United States
Department of Agriculture
Forest Service

Southwestern
Region

Final Environmental Impact Statement for Carlota Copper Project

Tonto National Forest

July 1997

Volume III

Equal Employment Opportunity Statement

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4.0 CONSULTATION AND COORDINATION

4.0 Consultation and Coordination

4.1 Public Participation and Scoping

The purpose of the public participation program and scoping process is to "involve interested and affected agencies, State and local governments, organizations, and individuals in planning and decision making" (Forest Service Manual, Chapter 1950.2). This section describes the elements of the public participation program for the Carlota Copper Project EIS.

On June 9, 1992, the Forest Service published in the *Federal Register* a notice of its intent to prepare an EIS. The Forest Service solicited public participation in the scoping process for the Carlota Copper Project EIS by (1) distributing approximately 475 scoping letters to individuals on the Forest Service mailing list, (2) issuing press releases to primary media outlets in Arizona to announce the project and public scoping meetings, and (3) conducting two public scoping meetings. The meetings were held in Globe, Arizona, on July 15, 1992, and Mesa, Arizona, on July 16, 1992. An estimated 120 people attended the Globe meeting, and approximately 75 people attended the Mesa meeting. Written scoping comments were solicited through July 31, 1992. Approximately 75 written comment letters or meeting forms were submitted during the public scoping period.

In February 1995, the Forest Service filed the Draft EIS with the EPA. The EPA published the notice of the filing in the *Federal Register* on February 3, 1995, and the Draft EIS was distributed to individuals, organizations, and agencies on the Forest Service's EIS mailing list for review and comment. There was a 97-day comment period on the Draft EIS beginning on February 3, 1995, and ending on May 11, 1995. During this public comment period, the Forest Service conducted two public meetings to discuss and accept comments on the Draft EIS. One public meeting was held in Claypool, Arizona, on March 8, 1995, and one public meeting was held in Phoenix, Arizona, on March 9, 1995.

4.2 List of Contacts

During the preparation of the EIS for the proposed Carlota Copper Project, the Forest Service communicated with and received input from various federal, state, and local agencies; elected representatives; environmental and citizen groups; industries; and individuals interested in the issues regarding the proposed project. The following is a summary of the contacts that were made for the proposed Carlota Copper Project.

4.2.1 Federal Agencies

U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
USDI, Bureau of Land Management
USDI, Bureau of Mines
USDI, Bureau of Reclamation
USDI, Fish and Wildlife Service
USDI, Geological Survey
USDI, National Park Service

4.2.2 State Agencies/Universities

Arizona Department of Agriculture
Arizona Department of Commerce
Arizona Department of Economic Security
Arizona Department of Environmental Quality
Arizona Department of Game and Fish
Arizona Department of Revenue, Mineral Valuation Division
Arizona Department of Transportation
Arizona Department of Water Resources
Arizona Office of the State Mine Inspector
Arizona State Historic Preservation Office
Arizona State University
University of Arizona
University of Nevada, Reno

4.2.3 Tribal Governments

Fort McDowell Yavapai-Apache
Hopi

San Carlos Apache
Salt River Pima-Maricopa
Tonto Apache
White Mountain Apache
Yavapai-Apache
Yavapai-Prescott
Zuni

4.2.4 Local Agencies

Canyon Fire Department
Central Heights Fire Department
City of Globe
Cobre Valley Community Hospital
Gila County
Globe School District
Miami School District
Pinal County
Salt River Project
Superior School District
Town of Miami
Town of Superior
Tri-City Fire Department

4.2.5 Organizations

Association of Forest Service Employees for Environmental Ethics
Citizens for the Preservation of Powers Gulch and Pinto Creek
Globe-Miami Chamber of Commerce
Globe-Miami People for the West
International Brotherhood of Electrical Workers
Maricopa Audobon Society
Mineral Policy Center
Mothers for Clean Water
Plumbers & Steamfitter's Local 741 and United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada
Sierra Club
Superstition Area Land Trust
Superstition Horsemen's Association
Superstition Mountains Historical Society

4.2.6 Private Entities

Air Resource Specialists
Apache Mobile Home Park
ASARCO
Ball State University
Carlota Copper Company
CH2M Hill
Cyprus Miami Mining Company
Drakovich Realty
G.N. Richardson & Associates
Grand Canyon University
J. E. General Contractors
Kachina Realty
Long and Company Real Estate
Magma Pinto Valley Mine (now BHP Copper)
Magma San Manuel (now BHP Copper)
Magma Superior Mine (now BHP Copper)
Simons and Associates
The Industrial Company

4.3 List of Agencies, Organizations, and Individuals to Whom Copies of this Final EIS and the Record of Decision Are Sent

4.3.1 Federal, State and Local Agencies and Representatives

Advisory Council on Historic Preservation
Arizona Department of Mines and Mineral Resources
Arizona Department of Water Resources, Dam Safety and Flood Engineering Unit
Arizona Department of Water Resources, Hydrology Division
Arizona Game and Fish Department
Bureau of Indian Affairs - Branch of EQS
Central Arizona Association of Governments
City of Globe
Federal Energy Regulatory Commission
Federal Highway Administration
Gila County
Gila County Board of Supervisors
Natural Resources Conservation Service, Ecological Science Division
Pinal County
Representative J. D. Hayworth, 6th District
Representative Jim Kolbe, 5th District
Representative Ed Pastor, 2nd District
Representative Matt Salmon, 1st District
Representative John Shadegg, 4th District
Representative Bob Stump, 3rd District

Senator Jon Kyl
Senator John McCain
Town of Miami
Town of Superior
U.S. Army Corps of Engineers, Los Angeles District
U.S. Department of Energy
U.S. Department of Transportation
U.S. Environmental Protection Agency
USDI, Bureau of Land Management
USDI, Fish and Wildlife Service
USDI, Office of Environmental Affairs
University of Arizona, KUAT TV
University of Montana, Economics Department
USDA, Animal & Plant Health Inspection Service
USDA, National Agricultural Library
USDA, Office of Equal Opportunity
USDA, OPA Publications Stockroom
Utah State University, S.J. & J.E. Library, Quinney College of Natural Resources

4.3.2 Tribal Agencies

Ak Chin Indian Community
Fort Apache Agency
Fort Apache Indian Agency
Fort McDowell Indian Community
Gila River Indian Community
Hopi Agency
Hopi Tribe
Pima Agency
Salt River Pima-Maricopa Indian Community
San Carlos Agency
Tohono O'Odham Nation Natural Resource Department
Tonto Apache Tribe
White Mountain Apache Tribe
Yavapai-Apache Nation
Yavapai-Prescott Tribe

4.3.3 Private Organizations

AFSEEE
American Rivers
Arizona Mining Association
Centerline Electric, Inc.
Co-op Extension
Cyprus Miami Mining
Dade-Dawson Consulting Engineering
Dames & Moore
Desert Botanical Garden
EEEE Ltd.
Environmental Management Associates
Environmental Strategies, Inc.
Errol L. Montgomery & Associates
Gochnour and Associates
Guzman Construction
Huachuca Hiking Club
Mediation & Public Management, Inc.
Mineral Policy Center
MM Stower
National Wildlife Federation
Papago Agency
Phelps Dodge Safford, Inc.
Phelps-Dodge
Post-Newsweek Cable
R-W Beck Co.
Radio Stations KIKO AM/FM
Salt River Agency
Salt River Project
Sierra Club Conservation Chair
Southern Gila County Economic Development Corporation
Southwest Center for Biological Diversity
Sparks, Tehan & Ryley, P.C.
Tame Tic Committee
The Law Fund
Top-of-the World Citizens for the Preservation of Powers Gulch and Pinto Creek
TerraMatrix
Traxton Canon Agency
Western Mining Action Project
Western States Public Lands Coalition, Globe-Miami Chapter
Wilderness Society
Winters Company

4.3.4 Individuals

Aker, Robert
Alevez, Gil
Allen, Donald B.
Alston, Roger D.
Amado, Richard
Armstead, Ronald and Dolly
Beauchamp, Wilma Hedberg
Bernstein, Jim
Bernstein, Ken
Brandon, Charles
Bridge, Gavin
Brockeit, James P.
Browne, Sharon
Bryant, Wayne

Butler, David Ellias
Chiles, Phil
Clark, Andy and Linda
Clary, Tom
Conwell, Mr. and Mrs. Cleland
Cooper, Leonard
Dalton, John H.
Dejarlais, Patty
Dodd, Jerry L.
Ducharme, Scott W.
Duerr, Herb
Eggers, William A.
Farmer, Gene
Gaona, Lupe
Ham, Deborah
Harlin, Howard
Haught, Mr. and Mrs. Jim
Hoff, Heather
Hull ,Bruce
Iles, Cal
Ingram, Floyd J.
Jenkins, C.E.
Jimenez, Frank T., Jr.
Johnson, Karla D. and Mitchell
Kannegaard, Matthew
Kilpatrick, Ken and Lorraine
La Chapelle, Gary W.
Lazzelle, Tom
Lenzi, Gary
Lesjak, Steve
Levick, Lainie
Lewis, Elizabeth B.
Lewis, Fred W.
Lewis, Patricia L.
Lindsey, Vincent and Candy
Listiak, Sharon
Lorenz, Ronald
Lowan-Norton, Cheryl
Lucas, Mark
Malkovich, Mitch
Manzano, Laurie
Marsh, Janet
Miller, Anton
Montoya-Nelson, Eloise
Morris, Anne F.
Norton, Kent
Nyenhuis, Jim
Paez, Gilbert and Marisa
Paulsen, Ken
Prendergast, Ray
Rebman, Jon
Richardson, Sandi
Richerson, David
Robinson, Rick
Rodgers, Robert C.
Santellanes, Ruben A.
Shake, George L.
Sims, Kris
Smith, Leo
Sonandres, Thomas W.
Spehar, Jay W.
Stakes, Donald
Taylor, Chuck
Thayer, John E.
Thomas, Randall W.
Trujillo, John
Van Winkle, Karen
Walish, Marcia and Joe
Walters, Jo
Welsh, Frank
Whitman, Kathy
Williamson, Jeff
Winter, Jon
Wintrich, Don
Wooldridge, Margaret
Zobel, Don W. and Louise

4.4 List of Agencies, Organizations, and Individuals to Whom Copies of the Record of Decision Only Are Sent

4.4.1 Federal, State, and Local Agencies

U.S. Bureau of Land Management, Phoenix Resource Area
City of Chandler
City of Phoenix
Phoenix Zoo

4.4.2 Private Organizations

Arizona Public Service Company
Arizona Riparian Council
Border Ecology Project
Cancer Registry-Dioxin Research
Dobson Ranch Medical Center
Friends of Arizona Rivers

Geotemps, Inc.
Henkel Corporation
KPFF Consulting Engineers
KQSS-FM
M&C Piastech Inc.
Pacific Standard Spec., Inc.
Phoenix Fuel Company
Process Equipment Company
Reevis Mt. School
Roosevelt Community Association
Sierra Club, Grand Canyon Chapter
Steve Arthur's Service
Superstition Area Land Trust
Tribune Newspaper

4.4.3 Individuals

Armstrong, Theresa
Baker, Jean
Banicevich, Frank
Banks, Ken
Bennett, Bethel
Besich, Steven L.
Binegar, Kathy and Alan
Bittner, Ross
Blanche, Judith
Borg, Sally
Bradford, Jack
Brake, Bill
Brock, Tom and Ruth
Bryant, Wes
Buffington, Suzie
Byrne, Ken
Casillas, Mark and Patricia
Clark, Jim
Clark, Sue
Conklin, Emma and Jack
Coons, Shannon
Cox, George R.
Cronin, John
Dal Molin, Frank and Betty
Den-Baars, Dirk and Beverly
Desmarais, Angie
Dimmit, Jeff
Divers, Connie Scott
Dryer, John
Eastlick, John
Earl, John E.
Ellett, William
Foder, L.
Franco, Richard
Fudge, Coley
Garvey, Jim
Gibson, Janet C.
Goelzer, James T.
Grange, Cecily C.
Green, Jim
Green, Robert F.
Guerrero, Edward G.
Guzman, Mike, Jr.
Hamilton, Elizabeth
Hamlet, Geri and Wayne
Heidenreich, Travis
Horinek, Howard
Houseweart, Jim
Ingersoll, Randy
Isham, Scott J.
Jackson, Nancy
Jacobs, Bernard and Dora
Johnson, Chris
Johnson, David and Ilene
Klecak, Joe and Lynne
Knight, Kenneth and Elizabeth
Lamkin, Marcia
Magsulit, Ralph
Manier, Bud
Mason, J.A.
Misany, John
Moeller, Janet and Ted
Moffett, Bob
Monarrez, Lois
Moore, Rusty
Moreno, Mary Anne
Mull, Doris and Hershal
Murray, Richard
Napp, Gordon and Joyce
Neary, John
Nessel, Laurie
Nock, Ruth L.
Nordhausen, Eric A.
O'Rourke, Priscilla
Obermeyer, Doris
Olson, Marc
Ortega, Linda Haught
Owen, Jack
Padgett, Fred
Pamperin, John
Pardee, David
Petracci, Rudy
Pfaff, Diana
Pratt, Ted
Raber, Carl

Rice, Clarence
Rivera, Bebe and Liz
Rivera, Manuel S.
Sanchez, Daniel
Sanchez, Pasoual H.
Schminke, William L.
Seidman, Mike
Shank, Lonnie
Sheppard, Lynn
Smith, Janet and Jeffrey
Sparks, Earl
Stahlnecker, Jon
Stipe, James M.
Stone, Jeff
Stratton, Steve
Tallman, Dick
Taylor, Tom
Thatcher, Liz
Trampp, Tommy and Susan
Tyer, Mary G.
Udall, Chris
Vandine, James
Vuksanovich, Louis
Walker, Betty
Watson, Kent
Weir, Shirley L.
Welhener, Herb
Wheat, Joel M.
White, Irby, Larue, and Everett
Worms, Thomas
Zache, Joanne
Zache, Robert E.

4.5 Public Review of the Draft EIS

The Forest Service received 89 letters addressing the Draft EIS during the 97-day public comment period. The Forest Service also received written and oral comments during the public meetings on the Draft EIS. All comments were reviewed, and comments requiring a response were identified. Responses were provided to clarify the content of the Draft EIS, modify or correct the Draft EIS, or provide additional information in the Final EIS. The Forest Service responded to the public comments based on the guidelines provided in 40 CFR 1503.4. All comments have been reviewed and considered by the Forest Service in determining the agency preferred alternative for the Carlota Copper Project.
Table 4-1 lists each of the individuals who commented on the Draft EIS. According to Forest Service policy, agency letters have been included in Appendix G in their entirety, and a response has been prepared for each substantive comment in these letters. Each substantive non-agency comment, including the comments received during the public meetings, has been summarized in Appendix G, and a response has been prepared. If a subject was addressed in a response to an agency comment, it was not repeated as a non-agency response. Therefore, to ensure that their comment has been addressed, commentors should review both agency and non-agency responses.

Table 4-1. Commentors on the Draft EIS

Name	Agency/Organization
Abooo, Lynn	
Abou-Haidar, Fareed	
Ackerson, Ron	
Aker, Robert R.	
Alexander, Robert D.	
Allen, Donald B.	
Anderson, Dick	
Anderson, Donna L.	
Anderson, Guy	
Andrade, Mary E.	
Antilla, Angela	
Antilla, Gary	
Arthur, Steve, Susan B., and Robert S.	Steve Arthur's Service
Baiza, Elias H.	
Baiza, Lee	U.S. Department of the Interior, National Park Service, Tonto National Monument
Banks, Ken	
Belson, Jerry	U.S. Department of the Interior, National Park Service, Southern Arizona Group
Benjamin, Barbara	
Benjamin, Vicki	
Bennett, Bethel	
Bernstein, Kenneth	
Besich, Steven I.	
Bessee, Judy	
Bigando, Robert	
Billingsley, Lyn	
Binegar, Alan H.	
Binegar, Kathy	
Bingham, Brent G.	
Bittick, Billie	
Bittick, Joe L. Jr.	
Blaine, Marjorie E.	U.S. Army Corps of Engineers
Blumer, Edward D.	
Bolinger, David	
Boulanger, Aimee	Mineral Policy Center
Bradford, Jack	
Brasher, Wayne J.	
Brockeit, James P.	
Browne, Sharon	
Bryant, Wayne	Plumbers & Steamfitter's Local 741 and United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada
Bryant, Wes	

Table 4-1. Commentors on the Draft EIS (continued)

Name	Agency/Organization
Bunney, Mark E.	
Burich, Susan	
Burke, David "Stoney"	
Byrne, Ken	
Byrne, William A.	
Calhoun, Tom	
Carnahan, Ron	
Carrillo, Joe	
Carrillo, Lillian	
Casillas, Mark	
Casillas, Patricia	
Cavanaugh, Joe	Empire Machinery
Cecil, Dana	
Chism, John	
Christofferson, Ron	Arizona Game & Fish Department
City Clerk, Vice-Mayor, City Attorney	Mayor and Council of the City of Globe
Clark, Andy	
Clark, Pat	
Clark, Sue	
Coe, Anne	Superstition Area Land Trust
Coggin, H. Mason	Department of Mines and Mineral Resourcces, Arizona Mining and Mineral Museum
Colgate, Vera	
Collins, Don E.	DE/EN/CON Construction, Co., Inc.
Collins, Pamela G.	DE/EN/CON Construction, Co., Inc.
Conklin, Jack	
Conto, Susan	
Conto, Thomas A.	
Conwell, Cleland N.	
Cook, Catherine S.	
Cook, John	
Cooley, Florine	
Coons, Shannon E.	
Coughlin, Robert P.	
Cox, George R.	
Cox, Hazel	
Crockett, Kenneth	
Crossatt, Dave	
Culwell, Janet A.	
Culwell, Miles J.	
Dahl, Clifford	
Dale, Bob	Association of Forest Service Employees for Environmental Ethics
Dalmolin, Frank R.	
Daniels, Janet	

Table 4-1. Commentors on the Draft EIS (continued)

Name	Agency/Organization
Dawson, Shirely L.	
Dean, Charlene	
Dearbaugh, Wes	
Den-Baars, Dirk	
DeRose, Jerry B., Steven L. Besich, Edward G. Grerrero, Ron Christensen, Cruz Salas	Gila County Board of Supervisors
Diamanti, David	
Dimmit, Dr. Jeff	
Dodd, Jerry L. and Evelyn	
Downell, Laura	
Ducharme, Scott W.	
Duke, Tamara	
Dumas, Duna	
Duncan, Gary	
Dupuis, Marie-Therese	
Durnan, Patrick	
Dzera, Keith	
Eastuck, John T.	
Eggers, William A.	
Ehrman, Steve	
Ellinger, Virginia	
Eredia, Jose	
Esteves, Judy	
Etzel, Barney	Sundt Corp.
Fenn, Richmond	
Fisher, Stuart G.	Arizona State University
Flory, Don	
Fortman, Dennis	
Fox, Edward Z.	Arizona Department of Environmental Quality
France, Ron	
Franquero, David A.	Office of the Mayor, City of Globe
Frederickson, A.D.	
Funk, Cory	Phoenix Fuel Co.
Garcia, Charles	
Garcia, Kathy	
Gardea, Edward	
Garvey, Jim	
Gaspers, John C.	Filtemp Sales, Inc.
Gibson, Stanley	City of Globe Councilman
Gillette, Frank	
Goelzer, James T.	
Goodale, Donna	Top-of-the-World Citizens for the Preservation of Powers Gulch and Pinto Creek
Gore, Alvin Joe	
Goslin, Teri L.	

