personnel post necessary warnings and construct barriers to prevent access to open trenches and other active construction areas. Construction crews would be responsible for properly securing active construction areas at the end of each workday.

Fire and Emergency Services

It is not anticipated that a significant increase in demand for fire protection or medical services would be needed in the short or long term. Construction of the Cadiz Project would attract between approximately 1,200 and 1,400 construction workers to the Cadiz Project area at any one time, depending on the alternative. However, some workers would be expected to commute from neighboring communities such as Barstow, Essex, Needles, Twentynine Palms and Desert Center. Service demand could increase due to the possibility of heat exhaustion and/or sunstroke due to the extreme warm temperatures in the Cadiz area during periods of extreme heat waves. In addition, accidents with equipment may occur. This demand would largely be met by temporary provision of emergency medical services to address heat-related illnesses and minor injuries in the construction areas. Open trenches and/or temporary storage of combustible construction materials and equipment could impede access for emergency vehicles through the Cadiz Project area. Therefore, there would be a minor increase in the demand for emergency medical services in the short term. The existing fire station at Wonder Valley would be adequate to meet the demand for fire and emergency services arising from project construction. Therefore, the Eastern and Eastern/Canal Alternatives would not result in significant adverse impacts related emergency services.

The SBCFD has indicated that the Cadiz Project would not generate the need for additional fire service equipment and personnel to meet short-term increases in demand. The Cadiz Project would not be anticipated to change response times or create the need for additional facilities. Therefore, the Cadiz Project would be anticipated to result in impacts that are below a level of significance.

Temporary construction roads and provision of water supplies for fire fighting would be required during construction. Construction contractors would be required under mitigation measure PS-1, provided later in this Section, to prepare and implement temporary fire control systems and plans consistent with the requirements of the SBCFD. Therefore, the overall impact during construction would be below a level of significance.

It is not anticipated that the Cadiz Project would adversely impact long term fire and emergency services to the Cadiz Project area since only a very small number of new long term employees will be present

on site. In addition, water facilities do not generally experience fires.

Schools

The Cadiz Project does not include temporary or permanent residential development. Therefore, the Cadiz Project is not anticipated to result in an increase in the permanent population in the area or in the need for schools. Because the Cadiz Project would not generate the need for housing or school services, the project would not result in the need to expand existing or construct new school facilities/or affect school related services.

Construction of the Eastern and Eastern/Canal alternatives would not directly or indirectly impact schools because there are no schools on or in the immediate vicinity of the Cadiz Project area. Therefore, no construction-related impacts on school facilities and services are anticipated.

Libraries

The Cadiz Project does not include temporary or permanent residential development, and would not result in an increase in the permanent population in the area. Therefore, the construction and operation of the Eastern and Eastern/Canal Alternatives would not require an expansion of library facilities or an addition to the bookmobile serving the Cadiz area. As a result, the Cadiz Project would not result in an increase in the demand for, or a significant adverse impact on, library services.

Construction under the Eastern and Eastern/Canal alternatives would not directly or indirectly impact existing libraries, as there are no libraries on or in the vicinity of the Cadiz Project area. Therefore, no construction-related impacts on library services would occur.

Impacts of the Western Alternative Related To Public Services

The potential impacts of the Western Alternative related to police and law enforcement services, fire and emergency services, school services and library services would be the same as the potential impacts evaluated under the Eastern and Eastern/Canal Alternatives.

Impacts of the Combination Alternative Related to Public Services

The potential impacts of the Combination Alternative related to police and law enforcement services, fire and emergency services, school services and library services would be the same as the potential impacts evaluated under the Eastern and Eastern/Canal Alternatives.

Impacts of the No Project Alternative Related to Public Services

The No Project Alternative would not include any of the construction impacts on public services associated with the project alternatives.

5.12.5 MITIGATION MEASURES

PS-1 Metropolitan, or its contractors, will submit a construction-phasing plan to the SBCFD. The plan will be consistent with SBCFD Fire Code requirements for temporary fire control and emergency response.

PS-2 Metropolitan, or its contractors, will coordinate with the applicable public service providers to determine their needs to protect existing facilities and services

during the construction of the Cadiz Project.

PS-3 During construction, warnings and construction barriers shall be constructed and maintained to prevent access to open trenches and other active construction areas.

5.12.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Construction of any of the Cadiz Project alternatives would result in short-term impacts on police and law enforcement services, and fire and emergency services. However, this increase in demand in the short term would not generate the need for additional staff, equipment or facilities to maintain acceptable levels of service. The Cadiz Project build alternatives would not directly result in substantial increased demand for any public services over the long-term. Implementation of mitigation measures PS-1, PS-2 and PS-3 would reduce potential impacts to below a level of significance for all the Cadiz Project alternatives.

5.13 UTILITIES AND SERVICE SYSTEMS

5.13.1 AFFECTED ENVIRONMENT

The Cadiz Project area is located in a very rural area with little or no local utility services. Of the known utilities within the area, Pacific Bell (PacBell), Pacific Gas and Electric (PG&E), and Southern California Edison (SCE) have facilities. In addition to these utilities, there are two interstate crude oil pipelines which transverse the Cadiz Project area. One is owned and operated by the All American Pipeline, L.P. (formerly All American Pipeline Company) and the other by Questar as shown on Figure 5.13-1.

Telephone

PacBell provides services to the communities of Amboy and Cadiz through microwave transmissions and underground local telecommunication lines. PacBell's telephone conduits and microwave transmission towers are not located within the Cadiz Project area, however. Local lines are limited to the communities north of the Cadiz Project site, along National Trails Highway.

Each of the railroad companies in the area, BNSF and the ARZC, has its own telephone lines located adjacent to and within the rights-of-way of their respective rail lines.

Both AirTouch Cellular and AT&T Wireless provide service in the Cadiz Valley through booster stations. The AirTouch Cellular and the AT&T Wireless booster stations are located within the Cadiz Project area.

Crude Oil

Both All-American Pipeline, L.P. and Questar have interstate crude oil, pipelines within the Cadiz Project area.

All American Pipeline, L. P. owns and operates a 30-inch diameter, high pressure, common carrier, crude oil pipeline. This pipeline flows northwest to southeast through a portion of the Project wellfield. A pump and heater station (Cadiz Station) is located in the southeast corner of Section 26, T5N, R14E. This pump station is located in the southeastern corner of the Project wellfield and adjacent to Cadiz-Rice Road. Pump station facilities include two 150,000 barrel floating roof crude oil storage tanks and other facilities and equipment.

The Questar pipeline runs generally southwest to northeast through the Project wellfield. Both the All American and Questar pipelines cross the proposed Cadiz Project water conveyance facilities for all project construction alternatives.

Natural Gas

Three interstate natural gas pipelines, and appurtenant facilities are located north of National Trails Highway and north of the Cadiz Project area. One pipeline facility is owned and operated by PG&E and is utilized to provide natural gas service in the general vicinity of the Cadiz Project area. A second pipeline facility, located approximately 200 feet to the north, is owned and operated by the Mojave Pipeline Operating Company. A third pipeline facility, located several miles north of the PG&E and Mojave Pipeline Operating Company facilities, is owned and operated by SCE.

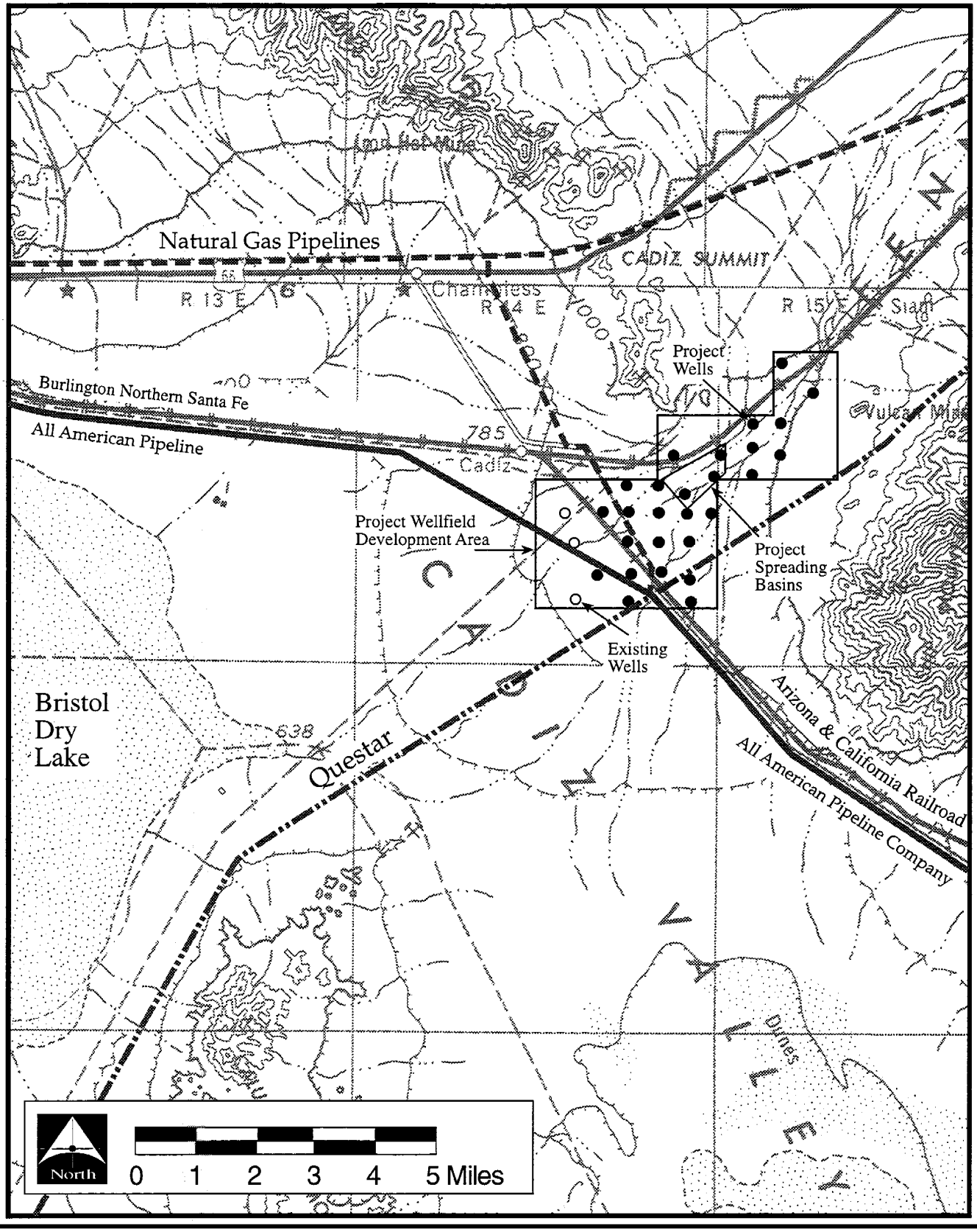


Figure 5.13-1

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Railroads and Pipelines in Proximity to the Project Wellfield and Spreading Basins

The All American Pipeline, L.P. owns and operates a 6-inch, underground natural gas pipeline within the Cadiz Project area. This pipeline originates at the PG&E pipeline and runs south, along the east side of the ARZC rail line. The pipeline then crosses to the west side of the ARCZ rail line to provide natural gas to the Cadiz pump station.

Electricity

SCE provides electrical service to Amboy, Cadiz and other communities located on National Trails Highway.

Currently, the only electrical lines at the Cadiz Project area are those servicing the limited domestic and related uses in the communities along National Trails Highway.

Sewer

Sewage disposal is handled locally using septic tanks and leach lines. There are no public sewage treatment plants serving the Cadiz Project area.

Water

Residents and businesses in the nearby communities of Amboy, Chambless and Essex, to name a few, obtain water using private wells or water is shipped in by truck or rail. Cadiz Inc. agricultural operations provide their own domestic water supply and agricultural irrigation water supply needs through their existing groundwater wells.

Storm Drains

The Cadiz Project area consists of mountainous regions scattered through low lying valley areas. Runoff becomes concentrated through the mountain ravines, and as a result, flash floods occur in the valleys. Due to the lack of development, storm drain systems operated by a public agency do not exist in the area. Individual entities, however, have taken precautions to protect their facilities. The ARZC and BNSF have constructed and maintain levees along their respective rail lines alignments to divert runoff to undercrossings to protect their rail lines and other facilities.

Solid Waste Disposal Facilities

Solid waste generated by the Cadiz Inc. agricultural operations is collected by Sierra Environmental and is transported to the Twentynine Palms Landfill. This landfill has sufficient capacity to dispose of additional amounts of solid waste into the foreseeable future. Private residences located in the vicinity of the Cadiz Project area individually dispose of their solid waste. For example, individuals haul their solid waste to the Twentynine Palms landfill or another permitted facility.

5.13.2 THRESHOLDS OF SIGNIFICANCE

A project will normally have a significant adverse environmental impact on utilities and service systems if it results in:

- Exceedance of the wastewater treatment requirements of the Colorado River Basin Regional Water Quality Control Board.

- A need for expansion or construction of new water or wastewater treatment facilities, the construction of which could cause significant environmental effects.

- A need for expansion or construction of new storm water drainage facilities, the construction of which could cause significant environmental effects.

- The need for significant new or expanded water supplies or water entitlements.

- A determination by the local wastewater treatment provider that, in addition to its existing commitments, it cannot serve the project because of a lack of adequate wastewater treatment plant capacity.

- Insufficient permitted capacity in the landfill serving the project to accommodate the project's solid waste disposal needs.

- Disruption of service provided by privately owned utility companies.

- Conflict with federal, state or local statutes and regulations related to solid waste disposal.

5.13.3 METHODOLOGY

Several resources were utilized to obtain utility information. These resources included a request to DigAlert, review of USGS quadrangle maps, and phone consultation. After reviewing the responses from DigAlert and the USGS maps, a utility request package was prepared for distribution. This utility package included maps of the Cadiz Project area, a description of the Cadiz Project, and a request for information sent to each utility company regarding its facilities in the Cadiz Project area.

To facilitate the request for information, follow up telephone calls were made. In several cases, additional multiple information packages were prepared for several individuals within the same utility company in order to ensure that the correct individuals were contacted. Attempts were made to contact unresponsive addressees by phone and voice message, where possible.

Typically, a lack of response was due to the absence of any utility company facilities within or sufficiently close to the Cadiz Project area. Of those utility companies that did respond, the majority sent a letter asking questions regarding their concerns about the Project but omitted maps of their facilities. Follow up to obtain the locations of facilities within or serving the Cadiz Project area often had to be made. Whenever possible and available, the utility companies provided maps detailing the locations of their respective facilities.

5.13.4 IMPACTS

Eastern Alternative

Telephone

Construction and operation of the Cadiz Project would result in a slight increased

need for telephone communication services to serve the telecommunications needs for facilities such as the Cadiz Pumping Plant, Project wellfield and related Cadiz Project facilities. During construction, communications are expected to use cell phones and two-way radios. The Project would also install its own telecommunications wiring. Existing telecommunications booster stations would be used. The volume of communications resulting from Cadiz Project operations would not result in a need for additional or upgraded booster stations. Therefore, no significant adverse impact would be created on telephone services as a result of the Cadiz Project.

Crude Oil

The construction of the Cadiz Project would be coordinated with All American Pipeline, L.P. and Questar. All American Pipeline, L.P. has indicated that it should be possible to construct Cadiz Project water conveyance facilities beneath their existing facilities. This would require adherence to All American Pipeline, L.P. operating procedures. For example, an adequate amount of cover would be provided between and separating the water conveyance facilities from All American's existing pipeline. Blasting near oil pipelines would not be permitted due to potential explosion hazard.

Natural Gas

Although the use of natural gas was considered as a power source for the Cadiz Project to eliminate the need for lengthy electrical transmission lines, it was determined that natural gas would not be used in the construction or operation of the Cadiz Project facilities. Refer to Section 5.9 (Energy and Mineral Resources) for a description of this analysis. The water conveyance facilities would be designed to avoid the All American Pipeline, L.P. facilities, including its 6-inch natural gas pipeline. Proper separation of conveyance facilities and other Cadiz Project facilities from the gas pipeline will be incorporated into the Cadiz Project design. For example, if necessary, the conveyance facilities would be constructed underneath the gas pipeline and in accordance with the requirements of the pipeline owners and operators. Blasting near the gas pipeline would not be permitted due to potential explosion hazard. Therefore, construction of the proposed Cadiz Project would not significantly impact the existing natural gas pipelines, nor would natural gas be required for project operations.

Electricity

Construction of the Cadiz Project would require electricity to operate construction equipment. This would be provided by the use of portable generators and the use of electrical power presently available at Cadiz and at Iron Mountain Pumping Plant. Substantial amounts of electrical power would be required on a long-term basis to operate Project wellfield pumps and the Cadiz Pumping Plant when extraction or spreading activities are occurring. Some electrical power would be needed for security lights at Cadiz Project facilities. Electricity to power these facilities would be obtained from Metropolitan's power supply currently used to provide power to other pumping plants along the Colorado River Aqueduct. As explained in Section 5.9 (Energy and Mineral Resources), other pumps would be taken off-line when the

Cadiz Project was in spreading or withdrawal mode. New electrical equipment would be installed as necessary to supply power to Cadiz Project facilities. These new power lines would parallel the water conveyance facility and wellfield pipelines. Therefore, Metropolitan's existing power supply is sufficient to power the Cadiz Project facilities.

Water

A supply of water would be required to construct the Cadiz Project. Water would also be consumed on a daily basis by construction crews and by operations and maintenance staff once the Project has been constructed. Construction water would be obtained from Cadiz Inc. agricultural operations wells and from Iron Mountain Pumping Plant. Water used for construction purposes would be trucked to construction areas and stored in tanks. During construction, a large quantity of water would also be needed for pressure testing the water conveyance facility. Since a sufficient supply of water is currently available in the Cadiz Project area, the Project would not create a significant adverse impact on the area's water supply or water supply facilities.

Stormwater Runoff Facilities

Cadiz Project construction activities would not impact any existing storm runoff facilities. Construction activities would also avoid impacts to the drainage diversion berms constructed by the railroads.

Solid Waste Facilities

Construction of the Cadiz Project would generate small quantities of solid waste. This solid waste would be associated with construction worker activities such as meals, office record keeping, etc. This waste material would be collected and periodically hauled off the site to be disposed of at the Twentynine Palms Landfill. Cadiz Project operations would generate only negligible quantities of solid waste associated with permanent employee activities such as operation and maintenance of Project spreading basins and Cadiz Pumping Plant maintenance. Since sufficient capacity is available in the Twentynine Palms Landfill, the proposed Project would not adversely impact the solid waste disposal facility.

Western Alternative

Construction and operation of the Western Alternative would result in the same impacts to services and utility systems as would occur under the Eastern Alternative. The Western Alternative requires construction of power lines from the Iron Mountain Pumping Plant to the West Portal in order to connect the Cadiz Project to Metropolitan's existing electric power supply.

Combination Alternative

Construction and operation of the Combination Alternative would result in the same impacts to service and utility systems as would occur under the Western Alternative.

Eastern/Canal Alternative

Construction and operation of the Eastern/Canal Alternative would result in the same impacts to service and utility system as would occur with the Eastern Alternative. The canal segment of the

Eastern/Canal Alternatives does not cross any pipelines or other utility lines.

No Project Alternative

The No Project Alternative would have no impact on utilities and service systems because the Cadiz Project would not be constructed, operated or maintained.

5.13.5 MITIGATION MEASURES

The following mitigation measures are proposed to reduce the Cadiz Project's impacts on utility and services systems.

USS-1 The water conveyance facilities shall be constructed underneath the existing crude oil and natural gas pipelines. All construction activities shall be closely coordinated with the operators of the affected oil and gas pipelines.

USS-2 Utilities that the conveyance facilities crosses underneath shall be supported in place during pipeline construction.

USS-3 Should a utility line be damaged during Cadiz Project construction activities, the utility service providers shall be immediately contacted to determine appropriate repair actions.

5.13.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

With implementation of mitigation measures USS-1 through USS-3, impacts of the Cadiz Project on utilities and service systems would be reduced to below a level significance for all project alternatives.

5.14 AESTHETICS

5.14.1 AFFECTED ENVIRONMENT

Aesthetics

The Cadiz Project site is located in a generally undeveloped area in the Mojave Desert. The area has expansive views of sand, rocks and scrubby growth to views of distant mountain ranges. Parts of the north end of the Cadiz Project are currently cultivated. The green of citrus trees and table grapes contrasts sharply with the tans and muted tones of the native desert landscape. North of the northernmost cultivated land on the Cadiz Project site, there is a small airstrip with a temporary office. The only other development in the study area, aside from unpaved roads, is the Iron Mountain Pumping Plant at the southern end of the Cadiz Project area. The Iron Mountain Pumping Plant is owned and operated by Metropolitan. It consists of a pumping plant, forebay, electric power substation, housing for staff, maintenance facilities and a small airstrip.

There are no state or local scenic highways that have views of the Cadiz Project site.

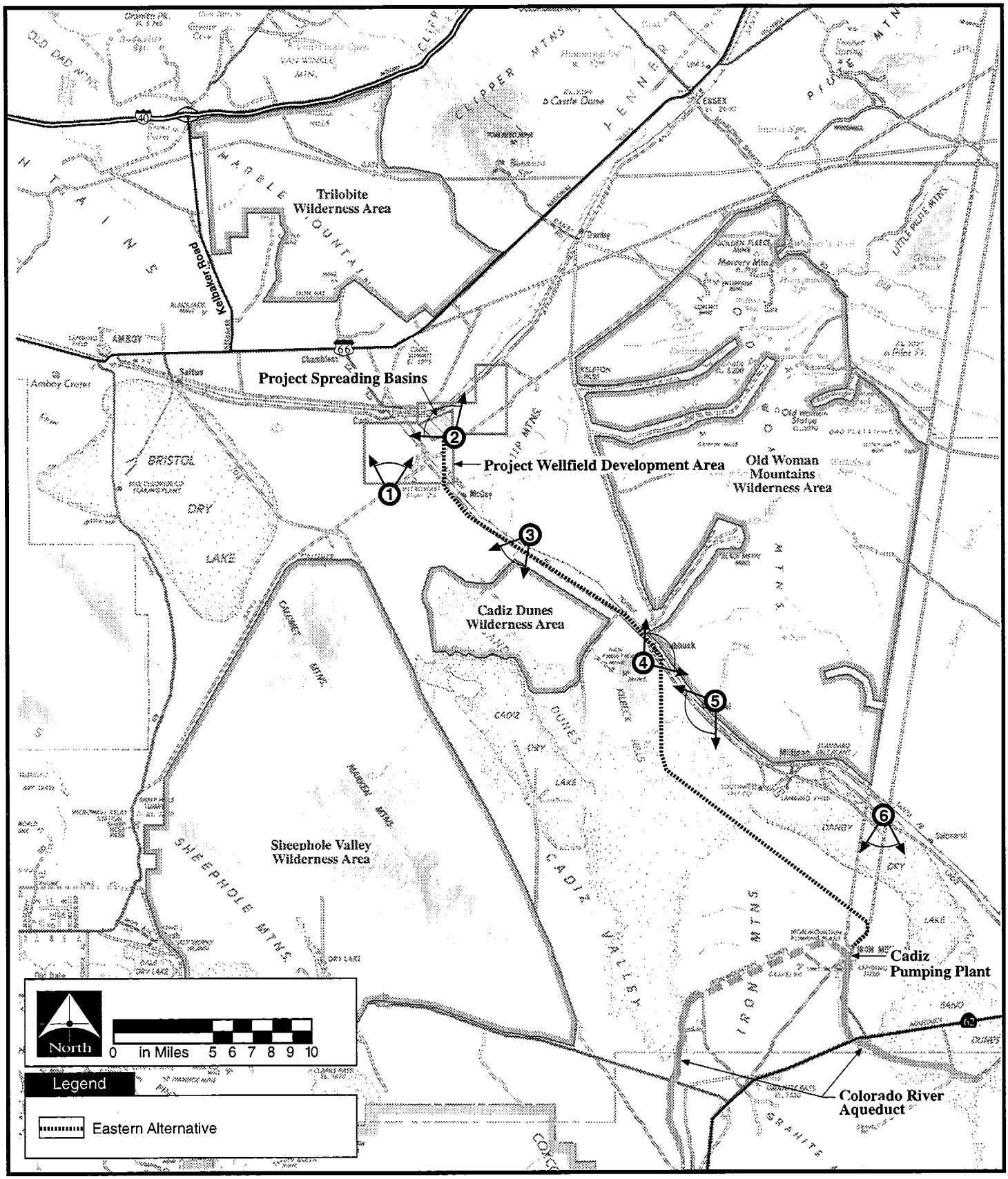
There are four Federal Wilderness Areas managed by the BLM in the vicinity of the Cadiz Project, as shown later on Figure 5.17-1. The Trilobite Wilderness Area is north of the Cadiz Project site, with the closest boundary approximately 3.5 miles away. Much of this Wilderness Area is shielded from the Cadiz Project area by the southern part of the Marble Mountains. The Old Woman Mountains Wilderness Area is east of the Cadiz Project area. The western boundary of this Wilderness Area would be more than six miles from the Project wellfield wells and Project spreading basins located in the northern part of the Cadiz Project area. However, part of this Wilderness Area would be within several hundred feet of the Eastern and Eastern/Canal alternatives conveyance and power distribution facilities. Cadiz Dunes Wilderness Area is directly adjacent to the northerly segment of the water conveyance facility alignment common to all the Cadiz Project Alternatives. The northeast boundary of this Wilderness Area lies within a 100 feet of the alignment for a distance of approximately five miles. The southeast boundary of Cadiz Dunes wilderness area is also proximate to the Western Alternative. The Sheephole Valley Wilderness Area is west of the Cadiz Project area. At the closest point, the east boundary of this Wilderness Area is approximately five miles away.

Eastern and Eastern/Canal Alternatives

5.14-1 illustrates the vantage points and directions from which photographs of existing views of the Cadiz Project area were taken. Photographs of existing views of the Cadiz Project area, shown in 5.14-2, are described in the following sections.

Photo 1. This view is from the location of the Project wellfield looking north/northwest. A field of table grapes is on the left side of the dirt road and an oleander hedge is on the right side. The Marble Mountains are in the far distance, outside the Cadiz Project area.

Photo 2. This view, looking northwest across the location of the Project spreading basins, shows sparse vegetation stretching into the distance and the Marble Mountains in the background in the center and left of the photograph. The Clipper Mountains



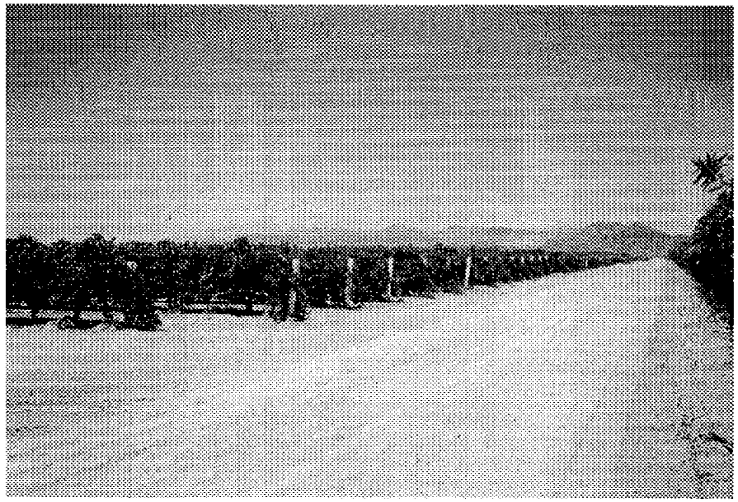
Source: P&D Consultants, Inc. (1999).

Figure 5.14-1

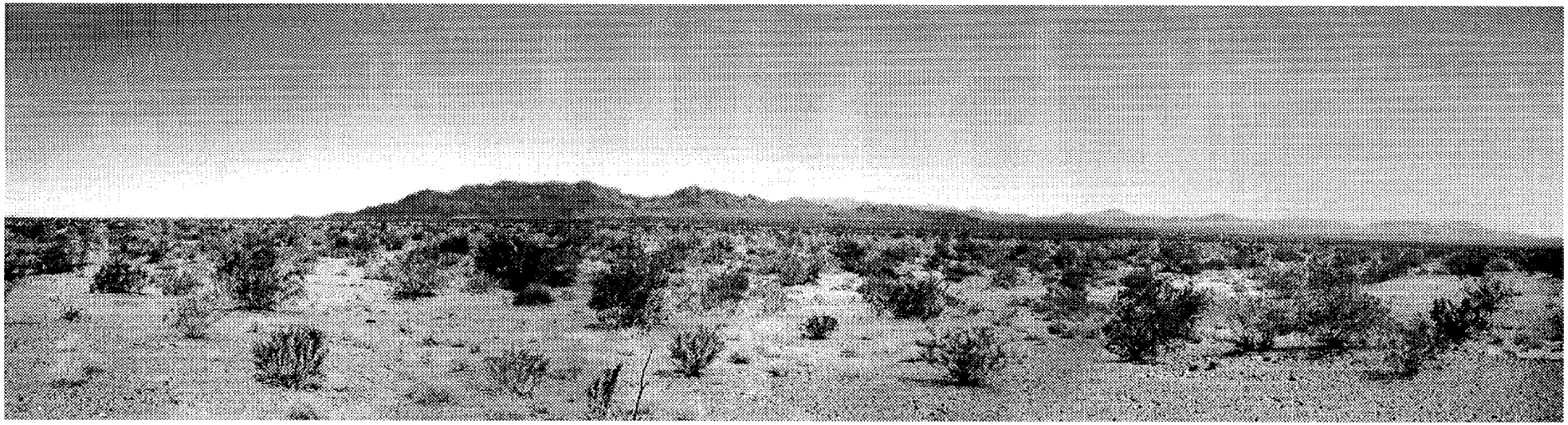
Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Eastern Alternative Photo Key Map



1. Project wellfield area looking north/northwest.

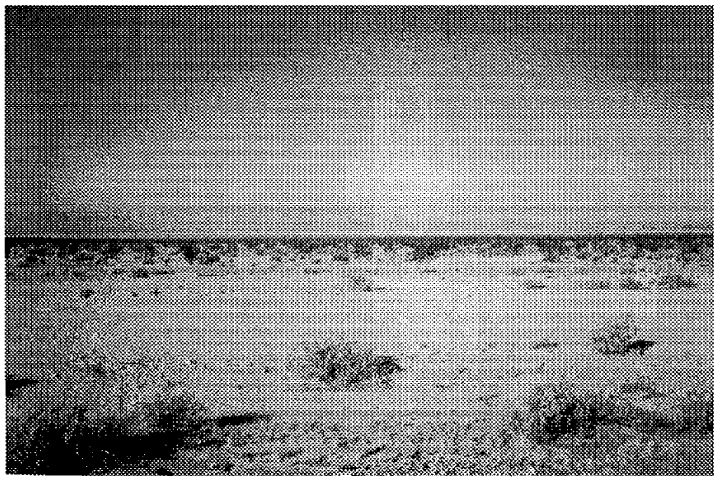


2. Project spreading basin area looking northwest.

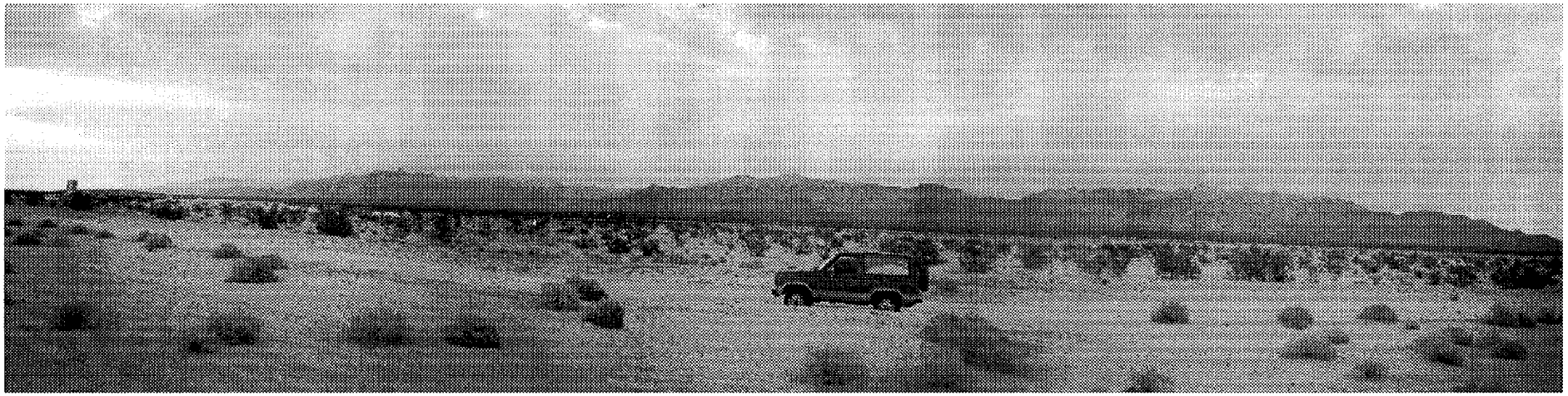
Figure 5.14-2

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Eastern Alternative Site Photos (Page 1 of 3)



3. From Cadiz-Rice Road looking southwest to Cadiz Dunes Wilderness Area.

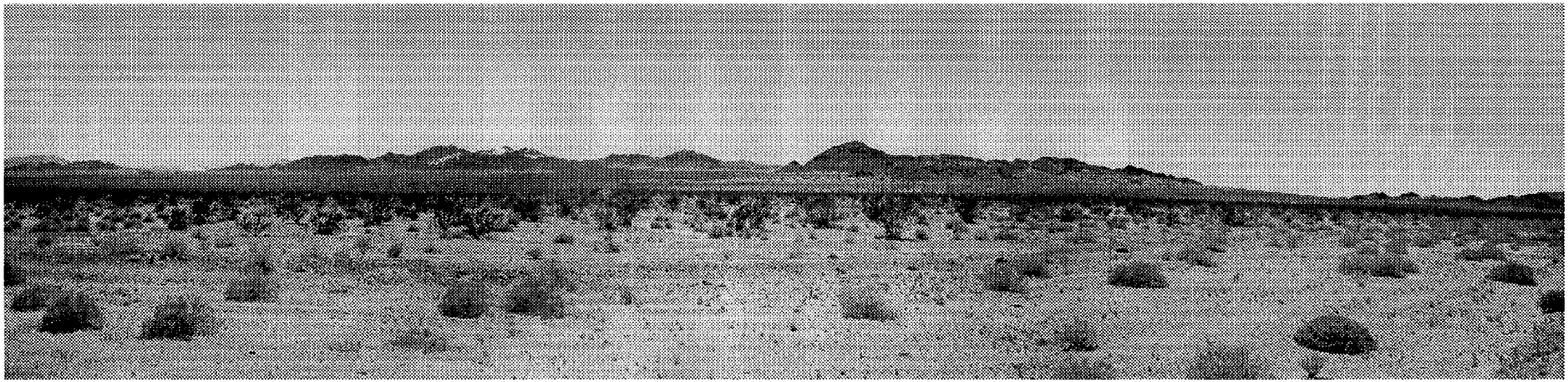


4. From Cadiz-Rice Road looking northeast across the water conveyance facility alignment to the Old Woman Mountains and Wilderness Area.

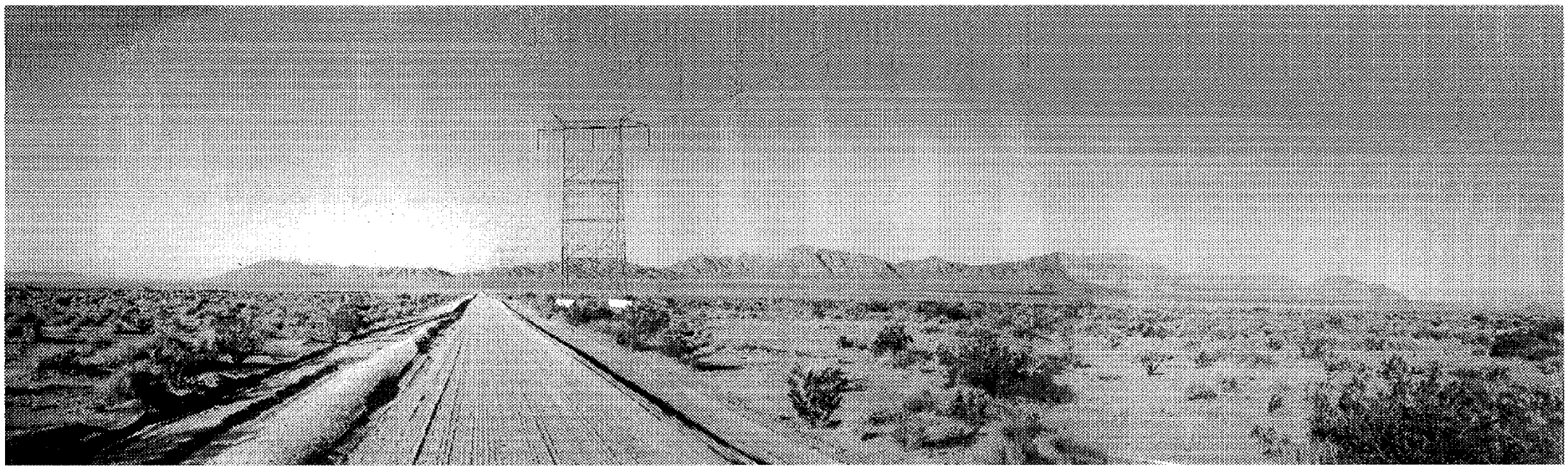
Figure 5.14-2

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Eastern Alternative Site Photos (Page 2 of 3)



5. From Cadiz-Rice Road looking west across the water conveyance facility alignment to the Kilbeck Hills.



6. From an unnamed road looking south/southwest across Danby Dry Lake, past the water conveyance facilities alignment, to the Iron Mountains.

Figure 5.14-2

Eastern Alternative Site Photos (Page 3 of 3)

are visible in the right of the photograph. The BNSF rail lines which cross the Cadiz Project area on the north side of the location of the Project spreading basins are not visible in this view.

Photo 3. This view is from the north side of Cadiz-Rice Road adjacent to the location of the proposed water conveyance and power distribution facilities looking southwest across Cadiz-Rice Road to the Cadiz Dunes Wilderness Area just beyond Cadiz-Rice Road. The light stripe in the distance is Cadiz Dry Lake and farther in the distance is the Calumet Mountain range. The location of the proposed water conveyance and power distribution facilities is behind the point where the photo was taken.

Photo 4. This view is from the southwest side of Cadiz-Rice Road looking across the location of the water conveyance and power distribution facilities to the Old Woman Mountains Wilderness Area and the Old Woman Mountains in the northeast. The location of the alignment for these facilities is between Cadiz-Rice Road and the ARZC track to the east. The edge of the Old Woman Mountains Wilderness Area is adjacent to the east side of the rail line at this view point. In the far left of the photograph, the ruins of the abandoned Chubbuck Station are visible.

Photo 5. This view is from Cadiz-Rice Road looking west across the location of the water conveyance and power distribution facilities and the Kilbeck Hills beyond.

Photo 6. This view looking south/ southwest is taken from south of Cadiz-Rice Road on an unnamed dirt road that crosses Danby Dry Lake. The canal segment of the Eastern/Canal Alternative would be visible here. Danby Dry Lake is visible as a light line across the photograph in front of the Iron Mountains in the distance. The water conveyance and power distribution facilities for the Eastern Alternative, between Danby Dry Lake and the Iron Mountains, would be approximately four miles from this view location. The dominant feature in the view is one of a series of Southern California Edison and Metropolitan electrical power transmission towers and high voltage lines. These facilities provide electricity to the Iron Mountain Pumping Plant, located on the far side of the Iron Mountains in this photograph, as well as to Southern California Edison customers.

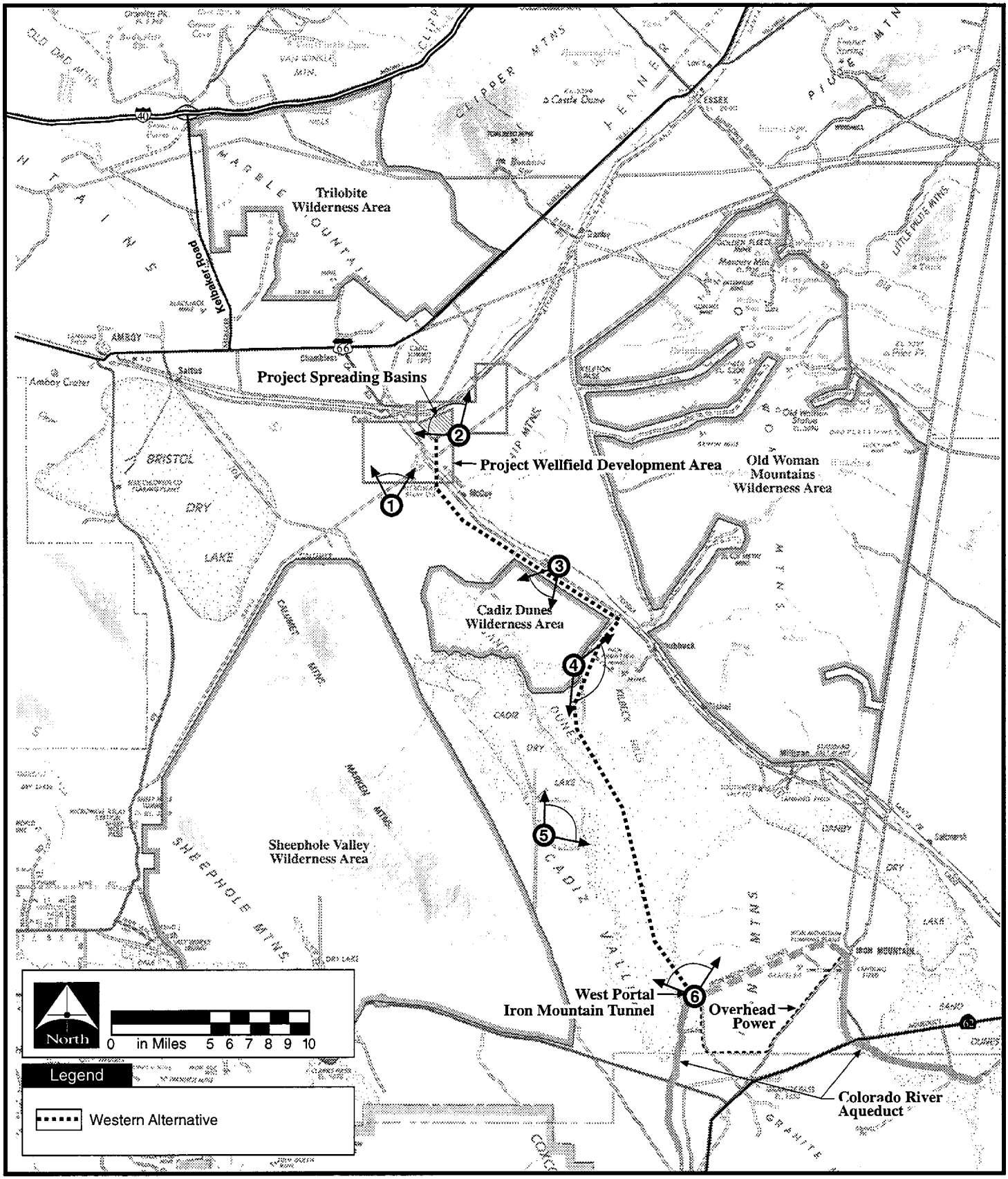
Western Alternative

Figure 5.14-3 illustrates the vantage points and directions from which photographs of existing views of the Western Alternative were taken. Photographs of existing views of the Cadiz Project area are shown in Figure 5.14-4 and are described in the following sections.

Photos 1 through 3. Vantage points 1 through 3 on Figure 5.14-3 are the same as vantages point 1 through 3 shown earlier on Figure 5.14-1 for the Eastern Alternative. Photographs for these points are shown on Figure 5.14-2 and described in the text for the Eastern Alternative.

Photo 4. This view is from a dirt road along the southeast boundary of the Cadiz Dunes Wilderness Area looking across the location of the Western Alternative southeast to the Kilbeck Hills beyond. The most dominant feature is the range of hills in the distance.

Photo 5. This view is from a point on a dirt road approximately two miles east of the Sheephole Valley Wilderness Area

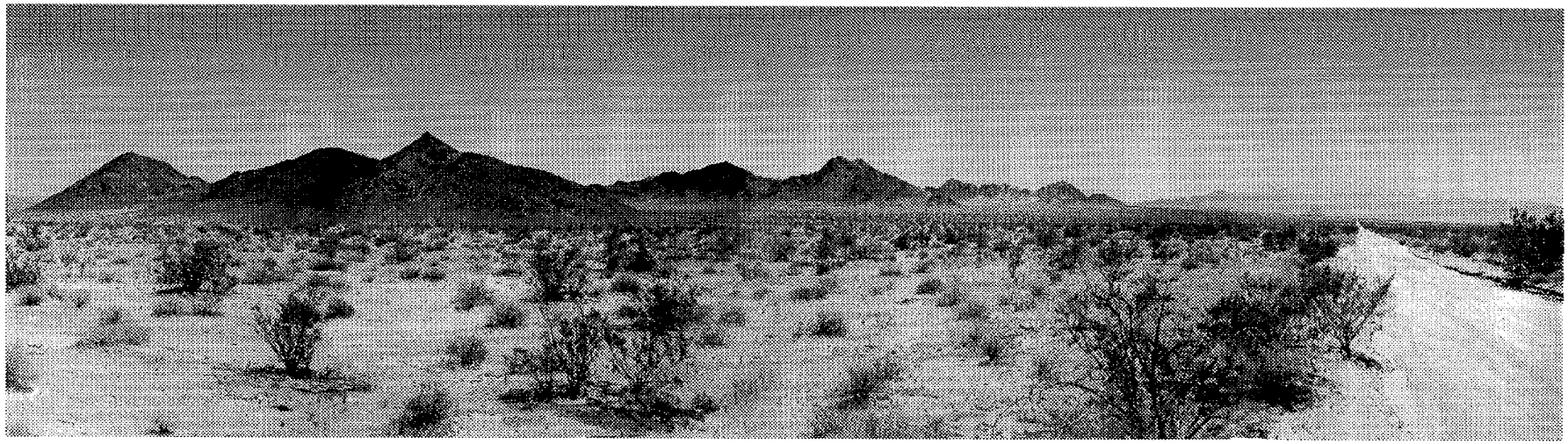


Source: P&D Consultants, Inc. (1999).

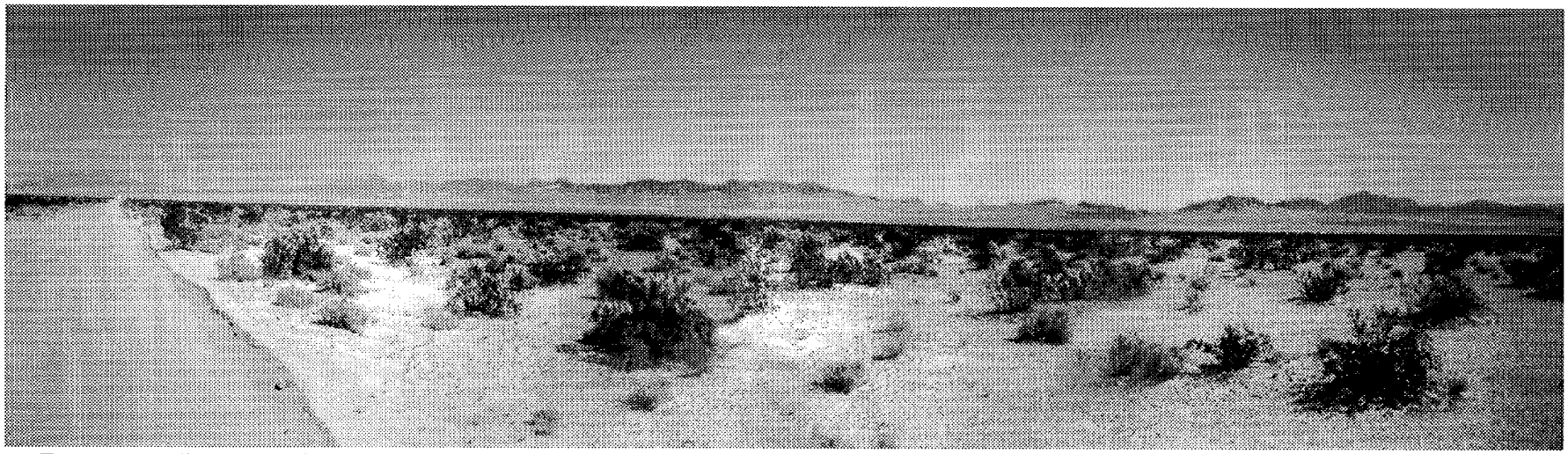
Figure 5.14-3

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Western Alternative Photo Key Map



4. From the southeast boundary of Cadiz Dunes Wilderness Area looking southeast across the water conveyance facility alignment to the Kilbeck Hills.