Table 4-1. Commentors on the Draft EIS (continued)

Name	Agency/Organization
Gozman, Mike Jr.	
Gresham, Richard	
Guerrero, Edward G.	
Guerrero, Linda	
Haag, Terri	Geotemps, Inc.
Hakes, Eric	
Halby, Kenderik	
Hale, Jane	
Hale, Tom	
Ham, Deborah	Deborah Ham, Attorney at Law
Hammond, Robert L.	
Handley. Theresa	
Harbison, J.M.	
Haught, C.A.	
Haught, Sherri	
Haught-Ortega, Linda	
Herron, James C. and Phyllis	
Hesketh, Ed	
Hesketh, Jakie	
Hoff, John & Karol	
Holder, Kendrick	
Holder, Lora Mae	
Hopp, Roger	
Horinek, Howard H.	
Huff, Rose	
Hughes, Bill	
Hughes, Debra	BizTec
Hulme, Danielle	
Hummer, Chad	
Hutson, Bill	
Hyde, Dena	
Iles, Carl	
Jackson, Nancy R.	
Jenkins, C.E. "Chuck"	
Jertson, Jeannie	
Johnson, Karla	Top-of-the-World, Citizens for the Preservation of Powers Gulch and Pinto Creek
Jones, John L.	
Kaaua, Judy	
Kannegaaro, Matthew	
Keefer, Robert W.	
Kenney, Kevin	
Kilpatrick, Ken	
Kilpatrick, Lorraine	
Kirk, Dorland	DE/EN/CON Construction, Co., Inc.

Table 4-1. Commentors on the Draft EIS (continued)

Name	Agency/Organization
Kline, Jay	
Knapp, Bill	
Koerner, Nancy	
Kordosky, Gary	
Kretsch, Ellen	
Kroese, Keith W.	Haralson, Kinerk, & Morey, Attorneys at Law
LaCombe, Mike	
Lamkin, Marcia	Plateau Group of the Sierra Club, Grand Canyon Chapter
Lang, Charles	
Laux, Daniel P.	
Leach, Pattie	
LeCompte, Larry	
Lenox, Leon	
Lenox, Myrna	
Lenzi, Gary	
Levick, Lainie	Sierra Club, Grand Canyon Chapter
Lewis, Fred W.	
Lewis, Patricia L.	
Liessmann, J.L.	
Long, William	William Long & Company
Lorenz, Ronald	Superstition Mountains Historical Society
Lucas, Mark	
Mace, Carol Ann	
Mace, Robert C.	
Mackay, Nancy	
Malkovich, Mitch	
Marcus, Felicia and J. Geselbracht	U.S. Environmental Protection Agency, Office of Federal Activities
Markin, Eugene	
Marr, Allen G.	
Marsh, Janet	Arizona State University
Mason, Jack	
Mathias, Russell C.	
Matt, Jim P.E.	Arizona Department of Environmental Quality
McClain, Steven M.	ACM Equipment Rental and Sales Co.
McDonald, Pamela	
McGaugh, Danny	Driltech Inc.
McGregor, Douglas R.	Magma Copper Company
Members	International Brotherhood of Electrical Workers
Merigold, C.R.	
Miller, Anton Rocky	
Miller, Dr. Fred R.	
Mitchell, Jesse	
Monarrez, Lois	Gila County Miniature Golf

Table 4-1. Commentors on the Draft EIS (continued)

Name	Agency/Organization
Montoya-Nelson, Eloise	
Moore, Rusty	
Moore, Zean	Globe-Miami People for the West
Moreno, Mary Anne	
Morgan, Daniel P.	
Morrow, Mark	
Mosley, Diane	
Mounce, Robert L.	Pinal Equipment Rental
Mueller, Mary and Theodore	
Mull, Hershel	
Napp, Gordon E.	
Neary, John	
Nelson, Kathy J. and Dana D. Bayer	Mothers for Clean Water
Nelson, Therese M.	
Nickell, Matt	
Nock, Ruth L.	
Nordhausen, Eric A.	
Norton, Gordon B.	
Nowicki, Teri	
O'Donnell, Faye	
O'Donnell, John F.	
Olsen, LeiLani	The Leader Daily Newsletter
Otter, Elna L.	
Owen, Jack	
Paez, Nancy J.	
Pampen, John	
Pardee, David	
Partida, Jessic	DE/EN/CON Construction, Co., Inc.
Peabody, Ivone	
Peabody, Mark	
Peeples, Bob	
Pepper, Sue	
Pieta, Jill, CTC	World Travel 'N' Cruise
Piña, Elizabeth C.	
Pinson, Pam	
Pio, Linda A.	
Port, Patricia Sanderson	U.S. Department of the Interior, Office of the Secretary, Office of Environmental Policy and Compliance
Porter, Jenise	
Powell, Brandon	
Power, Victor O.	
Pratt, Ted	
Prendergast, Ray	
Radicke, Ingo	Post-Newsweek Cable

Table 4-1. Commentors on the Draft EIS (continued)

Name	Agency/Organization
Radonovich, Sharon	
Rancarrow, Barbara	
Rasmussen, James B.	
Rasmussen, Marilynn	
Rasmussen, Tommie N.	
Redder, Mark	
Residents at Top-of-the-World	
Ressler, Bob	
Rhodes, Larry L.	
Rice, Clarence	
Rice, Fred D. Jr.	
Richardson, Sandi	
Ridenour, Dwight F.	
Rivera, Angie C.	
Rivera, Manuel S.	
Robbins, Eric	
Roberts, David C.	Salt River Project
Robinette, Charlie	M & C Plastech, Inc.
Robinson, John M.	
Robinson, Rick	
Rodgers, Bob	Pinal Mountain Section of A.I.M.E.
Rodgers, Robert C.	
Rodriguez, George	
Runbeck, Charles	
Salas, Cruz	
Santellanes, Ruben A.	
Santo Anna, Oho	
Scales, Karen	
Scales, Mike	
Schminke, William L.	
Schulze, John C.	
Scott, B.C.	
Sewell, Darlene and Joseph	
Shank, Lonnie	
Sheahan, Greg	
Sheppard, Lynn M.	
Sims, Kris	
Smith, Jeffery P.	
Soderstrom, Matthew	
Sparks, Earl H.	
Spehar, Jay W.	
Spencer, Orson W.	
Stahlnecker, Jon and Laurie Manzano	
Stephenson, William V., CED	Arizona Public Service Company
Steuter, Don	Sierra Club, Grand Canyon Chapter

Table 4-1. Commentors on the Draft EIS (continued)

Name	Agency/Organization
Stokowski, Jeff	
Stover, M.M.	
Stratton, Rick	
Stratton, Steve	
Taylor, Bill	Arizona's KISS fm 98.3
Thayer, John E. "Ted"	
Thetford, Dillard	Pacific Standard Spec., Inc.
Thomas, Randall W.	
Thomson, J. M.	Top-of-the-World
Tolle, Donald	
Trampp, Susan	
Trampp, Tommy R.	
Troglio, Hazel	
Tunis, Bob	
Turney, Charles	
Turney, Elizabeth Ann	
Udall, Chris	
Valemeuck, Jim	
Valenzuela, James J.	Arizona Public Service Company
Valenzuela, Kimberly A.	
Valenzuela, Patricia	
Verksuvich, Martha	
Verksuvich, Mitchell	
Vuksanovich, Louis	
Walish, Joe	
Walish, Marcia	
Walish, Robert C.	Carlota Copper Company
Walrauen, Ed	
Watson, Kent	
Watts, James C.	
Weigel, Myles	
Weimer, Katie	
Weir, Jeffery H.	Southern Gila County Economic Development Corporation
Weir, Shirley L.	
Welsh, Frank	Maricopa Audubon Society
Wheat, Joel M.	
Wheeler, Anita	
Wheeler, Terence O.	
White, Don	
White, Irby C.	
White, Larue	
Whitman, Kathy	
Whitten, Tim	DE/EN/CON Construction, Co., Inc.

Table 4-1. Commentors on the Draft EIS (continued)

Name	Agency/Organization
Wilson, Ron	
Wilson, Van	
Winslow, Nancy	
Withers, Charles D.	
Woods, Jimmie	
Woods, Mike	
Wurst, Fred	
Zache, Joanne	
Zache, Robert E.	
Zobel, Don W.	

5.0 LIST OF PREPARERS AND REVIEWERS

5.0 List of Preparers and Reviewers

Agency EIS Interdisciplinary Team:

Responsibility	Name	Qualifications
EIS Coordinator	Paul M. Stewart Tonto National Forest Supervisor's Office	B.S. in Watershed Management 21 years experience
Water Resources	Grant Loomis Tonto National Forest Supervisor's Office	M.S. (abt) in Hydrology B.A. in Economics 16 years experience
Geology, Minerals, and Hazardous Materials	Karyn Bronson Harbour Tonto National Forest Supervisor's Office	B.S. in Geology 14 years experience
Mining Engineering, Reclamation	Dean C. Morgan Tonto National Forest Globe Ranger District	M.S. Natural Resource Management and Mining Engineering, Geology B.S. Range Resources A.S. Forest Resources
Recreation, Wilderness, and Land Use	Stuart J. Herkenhoff Tonto National Forest Globe Ranger District	B.S. in Wildlife Management B.S. in Range Management 25 years experience
Biological Resources, T & E and Riparian	Don A. Pollock Tonto National Forest Globe Ranger District	B.S. in Wildlife Biology 17 years experience
Visual Resources	Ron Wilson Tonto National Forest Supervisor's Office	B.S. in Landscape Architecture 26 years experience
Air Resources and Noise	Peter Lahm Tonto National Forest Supervisor's Office	Master of Environmental Mgmt. B.A. in Chemistry 9 years experience
Aquatic Biology	Lisa Bizios Tonto National Forest Supervisor's Office	B.S. in Zoology B.S. in Mathematics 9 years experience
Cultural Resources	Michael Sullivan Tonto National Forest Supervisor's Office	B.A. in Anthropology 20 years experience
Soils and Reclamation	Norm Ambos Tonto National Forest Supervisor's Office	B.S. in Soils B.A. in Chemistry 20 years experience
Clean Water Act 404 Permitting	Marjorie Blaine U.S. Army Corps of Engineers	M.S. in Wildlife Biology B.S. in Biology/Chemistry 17 years experience
T & E Species	Individual Specialists U.S. Fish & Wildlife Service	

Riverside Technology, inc. EIS Team:

Responsibility	Name	Qualifications
Project Manager	Valerie J. Randall Riverside Technology, inc. Fort Collins, Colorado	B.A. Urban Studies 19 years experience
Water Resources	Richard Spotts, P.E. Riverside Technology, inc. Fort Collins, Colorado	B.S. Civil Engineering 24 years experience

Riverside Technology, inc. EIS Team (Continued):		
Responsibility	**Name**	**Qualifications**
Water Quality and Wetlands	Stephen Johnson Riverside Technology, inc. Fort Collins, Colorado	M.S. Water Quality Hydrology B.S. Biology/Chemistry 12 years experience
Water Quality and Wetlands	William Schenderlein Riverside Technology, inc. Fort Collins, Colorado	M.S. Civil Engineering B.S. Chemistry 11 years experience
Ground Water, Geology and Minerals, Hazardous Materials	Patrick Plumley, C.E.G., R.G. Riverside Technology, inc. Fort Collins, Colorado	M.S. Geology B.S. Geology 14 years experience
	Terry Geiselman, R.G. Riverside Technology, inc. Fort Collins, Colorado	B.S. Geology 14 years experience
Soils and Reclamation, Surface Water	James Burrell Riverside Technology, inc. Fort Collins, Colorado	M.S. Civil Engineering B.S. Forest Management 16 years experience
Socioeconomics, Recreation and Wilderness, Land Use	Jennifer Kathol Kathol & Company Fort Collins, Colorado	B.S. Natural Resource Economics 18 years experience
Terrestrial Biology	Frank Reichenbacher Southwestern Field Biologists Tucson, Arizona	M.S. Ecology/Evolutionary Biology B.S. Environmental Studies 15 years experience
	Joshua Taiz Southwestern Field Biologists Tucson, Arizona	B.S. Ecology/Evolutionary Biology 10 years experience
Aquatic Biology	William Miller, Ph.D. W.J. Miller & Associates Fort Collins, Colorado	Ph.D. Fisheries M.S. Recreation Resources B.A. Biology 17 years experience
	Rollin Daggett Riverside Technology, inc. Fort Collins, Colorado	M.S. Aquatic Biology B.S. Zoology 23 years experience
Air Resources	David Randall Air Sciences, Inc. Lakewood, Colorado	M.S. Civil Engineering *(in progress)* B.S. Land Resources Planning 8 years experience
Mining Engineering	Eldon Strid, P.E. Mine Engineers, Inc. Cheyenne, Wyoming	B.S. Mining Engineering 22 years experience
Cultural Resources	Christian Zier, Ph.D. Centennial Archaeology, Inc. Fort Collins, Colorado	Ph.D. Anthropology M.A. Anthropology B.S. Anthropology 25 years experience
Transportation and Noise	Bernhard Strom Planera, Inc. Fort Collins, Colorado	M.C.R.P. City and Regional Planning B.S. Urban Planning 24 years experience

Riverside Technology, inc. EIS Team (Continued):		
Responsibility	**Name**	**Qualifications**
Visual Resources	Craig Taggart EDAW, Inc. Fort Collins, Colorado	M.L.A. Landscape Architecture B.S. Zoology 27 years experience
Project Coordinator/ Technical Editor	Susan Blythe Riverside Technology, inc. Fort Collins, Colorado	M.A. English B.A. History 8 years experience

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7.0 ACRONYMS AND ABBREVIATIONS

7.0 Acronyms and Abbreviations

ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADT	Average daily traffic
AEC	Applied Environmental Consultants
AIP	Air Installation Permit
ANFO	Ammonium-nitrate and fuel oil
ANSI	American National Standards Institute
AQG	Ambient Air Quality Guideline
AQRV	Air Quality Related Values
ARPA	Archaeological Resource Preservation Act
ASM	Arizona State Mine Inspector
AUM	Animal unit month
BADCT	Best Available Demonstrated Control Technology
bext	Extinction coefficient
BLM	U.S. Bureau of Land Management
BMPs	Best Management Practices
BOR	U.S. Bureau of Reclamation
CAP	Central Arizona Project
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CHEMTEC	Chemical Transportation Emergency Center
COE	U.S. Army Corps of Engineers
CPT	Corrugated polyethylene tubing
CWA	Clean Water Act
DAT	Diversity and Taxa
dv	Deciview
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ft-amsl	Feet above mean sea level
GIS	Geographic Information System
gpm	Gallons per minute
GWRC	Ground Water Resource Consultants
HCDA	Historic Context Development Area
HDPE	High-density polyethylene
H:V	Horizontal to vertical
IMPROVE	Interagency Monitoring of Protected Visual Environment
IO	Isolated occurrence
km	Kilometer
KOP	Key Observation Point
LCRS	Leachate collection and recovery system
LOS	Level of service
m/s	Meters per second
MCL	Maximum Contaminant Level
mm	Millimeters
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
MWMT	Meteoric Water Mobility Tests
mybp	Million years before present
NAAQS	National Ambient Air Quality Standards

NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NWS	National Weather Service
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated biphenyl
PCDOT&FCD	Pima County Department of Transportation and Flood Control District
PLS	Pregnant leach solution
PM_{10}	Respirable particulate matter less than 10 microns in aerodynamic diameter
ppb	Parts per billion
ppm	Parts per million
PSD	Prevention of significant deterioration
psi	Pounds per square inch
RACM	Reasonably Available Control Methods
RACT	Reasonably Available Control Technologies
RATM	Resource Access Travel Management
RNA	Roaded Natural
ROS	Recreation opportunity spectrum
RUSLE	Revised Universal Soil Loss Equation
RV	Recreational vehicle
RVD	Recreational visitor day
SCHMM	Spill Containment and Hazardous Materials Management
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SLA	Simons, Li and Associates
SPN	Semi-primitive motorized
SPNM	Semi-primitive non-motorized
SVR	Standard visual range
SWPP	Stormwater Pollution Prevention Plan
SX/EW	Solvent extraction-electrowinning
TCP	Traditional Cultural Properties
TERO	Tribal Employment Rights Office
TNW	Threatened Native Wildlife
TPS	Total production stripping
TSP	Total suspended particulate
TSS	Total suspended solids
U	Urban
USGS	U.S. Geological Survey
USLE	Universal Soil Loss Equation
UTM	Universal Transverse Mercator
VLDPE	Very-low-density polyethylene
VOC	Volatile organic carbon
VQO	Visual Quality Objective

8.0 GLOSSARY

8.0 Glossary

Acid Mine Drainage	Drainage with a pH of 2.0 to 4.5 from mines and mine wastes that is the result of oxidation of sulfides exposed during mining.
Acre-feet	The volume of liquid or solid required to cover 1 acre to a depth of 1 foot, or 43,560 cubic feet; measure for volumes of water, reservoir rock, etc.
Adit	A nearly horizontal passage in an underground mine, driven from the surface, by which a mine may be entered, ventilated, and/or dewatered.
Allotment	A unit of land suitable and available for livestock grazing that is managed as one grazing unit.
Alluvium	Unconsolidated or poorly consolidated gravel sands and clays deposited by streams and rivers on riverbeds, floodplains, and alluvial fans.
Ambient	The environment as it exists at the point of measurement and against which changes or impacts are measured.
Animal Unit Months (AUMs)	Grazing of a cow/calf pair for 1 month.
Aquifer	A subsurface zone that is sufficiently permeable to conduct ground water and to yield economically significant quantities of water to wells and springs.
Artifact	Any object showing human workmanship or modification especially from a prehistoric or historic culture.
Baghouse	A dust collection and control facility.
Best Available Demonstrated Control Technology (BADCT)	Processes, structures, operating methods or other alternatives used to design, construct, and operate a facility so as to ensure the greatest degree of discharge reduction achievable, including, where practicable, a technology permitting no discharge of pollutants.
Best Management Practices (BMPs)	Practices designed to prevent, reduce, or control impacts to surface resources.
Candidate	Taxa for which the U. S. Fish and Wildlife Service has substantial information on biological vulnerability and threat(s) to support proposing the species for listing as threatened or endangered. Listing proposals are either being prepared or have been delayed by higher-priority listing work.
Candidate, Category 2 (C2)	Taxa with the C2 designation were listed as such at the initiation of the Carlota EIS analysis. Since that time, the U.S. Fish and Wildlife Service has issued a more recent listing of candidate species (Federal Register 61: 7596-7613, February 28, 1996). As a result of this update, none of the species addressed by the EIS are listed as candidate (C2) species.
Code of Federal Regulations (CFR)	The compilation of federal regulations adopted by federal agencies through a rule-making process.
Clean Water Act (CWA)	The Federal Water Pollution Control Act, as amended.

Colluvium	General term applied to loose and incoherent deposits, usually at the foot of a slope or cliff (e.g., talus and cliff debris) and brought there chiefly by gravity.
Community Types	A group of plants living in a specific region under relatively similar conditions.
Cone of Depression	The depression of heads around a pumping well caused by the withdrawal of water.
Confining Bed	A layer of rock having very low hydraulic conductivity that hampers the movement of water into and out of an aquifer.
Contrast	The effect of a striking difference in the form, line, color, or texture of the landscape features within the area being viewed.
Critical Habitat	Habitat that is present in minimum amounts and is the determining factor in the potential for population maintenance and growth.
Cumulative Effects	The combined environmental impacts that accrue over time and space from a series of similar or related individual actions, contaminants, or projects. Although each action may seem to have a negligible impact, the combined effect can be significant. Included are activities of the past, present, and reasonably foreseeable future. Synonymous with direct impacts.
dBA	The sound pressure levels in decibels measured with a frequency-weighing network corresponding to the A-scale on a standard sound level meter. The A-scale tends to suppress lower frequencies, e.g., below 1,000 Hz.
Decibel (dB)	A unit used in expressing ratios of electric or acoustic power. The relative loudness of sound.
Direct Impacts	Impacts that are caused by the action and occur at the same time and place (40 CFR 1508.7). Synonymous with direct effects.
Discharge	The volume of water flowing past a point per unit time, commonly expressed as cubic feet per second (cfs), gallons per minute (gpm), or million gallons per day (mgd).
Drainage	Natural channel through which water flows some time of the year. Natural and artificial means for effecting discharge of water as by a system of surface and subsurface passages.
Drawdown	The lowering of the water level in a well as a result of withdrawal; the reduction in head at a point caused by the withdrawal of water from an aquifer.
Electrowinning (Electrometallurgy)	The process of electrolytically depositing metals, or separating them from their ores or alloys.
Endangered Species	Any species in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act.

Ephemeral Stream	A stream or portion of a stream that flows briefly in direct response to precipitation in the immediate vicinity, and whose channel is at all times above the water table.
Erosion	The wearing away of soil and rock by weathering, mass wasting, and the action of streams, glaciers, waves, wind, and underground water.
Evapotranspiration	The portion of precipitation returned to the air through evaporation and plant transpiration.
Exploration	The search for economic deposits of minerals, ore, and other materials through practices of geology, geochemistry, geophysics, drilling, and/or mapping.
Fault	A fracture in rock units along which there has been displacement.
Floodplain	That portion of a river valley, adjacent to the channel, that is built of sediments deposited during the present regimen of the stream and is covered with water when the river overflows its banks at flood stages.
Forage	Vegetation used for food by wildlife, particularly big game wildlife and domestic livestock.
Forb	Any herbaceous plant other than a grass, especially one growing in a field or meadow.
Fugitive Dust	Dust particles suspended randomly in the air from road travel, excavation, and rock loading operations.
Geochemistry	The study of the distribution and amounts of the chemical elements in minerals, ores, rocks, soils, water, and the atmosphere, and their circulation in nature on the basis of the properties of their atoms and ions.
Geotechnical	A branch of engineering concerned with the engineering design aspects of slope stability, settlement, earth pressures, bearing capacity, seepage control, and erosion.
Grade	A slope stated in feet per mile or as feet per feet (percent); the content of precious metals per volume of rock (ounces per ton).
Ground Water Table	The surface between the zone of saturation and the zone of aeration; that surface of a body of unconfined ground water at which the pressure is equal to that of the atmosphere.
Heap Leach	The process of recovering metals from ores by leaching ore that has been mined and placed on a specially prepared pad. A chemical solution is applied through low volume emitters, and the metal-bearing leachate solution percolates and is collected.
Heavy Metals	A group of elements, including copper (Cu), lead (Pb), mercury (Hg), molybdenum (Mo), nickel (Ni), cobalt (Co), chromium (Cr), iron (Fe), silver (Ag), etc., that may be acquired by organisms in trace amounts that are toxic in higher concentrations.

Hydraulic Conductivity	The capacity of a geologic material to transmit water. It is expressed as the volume of water at the existing kinematic viscosity that will move in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow.
Hydraulic Gradient	Change in head per unit of distance measured in the direction of the steepest change.
Igneous	Rock or mineral that solidified from molten or partly molten magma; processes relating to or resulting from the formation of such rocks.
Impact	A modification in the status of the environment brought about by the action.
Impoundment	The accumulation of any form of water in a reservoir or other storage area.
Indirect Impacts	Impacts that are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable (40 CFR 1508.8). Synonymous with indirect effects.
Infiltration	The movement of water or some other liquid into the soil or rock through pores or other openings.
Infrastructure	The basic framework or underlying foundation of a community, or project including road networks, electric and gas distribution, water and sanitation services, and facilities.
Interdisciplinary Team	A team of individuals with skills from different disciplines that analyze environmental impacts.
Irretrievable	Applies to the loss of production or commitment of renewable natural resources.
Irreversible	Applies primarily to the use of nonrenewable resources, such as minerals, cultural resources, wetlands, or to those factors that are renewable only over long time spans, such as soil productivity. Irreversible also includes loss of future options.
Key Observation Point (KOP)	An observer position on a travel route used to determine visible area.
Landscape Features	The land and water forms, vegetation, and structures that compose the characteristic landscape.
Lifts	Changes in slopes on the faces of waste rock or heaps that are the result of constructing the dump or heap in a series of layers.
Lithic Scatter (Archaeology)	A discrete grouping of flakes of stone created as a byproduct in the tool-making process. Often includes flakes used as tools as well as formal stone tools, such as projectile points, knives, or scrapers.
Lithology	The description of the physical character of a rock, including mineral composition, grain size, color, and other physical characteristics.

Makeup Water	Water needed to supplement water removed by milling or processing ore and losses to evaporation.
Mantle	The zone of the earth below the crust and above the core with a transition zone between.
Maximum Modification	A visual quality objective that allows activities that alter the vegetation and landform to dominate the original characteristic landscape with some limitations.
Mine Rock	Non-ore rock that is extracted to gain access to ore. It contains no ore metals, or contains ore metals at levels below the economic cutoff value, and must be removed to recover the ore.
Mineralization	The process by which a valuable mineral or minerals are introduced into a rock.
Mitigate, Mitigation	To cause to become less severe or harmful; actions to avoid, minimize, rectify, reduce or eliminate, and compensate for impacts to environmental resources.
Modification	A visual quality objective in which man's activity may dominate the characteristic landscape, but should appear as a natural occurrence when viewed as background.
Monitor	To systematically and repeatedly watch, observe, or measure environmental conditions in order to track changes.
Multiple Use	The concepts under which the National Forest System lands are administered that involve managing resources in combinations that will best serve the public.
Native Species	Plants that originated in the area in which they are found, i.e., they naturally occur in that area.
National Environmental Policy Act (NEPA)	The national charter for protecting the environment. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Regulations from 40 CFR 1500-1508 implement the act.
National Pollutant Discharge Elimination System (NPDES)	A part of the CWA, that requires point source dischargers to obtain permits. These permits are referred to as NPDES permits and are administered by the U. S. Environmental Protection Agency (EPA).
National Register of Historic Places (NRHP)	A list, maintained by the National Park Service, of areas that have been designated as being of historical significance.
Nutrients	Essential chemicals needed by plants or animals for growth and health. If other physical and chemical conditions are optimal, excessive amounts of nutrients can lead to degradation of water quality by promoting excessive growth, accumulation, and subsequent decay of plants, especially algae. Some nutrients can be toxic to animals in high concentrations.
Ore	A deposit of rock from which a valuable mineral or minerals can be economically extracted.

Paleozoic	Span of time from the end of the Precambrian to the beginning of the Mesozoic, ranging from approximately 570 million to 250 million years ago.
Partial Pit Backfill	Placing waste rock in a mined-out pit to less than the capacity of the pit.
Partial Retention	A visual quality objective in which man's activities may be evident, but must remain subordinate to the characteristic landscape.
Patent	A document conveying title to land from the U. S. Government to private ownership.
Patented Claims	Private land that has been secured from the U. S. Government by compliance with laws relating to such lands.
Peak Flow	The greatest flow attained during melting of winter snowpack or during a large precipitation event.
Perennial Stream	A stream or reach of a stream that flows throughout the year.
Permeable	The property or capacity of a porous rock, sediment, or soil to transmit a liquid.
pH	The measure of the acidity or basicity of a solution.
Plan of Operations	As required by 36 CFR 228.4: Operators submit plans of operation outlines to the U. S. Forest Service that include the name and address of the operator; location of the proposed area of operation; and information sufficient to describe the type of operation proposed, the type and stands of roads, the means of transportation to be used, the period when the proposal will take place, and measures to be taken to meet the requirements for environmental protection.
Porosity	The voids or openings in a rock. Porosity may be expressed quantitatively as the ratio of the volume of openings in a rock to the total volume of the rock.
Potentiometric Surface	A surface that represents the total head in an aquifer; that is, it represents the height above a datum plane at which the water level stands in tightly cased wells that penetrate the aquifer.
Precambrian	Approximately 90 percent of geologic time more than 2.5 billion years old; precedes Paleozoic.
Pregnant Leach Solution	Solutions derived from the leaching process that contain dissolved metals.
Probable Maximum Flood (PMF)	The largest flood resulting directly from the probable maximum precipitation event for which there is any reasonable expectancy in this climatic era.
Probable Maximum Precipitation (PMP)	The theoretically greatest depth of precipitation for a given duration that is physically possible over a particular drainage basin at a particular time of year.
Project Alternatives	Alternatives to the proposed project developed through the NEPA process.
Raptor	A bird of prey (e.g., eagle, hawk, falcon, and owl).

Reclamation	Taking measures, where practicable, to prevent or control damage to surface resources by restoring and/or revegetating the land to meet postmining land use goals.
Recontouring	Restoration of the natural topographic contours by reclamation measures, particularly in reference to roads.
Recreation Opportunity Spectrum (ROS)	The land classification system that categorizes land by its setting and the probable recreation experiences and activities it affords.
Reserves	Identified resources of mineral-bearing rock from which the mineral can be extracted profitably with existing technology and under present economic conditions.
Resources (geologic)	Reserves plus all other mineral deposits that may eventually become available—either known deposits that are not yet recoverable at present, or unknown deposits that may be inferred to exist but have not yet been discovered.
Retention	A visual quality objective that generally means man's activities should not be evident to the casual forest visitor.
Right-of-Way	Strip of land or corridor over which a power line, access road, or maintenance road would pass.
Riparian	Situated on or pertaining to the bank of a river, stream, or other body of water. Riparian is normally used to refer to plants of all types that grow along streams, rivers, or at spring and seep sites.
Runoff	That part of precipitation that appears in surface streams; precipitation that is not retained on the site where it falls and is not absorbed by the soil.
Sediment	Material suspended in or settling to the bottom of a liquid. Sediment input comes from natural sources, such as soil erosion, rock weathering, anthropogenic sources, such as forest or agricultural practices, or construction activities.
Sediment Load	The amount of sediment (sand, silt, and fine particles) carried by a stream or river.
Seismicity	The likelihood of an area being subject to earthquakes; the phenomenon of earth movements.
Sensitive Receptors	Activities or land uses that are more susceptible than others to noise interference.
Shaft	An underground vertical passage sunk into an orebody or near an orebody, generally on the footwall side.
Significant	As used in NEPA determination of significance, requires consideration of both context and intensity. Context means that the significance of an action must be analyzed in several contexts, such as society as a whole, and the affected region, interests, and locality. Intensity refers to the severity of impacts (40 CFR 1508.27).
Solvent Extraction	The processing of the pregnant leach solution to produce raffinate and copper-loaded organic.

Species	A group of individuals of common ancestry that closely resemble each other structurally and physiologically, and in nature interbreed producing fertile offspring.
Stratification	The layered structure of sedimentary rocks.
Stratigraphy	Form, arrangement, geographic distribution, chronologic succession, classification, and relationships of rock strata.
Sub-grade (leach pad liner design)	Prepared foundation for the geomembrane component of a leach pad liner.
Sub-grade (ore)	Ore from which minerals cannot be extracted profitably with existing technology and under present economic conditions.
Substation	A facility in an electrical transmission system with the capacity to route and control electrical power and to transform power to a higher or lower voltage.
Tertiary	Span of time between 65 and 3 to 2 million years ago.
Threatened Species	Any species of plant or animal that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
Total Dissolved Solids (TDS)	Total amount of dissolved material, organic or inorganic, contained in a sample of water.
Total Suspended Solids (TSS)	Amount of undissolved particles suspended in liquid.
Traditional Cultural Properties (TCPs)	A property that is eligible for inclusion in the NRHP because of its association with cultural practices or beliefs of a living community that (a) are rooted in that community's history and (b) are important in maintaining the continuing cultural identity of the community.
Transmissivity	The rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of an aquifer under a unit hydraulic gradient. It equals the hydraulic conductivity multiplied by the aquifer thickness.
Tunnel	A relatively level underground passage through a mountain with two openings.
Visual Quality Objective (VQO)	A desired level of excellence based on the physical and sociological characteristics of an area; refers to degree of acceptable alteration of the characteristic landscape.
Visual Resource	The composite of basic terrain, geologic features, water features, vegetation patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for viewers.
Water Table	The level in the saturated zone at which the pressure is equal to the atmospheric pressure.

Waters of the U.S.

A jurisdictional term from Section 404 of the CWA referring to all navigable waters: all interstate waters, including interstate wetlands; all other waters; including lakes, rivers, streams, mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, and natural ponds; all tributaries of waters; and all adjacent wetlands to waters. The use, degradation, or destruction of these waters could affect interstate or foreign commerce.

Watershed

The geographic region from which water drains into a particular stream, river, or body of water. A watershed includes hills, lowlands, and the body of water into which the land drains. Watershed boundaries are defined by the ridges or divides separating them.

Weir

An overflow structure built across an open channel, usually to measure the rate of water flow.

Wetlands

Areas that are inundated by surface or ground water with a frequency sufficient to support (and under normal circumstances do or would support) a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. The criteria for determining wetland boundaries are in the 1987 U.S. Army Corps of Engineers *Wetland Delineation Manual*. Impacts to wetlands are regulated by the U.S. Army Corps of Engineers.

9.0 INDEX

9.0 Index

APPENDIX A

CLEAN WATER ACT SECTION 404(b)(1) ALTERNATIVES ANALYSIS

APPENDIX A

CLEAN WATER ACT SECTION 404(b)(1) ALTERNATIVES ANALYSIS

Prepared By:
CARLOTA COPPER COMPANY

This appendix to the Carlota Copper Project Environmental Impact Statement (EIS) is intended to supplement the alternatives presented in Sections 2.2.1, Alternatives Considered in Detail, and 2.2.2, Alternatives Eliminated from Detailed Consideration, of the EIS in compliance with the needs of the Clean Water Act (CWA) Section 404(b)(1) guidelines, which require an analysis of the alternatives to Carlota's proposed action related to Section 404 issues. This alternatives analysis identifies practical and reasonable alternative locations and methods that have been analyzed relative to the potential impact to waters of the U.S., including wetlands. The U.S. Environmental Protection Agency (EPA) regulations implementing the Section 404 (b)(1) guidelines are found at 40 CFR 230. These regulations require that the least environmentally damaging, most practicable alternative in light of cost, existing technology, and logistics considering the overall project purpose be permitted. The following alternatives analysis addresses these factors.

Regulations in 33 CFR Chapter 2, Section 320.4, the U.S. Army Corps of Engineers (COE) regulations covering Section 404 permits, assume that for a private enterprise, appropriate economic evaluations have been completed by the applicant to assure itself that the project is both economically viable and needed in the marketplace. These internal analyses have been completed by Carlota but are not included in the following alternatives analysis as it is not intended to demonstrate the viability of the project. In addition, a purpose and need statement for the project, in compliance with the COE and EPA requirements, was developed in September 1994 and is included in the EIS and the Section 404 Permit.

As agreed to in several preliminary meetings between the Carlota Copper Company and both the COE and the EPA, this alternatives analysis addresses the following four major areas:

- Other oxide copper projects in Arizona
- Larger scale project at the Carlota site
- Smaller scale project at the Carlota site
- Alternative locations to the proposed project facilities on the Carlota site

These alternative facility sites are addressed, for the most part, in the body of the EIS, primarily in Sections 2.2.1 and 2.2.2. In the following alternatives discussion, unless additional information is required to meet the Section 404 Permit requirements, only a brief summary of the alternative facility is presented here, and the reader is directed to the specific section in the EIS for further details on this alternative.

1.0 Other Oxide Copper Projects in Arizona

Carlota's objective as a mining company is to locate and acquire properties in the United States containing commercially-viable copper deposits amenable to heap leaching and solvent extraction/electrowinning (SX/EW) technology and to operate those properties by mining, processing, and selling the copper. Commercial viability is determined by a variety of factors, including, but not limited to, ore grade; ore reserves; access to the deposit; topography; price and terms of the acquisition; copper prices; environmental considerations; susceptibility to different mining and processing technologies; availability, if any, of existing infrastructure; availability, if any, of a local and skilled workforce; and market conditions. The weight placed on each of these and other factors varies from mining company to mining company based upon such individual company characteristics as the size and assets of the mining company, the mining and processing technologies employed by the mining company, how the specific characteristics of a given copper property fit into the portfolio of properties already owned and/or operated by the mining company, and the location of a given copper property relative to other copper properties already owned and/or operated by the mining company.

The market of commercially viable copper properties available for acquisition in the United States is finite and small, particularly when compared to the number of mining companies competing for such properties. Very few of the copper properties located and explored by the industry contain deposits that may be feasibly developed. The competition for properties among copper mining companies arises by virtue of the fact that a mining company can only grow and lower its costs through the acquisition of properties, which allows the company to build ore reserves and produce increasingly large volumes of copper economically and at a competitive price. The production of copper at a competitive price is critical to the competitive success of mining companies because the market for copper, a commodity, is itself highly competitive and subject to wide fluctuations in price.

At the time the Carlota deposit was acquired in 1989, Carlota's predecessor-in-interest, Westmont Mining Inc. (Westmont), had evaluated 20 potential copper deposits. None of those deposits, other than the Carlota deposit, met the criteria established by the company for developing a commercially viable oxide copper deposit amenable to SX/EW technology. Indeed, most of the deposits evaluated contained an insignificant and uneconomic ore deposit.

In 1987, Westmont was a small company with no copper properties and limited funds available for property acquisition and development. The company initiated a plan to acquire one or more domestic properties containing an oxide copper deposit that would be amenable to a relatively new hydrometallurgical technology known as heap leaching by an SX/EW recovery process, which significantly lowers the costs associated with processing low-grade, oxidized copper ore. Given the prevailing low copper price throughout much of the 1980s, this new technology provided the impetus for the acquisition and development of new copper mines or redevelopment of existing copper mines, particularly in the states of Arizona and New Mexico. Preliminary evaluation criteria used by Westmont for the screening and ranking of properties included locating non-exploratory copper properties containing a defined mineral resource or mineable reserve and an orebody of predominately copper oxide-type mineralization grading ranging from 0.3 to 0.8 percent total copper, available at relatively low waste-to-ore ratios, and capable of producing at least 20 to 30 million pounds per year of copper for at least 10 years. Additionally, the deposit was required to have relatively low sulfuric acid consumption rates, favorable metallurgy, mineralogy that favored copper recovery using SX/EW methods, and minimal potential for adverse environmental disturbance associated with project development. Potential copper properties requiring initial exploration work were not evaluated by Westmont during the late 1980s primarily because the company's goal was to expedite its entry into the copper producing market by acquiring a defined copper deposit.

After having identified the financial and technical parameters for achieving its goal, Westmont identified approximately 20 oxide copper deposits in Arizona and New Mexico controlled by individuals or small companies (i.e., properties not held by large, established copper producers and, thus, not available for sale or joint venture), that were thought to have the potential to satisfy the company's minimum criteria for acquisition. Westmont conducted a literature review and site visit of all 20 properties and documented its evaluation of each property pursuant to the company's criteria for acquisition. The information collected and evaluated by Westmont about these properties is extensive and is included in materials submitted to the COE and the EPA by the company in 1995. The information submitted includes geologic, economic, and other data about each property, including information about whether the property satisfied Westmont's criteria for acquisition. Because much of the information submitted to the agencies has been determined to be confidential business information, it is not described in detail here.