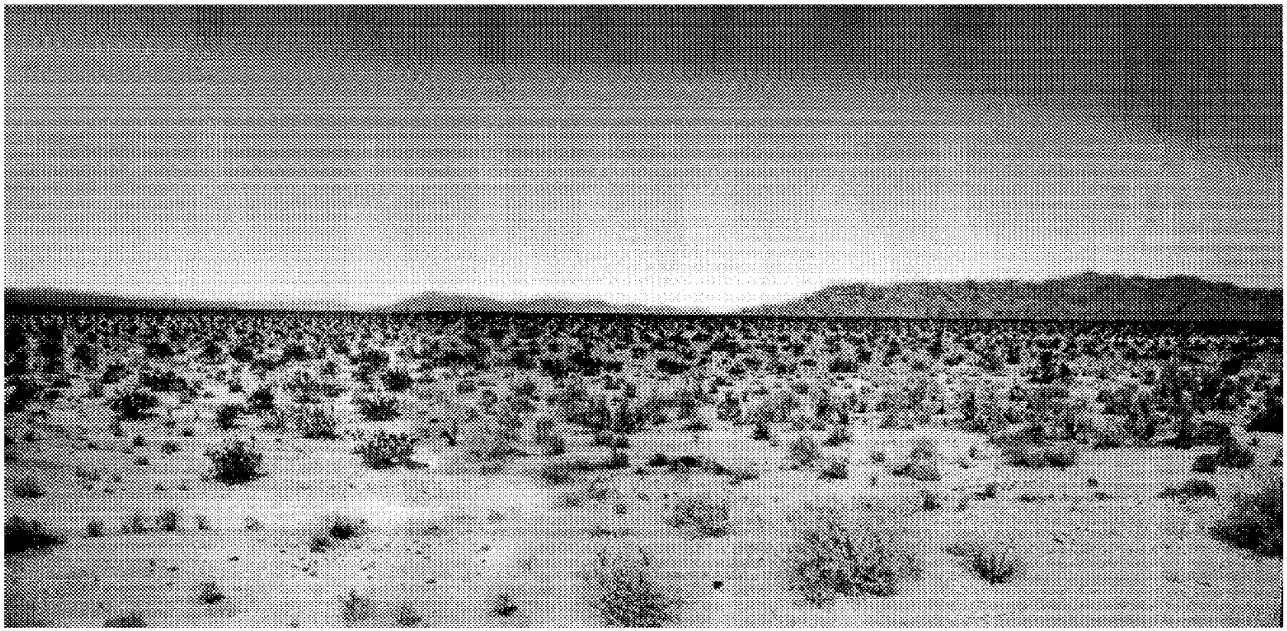
5. From two miles east of the Sheephole Valley Wilderness Area boundary looking northeast. The water conveyance facility alignment is between Cadiz Dry Lake and the Kilbeck Hills.

Figure 5.14-4

Cadiz Groundwater Storage & Dry-Year Supply Program

EIR/EIS

Western Alternative Site Photos (Page 1 of 2)



6. From the proposed substation looking north along the water conveyance facility alignment.

Figure 5.14-4

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Western Alternative Site Photos (Page 2 of 2)

boundary, looking to the northeast. Cadiz Dry Lake is visible as a light area in the center and left of the photo, the Ship Mountains are at the far left, the Kilbeck Hills are in the center of the photo in the distance and the Iron Mountains are in the right of the photo. The location of the water conveyance and power transmission facilities under the Western Alternative would run in front of the Iron Mountains and between Cadiz Dry Lake and the Kilbeck Hills. The location of the water conveyance and power transmission facilities would be approximately four miles from this photo point.

Photo 6. This view, looking north, is taken from the location of the Western Alternative substation which would be located immediately north of the Colorado River Aqueduct. The Iron Mountains are on the right and the Kilbeck Hills are just visible in the center of the photo. Cadiz Dunes are in the left of the photo. The water conveyance and power transmission facilities under the Western Alternative would run in a northwest direction from the center foreground into the distance toward the left of the photo, between Cadiz Dunes and the Kilbeck Hills.

Combination Alternative

Figure 5.14-5 illustrates the vantage points and directions from which photographs of existing views of the location of the Combination Alternative were taken. Photographs of existing views of the Cadiz Project area are shown in Figure 5.14-6 and are described in the following sections.

Photos 1 through 5. Vantage points 1 through 5 on Figure 5.14-5 are the same as vantage points 1 through 5 shown earlier on Figure 5.14.1 for the Eastern Alternative. Photographs for these points are shown on Figure 5.14-2 and are described in the text for the Eastern Alternative.

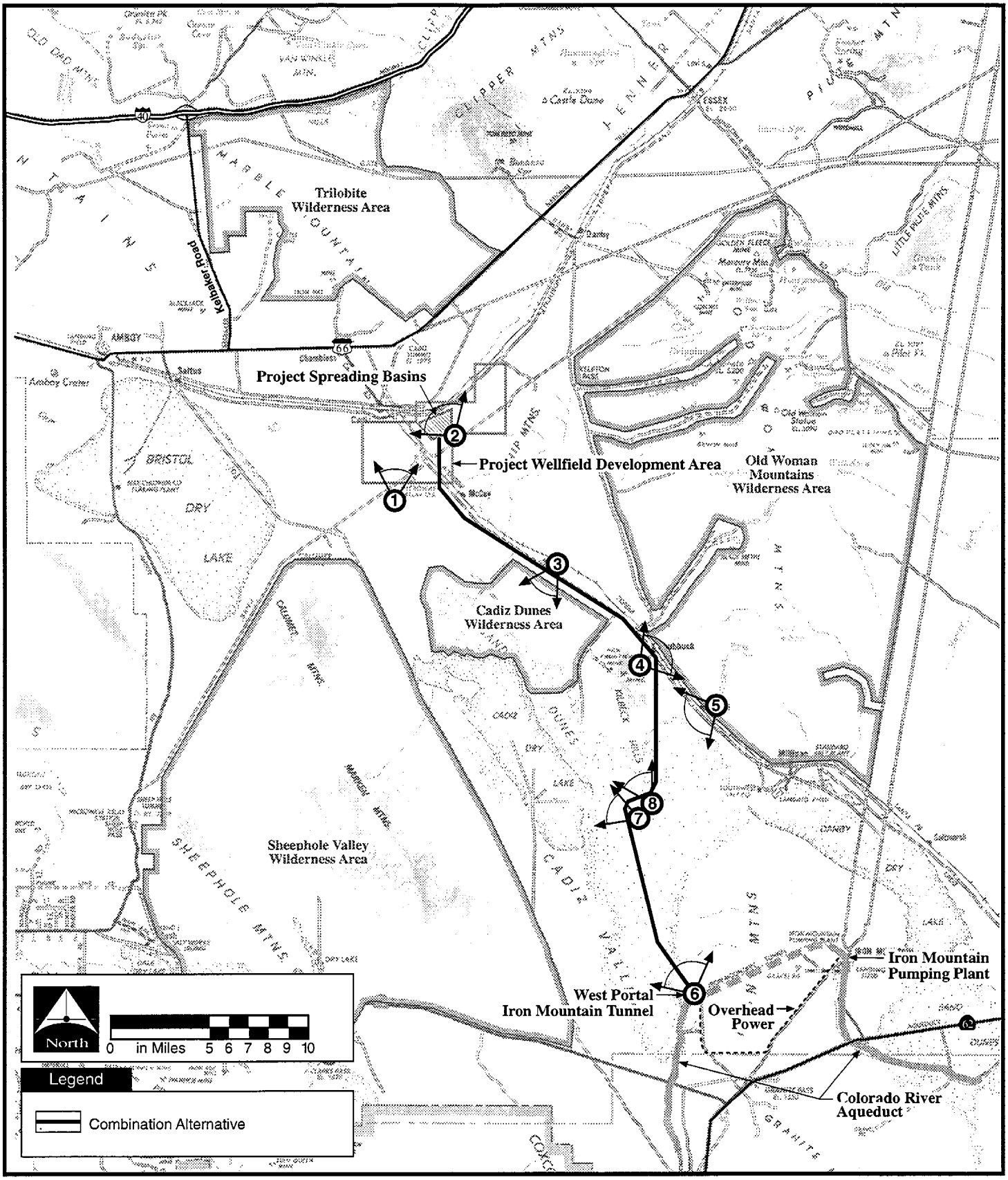
Photo 6. Vantage point 6 on Figure 5.14-5 is the same as vantage point 6 on Figure 5.14-3 for the Western Alternative. The photograph for this point is shown on Figure 5.14-4 and is described in the text for the Western Alternative.

Photo 7. This view is taken from the south side of the location of the water conveyance and power transmission facilities under the Combination Alternative looking toward the northwest, past Cadiz Dry Lake to the Calumet Mountains in the distance. This photo point is extremely remote and is not accessible from a road or four-wheel drive track.

Photo 8. This view is taken from the south side of the location of the conveyance facilities under the Combination Alternative looking north. The Kilbeck Hills are in the right of the photo.

Light and Glare

There are few sources of night light and glare in the vicinity of the Cadiz Project area because it is largely undeveloped. A slight amount of reflection is generated from the windows and bodies of vehicles using Cadiz-Rice Road and the other unpaved roads near the Cadiz Project area. However, traffic in the area is minimal. Night light is also present from infrequent

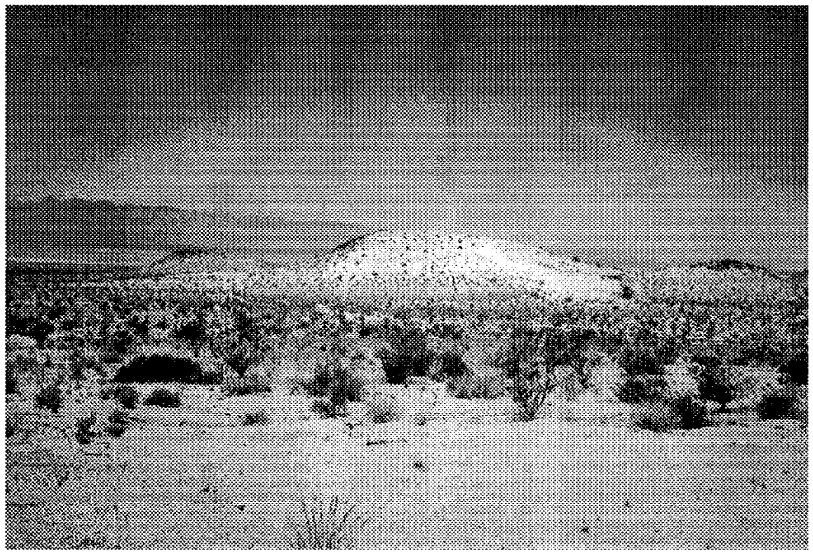


Source: P&D Consultants, Inc.

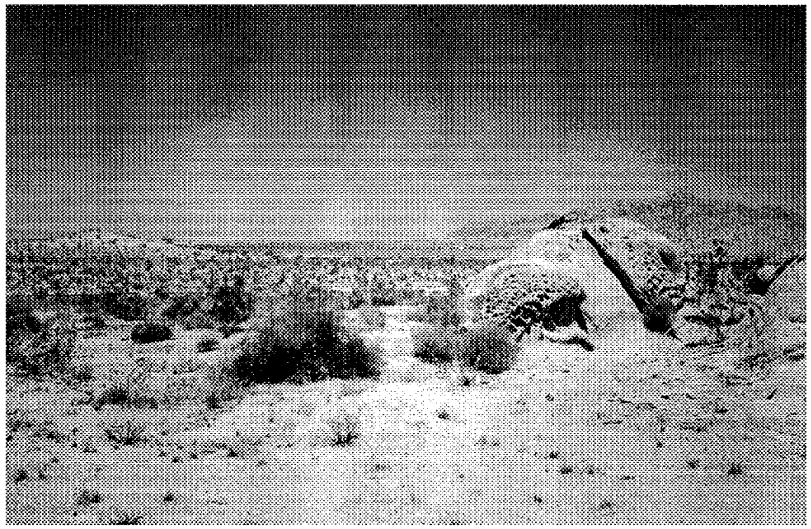
Figure 5.14-5

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Combination Alternative Photo Key Map



7. From south of the water conveyance facility alignment looking northwest across the alignment to Cadiz Dry Lake.



8. From south of the water conveyance facility alignment looking north across the alignment.

Figure 5.14-6

Combination Alternative Site Photos

vehicles using the roads after dark. Lights from several salt mining operations on Bristol and Cadiz dry lakes are visible in the evening hours. There is also night lighting at the Iron Mountain Pumping Plant.

5.14.2 THRESHOLDS OF SIGNIFICANCE

A project would normally have a significant adverse environmental impact related to aesthetics if it results in:

- A degree of visual contrast that that exceeds the parameters of the BLM designated Visual Resource Management classifications.
- A substantial adverse effect on a scenic vista, such as construction and operation activities that strongly contrast with the existing landscape, resulting in discordant elements that would adversely affect the visual quality of a sensitive viewpoint.
- Substantial damage to scenic resources, including but not limited to: trees, rock outcroppings and historic buildings visible from a state or local scenic highway.
- Substantial degradation of the existing visual character or quality of the project site and its surroundings.
- The creation of a new source of light or glare which will adversely affect views in the project area during the day or night.

5.14.2 METHODOLOGY

The potential visual impacts of the Cadiz Project were assessed based on the existing visual characteristics of the site and the surrounding area. The assessment also included the character of the completed Cadiz Project and the Cadiz Project under construction that would be visible from adjacent sensitive land uses. Photographs of the existing area and anticipated changes in views with the Cadiz Project were reviewed. Photographs of the existing visual conditions in the Cadiz Project area and changes in views that would be expected if the Cadiz Project were completed, assisted in identifying the potential aesthetic impacts of the Cadiz Project.

The BLM uses a system called Visual Resource Management (VRM) to: 1) define visual quality and scenic values for land that it manages and to 2) determine acceptable levels of visual modification to these lands. The system has five classes, each with a different degree of acceptable modification to the basic visual elements of form, line, color and texture. The VRM classes are as follows:

Class I. Areas where natural ecological changes and very limited management alterations are allowed. Any contrast created in an existing landscape must not attract attention. This class applies to wilderness areas, wild and scenic rivers and similar situations.

Class II. Areas where changes in any of the basic visual elements of form, line, color and texture caused by a project should not be evident in the existing characteristic landscape. Contrasts may be seen but should not be evident.

Class III. Areas where contrasts to basic elements caused by a project

may be evident, but should remain subordinate to the existing characteristic landscape.

Class IV. Areas where project-created contrasts can attract attention and may be dominant landscape features in terms of scale. However, the changes should repeat the form, line, color and/or texture in the existing characteristic landscape.

Class V. Areas where the natural character of the landscape has been disturbed to a point where rehabilitation is needed to allow the terrain to be classified into one of the previous four classifications.

The changes in views anticipated with implementation of the Cadiz Project were compared with the visual modifications allowed for the assigned VRM classification. Visual impacts of the Cadiz Project were determined to be within or outside of the allowable VRM classification parameter.

The potential light and glare impacts associated with the Cadiz Project were assessed by comparing anticipated future light and glare that would be generated in the Cadiz Project area to the existing light and glare characteristic of the Cadiz Project area and adjacent areas.

5.14.4 IMPACTS

Eastern and Eastern/Canal Alternatives

Project Wellfield and Project Spreading Basins

Changes in Visual Character. A wellfield consisting of 30 wells, piping and manifold, and approximately 390 acres of Project spreading basins would be located at the north end of the Cadiz Project area. A site plan for the Project wellfield is provided in Section 4. Each well site would typically be 80 feet by 130 feet enclosed by 6-foot high chain link fence. Inside the fence, crushed gravel would surround the 35 foot by 75 foot concrete slab that supports the well equipment. Equipment would include pipe, various types of valves, gauges and meters, pump motor and starter equipment, a lighting panel and an SCADA panel. The tallest equipment will be up to 12 feet high. The well sites would typically be at least one-half mile apart.

Project wellfield substations would be located in the Project wellfield. A typical substation plan is provided in Section 4. A typical substation would be 50 feet by 95 feet enclosed with 6-foot high chain link fence. Equipment would include various batteries, a switcher separated from a transformer by a 10-foot high concrete wall and connected by an overhead duct, two disconnect switches and an oil circuit breaker. A cable would connect the

disconnect switch with overhead power lines. The tallest element on the site would be the duct at approximately 12 feet high.

The Project spreading basins would be constructed by scraping the soil surface and building up the scraped soil to form berms for the sides of the basins. The berms would be low, with a maximum height of four to five feet, and would be composed of native soils having the same texture and color as the adjacent landscape. The area of the Project spreading basins would look different than the surrounding area because the existing vegetation would be removed. Although the shapes of the Project spreading basins would be visible from high elevations, such as parts of the Ship or Marble mountains, the Project spreading basins would blend with the earth tones of the surrounding landscape during periods when the basins are empty. When the Project spreading basins contain water, the water surface would contrast with the existing landscape in color and texture from these same high elevation views. However, the Project spreading basins area would be level and not much higher than ground level (four to five feet above ground level). Therefore, when viewed from the valley floor, the basins, and any water they might intermittently contain, would not be noticeable.

Visual Contrast Analysis. The areas of the Cadiz Project wellfield and spreading basins have a BLM-designated VRM classification of III. In this class, contrasts to the basic visual elements of form, line, color and texture created by a project may be evident but should remain subordinate to the existing characteristic landscape.

There are existing extraction wells on the Cadiz Project site. Three of these existing wells, with the addition of upgraded motors, would be used for the Cadiz Project. The addition of the motors would not substantively alter the appearance of these wells. However, the Project wellfield facilities and substations would contrast in form and line with the characteristic landscape. The contrast would occur because the Project wellfield would be at least one-half mile from existing Cadiz Inc. agricultural operations wells, and there are no elements in the existing landscape adjacent to the Project wellfield that are geometrically shaped. Although the new well facilities and substations would be evident from near views, they have low profiles. The tallest point would be 12 feet high and most of the equipment would be within a few feet of the ground level. The chain link fence will become indistinct from a distance. These elements would be subordinate to the panoramic views of open expanse and distant mountains ranges. Therefore, these Cadiz Project elements would be within the VRM contrast parameters established for the area and these Cadiz Project impacts related to aesthetics would be below a level of significance.

The Project spreading basins, which are proposed for an area with a VRM classification of III, would blend in with the surrounding landscape during periods when the Project spreading basins would be empty. The berms forming the sides of the basins would be low, with a maximum height of four to five feet, and would be composed of native soils having the same texture and color as the adjacent landscape. The area of the Project spreading basins would look different than the surrounding area because vegetation would be permanently removed. When the Project

spreading basins contain water, the surface would contrast with the existing landscape in color and texture. However, the Project spreading basin area and vicinity are level and the basins are not much higher than ground level (four to five feet). Therefore, when viewed from the valley floor, the Project spreading basins would not be noticeable. When filled, the Project spreading basins would be more obvious from higher elevations such as parts of the Ship or Marble Mountains, much of which are managed by BLM. The Project spreading basins would be filled on an intermittent basis. In some years they may contain water for several weeks or months, at other times water may not be pumped to the basins for a year or more. The Project spreading basins would contrast with the existing landscape only on the intermittent occasions when they are filled with water and at these times would only be noticeable from elevated views. Therefore, the Project spreading basins would be considered to be within the VRM Class III parameters established for the area and impacts associated with the Project spreading basins related to aesthetics would be below a level of significance.

Pumping Plants

Changes in Visual Character. For the Eastern Alternative, the Cadiz Pumping Plant would be located at the existing Iron Mountain Pumping Plant east of the existing pump house and north of the forebay. The Cadiz Pumping Plant has been designed to be compatible with the existing Iron Mountain Pumping Plant buildings. The plant would be built on vacant land and the existing Iron Mountain Pumping Plant landscaping would not be altered or disturbed.

The Eastern/Canal Alternative would have two new pumping plants located at the northern (Intermediate Pumping Plant No. 1) and southern (Intermediate Pumping Plant No. 2) end points of the canal section of the water conveyance facility. These pumping plants would be similar to the Cadiz Pumping Plant, but would be located within the water conveyance facility right-of-way.

Visual Contrast Analysis. The Cadiz Pumping Plant would be constructed adjacent to an area that has historic buildings. The Cadiz Pumping Plant at the Iron Mountain Pumping Plant would be designed to be visually compatible with these existing historic structures. Therefore, the contrast between the Cadiz Pumping Plant and the existing structures would be minimal. The Cadiz Pumping Plant would be within the VRM Class III parameters established for the area. Therefore, the impacts of the Cadiz Pumping Plant related to aesthetics would be below a level of significance.

The two intermediate pumping plants for the Eastern/Canal alternative would be constructed in an area of the water conveyance alignment with a VRM classification of IV. These pumping plants would be within VRM Class III parameters and therefore would be visually compatible in a lesser Class IV context.

Water Conveyance and Power Distribution Facilities

Changes in Visual Character. There are currently wooden utility poles and lines in the vicinity of the ARZC and BNSF rail lines. Following implementation of the Cadiz Project, the power distribution facilities, comprised of new utility poles and lines, would be visible from the adjacent areas including Cadiz-Rice Road and BLM lands and wilderness areas. The location of the Eastern and Eastern/Canal alternatives water conveyance and power distribution facilities would be within 100 feet of Cadiz-Rice Road for a distance of approximately 13.5 miles. Power poles and lines and ground disturbance associated with the installation of the water conveyance facility would be most apparent to users of this road.

The location of the Eastern and Eastern/Canal alternatives water conveyance and power distribution facilities would be within several hundred feet of the west boundary of the Old Woman Mountains Wilderness Area for approximately 1.25 miles. The alignment for these facilities is within 100 feet of the eastern boundary of the Cadiz Dunes Wilderness Area for approximately five miles. As a viewer would move farther away from the power distribution facilities, the poles and lines would be less and less distinct in the view, especially when viewed against the backdrop of the distant mountain ranges. Ground surface disturbance from the installation of the water conveyance facility would also be visible from adjacent areas. An approximate 200 foot-wide construction area for the water conveyance facility would be altered by crushing or grubbing of vegetation and stockpiling and respreading vegetation and topsoil causing a visible mark on the landscape.

For the Eastern Alternative, after the completion of pipeline construction, an 80-foot wide right-of-way for operation and maintenance of the Cadiz Program would remain. Within this 80-foot right-of-way there would be located a 20-foot wide, dirt maintenance road and alongside this road there would be located distribution facilities and low markers (to show the location of the underground pipeline).

For the Eastern/Canal Alternative, a 120-foot wide permanent right-of-way would remain for the canal segment. Within this 120 feet would be the canal and two 10-foot wide maintenance roads, one on each side of the canal. Berms forming the sides of the canal would be visible from a distance.

Currently, visitors to the Cadiz Dunes and Old Woman Mountains Wilderness Areas experience views of vast expanses of open desert land interspersed by linear features including utility poles and lines, unpaved roads and railroad tracks. With implementation of the Cadiz Project's water conveyance facility (underground pipeline or pipeline and canal), power distribution facility and scarring from the temporary right-of-way, visual disturbance from additional man made linear features would be introduced into the area. The closer these project features would be to a viewer, the more noticeable they would be and the greater the intrusion would be on the sense of open wild land. Both the Cadiz Dunes and the Old Woman Mountains Wilderness Areas extend a considerable distance away from the Eastern and Eastern/Canal alternatives. Cadiz Dunes extends 4.5 to six miles away

from the adjacent alignment and the Old Woman Mountains Wilderness Area extends more than 17 miles away from the alignment. Therefore, the utility lines and surface disturbance would not be particularly noticeable from major portions of these Wilderness Areas, nor would they be noticeable from roads and BLM lands similarly distant from the alignment. However, the Eastern/Canal Alternative would have additional visual impacts because its seven mile canal section would be visible from the hills on both sides of Danby Dry Lake, as well as from the valley floor. The concrete canal would be empty for long periods and would only contain water during spreading and withdrawal operations.

Visual Contrast Analysis. From the southernmost end of the conveyance and power distribution facilities alignment to approximately two miles north of Chubbuck, the VRM classification is IV, and from this point north to the end of the conveyance facilities and power distribution facilities the classification is III. The power distribution facility would contrast in form and line with the characteristic landscape, as there are relatively few elements in the existing landscape that are tall and straight. The construction zone, with the exception of the dirt road and power distribution facility is expected to be revegetated. However, due to the arid conditions in the Cadiz Project area, it would be expected that many years would pass before the vegetation is mature enough to be indistinguishable from the surrounding landscape. The scar from disturbance in the construction right-of-way would be visible for a long period of time.

Although the utility poles and surface scarring from construction would be evident from near views such as Cadiz-Rice Road and adjacent parts of wilderness areas, they would be less and less distinct from more distant views. This is especially the case when poles would be viewed against the backdrop of distant mountain ranges. The right-of-way disturbance would not be noticeable in the distance from the valley floor but would be more noticeable from higher elevations which may be used by visitors on BLM lands.

Although the utility poles and construction disturbance would contrast with the existing landscape, they would be subordinate to the panoramic views of open expanse and distant mountains. Therefore, these Cadiz Project elements would be within the VRM contrast parameters established for the area and the Cadiz Project impacts related to aesthetics would be below a level of significance.

Light and Glare Impacts

There would be night lighting associated with the Project wellfield and substations and pumping plants. There would be no lighting associated with the operation of the water conveyance and power distribution facilities. Lighting would be used during construction. Lighting would be noticeable in the Project wellfield because there are few, if any, other sources of light in this area. The addition of light at the Iron Mountain Pumping Plant would not be obvious because other sources of light are present at the existing Iron Mountain facility. Night lighting at the intermediate pumping plants for the Eastern/Canal Alternative would be visible

from Cadiz Rice Road. Although the Cadiz Project would introduce new sources of light to the Cadiz Project area, implementation of mitigation measure AS-2 would reduce the potential impacts related to light to below a level of significance.

Some glare would be generated from fencing and/or other metallic or hard, smooth surfaces associated with the Project spreading basins, wellfield and substations. However, this glare would be minimal because of the relatively small scale of these facilities. The reflective water surface in the Project spreading basins could generate considerable glare, depending on the acreage covered with water at a given time. Potentially, 330 acres of water surface would be generated. The water surface in the canal on the Eastern/Canal Alternative could also introduce glare when viewed from higher elevations. However, as described earlier, the Project spreading basins would be filled on an intermittent basis. In some years they may contain water for several weeks or months, at other times water may not be pumped to the Project spreading basins for a year or more. Also, the Project spreading basins would not be noticeable from the valley floor but only from elevated vantage points such as parts of the Ship and Marble mountains. Therefore, the potential impacts of the Project spreading basins associated with glare are considered to be below a level of significance.

Construction Related Impacts

During implementation of the Cadiz Project, construction activities would be visible, and construction noise would be evident from areas adjacent to the active construction zone. Construction activities would include topsoil removal and stockpiling, trench and basin excavation, utility preservation/relocation, pipe and power pole placement, well drilling, power line and equipment installation, backfill, concrete pouring and appurtenant construction. It is anticipated that construction of the Project wellfield would take up to 18 months to complete. Project spreading basin construction would be expected to last approximately eight months and the Cadiz Pumping Plant would have a construction period of 18 months. Construction of the conveyance and power distribution facilities would be approximately 18 months. Within that 18-month period, it would be anticipated that construction activities may last up to three months along the adjacent boundary with Cadiz Dunes Wilderness Area and a much shorter period than this along the boundary with the Old Woman Mountains Wilderness Area.

These short-term aesthetic impacts associated with the construction of the proposed Cadiz Project would be temporary but substantial. Views for users of Cadiz-Rice Road and portions of the wilderness areas and BLM lands near the Cadiz Project area would be of heavy construction equipment, supply trucks,

pipeline trenches and other excavated areas. Because these construction impacts related to aesthetics would be of relatively short duration, they are not considered as important as long-term effects. These construction impacts would therefore be considered to be adverse, but not significant.

Western Alternative

Project Wellfield and Project Spreading Basins

The aesthetic impacts of the Project wellfield and Project spreading basins related to aesthetics are the same for the Western Alternative as described earlier for the Eastern and Eastern/Canal alternatives. They will be less than significant.

Pumping Plant

Changes in Visual Character. The West Portal facilities would include a forebay similar to the existing forebay at the Iron Mountain Pumping Plant. Pumping plant and substation facilities under the Western Alternative construction would be similar to those for the Cadiz Pumping Plant described under the Eastern Alternative only they would be introduced into a more remote area with few existing man-made features.

Visual Contrast Analysis

The proposed forebay would be similar to but wider than the adjacent Colorado River Aqueduct. Visually, the forebay would blend with the Colorado River Aqueduct. The West Portal pumping plant would contrast in form and line with the characteristic landscape, as there are no elements in the existing landscape that are geometrically shaped like the pumping plant. However, mitigation measure AS-1 would require that the earth tone color of the facility blend with the landscape. The pump plant would be also small in scale and would be subordinate to the panoramic views of open expanse and distant mountain ranges. Therefore, the pumping plant and forebay, which would blend with the existing Colorado River Aqueduct, would be within the VRM Class III parameters established for this area. The impacts of these elements related to aesthetics would be below a level of significance.

Water Conveyance and Power Distribution Facilities

The Western Alternative is within several hundred feet of the southeast boundary of the Cadiz Dunes Wilderness Area for approximately 1.25 miles and within 100 feet of the east boundary of the Cadiz Dunes Wilderness Area for approximately five miles. The effects along these parts of the Western Alternative and the balance of the alignment are the same as described previously for the Eastern and Eastern/Canal alternatives. However, the southern segment of the Western Alternative is an area with few man-made features. From the southernmost end of the water conveyance facilities alignment to Cadiz-Rice Road the VRM classification is III, with the exception of a section of the alignment extending from the east edge of Cadiz Dunes to the west edge of the Kilbeck Hills that is Class IV. The VRM classification from the intersection with Cadiz-Rice Road north to the end to the water conveyance facilities alignment is a Class IV. The Cadiz Project elements associated with the water conveyance and power distribution facilities would be within the VRM contrast parameters established for a Class III area and would therefore be compatible with both the Class

III and Class IV segments of this alignment.

Therefore, the level of significance of impacts of the water conveyance facilities related to aesthetics for the Western Alternative would be the same as for the Eastern Alternative, less than significant.

Light and Glare

The impacts of the Western Alternative related to light and glare are less than significant, the same as for the Eastern Alternative.

Construction

The impacts of the Western Alternative related to construction are less than significant, the same as for the Eastern Alternative.

Combination Alternative

Project Wellfield and Project Spreading Basins

The Cadiz Project impacts related to aesthetics are the same for the Combination alternative as those described earlier for the Eastern, Eastern/Canal and Western alternatives for the extraction wells and spreading basins. They are less than significant.

Pumping Plant

The impacts of the West Portal Facilities related to aesthetics are the same for the Combination Alternative as those described earlier for the Western Alternative. They are less than significant.

Water Conveyance and Power Distribution Facilities

From the southernmost end of the conveyance facilities and power distribution facilities alignment to northwest of the Iron Mountains, the VRM classification is III. From this point to approximately two miles north of Chubbuck, the VRM classification is IV and the remainder of the alignment from this point north is Class III. The Cadiz Project elements associated with the water conveyance and power distribution facilities would be within the VRM contrast parameters established for a Class III area and would therefore be compatible with both the Class III and Class IV segments of this alignment.

The Cadiz Project impacts related to aesthetics are the same for the water conveyance and power distribution facilities for the Combination Alternative as those described earlier for the Eastern Alternative. These impacts are less than significant.

Light and Glare

Similar to the Eastern Alternative, the impacts of the Combination Alternative related to light and glare would be less than significant.

Construction

Similar to the Eastern, Eastern/Canal and Western alternatives, the temporary construction impacts of the Combination Alternative would be less than significant.

No Project Alternative

Under the No Project Alternative, the Cadiz Project would not be constructed.

Therefore, views in the area would remain as they currently exist and there would be no impacts to aesthetics caused by the project.

5.14.5 MITIGATION MEASURES

Mitigation measure AS-1 applies to the Western, Combination and Eastern/Canal Alternatives to ensure that the color of the pumping plants at the West Portal and along the canal segment blend with the existing landscape.

AS-1 The Pumping Plants at the West Portal and the Canal will be constructed of earth-toned materials, such as block or painted earth tones.

Mitigation measure AS-2 applies to all the alternatives.

AS-2 Metropolitan shall ensure that all outdoor lighting and fixtures are shielded or designed and located so that direct light is contained within the Project site so that adjacent properties including BLM lands are protected from spillover light.

5.14.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

With the application of the above mitigation measures; AS-1 and AS-2, none of the project alternatives results in a visual contrast that exceeds the parameters of the BLM designated Visual Resource Management Classification. In addition, no significant adverse aesthetics impacts will result, nor will scenic resources be adversely affected. The visual quality of the area will not be significantly degraded by any of the Cadiz Project alternative.

There are also no state or scenic highways in the Cadiz Project area and, therefore, no Cadiz Project impacts related to aesthetics on scenic highways. As a result, residual impacts on aesthetics will be less than significant for all Cadiz Project alternatives.

5.15 CULTURAL RESOURCES

5.15.1 AFFECTED ENVIRONMENT

The following description is based on the results of the archaeological literature and records search, review of available historical records and maps, comparisons with similar environmental localities, and field surveys within the Cadiz Project Area of Potential Effect (APE). The cultural resources research and investigation are documented in Cadiz Groundwater Storage and Dry Year Supply Program, Environmental Planning Technical Report: Cultural Resources, Report No. 1165 Applied Earthworks, Inc. (November 1999). This technical report is available for review by qualified professional archaeologists and historians at Metropolitan, the BLM offices in Riverside and Needles, and the San Bernardino Archeological Information Center (AIC).

Background

Prehistorically, the Cadiz Project region was used by Native Americans, most recently by the Mojave and Chemehuevi cultural groups. Because of the lack of permanent, reliable and potable water sources in the immediate vicinity of the Cadiz Project APE, extensive Native American habitation sites do not occur. However, temporary encampments and prehistoric trails used by small groups traveling west from the Colorado River region on collection forays for biotic, lithic and salt resources are found in the Cadiz Project region. Prehistoric cultural feature types include fire hearths and agave roasting pits, cleared areas in the desert pavement believed to represent "sleeping circles" or activity areas, circular depressions, intaglios (stone figures), rock alignments that may have functioned as hunting blinds or wind breaks, and rock cairns and rock art panels (petroglyphs) that may have functioned as trail markers.

Historical resources found in the Cadiz Project APE during the course of the archaeological survey include a variety of historical site types related to the development and maintenance of the BNSF and the ARZC rail lines. The ARZC formerly was the Arizona & Pacific Railroad and later the Atchison, Topeka & Santa Fe (AT&SF) Railway, Parker Cutoff. The BNSF rail line was once the main route of the AT&SF. Resource types include standing structures, foundations, trash dumps and railroad-related landscape features. Mining activity, beginning during the late 1800s in the region, resulted in the alteration of the landscape and contributed to the historical development of the area. Mining-related features at the town and millsite of Chubbuck (CA-SBR-3283H) are remnants of this activity. After the 1920s, use of the desert region accelerated with the planning of the Colorado River Aqueduct. Surveyors began exploration expeditions in the area in 1923, while mapping of the region continued until the early 1930s when utilities and roads related to the development of the Colorado River Aqueduct were constructed. The Colorado River Aqueduct was constructed between 1932 and 1941, spawning a number of construction-related field camps, utility lines, transportation routes, maintenance and operation facilities, and the aqueduct canal, tunnel, pumping plant and siphon system. Also during the 1940s, General George S. Patton selected parts of the

Mojave Desert, including portions of the Cadiz Project APE, for the development of the Desert Training Center (DTC). The establishment of the Iron Mountain Camp, in the south part of the Project area, also occurred during this period.

Results of Field Surveys

The archeological survey in the Cadiz Project APE considered both prehistoric archeological resources, defined as archaeological resources dating to the pre-European contact period; and historical archaeological resources, defined as archaeological resources dating to the post-European contact period, as well as historical standing structures and/or buildings. The prehistoric archeological resources documented during the field survey included two prehistoric flaked stone tools and flake scatters and two isolated prehistoric flaked stone tools as shown on Table 5.15-1. The historical cultural resources documented during the Cadiz Project survey covered a range of site types including the Colorado River Aqueduct, the Iron Mountain Pumping Plant, the BNSF & ARZC rail lines, historical refuse scatters, an isolated cultural feature (i.e., probable burial), an historic town, historic mines and a temporary historical DTC encampment, as shown on Table 5.15-1.

Significant Cultural Resources within the Cadiz Project APE

In the context of a federally-permitted undertaking, such as the Cadiz Project, the significance of cultural resources must be determined by the federal agency (BLM) official in consultation with the State Historic Preservation Officer (SHPO). Any action, as part of an undertaking, that could affect a significant cultural resource is subject to review and comment under Section 106 of the National Historic Preservation Act (NHPA) of 1966. Historic properties listed, or eligible for listing, on the National Register of Historic Places (NRHP) must be managed in accordance with the Advisory Council's regulations (36 CFR 800). Cultural resources not determined to be significant usually do not require management consideration unless they possess noncultural qualities covered by NEPA or other laws. Significance is measured against the following NHRP criteria:

> The quality of significance in American history, architecture, archeology, engineering and culture is present in districts, sites, buildings, structures and objects that possess integrity of location, design, setting, materials and workmanship, feeling and association; and;
>
> a. that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> b. that are associated with the lives of persons significant in our past; or
>
> c. that embody the distinctive characteristics of a type, period or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> d. that have yielded, or may be likely to yield, information important in prehistory or history (36 CFR 0.4).

TABLE 5.15-1
REPORTED CULTURAL RESOURCES IN THE CADIZ PROJECT APE AND SIGNIFICANCE EVALUATIONS

Site Numbers		Project Alternatives (2)	Site Type (3)	Artifacts Found/ Features	Integrity Impaired?	Significant Resources	Significance Criteria Per 36 CFR 60.4
Trinomial (1)	Temporary						
CA-SBR-9898	Æ-CAD-1	1, 2, 3, 4	PFLS	11 flakes	No	No (4)	N/A
CA-SBR-9849H	Æ-CAD-2H	1, 2, 3, 4	HRS	17 items	Yes	No	N/A
CA-SBR-9850H	Æ-CAD-3H	1, 2, 3, 4	HRS	>300 items	Yes	No (4)	N/A
CA-SBR-9851H	Æ-CAD-4H	1, 2, 3, 4	HRS	>100 items	Yes	No (4)	N/A
CA-SBR-9852	Æ-CAD-5	1, 2, 3, 4	PFLS	20 tools, 40 flakes	Yes	No (5)	N/A
CA-SBR-9853H	Æ-CAD-6H	1, 2, 3, 4	RR	Railroad, 6 trestles, 6 levees, 2 culverts	Yes	Yes	A, C
CA-SBR-9854H	Æ-CAD-7H	3	HRS	>700 beer bottles	No	Yes	A, C, D
CA-SBR-9855H	Æ-CAD-8H	1, 2, 3, 4	ICF	Possible grave site	No	Unknown	Unknown
CA-SBR-9856H	Æ-CAD-11H	1, 2, 3, 4	HRS, THE	>100 items; small corral/enclosure	Yes	No (5)	N/A
CA-SBR-9857H	Æ-CAD-12H	1, 3 ,4	HMS	3 prospects, possible ramp	Yes	No	N/A
CA-SBR-9858H	Æ-CAD-13H	1, 3, 4	THE, HRS	>500 items, 17 features	Yes	Yes	A, C, D
CA-SBR-3283H	Chubbuck	1, 3, 4	HMS, RR, HRS, HT	>100,000 items, 37 features	Yes	Yes	A, D
CA-SBR-6693H	AT&SF Railroad	1, 2, 3, 4	RR	Railroad	No	Yes	A, C
--	Iron Mountain Pumping Plant	1, 4	CRA	Structures, Landscape	No	Yes	A, C
--	Æ-CAD-ISO-1	1, 4	PIT	Biface	No	No	N/A
--	Æ-AD-ISO-2	1, 2, 3, 4	PIT	Uniface	No	No	N/A

Notes:

(1) Permanent trinomials for the newly identified cultural resources are currently being acquired from the San Bernardino County Archaeological Information Center.

(2) Alternative 1 (Eastern Alternative); Alternative 2 (Western Alternative); Alternative 3 (Combination Alternative); Alternative 4 (Eastern/Canal Alternative).

(3) CRA – Colorado River Aqueduct; HMS - Historical Mining Site; HRS - Historical Refuse Scatter; HT - Historical Town; ICF - Isolated Cultural Feature; PFLS - Prehistoric Flaked Stone Scatter; PIT - Prehistoric Isolated Tool; THE -Temporary Historical Encampment; RR - Railroad.

(4) Recordation exhausted the data potential of this site.

(5) Recordation and limited testing with full reporting will exhaust the data potential of this site.

Therefore, cultural resources that retain integrity and meet one or more of these criteria of significance qualify as significant and are eligible for listing on the NHRP; such resources must be managed in compliance with 36 CFR 800 (36 CFR 60.4).

Based on the results of cultural resources studies, significance evaluations for the 14 cultural resources documented in the Project APE were formulated. Of the identified cultural resources, the minimal data potentials of seven sites (Æ-CAD-1, -2H, -3H, -4H, -5, -11H and -12H) were recorded completely during site survey and documentation as shown in Table 5.15-1. Therefore, sites Æ-CAD-1, -2H, -3H, -4H, -5, -11H and -12H are not considered significant cultural resources. Site Æ-CAD-8H is an historical rock feature located in close proximity to the BNSF & ARZC rail lines. A minor project redesign will assure that Æ-CAD-8H remains outside the APE, so no further significance evaluation is required.

The following six historical sites are considered significant resources: Æ-CAD-6H, -7H, -13H, CA-SBR-3283H, CA-SBR-6693H and the Iron Mountain Pumping Plant on the Colorado River Aqueduct.

Site Æ-CAD-6H, the ARZC rail line, is considered eligible for inclusion on the NRHP under criteria A and C. The specific values that make it eligible are the historic significance of the route itself, the physical construction and engineering of the railroad grade, and the resulting cultural landscape and viewshed.

Site Æ-CAD-7H is composed of seven discrete clusters of beverage bottles. The significant values of the site are: (1) its association with World War II training maneuvers; (2) that it is the only recorded site of its type; and (3) that it has yielded or is likely to yield information important in history. Site Æ-CAD-7H is believed to be related to General Patton's DTC maneuvers and is clearly associated with historic military training activities in the Mojave Desert. As such, the BLM has determined that Site Æ-CAD-7H is eligible under criteria A, C and D; if associated with General Patton himself, it would also be eligible under criterion B.

Site Æ-CAD-13H contains the remains of a 1940s-era historical military encampment west of Cadiz Road. The site extends west outside the Cadiz Project APE. Similar to Site Æ-CAD-7H, Site Æ-CAD-13H is believed to be related to General Patton's DTC maneuvers and is clearly associated with historic military training activities in the Mojave Desert. Therefore, the military encampment component of Æ-CAD-13H is significant: (1) for its contribution to historical themes such as United States preparation for World War II and United States military training (Bischoff 1999; criterion A); (2) as representative of a distinctive site type (criterion C); and (3) for its data potential (criterion D). There is also an earlier component, historical refuse scatters, east of Cadiz Road and on either side of the railroad grade. This component appears to be related to the construction and early use of the railroad. The specific significant values of this component are the route itself and an earthen siding on the western edge of the rail tracks, both of which have been determined eligible by the BLM under criteria A and C, and the associated trash scatters which have been determined

eligible as archaeological resources under criterion D.

The BLM has determined that site CA-SBR-3283H, the town mill site and related features in the vicinity of Chubbuck, is eligible for listing on the NRHP under criteria A and D. This site is representative of early 19th Century historical mining activity in the desert and is associated with the ARZC rail lines (Æ-CAD-6H). Significant values of this site include: (1) the arrangement of foundation, structure pads, ruins and building remnants representing the original layout of the town and mill site; (2) the historic landscape including the railroad itself and the siding at the mill ruins; (3) the nearby Desert Butte Mines; (4) the linear features (two narrow-gauge rail spurs and a truck road) connecting the three aspects of the site; (5) representation of a significant and distinguishable entity whose components may lack individual distinction; and (6) the data potential from archaeological deposits.

Site CA-SBR-6693H, the former AT&SF rail line, was determined eligible for the NRHP in 1994. This site is the original grade and route of the main line of the AT&SF, now the BNSF rail line, and is considered eligible for the NRHP under criteria A and C. The specific values that make it eligible are the historic significance of the route itself, the physical construction and engineering of the railroad grade, and the resulting cultural landscape and viewshed.

The BLM has determined that the Iron Mountain Pumping Plant, a Colorado River Aqueduct complex, containing structures and a cultural landscape characteristic of the 1930s, is eligible for listing on the NRHP under criteria A and C. The Iron Mountain Pumping Plant was documented to Historic American Engineering Records standards in 1998 (Gruen 1998).

5.15.2 THRESHOLDS OF SIGNIFICANCE

The following state and federal criteria for assessing the effects of Projects on cultural resources are applied in Section 5.15.4.

CEQA Criteria for Significant Impacts

Pursuant to CEQA and its implementing Guidelines, a project will typically have a significant adverse impact on cultural resources if it results in:

- A substantial adverse change in the significance of a historical resource as defined in Section 15064.5 of the CEQA Guidelines and/or is eligible for listing on the NRHP.

- A substantial adverse change in the significance of an archeological resource pursuant to Section 15064.5 of the CEQA Guidelines and/or Section 106 of the NHPA.

- Disturbance of any human remains, including those interred outside formal cemeteries.

- Impacts on Native American resources with a potential for affecting sites considered important for their positions in the Native American physical universe or belief system, and/or the possibility of reduced access to traditional areas or sacred sites.

Federal Criteria of Effects

Pursuant to Section 106 of the NHPA, the federal agency official, BLM, in consultation with the SHPO, will take into account the effects of the proposed undertaking on historic properties eligible for listing in the NRHP. An adverse effect occurs when an action may alter, directly or indirectly, the characteristics of an historic property that may qualify it for the NRHP, in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling or association (36 CFR 800.5(a)).

Consideration must be given to all qualifying characteristics of an historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the NRHP. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or be cumulative. Adverse effects on historic properties include, but are not limited to:

(1) Physical destruction of or damage to all or part of the property;

(2) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's *Standards for the Treatment of Historic Properties* (36 CFR Part 68) and applicable guidelines;

(3) Removal of the property from its historic location;

(4) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;

(5) Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;

(6) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and

(7) Transfer, lease or sale of the property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance (36 CFR 800.5(a)(2)).

5.15.3 METHODOLOGY

The cultural resources studies undertaken for the Cadiz Project began with an archaeological and historical literature and records search at the San Bernardino AIC at the San Bernardino County Museum in Redlands. The objective of this search was to determine if the Cadiz Project APE had previously been surveyed for cultural resources and to identify any previously recorded cultural resources within a one-mile radius of the Cadiz Project area.

Following the literature and records search, a Class III intensive cultural resources survey of the Cadiz Project APE

was undertaken. This Class III intensive archaeological survey of the Cadiz Project APE was performed by Applied EarthWorks, Inc., (Æ) under BLM permit CA-062-99-009 and in compliance with the stipulations of the California Desert Conservation Area Plan (1980, amended 1989), the NHPA (1966, as amended), NEPA (1969) and CEQA. Archaeologists undertook pedestrian surveys between April 5 and June 11, 1999. The desert conditions afforded good to excellent ground surface visibility. The field work resulted in the identification of 11 archaeological sites and two isolated prehistoric tools; the archaeological site records for two previously recorded historic sites were also reviewed and updated and the Iron Mountain Pumping Plant was examined. These 14 sites are summarized in Table 5.15.1.