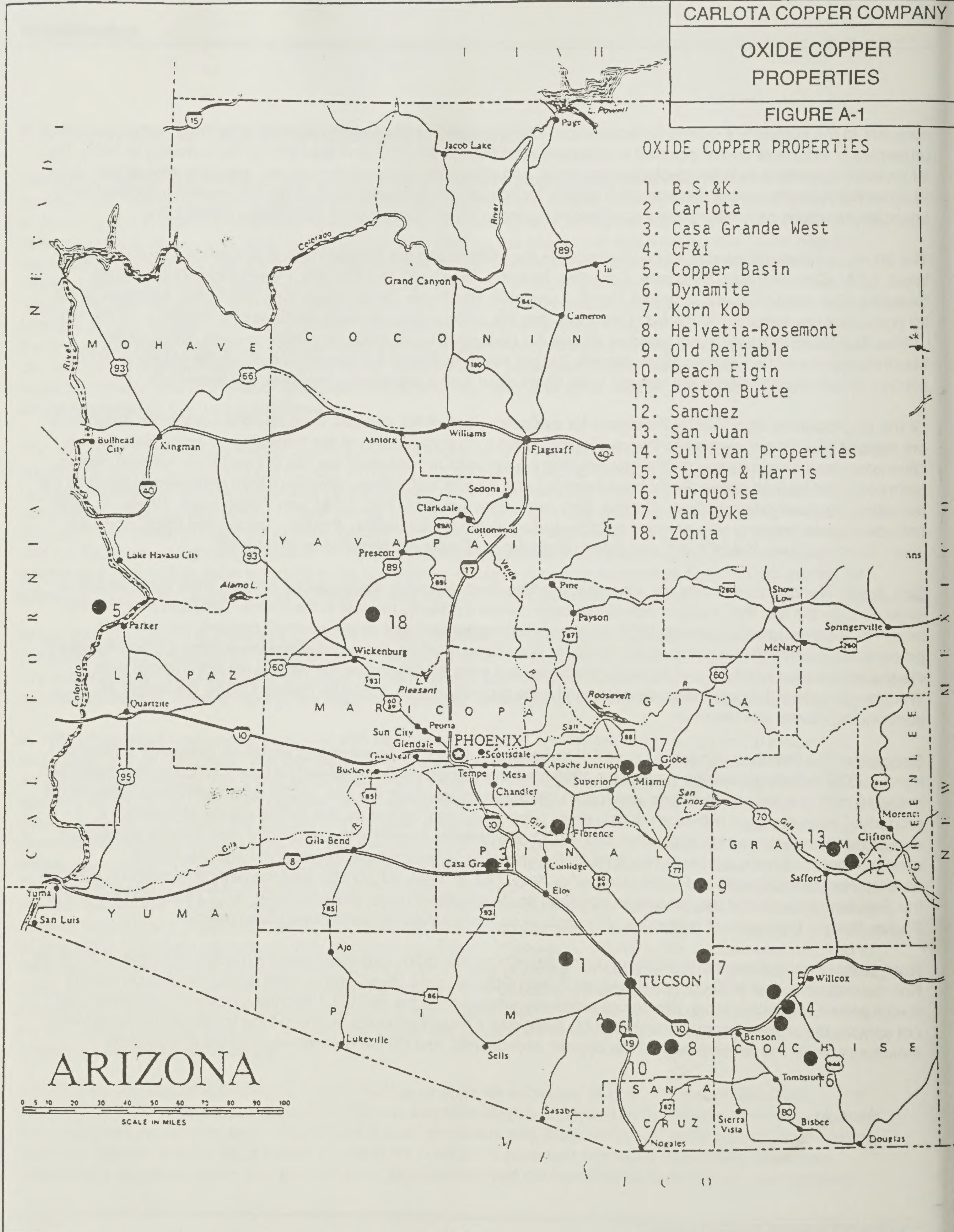
The 20 copper deposits evaluated by Westmont in the 1988 timeframe included B.S. & K, Carlota, Casa Grande West, CF&I, Copper Basin, Dynamite, Korn Kob, Helvetia-Rosemont, Old Reliable, Peach Elgin, Poston Butte, Sanchez, San Juan, Sullivan, Strong & Harris, Turquoise, Van Dyke, Zonia, MacArthur, and Vekol. Eighteen of the 20 properties are listed in *Figure A-1*. This figure lists the oxide copper deposits evaluated by Westmont in the late 1980s. The Vekol property is not listed on *Figure A-1* because it is not an oxide copper deposit. Although the MacArthur deposit is an oxide copper deposit, it is not listed on *Figure A-1* primarily because the property did not contain an ore deposit significant enough to be given more than a preliminary evaluation by Westmont.

Of the 20 properties identified by Westmont for evaluation, half of the deposits were found to contain an insignificant ore deposit that did not warrant further evaluation. Upon further evaluation of the remaining 10 properties, 4 were eliminated from consideration on the grounds that the deposits necessitated the use of new in situ solution mining technology rather than conventional heap-leaching and SX/EW technology. Westmont then narrowed its focus to the remaining six open-pit properties: Carlota, San Juan, Sanchez, Korn Kob, CF&I, and Peach Elgin. Finally, in 1989, only the Carlota property was deemed suitable and available for acquisition. For the reasons that follow, the San Juan, Sanchez, Korn Kob, CF & I, and Peach Elgin deposits were not acquired by Westmont.

San Juan: Negotiations to acquire, via lease, the San Juan deposit in south-central Arizona were complicated, in large part, by the fact that multiple individuals each owned a minority interest in the claims. Although negotiations began in 1988 and continued until 1992, an acquisition agreement was never reached, primarily because the property did not satisfy the company's criteria for acquisition. Further, the negotiations were complicated because of the multiple parties involved and because the terms and price demanded by the owners did not comport with Westmont's criteria for acquisition. Subsequently, the property was acquired by Phelps Dodge, the owner of surrounding claims and deposits.

Sanchez: The Sanchez deposit is located near Safford, Arizona, at the southeast end of an extensive mineralized trend. AZCO initially leased the property in 1988 after the Inspiration Consolidated Copper Company had expended over $10 million in extensive drilling and metallurgical investigations at the site. AZCO drilled additional holes on the property. Taken together with other drilling data collected by prior operators, the drilling results established a significant mineable reserve. Westmont and AZCO attempted to negotiate the terms of a joint venture agreement between them but were unable to reach mutually agreeable terms because the reserves and the cost of development did not justify the terms demanded by AZCO. In 1994, AZCO obtained the permits required to develop the Sanchez property but was unable to complete its development plans. Subsequently, AZCO sold the property to Phelps Dodge, the owner of numerous other copper deposits along the same mineralized trend.

Korn Kob: Previous exploration drilling during the 1960s and 1970s had established a modest resource at the Korn Kob deposit northeast of Tucson, Arizona, on Forest Service lands. Beginning in 1988 and continuing on and off over a period of several years, Westmont continued evaluation of the deposit. Ultimately, however, Westmont did not acquire the property primarily because (1) there was a limited potential to expand the known resource, (2) the metallurgy made the development of the deposit uneconomic, and (3) the deposit was located in a national



CARLOTA COPPER COMPANY

OXIDE COPPER PROPERTIES

FIGURE A-1

forest and beneath a perennial stream or water of the U.S., which would have required a more extensive and difficult stream diversion than that required for the Carlota project.

Peach-Elgin: The Peach-Elgin property is part of the larger Helvetia-Rosemont property package, which was originally assembled and owned by Anaconda. Anaconda and previous operators of the property had defined mineral resources present at Peach-Elgin and the larger Helvetia-Rosemont deposit. In 1988, Westmont ceased consideration of the property after it had determined that the Peach-Elgin deposit had inferior metallurgy that would require high acid consumption. Further, the property was highly visible from Green Valley, Arizona, a retirement community. Subsequently, a competing copper company acquired the entire land holdings of Anaconda in the area.

CF & I: The CF & I deposit was ultimately determined to be too deep for profitable open-pit operations. In addition, the deposit was located under a rail line, and production of the deposit would have required high acid consumption. For these reasons, Westmont eliminated this property from consideration.

These properties are the only properties evaluated by Westmont that had the potential to serve as alternatives to the Carlota deposit. However, for the reasons summarized above and described much more extensively in Carlota's confidential submissions to the agencies, these properties did not satisfy the minimum criteria Westmont had established for acquiring a property in the late 1980s.

After the Carlota deposit was acquired by Westmont in 1989, Westmont was bought by Cambior U.S.A., Inc., and Westmont changed its name to Carlota. In 1991, while development and permitting efforts at the Carlota deposit were underway, Carlota continued to investigate additional properties in order to expand the company's presence in the copper market and to complement its existing Carlota deposit holding. The additional properties evaluated by Carlota were not intended by the company to replace the Carlota Copper Project, but rather to add to the company's portfolio to provide a long-term potential to positively affect the company's economies of scale in the production of copper. The properties evaluated by Carlota included the Continental Mine, Lisbon Valley, Zonia, Poston Butte, White Mesa, and Ann Mason. These properties were evaluated after acquisition of the Carlota deposit as a means to expand the company's property holdings and long-term operations, not as alternatives to the Carlota Copper Project. However, the company's evaluations of the properties are nonetheless described below. Most of the properties contained insignificant and uneconomic ore deposits that did not meet the company's criteria for acquisition, and other of the properties were acquired by Carlota's competitors and were unavailable to Carlota. Carlota did not acquire any of these properties, with the exception of staking, and subsequently abandoning, claims on the Ann Mason property.

Continental Mine: In 1991, Carlota was notified by Cobre Mining Company that it had recently acquired the assets of Continental Copper Corporation, the owner of the Continental mine and mill complex in southwestern New Mexico. Cobre Mining intended to place the property back into production and was interested in exchanging an interest in the property for the financing required to resume production. Negotiations ensued for several months, but Carlota and Cobre Mining were unable to agree on terms that met Carlota's criteria for acquisition, including Carlota's requirement that it serve as the mine operator rather than a passive investor. Cobre Mining subsequently obtained financing through banks and has placed the property into production at a rate of approximately 75 million pounds of copper per year.

Lisbon Valley: The Lisbon Valley copper deposit, located in east-central Utah, was first evaluated by Carlota in 1991. Based on the available data largely developed by previous operators, Carlota determined that the Lisbon Valley deposit did not meet its acquisition criteria and was uneconomic for future development due to high stripping ratios, low copper grade, the size of the mineralized resource, poor metallurgy, and numerous legal and land complications, including relatively high royalty rates. The property was subsequently acquired by a competing company that has pursued permitting of its project and has announced plans for future development.

__Zonia__: The Zonia deposit is located in Yavapi County in central Arizona and underlies federal lands administered by the Bureau of Land Management as well as patented mining claims. This property has been subject to extensive past mining activities, and a significant amount of drilling has defined a modest mineable reserve. Evaluation of the data available during 1992 encouraged Carlota to approach the owner of the property regarding a possible option to purchase or a lease agreement. A competing copper company submitted a proposal to the owner similar to Carlota's proposal and ultimately defeated Carlota in its bid for the property, largely because the owner considered it a plus that Carlota's competitor operated other copper mines. The competing company acquired the property in 1993 and has announced plans to develop the mine in the near future.

__Poston Butte__: In 1993, Carlota became interested in acquiring the Poston Butte copper deposit from Conoco. Conoco had spent several million dollars performing extensive drilling, metallurgical investigations, and engineering on the project during the 1970s, but had deferred project development pending an increase in copper prices. A competitor copper company was already negotiating to acquire the property when Carlota submitted its offer. Conoco preferred to deal with only one company at a time and ultimately sold the property to the competitor company. The competitor company announced plans to develop the property in 1995 through the use of in situ mining methods.

__White Mesa__: In 1994, the lessee of the White Mesa copper deposit, located on the Navajo Indian Reservation in northeastern Arizona, approached Carlota regarding its possible interest in a joint venture development of the White Mesa property. Prior drilling on the property had defined a copper resource that, combined with other positive metallurgical information, suggested the property was marginally economic under favorable acquisition terms. Negotiations with the lessee of the property were initiated, and a formal offer was made subject to the re-negotiation of the terms of the lease with the Navajo Tribe. The existing terms of the lease were unacceptable to Carlota because of an exceedingly high royalty and onerous back-in provisions, which provided the Tribe with the right to acquire a 40 percent ownership interest in the project at no cost to the Tribe. These provisions rendered the property uneconomic to Carlota, if maintained. The Tribe was not willing to re-negotiate the agreement, and Carlota dropped its interest in acquiring the property in 1995.

__Ann Mason__: The Ann Mason property is located in west-central Nevada. Carlota had located claims on the property covering a shallow, relatively oxidized portion of a large porphyry copper deposit. Geologic mapping and sampling of available drill results and metallurgical investigations were performed over a 2-year period. However, Carlota's evaluation of the data indicated that the property was too small and too low in grade, with the copper mineralization present mostly as non-leachable sulfides not amenable to SX/EW recovery, for Carlota to justify further evaluation of the property. Carlota abandoned its claims to the deposit in 1993.

Subsequently, in 1993, it became apparent that the majority of copper deposits potentially meeting Carlota's criteria for acquisition--primarily the requirement that copper deposits have defined resources or reserves--had either already been evaluated by Carlota or had been acquired by a competitor copper company. As such, emphasis shifted toward acquiring less advanced or exploration stage copper properties. Because of this change, a higher emphasis was placed on the perceived size potential of the property as well as very preliminary indications as to metallurgy, mineralogy, environmental issues, and acquisition costs. Properties examined under these revised criteria included Suizo, Shakespeare, Little Hills, Coppercrete, North Star, and Red Hills. The information about these properties was primarily obtained from Cambior Exploration U.S.A., Inc., a wholly-owned subsidiary of Cambior U.S.A., Inc. which, although a sister company of Carlota, is a separate and distinct legal entity. None of these properties had adequate mineral resources to justify further development; therefore, Carlota never acquired an interest in any of these properties. However, for a short time, Cambior Exploration U.S.A., Inc. owned property interests in the Suizo, Shakespeare, Little Hills, and Coppercrete properties that facilitated its exploration activities at the sites. At this time, neither Cambior Exploration U.S.A., Inc. nor Carlota own these properties.

__Suizo__: The rights to explore the Suizo property were obtained by Cambior Exploration U.S.A., Inc. in 1993 after reconnaissance efforts identified small copper-bearing outcrops within an area of gravel cover. Cambior Exploration

U.S.A., Inc. evaluated the property by conducting soil sampling, geophysics, and trenching. Carlota reviewed the data about the property and found that, while surface work produced encouraging results, the subsequent drilling program failed to intercept any significant copper mineralization. Carlota did not acquire the property, and Cambior Exploration U.S.A., Inc. subsequently terminated its ownership interest in the property.

Shakespeare: The Shakespeare property was acquired by Cambior Exploration U.S.A., Inc. in 1993 through a mining lease with the underlying owner. Detailed mapping, sampling, and regional geophysics suggested that the property held the potential to host a buried porphyry copper system. A drill program, which included seven reverse-circulation holes drilled for a total of 5,210 feet, was completed in 1994 and failed to identify any copper mineralization or any evidence of a shallow porphyry system. Cambior Exploration U.S.A., Inc. terminated its lease agreement and rights to the property after completing the drilling program.

Little Hills: The Little Hills property was acquired by Cambior Exploration U.S.A., Inc. in 1994 through an option to purchase agreement. The property was being explored for landscaping material, and the exploration revealed copper mineralization in a number of open cuts and small pits. Mineralization is hosted in a large structural zone, which mapping had traced on the surface for a distance of 1.5 miles. A drill program, consisting of 19 reverse-circulation holes and 8,440 feet, was conducted to determine the extent of the copper mineralization, with holes spaced along the entire strike of the system. While copper mineralization was seen in the drilling, the low grade and discontinuous nature of the mineralization did not allow for the definition of an economic ore reserve. Upon evaluation of the data, Carlota determined that the property did not satisfy its criteria for acquisition. Subsequently, the option agreement held by Cambior Exploration U.S.A., Inc. was terminated in 1995.

Coppercrete: The Coppercrete property was acquired by Cambior Exploration U.S.A., Inc. through staking in 1994 when a copper-bearing conglomerate unit was discovered in an area of alluvial cover. Early in 1995, holes totaling 1,660 feet were drilled under the mineralized outcrop, but failed to intersect any copper mineralization. Carlota reviewed the data and determined that the property did not satisfy its minimum criteria for acquisition. At the completion of the drill program, Cambior Exploration U.S.A., Inc. terminated its ownership interest in the property.

North Star: The North Star copper prospect was evaluated in 1994. While there was an interest in acquiring the property, land and title problems prevented Carlota from making an offer. North Star is surrounded by lands affected by a notice of realty action, withdrawing them from mineral location. In addition, the property has several liens against it, putting its title in question.

Red Hills: The Red Hills property was reviewed by Carlota in 1994. Several weeks were spent on the site mapping and sampling. Based on the work performed on the property and the available results, it was determined that there was not sufficient potential to develop an economically viable copper deposit.

2.0 Larger Scale Project on the Carlota Site

There is little potential for the Carlota Copper Project to expand much beyond the size of the currently proposed operation. Very little potential exists for the impacts to either the waters of the U.S. or wetlands to increase appreciably, if at all, from a larger scale project at the Carlota site. An increase in impacts related to Section 404 issues would mean an increase to the affected areas of waters of the U.S. and/or wetlands as a result of a larger scale operation. Additional waters of the U.S. and/or wetlands could be affected only if either the Carlota/Cactus pit or the leach pad expanded upstream or downstream into Pinto Creek or Powers Gulch, respectively. Because of the physical limits of the orebodies of the project as described below, this type of appreciable expansion is not likely.

Hypothetically, the affected areas in the bottom of both the Pinto Creek and Powers Gulch drainages could increase if the current limits of the Carlota/Cactus pit expanded, either aerially or by mining deeper to recover more ore. This increased ore tonnage could, hypothetically, result in an expansion to the size of the leach pad. Neither of these situations is the case, however.

The current ultimate limit of the Carlota/Cactus pit is controlled more by the physical limit of the orebody than by copper economics. Nearly all of the available mineable ore is currently contained within the proposed pit limits. In a typical copper orebody (which is an endemic deposit or exists at its place of origin), copper mineralization typically transitions from oxide copper minerals near the surface to sulfide copper minerals at depth. A rising copper price can result in more of this deeper sulfide ore becoming economic, which may result in an expanded pit. This is not the case with the Carlota/Cactus orebody. This orebody is an exotic deposit, i.e., it is located away from the place of origin of the mineralization. The Tertiary Cactus breccia is the primary ore-rock type in the Carlota/Cactus pit in terms of volume. The breccia appears to be of sedimentary origin and likely represents either an ancient subaerial landslide deposit or the remnant of the basal slide plane of the Cactus breccia along the Cactus fault. The fragments and the copper mineralization in the breccia are believed to have originated in the primary copper orebody located east of the Carlota project site.

The three faults in the pit area—the North fault, Kelly fault on the west, and Cactus fault on the south and east sides of the pit—define the limits of the Cactus orebody and the contained copper mineralization. The proposed mineable pit limits would result in the recovery of nearly all of the available mineable ore, including up to the limits of the Cactus and Kelly faults and most of the North fault. There is additional ore in the bottom of the pit, which could become economic if copper prices were to rise in the future, but most of this ore would be accessible from the currently designed pit bottom without the need to expand the pit limits.

The Eder pits would not directly affect waters of the U.S. or any wetland areas. An increase in the ore mined from these pits could, theoretically, have an indirect effect on waters of the U.S. by requiring a larger leach pad. However, there is very little potential for any appreciable increase in the amount of ore mined from these pits. The Eder pits have the lowest average copper grades of the pits on the property, and the orientation of the mineralized zones in these pits precludes a large expansion of the mineable ore.

The Eder pits are located on the west side of Powers Gulch, and the steep terrain increases the strip ratio (mine rock:ore) dramatically as the pits are expanded to the west. The mineralized zones plunge downward into the hillside to the west, which increases the strip ratios in each pit even more. The increasing strip ratios, coupled with the lower economic value of the ore (because of its lower grade), will limit the expansion of the Eder pits, even if there is a significant increase in the price of copper.

Considering the physical limits of the orebodies as described above, no more than a 10 percent increase over current mineable reserves, or a project total of approximately 110 million ore tons, would be reasonably expected in defining a "larger project."

There is also very little potential for expanded impacts to either the waters of the U.S. or wetlands from a larger leach pad in Powers Gulch. If the project's mineable reserves did, hypothetically, expand by the amount described above, the proposed leach pad could handle the additional tonnage in three ways without increasing the impact to waters of the U.S. or wetlands. First, the current design limits of the pad have additional capacity, added as a contingency factor, to handle most of a 10 percent increase in reserves. Second, there is additional room at the top of the existing pad for more ore. Third, there is additional expansion room in some areas along the side of the pad to accommodate additional ore. In summary, the pad would not expand upstream or downstream to impact additional waters of the U.S. or wetlands.

3.0 Smaller-Scale Project on the Carlota Site

Two separate smaller-scale project alternatives were analyzed to determine if a scaled-down project could be identified that was both economically viable and had fewer impacts to waters of the U.S. The first alternative considered which portion of the three Carlota ore bodies could be mined to eliminate or minimize the impacts to waters of the U.S. This alternative is identified as the small project in the following sections.

The small project was found to be uneconomic, which led to the investigation of a second smaller-scale project alternative. This alternative, which is identified as the intermediate project, involved finding a logical portion of the project ore bodies that could be mined to meet Carlota's minimum economic requirements. Impacts to waters of the U.S. were then analyzed for this alternative.

The Small Project: It would be possible to mine a portion of the ore in the eastern part of the Carlota/Cactus pit without having to relocate Pinto Creek. Mining this smaller pit, along with the two Eder pits (which do not impact waters of the U.S.), would comprise a smaller-scale project and would result in the mining of approximately 40 million tons of ore. This small project was evaluated under two operating scenarios--one that took advantage of the same economies of scale that exist in Carlota's proposed action by mining at the same 7-million-ton annual rate and using the same size mining equipment, and a second scenario that attempted to decrease project capital by mining ore at a lower 5-million-ton annual rate and using smaller mining equipment.

This alternative would reduce the impacts to waters of the U.S. to approximately 2.18 acres, all due to the leach pad in Powers Gulch. Impacts to approximately 6.94 acres of waters of the U.S. and 0.34 acre of wetlands in Pinto Creek would be eliminated.

While this small project appears to be technically and logistically feasible, an economic evaluation of these scenarios showed that in both cases the project would be uneconomic, as described later in this section. The unit operating costs for both scenarios were either at or above the projected price of copper and left no additional income for a reasonable profit. The internal rates of return (IROR) for both scenarios were either negative (-2.3 percent) or just barely above zero (1.0 percent). One of the scenarios did not even pay back the capital investment of the project, and the second scenario barely paid back the investment by the last year of the project; both conditions would be unacceptable.

The fact that this small project was not economic was well documented by Carlota's preliminary economic evaluations. The project's mineable reserves were increased through additional development drilling from 1992 to 1995, providing the basis for a larger-scale project with more favorable economics.

The Intermediate Project: The intermediate project would involve mining the 80.8 million tons of ore available in the Carlota/Cactus pit. The ore in this pit is the highest-grade ore on the project and would result in the best project economics assuming all three of the ore bodies were not developed. The lower grade Eder North and Eder South ore bodies, which are mined essentially at the end of the project in the proposed action, would be left unmined.

Because of the technical deficiencies associated with the other on-site leach pad alternative locations presented in Sections 2.2.1.2 and 2.2.2.3 of the EIS (i.e., the Eder side-hill, on top of waste dumps, etc.), the 80.8 million tons of ore to be mined in the intermediate case were sited in the valley-fill leach pad in Powers Gulch. The only portion of the watershed in the area of the leach pad that is designated waters of the U.S. is the main axis of Powers Gulch itself; the smaller side drainages are not designated. The intermediate project's leach pad footprint in the main drainage of Powers Gulch would remain essentially unchanged compared with the proposed action; the only change would be that the top elevation of the heap would decrease from approximately 4,250 feet amsl to 4,100 feet amsl. The area of impacted waters of the U.S. with this alternative would be unchanged from that of the proposed action (approximately 9.12 acres). This area includes 6.94 acres for the pit in Pinto Creek and 2.18 acres in Powers Gulch for the leach pad. The impacted area in Powers Gulch would be unchanged because the location of the main leach pad embankment and the location and gradient requirements of the main diversion channel would determine the amount of waters of the U.S. that would be affected. These parameters would remain unchanged in the intermediate project to maintain geotechnically and geomorphicly favorable conditions for the facility.

This intermediate project would be technically and logistically feasible; however, an economic evaluation of this case generated results (an IROR of 7.5 percent) that did not meet Carlota's minimum economic requirements. Because the intermediate alternative would impact the same area of waters of the U.S. as the proposed action and would not sustain economic viability, no additional alternate-sized projects were evaluated. From the standpoint of the smaller-project analysis required for the Section 404 permit, development of the full proposed project and recovery of the full mineral resource is justified because there are no smaller-scale projects that could result in fewer impacts to waters of the U.S. and maintain economic viability.

3.1 Description of the Smaller_Project Alternatives

3.1.1 The Small Project

With respect to the open pits, the small project would mine the same Eder pits presented in Carlota's proposed action and Phase I of the Carlota/Cactus pit. In Carlota's proposed action, the Carlota/Cactus pit contains the largest orebody on the property--approximately 81 percent of the mineable reserves. It would be oriented in a southeast-northwest direction and would span Pinto Creek. It would be developed in five mining phases, starting in the southeast portion of the pit and moving to the northwest.

With the small project alternative, only the first phase of mining would be completed in the Carlota/Cactus pit. The extent of this pit is presented in *Figure A-2*. The limits of this pit would lie to the east and north of Pinto Creek, and the creek would have to be relocated. This scenario would still require the same two temporary or life-of-mine crossings of Pinto Creek as needed in the proposed action--one for the main haul road from the pit to the primary crusher and main mine rock area (temporary) and the second for the mine access road (life-of-mine), which would carry small vehicle and service traffic from the main gate down to Pinto Creek and up to the mine truck shop and the SX/EW process area.

Table A-1 presents a comparison of the physical dimensions of the Carlota/Cactus pit for the small project compared to the Carlota/Cactus pit in the proposed action.

Table A-2 presents the mineable reserves from all three pits for the small project alternative. With this alternative, the Carlota/Cactus pit would contain only approximately one-half of the mineable ore from the project, and the resulting total mineable reserve of 40.3 million tons would represent a loss of approximately 60 percent of the resource that could be recovered if the Carlota/Cactus pit were fully developed through the total five phases. In addition, there is an even sharper drop in the amount of pounds of copper recovered. Most of the higher-grade mineralization in the Carlota/Cactus orebody is located at the lower elevations of the pit, and this higher grade ore would not be accessible if Pinto Creek were not relocated around the pit. In the smaller pit alternative, the average grade of the ore drops by 20 percent. This reduction in grade, coupled with the dramatic reduction in tons of mineable ore, would result in only 264 million pounds of copper being recovered compared to approximately 900 million pounds for the proposed action. This decrease in recovered copper would represent a 70 percent loss of the mineral resource compared to the recoverable copper available with the proposed action.

Table A-1. Comparison of Carlota/Cactus Pit Parameters for the Small Project Alternatives Versus the Proposed Action

Carlota/Cactus Pit Parameters	Small Project Pit	Intermediate Project	Proposed Action
Number of Mining Phases	1	5	5
Approximate Pit Area (footprint plus 100-ft buffer)	113 acres	290 acres	290 acres
Approximate Surface Dimension	3,000 ft L x 1,700 ft W	5,000 ft L x 3,200 ft W	5,000 ft L x 3,200 ft W
Approximate Pit Depth	3,200 ft elev (325 ft below Pinto Creek)	2,840 ft elev (685 ft below Pinto Creek)	2,840 ft elev (685 ft below Pinto Creek)
Carlota/Cactus Pit Reserves			
Mineable Ore Tons	20.8 million	80.8 million	80.8 million
Approximate Recoverable Copper (lb)	161 million	690 million	690 million
Total Project Reserves			
Mineable Ore tons	40.3 million	80.8 million	100.3 million
Approximate Recoverable Copper (lb)	264 million	690 million	900 million

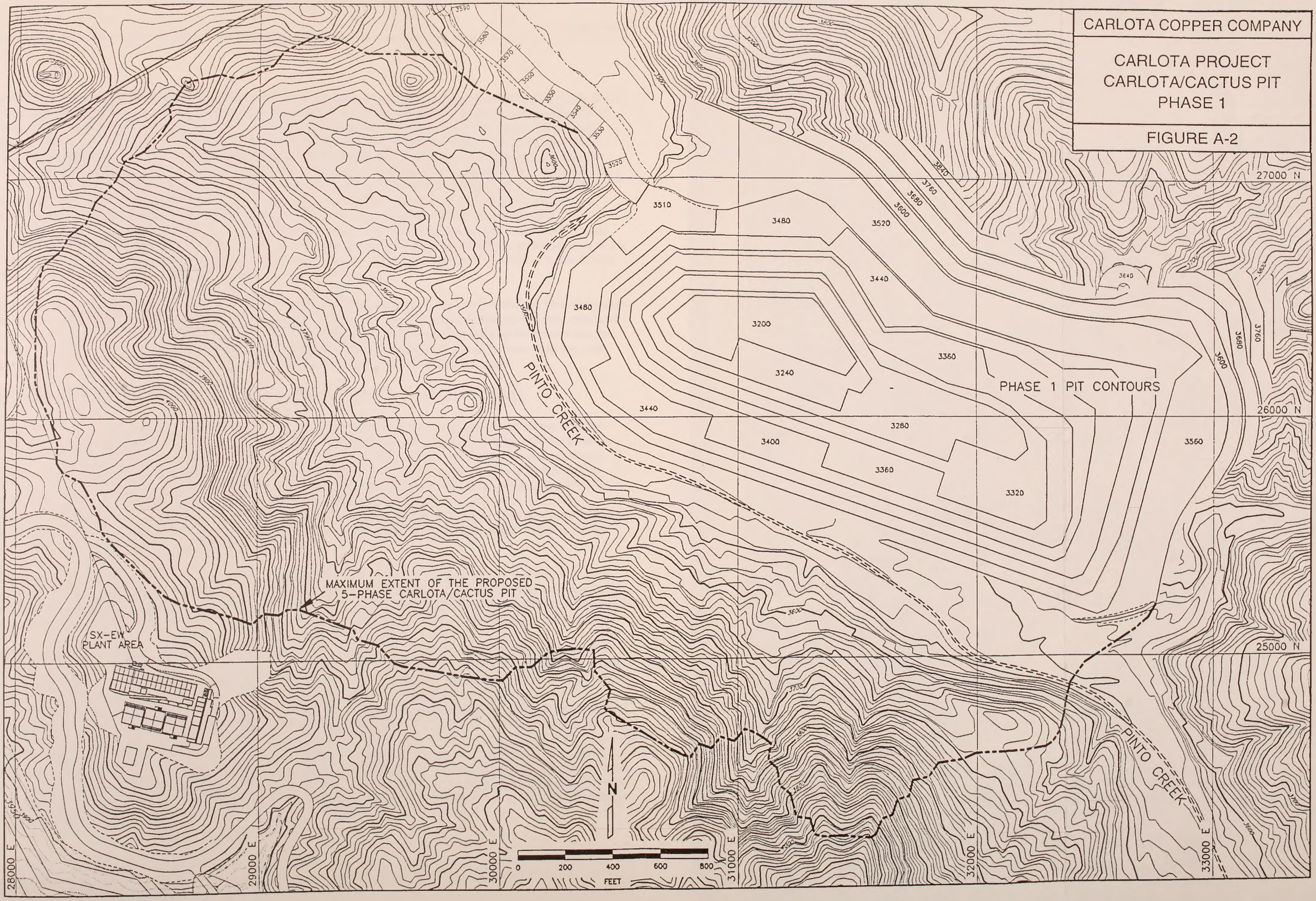
Table A-2. Mineable Reserve Summary for the Small Project Alternatives

	Ore (kton)	Mine Rock (kton)	Strip Ratio (mine rock:ore)
Carlota/Cactus Phase I	20,800	47,000	2.3:1
Eder South	16,300	11,400	0.7:1
Eder North	3,200	6,200	1.9:1
TOTAL	40,300	65,400	1.6:1

3.1.2 The Intermediate Project

If an intermediate project, whose size falls between the full proposed project and the small project (with its minimized impacts to waters of the U.S.) described in Section 3.1.1 above, were to be selected, the logical break point would be to mine the ore in the Carlota/Cactus pit and leave the Eder North and Eder South pits undeveloped. The ore in the Carlota/Cactus pit has a higher average grade than the ore in either of the Eder pits, and the large pit would allow more efficient operation of the mining equipment. All five mining phases proposed for the Carlota/Cactus pit would be developed, and the ultimate footprint and depth of the pit would be the same as the proposed action (see *Figure 2-3* in Chapter 2). Because this alternative would mine the entire Carlota/Cactus pit, the project's primary orebody, the mining rate was left unchanged from the 7 million tons ore/year for the proposed action.

Table A-1 presents the pit parameters and mineable reserves for the intermediate project. The intermediate project would mine approximately 80.8 million tons of ore, which is approximately 81 percent of the total of the proposed action. Because of the higher average grade of the ore in this alternative compared with the small project alternative, a proportionally larger portion of the mineral resource could be recovered with the intermediate project -- approximately 690 million pounds of copper, approximately 77 percent of the total produced by the proposed action. In comparison, the small project would recover only approximately 30 percent of the resource of the proposed action.


CARLOTA COPPER COMPANY
CARLOTA PROJECT
CARLOTA/CACTUS PIT
PHASE 1
FIGURE A-2
PHASE 1 PIT CONTOURS
MAXIMUM EXTENT OF THE PROPOSED
5-PHASE CARLOTA/CACTUS PIT
SX-EW
PLANT AREA
PINTO CREEK
PINTO CREEK
27000 N
26000 N
25000 N
28000 E
29000 E
30000 E
31000 E
32000 E
33000 E
N
0
200
400
600
800
FEET

Selection of the intermediate project, however, would not decrease the project's impact to waters of the U.S. These impacts would remain the same as with the proposed action -- a total of 0.34 acre of wetlands and a total of 9.12 acres of waters of the U.S. (6.94 acres in Pinto Creek and 2.18 acres in Powers Gulch). A valley-fill leach pad location in Powers Gulch (same as the proposed action) is the only viable site because of the same technical deficiencies (leach-pad and heap slope stability, subgrade differential settlement, etc.) and ore storage volume limitations associated with the leach pad alternate sites described in Sections 2.2.1.2 and 2.2.2.3. This leach pad location is based on a siting analysis performed by Knight Piésold LLC for the 80.8 million tons of ore identified in the intermediate alternative. Knight Piésold was directed to investigate the best approach to place the ore in a valley-fill pad in Powers Gulch to minimize impacts to waters of the U.S. Knight Piésold looked at heap arrangements other than the selected footprint of the main pad from the proposed action and concluded that the main leach pad, as proposed, is the preferred and more environmentally sound location. Other arrangements of the heap were either technologically impractical or resulted in increased impacts to waters of the U.S. or both. Knight Piésold's letter report of its investigations is presented as Attachment 2.

Given the reduced ore volume of the intermediate project, the North leach pad could be eliminated. The elimination of the North leach pad would be the best way to minimize the overall disturbance and would require only one leach pad embankment and PLS pond to be constructed and operated, thus minimizing the potential for environmental impacts. However, removing the North pad does not decrease impacts to waters of the U.S. since only the main axis of Powers Gulch was designated as waters of the U.S. and not any of the side drainages.

3.2 Technical and Logistical Evaluation of the Smaller Project Alternatives

Both of the smaller-scale project alternatives would be technically feasible and would rely on the same logistics network that is currently in place in the Miami-Globe area. The major change to project features with the small project would be downsizing the Carlota/Cactus pit. With the intermediate project, the Carlota/Cactus pit would remain the same size as in the proposed action, and the Eder pits would not be mined. All of the same project facilities described in the proposed action--the administration area, the mine truck shop/warehouse, the SX/EW plant, Pinto Creek well field and pipeline, and other support facilities--would be used in both smaller-scale alternatives. With the small project, some facilities might be downsized because of the shorter project life or the smaller annual volumes of either ore or total material moved. For the intermediate project, these facilities would remain unchanged from those of the proposed action.

The heap-leach pad would also decrease in size because of the reduction in mineable reserves associated with both alternatives. The reduction would be more noticeable with the small project, as the North leach pad would be eliminated and the Main leach pad would decrease in area. With the intermediate project, the North leach pad would also be eliminated; the Main leach pad would not decrease in area, but would be constructed to a lower height.

For the economic evaluation, which is described in the next section (3.3), it was assumed the leach pad would remain a valley-fill structure in the bottom of Powers Gulch for both of the alternatives. This assumption was made for two reasons. First, an alternative location for the leach pad that would remove the pad from the main drainage of Powers Gulch was evaluated and rejected in the EIS (see the evaluation of the Eder Side-hill Leach Pad alternative). Additional leach pad locations were eliminated from detailed consideration for environmental, technical, and/or economic reasons. While these alternative locations would remove the pad from the main drainage, they all had more stability and other technical problems than the proposed action, which was selected by the Forest Service as the agency preferred alternative. Second, all of the alternatives with a leach pad located outside of the valley bottom have construction costs that are 50 to 60 percent higher than the valley-fill leach pad of the proposed action. Since the economic evaluation of the smaller project alternatives resulted in an uneconomic project using the lower-cost valley-fill leach pad, adding the more expensive side-hill leach pad scenario would make the economic viability of such alternatives that much worse.

The evaluation of both alternatives assumed the use of both the primary crusher, located directly north of the mouth of the Carlota/Cactus pit, and the overland conveyor to transport ore to the Powers Gulch leach pad. While this would be the most efficient way to transport ore and results in lower operating costs, the reduced project reserves in the small project alternative may not be large enough to justify the higher capital cost of the overland conveyor. If these reserves are not large enough to justify an overland conveyor, the ore would have to be trucked up and over the ridge to the leach pad site, which would result in higher operating costs and greater air quality impacts during operation. The overland conveyor would be used with the intermediate project.

3.3 Economic Evaluation of the Smaller Project Alternatives

3.3.1 The Small Project

Two separate cases were investigated for the economic evaluation of this alternative. In the proposed action, mining and processing equipment were selected to optimize the various unit operations and to take advantage of the economies of scale by using larger mining equipment, both of which result in lower unit operating costs. The SX plant was designed near the optimum level for its particular layout and for leach solution flowrate.

The first case used in the evaluation of the small project attempted to maintain the same economies of scale by continuing to mine ore at a nominal 7-million-tons-per-year rate and maintaining the same throughput through the SX/EW process facilities as the proposed action. The intent was to maximize the annual project income, within reasonable limits dictated by the equipment proposed, in order to pay back the capital invested in the project as soon as possible, resulting in a more profitable project. In this scenario, mining at approximately 7 million tons of ore per year, the mine life is approximately 6 years. The total material movement would average approximately 17.6 million tons per year.

The second scenario attempted to lower the annual production rate in order to reduce the capital requirements for the project. In this scenario, ore production was reduced to 5 million tons per year, which resulted in a mine life of approximately 8 years. Total material movement dropped to an average of 13.2 million tons per year. In comparison, the proposed action would mine an average of 7 million tons of ore per year, total material movement would average approximately 20.6 million tons per year, and a total mining life would be approximately 15 years.

In both cases, project capital requirements were scaled down from the levels developed for the proposed action based on industry accepted scale factors. Mining equipment capital was reduced based on the ratio of annual total material movement. Capital costs for the leach pad were reduced by the ratio of the total ore tonnage. Capital costs for the SX/EW plant were reduced by the ratio of the amount of the annual copper production.

A summary of the project economics for both cases of the small project alternative is presented in *Table A-3*. Analysis of the economics revealed the following points, all of which verify that the alternative is uneconomic:

- The current development cost of the project is approximately $24 million. When this cost is spread over the available pounds of recoverable copper, the unit development cost more than triples, from $0.027 per pound of copper to $0.091 per pound in comparing the small project alternative to the proposed action. The increased development unit cost associated with the small project alternative is nearly 10 percent of the current selling price of copper and is unacceptable for a viable project.