The objective of the cultural resources field survey was to identify and document all cultural resources within the Cadiz Project APE, including prehistoric and historical archaeological resources, as well as historical resources such as buildings, structures, objects and linear resources. Additional field studies, including site boundary definition and depth assessment, were undertaken to assist in NRHP eligibility evaluation and impact assessment.

Next, extensive archival research was undertaken to compile a historical context for the Cadiz Project area. The objective of this task was to provide a context in which to evaluate the potential significance of the historical cultural resources documented during the survey.

Finally, 12 Native American tribes/ reservations from all areas surrounding the Cadiz Project area were notified of the proposed Cadiz Project as part of the NOI process. No properties of religious or cultural significance to Native Americans were identified.

The cultural resources research and investigation are documented in Cadiz Groundwater Storage and Dry Year Supply Program, Environmental Planning Technical Report: Cultural Resources, Report No. 1165 Applied Earthworks, Inc. (November 1999). This technical report is available for review by qualified professional archaeologists and historians at Metropolitan, the BLM offices in Riverside and Needles, and the San Bernardino AIC.

5.15.4 IMPACTS ON CULTURAL RESOURCES

Of the 14 documented cultural resources within the Cadiz Project APE, seven sites (Æ- CAD-1, -2H, -3H, -4H, -5, -11H and -12H) are no longer considered NRHP-eligible resources and no adverse effects on these resources are anticipated as a result of the construction and operation of the Cadiz Project. Minor project redesign will assure that site Æ-CAD-8H remains outside the APE and will not be affected by the Cadiz Project. Potential Project impacts to the remaining seven NRHP-eligible properties are considered in this Section.

Impacts of Construction

Construction of the Cadiz Project may adversely affect cultural resources by destroying or altering the resources and/or their environments in such a way that their significant qualities are diminished. Cadiz Project-related effects on cultural

resources eligible for listing in the NRHP may be direct and/or indirect.

Direct effects of construction are those that would directly impinge on or destroy cultural resources that are determined to be significant. Primary direct effects of this type include, but are not limited to, clearing and grading for the water conveyance facility trench and spreading basins; construction and use of access roads; disposal of spoils from trenching and grading; and activities in and around laydown and work areas.

Among the potential indirect effects on cultural resources related to construction of the Cadiz Project are erosion caused by regrading slopes and clearing vegetation; earthmoving during revegetation to control erosion; illegal artifact collection by construction personnel; and visual alteration of the settings in which the cultural resources are located.

Impacts of Operation and Maintenance

Post-construction direct effects on cultural resources would occur similar to those experienced during construction but would be less intensive, such as long-term use of service access roads and repair and/or maintenance of the facilities. They should not impact cultural resources that were not affected during the construction of the Cadiz Project.

Indirect effects would adversely affect cultural resources, not as a direct result of the construction, operation or maintenance of the Cadiz Project, but which would probably not occur if the Cadiz Project was not constructed. In the case of the Cadiz Project, indirect effects are most likely to occur as a consequence of increased public activity in the area. Increased public activity would be facilitated by the new access roads for construction and operation of the Cadiz Project. Activities such as artifact collecting and illicit digging could increase as a result of improved access and enhanced visibility of artifacts due to the disturbance of archaeological deposits.

Impacts of the Project Wellfield

One significant site, CA-SBR-6693H was documented in the Project wellfield APE, common to the Eastern, Western Combination and Eastern/Canal alternatives. Site CA-SBR-3283H is an operating railroad. Where required, construction would jack or tunnel under the railroad berm so as not to disrupt rail traffic. Disturbance to the railroad grade is avoided during all construction activities; no Cadiz Project effects to this site are anticipated.

Impacts of the Eastern and Eastern/ Canal Alternatives

Of the 14 documented sites, 10 sites (Æ-CAD-1, -2H, -3H, -4H, 5, -6H, -11H, -12H, -13H and CA-SBR-3283H) are located on the Eastern and Eastern/Canal alternatives. In addition, the existing historic Iron Mountain Pumping Plant is at the southern terminus of the Eastern and Eastern/Canal alternatives and CA-SBR-6693H is in the Project wellfield. Of these documented sites, only Æ-CAD-6H, Æ-CAD-13H, CA-SBR-3283H, CA-SBR-6693H and the Iron Mountain Pumping Plant are eligible for the NRHP. The discussion below addresses the impacts of these two alternatives on these significant sites.

Site Æ -CAD-6H, the ARZC rail line, is located along the Cadiz Project APE for the Eastern, Western Combination and Eastern/Canal Alternatives. Site CA-SBR-6693H, the main line of the BNSF rail line (previously the AT&SF) is located along the Cadiz Project APE in the Project wellfield. Because these two resources are operating railroads, where required, construction would jack or tunnel under the railroad berm so as not to disrupt rail traffic. Disturbance to the railroad grade would be avoided during all construction activities, and the surrounding landscape would be returned to its original condition; therefore, no effect to these resources would occur.

Site Æ-CAD-13H is located along the alignment common to the Eastern, Combination and Eastern/Canal alternatives. The trash scatter component of this site thought to be associated with construction and early use of the ARZC and AT&SF rail lines would be directly impacted by construction of these alternatives. However, this element of the site was extensively documented during the survey and no longer contributes to the site's NRHP eligibility. The rail line itself and the siding would be avoided during construction as described earlier for Æ-CAD-6H. Because the military component of Æ-CAD-13H would be avoided by these alternatives, no Cadiz Project effects to the significant elements of this cultural resource would occur.

CA-SBR-3283H, the town mill site, and related historical features at Chubbuck is located along the conveyance facilities alignment under the Eastern, Combination and Eastern/Canal alternatives. The significant elements of the site would be completely avoided during construction. Working limits would be narrowed to 40 feet and would be confined to the existing road and a 10-foot wide work corridor. Construction activities would be away from all cultural features. The construction corridor would be fenced and an archaeological monitor would be present. Following construction, the road would be returned to its preconstruction condition. As a result, there would be no Cadiz Project effects on significant elements of this cultural resource.

The Eastern and the Eastern/Canal alternatives would entail construction of the Cadiz Pumping Plant at the Iron Mountain Pumping Plant. The Iron Mountain Pumping Plant is a Colorado River Aqueduct complex containing structures and a cultural landscape characteristic of the 1930s. The Cadiz Pumping Plant required to complete the tie-in of the Eastern conveyance facilities to the Colorado River Aqueduct would be constructed in a previously disturbed context, would be erected some distance from extant historic buildings within a utilitarian portion of the complex. The pumping plant has been designed and would be built in a style compatible and sympathetic to the existing architecture of the Iron Mountain Pumping Plant buildings. Therefore, no Cadiz Project effects would occur on the Iron Mountain Pumping Plant complex.

Impacts of the Western Alternative

Seven of the documented sites are located on the Western Alternative: Æ-CAD-1, -2H, -3H, -4H, 5, -6H and -11H. Site CA-SBR-6693H is located within the Project wellfield. Of these, only Æ-CAD-6H and CA-SBR-6693H are eligible for the NRHP. Potential impacts to this site are discussed

below. No cultural resources were identified along the three-mile long cross-country corridor for the power distribution facilities to the West Portal associated with the Western and Combination Alternatives.

Site Æ-CAD-6H, the ARZC rail line (Parker Cut-off), is located along the Cadiz Project APE for the Eastern, Western, Combination and Eastern/Canal Alter-natives. Site CA-SBR-6693H, the main line of the BNSF (previously AT&SF) rail line is located along the Cadiz Project APE in the Project wellfield. Because this is an operating railroad, where required, construction would jack or tunnel under the railroad berm so as not to disrupt rail traffic. Disturbance to the railroad grade would be avoided during all construction activities and the surrounding landscape would be returned to its original condition. Therefore, no Cadiz Project effects to these resources would occur.

Impacts of the Combination Alternative

There are 11 sites on the Combination Alternative: Æ-CAD-1, -2H, -3H, -4H, 5, -6H, -7H, -11H, -12H, -13H and CA-SBR-3283H. Site CA-SBR-6693H is located within the Project wellfield. Of these, only Æ-CAD-6, -7H, -13H, CA-SBR-3283H, and CA-SBR-6693H are eligible for the NRHP. Impacts to these sites are discussed below. No cultural resources were identified along the three-mile long cross-country corridor for the proposed power distribution facility to the West Portal associated with the Western and Combination alternatives.

Site Æ-CAD-6H, the ARZC rail line (Parker Cut-off), is located along the Cadiz Project APE for the Eastern, Western, Combination and Eastern/Canal Alternatives. Site CA-SBR-6693H, the main line of the BNSF rail line, is located along the Cadiz Project APE in the Project wellfield. Because these two resources are operating railroads, where required, construction would jack or tunnel under the railroad berm so as not to disrupt rail traffic. Disturbance to the railroad grade would be avoided during all construction activities and the surrounding landscape would be returned to its original condition. Therefore, no Cadiz Project effects to these resources would occur.

Site Æ-CAD-7H is located along the Combination Alternative water conveyance facility and cannot be completely avoided during Project construction if this alignment is selected.

Site Æ-CAD-13H is located along the water conveyance facility alignment common to the Eastern, Combination and Eastern/Canal alternatives. The trash scatter component of this site, thought to be associated with construction and early use of the ARZC rail line (Parker Cut-off), would be directly impacted by construction of these alternatives. However, this element of the site was extensively documented during the survey and no longer contributes to the site's NRHP eligibility. The rail line itself and the siding will be avoided during construction as described earlier for Æ-CAD-6H. Because the military component of Æ-CAD-13H can be avoided by these alternatives, no Cadiz Project effects to the significant elements of this cultural resource would occur.

CA-SBR-3283H, the town, mill site and related historical features at Chubbuck, is located along the water conveyance facility alignment under the Eastern, Combination and Eastern/Canal alternatives. The significant elements of the site would be completely avoided during construction. Working limits would be narrowed to 40 feet and would be confined to the existing road and a 10 foot wide work corridor. Construction activities would be away from all cultural features. The construction corridor would be fenced and an archaeological monitor would be present. Following construction, the road would be returned to its preconstruction conditions. As a result, there would be no Cadiz Project effect on significant elements of this cultural resource.

Impacts of the No Project Alternative

The No Project Alternative would not result in the construction, operation or maintenance of any Project components in the Project area. Therefore, the No Project Alternative would not result in adverse impacts to cultural resources. No mitigation is required.

5.15.5 MITIGATION MEASURES

Of the 14 cultural resources documented in the APE, six historical sites have been determined eligible for the NRHP by the BLM. They are Æ-CAD-6H, -7H, -13H, CA-SBR-3283H, CA-SBR-6693H and the Iron Mountain Pumping Plant. Only one of these resources cannot be completely avoided, Æ-CAD-7H, the possible Patton-era bottle dump. Site Æ-CAD-7H would be affected by the water conveyance facility construction for the Combination Alternative. Because the Cadiz Project would have an adverse effect on historic properties if the Combination Alternative is selected, these recommended mitigation treatments must be reviewed by the SHPO. The BLM would consult with the SHPO regarding site treatment if site AE-CAD-7H will be affected. If the SHPO does not concur with these recommendations, in accordance with 36 CFR 800, acceptable treatments would be negotiated and implemented. Additional conditions have been set for construction monitoring to ensure treatment of any undiscovered buried archaeological sites.

CR-1 The following actions shall be implemented to minimize adverse impacts on cultural resource site Æ-CAD-7H, if the Combination Alternative is selected for implementation:

- The boundary of this site shall be identified on all Cadiz Project specifications and maps as an Environmentally Restricted Area (ERA), in consultation with the Project archeologist. The ERA shall be flagged prior to any construction activity within 1,000 feet of this site. No construction activity will be allowed within this ERA.

- Prior to any work, site preparation or construction, permanent photographic control points will be placed within the cultural resource site boundaries, in consultation with the Project archeologist.

- Prior to any work site preparation or construction, the

cultural resource site data potential will be recovered through detailed recording by the Project archeologist.

- The cultural resource site will be extensively photo documented by the Project archeologist prior to and during construction.

- After construction is complete, public access to this area will be prohibited. Gates, fencing and/or other barriers, as appropriate, will be provided by Metropolitan on the Metropolitan access roads in this area to restrict access to non-authorized persons.

CR-2 During final design, a Buried Site Treatment (BST) Plan will be prepared for the selected alternative. This plan will be developed in consultation with SHPO. This plan will address areas along the alignment with high potential for containing buried archeological deposits and appropriate treatments, such as pre-construction testing along the alignment, controlled recovery, monitoring during construction and other measures as appropriate. The recommendations of the BST Plan will be implemented prior to and during construction, as appropriate.

CR-3 Full-time monitoring will be conducted by the Project archeologist during all site preparation, grading and construction in the vicinity of Chubbuck (CA-SBR-3283H) and the Patton Camp (AE-CAD-13H). In the event significant archeological resources are encountered, the Project archeologist will immediately divert construction and the BLM will initiate consultation with the SHPO to implement an acceptable treatment plan.

CR-4 At the completion of construction of the selected Cadiz Project alternative, the Project archeologist will prepare a written report describing the cultural resources documentation, data recovery and protection activities that occurred throughout the construction period. This report will be provided to SHPO, the San Bernardino AIC and other parties as appropriate.

5.15.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

The potentially significant adverse impacts of the Combination Alternative on cultural resources will be mitigated to below a level of significance based on implementation of measures CR-1 to CR-4. The Eastern, Eastern/Canal and Western alternatives will not result in significant adverse impacts on cultural resources.

5.16 PALEONTOLOGICAL RESOURCES

15.6.1 AFFECTED ENVIRONMENT

Background

The Cadiz Project area is mostly located on lake playas which are part of a great trough running from Manix Lake southeast across the Mojave Desert via Bristol, Cadiz and Danby dry lakes. The trough is characterized by a series of broad, alluvial valleys outlined by fault zones. South of Amboy, the trough is named the Bristol-Cadiz-Danby Trough. It has been speculated that the Bristol-Cadiz-Danby Trough was a route which connected the ancestral Colorado River to the Mojave River. The Mojave River drainage system supported a series of permanent lakes in Pleistocene times the largest of which was Lake Manix (Reynolds 1991) to the northwest of the Cadiz Project site.

The extent and relationships of the Pleistocene bodies of water are unresolved, as is the structural nature of the trough. It is very likely that fossils from the Cadiz Project area could provide essential biostratigraphic data that would contribute to a greater understanding of these issues.

Results of the Literature Research and Field Surveys

Most of the project area is undeveloped and no paleontological resources are recorded for those areas. Fossils in the general region of the project were located as part of the All American-Celeron pipeline (10 localities) and Pacific Agriculture (169 localities) projects (Reynolds 1991).

During the field survey for this project, Gust Osteological Analysis and RMW Paleo Associates located 23 fossil localities and one fossil locality was located by Applied Earthworks (Æ) as shown in Table 5.16-1.

Identifiable fossils were recovered from 23 of the 24 localities as shown in Table 5.16-1. The fossils recovered along the water conveyance facility alignments consist largely of fragments of mammalian longbones and one rabbit bone. The variety of fossils collected from the wellfield area include flamingo, Canada goose, mammoth, camel, two kinds of horse, coyote, dwarf pronghorn antelope, jackrabbit, ground squirrel, kangaroo rat and freshwater snail. The fossils were identified by Christopher Shaw, Sherri Gust, Richard Reynolds and Daniel Guthrie. These specimens show excellent condition and demonstrate the potential for important information to be recovered.

Most of the Cadiz Project area consists of lake beds, paleosols and carbonate beds with a high potential for subsurface paleontological resources. A few parts of the Cadiz Project area appear to consist of paleosols overlain by recent alluvium, particularly where the Combination Alternative water conveyance facility alignment passes the Kilbeck Hills and to the north of the Iron Mountain Pumping Plant. Even those areas where no surface fossils were recovered have a high potential for subsurface fossil resources.

The area of abundant fossils in the Project wellfield area does not have the depositional characteristics of a lake bed. Rather, that area consists of carbonate beds, including caliche and root casts, interspersed with sandy silts. A lake margin playa or marsh environment is

TABLE 5.16-1

FOSSIL LOCALITIES DOCUMENTED IN THE CADIZ PROJECT FIELD SURVEY

Location No.	Location ID	USGS Quadrangle	Notes	Owner
59	TJM	Cadiz Lake NW	Alluvium	Cadiz Inc.
60	TJM	Cadiz Lake NW	Carbonate	Cadiz Inc.
65	MWT	Chubbuck	Paleosol	BLM
185	EAB	Chubbuck	Paleosol	BLM
186	EAB	Cadiz Lake NW	Carbonate	Cadiz Inc.
187	EAB	Cadiz Lake NW	Carbonate	Cadiz Inc.
188	EAB	Cadiz Lake NW	Carbonate	Cadiz Inc.
189	EAB	Cadiz Lake NW	Alluvium	Cadiz Inc.
190	EAB	Cadiz Lake NW	Alluvium	Cadiz Inc.
191	EAB	Cadiz Lake NW	Alluvium	Cadiz Inc.
192	EAB	Cadiz Lake NW	Alluvium	Cadiz Inc.
193	EAB	Cadiz Lake NW	Carbonate	Cadiz Inc.
194	EAB	Chubbuck	Paleosol	BLM
195	EAB	Cadiz Lake NW	Carbonate	Cadiz Inc.
206	SRA	Cadiz Lake NW	Carbonate	Cadiz Inc.
207	SRA	Cadiz Lake NW		Cadiz Inc.
208	MLP	Cadiz Lake NW	Carbonate	Cadiz Inc.
209	MLP	Cadiz Lake NW	Carbonate	Cadiz Inc.
210	MLP	Cadiz Lake NW	Carbonate	Cadiz Inc.
211	MLP	Cadiz Lake NW	Jacket	Cadiz Inc.
1272	DNS	Chubbuck	Not collected	BLM
1273	DNS	Cadiz Lake NW	Jacket	Cadiz Inc.
1274	DNS	Cadiz Lake NW		Cadiz Inc.

indicated by the fossil assemblage and the carbonate beds. This was also the conclusion reached by previous paleontologists (Reynolds 1991). This area is referred to as the Cadiz Playa in this EIR/EIS. The Cadiz Playa is east of the dry bed of Bristol Lake and north of the dry bed of Cadiz Lake. It may have received water from one, both or smaller drainages of Fenner Valley.

The time of deposition of the Cadiz Playa as currently exposed appears to have been within 1.8 to 0.4 million years ago. This estimate is based on the total faunal assemblage recovered from the Cadiz Playa, both by the survey for the Cadiz Project and previous work by the San Bernardino County Museum (SBCM). The land mammal chronological sequence for North America based on characteristic

faunal assemblages associated with geochemical dates is well defined in California (Lundelius et. al. 1987). The identification and analysis of the SBCM collection as reported in Reynolds (1991) and Reynolds and Reynolds (1992) indicated the presence of the giant tortoise (*Geochelone* sp.), which is found in Irvingtonian to Rancholabrean Age deposits. Additional review of that collection resulted in identification of nine specimens of the Rexroad cat (*Felis rexroadensis*) which is Blancan to Irvingtonian Age. The survey collection for this project contains mammoth (*Mammuthus* sp.) which is not present in the Blancan. Based on the presence of these temporally diagnostic genera, the Cadiz Playa is Irvingtonian in age (Lundelius et. al. 1987). Subdivisions of the Irvingtonian, based on rodent assemblages are also well defined (Repenning 1987), however the existing samples are insufficient for this type of analysis.

The boundary of the Blancan and Irvingtonian Age corresponds to the Pliocene-Pleistocene boundary. Since the current surface has partially exposed Irvingtonian deposits, there is enormous potential for subsurface excavation to reveal older deposits.

Comparative analysis of stratigraphy and fossil communities, as sampled throughout the Bristol-Cadiz-Danby Trough in conjunction with this Project, could provide information on paleohydrologic history, timing and prehistoric life.

5.16.2 THRESHOLDS OF SIGNIFICANCE

Paleontologic resources are nonrenewable resources of important scientific value which include fossils and fossiliferous deposits. A project would be considered to result in a significant adverse impact related to paleontological resources if it results in the disturbance or destruction of rock formations determined to have high potential for significant nonrenewable fossiliferous resources, as defined by the Society of Vertebrate Paleontologists (SVP). As noted earlier, there are fossiliferous formations documented for the Cadiz Project area. Because these formations have high potential for containing important paleontological resources, based on previously recorded sites in these formations, the disruption or destruction of these formations would be considered a significant adverse impact of the Cadiz Project.

Fossils are considered to be of significant scientific interest if one or more of the following guidelines apply:

- The fossils provide data on the evolutionary relationships and developmental trends among organisms, both living and extinct;

- The fossils provide data useful in determining the age(s) of the rock unit or sedimentary stratum, including data important in determining the depositional history of the region and the timing of geologic events therein;

- The fossils provide data regarding the development of biological communities or interaction between paleobotanical and paleozoological biotas;

- The fossils demonstrate unusual or spectacular circumstances in the history of life; and

- The fossils are in short supply and/or in danger of being depleted or destroyed by the elements, vandalism or commercial exploitation, and are not found in other geographic locations.

As defined, significant paleontologic resources are determined to be fossils or assemblages of fossils which are unique, unusual, rare, uncommon, diagnostically or stratigraphically important, and/or those which add to an existing body of knowledge in specific areas-stratigraphically, taxonomically and/or regionally. They can include fossil remains of large to very small aquatic and terrestrial vertebrates, remains of plants and animals previously not represented in certain portions of the stratigraphy, and assemblages of fossils that might aid in stratigraphic corrections, particularly those offering data for the interpretation of tectonic events, geomorphologic evolution, paleoclimateology and the relationships of aquatic and terrestrial species. For any or all of these reasons, paleontologic remains are recognized as nonrenewable resources significant to American culture, and as such are protected under provisions of the Federal Land Policy Management Act of 1976 and subsequent related legislation, policies and enacting responsibilities.

15.6.3 METHODOLOGY

Paleontological resource impacts were evaluated for the following components of the Cadiz Project alternatives:

- A pumping plant at the site of the existing Iron Mountain Pumping Plant and the Colorado River Aqueduct (Eastern and Eastern/Canal Alternatives) and at the Iron Mountain Pumping Plant West Portal of the Western and Combination alternatives water conveyance facility alignment.

- An approximately 35-mile long water conveyance facility from the Colorado River Aqueduct to the Cadiz-Fenner valleys for all the alternative alignments.

- Spreading basins and extraction wells in the Cadiz-Fenner valleys for all the alternatives.

- A power distribution facility easement north of the Riverside/San Bernardino County line for the Western and Combination Alternatives.

Background research included a review of pertinent geologic and paleontological literature, maps and other documentation. The Regional Paleontologic Locality Inventory at the SBCM was searched for records of previously recovered fossils in the Cadiz Project area.

Based on previous paleontological work in the area showing substantial surface fossils, a field survey was conducted of the alternative water conveyance facility alignments, the Project wellfield, project spreading basins and the power distribution facility.

The field survey was conducted in two-person teams spaced approximately 50 yards apart. Deviations to inspect potentially fossiliferous outcrops and exposures were made when appropriate. Surface visibility was excellent in most areas.

All potentially significant paleontological resources were documented with a written record and photographs. The presence of any identifiable paleontological resources constituted a fossil locality. Fossils judged to be both significant and subject to possible damage were collected and prepared in accordance with the SVP Guidelines.

15.6.4 IMPACTS

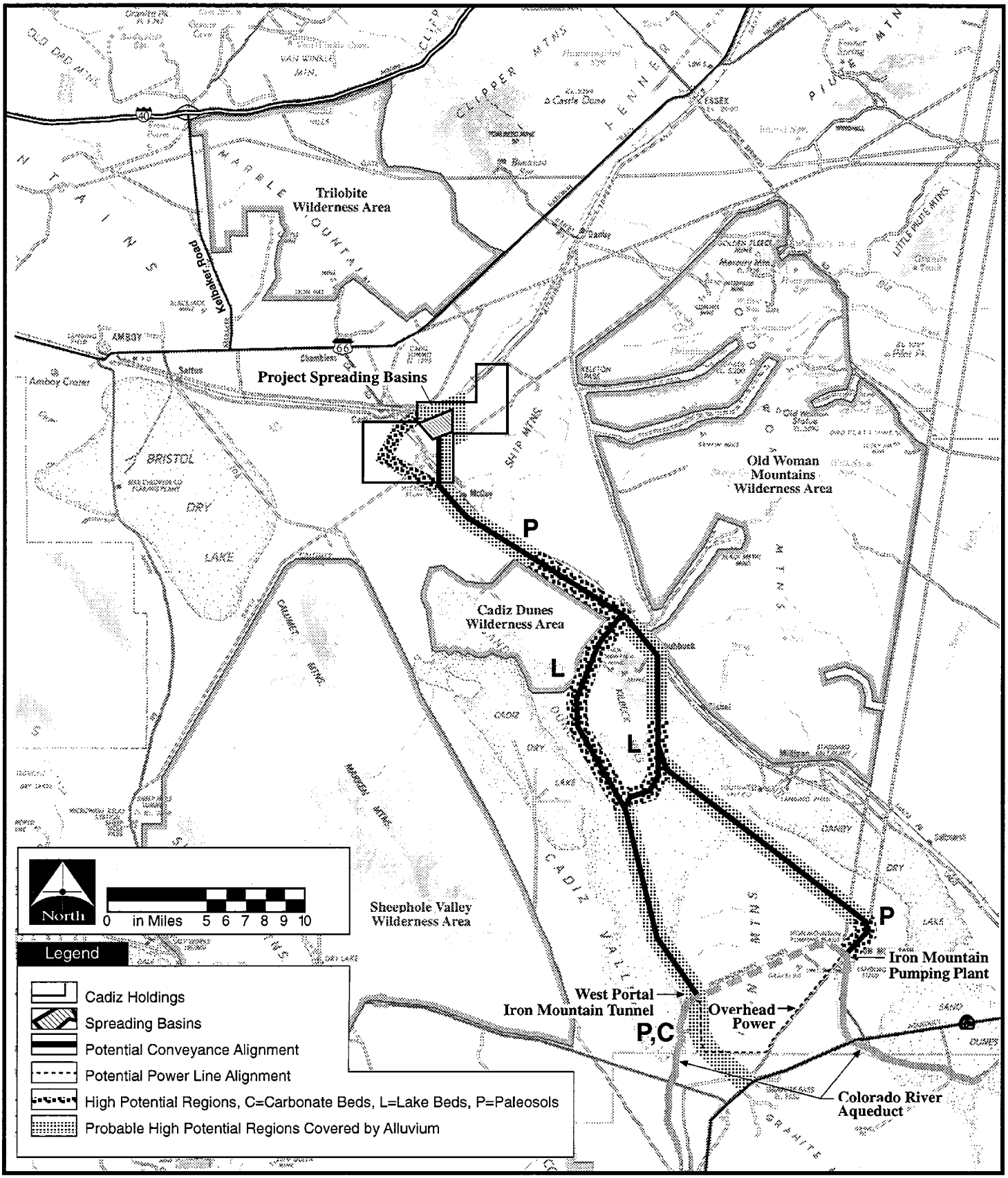
The Cadiz Project would have both beneficial and adverse effects related to paleontological resources. Adverse effects include direct impacts (crushing, breaking, removal) through ground-disturbing activities such as grading of the construction zone and trenching for the water conveyance facilities and wellfield. These activities could result in the loss of paleontologic resources. The construction duration would be short-term but the loss of paleontological resources would be permanent and irretrievable. Indirect adverse impacts during construction include clearing, dumping, vehicular damage (mostly from weight crushing fossils), construction storage and illegal collecting. Most of these impacts are also permanent and potentially significant as they make fossils permanently unavailable for scientific investigation by destroying or removing them.

Beneficial effects would result from retrieval of fossils and sediments for scientific study. As a byproduct of the recovery, scientific work and educational activities could occur.

The paleontologic significance of the Cadiz Project area was assessed based on the survey conducted and geologic maps of rock units. Overall, because of its location in the Bristol-Cadiz-Danby Trough with its richly fossiliferous lake beds, carbonate beds and paleosols, the Cadiz Project is in an area with high potential for paleontological resources. Figure 5.16-1 indicates the locations of important soil and rock units, with high potential for paleontological resources, along the water conveyance facility alignments and in the vicinity of the other Cadiz Project features.

Eastern and Eastern/Canal Alternatives

As shown on Figure 5.16-1, three segments of the Eastern and Eastern/Canal alternatives water conveyance facility alignment pass through areas of high potential for paleontological resources consisting of lake beds and paleosols. The Project wellfields and spreading basins are in areas with high potential for resources, including carbonate beds in the Cadiz Playa. The remaining segments of the Eastern and Eastern/Canal alternatives water conveyance facility pass through areas with recent alluvium. It is anticipated that the paleosols extend under this alluvium. Because the depth of the overlying alluvium is currently unknown, it is assumed that excavation would intercept the possible underlying paleosol. As a result, these segments of the Eastern and Eastern/Canal alternatives water conveyance facility alignments are identified as having probable high potential for paleontological resources. Because of the presence of high potential and probable high potential soils and rock



Source: P&D Consultants, Inc. (1999) and Gust Osteological Analysis (1999).

Figure 5.16-1

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Paleontologic Sensitivity

formations along the Eastern Alternative and Eastern/Canal alternatives water conveyance facility alignments and in the vicinity of the other project facilities, construction could result in significant adverse impacts on paleontological resources. Mitigation measures, provided later in this section, would substantially reduce this potential adverse impact of these alternatives. However, residual impacts could remain significant, particularly if the water conveyance facilities trench intercepts the underlying paleosol.

Once construction is completed, the only activity along the Eastern and Eastern/Canal alternatives water conveyance facility and at the Project facilities will be associated with operations and maintenance of the Project facilities. All traffic will be restricted to existing roads or permanent maintenance roads constructed as part of the Cadiz Project. Public access to maintenance roads will be controlled by use of gates. Therefore, in the long term, there are not anticipated to be any impacts on paleontological resources associated with the operations and maintenance of the Cadiz Project under these alternatives.

Western Alternative

As shown on Figure 5.16-1, a long segment in the middle part of the Western Alternative water conveyance facility passes through areas of high potential for paleontological resources consisting of lake beds and paleosols. The Project wellfield and Project spreading basins are in areas with high potential, including carbonate beds in the Cadiz Playa. The remaining segments of the Western Alternative water conveyance facility pass through areas with recent alluvium. It is anticipated that the lake beds and paleosols extend under this alluvium. Because the depth of the overlying alluvium is unknown at this time, it is assumed that pipeline trenching would intercept the anticipated underlying fossil-bearing formation.

As a result, these segments of the Western Alternative water conveyance facility are identified as having probable high potential for paleontological resources. Because of the presence of high potential and probable high potential soils and rock formations along the Western Alternative water conveyance facility and in the vicinity of the other Project features, construction of this alternative could result in significant adverse impacts on paleontological resources. Mitigation measures, provided later in this section, would substantially reduce this potential adverse impact of this alternative, but residual impacts could remain significant.

Once construction is completed, the only activity along the Western Alternative water conveyance facility and at the Project facilities will be associated with operations and maintenance. All traffic will be restricted to existing roads or permanent access roads constructed as part of the Cadiz Project. Public access to maintenance roads will be controlled by use of gates. Therefore, in the long term, there are not anticipated to be any impacts on paleontological resources associated with the operations and maintenance of the Cadiz Project under the Western Alternative.

Combination Alternative

As shown on Figure 5.16-1, two segments of the Combination Alternative water conveyance facility alignment pass

through areas of high potential for paleontological resources consisting of paleosols and lake beds. The Project wellfield and spreading basins are in areas with high potential, including carbonate beds. The remaining segments of the Combination Alternative water conveyance facility pass through areas with recent alluvium. It is anticipated that the lake beds and paleosols extend under this alluvium. Because the depth of the overlying alluvium is unknown at this time, it is assumed that pipeline trenching may intercept the anticipated underlying fossil-bearing formation.

As a result, these segments of this water conveyance facility alignment are identified as having probable high potential for paleontological resources. Because of the presence of high potential and probable high potential soils and rock formations along the Combination Alternative water conveyance facility and in the vicinity of the other Project facilities, construction of this Alternative could result in significant adverse impacts on paleontological resources. Mitigation measures provided later in this section would substantially reduce this potential adverse impact, but residual impacts could remain significant.

Once construction is completed, the only activity along the Combination Alternative and at the Project facilities will be operations and maintenance of the Project facilities. All traffic will be restricted to existing roads or permanent access roads constructed as part of the Cadiz Project. Public access to maintenance roads will be controlled by use of gates. Therefore, in the long term, there are not anticipated to be any impacts on paleontological resources associated with the operations and maintenance of the Cadiz Project under the Combination Alternative.

No Project Alternative

Fossils, including the significant assemblage of the Cadiz Playa, would not be affected by construction-related impacts under the No Project Alternative, since no construction would occur. However, erosion and damage from existing land uses would degrade the fossil resources. Fossils and related samples would not be available for scientific study, education or public relations under the No Project Alternative.

15.6.5 MITIGATION MEASURES

The mitigation program is designed to alleviate adverse impacts on paleontologic resources as a result of the Cadiz Project. Due to the fact that so much of the Cadiz Project area has high-potential for fossils, there could be significant adverse impacts on paleontological resources under all the build alternatives. To reduce these adverse impacts to an acceptable level, a major part of the mitigation effort would be directed toward the recovery of scientifically important fossils, recovery of associated scientific data, preliminary work to establish the significance of the collection and preservation of recovered specimens in a recognized repository to allow future study by qualified investigators. To accomplish these goals, the following mitigation measures are required for all Project alternatives:

P-1 Prior to initiation of Cadiz Project construction, a paleontologist shall relocate the fossil localities that are within the Cadiz Project construction right-of-way to evaluate the recorded sites and

determine the need for further data collection including excavation.

P-2 A paleontological monitor shall be present during construction trenching and grading operations within areas with a high potential to uncover fossils. If subsequent information indicates that alluvial layers overlying fossil-bearing strata are of sufficient thickness to avoid interception of those fossil-bearing areas, no paleontological monitor needs be present during ground disturbing activities in those areas.

P-3 The paleontological monitor shall work with the construction manager to salvage whole fossils or complete elements such as whole skeletons or sections of skeletons. Fossils may be salvaged from the trench spoil to the degree possible, and may be salvaged from within the trenches particularly to recover whole skeletons or sections of skeletons with the concurrence of the construction manager.

P-4 The paleontological monitor shall collect soil samples from random locations along the water conveyance facility trench where fossil-bearing strata are intercepted to obtain a representative sample of fossils and associated data in the Cadiz Project construction area. The paleontologist shall prepare a sampling program to be approved by BLM and Metropolitan.

P-5 The salvaged fossils and sediment samples shall be processed, analyzed and curated in accordance with accepted government standards. A report shall be promptly prepared to document methods, findings, results and conclusions and shall include an itemized inventory of specimens. The report shall be submitted to BLM, Metropolitan, and the County of San Bernardino.

P-6 Cadiz Project-sponsored funding of the paleontological salvage, processing, analysis, curation and report preparation shall not exceed 0.25 percent of the total construction costs for the Cadiz Project.

15.6.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Mitigation measures P-1 through P-6 would substantially reduce the adverse impacts of the Cadiz Project related to paleontological resources. It is anticipated that human error and the practical limitations on recovery imposed by the construction schedule will cause loss of some fossil remains and perhaps destruction of some unrecorded fossil localities. However, it is possible to reduce events of this nature based on the implementation of mitigation measures P-1 through P-6.

Nonetheless, the Cadiz Project could result in significant adverse impacts on paleontological resources that cannot be mitigated to a below a level of significance after mitigation.

5.17 WILDERNESS/RECREATION

5.17.1 AFFECTED ENVIRONMENT

There are four federal wilderness areas managed by the BLM in the vicinity of the Cadiz Project area. As defined in the Wilderness Act of 1964, (16 U.S.C. 1131-1136) wilderness is "...an area where the earth and its community of life are untrammeled by man, where man himself is a visitor and does not remain."

The Act further defines wilderness as "...an area of undeveloped Federal land retaining its primeval character, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable, (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation, (3) has at least 5,000 acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition, and (4) may also contain ecological, geological or other features of scientific, educational, scenic, or historical value, (16 U.S.C. 1131)."

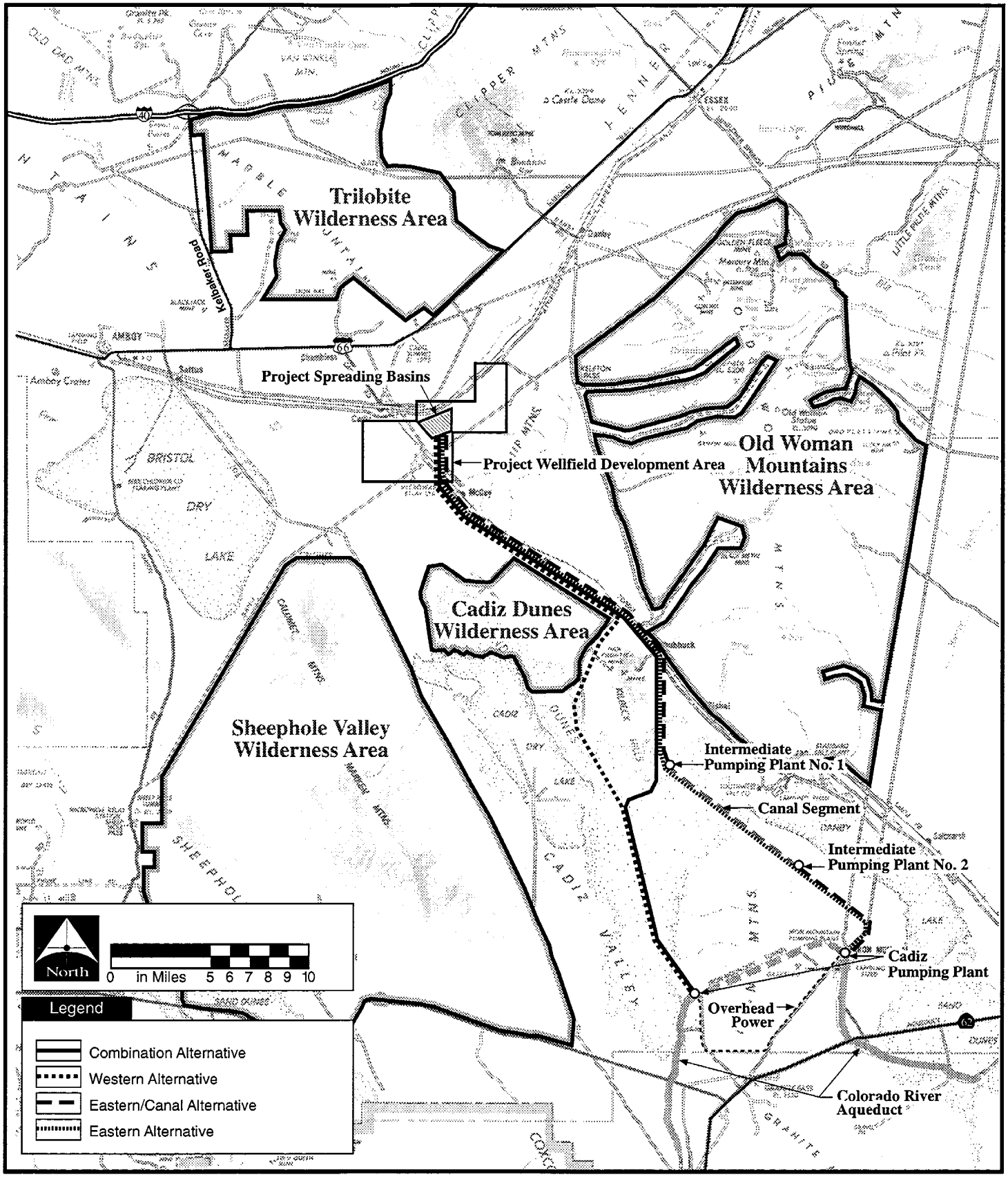
The areas designated as wilderness under the Act are to be administered "...for the use and enjoyment of the American people in such a manner as will leave them unimpaired for future use and enjoyment as wilderness." (16 U.S.C. Section 113[a] *et seq*; 78 stat. 891[a]).

Public Law 103-433, 108 stat. 4471, contains regulations regarding the administration of wilderness areas. Section 103(d) states, "The Congress does not intend for the designation of wilderness area in Section 102 of this title to lead to the creation of protective perimeters or buffer zones around any such wilderness area. The fact that nonwilderness activities or uses can be seen or heard from areas within a wilderness area shall not, of itself, preclude such activities or uses up to the boundary of the wilderness area."

Figure 5.17-1 shows the locations of the four wilderness areas in the vicinity of the Cadiz Project area. Trilobite Wilderness Area is north of the Cadiz Project area, with the closest boundary approximately three and one-half miles from the Cadiz Project area. This Wilderness Area, which covers 31,160 acres including a large portion of the Marble Mountains as well as long alluvial fans on both sides of the range, is named for the fossils found in the region. Much of this Wilderness Area is shielded from the Cadiz Project area by the south part of the Marble Mountains that lie outside the boundary of this Wilderness Area.

The 146,020-acre Old Woman Mountains Wilderness Area is east of the Cadiz Project area. Topography ranges from 800 feet to more than 5,300 feet at the summit of Old Woman Peak. The west boundary of this Wilderness Area is more than six miles from the Project wellfield and Project spreading basins on the northern part of the Cadiz Project area. However, approximately 1.25 miles of the west-central boundary of the Old Woman Mountains Wilderness Area is within several hundred feet of a portion of the Combination, the Eastern and Eastern/Canal alternatives.

Cadiz Dunes Wilderness Area, west of the Cadiz Project area, covers 39,740 acres and its focal point is the Cadiz Sand Dunes. These low dunes were formed from winds pushing sand from the area of Cadiz Dry Lake, located outside and west of this Wilderness Area. Cadiz Dunes Wilderness



Source: P&D Consultants, Inc. (1999).

Figure 5.17-1

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Wilderness Areas in the Project Vicinity

Area is directly adjacent to the water conveyance and power distribution facilities common to all the Project alternatives. The northeast boundary of this Wilderness Area is within several hundred feet of the water conveyance and power distribution facilities for a distance of approximately five miles. The southeast boundary of Cadiz Dunes Wilderness Area is within several hundred feet of the Western Alternative for approximately 1.25 miles.

The Sheephole Valley Wilderness Area, comprising some 174,800 acres, is west of the Cadiz Project area. The Calumet Mountains, the Sheephole Range and the Sheephole Valley that separates them are within this Wilderness Area. At the closest point, the east boundary of this Wilderness Area is approximately five miles from the Western Alternative and seven miles from the Project spreading basins.

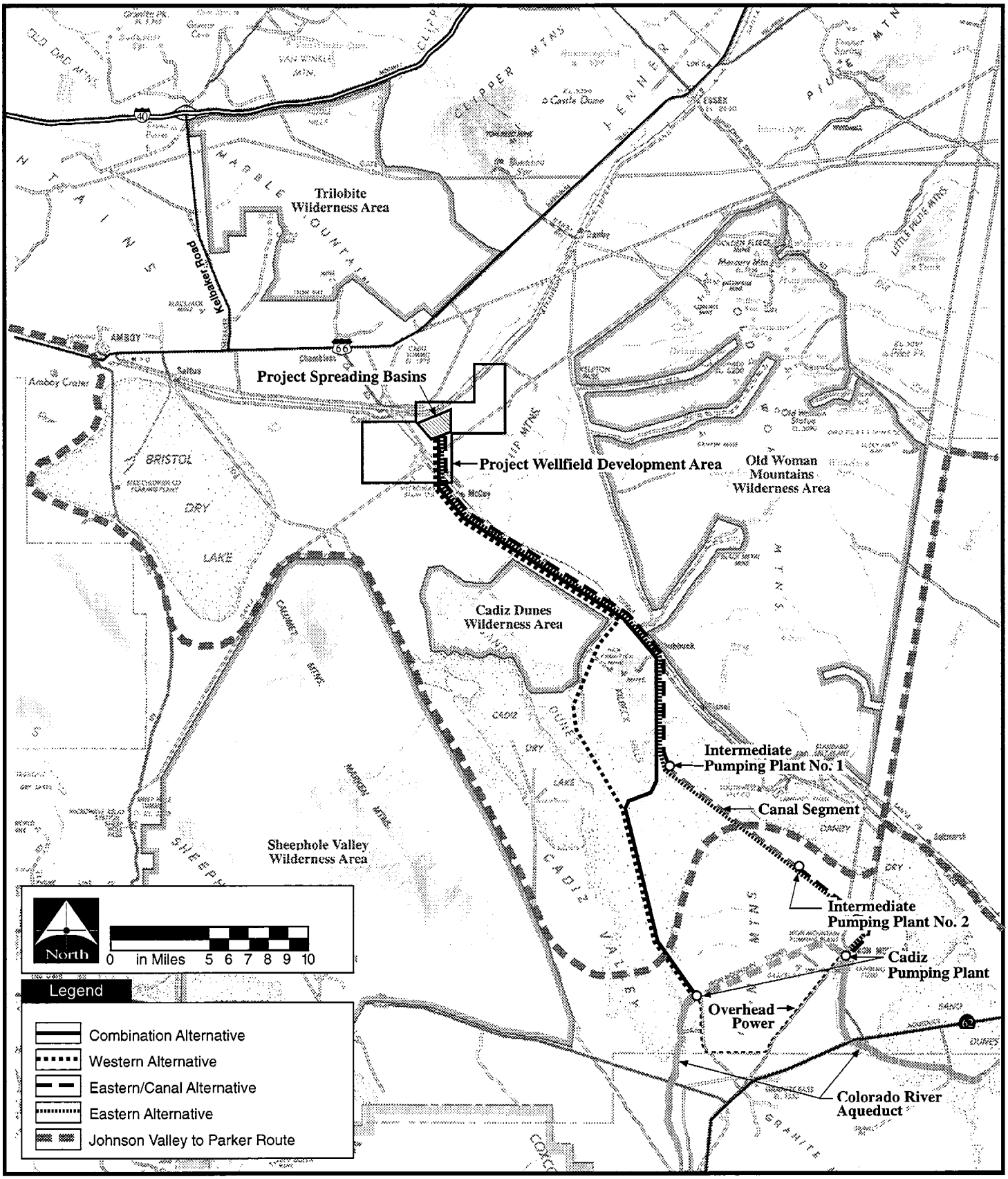
Only non-mechanical types of recreation are allowed in wilderness areas. Recreational opportunities include but are not limited to backpacking; primitive, unimproved site camping; hiking; horseback riding; nature study and observation; photography and painting; rock climbing; spelunking; hunting and rock hounding. Motorized vehicles and bicycles are not permitted in wilderness areas.

The BLM does not have a record of the number of people that use the wilderness areas or any data on the times and locations of use of the various wilderness areas.

In addition to the wilderness areas, the BLM manages much of the land in the vicinity of the Cadiz Project area. These lands are managed for multiple uses as described in the California Desert Conservation Act 1980 Plan, as amended. All the types of recreation activity permitted in wilderness areas are also allowable in other BLM managed areas. In addition, bicycles and various motorized vehicle uses are permitted on BLM land outside wilderness areas. Motorized vehicle use is only allowed on existing routes of travel and prohibited where a route is posted. Stopping, parking and vehicular camping along existing routes of travel are allowed within 300 feet of the route. There are no developed camping areas in the vicinity of the Cadiz Project area. In some locations, specific parking or stopping areas may be signed "open" or "closed" to protect fragile or sensitive resources or to provide a safe place to stop. Off road vehicle play is allowed in approved open areas. However, there are no open areas for off-road vehicles in the vicinity of the Cadiz Project area.

The Johnson Valley to Parker Route, shown on Figure 5.17-2, is a competitive, off-road motorcycle race route which crosses the water conveyance and power distribution facilities alignments. This American Motorcyclist Association sanctioned race was last held in 1983 and a new BLM permit must be obtained prior to each race. The BLM makes the final determination on the race schedule, speed restrictions, maximum number of participants and the exact alignment and course width, taking into consideration environmental factors and protection of special interest species. The sponsoring association may vary with each race.

There are no existing or planned county or local recreation facilities or parks in the vicinity of the Cadiz Project area.



Source: P&D Consultants, Inc. (1999).

Figure 5.17-2

Cadiz Groundwater Storage & Dry-Year Supply Program
EIR/EIS

Johnson Valley to Parker Route

5.17.2 THRESHOLDS OF SIGNIFICANCE

A project would have a significant adverse impact related to recreation if it would conflict with established recreational, educational, religious or scientific uses of an area.