Table A-3. Summary of Project Economics for Small Project Alternatives

	Small Project		Intermediate Project	Proposed Action
	6-Year Mine Life	8-Year Mine Life		
Total Recoverable Copper (lb x 10^6)	264	264	690	900
Average Ore Mining Rate (kton/yr)	7,000	5,000	7,000	7,000
Average Total Material Movement (kton/yr)	17,600	13,200	22,700	20,600
Total Project Capital ($000)	134,000	120,000	148,000	162,000
Development Unit Cost ($/lb Cu) (Current Cost = $24 million)	0.091	0.091	0.035	0.027
Operation Costs ($/lb Cu) - Cash Cost - Total Cost	 0.69 1.12	 0.71 1.06	 0.57 0.83	[1]
Internal Rate of Return (%)	-2.3	1.0	7.5	[1]
Project Payback Period (yr)	Does not pay back investment	7.7	7	[1]

[1]Carlota confidential business information

- Total operating costs for both cases of the alternative, which include all cash operating costs and the cost of capital, are over $1.00 per pound of copper and are either at or above the projected price of copper.

- The internal rate of return of a project is a standard for measuring the viability of the project. It measures the ability of the income from the project to repay the capital investment and to provide a reasonable return on that investment. Both cases of the small project alternative not only do not meet the company's minimum rate of return guidelines, but also barely repay, if at all, the capital investment. The 6-year mine life case has a negative rate of return and does not pay back the investment. The 8-year mine life case has an approximately 1 percent rate of return and would pay back the capital investment after 7.7 years of operation. A project payback period this long on an 8-year project life is unacceptable.

3.3.2 The Intermediate Project

The economic analysis of the intermediate project was based on mining approximately 7 million tons of ore/year. Total mine life was approximately 11 years with copper being produced from the heap and process plant for an additional year. The total material moved averaged approximately 22.7 million tons/year. Comparable economic parameters for the intermediate project are presented in *Table A-3.*

The intermediate project, as depicted in *Table A-3*, is not an economically viable project and thus cannot be considered as a practical alternative to the proposed project. Further, the intermediate project does not reduce the impacts to wetlands or waters of the U.S.

4.0 Alternative Locations for the Proposed Facilities on the Carlota Project Site

As part of the alternatives analysis presented in the EIS, alternative locations for project facilities were analyzed. The analyses of these alternative locations address the requirement of the CWA Section 404(b)(1) guidelines to investigate alternative locations for facilities that would impact waters of the U.S., including wetlands. For the proposed action, these facilities are the proposed Carlota/Cactus pit and the proposed leach pad. The project alternatives are described in Sections 2.2.1 and 2.2.2 of the EIS. Rather than duplicate the descriptions here for the areas that relate to the Section 404 issues, the particular alternative locations are identified here with a short summary, as appropriate, and the specific sections in the EIS are referenced for further detail on the particular alternatives. It should also be noted that none of the alternative locations listed below were selected by the Forest Service as the agency preferred alternative.

The alternative locations comprise two major groups: (1) alternatives to the Carlota/Cactus open pit, and (2) leach pad alternatives. The EIS groups alternatives within each group in two categories: (1) alternatives that were evaluated in detail, and (2) alternatives initially analyzed but eliminated from detailed evaluation.

4.1 Alternatives to the Carlota/Cactus Open Pit

Because the Carlota/Cactus orebody itself spans Pinto Creek, there are no alternate locations to this project feature. However, two alternative extraction methods were identified but were eliminated from detailed evaluation. The first method was underground mining, which is discussed in Section 2.2.2.1 and was determined to be technically and economically infeasible for mining the Carlota orebody.

The second alternative extraction method identified was in situ leaching where the ore is leached in place by injecting and recovering acid solutions. This alternative is described in Section 2.2.2.2 of the EIS. This in situ leaching method would apply as an alternative to both the open-pit mine and the heap-leach pad in Powers Gulch, because the ore would not be physically removed from the orebody. This method was deemed environmentally infeasible for the Carlota/Cactus orebody primarily because of the hydrogeologic conditions of the site. The presence of several fault and fracture zones, as well as groundwater resources in the ore zone, would result in an inability to control the solutions to be injected. Leach solutions would likely be lost with no reasonable means of recovery.

4.2 Leach Pad Alternatives

The proposed action comprises a valley-fill leach pad located in Powers Gulch. The primary alternative leach pad location, which was evaluated in detail, is the Eder side-hill leach pad. This alternative is described in Section 2.2.1.2 and is analyzed in Chapter 3 of the EIS. This alternative would eliminate the need for a Powers Gulch diversion and would minimize the direct disturbance of the main drainage of Powers Gulch, which is the primary component of the waters of the U.S. in Powers Gulch. The configuration of this alternative would require the construction of two separate leach pads on the side-hill slopes on either side of the main drainage of Powers Gulch. The leach pad on the west side would be located between the Eder North and Eder South open pits, and would require the relocation of the Eder mine rock area to the south of the Eder South pit. This alternative would also require the construction of two extensive toe berms—one along each side of Powers Gulch—to stabilize the heap and accommodate internal solution storage.

Significant engineering design disadvantages exist with this alternative, rendering it environmentally and economically infeasible. These disadvantages include a decrease in the slope stability and related factors of safety, a significant increase in the complexity of solution management and protection of leach solution pond integrity, and a significant increase in the construction costs of the facility. The environmental impacts of this alternative are analyzed for individual resources in Chapter 3 of the EIS.

The leach pad alternatives described below were initially considered but were eliminated from detailed evaluation. These alternatives were eliminated because of their environmental, technical, and economic infeasibility; they are specifically described in Section 2.2.2.3 of the EIS. Based on discussions with other federal agencies, it was suggested that five additional sites be evaluated in the FEIS. Several of these additional sites were in or near the general areas that had been previously identified as alternative sites, while one was in an area not previously evaluated. In the following discussion, these five additional sites are identified as Sites 1 through 5 (see *Figure 2-20* in Chapter 2).

Leach Pad and Main Mine Rock Disposal Area Switch (Site A): This alternative would entail placing the mine rock currently proposed for the Main ~~mine rock area in and around Powers Gulch and~~ building the heap-leach pads in the steeper drainages where the Main mine rock area is now proposed. In this scenario, leached ore would not be placed directly in Powers Gulch; however, the leach pad would be placed above the Powers Gulch and Pinto Creek drainages. The primary reasons for eliminating this alternative from further consideration were poor slope stability and steep slopes.

Two Small Leach Pads (Site B): This alternative would entail using two smaller pads that would be located in an area southeast of the Carlota/Cactus pit and just north of U.S. Highway 60 in the Pinto Creek drainage. Numerous engineering, economic, and environmental disadvantages eliminated this alternative from further consideration.

Existing BHP Copper Pinto Valley Tailings Impoundment (Site C): This alternative would entail placing the heap-leach pad on the existing Pinto Valley Cottonwood tailings impoundment located east of the Carlota/Cactus pit. This alternative was deemed infeasible because of poor slope stability conditions, the significant risk of losing liner integrity and containment because of differential settlement of the tailings under the load of heap ore, and the risk of a catastrophic failure of the system caused by liquefaction of the tailings base under seismic loading. In addition to the information contained in Section 2.2.2.3 of the EIS, see Attachment 1 at the end of this Appendix for additional technical information prepared by Knight Piésold and Company relative to the infeasibility of this alternative.

Knight Piésold also made initial estimates of the volume of Carlota ore that could be placed on the top of the Cottonwood tailings pond and found the site would hold only approximately 20 percent of the total volume of Carlota ore. The Cottonwood tailings site is smaller than Carlota's proposed leach pad site; less than 200 acres compared with over 300 acres, respectively. Additionally, because of the presence of either the BHP Copper Pinto Valley facilities or the main access road on three sides of the site, and adverse terrain on the fourth side, an ore heap on the tailings pile would have to slope away from the edge of the leach pad on all sides. This configuration would dramatically reduce the available storage volume. This reduction in volume would be compounded further by the need to set the edge of the leach pond back from the edge of the access road and BHP Copper facilities and the need to construct a containment berm for collecting leach solutions. For this preliminary volume estimate, Knight Piésold used the same overall leach pad side slope (2.5H:1V) and maximum leach pad height (300 feet) that were used in the design of the proposed leach pad. Assuming the tailings base would be less stable than the bedrock beneath the proposed leach pad in Powers Gulch, the slope would likely be flatter and the maximum height lower, which would also result in less ore storage capacity.

Proposed Main Mine Rock Area (Site A): This alternative would entail placing the leach pad on top of mine rock in an area that is proposed as the Main mine rock area. This alternative was eliminated from further consideration for a number of reasons, including inadequate storage volume for the ore, lack of integrity of the pad foundation and liner system because of the potential for differential settling of the mine rock material, and greater visual impacts with the leach pad being placed above the horizon on the Main mine rock area. In addition, excess mine rock, which would no longer fit in the proposed location, would have to be placed in a different location, resulting in no decrease in disturbed acres.

Sites West of the Eder Ridge (Including Sites 3 and 4): This alternative would entail constructing the heap-leach pad in an area approximately 1 to 1.5 miles west of the proposed leach pad location. This area is still within the Powers Gulch drainage, but it is to the west of the dacite ridge that forms the western edge of the Eder pit area (the Eder ridge). Site 3 is in the Mule Spring drainage, and Site 4 is in the next drainage north of Mule Spring. The surface of this entire area is within the Apache Leap dacite lithologic unit, which does not provide a suitable leach pad foundation, nor does it produce suitable subgrade material. The primary engineering and environmental reasons for eliminating this alternative from further consideration were steep slopes with resulting poor slope stability, lack of suitable subgrade material, the potential for greater impacts to the threatened Arizona hedgehog cactus than with the proposed site, and the potential for greater impacts to waters of the U.S. (including the wetlands in Mule Spring) than with the proposed site. Secondary environmental reasons included the potential for greater air quality, visibility, and visual impacts to the Superstition Wilderness than with the proposed site.

Fifty Dollar Spring Drainage (Site 5): This alternative would entail the construction of the heap-leach pad in an area approximately 2 miles north-northwest of the proposed leach pad location, north of Haunted Canyon and directly west of Carlota's proposed well field. The small basin is the drainage for Fifty Dollar Spring and is a tributary to Pinto Creek. The surface of this area is also within the Apache Leap dacite lithologic unit. The primary engineering and environmental reasons for eliminating this alternative from further consideration were steep slopes with resulting poor slope stability, lack of suitable subgrade material, the potential for greater impacts to the threatened Arizona hedgehog cactus than with the proposed site, and the potential for greater impacts to waters of the U.S. (because of the proximity to Pinto Creek) than with the proposed site. Secondary environmental reasons included the potential for greater air quality, visibility, noise, and visual impacts to the Superstition Wilderness than with the proposed site.

Sites in Upper Powers Gulch (Area D): This alternative considered sites farther up the drainage from the proposed heap location, and would entail constructing the heap-leach pad in the upper portion of the Powers Gulch watershed, just north of U.S. Highway 60. The surface of this area is within the Schultze granite lithologic unit, which does not provide a suitable leach-pad foundation, nor does it produce suitable subgrade material. The primary engineering and environmental reasons for eliminating this alternative from further consideration were steep slopes with resulting poor slope stability; lack of suitable subgrade material; and the potential for greater impacts to the threatened Arizona hedgehog cactus than with the proposed site. Secondary environmental reasons included the increased visual impacts to residents of the Top-of-the-World community and from viewpoints along Highway 60, and the potential for greater air quality and noise impacts to residents of Top-of-the-World than with the proposed site.

Sites Upstream in Pinto Creek Drainage (Including Sites 1 and 2): This area is similar in characteristics to the area described for the Sites in Upper Powers Gulch alternative, except all of the potential sites in this area would be in direct tributaries to Pinto Creek. The area is approximately 2 to 3 miles east of the proposed Carlota leach pad and south and east of Pinto Valley Mine's Cottonwood tailings pond. The surface of this area is within the Schultze granite lithologic unit, which does not provide a suitable leach pad foundation, nor does it produce suitable subgrade material. The Schultze granite is documented cactus habitat. The primary engineering and environmental reasons for eliminating this alternative from further consideration were steep slopes with resulting poor slope stability, lack of suitable subgrade material, the potential for greater impacts to waters of the U.S. (because of the proximity to Pinto Creek), and the potential for greater impacts to the threatened Arizona hedgehog cactus than with the proposed site. Secondary environmental reasons included the potentially increased visual impacts to residents of Top-of-the-World (with Site 2) and from viewpoints along Highway 60, and the potential for greater air quality and noise impacts to residents of Top-of-the-World (with Site 2) than with the proposed site.

Sites East of the Carlota-Cactus Pit (Area E): This alternative would entail constructing the heap-leach pad in areas directly east of the Carlota project site, primarily on lands owned or controlled by the BHP Copper Company. The primary reasons for eliminating this alternative from further consideration were the potential for greater impacts to waters of the U.S. in both Pinto Creek and Miller Spring (which contains wetlands) compared with the proposed site, and the fact that the area is owned by another company and is part of its operations plan.

5.0 Conclusion

This appendix presents the various alternatives to the proposed Carlota Copper Project that were analyzed relative to Section 404 Permit issues. The primary Carlota project features investigated were the proposed Carlota/Cactus pit in Pinto Creek and the proposed leach pad in Powers Gulch.

The alternative that reduces the size of the Carlota/Cactus pit to the point where impacts to waters of the U.S. are eliminated would result in an uneconomic project.

Alternatives to the proposed leach pad have been shown to be either technically infeasible to construct and operate or have a greater potential to impact waters of the U.S. in comparison to the proposed action.

In evaluating alternatives to the entire project, Carlota has evaluated and/or negotiated on at least 20 other oxide copper projects in the southwestern United States, and the Carlota project is the one project that has met the combination of requirements of availability, adequate ore reserves, favorable metallurgy, and favorable economics to reach the development stage.

This appendix also investigated both larger scale and smaller scale projects on the Carlota site that could potentially minimize impacts to waters of the U.S. and wetlands. With respect to the larger scale project, analyses showed the proposed action is close to the largest sized project anticipated, primarily because of the physical limits of the orebodies and the relative insensitivity of the expansion of the pit limits to an increase in copper price.

Two smaller-scale projects were analyzed. The first alternative, the small project, reduced impacts along Pinto Creek by mining only the first phase of five total mining phases proposed for the Carlota/Cactus pit. The two proposed Eder pits would also be mined in this alternative. This alternative would mine only 40 percent of the ore and recover only 30 percent of the copper available in the proposed action. Analysis of the alternative showed there would not be enough copper available to pay for the required capital investment, and the resulting project would be uneconomic.

A second smaller-scale alternative--the intermediate project--was analyzed and found to impact the same areas of waters of the U.S. and wetlands as the proposed action. Given that the smaller-scale projects were both determined to be uneconomic, and even the intermediate project, which provides the best potential for project-size reduction, does not result in a reduction in impacts to the waters of the U.S., development of the full proposed project is justified.

APPENDIX A

ATTACHMENT 1

Knight Piésold and Co.
CONSULTING ENGINEERS AND ENVIRONMENTAL SCIENTISTS

1050 Seventeenth Street, Suite 500
Denver, Colorado 80265-0500

Telephone (303) 629-8788
Telefax (303) 629-8789
YOUR REFERENCE 98-Regul.ltr
OUR REFERENCE 1198C

October 21, 1994

Carlota Copper Co.
8101 East Prentice Avenue
Suite 800
Englewood, Colorado 80111

Attention: Mr. Duane Bollig

Re: Carlota Copper Project
Support Information for Regulatory Submittals
for Alternative Heap Leach Siting at Existing
Cottonwood Tailing Facility

Gentlemen:

The U.S. Corps of Engineers (USCOE) has identified the Cottonwood tailing pond, currently owned by Magma Copper, as a potential alternative site for the proposed Carlota Copper heap leach facility currently sited in Powers Gulch. Siting a heap leach pad of this magnitude on top of a relatively unconsolidated tailing mass is virtually impossible. Since underdrainage was not part of the Cottonwood tailing facility design, the tailing is most likely saturated in the lower reaches. This, coupled with the relatively unconsolidated nature of the existing tailing, could result in liquefaction of the tailing mass during seismic loading. Such an occurrence would create large deformations within the existing tailing facility that would likely compromise the integrity of any liner system placed on top of the tailing. Due to the facility's proximity to Magma's access road, process solutions would likely be stored within the pad proper. In the event of liner damage, this would further complicate stability of the facility. The conditions cited above could result in large differential settlements and compromised liner systems, which could lead to catastrophic failure of the pad.

To assist potential stability of the heap leach pad sited on top of the existing Cottonwood tailing pond, a very rough slope stability analysis was performed. To look at general slope stability, the heap leach pad was set back 100 feet from the edge of the existing tailing pile, configured at a compound slope of 2.5:1 and stacked to an ultimate height of approximately 300 feet. With this configuration the static factor of safety is 0.962. Based on the assumed values for the existing tailing mass and subgrade materials, failure of the structure appears to be imminent. In addition, it should be noted that the phreatic surface within the heap leach pad has been maintained at a very low level within the heap. If the phreatic surface is allowed to rise within the heap leach pad, the factors of safety would likely reduce beyond that reported (see Figure 1).

Mr. Duane Bollig
Carlota Copper Co.

October 21, 1994

This apparent problem with slope stability, coupled with the fact that solutions are likely to be stored within the heap leach pad itself, which is located on top of the existing Cottonwood tailing facility, presents a scenario which could potentially be highly suspect.

In addition, preliminary volumetrics indicate that heap ore storage capacity on top of the Cottonwood tailing facility is less than 20 million tons. This constitutes less than 20 percent of the total minable ore reserve.

If there questions regarding this information, please contact this office at your earliest convenience.

Sincerely,

R. Michael Smith

R. Michael Smith, P.E.
Associate/Project Manager

RMS/ps/sb

TA K1 10-17-94 15:55

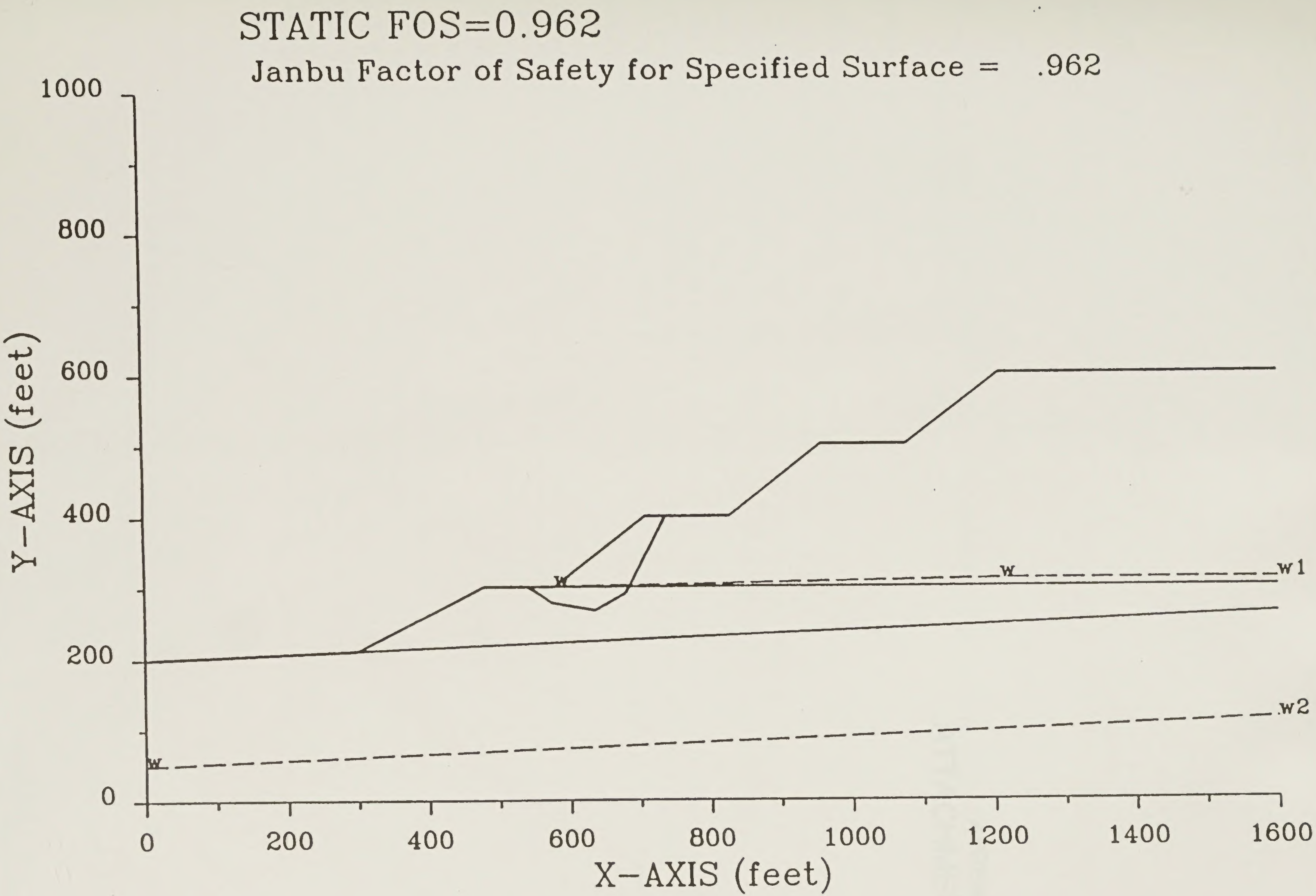


FIGURE 1

APPENDIX A
ATTACHMENT 2

Knight Piésold LLC
CONSULTING ENGINEERS AND ENVIRONMENTAL SCIENTISTS

1050 Seventeenth Street, Suite 500
Denver, Colorado 80265-0500

Telephone (303) 629-8788
Telefax (303) 629-8789

YOUR REFERENCE 1198C/D200
OUR REFERENCE USWater.Ltr

May 9, 1997

Carlota Copper Co.
8101 E. Prentice Ave., Suite 800
Englewood, Colorado 80111

Attention: Mr. Duane Bollig

Re: Carlota Copper Project; Evaluation of an Alternate Leach Pad Layout to Potentially Reduce Impact on Waters of the U.S.