5.17.3 METHODOLOGY

To assess the potential impacts of the Cadiz Project related to wilderness and recreation, existing recreation facilities and allowed recreation uses in the vicinity of the Cadiz Project area were identified. Cadiz Project compatibility or conflict with these facilities and uses was then assessed.

5.17.4 IMPACTS

Eastern Alternative

Wilderness Areas

The Eastern Alternative conveyance facilities and power distribution facilities are within several hundred feet of the west boundary of the Old Woman Mountains Wilderness Area for approximately 1.25 miles. The alignment is also within 100 feet of the eastern boundary of the Cadiz Dunes Wilderness Area for approximately five miles. Currently, there are utility poles and lines in the vicinity of the Cadiz Project area along the ARZC and BNSF rail lines. Following implementation of the Cadiz Project, the utility poles and lines associated with the power distribution facility for the Cadiz Project will also be visible from the adjacent parts of these Wilderness Areas.

As a viewer would move farther away from the utility lines, these lines would be less and less distinct in the view, especially as they are seen against the backdrop of distant mountain ranges. Ground surface disturbance from installation of the conveyance facilities would also be visible from adjacent Wilderness Areas. A maximum 200 foot-wide water conveyance facilities construction area would be altered by removal of vegetation and topsoil causing a visible mark on the landscape. Surface soils would be respread over 180 feet of the construction zone, ensuring that drainage depressions are accommodated. A 20-foot wide dirt maintenance road would remain within the 80-foot wide permanent easement along with power distribution system, power poles and low markers to show the location of the underground pipeline. The construction zone, with the exception of the dirt road and power pole locations, would be revegetated. Due to the arid conditions in the Cadiz Project area, it is expected that many years would be required before the vegetation is mature enough to be indistinguishable from the surrounding landscape.

As discussed in Section 5.14 (Aesthetics), users of the Cadiz Dunes and Old Woman Mountains wilderness areas experience views of vast expanses of open desert land interspersed by linear features including existing utility poles and lines along the ARZC and BNSF rail lines, unpaved roads and railroad tracks. Abandoned buildings and military camps and salt mine operations are the other limited man-made intrusions in this vast viewshed. These generally unobstructed desert views increase the feeling of being in a wilderness and away from civilization. With implementation of the Cadiz Project, scarring from the construction zone would introduce additional man-made objects in an area where man's intrusion is generally not noticeable. The closer these Cadiz Project features would be to a viewer, the greater

the intrusion would be on the sense of wilderness.

Both the Cadiz Dunes and Old Woman Mountains wilderness areas extend a considerable distance away from the Eastern Alternative. Cadiz Dunes extends an additional 4.5 to six miles from the alignment and the Old Woman Mountains Wilderness Area extends more than 17 miles away. Intervening topography blocks views of the Eastern Alternative from some parts of these wilderness areas. As a result, the Cadiz Project power distribution facility and surface disturbance would not be noticeable from major portions of these wilderness areas. There would also be no operational noise associated with the Cadiz Project discernible from these wilderness areas. The extraction operations associated with the Project wellfield will generate only low levels of noise. The closest well to a wilderness area is 4.5 miles away. Well- and pump-associated noise will not be detected at this distance.

Johnson Valley to Parker Race Route

The Johnson Valley to Parker Race Route crosses the Cadiz Project conveyance facilities and power distribution facilities alignment in the vicinity of the Iron Mountains. The last race took place in 1983. However, a potential conflict would occur if pipeline construction were to take place along the race route at the time of a future race. Mitigation measure REC-1 prohibits construction within 500 feet of the race route for ten days prior to, during and ten days following the race. This would eliminate any future potential Cadiz Project conflicts with the Johnson Valley to Parker Race.

Construction Related Impacts

During installation of the water conveyance and power distribution facilities, construction activities would be visible and construction noise would be evident from adjacent wilderness areas. The construction activities would include topsoil removal and stockpiling, trench excavation, utility preservation/relocation, pipe placement, backfill, appurtenant construction, topsoil replacement and revegetation. It would be anticipated that pipeline construction may last up to three months along the adjacent boundary with Cadiz Dunes Wilderness and a much shorter period along the boundary with the Old Woman Mountains Wilderness.

Western Alternative

Wilderness Areas

The Western Alternative is within several hundred feet of the southeast boundary of the Cadiz Dunes Wilderness Area for approximately 1.25 miles and within 100 feet of the east boundary of the Cadiz Dunes Wilderness for approximately five miles. The effects along these parts of the Western Alternative would be the same as described previously for the Eastern Alternative.

Johnson Valley to Parker Race Route

Cadiz Project impacts related to the Johnson Valley to Parker Race route would be the same for the Western Alternative as described earlier for Eastern Alternative.

Construction Related Impacts

Project construction impacts related to wilderness and recreation are the same for the Western Alternative as those described earlier for the Eastern Alternative. It is anticipated that construction of the water

conveyance facility may last up to three months along the adjacent southeast boundary and up to three months along the northeast boundary of Cadiz Dunes Wilderness Area.

Combination Alternative

Wilderness Areas

Cadiz Project impacts related to wilderness areas are the same for the Combination Alternative as those described earlier for the Eastern Alternative.

Johnson Valley to Parker Race Route

Cadiz Project impacts related to the Johnson Valley to Parker Race Route for the Combination Alternative would be the same as described earlier for the Eastern Alternative.

Construction Related Impacts

Cadiz Project construction impacts related to wilderness and recreation for the Combination Alternative would be the same as those described earlier for the Eastern Alternative.

Eastern/Canal Alternative

Wilderness Areas

Cadiz Project impacts related to wilderness areas would be the same for the Eastern/Canal Alternative as those described earlier for the Eastern Alternative. The canal section of the Eastern/Canal Alternative would be approximately three miles from the Old Woman Mountains Wilderness Area and would be visible from higher elevations.

Johnson Valley to Parker Race Route

Cadiz Project impacts related to the Johnson Valley to Parker Race Route for the Eastern/Canal Alternative would be the same as those described earlier for the Eastern Alternative.

Construction Related Impacts

Cadiz Project construction impacts related to wilderness and recreation for the Eastern/Canal Alternative would be the same as those described earlier for the Eastern Alternative.

No Project

Under the No Project Alternative, the Cadiz Project would not be constructed. Therefore, recreation and wilderness uses in the area would be expected to remain as they currently exist and there would be no Cadiz Project related impacts to recreation and wilderness.

5.17.5 MITIGATION MEASURES

REC-1 Pipeline construction scheduling in the vicinity of the Johnson Valley to Parker Race course shall be coordinated with the BLM. Pipeline construction shall be prohibited within 500 feet of the Johnson Valley to Parker Race route for 10 days prior to, during and for 10 days following a scheduled and permitted race date. Any construction that takes place within the race route must be completed at least 10 days prior to the race. This includes excavation, laying of pipe, backfilling and topsoil replacement.

Mitigation measure AS-1 provided earlier in Section 5.14 (Aesthetics) will protect views from BLM lands used for recreation by requiring that the Project Pumping Plants be earth toned to blend in with the surrounding environment.

Mitigation measure AS-2 provided earlier in Section 5.14 (Aesthetics) will protect BLM lands used for recreation from spillover light.

Mitigation measures N-1 and N-2 provided earlier in Section 5.11 (Noise) will reduce noise during construction. However, construction noise will still be perceptible in the nearby areas of the Cadiz Dunes and Old Woman Mountains Wilderness Areas.

5.17.6 LEVEL OF SIGNIFICANCE AFTER MITIGATION

The Eastern, Eastern/Canal, Western and Combination alternatives would not conflict with any established wilderness and recreational uses in the vicinity of the Cadiz Project area including: backpacking; primitive, unimproved site camping; vehicular camping; hiking; horseback riding; nature study and observation; photography and painting; rockclimbing; spelunking; hunting and rockhounding; or motorized vehicle and bicycle use on existing routes of travel. All these recreational uses can take place on BLM lands following Cadiz Project construction under these alternatives. Therefore, the potential impacts of the Cadiz Project under these alternatives related to these recreation uses will be below a level of significance.

During water conveyance and power distribution facilities construction, potential impacts to the Johnson Valley to Parker Race route would be reduced to below a level of significance with implementation of mitigation measure REC-1.

The views from certain points within adjacent wilderness areas would change because Cadiz Project power distribution facilities utility poles and lines and maintenance roads would be visible from some of these areas. The surface disturbance from the conveyance facilities construction would be visible for several years until vegetation matures enough to blend in with the adjacent landscape. These changes in views would be less distinct the farther the viewer is from the Cadiz Project area. These Cadiz Project features would not be noticeable from major portions of the wilderness areas. The changes in views from the wilderness areas would not interfere with wilderness uses of the areas. Therefore, the potential adverse impacts of the Cadiz Project related to wilderness will be below a level of significance.

Noise impacts associated with conveyance facility construction may detract from the wilderness experience in nearby portions of the Cadiz Dunes and Old Woman Mountains Wilderness Areas. This noise impact would be temporary only and would be mitigated by measures N-1 and N-2. Remaining impacts would be below a level of significance. There will be no Cadiz Project operations noise audible from within wilderness areas.

5.18 INDIAN TRUST ASSETS

5.18.1 AFFECTED ENVIRONMENT

Indian Trust Assets (ITAs) are legal interests in properties held in trust by the United States government for Native American tribes or individuals. Examples of potential ITAs are lands, minerals, hunting and fishing rights, and water rights. The United States, with the Secretary of the Interior as the trustee, holds many assets in trust for Native American tribes or Native American individuals. These assets are normally associated with Native American reservations or lands in proximity to a reservation. However, some assets may be located some distance from a Native American reservation. Specific concerns of Native American tribes, reservations and individuals, including the Mojave and Chemehuevi cultural groups, were identified via Native American consultation as described in Section 5.15 (Cultural Resources) of this EIR/EIS.

The United States government has the responsibility to protect and maintain rights reserved by or granted to Native American tribes or Native American individuals by treaties, statutes and Executive Orders, which are sometimes further interpreted through court decisions and regulations. This trust responsibility requires that all federal agencies, including the BLM, take all actions reasonable necessary to protect ITAs.

The Cadiz Project is located in a remote area in southeast San Bernardino County, California. No ITAs are known to exist in the vicinity of the Cadiz Project area, nor were any identified via the Native American consultation.

5.18.2 THRESHOLDS OF SIGNIFICANCE

The impacts of the Cadiz Project related to ITAs would be considered to be significant if they:

- Directly involve the use of land or sites of religious or cultural importance to Native Americans.

- Affect the use of reservation lands or sites of religious or cultural importance to Native Americans.

The BLM Indian Trust Asset Policy requires that the BLM carry out its activities in a manner which protects ITAs and avoids adverse impacts where possible. When the BLM cannot prevent adverse impacts to ITAs, it must ensure appropriate mitigation or compensation. A project which impacts ITAs directly or indirectly would create a significant environmental impact on these resources.

5.18.3 METHODOLOGY

The potential effect of the Cadiz Project on ITAs was evaluated based on BLM's Indian Trust Asset Policy of July 2, 1993; review of the ITAs categorical exclusion checklist; the Department of the Interior's Secretarial Order No. 3175 on the Department's Responsibilities for Indian Trust Resources, dated November 8, 1993; BLM's NEPA Handbook Insert: Procedures to Implement ITA Policy, dated December 15, 1993; Questions and Answers about BLM's ITA Policy and Implementing Procedures, dated August 31, 1994; and the Department of the Interior Secretarial Order No. 3206 on American Indian Tribal Rights, Federal-Tribal Trust Responsibilities and the Endangered Species Act, including

Appendix, Questions and Answers (June 5, 1997). The United States Bureau of Reclamation Lower Colorado Region Indian Reservations map was reviewed to determine if any identified Native American reservations were located in western San Bernardino County, California. Staff of the United States Bureau of Indian Affairs was also contacted to ascertain which, if any, ITAs might be impacted by the Cadiz Project.

5.18.4 IMPACTS

Eastern, Eastern/Canal, Western and Combination Alternatives

From a review of all information available on ITAs, no ITAs are known to exist in the Cadiz Project area. Therefore, there would be no impacts on ITAs under any alternatives for the Cadiz Project.

No Project

Under the No Project Alternative, no new facilities would be constructed. Therefore, there would be no impacts on ITAs under this Alternative.

5.18.5 MITIGATION MEASURES

There are no adverse impacts on ITAs under the Cadiz Project. No mitigation is necessary.

5.18.6 LEVEL OF SIGNIFICANCE

The Cadiz Project would not result in adverse impacts on ITAs.

5.19 ENVIRONMENTAL JUSTICE

The Cadiz Project would be constructed in Cadiz/Fenner Valleys in southeast San Bernardino County, California. Disadvantaged populations include minority ethnic or racial groups, elderly or disabled persons, Native Americans or persons with low incomes. No disadvantaged populations, households or businesses are within the proposed construction zone of the Cadiz Project, and none are expected to be in the future. Therefore, the Cadiz Project would not result in adverse impacts related to environmental justice.

The area potentially affected by the Cadiz Project includes the site of the water conveyance and power distribution facilities, Project wellfield, Project spreading basins and pumping facilities, as well as the surrounding areas, including communities in the region from Twentynine Palms to the Colorado River, and from Needles to Desert Center. Benefits associated with the Cadiz Project would accrue throughout the Metropolitan service area, while the impacts to the construction zones would be temporary and limited to those areas within and directly adjacent to the Project zones. The population characteristics in the Cadiz Project area were described earlier in Section 5.3 (Socioeconomics) of this EIR/EIS.

SECTION 6.0

Growth Inducement Impacts

SECTION 6.0
GROWTH INDUCEMENT IMPACTS

6.1 BACKGROUND

The California Environmental Quality Act (CEQA) requires a project proponent to address the growth inducing impacts of its proposed project. Specifically, Section 15126.2(d) of the CEQA Guidelines (CCR.14, Ch. 3) requires a discussion of the potential of a proposed project to:

"...foster economic or population growth, or the construction of additional housing, either directly or indirectly, in the surrounding environment. Included in this are projects which would remove obstacles to population growth..."

This section provides an evaluation of the regional potential for growth inducement that could result from the construction and operation of the Cadiz Project.

6.2 GROWTH AND ITS POTENTIAL SOCIOECONOMIC EFFECTS

Regional service and planning agencies, such as the Southern California Association of Governments (SCAG), San Bernardino Association of Governments (SANBAG), San Diego Association of Governments (SANDAG), South Coast Air Quality Management District (SCAQMD), the California Department of Finance and the California Department of Transportation, have prepared extensive studies and reports forecasting the region's economy, population and resources. The Growth Management Plan (GMP), Regional Mobility Plan (RMP) and Air Quality Management Plan (AQMP) and their respective Environmental Impact Reports (EIRs) have been approved and adopted by these agencies, in cooperation with local jurisdictions, as the most likely scenarios for growth in this region.

The coordinated projections of these agencies are used by virtually all other planning agencies in long range planning for vital infrastructure facilities, such as federal programs related to regional planning for transportation, wastewater treatment plant capacity and compliance with state and federal air quality standards. The purpose of these projections is to determine the likely future socioeconomic impacts of projected growth and identify the need for appropriate responses from local and regional governments. For example, the GMP developed by SCAG and SANDAG provided the basis for the State Implementation Plan of the Clean Air Act.

The SCAG, SANDAG and other projections assume a reasonable effort on the part of regional agencies to provide the services and infrastructure needed to support planned growth. The primary objectives of these demographic projections and the planning policies on which they are based are to evaluate the potential social, economic, environmental and fiscal impacts that may result from this level of projected growth and to identify mitigation required to reduce or eliminate these impacts. Some of the impacts that would occur based on these projections and policies over the next 20 years are:

- Continued increases in regional population, employment and housing;

- A decrease in household size;
- A potential for a reduction in housing affordability;
- A shift in employment from manufacturing to services sectors;
- An increase in the jobs/housing imbalance at the subregional and county levels;
- Continued urbanization and conversion of agricultural and open space land;
- Increases in demand for wastewater treatment, electricity and motor fuel;
- Depletion of most counties' existing landfill capacity;
- Increased generation of hazardous wastes;
- An increase in the need for teachers, law-enforcement officers, fire protection personnel and associated public facilities;
- Increases in regional person trips and vehicle miles traveled;
- Exceedance of the Draft 1988 AQMP target emissions levels for reactive organic gases, carbon monoxide, nitrogen oxide, sulfur oxides and inhalable particulate matter; and
- Regional shortfall in the water supply.

The growth projections for Southern California anticipate and take into account the predicted adverse impacts of growth. In short, state and regional planning agencies project growth to occur despite shortfalls in water supply, heavy traffic, poor air quality and other factors which are sometimes assumed to be growth limiting. SCAG, SANDAG and other planning agencies implicitly recognize that the availability of infrastructure is not a primary factor which induces growth.

Growth occurs as a result of many socioeconomic factors. Improvements in infrastructure are then demanded by the growing population, which expects public agencies to act to ameliorate the adverse effects of growth. Enhancement of infrastructure and acquisition of the resources needed to maintain public services are the response of public agencies to growth. Therefore, advanced planning to meet projected needs of a growing population does not foster growth; its purpose is to ensure that existing levels of public service are not degraded as a result of growth.

The Cadiz Groundwater Storage and Dry-Year Supply Program responds to projections of growth and the anticipated demand for dry-year water supply, based on the following basic assumptions:

- Adopted SCAG and SANDAG population, housing, employment and land use plans, and their associated water needs;
- Implementation of Best Management Practices in water conservation throughout Metropolitan's service area, resulting in documented annual water conservation savings from 1990 to 1998 of 480,000 acre-feet per year, with projected 2020 annual conservation savings of 1,072,000 acre-feet;

- Implementation of all identified potential wastewater reclamation and reuse projects using Metropolitan's Local Project Program, with a projected 2020 annual yield of 500,000 acre-feet; and

- Maximum development and use of groundwater storage basins based on the capacity to replenish aquifers, using Metropolitan's seasonal storage and interruptible pricing programs and groundwater recovery program.

Future economic growth in Southern California depends on national and global economic factors, as well as regional population and job growth trends. Population, housing and employment growth in Metropolitan's service area are assumed to occur at levels projected by local, regional and state planning agencies. Metropolitan's programs and facilities are sized and planned in compliance with SCAG and SANDAG projections which incorporate growth management programs as promulgated in their GMPs.

6.2.1 POPULATION

Metropolitan provides service to a majority of the residents of Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura counties. Since 1970, the population in Metropolitan's service area has been approximately 50 percent of the State's total population as shown in Table 6-1. Metropolitan's share of population and economic growth in the future is expected to remain at about 50 percent of California's growth.

The population in this six county region experienced a 22 percent increase from 13.4 million persons in 1980 to 16.3 million persons in 1990, based on the 1990 United States Census as shown in Table 6-1. Regional population is projected to reach 19.4 million persons by 2010 and 21.3 million persons by 2020.

Forecasts also show a shift in population growth away from urbanized areas, toward the region's urbanizing and mountain/desert areas, especially in Riverside and San Bernardino counties. Between 1994 and 1998, the rate of growth in population in this region was about 1.5 percent per year.

For example, the 1980 population in Riverside County (1980 United States Census) was 663,000 persons. This increased to 1.2 million persons (1990 Census), making Riverside County one of the fastest growing counties in Southern California. In large part, this growth was attributable to the more affordable housing available in Riverside County when compared to Orange and Los Angeles counties. Western Riverside County is experiencing most of that county's development. Population growth in the Riverside County is expected to outpace regional growth over the next few decades. The population of Riverside County is projected to reach 2.8 million persons by 2020.

6.2.2 EMPLOYMENT AND INDUSTRY

Employment and industry are the primary factors underlying the region's past and projected growth. Population growth is essentially a socioeconomic indicator of these and other factors which cause people to move to and remain in an area. Trends in employment, industry and housing availability are, therefore, precursors of growth trends and the associated demand for public services in a particular area.

TABLE 6-1
POPULATION TRENDS
(Millions of People)

	1970	1980	1990
Metropolitan Service Area	10.23	11.95	14.90
California	19.97	23.67	29.76
United States	203.98	227.26	249.60
Percent Metropolitan Service Area is of California	51.2	50.5	50.1
Percent California is of the United States	9.8	10.4	11.9

Source: United States Census Bureau (1999).

Total employment in the six county region was estimated to be 8.4 million jobs in 1998, with the majority of these jobs in the services, manufacturing and retail trade sectors. Projected total employment in the six county area is expected to reach 10.5 million jobs by 2010 and 12.1 million jobs in 2020. Employment in the Metropolitan service area is projected to increase by approximately 45 percent between 1998 and 2020.

6.2.3 HOUSING

The region's housing stock included 6.5 million permanent housing units in 1990 (1990 United States Census). Regional estimates of 1998 housing stock were 6.6 million permanent units, with an additional 2.6 million units projected for 2020, bringing the total available housing to 9.2 million units. Housing growth is expected to be greater in inland counties than the region as a whole, due to the relative availability of affordable and developable land. For example, housing is forecast to increase in Riverside County to 864,000 units by 2010 and 1.1 million units by 2020. Overall, housing in the Metropolitan service area is projected to increase by approximately 1.2 percent per year from 1990 to 2020, rising from 5.2 million units to 7.1 million units.

6.2.4 JOBS/HOUSING BALANCE

The concept of jobs/housing balance reflects the relationship between land use and environmental impacts, and is a valuable analytic tool for estimating the potential growth inducing impacts of a project in a regional context. Jobs and housing are in balance when an area has sufficient employment opportunities for most of the people who live there and a sufficient number of housing units for most of the people who work there. The SCAG and SANDAG GMP contains policies that local jurisdictions may adopt to achieve jobs/housing balances in their areas. These GMP concepts include encouraging residential development in housing poor areas and increasing the amount of commercial and industrial development in job poor areas.

6.3 RELATIONSHIP OF THE PROJECT TO REGIONAL GROWTH MANAGEMENT PLANS

The demographic and economic basis for dry-year water demand in Metropolitan's service area is the most recent SCAG and SANDAG adopted population projections and their GMP mitigation measures. Metropolitan, in its planning of water distribution system improvements, uses the

adopted SCAG and SANDAG projections to maintain consistency with other regional planning efforts. Adopted GMPs specify actions which should be taken by appropriate public agencies to mitigate the impacts of projected growth.

The recent GMPs have identified the following as prime objectives with respect to water for Southern California:

- The provision of a dependable and reliable supply of water;
- Preservation of the quality and integrity of surface and groundwater resources;
- Commitment to water conservation; and
- Accomplishment of water supply and quality improvements in a cost-effective manner.

Metropolitan is actively pursuing all the SCAG mitigation measures with respect to water supply. As discussed in Section 2, since the 1980s, Metropolitan has implemented a number of comprehensive programs to encourage active water conservation and water recycling practices through direct financial incentives with its member agencies. These programs have grown to represent the largest commitment in the state to water conservation and water recycling practices.

6.4 GROWTH INDUCEMENT

A sustained level of population growth and development in Southern California over the years has led to concerns about the amounts and merits of additional growth in the region. Spurred in part by the conversion of wartime industry to civilian uses, dominance of the entertainment industry, rising tourism and an expansion of trade with Asian markets, Southern California experienced a rapid economic expansion. This expansion continues as Southern California has become a center for world trade, a center for new technology development and a Pacific Rim financial center. This economic growth has created prosperity, but has also led to urban sprawl, increased traffic and deteriorating air quality. As such, the relationship of the Cadiz Project to growth in Southern California is an important issue to many citizens.

Many factors affect the rate and location of growth in a region. However, the Cadiz Project will not significantly affect any of these factors. As noted above, the primary factors responsible for growth are general socioeconomic conditions including labor supply, cost of living and the cost of labor. Relative intangibles, such as favorable weather or aesthetics, may also have a significant impact on growth in Southern California.

Given that these and other socioeconomic factors are favorable, projected growth will create a significant dry-year regional water supply shortfall, as discussed in Section 2. As the primary provider of supplemental water supply for Southern California, Metropolitan is responsible for developing programs to meet the dry-year regional water supply deficit. The purpose of the Cadiz Project is to help meet these dry-year demands.

The Cadiz Project would neither induce growth nor remove a constraint shown to limit growth. This is clearly evident from growth rates in Southern California during previous dry years, including the significant droughts of 1976-77 and 1987-1992. During these droughts, Southern

Californians were required to implement significant conservation efforts to reduce demand. These temporary efforts did not affect growth and development. For example, from 1987 to 1992, the rate of population growth in Southern California remained at 2.5 percent per year. Population growth continued in warmer parts of the Metropolitan service area despite drought conditions. Net annual growth, including immigration, in Southern California averaged 300,000 per year during this period, approximately the same net increase as has occurred during the much wetter period from 1995 to 1998. Immigration, from within and outside the United States, continued to occur to Southern California during the drought periods. Short-term water shortages and the implementation of conservation measures did not appear to alter the underlying socioeconomic attractions of Southern California or affect the rate of population growth.

In short, population trends do not respond to the short-term inconveniences of drought, which do not affect the underlying socioeconomic forces which SCAG and SANDAG have found to affect growth.

6.5 CONCLUSIONS

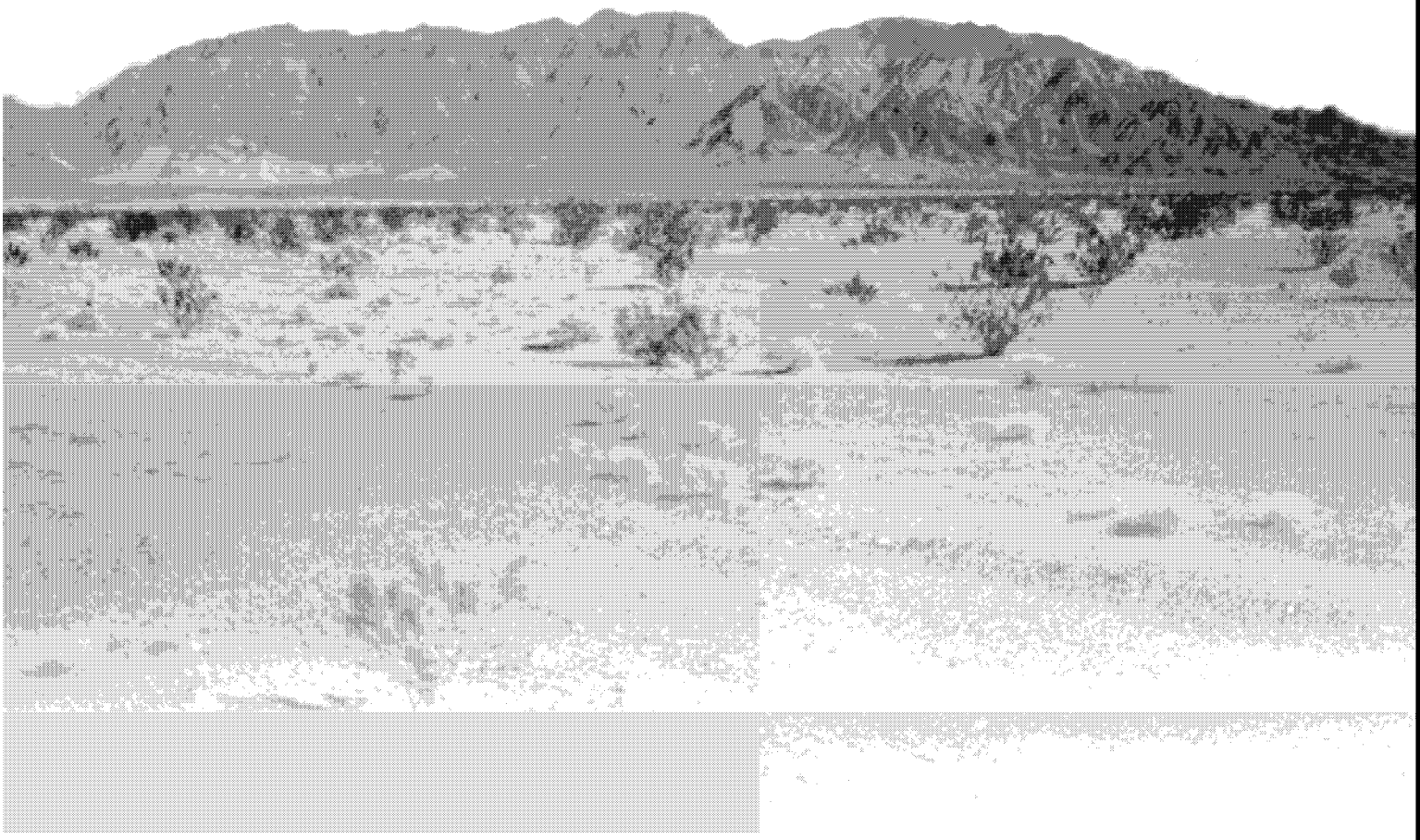
Growth in Southern California is a result of tangible socioeconomic factors and intangibles such as favorable weather. Taking these factors into account, SCAG, SANDAG and other state and regional planning agencies project substantial growth in Southern California over the next 20 years, resulting in a population of approximately 21.3 million people by 2020. Water supply, particularly short-term dry-year water supply deficits, appear to be unrelated to the attractiveness of Southern California as a place to live.

SCAG and SANDAG recognize these factors will create relatively steady growth into the future and that this growth will result in a number of adverse impacts that must be mitigated by development of appropriate public works such as roads, parks, schools, water supply and other infrastructure.

Metropolitan's Cadiz Project is a mitigation project, intended to help offset the adverse impacts of growth on water supply, in particular on dry-year water supplies. The Cadiz Project responds to needs generated by growth, but does not itself induce growth or eliminate a constraint that has been shown to limit growth.

SECTION 7.0

Cumulative Impacts



SECTION 7
CUMULATIVE IMPACTS

7.1 BACKGROUND

Cumulative impacts refer to two or more individual impacts which, when considered together, are considerable or which compound or increase other environmental impacts. The individual effects may be changes resulting from a single project or from a number of projects. A cumulative impact refers to the degree of change in the environment resulting from a particular project, plus the incremental impacts created by other closely-related past, present and reasonably foreseeable future projects. Cumulative impacts may reveal that relatively minor impacts associated with a particular project may contribute to more significant impacts when considered collectively with other projects taking place over a period of time.

Environmental resources included in the consideration of cumulative impacts include agriculture; land use; socio-economic and growth inducement; topography, geology, seismicity and soils; water resources; air quality; transportation; biological resources; energy and mineral resources; hazards and hazardous materials; noise; public services; utilities and service systems; aesthetics; cultural resources; paleontological resources; wilderness/ recreation; and Indian Trust Assets.

This section summarizes potential cumulative environmental impacts of the Cadiz Project and any related projects. There are no known closely related, past, present and reasonably foreseeable probable future projects in the Cadiz Project Area. A solid waste disposal project (Railcycle Project) has been proposed for the region and a nuclear waste disposal facility (Ward Valley Project) was also proposed. Neither of these projects is currently in advanced planning stages and their implementation is uncertain. There are significant legal, financial and environmental hurdles facing both projects before they can be considered likely to be implemented. In addition, official projections of population and development do not predict significant development in the region of the Cadiz Project. For purposes of cumulative analysis, then, Metropolitan's Hayfield Groundwater Storage Project was considered the only other project in the region.

The analysis of potential cumulative impacts associated with the Cadiz Project and other approved, planned and reasonably foreseeable projects evaluates these impacts regionally, based on population and employment projections for 2020, and on a more specific level based on known planned land uses and the Cadiz Project alternatives.

7.2 CUMULATIVE PROJECTS

7.2.1 REGIONAL PLANS

The proposed construction and operation of the Cadiz Project would be coordinated, and is consistent with, the regional plans of the Southern California Association of Governments (SCAG), the San Bernardino Association of Governments (SANBAG) and the San Diego Association of Governments

(SANDAG). These plans, as well as the Regional Mobility Plans, Growth Management Plans, Air Quality Management Plans and the San Bernardino County General Plan and BLM California Desert Conservation Area Plan, have been the subject of separate Environmental Impact Reports and Environmental Impact Statements that specifically address their particular impacts.

The Hayfield Project has and will be similarly coordinated with, and is consistent with, SCAG's regional plans, the Riverside County General Plan and other applicable regional and local plans.

By assisting in the provision of dry-year water supply to reliably serve the population forecast by these regional plans, the Cadiz and Hayfield Projects are found to be jointly consistent with meeting forecast infrastructure needs. Together, the Cadiz and Hayfield projects are also not in conflict with any plan policies or goals. Both projects provide a dry-year supply of water that would be conveyed to Metropolitan's distribution system for use in a manner that is fully consistent with regional and local land use plans.

7.2.2 APPROVED AND PROPOSED LAND DEVELOPMENT IN THE CADIZ PROJECT AREA

According to the County of San Bernardino, there are no locally planned, approved or reasonably anticipated land development projects in the vicinity of the Cadiz Project. Therefore, no cumulative effects will result due to land development activities occurring cumulatively with the Cadiz Project.

7.2.3 OTHER WATER SUPPLY PROJECTS

Metropolitan recently approved the Hayfield Project as part of its efforts to provide sites for storage of Colorado River Aqueduct water. The Hayfield groundwater basin is located in the Mojave Desert north of Interstate 10 (I-10), approximately three miles east of Chiriaco Summit and eight miles west of Desert Center, between Metropolitan's Eagle Mountain and Julian Hinds pumping plants on the Colorado River Aqueduct. The project site is directly adjacent to the Colorado River Aqueduct. Preliminary feasibility analysis indicated that groundwater storage in the Hayfield basin was technically feasible and cost effective. This project is currently under construction.

The Hayfield Project includes the following three components:

1. Geotechnical and hydrogeological investigations and a pilot demonstration program;

2. Construction of the full-scale facilities to store and retrieve groundwater; and

3. Land acquisition in the vicinity of the project to consolidate property ownership to protect groundwater resources and quality.

Under the Hayfield Project, Metropolitan would store approximately 1.0 maf of available Colorado River Aqueduct water in the Hayfield groundwater basin. Similar to the Cadiz Project, during years of water shortage, this stored water would be recovered and placed in the Colorado River Aqueduct for use in Metropolitan's

service area. Expected recharge and return capacity of the Hayfield Project is approximately 150,000 acre-feet per year.

7.3 THRESHOLDS OF SIGNIFICANCE

Cumulative impacts are considered to occur if a project is determined to have impacts which become cumulatively considerable when viewed together with the effects of related projects.

7.4 METHODOLOGY

Cumulative impacts were assessed by reviewing the impacts of the Cadiz Project and the Hayfield Project and considering them in conjunction with one another. The Cadiz Project was determined to have cumulative impacts if its added impacts would significantly increase the level of impact to a resource already adversely impacted by the Hayfield Project. If neither project resulted in a significant adverse effect, but did cause some adverse impacts, the impacts of both projects were considered jointly to make a determination of the extent and significance of their cumulative impacts.

7.5 CUMULATIVE IMPACTS

The potential cumulative impacts of the Hayfield Project in conjunction with the Cadiz Project are discussed below by environmental category. In particular, this discussion notes those categories where the Cadiz Project's contribution to impacts would be significant and therefore would potentially contribute to a cumulative impact when considered in conjunction with the impacts of the other conjunctive-use project.

7.5.1 AGRICULTURE

Neither the Hayfield Project nor the Cadiz Project would impact prime farmland, and only a small amount of farmland at the Cadiz Inc. agricultural operations would actually be impacted by the wellfield facilities necessary to implement the Cadiz Project. Therefore, the cumulative impact on agriculture would not be significant.

7.5.2 LAND USE, PLANNING AND POLICIES

The Hayfield Project will be developed on vacant land, and does not conflict with any applicable land use plan, policy or regulation or natural community conservation plan.

The part of San Bernardino County where the Cadiz Project would be located is mostly vacant and undeveloped. A small part of this area is used for agricultural purposes. Land administered by the BLM in the Cadiz Project area is used for recreation, open space and mineral extraction. The Cadiz Project would not result in a significant adverse impact to the land use character of the Cadiz Project area, as many of the facilities to be constructed for this Project would be located underground. The above ground facilities (Project wellfield, Project spreading basins, etc.) and power distribution lines are consistent with the open space character of the surrounding area.

With the previously mentioned exception of a small amount of farmland, impacts of the Cadiz Project would be short-term and would not result in displacement of existing land uses. Implementation of the Cadiz Project would require acquisition of

a grant of right-of-way from the BLM, but this would not result in a significant adverse impact, since the major Cadiz Project facilities and the water conveyance facilities would be buried. Other permanent surface facilities including the spreading basins, power distribution facilities and unimproved maintenance access roads would be consistent with the open space character of the surrounding area and, in addition, would occupy only a small percentage of total acreage in the Cadiz Project area. In addition, the Cadiz Project construction activities would be coordinated with area railroads and Cadiz Inc. agricultural operations and the operations of the Colorado River Aqueduct so as to minimize impacts on these land uses. Therefore, the Cadiz Project is not expected to contribute to either short or long term cumulative land use impacts when considered in conjunction with the Hayfield Project.

7.5.3 SOCIOECONOMICS AND GROWTH INDUCEMENT

Neither the Hayfield Project nor the Cadiz Project would displace existing housing or induce population growth in the surrounding area.

A number of short-term construction jobs would be created by the Cadiz Project and future phases of the Hayfield Project, but construction workers are expected to come from the cities some distance from the Cadiz Project area and from the regional labor pool. These jobs are not expected to significantly change the economy of the area or region.

Excess water available from the Colorado River Aqueduct would be banked by both projects for future use. The use of this waer to meet dry-year demands is consistent with regional plans and is considered by regional planning agencies to mitigate the adverse impacts of planned growth. Therefore, the Cadiz Project, when considered in conjunction with the Hayfield Project, would not result in significant adverse cumulative area or regional socioeconomic or growth inducement impacts. Refer also to Section 6.0 (Growth Inducement Impacts).

7.5.4 TOPOGRAPHY, GEOLOGY, SEISMICITY AND SOILS

The Hayfield and the Cadiz Projects do not involve significant changes to the existing topography, as they are both planned in areas of relatively mild topographic relief.

Development of the Cadiz Project would not contribute to cumulative significant changes in the existing topography and soils. In areas where conveyance facilities traverse major topographic features, construction would be limited to cut-and-cover excavation with limited surface modification for pumping stations, wells and electrical substations. Therefore, the Cadiz Project would not result in a significant adverse impact on topography by itself and would not cause a significant cumulative effect when considered in combination with the Hayfield Project, which also involves only minor, insignificant surface disturbance.

With respect to geological impacts, the two projects would be designed and constructed in compliance with all applicable federal, state, regional and local regulations relating to site specific geologic conditions and would not, individually or together, result in significant cumulative impacts with respect to geologic conditions.

7.5.5 WATER RESOURCES

The Cadiz Project and Hayfield Project would both use excess Colorado River Aqueduct water for storage in the aquifer systems underlying their respective project areas for use during dry-years. Therefore, cumulatively the Cadiz Project would add to the availability of water for use in dry-years and would contribute to a cumulative beneficial water resource impact in the region.

Other than changing the elevation and quantity of groundwater in the basins used in the specific portion of the aquifer system that would be utilized and managed for water storage and extraction, neither the Cadiz Project nor the Hayfield Project would result in any substantial short or long term changes in area hydrology. Therefore, neither the Cadiz Project or the Hayfield Project would cause any significant cumulative hydrologic impacts. The full implementation of the Cadiz Project's Groundwater Monitoring and Management Plan would ensure this.

7.5.6 AIR QUALITY

The Mojave Desert Air Quality Management District adopted the 1990 Air Quality Management Plan that projected growth-related increases in air pollution emissions in the Air Basin and established rules and controls that guide and direct activities that would result in an overall improvement in air quality over the next 20 years. The Cadiz Project is in a nonattainment area for ozone, carbon monoxide and particulate matter less than 10 microns in diameter. Air quality impacts generated by the Cadiz Project would predominately be short term and related to construction. In particular, short term Cadiz Project emissions of NOx, CO, fugitive dust and particulates would be generated during the construction of the Cadiz Project. Over the short term, these adverse construction impacts would be significant.

Construction impacts on air quality for the Hayfield Project were determined to be insignificant, but could cumulatively add to the significant construction emissions of the Cadiz Project. However, the effects of these potential impacts would be localized in the construction area for each project, and their cumulative effect would be highly dependent on the timing of construction activities between the Cadiz and the Hayfield projects. The two projects contribute to a short term significant cumulative impact on local air quality during construction due to the contribution of pollutants into a non-attainment area along with pollutants from the Hayfield Project.

However, when considered over the long term, the Cadiz and Hayfield projects together would not result in a significant cumulative adverse impact on local or regional air quality since they would draw from an existing power supply and would involve few employees and maintenance trips.

7.5.7 TRANSPORTATION

Due to the very low volumes of background traffic, the forecasted increases in traffic volumes in eastern San Bernardino County associated with the construction of the Hayfield Project and Cadiz Project together would not result in a significant cumulative effect on transportation, even with construction of these two projects occurring simultaneously.

Due to the relatively small number of employees and limited number of trips required for operations and maintenance activities, the Hayfield Project and Cadiz Project would not be expected to generate significant trip in the long term activity throughout the study area. Therefore, these Projects would not result in a significant cumulative traffic impact over the long term.

The operation of the Hayfield Project and Cadiz Project would likely generate only one or two flights per week into the private airstrips adjacent to the respective project sites. Therefore, the Cadiz Project and the Hayfield Project would not result in a significant cumulative air traffic impact.

7.5.8 BIOLOGICAL RESOURCES

Regional resources such as Mojave creosote scrub, Mojave wash scrub and desert dunes/desert sand fields are being removed as growth and development continue in Mojave desert. However, there is relatively little development activity and corresponding growth in this subregional area. There is no current development activity in the Cadiz Project area.

Although there is little loss of habitat due to development of the Cadiz and Hayfield projects, there is a need to protect habitat and the species which utilize it from adverse impacts of recreational use. By placing currently unprotected habitats under Federal and/or Metropolitan protection in mitigation for Project impacts, the Cadiz Project and the Hayfield Project both offset localized biological resource impacts. Viewed together, they do not cause significant cumulative impacts to biological resources.

7.5.9 ENERGY AND MINERAL RESOURCES

The Cadiz and Hayfield projects do not impact any mineral resource areas in common. They both would require electrical power from Metropolitan's Iron Mountain Pumping Plant power distribution system, which distributes hydroelectric power generated on the Colorado River. A sufficient supply of power is currently available from Metropolitan's existing Colorado River Aqueduct power supply at Iron Mountain Pumping Plant to power the operation of the Cadiz Project. Cadiz Project facilities would be operated when certain Colorado River Aqueduct pumps are taken off line, freeing up the available power supply. The use of this available power not result in a an impact on the supply of energy available to the eastern part of San Bernardino County.

7.5.10 HAZARDS AND HAZARDOUS MATERIALS

Due to existing regulations governing hazardous materials, the Hayfield and Cadiz projects would not expected to result in significant adverse impacts related to the use or transport of hazardous materials or the generation or transport of hazardous wastes.

However, the Cadiz Project would have the potential to result in adverse impacts related to the presence of ordnance and explosives from former military exercises in the Cadiz Project area. The exact location and quantity of these materials are not known. Therefore, the

significance of this impact can not be quantified. Harmful ordnance and explosives have been discovered randomly throughout this part of the California desert on numerous occasions since the late 1940s. Although these discoveries have been infrequent in recent times, each discovery poses a potentially significant hazard. Therefore, excavation and grading for the Cadiz Project have the potential to result in significant adverse impacts related to ordnance and explosives.

The Hayfield Project is not anticipated to result in significant adverse impacts related to unexploded ordnance, as it is located in an area not likely to contain unexploded ordnance.

The Cadiz Project would have a cumulatively beneficial impact by providing important information to the BLM and other agencies concerning the location of remaining ordnance and explosive wastes in the area and methodologies used to locate and remove them. The Cadiz Project would also result in clearance of explosive hazards from an area of desert land.

7.5.11 NOISE

The Hayfield Project and Cadiz Project would not be expected to result in significant adverse noise impacts on sensitive land uses during construction or operations.

The San Bernardino County General Plan Land Use map designates most of the area of the Cadiz Project as Resource Conservation (RC) and a substantial amount of this area is under the jurisdiction of the BLM and other agencies. Therefore, it is unlikely that a substantial amount of new development or new cumulative noise sources would occur in this area over the life the Cadiz Project. In general, ambient noise levels in the Cadiz Project area are expected to remain low to very low in the future. Therefore, the Cadiz Project, the Hayfield Project and other potential projects in this area are not expected to contribute to significant long term, cumulative adverse noise impacts.

7.5.12 PUBLIC SERVICES

The Hayfield Project would have a negligible contribution to the cumulative effect on the demand for public services in eastern Riverside County, where that project is located. During construction, the Cadiz Project would create a slight increase in demand for public services. However, operational impacts of the Cadiz Project related to public services would be negligible. In combination, both projects would not result in a significant cumulative adverse impact on public services.

7.5.13 UTILITIES AND SERVICE SYSTEMS

The Hayfield Project would not significantly contribute to a cumulative effect on the demand for utilities in eastern Riverside County. The Cadiz Project would create a slight increase in demand for utilities in the Cadiz Project area in San Bernardino County. However, the Cadiz Project would not contribute to a significant cumulative impact when considered with the Hayfield Project because of the very small utility and service system demands associated with both projects over the long term.

The Hayfield Project and Cadiz Project would contribute to a cumulatively positive impact on water supply availability since the projects would help to provide an additional supply of water for use during dry-years.

7.5.14 AESTHETICS

The eastern Riverside County area where the Hayfield Project is located and eastern San Bernardino County where the Cadiz Project is located are mostly undeveloped. Some agricultural, resource extraction and recreational/open space uses are present in these areas. As additional projects are developed in these areas, their visual quality will be modified.

Both the Hayfield Project and the Cadiz Project areas would result in temporary adverse aesthetic impacts during construction. The Cadiz Project water conveyance and power distribution facilities construction would be visible from BLM wilderness areas located adjacent to the alignments of these facilities. Associated construction activities would result in the temporary degradation of views from these wilderness areas. Construction activities for the Hayfield Project would involve disturbances for pipeline and wellfield construction. The Hayfield Project may also involve spreading basin construction in the area of Cholla Wash. As with the Cadiz Project, the Hayfield Project would result in temporary areas of bare soil, construction equipment and materials storage areas that create a temporary aesthetic impact. For the Hayfield Project, these areas will be visible from I-10. The Cadiz Project construction activities, when considered together with the Hayfield Project construction activities, would result in a temporary significant cumulative adverse impact on aesthetics.

Over time, the area where the Cadiz Project water conveyance and power distribution facilities would be developed would be revegetated, although it would take some years for the vegetation to mature because of the limited amount of local rainfall. Due to the existence of the Colorado River Aqueduct, the presence of pumping stations, pipelines, power lines, canals and other infrastructure in the visual context of the Cadiz Project is a relatively common occurrence. The Cadiz Project would add to these existing facilities with its new pump stations, wells, spreading basins and substations. The Hayfield Project is adjacent to the Colorado River Aqueduct and the Eagle Mountain Mine and, therefore, the new wells, spreading areas and ancillary facilities would not adversely affect the long-term appearance of that area. Jointly, the Cadiz and Hayfield projects do not result in a long-term significant cumulative aesthetic impact.

7.5.15 CULTURAL RESOURCES

Cultural resources in the Cadiz Project area are related to the early development of this area including the development of railroads, the Colorado River Aqueduct and the Iron Mountain Pumping Plant; and the extensive use of this area for military purposes. As described earlier, only limited additional development is anticipated in the Cadiz Project area. Other future development projects would be required to comply with applicable regulations regarding the protection and avoidance of cultural resources, and the recovery and documentation of resources when avoidance is not possible.

The Hayfield Project area has been used by Native Americans, the historical development of mining activities, the Colorado River Aqueduct and Hayfield Pumping Station. Mine facilities, Colorado River Aqueduct facilities and equipment are part of the cultural resource context of the Hayfield site.

The Hayfield Project and Cadiz Project would not result in significant adverse impacts related to cultural resources after implementation of Project specific mitigation measures. There would be a beneficial Project effect related to increased knowledge regarding the prehistory and history of the Cadiz Project and Hayfield Project areas, based on recovery and documentation of cultural resources prior to and during construction of the two projects.

Therefore, the Cadiz Project and the Hayfield Project would not contribute to a cumulatively significant adverse impact on cultural resources.

7.5.16 PALEONTOLOGICAL RESOURCES

There are no known paleontological resources or sites within the impact area of the Hayfield Project.

There are known paleontological resources or sites within the Cadiz Project area. The Cadiz Project would result in significant adverse impacts related to paleontological resources after implementation of the Cadiz Project mitigation measures. There would be a beneficial effect of the Cadiz Project related to increased knowledge regarding soil and rock formations in this area based on the recovery and documentation of the paleontological resources contained in these formations during construction of the Cadiz Project.

Only limited additional development is anticipated in the Cadiz Project area in the future because much of the land is under the protection of the state and the BLM. Much of this area has been documented as containing fossil bearing soils and rock formations. Other projects would be required to comply with applicable regulations regarding the protection and avoidance of paleontological resources and the recovery and documentation of resources when avoidance is not possible.

Construction of the Cadiz Project would result in the disturbance and unearthing of paleontological resources.

Mitigation measures included in the Cadiz Project would substantially reduce the short-term impact of the Cadiz Project on paleontological resources, but not to below a level of significance. This would be an unavoidable adverse impact during construction of the Cadiz Project. Therefore, the Cadiz Project would result in adverse impacts on paleontological resources. However, because only limited additional development is anticipated in this region, this would not be a significant cumulative adverse impact of the Cadiz Project and other projects in this region, including the Hayfield Project.

Therefore, the Cadiz Project and Hayfield Project would not contribute to a cumulatively significant adverse impact on paleontological resources.

7.5.17 WILDERNESS/RECREATION

The Hayfield Project would not result in the loss of any wilderness or recreational resources. The Cadiz Project would not

directly impact any wilderness or recreational resources, although parts of the Cadiz Project area are adjacent to a wilderness areas under the jurisdiction of the BLM. Visitors to these wilderness areas would have off-site views of the construction of the water conveyance and power distribution facilities that are part of the Cadiz Project and some construction activity may be audible in those areas closer to active construction zones. This would not be considered a significant cumulative adverse impact since no wilderness or recreational areas would be lost and construction noise would be only temporary effect of the Cadiz Project.

7.5.18 ENVIRONMENTAL JUSTICE

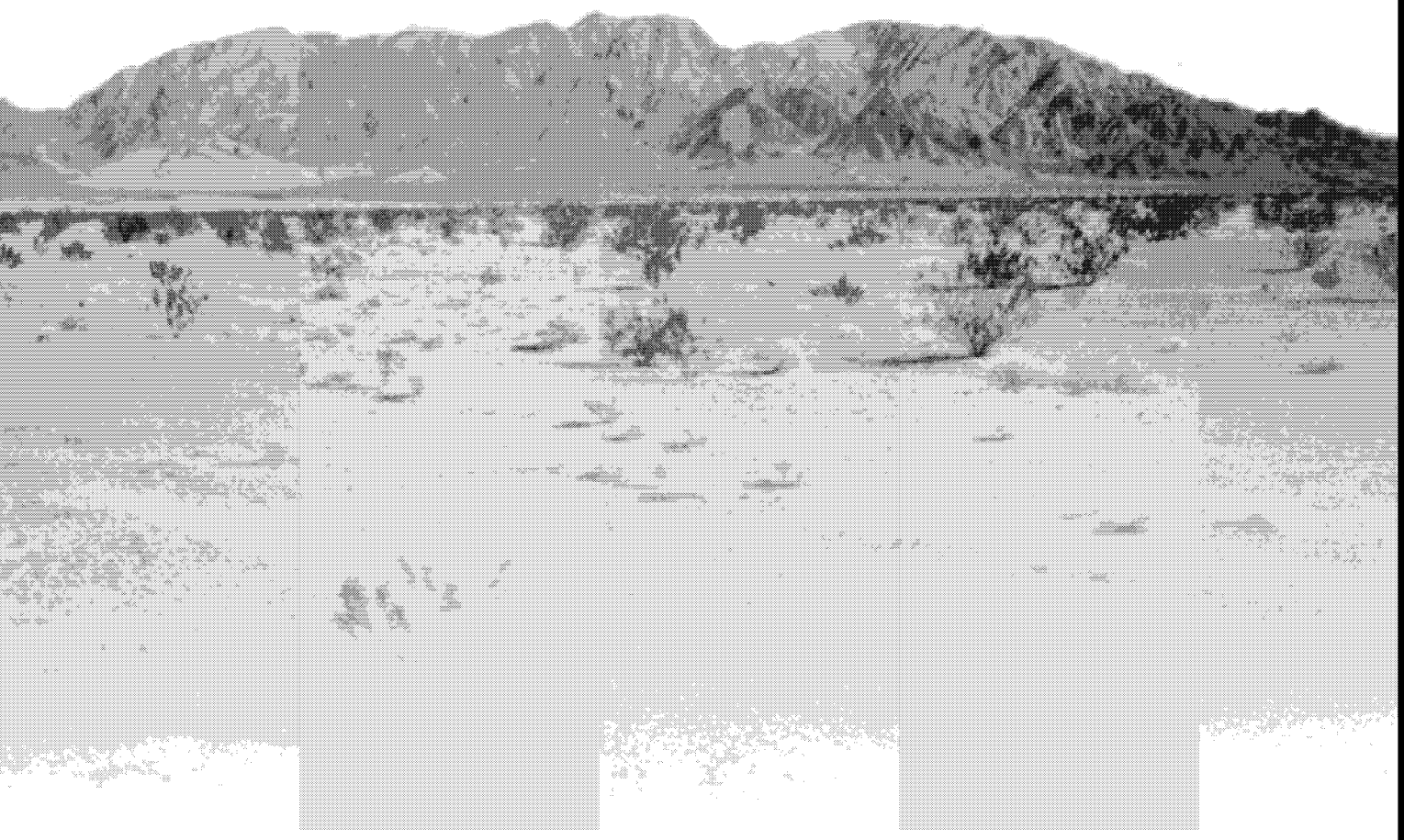
The Hayfield Project and the Cadiz Project would not create any environmental justice impacts since no homes or businesses are located within either project area. Water supply from both projects would be equitably distributed by Metropolitan in adherence to Board policy. Neither the construction nor operation of either project would disproportionately impact or benefit any disadvantaged populations. Therefore, no adverse cumulative impacts on environmental justice would arise as a result of the Hayfield and Cadiz projects.

7.5.19 INDIAN TRUST ASSETS

The Hayfield Project and Cadiz Project would not create any impacts on Indian Trust Assets (ITAs) since none are located in the areas of these projects. Therefore, the Hayfield Project, the Cadiz Project and any related projects would not create any adverse cumulative impacts on ITAs.

SECTION 8.0

Unavoidable Significant Adverse Impacts



SECTION 8.0
UNAVOIDABLE SIGNIFICANT ADVERSE IMPACTS

8.1 INTRODUCTION

In previous Sections of this EIR/EIS, potential environmental impacts resulting from the Cadiz Project alternatives are evaluated for both construction and operations. Construction impacts would occur during the building of the water conveyance facilities, power distribution facilities, pumping and/or booster stations, Project spreading basins and the Project wellfield. These impacts are generally temporary, extending only through the construction period, but would typically be relatively short in duration at any one location along the Cadiz Project (i.e. at any one place along the water conveyance facilities). Some construction activities would result in longer term impacts, such as scarification from trench excavation or displacement of existing uses or biological resources. Operations and maintenance activities could also result in environmental effects.

The topical analyses in Section 5 evaluated the potential direct and indirect impacts of the Cadiz Project on agriculture; land use plans and policies; socioeconomics; topography, geology, seismicity and soils; water resources; air quality; transportation; biological resources; energy and mineral resources; hazardous materials; noise; public services; utilities and service systems; aesthetics; cultural resources; paleontological resources; wilderness/recreation; environmental justice and Indian Trust Assets. Each discussion in Section 5 described potential impacts and, if necessary, identified mitigation measures to reduce significant adverse effects. Remaining significant impacts following mitigation were also specified. Section 6 addressed the issue of growth inducement and Section 7 addressed the cumulative impacts of the Cadiz Project. From these analyses it has been determined that the Cadiz Project would not result in significant adverse effects after mitigation related to the following parameters:

- Agriculture
- Land use plans and policies
- Socioeconomics
- Topography, geology, soils and seismicity
- Water resources
- Transportation
- Biological resources
- Energy and mineral resources
- Noise
- Public services
- Utilities and service systems
- Aesthetics
- Cultural resources
- Paleontological resources
- Wilderness/recreation
- Environmental justice
- Indian Trust Assets

For the following parameters, the possibility of some significant adverse effects remains, even after the implementation of the mitigation measures identified in Section 5:

- Air quality
- Hazardous materials
- Paleontological resources

8.2 AIR QUALITY

All the build alternatives would be anticipated to result in significant adverse air quality impacts during construction. Because of the magnitude of the Project and the simultaneous construction by multiple construction teams, air emissions standards will be exceeded for CO, ROC (VOC), NO_x and PM_{10}. During operations of the Cadiz Project, there would be occasions, typically once a year during maintenance of the Project spreading basins, that localized PM_{10} emissions would exceed standards. These impacts are unavoidable. When not undergoing maintenance and not being used for water recharge, it would be expected that the Project spreading basins would not contribute to PM_{10} levels any more than the surrounding open desert land. This is because the surface soils of the basins provide a finite volume of this size of soil material.

8.3 BIOLOGICAL RESOURCES

The build alternatives would not have any impacts on federally protected wetlands or conflict with any local policies or ordinances for protection of biological species, nor would these alternatives be in conflict with any adopted biological management plans. With the implementation of the extensive mitigation measures that are proposed, the impacts of the build alternatives on sensitive plant communities are not significant. This is also because of the small amount of the remaining acreage of these community types that are both temporarily and permanently affected. The proposed mitigation measures include: construction worker training, restricted/limited vegetation removal, salvage and replacement/re-contouring of topsoil, post-construction weed control, access controls and controls on construction vehicle fueling and replacement acreage for temporary and permanent acreage losses of Mojave wash scrub and desert tortoise habitat at a 1:1 ratio. These mitigation measures and others that reduce direct impacts to individual animals, also reduce the impacts to the endangered desert tortoise to a level of non-significance.

Unlike the buried pipeline of the other build alternatives, the canal segment of the Eastern/Canal Alternative will constrain the passage of animals between the Iron Mountains and the Old Woman Mountains. However, siphons would be provided at major washes along the canal, allowing for wildlife movement and thereby reducing this impact to a less than significant level. As a result, there would be no remaining significant impacts to biological resources as a result of implementing any of the build alternatives.

8.4 HAZARDOUS MATERIALS

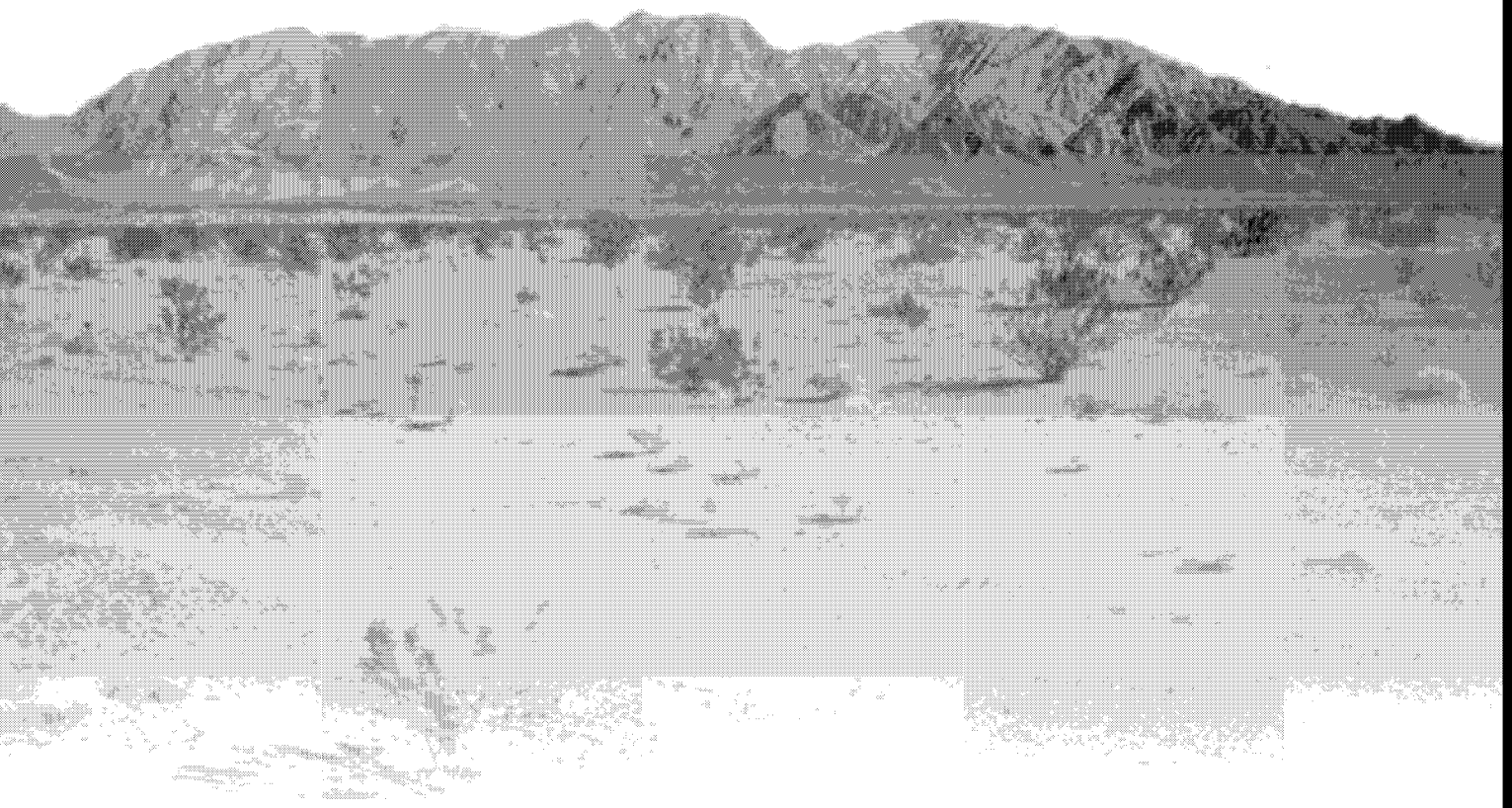
The Cadiz Project area was used for military exercises resulting in the presence of unexploded ordnance in this area. Implementation of the Cadiz Project mitigation measures would substantially reduce potential impacts from unknown explosive wastes. However, methodologies used to detect ordnance and explosive wastes may not be 100 percent effective. Therefore some ordnance may remain within the construction zone after pre-screening has been conducted. As a result, the potential hazards related to ordnance and explosive wastes remain an unavoidable adverse impact of the Cadiz Project.

8.5 PALEONTOLOGICAL RESOURCES

The water conveyance facility alignment alternatives pass through areas of high potential for paleontological resources consisting of lake beds and paleosols. The Project wellfields and spreading basins are in areas with high potential for resources, including carbonate beds in the Cadiz Playa. Portions of the water conveyance facility alternatives pass through areas with recent alluvium. It is anticipated that the paleosols extend under this alluvium. Because the depth of the overlying alluvium is currently unknown, it is assumed that excavation would intercept the possible underlying paleosol, resulting in significant adverse impacts to paleontological resources. The Project mitigation measures would reduce this impact, but may not be able to reduce this potential impact to below a level of significance in the event that the paleosol is intercepted by Project construction.

SECTION 9.0

Short Term Versus Long Term Productivity Impacts



SECTION 9.0
SHORT TERM VERSUS LONG TERM PRODUCTIVITY IMPACTS

9.1 SHORT TERM USE VERSUS LONG TERM PRODUCTIVITY

The Cadiz Project has been planned to increase water storage and supply for dry years to improve Metropolitan's overall capability to provide raw water throughout its service area in the event of drought conditions. The need for the Cadiz Project, as described in Section 2 of the EIR/EIS, is based on the long-term water needs of the Southern California region. These needs were, in turn, based on demographic projections prepared by the Southern California Association of Governments (SCAG), San Diego Association of Governments (SANDAG) and the California State Department of Finance. These projections are consistent with the regional and State Air Quality Management Plans and have subsequently been incorporated into the State Implementation Plan.

9.1.1 AGRICULTURAL RESOURCES

The Cadiz Project would not appreciably affect existing agricultural resources in the Cadiz Project area. Future expansion of Cadiz Inc. agricultural operations, if any, within and in the vicinity of the Cadiz Project would occur only in compliance with and pursuant to the requirements of a Groundwater Monitoring and Management Plan that would be established in conjunction with the Cadiz Project.

9.1.2 LAND USE, PLANNING AND POLICIES

Development of some vacant land in the Cadiz Project area for other uses would be precluded by the construction and operation of the Cadiz Pumping Plant, (and booster stations, if applicable) water conveyance facilities, Project spreading basins, Project wellfield and other support facilities. As a result, the long-term productivity of the land for other purposes would be reduced accordingly.

9.1.3 SOCIOECONOMICS

The Cadiz Project would result in short-term construction employment that will benefit the local labor supply, construction equipment and materials suppliers and service businesses that directly support Cadiz Project construction workers. It would have indirect benefits on those businesses that supply raw materials and services to construction equipment and materials suppliers and the service providers who directly meet the needs of the construction teams. Over the long-term, the Cadiz Project would assist Metropolitan in meeting dry-year water supply needs in its service area. The Cadiz Project will help prevent more severe drought year water shortages that would adversely impact residents and businesses in Metropolitan's service area. Within the planning period, severe water use restrictions could potentially be reduced or avoided.

9.1.4 TOPOGRAPHY, GEOLOGY, SEISMICITY AND SOILS

Short- and long-term effects would occur to site topography and soils. Short-duration aggregate demand would result from the use of concrete for construction of structures and facilities, and for bedding material for water conveyance facilities. This short-duration demand would not significantly affect the local or regional availability of aggregate since adequate supplies of aggregate are available for Cadiz Project use. Minimal short- and long-duration effects would be expected due to geologic hazards in the Cadiz Project area. Short-duration effects to soils that could be caused by erosion would be mitigated by use of soil binders, watering and respreading of surface soil to encourage re-vegetation of exposed areas. Long-term impacts due to potential seismic events would be mitigated by construction of Cadiz Project facilities according to the Uniform Building Code and other seismic design features.

9.1.5 WATER RESOURCES

The Cadiz Project would not appreciably affect the availability of water resources for other purposes, since the aquifer system underlying the Cadiz Project area (where water would be stored or withdrawn from) is not connected to other watersheds or aquifer systems in the area. The Cadiz Project area overlying the affected aquifer system is also extremely remote, with little growth in population or employment. In the long-term, transfers of indigenous groundwater would be monitored and groundwater use would be limited to ensure replenishment to pre-Cadiz Project levels. Therefore, the long-term productivity of the region would not be impacted. Implementation of the mitigation measures included in the Cadiz Project would reduce construction-related impacts on stream crossings and water resources to below a level of significance. The increase in water storage and supply during dry years that would result from implementation of the Cadiz Project would improve overall water system reliability in the Metropolitan service area.

9.1.6 AIR QUALITY

The Cadiz Project would cause some short-term deterioration in existing air quality during the construction of the Cadiz Pumping Plant, water conveyance facilities, Project spreading basins, Project wellfield and support facilities. This increase in emissions would be reduced to acceptable levels by mitigation measures included in the Cadiz Project. Long-term impacts would be negligible because operation of Cadiz Project facilities would not emit pollutants into the atmosphere in quantities that would exceed local air pollution control district standards. Therefore, no effects on the maintenance and enhancement of long-term productivity related to air quality would occur because of the implementation of the Cadiz Project.

9.1.7 TRANSPORTATION

The short-duration Cadiz project-generated traffic associated with construction activity would result in some decrease in the convenience afforded users of the regional roads that would be used to ship Cadiz Project equipment and supplies. In terms of the long-term operation of the transportation system, no disturbance would be expected after completion of Cadiz Project activities and long-term productivity should not be

affected. A minor long-term benefit to emergency access would be provided by non-public graded maintenance roads associated with the Cadiz Project facilities.

9.1.8 BIOLOGICAL RESOURCES

The Cadiz Project would result in the short-term loss of vegetation and wildlife habitat in some of the areas where the water conveyance facilities would be constructed and in construction equipment and supply storage yards. Permanent loss of vegetation and wildlife habitat would occur in the areas where the access roads are located for the Cadiz Project water conveyance facilities and power distribution facilities, Project spreading basin and Project wellfield. The gradual revegetation of areas within the Cadiz Project construction right-of-way would contribute to the long-term productivity of affected species and habitats. However, ecological recovery rates would be expected to be relatively slow, resulting in potential longer term adverse effects to these areas.

9.1.9 ENERGY AND MINERAL RESOURCES

The Cadiz Project would not appreciably affect the short-term supply of energy in the region. No mineral extraction occurs in the Cadiz Project area. The Cadiz Project would not impact mineral extraction in the area, nor are new mineral claims in the area anticipated. Therefore, short- and long-term mineral extraction operations would not be adversely affected by the Cadiz Project. The amount of energy required to operate the Cadiz Project would be available from the dedicated electrical supply established by Metropolitan for their Iron Mountain Pumping Plant. Therefore, the Cadiz Project would not appreciably affect the long-term productivity of the region with respect to energy and mineral resources.

9.1.10 HAZARDS AND HAZARDOUS MATERIALS

The Cadiz Project would result in short-term Project-related hazards primarily associated with construction of the water conveyance facilities and other support facilities in an area where military ordnance is known to occur. However, mitigation measures included in the Cadiz Project require the survey for and removal of any ordnance within the right-of-way of Cadiz Project construction activities. A long-term hazard may be created should the water conveyance facilities fail during a seismic event, potentially flooding generally uninhabited areas adjacent to the Cadiz Project area. However, this is considered a remote possibility because the Cadiz Project facilities would be constructed according to the American Water Works Association and other applicable design standards. Cadiz Project facilities would be able to withstand all but a catastrophic earthquake. The Cadiz Project site is also located in a remote area with few residential or other land uses that could be flooded should there be a breach in the water conveyance facilities. Therefore, the Cadiz Project should not create a long-term hazard to people or property or reduce productivity.

9.1.11 NOISE

Implementation of the Cadiz Project would result in short-term, project-related noise impacts associated with the construction of the Cadiz Project

facilities. No appreciable long term noise effects would be anticipated.

9.1.12 PUBLIC SERVICES

Due to the remote location of the Cadiz Project and the nature of its operation, implementation of the Cadiz Project would not result in the significant short-term impacts on public services. Contractors would be required to provide on-site emergency first aid services during Cadiz Project construction. The facilities being installed or constructed do not create a demand for public services. The number of new long-term employees would be negligible and could be provided by the existing employment base. Therefore, there would not be an increase in the need for public facilities as a result of the Cadiz Project. Thus, the Cadiz Project would have no effect on the maintenance and enhancement of long-term productivity of the region related to public services.

9.1.13 UTILITIES AND SERVICE SYSTEMS

The Cadiz Project would not appreciably affect area or region utility or service systems and would, therefore, not adversely affect the long-term productivity of the region related to utilities and service systems.

9.1.14 AESTHETICS

Implementation of the Cadiz Project would create short-term disruptions of visual quality along the water conveyance facilities and power distribution facilities because of soil and vegetation disturbances and the visual contrast created between Cadiz Project structures and the existing landform. For the water conveyance facilities, over the long-term, soil and vegetation conditions would very gradually improve and diminish most of these impacts. However, the canal segment of the Eastern/Canal Alternative would remain a clearly visible man-made feature contrasting with surrounding terrain over the long-term. The visual impacts of the power distribution facilities installed along-side the water conveyance facilities would not be considered significant when taken into consideration with similar existing facilities and the totality of the entire Cadiz Project area and region.

9.1.15 CULTURAL RESOURCES

The Cadiz Project related field studies, data recovery and analyses would contribute to the present level of knowledge about cultural resources. Information resulting from the documentation of resources and the possible loss of one site should be useful in future efforts to interpret and educate people about the cultural resources in the Cadiz Project area. In the absence of the Cadiz Project, recovery and interpretation of these sites would not be expected to occur.

9.1.16 PALEONTOLOGICAL RESOURCES

The effects of the Cadiz Project include the loss of paleontological resources. However, Cadiz Project-related field studies, and data recovery and analyses would contribute to the present level of knowledge about paleontological resources in southeastern San Bernardino County. The information resulting from the recovery of fossils should be useful in future efforts to interpret and educate people about those resources. The Cadiz

Project would affect only a small percentage of estimated paleontological resources in the region and would, therefore create no significant long-term loss of potential for exploration and recovery of these resources.

9.1.17 WILDERNESS/RECREATION

The Cadiz Project would not appreciably create a long-term effect on wilderness or recreation resources and would, therefore, not adversely affect the long-term productivity of the region related to these resources.

9.1.18 INDIAN TRUST ASSETS

The Cadiz Project facilities would not be developed on any Indian lands. The Cadiz Project would also not create any impacts that would affect lands owned by Indian tribes in the vicinity of the Cadiz Project area. In addition, the Cadiz Project would not create any short- or long-term effects on Indian Trust Assets. Therefore, no effects on the maintenance and enhancement of long-term productivity of Indian Trust Assets would occur as a result of the Cadiz Project.

9.1.19 ENVIRONMENTAL JUSTICE

Implementation of the Cadiz Project would not change the character of the area where the Cadiz Project facilities would be located. In addition, they would be located in a remote area away from population centers where environmental justice issues might arise. Therefore, the Cadiz Project would not create any environmental justice issues and will not interfere with the long-term productivity of the region.

SECTION 10.0

Irreversible and Irretrievable Commitment of Resources

SECTION 10
IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

10.1 INTRODUCTION

The planned life of the Cadiz Project is through 2050. For this evaluation of irreversible and irretrievable commitment of resources, it has been assumed that the water conveyance facilities could be operated indefinitely and that it would not be feasible to restore all natural resources to their pre-Cadiz Project conditions.

For the following resource categories, implementation of the Cadiz Project would not cause an irreversible or irretrievable commitment of resources as described in detail in Section 5.0: agriculture, socio-economics and growth inducement, air quality, transportation, hazards and hazardous materials, noise, public services, utilities and service systems, wilderness and recreation, environmental justice and Indian Trust Assets.

The irreversible and irretrievable commitments of resources that would occur as a result of the Cadiz Project would impact the categories of resources described in the following sections.

10.2 LAND USE

The use of land for the Cadiz Project would result in an irreversible and irretrievable commitment of slightly less than six acres of agricultural land at Cadiz for the Project wellfield. Substantial open space values would be retained as a result of the overall land acquisition requirements of the Cadiz Project.

The primary long-term commitment of resources associated with the Cadiz Project would be related to the commitment of land. While some of the land required for the Project would be located in and around previously disturbed areas, there would be a substantial commitment of land located in areas that are currently undeveloped and relatively undisturbed.

Pipeline segments of the water conveyance facilities would be constructed using cut-and-cover methods in undeveloped desert areas and would result in a long-term commitment of land resources. The presence of the water conveyance facilities and the need for a surface-level right-of-way overlying and along side the pipeline segments would prevent the development of other surface land uses except perhaps non-structural uses such as open space. The canal segment of the Eastern/Canal Alternative is a physical facility that represents a long term land use commitment. The commitment of these land areas as rights-of-way for the water conveyance facilities is an irreversible commitment of resources to the Cadiz Project.

10.3 TOPOGRAPHY, GEOLOGY, SEISMICITY AND SOILS

Although construction would involve replacement of topsoils and cryptogamic soil crust may eventually be reestablished, exposed soils would suffer some loss during and following construction as a result of wind erosion and runoff. Most losses will be relatively minor. The Cadiz

Project would have minor impacts to topography. The surface elevation of the Project spreading basin is only 40 feet higher than the surface elevation of the Iron Mountain Pumping Plant approximately 35 miles away. The intervening terrain is composed of broad, gently sloping valleys and small hills. No large-scale landform modification would be necessary. The water conveyance facilities would be below ground and the Project spreading basin berms would be approximately five feet high.

All Cadiz Project facilities would be designed and constructed to the appropriate seismic standards.

No unique geologic features or formations would be impacted by the Cadiz Project.

Soils in the permanent rights-of-way and those covered by Cadiz Project features such as the Project wellfields, pumping plants, Project spreading basins and the operation and maintenance roads would be precluded from other uses during the 50-year term of the Cadiz Project, as would the canal segment of the Eastern/Canal Alternative.

10.4 WATER RESOURCES

The Cadiz Project would have relatively limited effects on surface and subsurface flows. All naturally-occurring flows would pass largely unaffected to the downstream watersheds.

The water quality impacts of Cadiz Project construction would mostly be of short duration and would not permanently change the availability or quality of the resource from baseline conditions. Therefore, the Cadiz Project would not result in any irreversible or irretrievable commitments of water resources with respect to water quality.

A Groundwater Monitoring and Management Plan would be implemented as an integral part of the Cadiz Project. It would include monitoring and adjustment of Project operations, if and when appropriate, based on the aquifer system's response to Cadiz Project operations. No irreversible changes to groundwater hydrology are expected as a result of the Cadiz Project.

10.5 BIOLOGICAL RESOURCES

The permanent removal of vegetation and wildlife habitat for construction of the Cadiz Project spreading basins, Project wellfield, water conveyance and power distribution facilities represents an irreversible and irretrievable commitment of these resources. Biological habitats would be temporarily disturbed during construction of the water conveyance facilities. Given sufficient time and adequate conditions, all these areas, except the maintenance access roads, Project spreading basins, Project wellfield and the canal segment of the Eastern/Canal Alternative, would be expected to recover to a state approximating pre-disturbance conditions.

10.6 ENERGY AND MINERALS

Consumption of construction grade minerals (sand, gravel, rock) in cement, bedding material, blocks, metallic minerals (iron, steel) for water conveyance facilities, power distribution facilities, pumping stations, wellfield and spreading basins would be necessary for the Cadiz Project. This would represent an irreversible and irretrievable commitment of these resources to this project.

10.7 AESTHETICS

The construction and operation of the Cadiz Project would result in minor permanent and irreversible changes in the visual nature of the area. These changes would be minor in scale and magnitude. They would diminish through time but are expected to be discernible after 2050. Therefore, these impacts are considered to be an irreversible and irretrievable resource commitment for visual resources.

10.8 CULTURAL RESOURCES

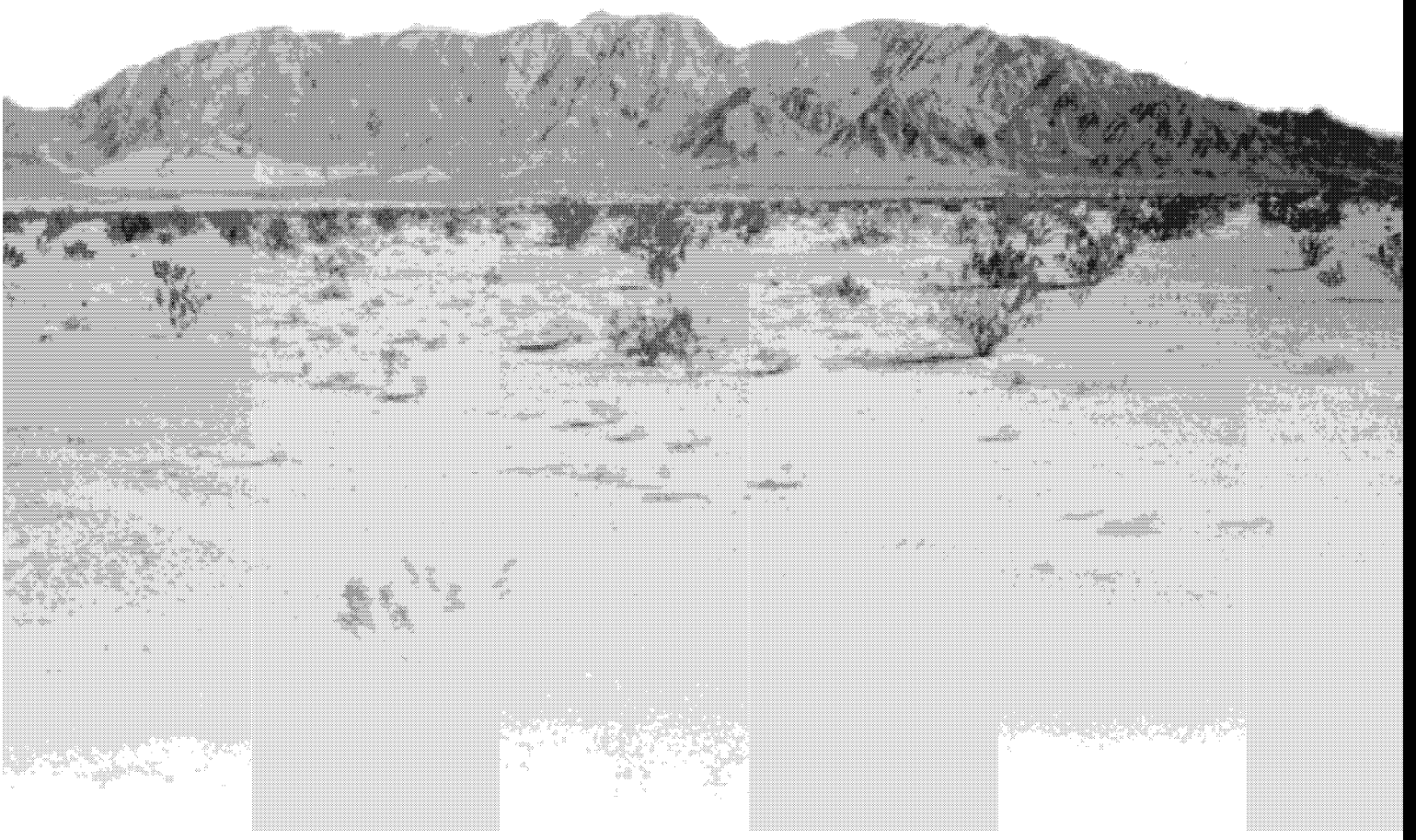
The potentially significant adverse impacts of the Cadiz Project on cultural resources will be mitigated to below a level of significance. However, despite the best application of mitigation measures, some unavoidable losses could occur. Even data recovery would involve some loss because it would require removal of artifacts from their original context.

10.9 PALEONTOLOGICAL RESOURCES

Potentially significant paleontological resources could be disturbed by construction of the Cadiz Project. Despite the best application of mitigation measures, some unavoidable losses could occur. Even data recovery involves some loss because it requires excavation and removal of artifacts from their depositional context.

SECTION 11.0

Public Involvement and Agencies and Persons Consulted



SECTION 11.0
PUBLIC INVOLVEMENT AND AGENCIES AND PERSONS CONSULTED

11.1 INTRODUCTION

In accordance with the requirements of CEQA and NEPA, Metropolitan and BLM implemented a consultation and coordination process for the Cadiz Project. The information received during this consultation and coordination process helped to identify the issues and topics of concern to be addressed in this EIR/EIS. Consultation and coordination activities included publishing announcements in newspapers of general circulation and mailing notices; conducting public scoping meetings; conducting meetings with various organizations, agencies, groups and individuals; conducting an Inter-Nation Consultation with Native American tribes and receiving written comments. Additionally, comments received after the close of the public comment period were also taken into consideration in the preparation of the EIR/EIS. Scoping activities for the Cadiz Project have fulfilled the requirements under CEQA and NEPA.

11.2 EIR/EIS SCOPING PROCESS AND INPUT RECEIVED

11.2.1 NOTIFICATION

Copies of the documents, notices, lists, newspaper articles and other materials described in this section are included in the Draft Environmental Impact Report/Draft Environmental Impact Statement Environmental Planning Technical Report No. 1161 (Public Participation Report) incorporated by reference in this EIR/EIS. This Technical Report is available for review at Metropolitan's office and at the BLM's offices in Riverside and Needles.

A Notice of Preparation (NOP) of an EIR was distributed by certified mail, advertised in general circulation newspapers and posted in compliance with CEQA. The NOP included a cover letter, seven-page description of the Cadiz Project and the environmental effects to be studied, a notice of the upcoming public scoping meetings, and information on how to submit written comments. A legal notice of the NOP was posted and was published in the *San Bernardino Sun*, a San Bernardino County daily newspaper on February 10, 1999. This notice described the Cadiz Project; solicited public comments; publicized the dates, times and locations of scheduled public scoping meetings; and publicized the deadline for submitting public comments. The *San Bernardino Sun* also published an article that provided an extensive overview of this same information. Additionally, a mailing of the NOP together with a description of the Cadiz Project, the environmental effects to be studied and information regarding upcoming public scoping meetings was sent to approximately 150 parties including but not limited to: federal, state, regional and local agencies; governmental officials from nearby cities; special interest groups; public libraries; and interested individuals. The mailing took place on February 5, 1999 via certified United States mail.

The BLM prepared a Notice of Intent (NOI) to prepare an EIR/EIS. The NOI was published in the Federal Register on March 1, 1999 and in the *San Bernardino Sun* on February 10, 1999. A second notice was prepared by the BLM and published in the Federal Register on May 4, 1999. This notice was also published in the *Needles Desert Star* on April 28, 1999, the *San Bernardino Sun* on May 10, 1999 and in the *Paramount Journal* on May 13, 1999. Both of BLM's notices described the Cadiz Project; the public comment period schedule; the dates, locations and times of upcoming public scoping meetings; and the address where comments should be sent.

Three public scoping meetings were held: February 23 at the Cadiz Inc. farming operations office at Cadiz; February 25 at the City of Twentynine Palms Council Chambers; and May 10 at the City of Needles Council Chambers.

The public comment period for the Cadiz Project began on February 10, 1999 and concluded on May 30, 1999. As stated above, comments received after the close of the public comment period were also taken into consideration in the preparation of this EIR/EIS and are provided in the Public Participation Report.

In all, nearly 250,000 households received a notification of the proposed Cadiz Project, the environmental process and the public comment period through published newspaper articles. In addition, a brochure that provided a program overview, identified the environmental issues to be studied, and solicited public comment and input was produced and distributed. Since the scoping process formally commenced, approximately 3,000 brochures have been distributed to interested parties.

11.2.2 SCOPING MEETINGS

The first scoping meeting was noticed in the Federal Register and the *San Bernardino Sun*, and was held at the Cadiz Ranch on February 23, 1999. Approximately 15 people were in attendance in addition to representatives of the BLM Advisory Council and the National Park Service (NPS). Refer to the Public Participation Report for specific comments received during this scoping meeting.

The second scoping meeting was noticed in the Federal Register and the *San Bernardino Sun* newspaper and was held on February 25, 1999 at the City of Twentynine Palms Council Chambers. Approximately 19 people attended the meeting, including representatives of the City of Twentynine Palms, the Desert Environmental Response Team, the Fort Mojave Indian Tribe, the Joshua Basin Water District, the Morongo Basin Conservation Association and the Morongo Basin Economic Development Consortium. Refer to the Public Participation Report for specific comments received during this scoping meeting.

The third scoping meeting was held in the City of Needles Council Chambers on May 10, 1999 and approximately 20 persons attended, including representatives of the City of Needles, the County of San Bernardino, People Against Radioactive Dumping and the NPS. Refer to the Public Participation Report for specific comments received during this scoping meeting.

Handouts were provided at all these scoping meetings. Copies of the scoping meeting handouts are included in the Public Participation Report.

11.2.3 WRITTEN COMMENTS

During the public review period, a total of 25 written comment letters were received. Several governmental agencies, organizations and individuals submitted written comments including: the United States Fish and Wildlife Service (USFWS); California Department of Fish and Game (CDFG); Fort Mojave Tribe; Southern California Association of Governments; County of San Bernardino Public Services Group; All American Pipeline, L.P.; Tetra Technologies, Inc.; San Bernardino Valley Audubon Society; California Native Plant Society; People Against Radioactive Dumping and private residents. Additionally, comments received after the close of the public comment period for the NOP/NOI were also considered in the preparation of this EIR/EIS. See the Public Participation Report for the specific written comments.

11.2.4 OVERVIEW OF COMMENTS

Many of the comments received at the scoping meetings and from written correspondence addressed similar issues of concern. A summary of the issues is provided here and written comments received are provided in the Public Participation Report.

- **The inter-relationship of ground-water basins in the area.** Will the Cadiz Project affect neighboring groundwater basins? Are the groundwater basins in the area hydrologically connected?

- **Water quality.** What happens to water quality when you import Colorado River water into the groundwater basin?

- **Withdrawals of indigenous water during dry years.** Will withdrawals of indigenous water impact the groundwater basin or the water supplies of neighboring communities?

- **Monitoring.** Through what mechanism will the storage and withdrawal of water be monitored to ensure safe operation of the groundwater basin?

- **Evaporation.** Will a large amount of water evaporate off the spreading basins during storage operations, and should injection wells be considered as an alternative?

- **Earthquakes.** Could earthquakes create fractures within the neighboring groundwater basins, allowing stored Colorado River water to travel to those neighboring basins? Could the storage of water instigate future fault activity?

- **Endangered, threatened and sensitive species.** What would be the Cadiz Project's potential impact on native plant and animal species? Would appropriate mitigation measures be implemented to offset adverse impacts?

- **Contingency Plans.** Will there be a contingency plan to prevent flooding or erosion in the event of a failure of the water conveyance facilities?

- **Economic and population impacts.** Are there any potential economic and population impacts in the Lower Colorado River Valley?

- **Use of Canals.** Would the use of canals, as conveyance facilities, impact native animal species?

- **Cost.** How much would the Cadiz Project cost, specifically the environmental documentation cost, and who would bear those costs?

- **San Bernardino County**. How will San Bernardino County residents benefit from this Project?

The following two comments were also received, which are not environmental issues under CEQA and NEPA, and therefore are not addressed in this document.

- **California law and groundwater transfers.** Will the proposed transfer of indigenous water meet all requirements under California law?

- **Relationship of Best, Best and Kreiger.** Is there a conflict of interest because the firm of Best, Best and Krieger represents Metropolitan, the City of Needles and the County's Local Area Formation Commission?

11.3 AGENCY CONSULTATION

Metropolitan and the BLM jointly prepared this EIR/EIS. As such, Metropolitan and the BLM have coordinated extensively with other agencies and public bodies to attempt to formulate a broadly accepted project alternative, while attempting to avoid or minimize environmental effects. Specifically, Metropolitan focused on the following objectives:

- Avoid environmental impacts to the extent practicable, and where not possible, mitigate such impacts.

- Attempt to integrate the Cadiz Project mitigation needs with the broader open space and ecological values of the Project region.

- Obtain a cost-effective dry-year supply of water to help meet anticipated water shortages over the life of the Cadiz Project.

Metropolitan sought input from various resource agencies in addition to BLM including the USFWS, CDFG and the United States Army Corps of Engineers (ACOE) early in the planning process to help identify potentially acceptable mitigation measures associated with the Cadiz Project.

A listing of agency and special interest group coordination activities for the Cadiz Project is provided in Table 11-1. The initial coordination efforts for the Cadiz Project focused on briefings regarding protocols for the reconnaissance studies that were being conducted. Later meetings addressed specific topics dealing with the issues raised by these studies, mitigation planning and the development of mitigation and management agreements for the mitigation areas.

TABLE 11-1
AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONTACTED

Month	Organization/Individual
October	County of San Bernardino, Supervisor's Office Arizona & California Railroad Tate & Associates San Bernardino County Grand Jury TETRA Technologies, Inc. Santa Ana Watershed Project Authority (SAWPA) Inland Empire Utilities Agency San Bernardino Valley Municipal Water District San Bernardino Associated Governments Western Municipal Water District Orange County Water District Eastern Municipal Water District
September	Catellus Development Corporation Association of Groundwater Agencies (AGWA) Chino Basin Watermaster Watermaster, Upper Los Angeles River Area Tehachapi-Cummings County Water District Eastern Municipal Water District San Bernardino Valley Water Conservation District Orange County Water District Main San Gabriel Basin Watermaster Chino Basin Water Conservation District Inland Empire Utilities Agency Navigant Consultants Montgomery Watson Regional Water Quality Control Board California Department of Water Resources Psomas Calleguas Municipal Water District Santa Ana Watershed Protection Agency All American Pipeline Operating Company Burlington Northern Santa Fe Corporation Lee Chemical County of San Bernardino
August	
July	County of Los Angeles, Supervisor's Office Arvin-Edison Water Storage District Kern County Water Agency Kern Delta Water District Madera Irrigation District Semitropic Water Storage District Shafter-Wasco Irrigation District Wheeler Ridge-Maricopa Water Storage District Cawelo Water District Paramount Farming Company

TABLE 11-1
AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONTACTED

Month	Organization/Individual
June	National Park Service Fort Mojave Indian Tribe United States Bureau of Indian Affairs Office of Governor Gray Davis California Department of Water Resources Senate, Agriculture & Water Resources Committee Assembly Rules Committee County of San Bernardino, Supervisor's Office Department of Transportation/Flood Control County of Los Angeles, Supervisor's Office Utility Board, City of Needles City of Twentynine Palms Heal the Bay Association of California Water Agencies (ACWA) Twentynine Palms Water District Joshua Basin Water District Baker Community Services District East Valley Water District San Bernardino Valley Water Conservation District Valley Water District Santa Ana Watershed Project Authority (SAWPA) Joshua Tree Water District
May	Office of Governor Gray Davis Natural Resources & Environment Committee California Resources Agency California Department of Parks Senate Budget Committee CalFed Bay Delta Program California Highway Patrol/Needles Department County of San Bernardino, Supervisor's Office City of Twentynine Palms/Council Meeting City of Needles/Council Meeting City of Needles Morongo Basin Conservation Association San Diego County Water Authority Twentynine Palms Water District Santa Ana Watershed Project Authority (SAWPA)
April	Bay Delta Advisory Committee California Department of Water Resources County of San Bernardino, Supervisor's Office County of San Bernardino, Department of Transportation/Flood Control County of San Bernardino, Supervisor's office Planning & Conservation, Sierra Club (San Gorgonio Chapter) Mojave Resource Conservation District Inland Empire Utilities Agency Northern California Environmental Water Caucus Catellus Development Corporation

TABLE 11-1
AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONTACTED

Month	Organization/Individual
March	United States Department of the Interior United States Fish and Wildlife Service County of San Bernardino, Supervisor's Office Department of Transportation/Flood Control, County of San Bernardino
February	County of San Bernardino, Supervisor's Office Department of Transportation/Flood Control Association of the San Bernardino County Special Districts Morongo Basin Conservation Association Imperial Irrigation District Conservation Committee Coachella Valley Water District City of Twentynine Palms Cadiz Ranch, Public Scoping Meeting City of Needles/Council Meeting Sierra Club of California

Metropolitan and the BLM also coordinated and consulted with the California Native American Heritage Commission regarding the Cadiz Project. In addition to the California Native American Heritage Commission, the following Native American tribes were notified of the Project by Metropolitan during scoping for the Proposed Project:

- Agua Caliente Indian Reservation
- Augustine Indian Reservation
- Cabazon Band of Mission Indians
- Chemehuevi Indian Reservation
- Colorado River Indian Tribes
- Fort Mojave Indian Tribe
- Los Coyotes Indian Reservation
- Morongo Indian Reservation
- Torrez Martinez Indian Reservation
- Twentynine Palms Indian Reservation

The BLM also notified the following American Indian tribes to determine their interest in a government to government consultation:

- Chemehuevi Indian Reservation
- Colorado River Indian Tribes
- Fort Mojave Indian Tribe

Only the Fort Mojave Indian Tribe responded to the notification and a meeting was held with the Tribe in June 1999. A copy of their written response to the proposed project is found in the Cadiz Groundwater Storage and Dry-year Supply Program, Draft Environmental Impact Report/Draft Environmental Impact Statement: Public participation (Report No. 1161).