Gentlemen:

Knight Piésold LLC (Knight Piésold) was commissioned by Carlota Copper Co. to evaluate smaller heap leach pad alternatives in the Powers Gulch drainage. The smaller heap leach pad (approximately 80 million tons) was evaluated within Powers Gulch to determine the best placement of this reduced ore volume. The proposed heap leach pad footprint and an alternate location upstream of the proposed configuration were analyzed to determine the relative impact to waters of the U.S. Figure 1 shows the 80-million-ton heap leach pad as it would appear on the proposed heap leach pad footprint, which, in our opinion, is the most efficient dam location. Figure 2 shows an 80-million-ton pad at an alternative site located upstream of the proposed location.

Upon review of the two layouts it is obvious that the existing footprint offers considerably less disturbance to waters of the U.S. than the next best location in Powers Gulch (see Figure 2). The relative impact to the waters of the U.S. is a function of dam location at the lower end of the pad, as well as the alignment and grade of the diversion channels. The location of the dam and its required size set the minimum channel outfall elevation, and the hydraulic design determines the alignment and grade requirements of the channel. With the outfall elevation fixed as a function of dam size and location, and the channel configuration prescribed by the design, the limits of the pad are fixed. This in turn drives the pad layout, which directly affects the relative impact to the waters of the U.S. The proposed layout shown in Figure 1 impacts approximately 6920 linear feet of the valley bottom considered to be waters of the U.S. The alternative layout, shown in Figure 2, impacts approximately 8040 linear feet of what would be considered waters of the U.S.

It should be noted that the configuration shown as the alternative in Figure 2 does not maintain minimum leach areas at the top of the pad. If the minimum leach areas are maintained, the length of disturbance would increase based on the need to elongate the pad to generate the area required. Elongation of the pad would likely be required since the topography, as you move upstream in Powers Gulch, is considerably steeper on the side slopes of the valley and less

Mr. Duane Bollig
Carlota Copper Co.

May 9, 1997

conducive to pad placement. The less favorable topography on the valley side slopes would require that the pad be maintained in the lower reaches of the valley, thereby requiring additional length. In addition, the alternative layout impacts substantially more sensitive species or cactus habitat than does the preferred layout.

It is Knight Piésold's opinion that the current proposed location of the terminal embankment is the most efficient from a storage capacity standpoint and will produce the least amount of impact to waters of the U.S. under either the full proposed action in the EIS or the reduced 80-million-ton case discussed herein.

If there are questions regarding this comparative evaluation, please contact this office at your earliest convenience.

Sincerely,

Dennis Hanneman for R. Michael Smith

R. Michael Smith, P.E.
Principal/Senior Project Manager

RMS:gm/ps
Enclosure

NOTE:

1. LENGTH OF WATER OF U.S. AFFECTED IS APPROXIMATELY 6920 FEET.
2. THE MAXIMUM ELEVATION OF THE PAD IS 4100 FEET.

CLIENT	CARLOTA COPPER COMPANY
PROJECT	CARLOTA COPPER PROJECT
TITLE	80 MILLION TON CASE WITHIN EXISTING FOOTPRINT

Knight Piésold LLC
CONSULTING ENGINEERS AND ENVIRONMENTAL SCIENTISTS

DESIGNED BY	DW	CHECKED BY		DATE	DRAWING No.	FIGURE No.	REV.
DRAWN BY	CCL	APPROVED BY		5/8/97	198M171A	1	A

NOTES:

1. LENGTH OF WATER OF U.S. AFFECTED IS APPROXIMATELY 8040 FEET.
2. IT IS ASSUMED THAT THE INLET CONTROL STRUCTURE IS APPROXIMATELY THE SAME CONFIGURATION.
3. THE MAXIMUM ELEVATION OF THE PAD IS 4200 FEET.

CLIENT	CARLOTA COPPER COMPANY
PROJECT	CARLOTA COPPER PROJECT
TITLE	80 MILLION TON CASE ALTERNATIVE FOOTPRINT

Knight Piésold LLC
CONSULTING ENGINEERS AND ENVIRONMENTAL SCIENTISTS

DESIGNED BY	DW	CHECKED BY		DATE	DRAWING No.	FIGURE No.	REV.
DRAWN BY	CCL	APPROVED BY		5/8/97	198M170A	2	A

XREF NO NA | PLOT SCALE 1=600

APPENDIX B

AIR QUALITY ANALYSES

B1

PLUVUE II Model Input Parameters

Table B1-1. PLUVUE II Model Input Parameters

Card No.	Format	Variables	Description	Input Value
5	F5.1	U	Wind speed (mph)	variable
	I5	I	Stability index	variable
	F5.2	ALAPSE	Ambient temperature lapse rate (°F/1000 ft)	-5.5 °F/1000 ft
6	I2	IUSFC	Index for height for U (=1 for 7 m, 0 for effective stack height)	1
7	F10.0	YINITL	Initial plume y-dimension for area source (m)	2,000 meters
	F10.0	ZINITL	Initial plume z-dimension for area source (m)	20 meters
8	F10.1	HPBLM	Mixing depth (m)	2,000 meters
9	F10.3	RH	Relative humidity (percent)	variable
10	I5	IDIS	Flag indicating diffusion parameters to be used for stability index I ("1" for TVA, "0" for Pasquill-Gifford-Turner values, "9" for user input values)	0
11	I2	IFLG1	Flag for optics calculation of horizontal views with sky background	1
	I2	IFLG2	Flag for optics calculation with nonhorizontal views and sky background	1
	I2	IFLG3	Flag for optics calculation for white, gray, and black background	1
	I2	IFLG4	Flag for optics calculation along the plume centerline	0
	I2	NX2	Index indicating the number of downwind distances desired (2 < NX2 < 16)	variable
	I2	NT1	Starting index for the scattering angles used in the generic calculation (set to 1 when executing only observed-based calculations)	1

Table B1-1. PLUVUE II Model Input Parameters (continued)

Card No.	Format	Variables	Description	Input Value
	I2	NT2	Ending index for the scattering angles used in the plume-based calculation (set to 7 when executing only observer-based calculations)	7
	I2	NZF	Index for the number of altitudes for visual impact calculations: "1" for plume centerline only, "2" for plume centerline and ground level downwind	1
	I2	NX3	Number of downwind points selected for optical size calculations (Recommended value is 0)	0
	I2	NX4	Number of downwind points selected for optical size calculations (Recommended value is 0)	0
	I2	NX5	Number of downwind points selected for optical size calculations (Recommended value is 0)	0
12	I2	IDILU	Switch for printout of table for initial plume rise data	0
	I2	I1HFAU	Number of hundred points to use in generating vertical scans (Recommended value is 0)	0
	I2	I1DFAU	Number of tens and units of points to use in generating vertical scans (Recommended value is 0)	0
	I2	I2FAU	Stepping interval for printout of vertical scan (Recommended value is 0)	0
	I2	I3FAU	Option to select individual channel plots (Recommended value is 0)	0
	I2	I4FAU	FORTRAN output unit number (Recommended value is 0)	0
13	8F10.0	DIST(1) I=1, NX2	Downwind distances for visibility impact calculations (2 < NX2 < 16) (2 cards for NX2 > 8)	variable
14	8F10.0	DIST(1)(cont.)		

Table B1-1. PLUVUE II Model Input Parameters (continued)

Card No.	Format	Variables	Description	Input Value	
15	F10.2	QSO2	Total SO_2 emissions rate from all stacks in tons per day	Original	Revised
				0.07[1]	0.03[4]
				0.08[2]	0.04[5]
				0.07[3]	0.03[6]
	F10.2	QNOX	Total No_x emission rate from all stacks in tons per day	Original	Revised
				2.81[1]	0.96[4]
				3.78[2]	1.93[5]
				2.8[3]	0.95[6]
	F10.2	QPART	Total primary particulate emissions rates from all stacks in tons per day	Original	Revised
				1.71[1]	0.29[4]
				1.72[2]	0.29[5]
				1.1[3]	0.21[6]
16	F10.1	FLOW	Flue gas flow rate (cfm) per stack	0.1 cfm	
	F10.1	FGTEMP	Flue gas exit temperature (°F)	variable	
	F10.1	FGO2	Flue gas oxygen concentration (mole percent) [3]	3 mole %	
	F10.2	WMAX	Flue gas stack exit velocity (m/s)	0.01 m/s	
17	F5.1	UNITS	Number of stacks	1	
	F5.1	HSTACK	Stack height (feet)	33 feet	
18	F10.1	TAMB	Ambient temperature (°F)	variable	
19	F10.3	AMBNOX	Ambient $[NO_x]$ in ppm [0]	0.003 ppm	
	F10.3	AMBNO2	Ambient $[NO_2]$ in ppm [0]	0.003 ppm	

Table B1-1. PLUVUE II Model Input Parameters (continued)

Card No.	Format	Variables	Description	Input Value
	F10.3	O3AMB	Ambient [O_3] in ppm [0.04]	0.04 ppm
	F10.3	AMBSO2	Ambient [SO_2] in ppm [0]	0.055 ppm
20	F10.3	ROVA	Mass median radius (μm) for background accumulation mode aerosol [0.16]	0.15 μm
	F10.3	ROVC	Mass median radius (μm) for background coarse mode aerosol [3.0]	3.0 μm
	F10.3	ROVS	Mass median radius (μm) for plume secondary aerosol [0.10]	0.10 μm
	F10.3	ROVP	Mass median radius (μm) of emitted primary particulate [1.0]	Original / Revised 2.83 μm[1] / 2.77 μm[4] 2.71 μm[2] / 2.07 μm[5] 2.65 μm[3] / 2.64 μm[6]
21	F10.3	SIGA	Geometric standard deviation of background accumulation mode aerosol radius [2.0]	2.0
	F10.3	SIGC	Geometric standard deviation of background coarse mode aerosol radius [2.2]	2.2
	F10.3	SIGS	Geometric standard deviation of plume secondary aerosol radius [2.0]	2
	F10.3	SIGP	Geometric standard deviation of plume primary aerosol radius [2.0]	2
22	F10.3	DENA	Particle density (g/cm^3) of background accumulation mode aerosol [1.5]	1.5 g/cm^3
	F10.3	DENC	Particle density (g/cm^3) of background coarse mode aerosol [2.5]	2.5 g/cm^3
	F10.3	DENS	Particle density (g/cm^3) of plume secondary aerosol [1.5]	1.5 g/cm^3
	F10.3	DENP	Particle density (g/cm^3) of emitted primary particulate [2.5]	2.5 g/cm^3

Table B1-1. PLUVUE II Model Input Parameters (continued)

Card No.	Format	Variables	Description	Input Value
23	F10.3	ROVCAR	Mass median radius (μm) for carbonaceous aerosol [0.05]	0.05 μm
	F10.3	SIGCAR	Geometric standard deviation of carbonaceous aerosol radius [2.0]	2.0
	F10.3	DENCAR	Particle density (g/cm^3) of carbonaceous aerosol [2.0]	2 g/cm^3
	F10.3	FRACTC	Carbonaceous aerosol fraction of plume primary aerosol [0.0]	Original / Revised 0.105[1] / 0.126[4] 0.144[2] / 0.350[2] 0.162[3] / 0.167[2]
	F10.3	AMBCAR	Background atmospheric carbonaceous aerosol (μg/m^3) [0.0]	0
24	F10.3	RFRSO4	Real part of index of refraction of accumulation mode aerosol [1.5]	1.5
	F10.3	RFISO4	Imaginary part of index of refraction for accumulation mode aerosol [0.0]	0.0
	F10.3	RFRCOR	Real part of index of refraction for background coarse mode aerosol [1.5]	1.5
	F10.3	RFICOR	Imaginary part of index of refraction for background coarse mode aerosol [0.0]	0.0
25	F10.3	RFRPRM	Real part of index of refraction for emitted primary aerosol [1.5]	1.5
	F10.3	RFIPRM	Imaginary part of index of refraction for emitted primary aerosol [0.0]	0.0
	F10.3	RFRCAR	Real part of index or refraction fro carbonaceous aerosol [2.0]	2.0
	F10.3	RFICAR	Imaginary part of index of refraction for carbonaceous aerosol [1.0]	1.0
26	F10.3	CORAMB	Ambient coarse mode aerosol concentration (μg/m^3)	11.7 μg/m^3

Table B1-1. PLUVUE II Model Input Parameters (continued)

Card No.	Format	Variables	Description	Input Value
27	I5	INTYP	Switch for next card (=1 for $AMBSO_4$ AND $AMBSO_3$, ≠ 1 for RVAMB)	2
28a (INITYP=1)	F10.3	AMBSO4	Ambient background sulfate mass concentration (μg/m^3)	-
	F10.3	AMBNO3	Ambient background nitrate mass concentration (μg/m^3)	-
28b (INITYP≠ 1)	F10.3	RVAMB	Ambient background visual range (km)	Best estimate for 90% background SVR for SWA (spring - 216 km; summer 192 km; Fall - 240 km; winter - 264 km)
29	F5.2	VDSO2	SO_2 deposition velocity (cm/sec) [1]	1.0 cm/sec
	F5.2	VDNOX	NO_x deposition velocity (cm/sec) [1]	0.5 cm/sec
	F5.2	VDCOR	Coarse mode aerosol deposition velocity (cm/sec) [0.1]	5.0 cm/sec
	F5.2	VDSUB	Accumulation mode aerosol deposition velocity (cm/sec) [0.1]	0.1 cm/sec
30	I5	ICON	Index for SO_2-to-$S0_4$ = conversion rate added to rate predicted from OH chemistry. ICON = 0 for conversion rate, set constant with distance from source. ICON = 1 for separate values for each point of analysis downwind of the source [0]	0
31	F10.7	RSO2C	Rate constant for SO_2-to-$S0_4$ = conversion to be added to prediction from OH chemistry (%/hr) [0.0]	1%
A-1** (If ICON=1)	8F10.7	RSO2(NX) NX = 1, 8	SO_2-to-$S0_4$ = conversion rates to be added to predictions from OH chemistry at each point of analysis on plume (%/hr)	
A-2** (CNT of A-1)	8F10.7	RSO2(NX), NX = 9, NX2	(Continuation as needed)	

Table B1-1. PLUVUE II Model Input Parameters (continued)

Card No.	Format	Variables	Description	Input Value
32	I5	NC1	Index to control type of calculations. NC1 = 1 for plume-based calculations, 2 for observer based calculations only	2
	I5	NC2	Index to control calculations NC2 = 1 for plume-based calculations only, 2 for observer-based calculations	2
A-3** (If NC1 = 1)	612	NPP	Indices for controlling the subset of results (from plume-based calculations of horizontal views with sky, white, gray and black backgrounds) to be written to a file for later use by the VISPLOT program for generating plots. NPP controls the distance from the observer to the plume for sky background [3]	-
		NTP	Index for selecting the scattering angle of plume-based data to be plotted	
		NZP	Index for selecting the level of the line of sight through the plume for plume-based data to be plotted [3]	
		I01P	Index for selecting the distance from the observer to the background object for the plume-based data to be plotted	
		IPP	Index for selecting the distance from the observer to the plume for plume-based plot data with background object views	
A-3** (If NC2 = 2)	F10.1	XOBS	UTM x-coordinate of observer position (km) for observer-based calculations	variable
	F10.1	YOBS	UTM y-coordinate of observer position (km)	variable
	F10.1	ZOBS	Elevation (ft MSL) of observer position	variable
33	F10.1	XSTACK	UTM x-coordinate of source (km)	500.8 km
	F10.1	YSTACK	UTM y-coordinate of source (km)	3,693.7 km
	F10.1	ZSTACK	Elevation of source location (ft MSL)	3,800 ft

Table B1-1. PLUVUE II Model Input Parameters (continued)

Card No.	Format	Variables	Description	Input Value
34	I5	IZONE	UTM grid zone number within which source is located	12
	I5	IMO	Number of month for date of simulation	variable
	I5	IDAY	Day of month for date of simulation	variable
	F5.0	TIME	Time of day (24-hr clock)	variable
	F5.0	TZONE	Time zone number	7
	I5	IYEAR	Year for date of simulation	1993
A-4** (If NC2 = 2)	8F10.1	TER (NX), NX = 1, 8	Elevation of terrain at the selected points downwind of the source along the plume trajectory (ft MSL) (for observer-based calculation)	variable
A-5** (If NC2 = 2)	8F10.1	TER (NX), NX = 9, NX2	(Continuation as needed)	variable
A-6** (If NC2 = 2)	8F10.1	ROBJCT (NAZ), NAZ = 1, 8	Distances in kilometers form observer to background terrain for observer azimuths of 15°, 30°, 45°, 60°, 75°, 90°, 105°, 120°	variable
A-7** 180°, (CNT of A-4)	8F10.1	ROBJCT(NAZ), NAZ = 9, 16	Distances for azimuths of 135°, 150°, 165°, 195°, 210°, 225°, 240°	variable
A-8** 300°, (CNT of A-5)	8F10.1	ROBJCT(NAZ), NAZ = 17, 24	Distances for azimuths of 255°, 270°, 285°, 315°, 330°, 345°, 360°	variable
A-9** (If NC2 = 2)	F10.1	WIND	Wind direction azimuth (degrees from North)	120°
A-10** (If IDIS = 9)	F5.1	SY	Dispersion parameters in meters	-
(If A-10** + NX2)	F5.1	SZ	One card for each distance	-

Table B1-1. PLUVUE II Model Input Parameters (continued)

Card No.	Format	Variables	Description	Input Value

**"A-n" refers to cards that are optional. They are inserted only when values of prior flags or indices are set to require additional input data, e.g., when ICON = 1, cards A-1 and A-2 are required.

[1] Emission rates based on maximum 24-hour emissions rates, excluding emergency generators, including particulate process emissions from ore processing sources (crushers and conveyors).

[2] Emission rates based on maximum 24-hour emissions, including emergency generators, excluding particulate process emissions from ore processing sources (crushers and conveyors).