TABLE 11-1
AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONTACTED

Month	Organization/Individual
May	Governor Gray Davis Senator John Burton Mary Shallenberger, Consultant, Natural Resources & Environment Committee Secretary Mary Nichols, California Resources Agency John "Rusty" Areias, Director, California Department of Parks Senator Steve Peace, Chair, Budget Committee Lester Snow, Executive Director, CalFed Bay Delta Program Nancy Cisneros, Field Representative, Office of Assemblymember Bill Leonard Office of Assemblymember Keith Olberg Bill Postmus, District Director California Highway Patrol/Needles Department Supervisor Fred Aguiar, County of San Bernardino Office of Supervisor Kathy Davis Jim Ventura, Field Representative City of Twentynine Palms Councilmember Mac Dube Councilmember DJ Masker Councilmember Jim Bagley City of Needles/Council Meeting (~40 attendees) Mayor Murl Shaver, City of Needles Public Scoping Meeting City of Needles (~15 attendees) Susan Reilly, Morongo Basin Conservation Association San Diego County Water Authority Chris Frahm, Chair Maureen Stapleton, General Manager Tina Johnson, General Manager, Twentynine Palms Water District Santa Ana Watershed Project Authority (SAWPA) Joe Grindstaff, General Manager Lindell Marsh, Sieman, Larsen & Marsh
April	Anthony Saracino, Bay Delta Advisory Committee Carl Hauge, Chief Hydrologist, California Department of Water Resources Assemblymember John Longville Senator Jim Brulte Assemblymember Bill Leonard County of San Bernardino Supervisor Dennis Hansberger Steve Wilson, Chief of Staff Jim Foster, Special Project Coordinator Bruce Davis, Field Representative County of San Bernardino, Department of Transportation/Flood Control Ken Miller, Director Ken Guidry Pat Mead Mike Fox Mike Williams Supervisor Kathy Davis, County of San Bernardino Allen Bartleman, Chairman, Planning & Conservation, Sierra Club (San Gorgonio Chapter) Mojave Resource Conservation District (~30 attendees)

TABLE 11-1
AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONTACTED

Month	Organization/Individual
April (Continued)	Inland Empire Utilities Agency (~10 attendees) Northern California Environmental Water Caucus (~10 attendees) Catellus Development Corporation
March	U.S. Department of the Interior Bruce Babbitt, Secretary David Hayes, Deputy Secretary Ray Brandsfield, U.S. Fish & Wildlife Service County of San Bernardino Supervisor Fred Aguiar Scott Reid, Chief of Staff Ken Miller, Director, Department of Transportation/Flood Control, County of San Bernardino
February	County of San Bernardino Jim Martin, Chief of Staff George Westcott, Chief of Staff Scott Reid, Chief of StaffSteve Wilson, Chief of Staff George Collier, Chief of Staff Ken Miller, Director, Department of Transportation/Flood Control Association of the San Bernardino County Special Districts Morongo Basin Conservation Association (~20 attendees) Imperial Irrigation District Conservation Committee (~20 attendees) Tom Levy, General Manager, Coachella Valley Water District Speaker Antonio Villaraigosa Senator Chuck Poochigian Senator Jim Brulte City of Twentynine Palms (~18 attendees), Public Scoping Meeting Cadiz Ranch (~14 attendees), Public Scoping Meeting City of Needles/Council Meeting (~20 attendees) Bill Craven, State Director, Sierra Club of California

Metropolitan and the BLM also coordinated and consulted with the California Native American Heritage Commission regarding the Cadiz Project. In addition to the California Native American Heritage Commission, the following Native American tribes were notified of the Project by Metropolitan during scoping for the Proposed Project:

- Agua Caliente Indian Reservation
- Augustine Indian Reservation
- Cabazon Band of Mission Indians
- Chemehuevi Indian Reservation
- Colorado River Indian Tribes
- Fort Mojave Indian Tribe
- Los Coyotes Indian Reservation
- Morongo Indian Reservation
- Torrez Martinez Indian Reservation
- Twentynine Palms Indian Reservation

The BLM also notified the following American Indian tribes to determine their interest in a government to government consultation:

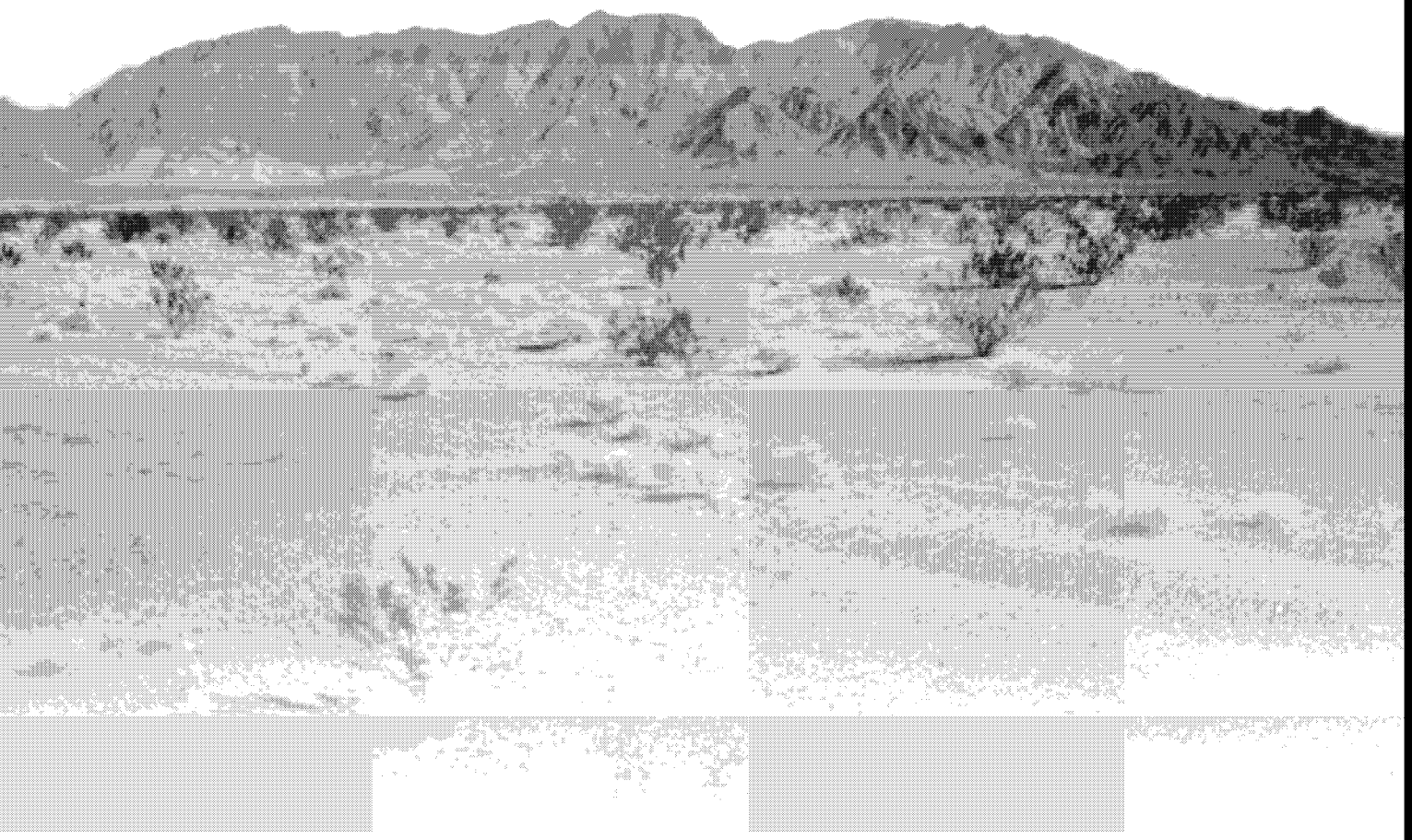
- Chemehuevi Indian Reservation
- Colorado River Indian Tribes
- Fort Mojave Indian Tribe

Only the Fort Mojave Indian Tribe responded to the notification and a

meeting was held with the Tribe in June 1999. A copy of their written response to the proposed project is found in the Cadiz Groundwater Storage and Dry-year Supply Program, Draft Environmental Impact Report/Draft Environmental Impact Statement: Public participation (Report No. 1161).

SECTION 12.0

Permits Required for the Cadiz Project



Section 12.0
PERMITS REQUIRED FOR THE CADIZ PROJECT

To construct the Cadiz Project, Metropolitan may be required to obtain permits and/or approvals from other agencies. These agencies may include, but are not limited to, the following:

12.1 FEDERAL AGENCIES

United States Bureau of Land Management
United States Army Corps of Engineers
United States Fish and Wildlife Service

12.2 STATE AGENCIES

California Department of Fish and Game
California Department of Transportation
Colorado River Basin Regional Water Quality Control Board
State Lands Commission

12.3 LOCAL/REGIONAL AGENCIES

Mojave Desert Air Quality Management District

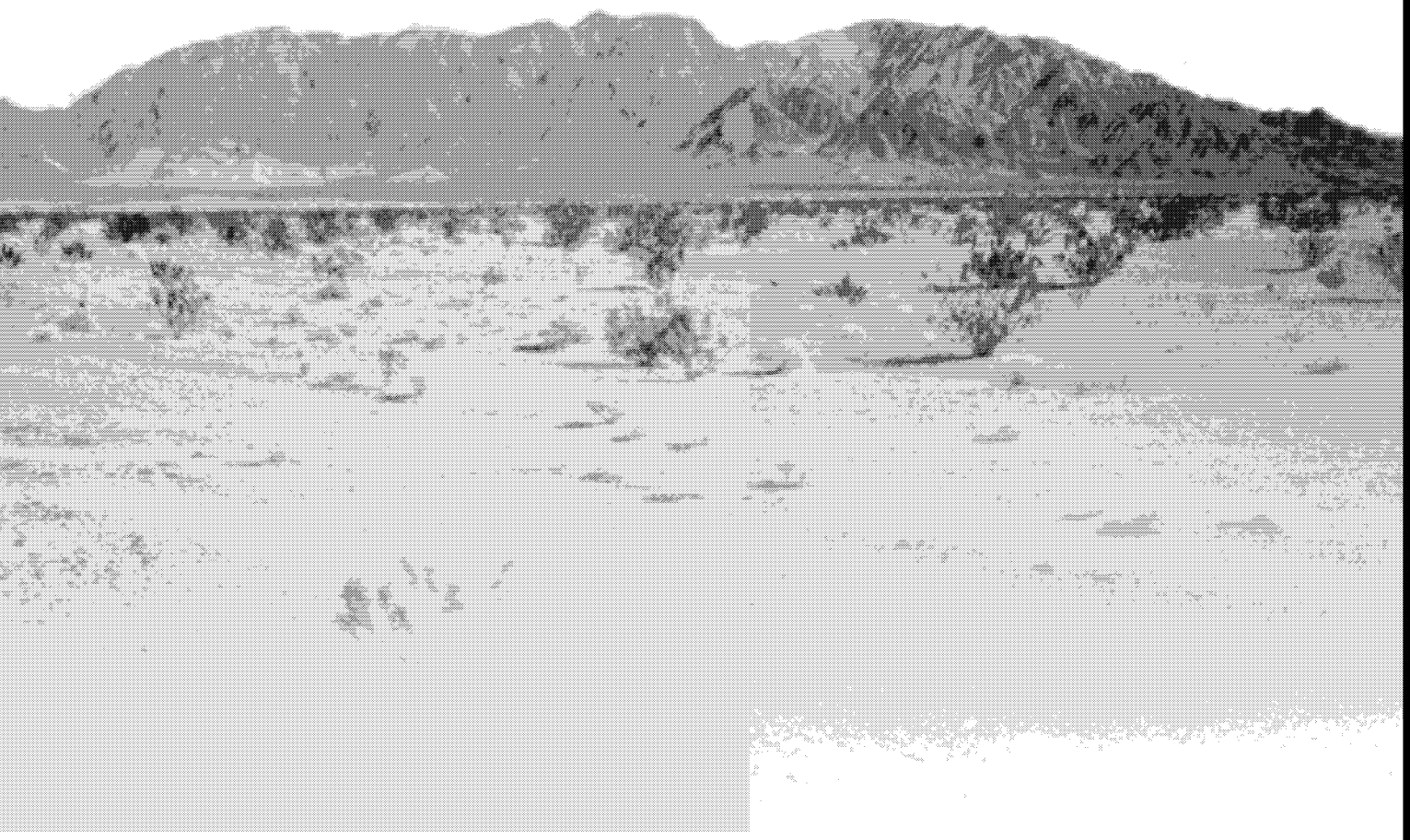
The permits and approvals that may be required are summarized in Table 12-1.

TABLE 12-1
PERMITS THAT MAY BE REQUIRED

Federal Agencies	
United States Army Corps of Engineers	Section 404 permit pursuant to the Clean Water Act
United States Bureau of Land Management	Permits for use of land for geotechnical exploration Permits for construction areas and associated activity Right-of-way permits for permanent easement Amendment for an exception to the utility corridor requirements of the California Desert Conservation Area Plan
United States Fish and Wildlife Service	Section 7 consultation pursuant to the Endangered Species Act
State Agencies	
California Department of Fish and Game	Section 1601 permit pursuant to the Fish and Game Code (Streambed Alteration Agreement) Section 2081 permit or Section 2081.1 consistency determination pursuant to the California Endangered Species Act
Regional Water Quality Control Board	Permit for construction water discharge certification for placement of fill Clean Water Act Section 401 water quality discharge certification for placement of fill
State Lands Commission	Construction easement (Western and Combination Alternatives)
Local/Regional Agencies	
Mojave Desert Air Quality Management District	Permits for stationary emissions sources

SECTION 13.0

List of Preparers



SECTION 13.0
LIST OF PREPARERS

The following public agencies, firms and individuals contributed to the preparation of the Cadiz Project EIR/EIS.

13.1 METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Project Action, Location and Background; Water Demand and Available Supply; Statement of Project Purpose and Need; Project Objectives; Process Used to Develop Project Alternatives; Description of Project Alternatives; Mitigation Incorporated into the Project Alternatives; Selection of Preferred Alternative; Issues Remaining to be Resolved; Thresholds of Significance; Energy and Mineral Resources/Mine Claims; Hazards and Hazardous Materials/Existing Conditions; Cumulative Impacts and Document Distribution List.

Kathy M. Kunysz
Dirk W. Reed
Jack Safely

Independent Consultants

Judd Monroe, Ph.D.

13.2 UNITED STATES BUREAU OF LAND MANAGEMENT

Thresholds of Significance; Information on Required Permits and Approvals; Agricultural Resources; Land Use, Planning and Policies; Topography, Geology, Seismicity and Soils; Water Resources; Biological Resources; Energy and Mineral Resources; Hazards and Hazardous Materials; Public Services; Utilities and Service Systems; Aesthetics; Cultural Resources; Paleontological Resources; Wilderness/Recreation; Environmental Justice and Cumulative Impacts.

Molly Brady
Dick Crowe
Ken Downing
Rolla Queen
Douglas Romoli
Timothy Salt
James Williams

13.3 P&D ENVIRONMENTAL

Environmental Impact Report/Environmental Impact Statement; Screening of Project Alternatives; Scoping Meetings and Scoping Report; Topography, Geology, Seismicity and Soils; Air Quality; Agriculture; Traffic Study; Transportation; Socioeconomics; Hazardous Materials; Wilderness/ Recreation; Public Services; Biological Resources; Energy and Mineral Resources; Noise; Aesthetics and Indian Trust Assets.

Frances Amanna
Michael Benner
Betty Dehoney
Anthony DeJulio
Shelly Feeney
Michele Goldman
Gregory Graber
Mark Harvey
Christine Huard-Spencer
Tony Mann
Jose Mortero
Robert Olsen
Anne Pietro
Jeff Post
Robert Price
Shambhavi Rao

Ann Reynolds
Robert Rusby
Sylvia Salenius
Ronald Siecke
Warren Sprague
Cuong Van
Douglas Willick

13.4 APPLIED EARTHWORKS

Archaeological and Historical Resources Studies.

Joan E. George
Susan Goldberg
M. Colleen Hamilton
Melinda C. Horne
Cari Inoway
Michael F. Rodarte
Dennis P. McDougal

13.5 BLACK & VEATCH

Design of Project Facilities; Process Used to Develop Project Alternatives; Description of Project Alternatives; Mitigation Incorporated into the Project Alternatives; Topography, Geology, Seismicity and Soils; Transportation; Energy and Mineral Resources; Hazards and Hazardous Materials; Noise; and Utilities and Service Systems.

Bruce Ainsworth
Dave Argo
Steve Foellmi
Randy Hill
John Hollenbeck
Richard Mort
Victor Tsai

13.6 CIRCLE MOUNTAIN BIOLOGICAL CONSULTANTS

Specialty Biological Resource Surveys.

Sharon Daugherty
Ed LaRue

13.7 GEOSCIENCE SUPPORT SERVICES, INC.

Specialty Groundwater Study and Water Resources.

Dennis Williams, Ph.D.
Thomas Harder

13.8 GUST OSTEOLOGICAL

Paleontological Resources Study.

Sherri Gust

13.9 HERNANDEZ KROONE

Land Surveying; Land Use, Planning and Policies; Transportation and Railroads; and Utilities Systems.

Anne Hernandez
Richard Hernandez
Phillip Nava

13.10 LAER PEARCE ASSOCIATES

EIR/EIS Scoping Meetings and Scoping Report.

Sheri D. Johnson
Janell Kasmer

13.11 WOODWARD CLYDE

Topography, Geology, Seismicity and Soils.

S. Thomas Freeman
John Waggoner

SECTION 14.0

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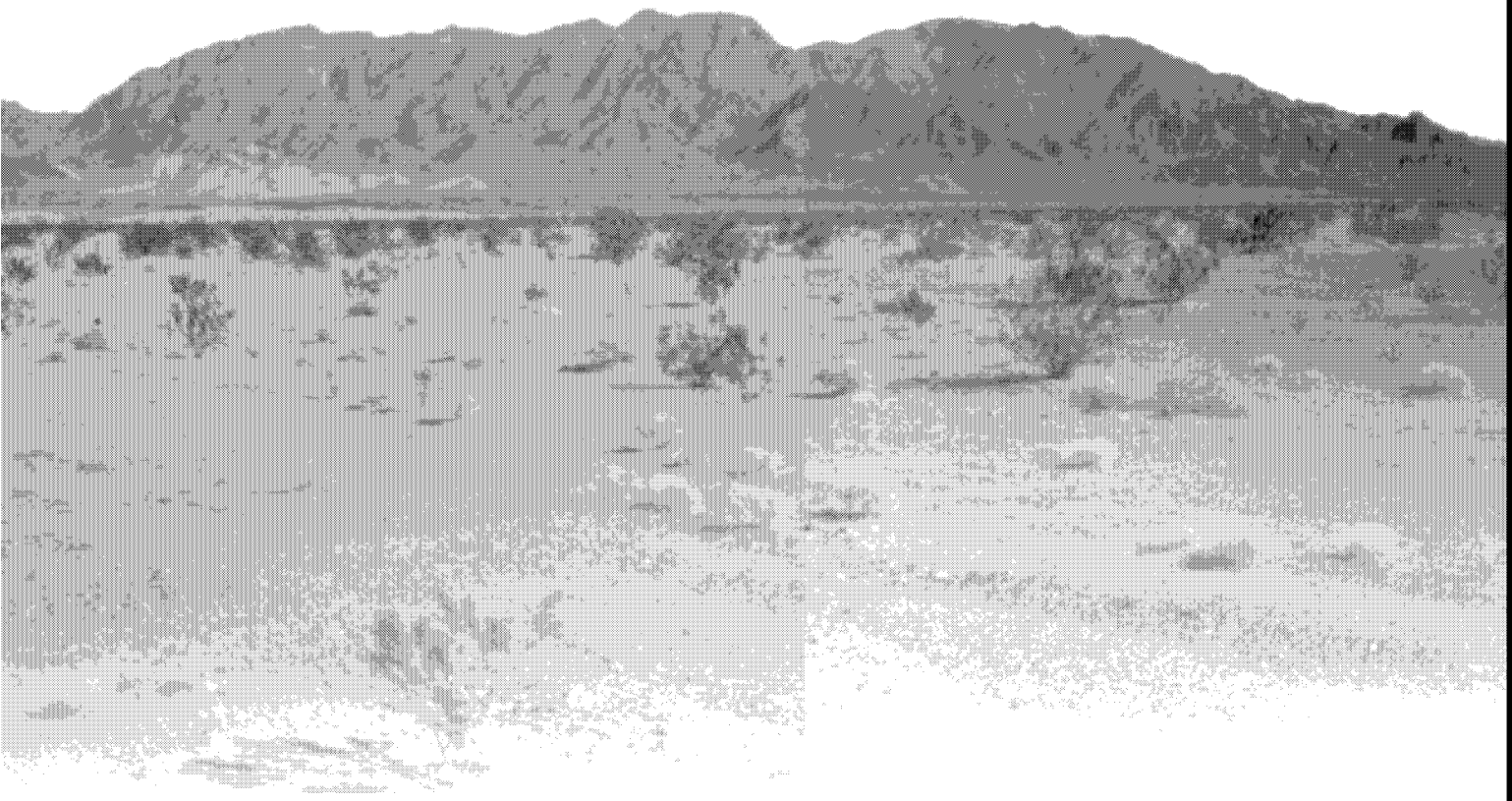

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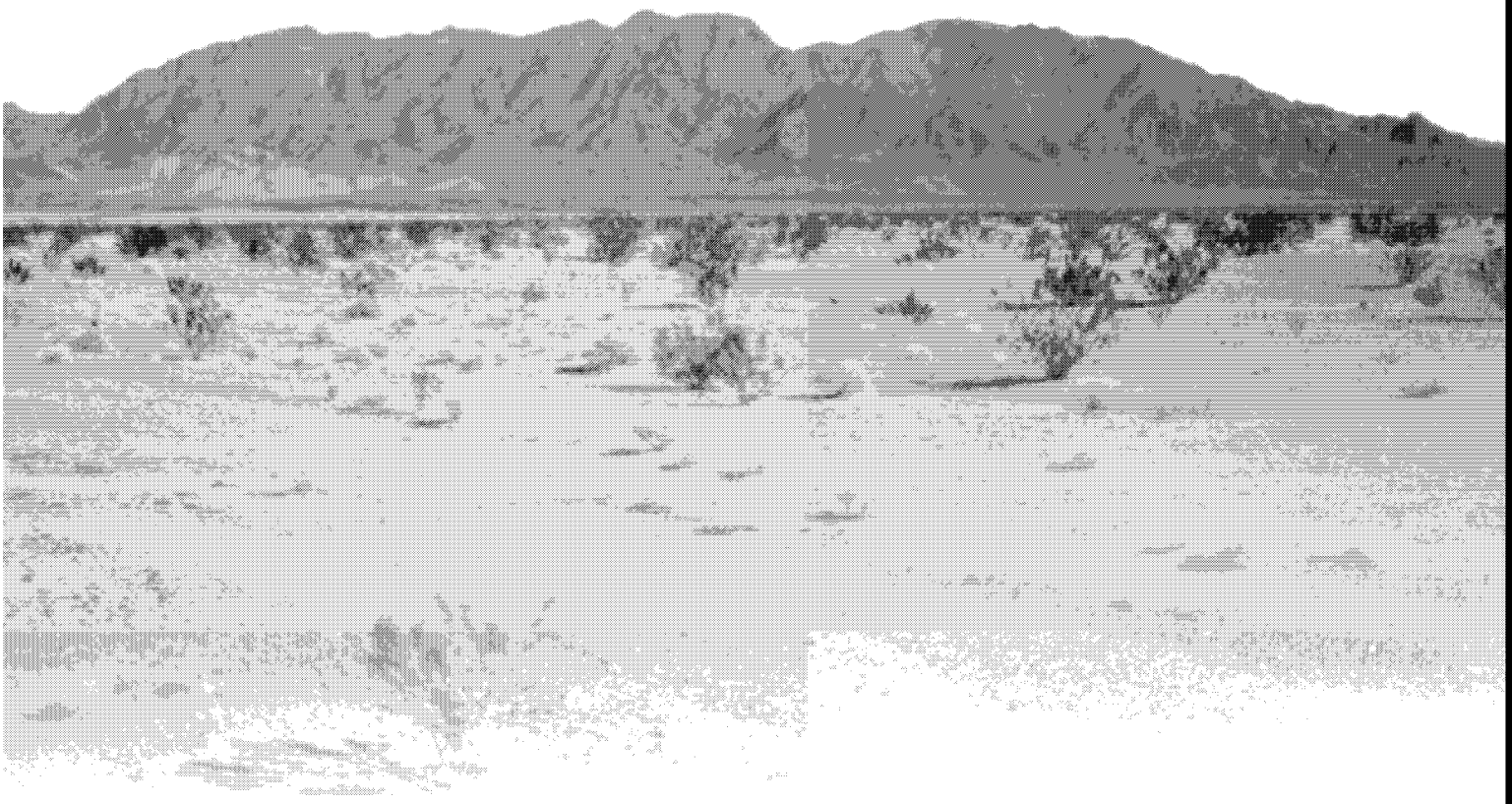
SECTION 15.0

Glossary of Terms, Acronyms and Units of Measurement



SECTION 15.0
GLOSSARY OF TERMS, ACRONYMS AND UNITS OF MEASUREMENT

15.1 TERMS

Acre-Foot. The volume of the water that covers one acre to a depth of one foot; approximately 326,000 gallons.

Active Fault. A fault on which movement has occurred during the past 10,000 years and which may be subject to recurring movement usually indicated by small, periodic displacement or seismic activity.

Advisory Council on Historic Preservation. A 19-member body appointed, in part, by the President of the United States to advise the President and Congress and to coordinate the actions of federal agencies on matters relating to historic preservation, to comment on the effects of such actions on historic and archaeological cultural resources, and to perform other duties as required by law (Public Law 89-655: 16 USC Section 470).

Air Quality Control Region. An area designated by Section 107 of the Clean Air Act, which is based on jurisdictional boundaries, urban-industrial concentrations and other factors including atmospheric areas, that is necessary to provide adequate implementation of air quality standards.

Alluvium. A general term applied to sediments deposited by a stream or running water.

Ambient Air. That portion of the atmosphere, outside buildings, to which the general public has access.

Ambient Air Quality Standards. Standards established on a state or federal level that define the limits for airborne concentrations of designated criteria pollutants (nitrogen dioxide, sulfur dioxide, carbon monoxide, total suspended particulates, ozone and lead) to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility and materials (secondary standards).

Anticline. A fold of rockbeds that is convex upward.

Aquifer. A body of rock that is sufficiently permeable to conduct significant quantities of water to wells and springs.

Archaeology. A scientific approach to the study of human ecology, cultural history and cultural process.

Artifact. Anything that owes its shape, form or placement to human activity. In archaeological studies, the term is applied to portable objects such as tools and the by-products of their manufacture.

Attainment Area. An area that has been designated by the Federal Environmental Protection Agency and the appropriate state air quality agency as having ambient air quality levels below the ceiling levels defined under the National Ambient Air Quality Standards.

Average Annual Daily Traffic. For a one-year period, the total volume passing a point or segment of a highway facility in

both directions, divided by the number of days in the year.

Basalt. A general term for dark-colored mafic igneous rocks.

Baseline. The existing and future growth characterization of an area without a proposed project.

Basin. A drainage or catchment area of a stream or lake.

Bedrock. Geologic formation or unit which underlies soil or other unconsolidated surficial deposits.

Cairn. A distinctly artificial pile of rocks that may mark or enclose burials, vision quests, caches or geodetic locales.

Campsite. A short term habitation site containing evidence of daily living activities, as opposed to specialized activities (e.g., quarry site). Campsites are generally open air occupations of perhaps weeks to months in duration.

Capacity (Transportation). The traffic-carrying ability of a facility while maintaining prescribed operational qualities (e.g., a specific level of service); the maximum amount of traffic that can be accommodated by a given facility. Traffic facilities generally operate poorly at or near capacity, and facilities are rarely designed or planned to operate within this range.

Carbon Dioxide (CO_2). Common product of combustion. Not a criteria pollutant, but an important greenhouse gas. CO_2 is important on a national and a global scale.

Carbon Monoxide (CO). Common product of incomplete combustion. CO is a criteria pollutant with state and federal standards. Not a primary photochemical reaction compound, but involved in photochemical reactions. Dissipates rapidly and is, therefore, only important on a local scale near pollutant sources.

Chronology. The science of arranging time in periods and ascertaining the dates and historical order of past events.

Climate. The prevalent or characteristic meteorological conditions and their extremes of any given location or region.

Color. The property of reflecting light of a particular wavelength that enables the eye to differentiate otherwise indistinguishable objects.

Component. One location or element within a settlement/subsistence system. Archaeological sites may contain several components that reflect the use of the locality by different groups in different time periods.

Comprehensive Plan. A public document adopted and approved by a local government legislative body which describes future land uses, goals and policies.

Confined Aquifer. An aquifer bounded above and below by impermeable beds, or by beds of distinctly lower permeability than that of the aquifer itself; and an aquifer containing confined groundwater.

Contrast. The effect of a striking difference in form, line, color or texture of a landscape's features.

Corridor. A strip of land of various widths on both sides of a particular linear facility such as a highway or rail line.

Crepuscular. Active in twilight, at dawn or dusk; including many species of birds, mammals and insects.

Criteria Pollutants. Those air pollutants specifically identified for control under the Federal Clean Air Act. There are currently six criteria pollutants: carbon monoxide, nitrogen oxides, lead, sulfur oxides, ozone and particulates.

Cultural Complex. A group of artifacts and sites that are distinct from other groups.

Cultural Modification. Any man-made change in land, waterform or vegetation (roads, bridges, buildings or fences); the addition of a structure which creates a visual contrast to the natural character of a landscape.

Culture. The system of behavior, beliefs, institutions and objects human beings use to relate to each other and to the environment.

Cumulative Impacts. The combined impacts resulting from all projects occurring concurrently at a given location.

Debitage. Waste flakes resulting from stone tool manufacture.

Decibel. The unit of measurement of sound level calculated by taking ten times the common logarithm of the ratio of the magnitude of the particular sound pressure in the standard reference sound pressure of 20 micropascals and its derivatives.

Decumbent. Lying down; reclining on the ground but with ascending apex or extremity.

Delay. Additional travel time experienced by a driver, passenger or pedestrian beyond what would reasonably be desired for a given trip.

Dependable Yield. Water supply that can be expected to be available during a drought period based on historic records.

Detritus. Fragmented particulate organic matter derived from the decomposition of plant and animal remains.

Developed. Said of land, a lot, a parcel or an area that has been built on or where public services have been installed prior to residential or commercial development.

Direct Effect. Effect that is an immediate consequence of project activities.

Direct Impact. Effect resulting solely from project implementation.

District. National Register of Historic Places designation of geographically defined urban or rural area possessing a significant concentration, linkage or continuity of sites, structures or objects united by past events (theme) or aesthetically by plan of physical development.

Disturbed Area. Land that has had its surface altered by grading, digging or other construction-related activities.

Earthquake. A sudden motion or trembling in the earth caused by the displacement of rocks below the earth's surface due to a release of strain.

Effect. A change in an attribute. Effects can be caused by a variety of events, including those that result from project attributes acting on the resource attribute

(direct effect); those that do not result directly from the action or from the attributes of other resources acting on the attribute being studied (indirect effect); those that result from attributes of other projects or other attributes that change because of other projects (cumulative effects); and those that result from natural causes (e.g., seasonal changes).

Endangered Species. A species that is threatened with extinction throughout all or a significant portion of its range.

Energy. The capacity for doing work; taking a number of forms which may be transformed from one into another, such as thermal, mechanical, electrical and chemical; in customary units, measured in kilowatt-hours or British thermal units.

Ephemeral. Lasting or existing briefly or temporarily.

Epicenter. The point on the earth's surface directly above the focus of an earthquake.

Escarpment. A long cliff or steep slope separating two comparatively level or more gently sloping surfaces; results from erosion or faulting.

Ethnography. The description of human groups and their behavior by direct observation and/or by transcription of statements by living persons.

Exotic Species. An organism or species that is not native to the area in which it is found.

Fault. A fracture or zone of fractures along which there has been displacement of the sides relative to one another parallel to the fracture.

Fault Zone. An area or region that is expressed as a zone of numerous fractures or faults.

Feature. Nonportable portion of an archaeological site. These include facilities such as fire pits, storage pits, stone circles or foundations.

Federal-Candidate Species. Species which are candidates for possible addition to the List of Endangered and Threatened Species.

Flake. A small stone fragment produced as a byproduct of stone tool manufacturing; may also be used unmodified as a tool itself.

Floodplain. The relatively flat land lying adjacent to a river channel that is covered by water when the river overflows its banks.

Flora. Plants; organisms of the plant kingdom taken collectively.

Fluvial. Pertaining to a river or stream.

Forage. Food for animals (e.g., desert tortoise), especially when taken by browsing or grazing.

Form. The mass or shape of an object which appears unified; often defined by edge, outline and surrounding space.

Freeway. A multilane, divided highway with a minimum of two lanes for exclusive use of traffic in each direction, allowing full control of access and egress.

Fugitive Dust. Particulate matter composed of soil that is uncontaminated by pollutants from industrial activity. Fugitive dust may include emissions from

haul routes, wind erosion of exposed soil surfaces, and other activities in which soil is either removed or redistributed.

Fugitive Emissions. Emissions released directly into the atmosphere that could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening.

Geologic Hazard. A naturally occurring or manmade geologic condition or phenomenon that presents a risk or is a potential danger to life and/or property.

Geologic Scale. Scale of time ranging from Precambrian (approximately 3.8 billion years ago) to the present.

Geologic Unit. A geologic formation, group or member.

Geothermal. Pertaining to heat in the earth's interior.

Gneiss. A foliated metamorphic rock corresponding in composition to granite or some other feldspathic plutonic rock.

Granite. A broadly used term for a quartz-bearing, coarse, crystalline igneous rock formed deep beneath the earth's surface.

Ground Surface Rupture. Surface expression of fractures that are usually a result of seismic activity.

Groundstone Artifacts. Stone artifacts made by grinding rather than flaking (e.g., milling stones and mortar and pestle).

Gypsum. A widely distributed mineral consisting of hydrous calcium sulfate.

Hazardous Material. A substance, or combination of substances, which, because of its quantity, concentration or physical, chemical or infectious characteristics, may either cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of or otherwise managed.

Hazardous Waste. A waste, or combination of wastes, which, because of its quantity, concentration or physical, chemical or infectious characteristics, may either cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of or otherwise managed.

Hearth/Firepit. A feature used for the placement of fires; may be lined with clay or stones.

Herperofauna. Referring to amphibians and reptiles.

Historic. A period of time after the advent of written history dating to the time of first Euro-American contact in an area. Also refers to items primarily of Euro-American manufacture.

Hydrology. The science dealing with the properties, distribution and circulation of water on the surface of the land and in the soil and underlying rocks.

Inactive Fault. A fault with no historic activity within the past approximately

11,000 years; not recognized as a source of earthquakes.

Indirect Effect. Project-related impacts (usually population changes and resulting impacts) not directly attributable to the project itself.

Intermittent Stream. A stream that does not flow continuously during all periods of the year.

Interstate. The designated National System of Interstate and Defense Highways located in both rural and urban areas; they connect the East and West coasts and extend from the Canadian border points to various points on the Mexican border.

Isolated Artifact. An artifact or a small, disarticulated group of artifacts that cannot be associated with, or are situated outside of, a cultural resource site.

Land Use Plans and Policies. Guidelines adopted by governments to direct future land use within their jurisdictions.

Landslide. The downslope movement of soil and/or rock material under gravitational influence.

Ldn Noise Level. The 24-hour average-energy sound level expressed in decibels, with a 10-decibel penalty added to sound levels between 10:00 PM and 7:00 AM.

Lead (Pb). A heavy metal present in the environment mainly due to historical use in motor vehicle fuel. Lead is a criteria pollutant with state and federal standards and is primarily of concern near pollutant sources.

Leq Noise Level. A constant amount of acoustic energy equivalent to the energy contained in the time-varying noise measured from a given source for a given time.

Level of Service. In transportation analyses, a qualitative measure describing operational conditions with a traffic stream and how they are perceived by motorists and/or passengers.

Line. The path that the eye follows when perceiving abrupt differences in form, color or texture. In the landscape, ridges, skylines, structures, changes in vegetation, or individual trees and branches may be perceived as a line.

Liquefaction. The transformation during an earthquake or groundshaking of unconsolidated water-saturated sediment into a liquid form.

Lithic Scatter. An archaeological site consisting only of stone artifacts.

Lithology. The physical character of a rock such as its color, hardness, mineral composition and grain size.

Locality. A particular spot within a geologic unit from which a specimen is obtained or may be found; usually a location of dense or well-preserved fossils.

Long-Term (Long Duration). Impacts that would occur over an extended period of time, whether they start during the construction or operations phase. Most impacts from the operations phase are expected to be long term since project operations essentially represent a steady-state condition (i.e., impacts resulting from actions that occur repeatedly over a

long period of time). However, long term impacts could also be caused by construction activities if a resource is destroyed or irreparably damaged or if the recovery rate of the resource is very slow.

Magnitude (earthquake). A measure of strength of an earthquake or the energy it releases.

Maximum Credible Earthquake. The largest earthquake capable of being produced from a source, structure or region under the currently known tectonic framework.

Mitigation. A method or action to reduce or eliminate project impacts.

National Register of Historic Places. A register of districts, sites, buildings, structures and objects important in American history, architecture, archaeology and culture, maintained by the Secretary of the Interior under authority of Section 2(b) of the Historic Sites Act of 1953 and Section 101(a)(1) of the National Historic Preservation Act of 1966, as amended.

Native Americans. Used in a collective sense to refer to individuals, bands or tribes who trace their ancestry to indigenous populations of North America.

Native Vegetation. Indigenous plant life that occurs naturally in an area without agricultural or cultivational efforts.

Nonattainment Area. An area that has been designated by the Federal Environmental Protection Agency and the appropriate state air quality agency as exceeding one or more National Ambient Air Quality Standards.

Non-Native Vegetation. Plant communities dominated by exotic species that have been planted or resulting from the invasion of disturbed natural communities.

Oxides of Nitrogen (NO_x). Common product of combustion in the presence of nitrogen. Includes nitrogen dioxide (NO_2), which is a criteria pollutant with state and federal standards. NO_x is locally and regionally important due to its involvement in the photochemical formation of ozone.

Oxides of Sulfur (SO_x). Common product of combustion in the presence of sulfur. Associated primarily with diesel and coal burning. Includes sulfur dioxide (SO_2), a criteria pollutant with state and federal standards. SO_x is primarily of concern near pollutant sources.

Ozone (O_3). A gas mainly produced by a photochemical reaction between reactive organic gases and NO_x in the presence of sunlight. O_3 is a strong oxidant that is damaging at ground level but necessary at high altitude, in the stratosphere, where it absorbs dangerous ultraviolet light. Also considered an important greenhouse gas. O_3 is a criteria pollutant with state and federal standards.

Paleo-. Prefix meaning old or ancient.

Paleontological Resources. Fossilized organic remains from past geological periods.

Particulate Matter (TSP or PM_{30}). Solid or liquid matter suspended in the atmosphere, excluding water. Includes aerosols and droplets that form in the atmosphere. Particulate matter is locally and regionally important.

Peak Hour. The hour of highest traffic volume on a given section of roadway between 7:00 AM and 9:00 AM or between 4:00 PM and 6:00 PM.

Peak Year. The year when a particular project-related effect is greatest.

Perennial Stream. A stream that flows continuously throughout the year.

Permanently Disturbed Land. Surfaces covered by permanent or semi-permanent materials or kept in a cleared condition.

Physiognomy. The characteristic features or appearance of a plant community or vegetation.

Physiographic Province. A region with similar geologic structure and climate that has a unified geomorphic history.

Potentiometric Level. That level to which groundwater would rise under unconfined conditions; it may assume values higher than the local topography.

Prehistoric. The period of time before written records.

Prevention of Significant Deterioration Area. A requirement of the Clean Air Act (Section 160 et seq.) that limits the increases in ambient air pollutant concentrations in clean air areas to certain increments even though ambient air quality standards are met.

Primary Road. A consolidated system of connected main roads important to regional, interstate and statewide travel; they consist of rural arterial routes and their extensions into and through urban areas of 5,000 or more population.

Prime Farmland. Land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides and labor, and without intolerable soil erosion, as determined by the United States Secretary of Agriculture (Farmland Protection Policy Act, 7 CFR Section 658).

Principal Aquifer. The particular aquifer that supplies the majority of the groundwater used in a given region.

Protohistoric. The period when Native American cultures were affected by Euro-Americans without direct contact. For instance, inland Indian tribes received trade goods and reports of European cultures from coastal tribes before the arrival of European explorers in the interior.

Quarry. An open pit, mine or excavation where stone, sand, gravel or minerals are obtained from open faces with or without a waste rock overburden.

Quartzite. A compact granular rock composed of quartz and derived from sandstone by metamorphism.

Reactive Organic Gases/Volatile Organic Compounds/ Non-Methane Organic Gases/ Non-Methane Organic Compounds (ROG, VOC, NMOG, NMOC). A portion of total organic compounds or gases, excludes methane, ethane and acetone (due to low photochemical reactivity). ROG is generally used by the California Air Resources Board (CARB), VOC is generally used by the United States Environmental Protection Agency (USEPA). However, all four terms are

interchangeable for most uses. Regionally important due to its involvement in the photochemical reaction that produces O_3.

Recharge. The process by which water is absorbed and added to the zone of saturation, either directly into a formation or indirectly by way of another formation.

Relative Abundance. The total number of individuals of one species compared to the total number of individuals of all other species combined, per unit area, volume or community.

Relief. The vertical difference in elevation between the hilltops or mountain summits and the lowlands or valleys of a given region.

Respirable Particulate Matter (PM_{10}, and $PM_{2.5}$). The portion of particulate matter which tends to penetrate into the human lung. The subscript refers to the aerodynamic diameter of the particles. These are criteria pollutants with state and federal standards. Locally and regionally important.

Revegetation. Regrowth or replacement of a plant community on a disturbed site. Revegetation may be assisted by site preparation, planting and treatment, or it may occur naturally.

Reverse Osmosis. An advanced method of wastewater treatment that relies on a semipermeable membrane to separate water from constituents which may be pollutants.

Richter Magnitude Scale. Measure of an earthquake size based on the amplitude of seismic waves that are recorded on a seismograph. The magnitude is based on a logarithmic scale (base 10) of ground motion.

Riparian. Of or relating to land lying immediately adjacent to a water body and having specific characteristics of that transitional area (e.g., riparian vegetation).

Rockshelter. A naturally formed sheltered overhang that was commonly inhabited by prehistoric groups, it is generally found on a vertical rock face and is not as deep as a cave.

Runoff. The non-infiltrating water entering a stream or other conveyance channel shortly after a rainfall event.

Rural Area. The area outside towns, cities or communities that is characterized by very low-density housing concentrations, agricultural uses and a general lack of most public services.

Safe Sustained Yield. Pumpage over a period of time from a groundwater basin or aquifer that can be permanently maintained without substantially lowering the groundwater below a predetermined level.

Sampling. The selection of a part of a study area or population, the analysis of which is intended to permit generalization about the entire population. In archaeology, samples are often used to reduce the amount of land area covered in a survey or the number of artifacts analyzed from a site. Statistical sampling is generally preferred since it is possible to specify the bias or probability of error in the results, but judgmental or intuitive samples are sometimes used.

Sandstone. A sedimentary rock composed of detrital materials generally consisting

of quartz and deposited by physical processes.

Secondary Highways. Rural major collector routes that carry extensive local traffic.

Seismic. Pertains to the characteristics of an earthquake or earth vibrations including those that are artificially induced.

Seismic Zone. An area of seismicity related to a particular earthquake.

Seismotectonic Province. A region characterized by similar tectonic and seismic characteristics.

Shale. A fine-grained sedimentary rock formed by the consolidation of clay, silt and mud.

Sheet Erosion. Erosion caused by a layer of water moving downward on a surface that has not yet developed channels, rills or gullies. Uneven sheet erosion leads to the formation of rills and eventually gullies.

Short-Term (Short Duration). Transitory effects of a proposed project that are of limited duration and are generally caused by construction activities or initiating operations.

Significance. The magnitude of a given impact on a specific resource as defined under the California Environmental Quality Act and Guidelines.

Siltstone. A fine-grained sedimentary rock composed of silt-sized detritus.

Site. Any location where humans have altered the terrain or discarded artifacts.

Soil. A natural body consisting of layers or horizons of mineral and/or organic constituents of variable thickness and differing from the parent material in their morphological, physical, chemical and mineralogical properties, and biological characteristics.

Soil Association. A collection of soils found to geographically occur together.

Soil Series. The lowest category used for differentiating groups of soils based on similar properties and characteristics. Soils are homogenous with respect to profile characteristics except for the A or surface horizon, which may vary in texture.

Soil Types. A category or detailed mapping unit used for soil surveys based on phases or changes within a series (e.g., slope, salinity).

Sole Source Aquifer. An aquifer that provides all or most of the potable water in an area and that has been specifically designated by the Federal Environmental Protection Agency as provided for in the Safe Drinking Water Act. Projects that might affect a sole source aquifer are subject to special review procedures.

Species Diversity. A measure of the number of species and their relative abundance in a given assemblage or community.

Species Richness. The number of different species in a given assemblage or community.

State Historic Preservation Officer. The official in each state, authorized by the state at the request of the United States Secretary of the Interior, to act as liaison

for purposes of implementing the National Historic Preservation Act.

State-Sensitive/State-Recognized Species. Plant and wildlife species in each state that are monitored and listed for purposes of protection.

Stratified Site. An archaeological site exhibiting various strata or layers of occupation; usually implies a large site with a long occupation. The interpretation and analysis of strata are concerned with the original succession and age relations of layered materials and their individual properties (i.e., cultural materials are dated relative to each other by their position in stratigraphic layers).

Succession (Plant). The progressive development of vegetation toward its highest ecological expression, the climax; replacement of one plant community by another.

Surface Collection. Systematic mapping and removal of artifacts from a site by means not involving excavation.

Surficial. Material at or near the surface.

Syncline. A fold of rockbeds that is convex downward.

Taxon (pl.) Taxa. A taxonomic entity (species, subspecies or variety) or a group of such entities.

Tectonic. Dealing with the regional assembling of structural or deformational features, and includes a study of their mutual relations, origin and historical evolution.

Temporarily Disturbed Land. Surfaces disturbed during construction, but later regraded and/or revegetated; or those able to return to a natural state during the operations life of the project.

Terrain Failure. A generalized term for any number of mechanisms by which soil or rock is transported downslope under the effect of gravity.

Terrestrial. Living on or in, or growing from, the land.

Texture. The visual manifestation of the interplay of light and shadow created by variations in the surface of an object.

Threatened Species. Plant and wildlife species likely to become endangered in the foreseeable future.

Thrust Fault. A fault with a low angle of dip on which the hanging wall has moved upward relative to the footwall.

Topsoil. The upper or productive layer(s) of a soil.

Total Dissolved Solids (TDS). The concentration of solid materials that is dissolved in a sample of water; determined as the weight of the residue of a water sample on filtration and evaporation divided by the weight of the total volume of the sample. Expressed in terms of parts per million or milligrams per liter.

Total Organic Compounds/Gases (TOC or TOG). Compounds containing at least one atom of carbon, except CO, CO_2 carbonic acid, metallic carbides and metallic carbonates. Primarily methane in the atmosphere. Includes greenhouse gases, especially methane.

Total Water Use. The amount of water withdrawn from the natural resource base for a beneficial purpose, excluding water used for hydroelectric power generation, and certain nonconsumptive uses such as once-through cooling water for thermoelectric power generation, wildlife habitat and fish farming.

Two-Lane Highway. A road having a two-lane cross section, with one lane for each direction of flow, and where passing maneuvers must be made in the opposing lane.

Unconfined Aquifer. An aquifer where the water table is exposed to the atmosphere through openings (pores) in the overlying materials.

Unique and Sensitive Habitats. Areas that are especially important to regional wildlife populations or protected species that have other important biological characteristics (e.g., severe wintering habitats, nesting areas and wetlands).

Unique Farmland. Land other than prime farmland that is used for production of specific high-value food and fiber crops as determined by the United States Secretary of Agriculture. It has the special combination of soil quality, location, growing season and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods. Examples of such crops include citrus, tree nuts, olives, cranberries, fruits and vegetables.

Variety. The condition of having differentiated parts; the absence of monotony or sameness.

Viewshed. A geographic area of land where all features are visible.

Volume (Transportation). The total number of vehicles that pass over a given point or segment of a road during a given time interval. Volumes may be expressed in terms of annual, daily, hourly or subhourly periods.

Water Table. The surface in an unconfined aquifer (or in a confined aquifer) at which the pore water pressure is atmospheric.

Waterfowl. Birds species (e.g., ducks, geese, cranes) that live on or near water bodies.

Watershed. A drainage or catchment area of a stream or lake.

Well Yield. The volume of water discharged from a well per unit of time, often expressed in gallons per minute.

Wetlands. Areas that are inundated or saturated with surface water or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil, including swamps, marshes, hogs and similar areas.

Wind Erosion. Detachment, transportation and deposition of loose soil by wind action.

Zoning. The division of a municipality into districts for the purpose of regulating land use, bulk of building, required yards, necessary off-street parking and other prerequisites to development. Zones are generally shown on a map and the Zoning Ordinance specifies requirements for each zoning category.

15.2 ACRONYMS

91-Bank	1991 Governor's Water Bank
AAQS	Ambient Air Quality Standards
ACEC	Area of Critical Environmental Concern
ACHP	Advisory Council on Historic Preservation
ACOE	United States Army Corps of Engineers
ADT	Average Daily Traffic
Æ	Applied Earthworks, Inc.
AG	Agriculture
AIC	Archeological Information Center
amsl	Above Mean Sea Level
APE	Area of Potential Effect
AQAP	Air Quality Attainment Plan
AQMA	Air Quality Management Area
AQMD	Air Quality Management District
AQMP	Air Quality Management Plan
ARZC	Arizona California Railroad
AT&SF	Atchison, Topeka and Santa Fe Railroad
bgs	Below Ground Surface
BLM	Bureau of Land Management
BMPs	Best Management Practices
BNSF	Burlington Northern Santa Fe Railroad
BST	Buried Site Testing
CALFED	California – Federal Agencies
Caltrans	California Department of Transportation
CAMA	California Arizona Movement Area
CAMA	California-Arizona Maneuver Area
CARB	California Air Resources Board
CCAA	California Clean Air Act
CDCA Plan	California Desert Conservation Plan
CDFG	California Department of Fish and Game
CDMG	California Division of Mines and Geology
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CHP	California Highway Patrol
CHP	California Highway Patrol
CNDDB	California Natural Diversity Data Base
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO	Carbon Monoxide
CRA	Colorado River Aqueduct
CRW	Colorado River Water

CSC	California Species of Special Concern
CVP	Central Valley Project
DB	Decibel
DBA	A-weighted decibel
DEIR	Draft Environmental Impact Report
DERP	Defense Environmental Restoration Program
DoD	United States Department of Defense
DOI	United States Department of Interior
DTC	Desert Training Center
DWP	Los Angeles Department of Water and Power
DWR	California Department of Water Resources
DWRSIM	Department of Water Resources Simulation Model
EA	Environmental Assessment
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
ERA	Environmentally Restricted Area
FCR	Field Contract Representative
FEIR	Final Environmental Impact Report
FEIS	Final Environment Impact Statement
FHWA	Federal Highway Administration
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FSC	Federal Species Special Concern
FUDS	Formerly Used Defense Sites
GIS	Geographic Information Systems
GMP	Growth Management Plan
GPS	Ground Positioning System
GTE	General Telephone Company
HABS	Historic American Building Survey
HAER	Historic American Engineering Record
HAS	Hydrographic Subarea
HC	Hydrocarbons
HCP	Habitat Conservation Plan
HSU	Hydrographic Subunit
HVU	Habitat Value Units
I-10	Interstate 10
I-15	Interstate 15
I-40	Interstate 40
IID	Imperial Irrigation District
IMMP	Iron Mountain Pumping Plant

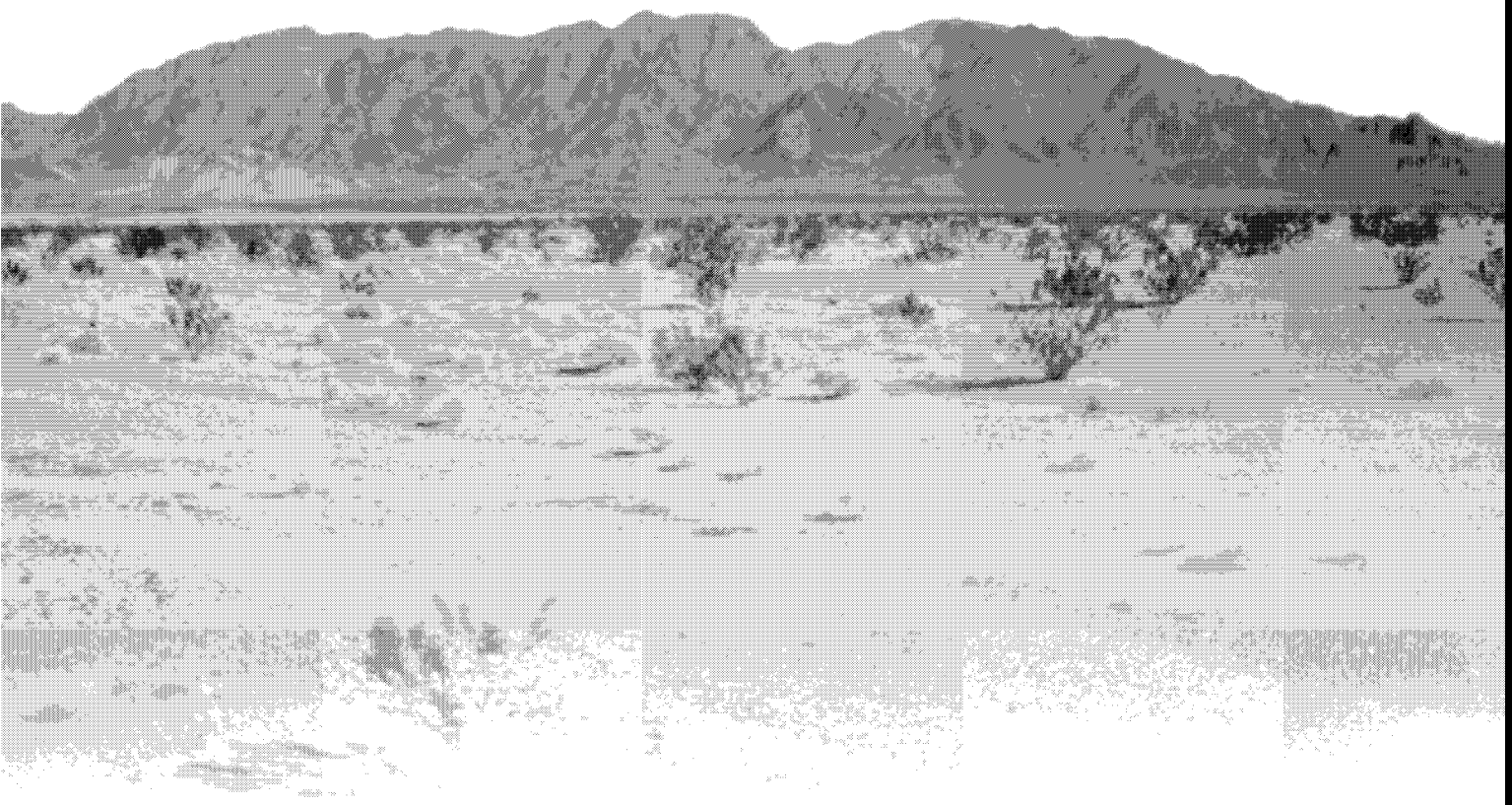
IS	Initial Study
ITA	Indian Trust Assets
IWR-MAIN	Institute of Water Resources-Municipal and Industrial Needs Water Use Forecasting System
KWB	Kern Water Bank
LAFCO	Local Agency Formation Commission
LCRBC	Lower Colorado River Basin Concept
LCRM-SHCP	Lower Colorado River Multi-Species Habitat Conservation Plan
Ldn	Day-Night Average Sound Level
Leq	Equivalent Noise Level
LLRW	Low Level Radioactive Waste
LOS	Level of Service
LPP	Local Projects Program
MCL	Maximum Containment Levels
MCX	Mandatory Centered Expertise
MDAB	Mojave Desert Air Basin
MDAQMD	Mojave Desert Air Quality Management District
Metropolitan	Metropolitan Water District of Southern California
MSL	Mean Sea Level
MWD-MAIN	Metropolitan's Adaptation of IWR-MAIN
NAAQS	National Ambient Air Quality Standards
NECO	Northern and Eastern Colorado Desert Plan
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOI	Notice of Intent
NOP	Notice of Preparation
NO_x	Nitrogen Oxides
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NUSD	Needles Unified School District
NW	Northwest
O_3	Ozone
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration

pcb	Polychlorinated biphenyl
PHEL	Population, Housing, Employment and Land Use
PM_{10}	Particulate Matter of 10 Microns or Less in Diameter
PMF	Probable Maximum Flood
RC	Resource Conservation
RMP	Regional Mobility Plan
ROG	Reactive Organic Gases
RTP	Regional Transportation Plan
SANBAG	San Bernardino Association of Government
SANDAG	San Diego Association of Governments
SBCFD	San Bernardino County Fire Department
SBCM	San Bernardino County Museum
SBCPL	San Bernardino County Public Library
SBCSD	San Bernardino County Sheriff's Department
SCADA	Supervisory Control and Data Acquisition
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SCS	United States Soil Conservation Service
SDC	San Diego Canal
SDCWA	San Diego County Water Authority
SDWMP	South Delta Water Management Program
SHPO	State Historic Preservation Officer
SIP	State Implementation Program
SO_2	Sulfur Dioxide
SPTC	Southern Pacific Transportation Company
SR 62	State Route 62
SR 66	State Route 66
SVP	Society of Vertebrate Paleontologists
SWMP	South Delta Water Management Program
SWP	State Water Project
SWRCB	State Water Resources Control Board
TDS	Total Dissolved Solids
TSP	Total Suspended Particulates
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
USMC	United States Marine Corps
UV	Ultraviolet
VOC	Volatile Organic Compounds
VRM	Visual Resources Management

15.3 UNITS OF MEASUREMENT

cfs	cubic feet per second
db	decibel
dBA	decibels on the A-weighted scale
fps	feet per second
gpm	gallons per minute
kV	kilovolt
kWh	kilowatt-hour
L_{dn}	day/night energy equivalent noise level
L_{eq}	energy equivalent noise level
m	meter
m^2	square meter
maf	million acre-feet
mg/L	milligrams per liter
µg/L	micrograms per liter
MGD	million gallons per day
MW	megawatt
PM_{10}	particulate matter less than or equal to 10 micrometers
ppm	parts per million
ug/m^3	micrograms per cubic meter

Appendices



Appendix A

CALIFORNIA DESERT PLAN AMENDMENT PROCESS

CHAPTER 7

Plan Amendment Process

The California Desert Plan has been designed to provide a guide for management over a long-term period. In order to do this, a process must be provided that will be flexible enough to permit changes in the face of unanticipated demands or response to future events that, as yet, cannot be foreseen.

PLAN INTERPRETATION AND CLARIFICATION

Due to the fact that the California Desert Plan is the first of its kind, covers such a large region, and deals with so many programs, t is anticipated that immediately after Plan approval a number of requests may be received which will requsre interpretation and/or clarification of the Plan to determine how the Plan affects a particular proposed use or activity. In some cases it may be necessary to clarify the meaning of statements in the Plan pertaining to guidelines, goals, and actions proposed.

The precise locations of designated boundaries may have to be determined in relationship to a particular existing activity. An activity or use may have been omitted from consideration in the Plan, and a determination may be needed as to how that activity is affected.

Request for Plan interpretation may be filed with the Desert District Office and will be responded to within 30 days of receipt of the request. The response will describe the interpretation made by the BLM authorized official and/or establish additional time needed to consider interpretation.

GENERAL PROCEDURES FOR PLAN AMENDMENTS

A Plan Amendment may be initiated at any time by the BLM District Manager, Desert District, in response to new findings under the continuing monitoring, review, and revision procedures.

Individuals and public or private organizations desiring to have the Plan or any of its elements amended may submit requests for amendment to the District Manager of the BLM California Desert District. The District Manager will respond in writing within 30 days, acknowledging receipt of the request and informing the applicant of the process to be followed in studying and deciding upon the amendment. Processes will be consistent with Bureau procedures.

The general categories of Plan amendments anticipated are described below:

Category 1 —The proposed changes (based on previous analysis) will not involve significant environmental impact, and/or E1S documentation is not required. Such changes would not cause significant changes in the geographic location and extent of a multiple-use class designation, multiple-use class guidelines, or significant changes in the goals and policies expressed in the Plan elements or in ACECs or Special Areas.

Category 2—The proposed change, based on prelimi nary analysis, will require a significant change in the location of a multiple-use class designation or the geographic location or extent of that designation, a significant change in a multiple-use class guideline, or in a Plan element, goals, policies, or the process as prescribed in that element.

Such changes based on preliminary analysis are likely to or are known to have a significant environmental impact and an E1S is required.

Category 3—The proposed change is submitted to accomodate a request for a specific use or activity which will require additional analysis and decision beyond the Plan Amendment decision.

Category 1 amendments will be considered at least on a semi-annual schedule and Plan amendments in Cate gories 2 and 3 will be considered on an annual schedule, beginning one year from the date of Plan approval. Spe cific Category 3 amendments may be considered at any time where the State Director determines that the proposed project is of such significance to the public interest that deviation from the annual schedule is justified.

BLM-INITIATED AMENDMENTS

The Bureau will monitor implementation of the Plan, as well as new internal data, and will review the need for a general revision at the end of one year after approval of the Plan. Amendments will be considered once a year for the next four years. The District Multiple-Use Advisory Council will play a major role in determining amendments.

Proposals for revision of the boundaries of the California Desert Conservation Area, or requests for changes in the Federal Land Policy and Management Act will be re ferred to the U.S. Congress for review and decision.

During the planning process, the need for, one boundary adjustment and concurrent BLM study of the administrative organization best suited to implement the Plan was identified. The McCain Valley area, encompassing approximately 15OOO0 acres of BLM-administered public lands along the present southwest boundary of the COCA, has been determined to be an area that should be included in the California Desert Conservation Area and managed under the framework of the Plan, from both ecological and resource management perspectives.

A precise determination of boundary adjustment in McCain Valley will be made, existing Resource Management Plans for the area will be reconciled to overall Plan guidelines, and the proposed revision, with appropriate environmental assessment, will be processed under the standard Plan Amendment procedures and referred to Congress in the form of a draft boundary adjustment amendment to the Federal Land Policy and Management Act of 1976. . the County Board of Supervisors.

Proposed revisions of the multiple-use classifications or their boundaries, guidelines, objectives, or decision criteria and major revisions of Plan elements, including significant changes in use levels or facilitylocations will be by the BLM California State Director under the amendment procedures outlined in this section.

INFORMATION REQUIRED FROM INDIVIDUALS AND ORGANIZATIONS

All requests for amendment must be submitted to the District Manager of the California Desert District. Any *requests* from individuals or private groups or organizations for amendments to or changes in the California Desert Plan must contain the following information:

(1)Reasons for the request.

(2) An explanation of how the individual, group, or organization is being adversely affected by existing requirements or management objectives in the Plan.

INFORMATION REQUIRED FROM GOVERNMENTAL AGENCIES

Federal, State, and local governmental units (including special districts) may file applications and petitions with Bureau for land and resource uses in accordance with established regulations. These applications and petitions will be reviewed in light of the Plan data and conclusions. event such applications or petitions are denied, on basis of the Plan or its supportive data, rights of appeal will be in accordance with established regulations for the type of application or petition involved. If the proposal has merit, in light of the presented circumstances, the Bureau will simultaneously consider the proposal and a related Plan amendment. Special priority will be given to requests of State and local governments and other Federal agencies.

CITIES AND SPECIAL DISTRICTS

If the request for an amendment to change the Plan is being submitted by an incorporated city or special district, the following information must be provided:

(1) The request must have been approved by vote of the City Council or Board of Directors.

(2) The city must show how it has been, is being, or will be adversely affected by the Plan, or parts thereof.

(3) The city must show how its proposed amendment is necessary for consistency with the officially adopted city general plan.

COUNTY

If the request for amendment is submitted by a county. or county service area, the following information must be submitted:

(1) The request must have been approved by vote of the County Board of Supervisors.

(2) The county must show how it has been, is, or will be adversely affected by the Plan, or parts thereof.

(3) The county must show how the proposed amendment is necessary for consistency with the officially decided
adopted county general plan.

STATE

If request for amendment is submitted by the Legislature or Executive Branch of the State of California, the following process must be followed:

(1) The request must have been approved by the Executive Director or Secretary of the submitting agency after indication of coordination with other potentially affected State agencies.

(2) The State must show how it has been, is, or will be adversely affected by the Plan, or parts thereof.

(3) The State must show how the proposed amendment is necessary for consistency with adopted State plans or programs.

FEDERAL AGENCY

If the request for amendment is submitted by a department, office, or bureau of the Executive Branch of the the U.S. Government other than the BLM, these steps will be
necessary:

(1) The request must have been approved by the director of the submitting department, office, or bureau.

(2) The agency must show how it has been, is, or will be adversely affected by the Plan, or parts thereof.

(3) The agency must show how the proposed amendment is necessary for consistency with officially adopted plans or programs.

PLAN AMENDMENT PROCESS

Upon receipt of a request to consider a Plan amendment, the Desert District Manager shall decide:

(1) To consider the Plan amendment, in which case he shall determine the category of amendment to be assigned;

(2) Not to consider the Plan amendment, in which case he shall notify the requestor stating the reasons for his decision.

Any decision to consider or not to consider a Plan amendment is subject to protest to the State Director.

AMENDMENT DECISIONS

Category I Amendments

(a) The Desert District Manager recommends an amendment to the State Director. If the State Director concurs, the District Manager makes a decision and a public notice of the amendment decision is given. This notice should clearly explain how the existing Desert Plan is changed.

(b) Protests will be received for 30 days following the public notice.

(c) An amendment may be implemented after protests are resolved and at least 30 days after the public notice.

Category 2 Amendments

(a) The Desert District Manager recommends a preferred alternative to the State Director. If the State Director concurs, the results of the above steps are published as a draft Desert Plan amendment and draft EIS for public review,

(b) The Desert District Manager evaluates comments received, then selects and recommends an amendment decision to the State Director for review and concurrence.

(c) Upon receipt of concurrence, a proposed Plan amendment and final EIS are prepared and published.

(d) Protests will be received for 30 days following the filing of the final EIS.

(e) An amendment may be approved and implemented after protests are resolved and at least 30 days after filing the final EIS.

Category 3 Amendments

(a) Based on additional analysis, the Desert District Manager recommends an amendment to the State Director. If the State Director concurs, the District Manager makes a decision and a public notice of the amendment decision is given. This notice should clearly explain how the existing Plan is to be changed.

(b) Protests will be received for 30 days following the notice.

(c) An amendment may be approved after protests are resolved and at least 30 days after public notice.

ANALYSIS OF PROPOSED AMENDMENTS

In analyzing any applicant's request for amending or changing the Plan, the BLM District Manager, Desert District, will:

(1) Determine if the request has been properly submitted and if any law or regulation prohibits granting the requested amendment.

(2) Determine if alternative locations within the CDCA are available which would meet the applicant's needs without requiring a change in the Plan's classification, or an amendment to any Plan element.

(3) Determine the environmental effects of grant ing and/or implementing the applicant's request.

4) Consider the economic and social impacts of granting and/or implementing the applicant's request.

(5) Provide opportunities for and consideration of public comment on the proposed amendment, including input from the public and from Federal, State, and local government agencies.

(6) Evaluate the effect of the proposed amendment on BLM management's desert-wide obligation to achieve and maintain a balance between resource use and resource protection.

DECISION CRITERIA FOR APPROVAL OR DISAPPROVAL

Before submitting a recommendation for a Plan amendment, the BLM Desert District Manager must determine that the proposed amendment is in accordance with applicable laws and regulations and will provide for the immediate and future management, use, development, and protection of the public lands within the CDCA. The BLM Desert District Manager will base his rationale for such determination on the principles of multiple use. sustained yield, and maintenance of environmental quality, as required in the Federal Land Policy and Management Act of 1976.

PUBLIC NOTIFICATION

Notification of proposed amendments to or changes in the California Desert Plan will be published in the *Federal Register.* In addition, notices will also be published in a newspaper, or newspapers, of general circulation in the area which would be affected by the proposed amendment(s). Further, a Plan amendment mailing list will be developed by BLM and will include appropriate publications which publish material of interest to people concerned about public lands of the California Desert. All individuals, organizations, and other public agencies requesting notices of Plan amendment proposals or decisions will receive such notices. All notices and information will be published in this manner no later than 30 days prior

to the first or subsequent public hearing, if one is to be held.

All county boards of supervisors and all 'city councils located where incorporated limits and spheres of influence encompass the land area which might be affected by a proposed amendment to the Plan will be notified of such application to amend no later than 30 days prior to any scheduled public hearings.

PUBLIC HEARINGS

Before the BLM Desert District Manager makes final decision(s) on proposed amendment(s), he may hold one or more public hearings to consider these proposals.

Appendix B

TRAFFIC ANALYSIS TABLES

TABLE B-1A
TYPICAL CREW AND EQUIPMENT REQUIREMENTS FOR THE CONVEYANCE FACILITY CONSTRUCTION (E/W/C)

Activity	Crew Size	Equipment Requirements Codes
Locate underground utilities	2	A, B
Support underground utilities	3	B, C, D
Fence	4	B, D
Trench excavation	4	B, E
Haul excess material	1	F
Unload, rehaul and handle pipe	4	G, H
Install pipe	6	B,G, H,W,X
Install pipe appurtenances	4	A,B,W,X
Place backfill/pipe zone	5	I, J, K, L,X
Place bedding with loader	5	I, J, K, L, M
Place backfill	3	J, L, N
Shield maintenance	3	O, P, Q
Steel piling and lagging/shore	4	K, R, S, T, U
Construction management	2	B
Total	**50**	

Equipment Code	Description	Hrs of Operation/10hr shift
A	Loader-Backhoe 1.5 cubic yards (cy)	9
B	Pickup Truck	5
C	Backhoe, 1.0 cy	9
D	Flatbed Truck w/ Crane	9
E	3cy Hydraulic Backhoe	9
F	End Dump Truck, 12 cy	10
G	Crane	9
H	Tractor/Lowboy Hauling Rig	9
I	Tamping Spade	9
J	Hand Held Vibrator Plate	9
K	Rubber Tire Loader	9
L	Water Truck	10
M	Bedding Hopper/Conveyor System	9
N	Vibrator Compactor	9
O	Forklift, 7.5 ton	6
P	Trench Shield	10
Q	Z-bar Shoring	10
R	Truck Mounted Vertical Auger Drill	9
S	Truck Crane	9
T	Pile Hammer, Diesel	9
U	Pile Leads	9
V	Miscellaneous Trucks	10
W	Concrete Trucks	6
X	Generators	10

Source: Black and Veatch (1999).

TABLE B-1B
TYPICAL CREW AND EQUIPMENT REQUIREMENTS FOR
THE CANAL SECTION OF CONVEYANCE FACILITY CONSTRUCTION (E P/C)

Activity	Crew Size	Equipment Requirements Codes
Locate underground utilities	2	A, B
Support underground utilities	3	B, C, D
Fence	4	B, D
Trench excavation	4	B, E
Haul excess material	1	F
Unload, rehaul and handle pipe	4	G, H
Install pipe	6	B,G, H,W,X
Install pipe appurtenances	4	A,B,W,X
Place backfill/pipe zone	5	I, J, K, L,X
Place bedding with loader	5	I, J, K, L, M
Place backfill	3	J, L, N
Shield maintenance	3	O, P, Q
Steel piling and lagging/shore	4	K, R, S, T, U
Canal Construction	10	B,E,G,I,K,L,M,W,Y,Z,AA
Construction management	2	B
Total	**60**	

Equipment Code	Description	Hrs of Operation/10hr shift
A	Loader-Backhoe 1.5 cubic yards (cy)	9
B	Pickup Truck	5
C	Backhoe, 1.0 cy	9
D	Flatbed Truck w/ Crane	9
E	3cy Hydraulic Backhoe	9
F	End Dump Truck, 12 cy	10
G	Crane	9
H	Tractor/Lowboy Hauling Rig	9
I	Tamping Spade	9
J	Hand Held Vibrator Plate	9
K	Rubber Tire Loader	9
L	Water Truck	10
M	Bedding Hopper/Conveyor System	9
N	Vibrator Compactor	9
O	Forklift, 7.5 ton	6
P	Trench Shield (3)	10
Q	Z-bar Shoring	10
R	Truck Mounted Vertical Auger Drill	9
S	Truck Crane	9
T	Pile Hammer, Diesel	9
U	Pile Leads	9
V	Miscellaneous Trucks	10
W	Concrete Trucks	6
X	Generators	10
Y	Dozer	9
Z	Scraper	9
AA	Compactor (sheep-foot)	9

Source: Black and Veatch (1999).

TABLE B-2A
TRAFFIC ESTIMATES FOR CONVEYANCE FACILITY CONSTRUCTION (E/W/C)*

Type/Description	Amount	Unit	Destination	Transp.	Total Two-Way Trips	Frequency
Equipment/Project						
Loader-Backhoe 1.5 cy	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Pickup Truck	5	EA	Cadiz, CS, IMPP	Truck	10	daily
Backhoe 1cy	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Flatbed Truck with crane	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
3cy Hydraulic backhoe	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
End dump truck	2	EA	Cadiz, CS, IMPP	Truck	4	once/month
Crane	2	EA	Cadiz, CS, IMPP	Truck	4	once/project
Tractor/Lowboy hauling rig	2	EA	Cadiz, CS, IMPP	Truck	4	once/project
Tamping spade	3	EA	Cadiz, CS, IMPP	Truck	6	once/project
Hand-held vibrator plate	2	EA	Cadiz, CS, IMPP	Truck	4	once/project
Rubber-tire loader	3	EA	Cadiz, CS, IMPP	Truck	6	once/project
Water truck	2	EA	Cadiz, CS, IMPP	Truck	4	once/project
Bedding hopper/ Conveyor system	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Vibrator compactor	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Forklift	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Trench shield	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Z-bar shoring	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Truck-mounted vertical Auger drill	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Truck crane	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Pile hammer	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Pile leads	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Miscellaneous Trucks	4	EA	Cadiz, CS, IMPP	Trucks	8	Daily
Generator	3	EA	Cadiz, CS, IMPP	Truck	6	once/project
Materials/Project						
Pipe	182,700	LF	Cadiz, CS, IMPP	Truck	9,134	4567 RT
Valves	102	EA	Cadiz, CS, IMPP	Truck	26	13 RT
Fence	50,000	LF	Cadiz, CS, IMPP	Truck	40	once/project
Concrete truck loads	230	EA	Cadiz, CS, IMPP	Truck	460	230 RT
Cement Truck Loads	25	EA	Cadiz, CS, IMPP	Truck	50	25 RT
Aggregate Truck Loads	138	EA	Cadiz, CS, IMPP	Truck	276	138 RT
Crew/Employees	50	Empl.	Cadiz, CS, IMPP	Auto	100	Daily

Source: Black & Veatch (1999).

- Traffic estimates are for one construction team Four construction teams are envisioned for the conveyance facility.
- 2 crews/day working 10 hour shifts are assumed in each construction team.

Abbreviations:

DC - Desert Center
TP - Twenty-Nine Palms
P - Parker
Cadiz - Cadiz Construction Site
CY - Cubic yards
RT - Round trips
CS - Chubbuck Construction Site
IMPP - Iron Mountain Pumping Plant Construction Site
EA - Each
LF - lineal feet
Empl. - Employees

TABLE B-2B
TRAFFIC ESTIMATES FOR THE CANAL SECTION OF THE CONVEYANCE FACILITY CONSTRUCTION (E P/C)*

Type/Description	Amount	Unit	Destination	Transp.	Total Two-Way Trips	Frequency
Equipment/Project						
Loader-Backhoe 1.5cy	1	EA	Cadi,z CS, IMPP	Truck	2	Once/project
Pickup Truck	8	EA	Cadiz, CS, IMPP	Truck	16	daily
Backhoe 1cy	2	EA	Cadiz, CS, IMPP	Truck	4	Once/project
Flatbed Truck with crane	1	EA	Cadiz, CS, IMPP	Truck	2	Once/project
3cy Hydraulic backhoe	2	EA	Cadiz, CS, IMPP	Truck	4	Once/project
End dump truck	4	EA	Cadiz, CS, IMPP	Truck	8	Once/project
Crane	3	EA	Cadiz, CS, IMPP	Truck	6	Once/project
Tractor/Lowboy hauling rig	2	EA	Cadiz, CS, IMPP	Truck	4	Once/project
Tamping spade	3	EA	Cadiz, CS, IMPP	Truck	6	Once/project
Hand-held vibrator plate	2	EA	Cadiz, CS, IMPP	Truck	4	Once/project
Rubber-tire loader	3	EA	Cadiz, CS, IMPP	Truck	6	Once/project
Water truck	3	EA	Cadiz, CS, IMPP	Truck	6	Once/project
Bedding hopper/ Conveyor system	1	EA	Cadiz, CS, IMPP	Truck	2	Once/project
Vibrator compactor	1	EA	Cadiz, CS, IMPP	Truck	2	Once/project
Forklift	1	EA	Cadiz, CS, IMPP	Truck	2	Once/project
Trench shield	1	EA	Cadiz, CS, IMPP	Truck	2	Once/project
Z-bar shoring	1	EA	Cadiz, CS, IMPP	Truck	2	Once/project
Truck-mounted vertical Auger drill	1	EA	Cadiz, CS, IMPP	Truck	2	Once/project
Truck crane	1	EA	Cadiz, CS, IMPP	Truck	2	Once/project
Pile hammer	1	EA	Cadiz, CS, IMPP	Truck	2	Once/project
Pile leads	1	EA	Cadiz, CS, IMPP	Truck	2	Once/project
Miscellaneous Trucks	4	EA	Cadiz, CS, IMPP	Trucks	8	daily
Generator	3	EA	Cadiz, CS, IMPP	Trucks	6	Once/project
Dozer	2	EA	Cadiz, CS, IMPP	Truck	4	Once/project
Scraper	4	EA	Cadiz, CS, IMPP	Truck	8	Once/project
Compactor (sheep-foot)	2	EA	Cadiz, CS, IMPP	Truck	4	Once/project
Materials/Project						
Pipe	182,700	LF	Cadiz, CS, IMPP	Truck	9,134	4,567 RT
Valves	102	EA	Cadiz, CS, IMPP	Truck	26	13 RT
Fence	134,480	LF	Cadiz, CS, IMPP	Truck	106	Once/project
Cement trucks	216	EA	Cadiz, CS, IMPP	Truck	432	216 RT
Aggregate trucks	1,238	EA	Cadiz, CS, IMPP	Truck	3,464	1,238 RT
Concrete truck loads for canal	1,900	EA	Cadiz, CS, IMPP	Truck	3,800	1,900 RT
Concrete truck loads for pipeline	177	EA	Cadiz, CS, IMPP	Truck	354	177 RT
Crew/Employees	60	Empl.	Cadiz, CS, IMPP	Auto	120	Daily

Source: Black & Veatch (1999).

- Traffic estimates are for one construction team. Four construction teams are envisioned for the conveyance facility.
- 2 crews/day working 10 hours shifts are assumed in each construction team.

Abbreviations:

DC - Desert Center
TP - Twenty-Nine Palms
P - Parker
Cadiz - Cadiz Construction Site
CY - Cubic Yards
RT - Round Trip
CS - Chubbuck Construction Site
IMPP - Iron Mountain Pumping Plant Construction Site
EA - each
LF - lineal feet
Empl. - Employees

TABLE B-3
TYPICAL CREW AND EQUIPMENT REQUIREMENTS FOR THE CADIZ PUMPING FACILITY CONSTRUCTION

Activity	Crew Size	Equipment Requirements Codes
Site Clearing	4	A, B,E
Trench excavation	4	C, D
Haul of excess material	1	E
Concrete work	8	F, K, N,Z
Substructure work	10	F, G, H, AA
Unload, rehaul and handle pipe	4	F, I
Install pipe	4	F, I, AA
Unload, rehaul and handle pump	4	F, I
Install pump	4	F, I
Unload, rehaul and handle motor	4	F, I
Install motor	4	F, I
Place backfill	3	K, M, O
Shield maintenance	3	P, Q, R
Steel piling and lagging/shore	4	L, S, U, V
Mechanical work	4	D
Electrical/Instrumentation work	4	D
Landscape work	4	W
Paving	5	A, B, X
Construction management	2	D
Total	**80**	

Equipment Code	Description	Hrs of Operation/10hr shift
A	Grader	9
B	Dozer	9
C	Hydraulic Backhoe, 1.0cy	9
D	Pickup Truck	5
E	End Dump Truck, 12cy	10
F	Crane	9
G	Gas Welding Machine	9
H	Torch, Gas & Air	9
I	Tractor/Lowboy Hauling Rig	9
J	Concrete Mixer	6
K	Hand Held Vibrator Plate	8
L	Rubber Tire Loader	9
M	Water Truck	10
N	Compressor	6
O	Vibrator Compactor	8
Q	Trench Shield (3)	10
R	Z-bar Shoring	10
S	Truck Mounted Vertical Auger Drill	9
U	Pile Hammer, Diesel	9
V	Pile Leads	9
W	Front End Loader	9
X	Roller	9
Y	Miscellaneous Trucks	10
Z	Concrete Trucks	10
AA	Generator	10

Source: Black and Veatch (1999).

TABLE B-4
TRAFFIC ESTIMATES FOR PUMPING FACILITY CONSTRUCTION

Type/Description	Amount	Unit	Destination	Transp.	Total One-Way Trip	Frequency
Equipment/Project						
Grader	1	EA	CPP	Truck	2	once/project
Dozer	1	EA	CPP	Truck	2	once/project
Hydraulic backhoe 1cy	1	EA	CPP	Truck	2	once/project
Pickup truck	3	EA	CPP	Truck	6	daily
End dump truck	2	EA	CPP	Truck	4	once/project
Crane	1	EA	CPP	Truck	2	once/project
Gas welding machine	2	EA	CPP	Truck	4	once/project
Torch, gas & air	1	EA	CPP	Truck	2	once/project
Tractor/lowboy hauling rig	1	EA	CPP	Truck	2	once/project
Concrete Mixer	2	EA	CPP	Truck	4	once/project
Hand held vibrator plate	3	EA	CPP	Truck	6	once/project
Rubber tire loader	2	EA	CPP	Truck	4	once/project
Water truck	1	EA	CPP	Truck	2	once/project
Compressor	2	EA	CPP	Truck	4	once/project
Vibrator compactor	2	EA	CPP	Truck	4	once/project
Trench shield	1	EA	CPP	Truck	2	once/project
Z-bar shoring	1	EA	CPP	Truck	2	once/project
Truck mounted vertical auger drill	1	EA	CPP	Truck	2	once/project
Pile hammer	1	EA	CPP	Truck	2	once/project
Pile leads	1	EA	CPP	Truck	2	once/project
Front end loader	1	EA	CPP	Truck	2	once/project
Roller	1	EA	CPP	Truck	2	once/project
Misc. truck	3	EA	CPP	Truck	6	daily
Generator	2	EA	CPP	Truck	4	once/project
Materials/Project						
Pump	2	EA	CPP	Truck	4	once/project
Motor	2	EA	CPP	Truck	4	once/project
Bridge Crane	1	EA	CPP	Truck	2	once/project
Switchgear	2	EA	CPP	Truck	4	once/project
Valves	12	EA	CPP	Truck	24	once/project
Pipes	600	LF	CPP	Truck	60	30 RT
Steel	900	TONS	CPP	Truck	80	40 RT
Concrete truck loads	420	EA	CPP	Truck	840	Once/project
Cement truck loads	39	EA	CPP	Truck	78	39 RT
Aggregate truck loads	222	EA	CPP	Truck	444	222 RT
Crew/Employees	80	Empl.	CCP	Auto	160	Daily

Source: Black & Veatch (1999).

Abbreviations:

DC - Desert Center
TP - Twenty-Nine Palms
P - Parker
CY - Cubic yards
RT - Round trips
CPP - Cadiz Pumping Plant
EA - each
LF - lineal feet
Empl. - Employees

TABLE B-5
TYPICAL CREW AND EQUIPMENT REQUIREMENTS FOR THE SPREADING BASIN CONSTRUCTION

Activity	Crew Size	Equipment Requirements Codes
Site Clearing	2	A, B, G
Stripping	2	C, D
Concrete work	5	E, F, H
Unload, rehaul and handle pipe	4	F, I
Install pipe	4	F, I,Z
Unload, rehaul and handle valve	4	F, I
Install valve	4	F, I,Z
Unload, rehaul and handle gates	4	F, I
Install gates	4	F, I,Z
Lagging/shore	4	L, U, V
Mechanical work (piping)	8	Y
Electrical/Instrumentation work	6	Y
Landscape work	2	M, W
Paving	5	A, B, X
Construction management	2	Y
Total	**60**	

Equipment Code	Description	Hrs of Operation/10hr shift
A	Grader	9
B	Dozer	9
C	Scraper	9
D	Compactor (sheep-foot)	9
E	Concrete Mixer	9
F	Crane	9
G	End Dump Truck, 12 cy	9
H	Concrete Truck	10
I	Tractor/Lowboy Hauling Rig	9
L	Rubber Tire Loader	9
M	Water Truck	10
T	Truck Crane	9
U	Trench Shield	9
V	Z-bar Shoring	9
W	Front End Loader	9
X	Roller	9
Y	Pickup Truck	5
Z	Backhoe, 1.0 cy	9
AA	Misc. Truck	5

Source: Black and Veatch (1999).

TABLE B-6
TRAFFIC ESTIMATES FOR SPREADING BASIN CONSTRUCTION

Type/Description	Amount	Unit	Destination	Transp.	Total Two-Way Trips	Frequency
Equipment per crew						
Grader	2	EA	Cadiz	Truck	4	once/project
Dozer	2	EA	Cadiz	Truck	4	once/project
Scraper	6	EA	Cadiz	Truck	12	once/project
Compactors (S.F.)	2	EA	Cadiz	Truck	4	once/project
Concrete Mixer	1	EA	Cadiz	Truck	2	once/project
Crane	1	EA	Cadiz	Truck	2	once/project
End dump truck	4	EA	Cadiz	Truck	8	once/project
Tractor/lowboy hauling rig	3	EA	Cadiz	Truck	6	once/project
Rubber-tire loader	1	EA	Cadiz	Truck	2	once/project
Water truck	2	EA	Cadiz	Truck	4	once/project
Truck crane	1	EA	Cadiz	Truck	2	once/project
Trench shield	1	EA	Cadiz	Truck	2	once/project
Z-bar shoring	1	EA	Cadiz	Truck	2	once/project
Front end loader	1	EA	Cadiz	Truck	2	once/project
Roller	1	EA	Cadiz	Truck	2	once/project
Pickup truck	3	EA	Cadiz	Truck	6	Daily
Backhoe	1	EA	Cadiz	Truck	2	once/project
Misc. truck	3	EA	Cadiz	Truck	6	daily
Materials/Project						
Pipes	3000	LF	Cadiz	Truck	36	18RTs
Gates	100	EA	Cadiz	Truck	20	10RTs
Valves	100	EA	Cadiz	Truck	20	10RTs
Concrete truck loads	10	EA	Cadiz	Truck	20	once/project
Cement truck loads	1	EA	Cadiz	Truck	2	1RT
Aggregate truck loads	7	EA	Cadiz	Truck	14	7RTs
Crew/Employees	60	Empl.	Cadiz	Auto	120	Daily

Source: Black & Veatch (1999).

Abbreviations:
DC - Desert Center
TP - Twentynine Palms
P - Parker
RT - Round trips
EA - each
LF - lineal feet
CY - Cubic yards
Empl. - Employees

TABLE B-7
TYPICAL CREW AND EQUIPMENT REQUIREMENTS
FOR THE WELLFIELD CONSTRUCTION

Activity	Crew Size	Equipment Requirements Codes
Site Clearing	2	A, B
Haul of excess material	1	E
Concrete work	5	F, D
Unload, rehaul and handle pipe	4	F, I
Install pipe	4	F, I, D
Unload, rehaul and handle pump	4	F, I
Install pump	4	F, I, D,N
Unload, rehaul and handle motor	4	F, I
Install motor	4	F, I,N
Unload, rehaul and handle valve	4	F, I
Install valve	4	F, I, D
Well drilling	6	D, I, F, H, L, M,P
Mechanical work	3	D, I
Electrical/Instrumentation work	6	D, I
Geotechnical investigation	2	I
Construction management	2	D
Total	**59**	

Equipment Code	Description	Hrs of Operation/10hr shift
A	Grader	9
B	Dozer	9
D	Pickup Truck	5
E	End Dump Truck, 12cy	9
F	Crane	9
H	Air Compressor	9
I	Tractor/Lowboy Hauling Rig	9
L	Rubber Tire Loader	9
M	Water Truck	10
N	Truck Crane	9
O	Misc. Truck	5
P	Well Driller	9

Source: Black and Veatch (1999).

TABLE B-8
TRAFFIC ESTIMATES FOR WELLFIELD CONSTRUCTION

Type/Description	Amount	Unit	Destination	Transp.	Total Two-Way Trips	Frequency
Equipment per Project						
Grader	1	EA	Cadiz	Truck	2	once/project
Dozer	1	EA	Cadiz	Truck	2	once/project
Pickup truck	2	EA	Cadiz	Truck	4	Daily
End dump truck	1	EA	Cadiz	Truck	2	once/project
Crane	1	EA	Cadiz	Truck	2	once/project
Air compressor	1	EA	Cadiz	Truck	2	once/project
Tractor/lowboy hauling rig	1	EA	Cadiz	Truck	2	once/project
Rubber-tire loader	1	EA	Cadiz	Truck	2	once/project
Water truck	1	EA	Cadiz	Truck	2	once/project
Truck crane	1	EA	Cadiz	Truck	2	once/project
Misc. truck	3	EA	Cadiz	Truck	6	daily
Well driller	3	EA	Cadiz	Truck	6	once/project
Materials/Project						
Pipes	87,500	LF	Cadiz	Truck	400	200RTs
Pump	30	EA	Cadiz	Truck	60	30RTs
Motor	30	EA	Cadiz	Truck	30	15RTS
Valves	135	EA	Cadiz	Truck	28	14RTs
Concrete truck loads	60	EA	Cadiz	Truck	120	once/project
Cement truck loads	6	EA	Cadiz	Truck	12	6 RTs
Aggregate truck loads	33	EA	Cadiz	Truck	66	33 RTs
Crew/Employees	59	Empl.	Cadiz	Auto	118	Daily

Source: Black & Veatch (1999).

Abbreviations:
DC - Desert Center
TP - Twentynine Palms
P - Parker
RT - Round trips
EA - each
LF - lineal feet
CY - Cubic yards
Empl. - Employees

TABLE B-9
TYPICAL CREW AND EQUIPMENT REQUIREMENTS FOR THE POWER TRANSMISSION CONSTRUCTION

Activity	Crew Size	Equipment Requirements Codes
Locate underground facilities	2	A, B
Footing Excavation	4	A, B, C, D
Install power poles	6	B, D
Install transmission line	8	B, E,
Substation Installation	8	A, B, C, D, E, G, I, K, L
Earthwork	2	A, C
Concrete structure	5	B, G, K
Fence	4	A,B,E, L
Electrical	6	B, E, I, L
Construction management	2	B
Total	**47**	

Equipment Code	Description	Hrs of Operation/10hr shift
A	Loader-Backhoe 1.5cy	9
B	Pickup Truck	5
C	End dump truck	9
D	Crane	9
E	Tractor/Lowboy hauling rig	9
F	Hand-held vibrator plate	9
G	Water truck	10
H	Miscellaneous Trucks	10
I	Forklift	9
J	Truck Mounted Auger Drill	9
K	Concrete Trucks	9
L	Generators	10

Source: Black and Veatch (1999).

TABLE B-10
TRAFFIC ESTIMATES FOR POWER TRANSMISSION CONSTRUCTION

Type/Description	Amount	Unit	Destination	Transp.	Total Two-Way Trips	Frequency
Equipment/Project						
Loader-Backhoe 1.5cy	1	EA	Cadi,z CS, IMPP	Truck	2	once/project
Pickup Truck	5	EA	Cadiz, CS, IMPP	Truck	10	Daily
End dump truck	1	EA	Cadiz, CS, IMPP	Truck	2	once/month
Crane	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Tractor/Lowboy hauling rig	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Hand-held vibrator plate	2	EA	Cadiz, CS, IMPP	Truck	4	once/project
Water truck	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Miscellaneous Trucks	2	EA	Cadiz, CS, IMPP	Trucks	4	Daily
Forklift	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Truck-mounted vertical Auger drill	1	EA	Cadiz, CS, IMPP	Truck	2	once/project
Generator	2	EA	Cadiz, CS, IMPP	Truck	4	once/project
Materials/Project						
Power Poles	148	EA	Cadiz, CS, IMPP	Truck	296	148RTs
Power Line	74	Miles	Cadiz, CS, IMPP	Truck	40	20RTs
Substation Components	50	EA	Cadiz, CS, IMPP	Truck	60	30RTs
Concrete truck loads	20	EA	Cadiz, CS, IMPP	Truck	40	once/project
Cement truck loads	2	EA	Cadiz, CS, IMPP	Truck	9	2 RTs
Aggregate truck loads	14	EA	Cadiz, CS, IMPP	Truck	28	14 RTs
Crew/Employees	47	Empl.	Cadiz, CS, IMPP	Auto	94	Daily

Source: Black & Veatch (1999).

*Traffic estimates are for one construction team. Four construction teams are envisioned for the power transmission facility.

Abbreviations:
DC - Desert Center
TP - Twentynine Palms
P - Parker
Cadiz - Cadiz Construction Site
CY - Cubic yards
CS - Chubbuck Construction Site
IMPP - Iron Mountain Pumping Plant Construction Site
EA - each
LF - lineal feet
RT - Round trips
Empl. - Employees

Appendix C

AIR QUALITY ANALYSIS TABLES

Cadiz Groundwater Storage and Dry Year Supply Project
Estimated Vehicular Emissions

EASTERN ALTERNATIVE

Daily Emissions

Construction Area	Haul Truck Trips								Auto Trips							
	trips/day	avg. trip distance	VMT	Emissions (lbs./day)					trips	avg. trip distance	VMT	Emissions (lbs./day)				
				CO	ROC	NOx	SOx	PM10				CO	ROC	NOx	SOx	PM10
Pipeline	236	176	41536	641.3	76.7	536.8	28.4	42.5	800	176	140800	1422.3	60.6	244.2	18.6	32.6
Pumping Plant	14	134	1876	29.3	3.5	24.3	1.3	1.9	320	134	42880	446.0	19.5	74.9	5.7	9.9
Power Distribution	64	176	11264	173.9	20.8	145.6	7.7	11.5	752	176	132352	1336.9	57.0	229.6	17.5	30.6
Spreading Basin	14	181	2534	39.1	4.7	32.7	1.7	2.6	240	181	43440	437.6	18.6	75.3	5.7	10.0
Well Field	11	181	1991	30.7	3.7	25.7	1.4	2.0	354	181	64074	645.5	27.5	111.1	8.5	14.8
		emissions subtotals=		914.3	109.3	765.1	40.4	60.6				4288.4	183.2	735.1	56.0	98.0
		*** total emissions (lbs./day)=**		**5202.7**	**292.5**	**1500.2**	**96.4**	**158.6**								

WESTERN ALTERNATIVE

Daily Emissions

Construction Area	Haul Truck Trips								Auto Trips							
	trips/day	avg. trip distance	VMT	Emissions (lbs./day)					trips	avg. trip distance	VMT	Emissions (lbs./day)				
				CO	ROC	NOx	SOx	PM10				CO	ROC	NOx	SOx	PM10
Pipeline	236	177	41772	644.8	77.1	539.8	28.5	42.8	800	177	141600	1429.6	60.9	245.6	18.7	32.7
Pumping Plant	14	137	1918	29.9	3.6	24.8	1.3	2.0	320	137	43840	454.8	19.9	76.5	5.8	10.1
Power Distribution	64	177	11328	174.9	20.9	146.4	7.7	11.6	752	177	133104	1343.8	57.3	230.9	17.6	30.8
Spreading Basin	14	181	2534	39.1	4.7	32.7	1.7	2.6	240	181	43440	437.6	18.6	75.3	5.7	10.0
Well Field	11	181	1991	30.7	3.7	25.7	1.4	2.0	354	181	64074	645.5	27.5	111.1	8.5	14.8
		emissions subtotals=		919.4	110.0	769.5	40.7	61.0				4311.4	184.1	739.4	56.3	98.5
		*** total emissions (lbs./day)=**		**5230.8**	**294.0**	**1508.9**	**97.0**	**159.5**								

filename vehicle2

Cadiz Groundwater Storage and Dry Year Supply Project
Estimated Vehicular Emissions
COMBINATION ALTERNATIVE

Daily Emissions

Construction Area	Haul Truck Trips								Auto Trips							
	trips/day	avg. trip distance	VMT	Emissions (lbs./day)					trips	avg. trip distance	VMT	Emissions (lbs./day)				
				CO	ROC	NOx	SOx	PM10				CO	ROC	NOx	SOx	PM10
Pipeline	236	177	41772	644.8	77.1	539.8	28.5	42.8	800	177	141600	1429.6	60.9	245.6	18.7	32.7
Pumping Plant	14	137	1918	29.9	3.6	24.8	1.3	2.0	320	137	43840	454.8	19.9	76.5	5.8	10.1
Power Distribution	64	177	11328	174.9	20.9	146.4	7.7	11.6	752	177	133104	1343.8	57.3	230.9	17.6	30.8
Spreading Basin	14	181	2534	39.1	4.7	32.7	1.7	2.6	240	181	43440	437.6	18.6	75.3	5.7	10.0
Well Field	11	181	1991	30.7	3.7	25.7	1.4	2.0	354	181	64074	645.5	27.5	111.1	8.5	14.8
		emissions subtotals=		919.4	110.0	769.5	40.7	61.0				4311.4	184.1	739.4	56.3	98.5
		*** total emissions (lbs./day)=**		**5230.8**	**294.0**	**1508.9**	**97.0**	**159.5**								

EASTERN/CANAL ALTERNATIVE

Daily Emissions

Construction Area	Haul Truck Trips								Auto Trips							
	trips/day	avg. trip distance	VMT	Emissions (lbs./day)					trips	avg. trip distance	VMT	Emissions (lbs./day)				
				CO	ROC	NOx	SOx	PM10				CO	ROC	NOx	SOx	PM10
Pipeline	174	177	30798	475.4	56.9	398.0	21.0	31.5	600	177	106200	1072.2	45.7	184.2	14.0	24.6
Canal	69	153	10557	163.8	19.6	136.5	7.2	10.8	240	153	36720	376.2	16.2	63.9	4.9	8.5
Pumping Plants	30	153	4590	71.2	8.5	59.3	3.1	4.7	640	153	97920	1003.2	43.3	170.4	12.9	22.6
Power Distribution	64	177	11328	174.9	20.9	146.4	7.7	11.6	752	177	133104	1343.8	57.3	230.9	17.6	30.8
Spreading Basin	14	181	2534	39.1	4.7	32.7	1.7	2.6	240	181	43440	437.6	18.6	75.3	5.7	10.0
Well Field	11	181	1991	30.7	3.7	25.7	1.4	2.0	354	181	64074	645.5	27.5	111.1	8.5	14.8
		emissions subtotals=		955.1	114.2	798.7	42.2	63.3				4878.6	208.5	835.8	63.6	111.4
		*** total emissions (lbs./day)=**		**5833.7**	**322.8**	**1634.5**	**105.8**	**174.6**								

* Includes emissions from trucks and autos
trips=maximum anticipated number of two way trips per day
avg. trip distance=average distance for two way trips per day
Daily VMT=vehcile miles travelled=(trips)(avg. trip length)
auto category includes passenger cars and pickup trucks
average trip distance is in miles
This table estmates PM10 for on and offroad vehicle round trips to and from the site.
passenger car emissions for SOx in lbs./day=(VMT)(0.06 grams/mile)/454
truck emissions for SOx in lbs./day=(VMT)(0.31 grams/mile)/454
source: Section 3.7 Transportation, 1993 SCAQMD CEQA Handbook (emissions equations and emissions factors)

filename vehicle2

Cadiz Water Storage and Dry Year Supply Project
Estimated Vehicular Emissions

EASTERN ALTERNATIVE

Annual Emissions

Construction Area	work days/yr.	Truck Trips					Auto Trips				
		Emissions (lbs./yr.)					Emissions (lbs./yr.)				
		CO	ROC	NOx	SOx	PM10	CO	ROC	NOx	SOx	PM10
Pipeline	239	153274.8	18331.3	128290.5	6778.4	10167.6	339919.1	14489.5	58375.0	4447.3	7782.8
Pumping Plant	313	9155.3	1095.8	7595.3	400.9	601.4	139612.9	6107.8	23444.9	1773.8	3104.1
Power Distribution	239	41566.0	4971.2	34790.7	1838.2	2757.3	319523.9	13620.1	54872.5	4180.5	7315.8
Spreading Basin	239	9342.8	1117.3	7826.0	413.5	620.3	104597.3	4447.9	17998.9	1372.1	2401.2
Well Field	365	11210.8	1340.7	9390.8	496.2	744.3	235617.6	10019.5	40544.6	3090.8	5408.9
subtotal (lbs./yr)=		224549.7	26856.3	187893.3	9927.3	14891.0	1139270.8	48684.8	195235.9	14864.4	26012.7
emissions subtotals (tons/yr.)=		112.3	13.4	93.9	4.96	7.4	569.6	24.3	97.6	7.4	13.0
*** total emissions (tons/yr.)=**		**681.9**	**37.8**	**191.6**	**12.4**	**20.5**					

WESTERN ALTERNATIVE

Annual Emissions

Construction Area	work days/yr.	Truck Trips					Auto Trips				
		Emissions (lbs./yr.)					Emissions (lbs./yr.)				
		CO	ROC	NOx	SOx	PM10	CO	ROC	NOx	SOx	PM10
Pipeline	239	154118.3	18431.9	129017.3	6816.9	10225.4	341666.8	14556.9	58699.2	4472.6	7827.0
Pumping Plant	313	9351.9	1119.2	7764.7	409.9	614.9	142359.6	6213.7	23954.6	1813.5	3173.6
Power Distribution	239	41794.8	4998.5	34987.7	1848.7	2773.0	321166.8	13683.5	55177.3	4204.2	7357.4
Spreading Basin	239	9342.8	1117.3	7826.0	413.5	620.3	104597.3	4447.9	17998.9	1372.1	2401.2
Well Field	365	11210.8	1340.7	9390.8	496.2	744.3	235617.6	10019.5	40544.6	3090.8	5408.9
subtotal (lbs./yr)=		225818.6	27007.7	188986.6	9985.3	14977.9	1145408.1	48921.4	196374.6	14953.1	26168.0
emissions subtotals (tons/yr.)=		112.9	13.5	94.5	4.99	7.5	572.7	24.5	98.2	7.5	13.1
*** total emissions (tons/yr.)=**		**685.6**	**38.0**	**192.7**	**12.5**	**20.6**					

filename vehicle2

Cadiz Water Storage and Dry Year Supply Project
Estimated Vehicular Emissions

COMBINATION ALTERNATIVE

Annual Emissions

Construction Area	work days/yr.	Truck Trips Emissions (lbs./yr.)					Auto Trips Emissions (lbs./yr.)				
		CO	ROC	NOx	SOx	PM10	CO	ROC	NOx	SOx	PM10
Pipeline	239	154118.3	18431.9	129017.3	6816.9	10225.4	341666.8	14556.9	58699.2	4472.6	7827.0
Pumping Plant	313	9351.9	1119.2	7764.7	409.9	614.9	142359.6	6213.7	23954.6	1813.5	3173.6
Power Distribution	239	41794.8	4998.5	34987.7	1848.7	2773.0	321166.8	13683.5	55177.3	4204.2	7357.4
Spreading Basin	239	9342.8	1117.3	7826.0	413.5	620.3	104597.3	4447.9	17998.9	1372.1	2401.2
Well Field	365	11210.8	1340.7	9390.8	496.2	744.3	235617.6	10019.5	40544.6	3090.8	5408.9
subtotal (lbs./yr)=		225818.6	27007.7	188986.6	9985.3	14977.9	1145408.1	48921.4	196374.6	14953.1	26168.0
emissions subtotals (tons/yr.)=		112.9	13.5	94.5	4.99	7.5	572.7	24.5	98.2	7.5	13.1
*** total emissions (tons/yr.)=**		**685.6**	**38.0**	**192.7**	**12.5**	**20.6**					

EASTERN/CANAL ALTERNATIVE

Annual Emissions

Construction Area	work days/yr.	Truck Trips Emissions (lbs./yr.)					Auto Trips Emissions (lbs./yr.)				
		CO	ROC	NOx	SOx	PM10	CO	ROC	NOx	SOx	PM10
Pipeline	239	113629.6	13589.65	95122.9	5026	7539.0655	256250.1	10917.7	44024.4	3354.4	5870.2
Canal	239	39140.7	4682.863	32621.3	1722.8	2584.2559	89916.2	3881.9	15274.9	1159.8	2029.7
Pumping Plants	313	22286.77	2666.429	18574.6	980.99	1471.4792	314017.0	13556.9	53345.1	4050.5	7088.4
Power Distribution	239	41794.8	4998.49	34987.7	1848.7	2772.9896	321166.8	13683.5	55177.3	4204.2	7357.4
Spreading Basin	239	9342.784	1117.299	7826.03	413.53	620.29976	104597.3	4447.9	17998.9	1372.1	2401.2
Well Field	365	11210.78	1340.692	9390.77	496.22	744.32263	235617.6	10019.5	40544.6	3090.8	5408.9
subtotal (lbs./yr)=		237405.5	28395.42	198523	10488	15732.413	1321565.1	56507.34	226365	17231.9	30155.8
emissions subtotals (tons/yr.)=		118.7	14.2	99.3	5.24	7.9	660.8	28.3	113.2	8.6	15.1
*** total emissions (tons/yr.)=**		**779.5**	**42.5**	**212.4**	**13.9**	**22.9**					

filename vehicle2

Cadiz Groundwater Storage and Dry Year Supply Project
Estimated Emissions Generated by Delivery and Removal of Equipment and Materials Before and After Construction

EASTERN, WESTERN AND COMBINATION ALTERNATIVES

Construction Area	Haul Truck Trips							
	trips/yr.	avg. trip distance	VMT	Emissions (lbs./yr.)				
				CO	ROC	NOx	SOx	PM10
Pipeline	416	177	73632	1136.7	133.3	951.5	50.3	75.4
Pumping Plant	62	137	8494	132.3	16.7	109.9	5.8	8.7
Power Distribution	88	177	15576	240.5	29.7	201.3	10.6	16.0
Spreading Basin	60	181	10860	167.5	21.4	140.3	7.4	11.1
Well Field	24	181	4344	67.0	9.7	56.1	3.0	4.4
		***total emissions (tons/yr.)=**		0.87	0.11	0.73	0.04	0.06

EASTERN/CANAL ALTERNATIVE

Construction Area	Haul Truck Trips							
	trips/yr.	avg. trip distance	VMT	Emissions (lbs./yr.)				
				CO	ROC	NOx	SOx	PM10
Pipeline	312	177	55224	852.5	100.5	713.7	37.7	56.6
Canal	104	153	15912	246.8	30.1	205.7	10.9	16.3
Pumping Plants	124	153	18972	294.3	35.5	245.3	13.0	19.4
Power Distribution	88	177	15576	240.5	29.7	201.3	10.6	16.0
Spreading Basin	60	181	10860	167.5	21.4	140.3	7.4	11.1
Well Field	24	181	4344	67.0	9.7	56.1	3.0	4.4
		***total emissions (tons/yr.)=**		0.93	0.11	0.78	0.04	0.06

* Only the annual emissions (tons./yr.) were calculated for the trips shown on this table.
The daily emissions from the trips shown on this table will occur before and after the construction of the project and will be substantially less than the daily emissions during construction.

Cadiz Groundwater Storage and Dry Year Supply Project
Estimated Emissions Generated by Cement Trucks Traveling Within the Construction Site During Construction

Alternative	Cement Truck Trips							
	trips	avg. trip distance	VMT	Emissions (lbs./day)*				
				CO	ROC	NOx	SOx	PM10
Eastern Alternative								
Pumping Plant	370	5.8	2146	83.5	11.63	26.9	1.465	2.198
Pipeline	230	17.3	3979	115.9	16.55	46.9	2.717	4.075
Spreading Basins	10	34.6	346	9.2	1.33	4.0	0.236	0.354
Well Field	60	34.6	2076	55.4	7.98	24.1	1.418	2.126
Power Transmission	20	17.3	346	10.1	1.44	4.1	0.236	0.354
		total (lbs./day)=		274.1	38.9	106.1	6.1	9.1
		total (tons/yr.)=		39.3	5.6	15.2	0.9	1.3
Western Alternative								
Pumping Plant	420	5.5	2310	91.7	12.76	29.2	1.577	2.366
Pipeline	220	16.5	3630	106.6	15.21	42.9	2.479	3.718
Spreading Basins	10	32.9	329	8.8	1.27	3.8	0.225	0.337
Well Field	60	32.9	1974	52.9	7.62	22.9	1.348	2.022
Power Transmission	20	16.5	330	9.7	1.38	3.9	0.225	0.338
		total (lbs./day)=		269.7	38.2	102.7	5.9	8.8
		total (tons/yr.)=		39.0	5.5	14.8	0.8	1.3
Combination Alternative								
Pumping Plant	420	5.6	2352	92.7	12.91	29.6	1.606	2.409
Pipeline	210	16.8	3528	103.3	14.74	41.7	2.409	3.613
Spreading Basins	10	33.6	336	9.0	1.29	3.9	0.229	0.344
Well Field	60	33.6	2016	53.9	7.76	23.4	1.377	2.065
Power Transmission	20	16.8	336	9.8	1.40	4.0	0.229	0.344
		total (lbs./day)=		268.7	38.1	102.5	5.9	8.8
		total (tons/yr.)=		38.9	5.5	14.8	0.8	1.3
Eastern/Canal Alternative								
Pumping Plants	740	8.5	6290	215.3	30.30	76.7	4.295	6.442
Canal	2000	7.4	14800	528.7	74.14	182.2	10.106	15.159
Pipeline	180	17.3	3114	90.7	12.95	36.7	2.126	3.189
Spreading Basins	10	11.5	115	3.6	0.52	1.4	0.079	0.118
Well Field	60	34.6	2076	55.4	7.98	24.1	1.418	2.126
Power Transmission	20	17.3	346	10.1	1.44	4.1	0.236	0.354
		total (lbs./day)=		903.8	127.3	325.1	18.3	27.4
		total (tons/yr.)=		118.3	16.7	42.7	2.4	3.6

assumes an average speed of 25 mph.

filename vehicle2/cement trucks

Cadiz Groundwater and Dry Year Supply Project
Estimated Mobile Equipment Emissions
EASTERN, WESTERN AND COMBINATION ALTERNATIVES

Project Component: Pipeline
Construction Days: 239

Hrs. of operation per day	No. of pieces of equipment	Equipment Description	H factors (lbs. per hour)					L factors (pounds per horsepower hours)					K (horsepower)	M (load fraction)	Emissions (lbs. per day)				
			CO	ROC	NOx	SOx	PM10	CO	ROC	NOx	SOx	PM10			CO	ROC	NOx	SOx	PM10
18	1	backhoe						0.015	0.003	0.022	0.002	0.001	79	0.7	14.9	3.0	21.9	2.0	1.0
0	0	compactor	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
18	4	crane						0.009	0.003	0.023	0.002	0.0015	194	0.7	88.0	29.3	224.9	19.6	14.7
0	0	dozer	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
20	1	end dump truck	1.8	0.19	4.17	0.45	0.26								36.0	3.8	83.4	9.0	5.2
12	1	forklift	0.52	0.17	1.54	0	0.093								6.2	2.0	18.5	0.0	1.1
0	0	grader	0.151	0.039	0.713	0.086	0.061								0.0	0.0	0.0	0.0	0.0
18	4	loader	0.572	0.23	1.9	0.182	0.17								41.2	16.6	136.8	13.1	12.2
10	6	pickup truck 3/4 ton	17.02	0.543	0.412	0.023	0.026								1021.2	32.6	24.7	1.4	1.6
18	1	pile hammer	0.675	0.15	1.7	0.143	0.14								12.2	2.7	30.6	2.6	2.5
0	0	roller						0.007	0.002	0.02	0.002	0.001	99	0.7	0.0	0.0	0.0	0.0	0.0
0	0	scraper	1.25	0.27	3.84	0.46	0.41								0.0	0.0	0.0	0.0	0.0
18	2	tamping spade						0.83	0.043	0.004	0.005	0.00025	4	0.7	83.7	4.3	0.4	0.5	0.0
18	1	tractor/lowboy hauling rig	3.58	0.18	1.27	0.09	0.14								64.4	3.2	22.9	1.6	2.5
18	1	truck mounted auger drill	0.675	0.15	1.7	0.143	0.14								12.2	2.7	30.6	2.6	2.5
18	1	vibrator compactor	0.675	0.15	1.7	0.143	0.14								12.2	2.7	30.6	2.6	2.5
20	3	water truck	0.675	0.15	1.7	0.143	0.14								40.5	9.0	102.0	8.6	8.4
0	0	well driller	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
														total lbs./per day=	1432.6	112.0	727.2	63.5	54.3
														total tons per year=	171.2	13.4	86.9	7.6	6.5

EASTERN/CANAL ALTERNATIVE

Project Component: Pipeline and Canal
Construction Days: 239

Hrs. of operation per day	No. of pieces of equipment	Equipment Description	H factors (lbs. per hour)					L factors (pounds per horsepower hours)					K (horsepower)	M (load fraction)	Emissions (lbs. per day)				
			CO	ROC	NOx	SOx	PM10	CO	ROC	NOx	SOx	PM10			CO	ROC	NOx	SOx	PM10
18	2	backhoe						0.015	0.003	0.022	0.002	0.001	79	0.7	29.9	6.0	43.8	4.0	2.0
18	1	compactor	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
18	6	crane						0.009	0.003	0.023	0.002	0.0015	194	0.7	132.0	44.0	337.3	29.3	22.0
18	1	dozer	0.675	0.15	1.7	0.143	0.14								12.2	2.7	30.6	2.6	2.5
20	1	end dump truck	1.8	0.19	4.17	0.45	0.26								36.0	3.8	83.4	9.0	5.2
12	1	forklift	0.52	0.17	1.54	0	0.093								6.2	2.0	18.5	0.0	1.1
0	0	grader	0.151	0.039	0.713	0.086	0.061								0.0	0.0	0.0	0.0	0.0
18	6	loader	0.572	0.23	1.9	0.182	0.17								61.8	24.8	205.2	19.7	18.4
10	7	pickup truck 3/4 ton	17.02	0.543	0.412	0.023	0.026								1191.4	38.0	28.8	1.6	1.8
18	1	pile hammer	0.675	0.15	1.7	0.143	0.14								12.2	2.7	30.6	2.6	2.5
0	0	roller						0.007	0.002	0.02	0.002	0.001	99	0.7	0.0	0.0	0.0	0.0	0.0
18	1	scraper	1.25	0.27	3.84	0.46	0.41								22.5	4.9	69.1	8.3	7.4
18	3	tamping spade						0.83	0.043	0.004	0.005	0.00025	4	0.7	125.5	6.5	0.6	0.8	0.0
18	2	tractor/lowboy hauling rig	3.58	0.18	1.27	0.09	0.14								128.9	6.5	45.7	3.2	5.0
18	1	truck mounted auger drill	0.675	0.15	1.7	0.143	0.14								12.2	2.7	30.6	2.6	2.5
18	1	vibrator compactor	0.675	0.15	1.7	0.143	0.14								12.2	2.7	30.6	2.6	2.5
20	4	water truck	0.675	0.15	1.7	0.143	0.14								54.0	12.0	136.0	11.4	11.2
0	0	well driller	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
														total lbs./per day=	1836.8	159.3	1090.9	97.6	84.2
														total tons per year=	219.5	19.0	130.4	11.7	10.1

filename mobile2

Cadiz Groundwater and Dry Year Supply Project
Estimated Mobile Equipment Emissions

EASTERN, WESTERN, COMBINATION AND EASTERN/CANAL ALTERNATIVES

Project Component: Pumping Plant
Construction Days: 313

Hrs. of operation per day	No. of pieces of equipment	Equipment Description	H factors (lbs. per hour) CO	ROC	NOx	SOx	PM10	L factors (pounds per horsepower hours) CO	ROC	NOx	SOx	PM10	K (horsepower)	M (load fraction)	Emissions (lbs. per day) CO	ROC	NOx	SOx	PM10
18	1	backhoe						0.015	0.003	0.022	0.002	0.001	79	0.7	14.9	3.0	21.9	2.0	1.0
0	0	compactor	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
18	8	crane						0.009	0.003	0.023	0.002	0.0015	194	0.7	176.0	58.7	449.8	39.1	29.3
18	2	dozer	0.675	0.15	1.7	0.143	0.14								24.3	5.4	61.2	5.1	5.0
20	2	end dump truck	1.8	0.19	4.17	0.45	0.26								72.0	7.6	166.8	18.0	10.4
0	0	forklift	0.52	0.17	1.54	0	0.093								0.0	0.0	0.0	0.0	0.0
18	2	grader	0.151	0.039	0.713	0.086	0.061								5.4	1.4	25.7	3.1	2.2
18	3	loader	0.572	0.23	1.9	0.182	0.17								30.9	12.4	102.6	9.8	9.2
10	4	pickup truck 3/4 ton	17.02	0.543	0.412	0.023	0.026								680.8	21.7	16.5	0.9	1.0
18	1	pile hammer	0.675	0.15	1.7	0.143	0.14								12.2	2.7	30.6	2.6	2.5
18	1	roller						0.007	0.002	0.02	0.002	0.001	99	0.7	8.7	2.5	24.9	2.5	1.2
0	0	scraper	1.25	0.27	3.84	0.46	0.41								0.0	0.0	0.0	0.0	0.0
0	0	tamping spade						0.83	0.043	0.004	0.005	0.00025	4	0.7	0.0	0.0	0.0	0.0	0.0
18	5	tractor/lowboy hauling rig	3.58	0.18	1.27	0.09	0.14								322.2	16.2	114.3	8.1	12.6
18	1	truck mounted auger drill	0.675	0.15	1.7	0.143	0.14								12.2	2.7	30.6	2.6	2.5
16	1	vibrator compactor	0.675	0.15	1.7	0.143	0.14								10.8	2.4	27.2	2.3	2.2
20	1	water truck	0.675	0.15	1.7	0.143	0.14								13.5	3.0	34.0	2.9	2.8
0	0	well driller	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
								EASTERN, WESTERN AND COMBINATION ALTERNATIVES						**total lbs./per day=**	**1383.9**	**139.7**	**1106.1**	**99.0**	**82.1**
								EASTERN, WESTERN AND COMBINATION ALTERNATIVES						**total tons per year=**	**216.6**	**21.9**	**173.1**	**15.5**	**12.9**
													EASTERN/CANAL ALTERNATIVE*	**total lbs./per day=**	**2767.8**	**279.4**	**2212.1**	**198.0**	**164.2**
													EASTERN/CANAL ALTERNATIVE*	**total tons per year=**	**433.2**	**43.7**	**346.2**	**31.0**	**25.7**
													* TWO PUMPING PLANTS						

EASTERN, WESTERN, COMBINATION AND EASTERN/CANAL ALTERNATIVES

Project Component: Spreading Basins
Construction Days: 239

Hrs. of operation per day	No. of pieces of equipment	Equipment Description	H factors (lbs. per hour) CO	ROC	NOx	SOx	PM10	L factors (pounds per horsepower hours) CO	ROC	NOx	SOx	PM10	K (horsepower)	M (load fraction)	Emissions (lbs. per day) CO	ROC	NOx	SOx	PM10
18	3	backhoe						0.015	0.003	0.022	0.002	0.001	79	0.7	44.8	9.0	65.7	6.0	3.0
18	1	compactor	0.675	0.15	1.7	0.143	0.14								12.2	2.7	30.6	2.6	2.5
18	7	crane						0.009	0.003	0.023	0.002	0.0015	194	0.7	154.0	51.3	393.5	34.2	25.7
18	2	dozer	0.675	0.15	1.7	0.143	0.14								24.3	5.4	61.2	5.1	5.0
18	1	end dump truck	1.8	0.19	4.17	0.45	0.26								32.4	3.4	75.1	8.1	4.7
0	0	forklift	0.52	0.17	1.54	0	0.093								0.0	0.0	0.0	0.0	0.0
18	2	grader	0.151	0.039	0.713	0.086	0.061								5.4	1.4	25.7	3.1	2.2
18	2	loader	0.572	0.23	1.9	0.182	0.17								20.6	8.3	68.4	6.6	6.1
10	3	pickup truck 3/4 ton	17.02	0.543	0.412	0.023	0.026								510.6	16.3	12.4	0.7	0.8
0	0	pile hammer	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
18	1	roller						0.007	0.002	0.02	0.002	0.001	99	0.7	8.7	2.5	24.9	2.5	1.2
18	1	scraper	1.25	0.27	3.84	0.46	0.41								22.5	4.9	69.1	8.3	7.4
0	0	tamping spade						0.83	0.043	0.004	0.005	0.00025	4	0.7	0.0	0.0	0.0	0.0	0.0
18	6	tractor/lowboy hauling rig	3.58	0.18	1.27	0.09	0.14								386.6	19.4	137.2	9.7	15.1
0	0	truck mounted auger drill	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
0	0	vibrator compactor	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
20	1	water truck	0.675	0.15	1.7	0.143	0.14								13.5	3.0	34.0	2.9	2.8
0	0	well driller	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
														total lbs./per day=	1235.6	127.6	997.8	89.7	76.5
														total tons per year=	147.7	15.2	119.2	10.7	9.1

filename mobile2

Cadiz Groundwater and Dry Year Supply Project
Estimated Mobile Equipment Emissions

EASTERN, WESTERN, COMBINATION AND EASTERN/CANAL ALTERNATIVES

Project Component: Well Field
Construction Days: 365

Hrs. of operation per day	No. of pieces of equipment	Equipment Description	H factors (lbs. per hour) CO	ROC	NOx	SOx	PM10	L factors (pounds per horsepower hours) CO	ROC	NOx	SOx	PM10	K (horsepower)	M (load fraction)	Emissions (lbs. per day) CO	ROC	NOx	SOx	PM10
0	0	backhoe						0.015	0.003	0.022	0.002	0.001	79	0.7	0.0	0.0	0.0	0.0	0.0
0	0	compactor	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
24	12	crane						0.009	0.003	0.023	0.002	0.0015	194	0.7	352.0	117.3	899.5	78.2	58.7
24	1	dozer	0.675	0.15	1.7	0.143	0.14								16.2	3.6	40.8	3.4	3.4
24	1	end dump truck	1.8	0.19	4.17	0.45	0.26								43.2	4.6	100.1	10.8	6.2
0	0	forklift	0.52	0.17	1.54	0	0.093								0.0	0.0	0.0	0.0	0.0
24	1	grader	0.151	0.039	0.713	0.086	0.061								3.6	0.9	17.1	2.1	1.5
24	1	loader	0.572	0.23	1.9	0.182	0.17								13.7	5.5	45.6	4.4	4.1
24	8	pickup truck 3/4 ton	17.02	0.543	0.412	0.023	0.026								3267.8	104.3	79.1	4.4	5.0
0	0	pile hammer	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
0	0	roller						0.007	0.002	0.02	0.002	0.001	99	0.7	0.0	0.0	0.0	0.0	0.0
0	0	scraper	1.25	0.27	3.84	0.46	0.41								0.0	0.0	0.0	0.0	0.0
0	0	tamping spade						0.83	0.043	0.004	0.005	0.00025	4	0.7	0.0	0.0	0.0	0.0	0.0
24	11	tractor/lowboy hauling rig	3.58	0.18	1.27	0.09	0.14								945.1	47.5	335.3	23.8	37.0
0	0	truck mounted auger drill	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
0	0	vibrator compactor	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
0	0	water truck	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
24	1	well driller	0.675	0.15	1.7	0.143	0.14								16.2	3.6	40.8	3.4	3.4
														total lbs./per day=	4657.9	287.3	1558.3	130.5	119.1
														total tons per year=	850.1	52.4	284.4	23.8	21.7

EASTERN, WESTERN, COMBINATION AND EASTERN/CANAL ALTERNATIVES

Project Component: Power Transmission
Construction Days: 239

Hrs. of operation per day	No. of pieces of equipment	Equipment Description	H factors (lbs. per hour) CO	ROC	NOx	SOx	PM10	L factors (pounds per horsepower hours) CO	ROC	NOx	SOx	PM10	K (horsepower)	M (load fraction)	Emissions (lbs. per day) CO	ROC	NOx	SOx	PM10
0	0	backhoe						0.015	0.003	0.022	0.002	0.001	79	0.7	0.0	0.0	0.0	0.0	0.0
0	0	compactor	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
9	3	crane						0.009	0.003	0.023	0.002	0.0015	194	0.7	33.0	11.0	84.3	7.3	5.5
0	0	dozer	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
18	3	end dump truck	1.8	0.19	4.17	0.45	0.26								97.2	10.3	225.2	24.3	14.0
18	2	forklift	0.52	0.17	1.54	0	0.093								18.7	6.1	55.4	0.0	3.3
0	0	grader	0.151	0.039	0.713	0.086	0.061								0.0	0.0	0.0	0.0	0.0
18	5	loader	0.572	0.23	1.9	0.182	0.17								51.5	20.7	171.0	16.4	15.3
10	8	pickup truck 3/4 ton	17.02	0.543	0.412	0.023	0.026								1361.6	43.4	33.0	1.8	2.1
0	0	pile hammer	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
0	0	roller						0.007	0.002	0.02	0.002	0.001	99	0.7	0.0	0.0	0.0	0.0	0.0
0	0	scraper	1.25	0.27	3.84	0.46	0.41								0.0	0.0	0.0	0.0	0.0
0	0	tamping spade						0.83	0.043	0.004	0.005	0.00025	4	0.7	0.0	0.0	0.0	0.0	0.0
18	4	tractor/lowboy hauling rig	3.58	0.18	1.27	0.09	0.14								257.8	13.0	91.4	6.5	10.1
0	0	truck mounted auger drill	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
0	0	vibrator compactor	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
20	2	water truck	0.675	0.15	1.7	0.143	0.14								27.0	6.0	68.0	5.7	5.6
0	0	well driller	0.675	0.15	1.7	0.143	0.14								0.0	0.0	0.0	0.0	0.0
														total lbs./per day=	1846.8	110.5	728.4	62.1	55.9
														total tons per year=	220.7	13.2	87.0	7.4	6.7

SUMMARY TABLE	CO		ROC		NOx		Sox		PM10	
Totals	(lbs./day)	(tons/yr.)	(lbs./day)	(tons/yr.)	(lbs./day)	(tons/yr.)	(lbs./day)	(tons/yr.)	(lbs./day)	(tons/yr.)
Eastern Alternative	10556.8	1606.2	777.0	116.1	5117.7	750.7	444.7	65.0	388.0	56.9
Western Alternative	10556.8	1606.2	777.0	116.1	5117.7	750.7	444.7	65.0	388.0	56.9
Combination Alternative	10556.8	1606.2	777.0	116.1	5117.7	750.7	444.7	65.0	388.0	56.9
Eastern/Canal Alternative	12344.8	1871.1	964.1	143.6	6587.4	967.2	577.8	84.6	500.1	73.3

filename mobile2

Cadiz Groundwater Storage and Dry Year Supply Project
Estimated PM10 Emissions from Construction Site

Trucks on Unpaved Roads (Traveling to and from the Site)
PM10 emissions (lbs. per day)=(VMT per day)(13 lbs of PM10/VMT)
PM10 emissions (tons per yr.)=(no. lbs. of PM10/day)(no. of days of construction per year)/(2000 lbs./ton)
Avg. truck weight assumed to be 10 tons

Alternative	Construction Area	trips	trip distance (miles)	VMT per day	PM10 (lbs./day)	PM10 (tons/year)
Eastern Alternative	Pipeline	236	18	4248	55224	6599.3
	Pumping Plant	0	0	0	0	0.0
	Power Distribution	64	18	1152	14976	1789.6
	Spreading Basin	0	0	0	0	0.0
	Well Field	0	0	0	0	0.0
				total=	**70200**	**8388.9**
Western Alternative	Pipeline	236	21	4956	64428	7699.1
	Pumping Plant	14	11	154	2002	313.3
	Power Distribution	64	21	1344	17472	2087.9
	Spreading Basin	0	0	0	0	0.0
	Well Field	0	0	0	0	0.0
				total=	**83902**	**10100.4**
Combination Alternative	Pipeline	236	21	4956	64428	7699.1
	Pumping Plant	14	11	154	2002	313.3
	Power Distribution	64	21	1344	17472	2087.9
	Spreading Basin	0	0	0	0	0.0
	Well Field	0	0	0	0	0.0
				total=	**83902**	**10100.4**
Eastern/Canal Alternative	Pipeline	174	12	2088	27144	3243.7
	Canal	69	19	1311	17043	2036.6
	Pumping Plants	30	19	570	7410	2667.2
	Power Distribution	64	12	768	9984	885.5
	Spreading Basin	0	0	0	0	1193.1
	Well Field	0	0	0	0	0.0
				total=	**61581**	**10026.2**

PM10 from Cement Trucks Driving Within the Alignment

Alternative	Trips	Distance	VMT	PM10 (lbs./day)	PM10 (tons/yr.)*
Eastern Alternative	700	13	9100	**118300**	**14811.2**
Western Alternative	730	12	8760	**113880**	**14257.8**
Combination Alternative	720	12	8640	**112320**	**14062.5**
Eastern/Canal Alternative	2910	9	26190	**340470**	**42626.8**

* assumes 313 days of construction for all project components, this overestimates annual PM10 generated by cement trucks

Autos on Unpaved Roads (Traveling to and From the Site)
PM10 emissions (lbs. per day)=(VMT per day)(5.56 lbs of PM10/day)
PM10 emissions (tons per yr)=(no. lbs. PM10/day)(no. of days of construction per year)/(2000 lbs/ton)

Alternative	Construction Area	trips	trip distance (miles)	VMT per day	PM10 (lbs./day)	PM10 (tons/year)
Eastern Alternative	Pipeline	800	18.5	14800	82288.0	9833.4
	Pumping Plant	0	0	0	0.0	0.0
	Power Distribution	752	18.5	13912	77350.7	9243.4
	Spreading Basin	0	0	0	0.0	0.0
	Well Field	0	0	0	0.0	0.0
				total=	**159638.7**	**19076.8**
Western Alternative	Pipeline	800	21	16800	93408.0	11162.3
	Pumping Plant	320	11	3520	19571.2	3062.9
	Power Distribution	752	21	15792	87803.5	10492.5
	Spreading Basin	0	0	0	0.0	0.0
	Well Field	0	0	0	0.0	0.0
				total=	**200782.7**	**24717.7**
Combination Alternative	Pipeline	800	21	16800	93408.0	11162.3
	Pumping Plant	320	11	3520	19571.2	3062.9
	Power Distribution	752	21	15792	87803.5	10492.5
	Spreading Basin	0	0	0	0.0	0.0
	Well Field	0	0	0	0.0	0.0
				total=	**200782.7**	**24717.7**
Eastern/Canal Alternative	Pipeline	600	12	7200	40032.0	4783.8
	Canal	240	19	4560	25353.6	3029.8
	Pumping Plants	640	19	12160	67609.6	10580.9
	Power Distribution	752	12	9024	50173.4	5995.7
	Spreading Basin	0	0	0	0.0	0.0
	Well Field	0	0	0	0.0	0.0
				total=	**183168.6**	**24390.2**

Cadiz Groundwater Storage and Dry Year Supply Project
Estimated PM10 Emissions from Construction Site
Construction Vehicles Traveling Within the Alignment

EASTERN, WESTERN AND COMBINATION ALTERNATIVES

Project Component: Pipeline
Construction Days per year: 239

Hrs. of operation per day	No. of pieces of equipment	Equipment Description	VMT*	PM10 (lbs./day)
18	1	backhoe	90	500.4
0	0	compactor	0	0
18	4	crane	360	2001.6
0	0	dozer	0	0
20	1	end dump truck	100	556
12	1	forklift	60	333.6
0	0	grader	0	0
18	4	loader	360	2001.6
10	6	pickup truck 3/4 ton	300	1668
18	1	pile hammer	90	500.4
0	0	roller	0	0
0	0	scraper	0	0
18	2	tamping spade	180	1000.8
18	1	tractor/lowboy hauling rig	90	500.4
18	1	truck mounted auger drill	90	500.4
18	1	vibrator compactor	90	500.4
20	3	water truck	300	1668
0	0	well driller	0	0
		total=		**11731.6**
		total (tons/yr.)=		**5.9**

*These tables assume an average vehicle speed of 5 mph

EASTERN/CANAL ALTERNATIVE

Project Components: Pipeline and Canal
Construction Days per year: 239

Hrs. of operation per day	No. of pieces of equipment	Equipment Description	VMT*	PM10 (lbs./day)
18	2	backhoe	180	1000.8
18	1	compactor	90	500.4
18	6	crane	540	3002.4
18	1	dozer	90	500.4
20	1	end dump truck	100	556
12	1	forklift	60	333.6
0	0	grader	0	0
18	6	loader	540	3002.4
10	7	pickup truck 3/4 ton	350	1946
18	1	pile hammer	90	500.4
0	0	roller	0	0
18	1	scraper	90	500.4
18	3	tamping spade	270	1501.2
18	2	tractor/lowboy hauling rig	180	1000.8
18	1	truck mounted auger drill	90	500.4
18	1	vibrator compactor	90	500.4
20	4	water truck	400	2224
0	0	well driller	0	0
		total=		**17569.6**
		total (tons/yr.)=		**8.8**

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Cadiz Groundwater Storage and Dry Year Supply Project
Estimated PM10 Emissions from Construction Site
EASTERN, WESTERN, COMBINATION AND EASTERN/CANAL ALTERNATIVES

Project Component: Pumping Plant
Construction Days per year: 313

Hrs. of operation per day	No. of pieces of equipment	Equipment Description	VMT*	PM10 (lbs./day)
18	1	backhoe	90	500.4
0	0	compactor	0	0
18	8	crane	720	4003.2
18	2	dozer	180	1000.8
20	2	end dump truck	200	1112
0	0	forklift	0	0
18	2	grader	180	1000.8
18	3	loader	270	1501.2
10	4	pickup truck 3/4 ton	200	1112
18	1	pile hammer	90	500.4
18	1	roller	90	500.4
0	0	scraper	0	0
0	0	tamping spade	0	0
18	5	tractor/lowboy hauling rig	450	2502
18	1	truck mounted auger drill	90	500.4
16	1	vibrator compactor	80	444.8
20	1	water truck	100	556
0	0	well driller	0	0
EASTERN, WESTERN AND COMBINATION ALTERNATIVES		**total=**		**15234.4**
EASTERN, WESTERN AND COMBINATION ALTERNATIVES		**total (tons/yr.)=**		**7.6**
EASTERN/CANAL ALTERNATIVE*		**total=**		**30468.8**
EASTERN/CANAL ALTERNATIVE*		**total (tons/yr.)=**		**15.2**

* The Eastern/Canal Alternative includes two pumping plants

EASTERN, WESTERN, COMBINATION AND EASTERN/CANAL ALTERNATIVES

Project Component: Spreading Basins
Construction Days per year: 239

Hrs. of operation per day	No. of pieces of equipment	Equipment Description	VMT*	PM10 (lbs./day)
18	3	backhoe	270	1501.2
18	1	compactor	90	500.4
18	7	crane	630	3502.8
18	2	dozer	180	1000.8
18	1	end dump truck	90	500.4
0	0	forklift	0	0
18	2	grader	180	1000.8
18	2	loader	180	1000.8
10	3	pickup truck 3/4 ton	150	834
0	0	pile hammer	0	0
18	1	roller	90	500.4
18	1	scraper	90	500.4
0	0	tamping spade	0	0
18	6	tractor/lowboy hauling rig	540	3002.4
0	0	truck mounted auger drill	0	0
0	0	vibrator compactor	0	0
20	1	water truck	100	556
0	0	well driller	0	0
		total=		**14400.4**
		total (tons/yr.)=		**7.2**

EASTERN, WESTERN, COMBINATION AND EASTERN/CANAL ALTERNATIVES

Project Component: Well Field
Construction Days per year: 365

Hrs. of operation per day	No. of pieces of equipment	Equipment Description	VMT*	PM10 (lbs./day)
0	0	backhoe	0	0
0	0	compactor	0	0
24	12	crane	1440	8006.4
24	1	dozer	120	667.2
24	1	end dump truck	120	667.2
0	0	forklift	0	0
24	1	grader	120	667.2
24	1	loader	120	667.2
24	8	pickup truck 3/4 ton	960	5337.6
0	0	pile hammer	0	0
0	0	roller	0	0
0	0	scraper	0	0
0	0	tamping spade	0	0
24	11	tractor/lowboy hauling rig	1320	7339.2
0	0	truck mounted auger drill	0	0
0	0	vibrator compactor	0	0
0	0	water truck	0	0
24	1	well driller	120	667.2
		total=		**24019.2**
		total (tons/yr.)=		**12.0**

Cadiz Groundwater Storage and Dry Year Supply Project
Estimated PM10 Emissions from Construction Site

EASTERN, WESTERN, COMBINATION AND EASTERN/CANAL ALTERNATIVES

Project Component: Power Transmission
Construction Days per year: 239

Hrs. of operation per day	No. of pieces of equipment	Equipment Description	VMT*	PM10 (lbs./day)
0	0	backhoe	0	0
0	0	compactor	0	0
9	3	crane	135	750.6
0	0	dozer	0	0
18	3	end dump truck	270	1501.2
18	2	forklift	180	1000.8
0	0	grader	0	0
18	5	loader	450	2502
10	8	pickup truck 3/4 ton	400	2224
0	0	pile hammer	0	0
0	0	roller	0	0
0	0	scraper	0	0
0	0	tamping spade	0	0
18	4	tractor/lowboy hauling rig	360	2001.6
0	0	truck mounted auger drill	0	0
0	0	vibrator compactor	0	0
20	2	water truck	200	1112
0	0	well driller	0	0
		total=		**11092.2**
		total (tons/yr.)=		**5.5**

Earthwork

PM10 emissions (lbs. per day)= (tons of material handled per day)(0.02205 lbs/ton)
PM10 emissions (tons per year)=(tons of material handled per year)(0.02205 lbs/ton)/(2000 lbs./ton)

Alternative	Construction Area	tons of material/day	tons material/yr.	PM10 lbs/day	PM10 tons/yr
Eastern Alternative	Pipeline	8334.7	1992000	183.8	22.0
	Pumping Plant	88.7	9400	2.0	0.1
	Spreading Basin	12878.7	3078000	284.0	33.9
	Well Field	439.0	137400	9.7	1.5
			total=	**479.4**	**57.5**
Western Alternative	Pipeline	8025.1	1918000	177.0	21.1
	Pumping Plant	319.8	33900	7.1	0.4
	Spreading Basin	12878.7	3078000	284.0	33.9
	Well Field	442.2	138400	9.7	1.5
			total=	**477.7**	**57.0**
Combination Alternative	Pipeline	8234.3	1968000	181.6	21.7
	Pumping Plant	88.7	9400	2.0	0.1
	Spreading Basin	12878.7	3078000	284.0	33.9
	Well Field	442.2	138400	9.7	1.5
			total=	**477.2**	**57.3**
Eastern/Canal Alternative	Pipeline	6407.6	1531415	141.3	16.9
	Canal	3854.2	921152	85.0	10.2
	Pumping Plants	256.6	27200	5.7	0.3
	Spreading Basin	12878.7	3078000	284.0	33.9
	Well Field	439.0	137400	9.7	1.5
			total=	**525.6**	**62.8**

Cadiz Groundwater Storage and Dry Year Supply Project
Estimated PM10 Emissions from Construction Site
Graded Surface Wind Erosion
PM10 emissions (lbs. per day)=(graded area acreage)(26.4 lbs of PM10/graded acre)
PM10 emissions (tons/yr.)=(graded area acreage)(26.4 lbs of PM10/graded acre)(365 days/yr)/(2000 lbs./ton)

Alternative	Construction Area	Graded Area (acres)	PM10 Emissions (lbs./day)	PM10 Emissions (tons/year)
Eastern Alternative	Pipeline	848	22387.2	
	Pumping Plant	8.6	227.0	
	Spreading Basin	400	10560.0	
	Well Field	11.3	298.3	
		total=	**33472.6**	**6108.7**
Western Alternative	Pipeline	824	21753.6	
	Pumping Plant	8.6	227.0	
	Spreading Basin	400	10560.0	
	Well Field	11.3	298.3	
		total=	**32839.0**	**5993.1**
Combination Alternative	Pipeline	824	21753.6	
	Pumping Plant	8.6	227.0	
	Spreading Basin	400	10560.0	
	Well Field	11.3	298.3	
		total=	**32839.0**	**5993.1**
Eastern/Canal Alternative	Pipeline/Canal	848	22387.2	
	Pumping Plants	17.2	454.1	
	Spreading Basin	400	10560.0	
	Well Field	11.3	298.3	
		total=	**33699.6**	**6150.2**

TOTALS

Alternative	PM10 total (lbs./day)	PM10 total (tons/year)
Eastern Alternative	**458568.5**	**48481.4**
Western Alternative	**508359.2**	**55164.1**
Combination Alternative	**506798.7**	**54969.1**
Eastern/Canal Alternative	**716995.0**	**83305.0**

Notes:

Pipeline (200 ft wide x 35 miles)=848 acres; 34 miles=824 acres
Spreading Basin=400 acres
Well Field (45 wells each 130 ft x 80 ft and 3 well field substations each 95 ft x 50 ft) =11.3 acres
Each pumping plant and staging area=8.6 acres
West portal staging area and pump station=13.8 acres

Cadiz Groundwater and Dry Year Supply Project
Estimated Stationary Equipment Emissions

Eastern, Western and Combination Alternatives

Project Component	Equipment	Gallons of fuel per day	L factor (lbs./gallons)					Emissions				
			CO	ROC	NOx	SOx	PM10	CO	ROC	NOx	SOx	PM10
Pipeline	generator and hand held vibrator	80	0.102	0.0321	0.469	0.0312	0.01675	8.2	2.6	37.5	2.5	1.3
Pumping Plant	gas welding machine, concrete mixer, generator hand held vibrator plate and compressor, torch	230	0.102	0.0321	0.469	0.0312	0.01675	23.5	7.4	107.9	7.2	3.9
Spreading Basins	concrete mixer and generator	140	0.102	0.0321	0.469	0.0312	0.01675	14.3	4.5	65.7	4.4	2.3
Well Field	air compressor and generator	100	0.102	0.0321	0.469	0.0312	0.01675	10.2	3.2	46.9	3.1	1.7
Power Transmission	concrete mixer, generator and compressor	123	0.102	0.0321	0.469	0.0312	0.01675	12.5	3.9	57.7	3.8	2.1
						total lbs./day=		68.6	21.6	315.6	21.0	11.3
						total tons/yr.=		9.7	3.1	44.7	3.0	1.6

Eastern/Canal Alternative

Project Component	Equipment	Gallons of fuel per day	L factor (lbs./gallons)					Emissions				
			CO	ROC	NOx	SOx	PM10	CO	ROC	NOx	SOx	PM10
Pipeline	generator and hand held vibrator	80	0.102	0.0321	0.469	0.0312	0.01675	8.2	2.6	37.5	2.5	1.3
Pumping Plants	gas welding machine, concrete mixer, generator hand held vibrator plate and compressor, torch	460	0.102	0.0321	0.469	0.0312	0.01675	46.9	14.8	215.7	14.4	7.7
Spreading Basins	concrete mixer and generator	140	0.102	0.0321	0.469	0.0312	0.01675	14.3	4.5	65.7	4.4	2.3
Well Field	air compressor and generator	100	0.102	0.0321	0.469	0.0312	0.01675	10.2	3.2	46.9	3.1	1.7
Power Transmission	concrete mixer, generator and compressor	123	0.102	0.0321	0.469	0.0312	0.01675	12.5	3.9	57.7	3.8	2.1
						total lbs./day=		92.1	29.0	423.5	28.2	15.1
						total tons/yr.=		13.4	4.2	61.5	4.1	2.2

Notes:
Emissions=(gallons of fuel per day)(L factors in lbs. per gallon)=lbs./day
SCAQMD emissions factors (L) from page A9-5 in the CEQA Handbook
Fuel use estimates from B&V May 24, 1999
Assume that diesel fuel is used
Table compilation: P&D Consultants 1999