[3] Emissions based on maximum annual emissions rates divided by 365 days, excluding emergency generators, including particulate process emissions ore processing sources (crushers and conveyors).

[4] Revised emission rates based on maximum 24-hour emissions rates, excluding emergency generators, including particulate process emissions from ore processing sources (crushers and conveyors) and additional mitigation measures.

[5] Revised emission rates based on maximum 24-hour emissions, including emergency generators, excluding particulate process emissions from ore processing sources (crushers and conveyors) and additional mitigation measures.

[6] Revised emissions based on maximum annual emissions rates divided by 365 days, excluding emergency generators, including particulate process emissions ore processing sources (crushers and conveyors) and additional mitigation measures.

B2

Summary of PLUVUE II Model Results

Table B2-1. Summary of PLUVUE II Model Results

Carlota Visibility Analysis - Primary Review

Model Scenario	Emission Inventory	Met. Condition	Total # of Valid Samples	# of Valid Samples > Threshold	% of Valid Samples > Threshold	# of Valid Samples > PC Threshold	# of Valid Samples > Delta E Threshold	# of Valid Samples > PC Threshold (sky bckgrd)	# of Valid Samples > PC Threshold (terrain bckgrd)	# of Valid Samples > Delta E Threshold (sky bckgrd)	# of Valid Samples > Delta E Threshold (terrain bckgrd)	Median % above PC Threshold	Median % above Delta E Threshold	Median % above PC Threshold (sky bckgrd)	Median % Above PC Threshold (terrain bckgrd)	Median % above Delta E Threshold (sky bckgrd)	Median % Above Delta E Threshold (terrain bckgrd)
1-1	1	1	1942	332	17.1%	119	213	26	93	79	134	81%	60%	51%	88%	75%	47%
4-1	4	1	1942	19	1.0%	4	15	0	4	9	6	22%	12%	n/a	22%	9%	16%
1-5	1	5	1942	47	2.4%	13	34	3	10	13	21	74%	44%	27%	76%	42%	45%
4-5	4	5	1942	5	0.3%	0	5	0	0	3	2	n/a	21%	n/a	n/a	111%	21%
2-1	2	1	1942	421	21.7%	139	282	34	105	102	180	107%	80%	82%	124%	103%	75%
5-1	5	1	1942	160	8.2%	52	108	11	41	56	52	36%	35%	36%	40%	39%	34%
2-5	2	5	1942	76	3.9%	17	59	3	14	24	35	88%	45%	72%	103%	41%	47%
5-5	5	5	1942	15	0.8%	2	13	0	2	6	7	55%	33%	n/a	55%	35%	33%
3-1	3	1	1942	320	16.5%	116	204	26	90	78	126	66%	59%	48%	79%	78%	49%
6-1	6	1	1942	15	0.8%	2	13	0	2	8	5	31%	10%	n/a	31%	12%	10%
3-5	3	5	1942	45	2.3%	13	32	3	10	13	19	53%	45%	26%	66%	45%	45%
6-5	6	5	1942	5	0.3%	0	5	0	0	3	2	n/a	21%	n/a	n/a	110%	21%

Carlota Visibility Analysis - Secondary Review

Model Scenario	Emission Inventory	Met. Condition	Total # of Valid Samples	# of Valid Samples Iron Mt.	# of Valid Samples Mound Mt.	# of Valid Samples Govt. Hill	# of Valid Samples > Threshold Iron Mt.	# of Valid Samples > Threshold Mound Mt.	# of Valid Samples > Threshold Govt. Hill	% of Valid Samples > Threshold Iron Mt.	% of Valid Samples > Threshold Mound Mt.	% of Valid Samples > Threshold Govt. Hill	# of Valid Samples (sky bckgrd)	# of Valid Samples (white terrain)	# of Valid Samples (gray terrain)	# of Valid Samples (black terrain)	# of Valid Samples > Threshold (sky bckgrd)	# of Valid Samples > Threshold (white terrain)	# of Valid Samples > Threshold (gray terrain)	# of Valid Samples > Threshold (black terrain)	% of Valid Samples > Threshold (sky bckgrd)	% of Valid Samples > Threshold (white terrain)	% of Valid Samples > Threshold (gray terrain)	% of Valid Samples > Threshold (black terrain)
1-1	1	1	1942	988	860	94	249	73	10	12.8%	3.8%	0.5%	466	492	492	492	105	72	47	108	5.4%	3.7%	2.4%	5.6%
4-1	4	1	1942	988	860	94	18	1	0	0.9%	0.1%	0.0%	466	492	492	492	9	4	0	6	0.5%	0.2%	0.0%	0.3%
1-5	1	5	1942	988	860	94	42	5	0	2.2%	0.3%	0.0%	466	492	492	492	16	11	4	16	0.8%	0.6%	0.2%	0.8%
4-5	4	5	1942	988	860	94	0	5	0	0.0%	0.3%	0.0%	466	492	492	492	3	2	0	0	0.2%	0.1%	0.0%	0.0%
2-1	2	1	1942	988	860	94	305	100	16	15.7%	5.1%	0.8%	466	492	492	492	135	97	67	122	7.0%	5.0%	3.5%	6.3%
5-1	5	1	1942	988	860	94	128	25	7	6.6%	1.3%	0.4%	466	492	492	492	67	38	8	47	3.5%	2.0%	0.4%	2.4%
2-5	2	5	1942	988	860	94	67	8	1	3.5%	0.4%	0.1%	466	492	492	492	27	15	9	25	1.4%	0.8%	0.5%	1.3%
5-5	5	5	1942	988	860	94	11	4	0	0.6%	0.2%	0.0%	466	492	492	492	6	5	0	4	0.3%	0.3%	0.0%	0.2%
3-1	3	1	1942	988	860	94	242	68	10	12.5%	3.5%	0.5%	466	492	492	492	104	72	44	100	5.4%	3.7%	2.3%	5.1%
6-1	6	1	1942	988	860	94	14	1	0	0.7%	0.1%	0.0%	466	492	492	492	8	4	0	3	0.4%	0.2%	0.0%	0.2%
3-5	3	5	1942	988	860	94	40	5	0	2.1%	0.3%	0.0%	466	492	492	492	16	11	3	15	0.8%	0.6%	0.2%	0.8%
6-5	6	5	1942	988	860	94	0	5	0	0.0%	0.3%	0.0%	466	492	492	492	3	2	0	0	0.2%	0.1%	0.0%	0.0%

Carlota Visibility Analysis - Secondary Review

Model Scenario	Emission Inventory	Met. Condition	Total # of Valid Samples	# of Valid Samples Winter	# of Valid Samples Spring	# of Valid Samples Summer	# of Valid Samples Fall	# of Valid Samples > Threshold Winter	# of Valid Samples > Threshold Spring	# of Valid Samples > Threshold Summer	# of Valid Samples > Threshold Fall	% of Valid Samples > Threshold Winter	% of Valid Samples > Threshold Spring	% of Valid Samples > Threshold Summer	% of Valid Samples > Threshold Fall	# of Valid Samples (morning)	# of Valid Samples (noon)	# of Valid Samples (evening)	# of Valid Samples > Threshold (morning)	# of Valid Samples > Threshold (noon)	# of Valid Samples > Threshold (evening)	% of Valid Samples > Threshold (morning)	% of Valid Samples > Threshold (noon)	% of Valid Samples > Threshold (evening)
1-1	1	1	1942	478	498	494	472	110	49	70	103	5.7%	2.5%	3.6%	5.3%	652	640	650	125	95	112	6.4%	4.9%	5.8%
4-1	4	1	1942	478	498	494	472	10	0	3	6	0.5%	0.0%	0.2%	0.3%	652	640	650	8	3	8	0.4%	0.2%	0.4%
1-5	1	5	1942	478	498	494	472	13	2	2	30	0.7%	0.1%	0.1%	1.5%	652	640	650	16	14	17	0.8%	0.7%	0.9%
4-5	4	5	1942	478	498	494	472	0	3	2	0	0.0%	0.2%	0.1%	0.0%	652	640	650	1	0	4	0.1%	0.0%	0.2%
2-1	2	1	1942	478	498	494	472	143	63	84	131	7.4%	3.2%	4.3%	6.7%	652	640	650	151	121	149	7.8%	6.2%	7.7%
5-1	5	1	1942	478	498	494	472	57	18	32	53	2.9%	0.9%	1.6%	2.7%	652	640	650	60	42	58	3.1%	2.2%	3.0%
2-5	2	5	1942	478	498	494	472	22	7	6	41	1.1%	0.4%	0.3%	2.1%	652	640	650	28	17	31	1.4%	0.9%	1.6%
5-5	5	5	1942	478	498	494	472	3	2	2	8	0.2%	0.1%	0.1%	0.4%	652	640	650	4	3	8	0.2%	0.2%	0.4%
3-1	3	1	1942	478	498	494	472	106	45	67	102	5.5%	2.3%	3.5%	5.3%	652	640	650	119	91	110	6.1%	4.7%	5.7%
6-1	6	1	1942	478	498	494	472	10	0	1	4	0.5%	0.0%	0.1%	0.2%	652	640	650	5	2	8	0.3%	0.1%	0.4%
3-5	3	5	1942	478	498	494	472	13	2	2	28	0.7%	0.1%	0.1%	1.4%	652	640	650	15	13	17	0.8%	0.7%	0.9%
6-5	6	5	1942	478	498	494	472	3	2	0	0	0.2%	0.1%	0.0%	0.0%	652	640	650	1	0	4	0.1%	0.0%	0.2%

APPENDIX C

WATER RESOURCES DATA

C-1

Surface Water Quality Data

Table C1-1. Pinto Creek Surface Water Quality Summary

Constituent	Units	Standards: A & Ww Acute	A & Ww Chronic	FBC	FC	AgI	AgL	Pinto Creek Upstream of Proposed Carlota / Cactus Pit (1) n	AVG	SD	MIN	MAX	Pinto Creek Downstream of Proposed Carlota / Cactus Pit (2) n	AVG	SD	MIN	MAX	Pinto Creek from below Haunted Canyon Confluence to above Salt River Confluence (3) n	AVG	SD	MIN	MAX
Physical and Aggregrate Properties																						
Conductivity	umhos/cm @ 25 C	---	---	---	---	---	---	1	525	172	230	660	1	1000	339	500	1400	4	1002	360	590	1600
Discharge	Ft3/sec (cfs)	---	---	---	---	---	---	1	1.4	2.7	0.0102	5.5	1	1.66	2.68	0.098	5.65	4	1.2	1.25	0.22	5.43
Total Dissolved Solids	mg/L @ 180 C	---	---	---	---	---	---	1	384	111	192	462	1	932	343	396	1270	4	840	449	432	1610
Total Hardness	mg/L as CaCO3	---	---	---	---	---	---	1	202	61	96	246	1	575	201	247	748	4	614	363	298	1242
Total Suspended Solids	mg/L @ 103 C	---	---	---	---	---	---	1	6	4	2	11	1	0.8	0.8	<0.1	2	4	3.6	2.7	<0.1	8.5
Turbidity	NTU	50	50	50	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Water Temperature	Deg. C	+3.0	+3.0	---	---	---	---	1	15.3	3.9	10.7	21.5	1	15.4	4.3	11.8	22.5	4	19.1	3.2	14.4	31
Major Cations																						
Calcium	mg/L as Ca	---	---	---	---	---	---	1	61.9	19.4	28.5	75.3	1	164	56.9	72.2	212	4	179	109	81.3	367
Magnesium	mg/L as Mg	---	---	---	---	---	---	1	11.5	3.1	6.2	14	1	39.9	14.4	16.1	53.6	4	38.1	18.7	23.9	70.3
Potassium	mg/L as K	---	---	---	---	---	---	1	5.3	0.4	<5	6	1	5.8	1.3	<5	8	4	6.2	0.9	<5	18
Sodium	mg/L as Na	---	---	---	---	---	---	1	27	5.2	19	32.3	1	48.1	14.8	28.6	66.2	4	33	17	17	62.8
Major Anions																						
Bicarbonate	mg/L as HCO3	---	---	---	---	---	---	1	94	20	71	123	1	163	45	90	203	4	230	56.8	151	352
Chloride	mg/L as Cl	---	---	---	---	---	---	1	14	4.6	7.2	18.9	1	35.8	13.3	13.6	48.8	4	28.6	18.0	10.8	59.0
Sulfate	mg/L as SO4	---	---	---	---	---	---	1	169	73.1	55.9	260	1	463	184	166	644	4	347	275	90	818
Inorganic Nonmetallics																						
Boron	mg/L as B	---	---	12.6	---	1.0 TR	---	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	4	<0.1	0.05	0.001	<0.1
Cyanide	mg/L as CN	0.041 TR	0.0097 TR	2.8 TR	210 TR	---	0.2 TR	1	<0.1#	0.0	<0.1#	<0.1#	1	<0.1#	0.04	<0.01#	<0.1#	4	<0.4#	0.05	<0.04#	<0.4#
Dissolved Oxygen	mg/L as O2	6.0	---	---	---	---	---	1	8.1	2.3	**4.9**	10.05	1	7.4	1.2	**5.7**	8.58	3	8.1	2.3	**5.4**	10.5
Fluoride	mg/L as F	---	---	8.4	---	---	---	1	<0.5	0.0	<0.5	<0.5	1	<0.5	0.0	<0.5	<0.5	4	0.4	0.3	0.3	0.9
Nitrate	mg/L as N	---	---	224	---	---	---	1	<5	0.6	3.5	<5	1	<5	0.6	3.5	<5	4	<5	0.8	<0.4	<5
Nitrite	mg/L as N	---	---	14	---	---	---	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	4	<0.1	0.0	<0.1	<0.1
Nitrogen, Kjeldahl	mg/L as N	---	---	---	---	---	---	1	---	---	---	---	1	---	---	---	---	4	0.2	0.1	<0.1	0.61
Orthophosphate	mg/L as P	---	---	---	---	---	---	1	<0.5	0.0	<0.5	<0.5	1	<0.5	0.0	<0.5	<0.5	4	<0.5	0.0	<0.5	<0.5
pH	std. units	6.5 - 9.0	6.5 - 9.0	6.5 - 9.0	---	4.5 - 9.0	6.5 - 9.0	1	7.7	0.4	7.2	8.2	1	7.7	0.4	6.9	8.0	4	7.5	0.3	6.8	8.4
Silica	mg/L as SIO2	---	---	---	---	---	---	1	22.7	4.2	15.6	25.7	1	26.2	4.2	19.6	30.3	4	34.6	4.5	27.5	41.1
Sulfide	mg/L as S	0.1	---	---	---	---	---	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	4	<0.1	0.0	<0.1	<0.1
Total Ammonia	mg/L as N	(4)	---	---	---	---	---	1	<0.1	0.0	<0.1	0.1	1	0.1	0.04	<0.1	0.2	4	<0.1	0.01	<0.1	0.2
Total Phosphorus	mg/L as P	1.00	0.12	---	---	---	---	1	<0.5#	0.0	<0.5#	<0.5#	1	<0.5#	0.0	<0.5#	<0.5#	3	<0.5#	0.0	<0.5#	<0.5#

(1) Data are for surface water monitoring station PC-3.
(2) Data are for surface water monitoring station PC-5.
(3) Data are for surface water monitoring stations PC-7, PC-7.5, PC-8, and PC-10.
(4) Value based on field measurements of pH and water temperature.

n = Number of surface water monitoring stations included in summary
AVG = Spatial average: computed average of the mean concentration for each surface water monitoring station
SD = Spatial standard deviation computed for multiple surface water monitoring stations or temporal standard deviation of the mean concentration for a single surface water monitoring station
MIN = Minimum analysis result: range includes all samples at each surface water monitoring station
MAX = Maximum analysis result: range includes all samples at each surface water monitoring station
TR = Total recoverable fraction
D = Dissolved fraction
A&Ww = Aquatic wildlife (warm water fishery)
FBC = Full body contact
FC = Fish consumption
AgI = Agricultural irrigation
AgL = Agricultural livestock watering

Notes:
Detection level data are treated as values at the reported level of detection when combined with detection values for average and standard deviation calculations (e.g., <1 mg/L and 3 mg/L has an average of 2 mg/L).
Water quality standard or criterion exceedance values are bolded; detection levels above the standard or criterion are indicated with a "#."

Source: GWRC (1996)

Table C1-1. Pinto Creek Surface Water Quality Summary (continued)

Constituent	Units	Standards						Pinto Creek Upstream of Proposed Carlota / Cactus Pit (1)					Pinto Creek Downstream of Proposed Carlota / Cactus Pit (2)					Pinto Creek from below Haunted Canyon Confluence to above Salt River Confluence (3)				
		A & Ww																				
		Acute	Chronic	FBC	FC	AgI	AgL	n	AVG	SD	MIN	MAX	n	AVG	SD	MIN	MAX	n	AVG	SD	MIN	MAX
Metals																						
Aluminum (TR)	mg/L as Al	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	3	<2.0	0.0	<2.0	<2.0
Aluminum (D)	mg/L as Al	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	3	<2.0	0.0	<2.0	<2.0
Antimony (TR)	mg/L as Sb	---	---	0.056	0.14	---	---	1	<0.2#	0.084	<0.005	<0.2#	1	<0.2#	0.084	<0.005	<0.2#	4	<0.2#	0.044	<0.004	<0.2#
Antimony (D)	mg/L as Sb	0.088	0.300	---	---	---	---	1	<0.2#	0.084	<0.005	<0.2#	1	<0.2#	0.084	<0.005	<0.2#	4	<0.2#	0.080	<0.004	<0.2#
Arsenic (TR)	mg/L as As	---	---	0.05	1.45	2.0	0.2	1	<0.005	0.000	<0.005	<0.005	1	<0.005	0.000	<0.005	<0.005	4	<0.003	0.002	<0.001	0.006
Arsenic (D)	mg/L as As	0.360	0.190	---	---	---	---	1	<0.005	0.000	<0.005	<0.005	1	<0.005	0.000	<0.005	<0.005	4	<0.003	0.002	<0.001	0.005
Barium (TR)	mg/L as Ba	---	---	---	---	---	---	1	<1	0	<1	<1	1	<1	0	<1	<1	4	<0.80	0.21	<0.01	<1
Barium (D)	mg/L as Ba	---	---	9.8	---	---	---	1	<1	0	<1	<1	1	<1	0	<1	<1	4	<0.80	0.21	<0.01	<1
Beryllium (TR)	mg/L as Be	---	---	0.004	0.00021	---	---	1	<0.1#	0.0	<0.1#	<0.1#	1	<0.1#	0.0	<0.1#	<0.1#	4	<0.02 #	0.02	<0.0009#	<0.1#
Beryllium (D)	mg/L as Be	0.065	0.0053	---	---	---	---	1	<0.1#	0.0	<0.1#	<0.1#	1	<0.1#	0.0	<0.1#	<0.1#	4	<0.04#	0.04	<0.0009#	<0.1#
Cadmium (TR)	mg/L as Cd	---	---	0.07	0.041	0.05	0.05	1	<0.003	0.000	<0.003	<0.003	1	<0.003	0.000	<0.003	<0.003	4	0.007	0.006	<0.0005	0.017
Cadmium (D)	mg/L as Cd	0.053	0.002	---	---	---		1	<0.003#	0.000	<0.003#	<0.003#	1	<0.003#	0.000	<0.003#	<0.003#	4	<0.005#	0.001	<0.0005	<0.005#
Chromium (VI) (TR)	mg/L as Cr	---	---	0.7	3.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Chromium (VI) (D)	mg/L as Cr	0.016	0.011	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Chromium (total) (TR)	mg/L as Cr	---	---	---	---	1	1	1	<0.03	0.00	<0.03	<0.03	1	<0.03	0.00	<0.03	<0.03	4	<0.043	0.01	<0.005	<0.05
Chromium (total) (D)	mg/L as Cr	---	---	---	---	---	---	1	<0.03	0.00	<0.03	<0.03	1	<0.03	0.00	<0.03	<0.03	4	<0.043	0.01	<0.005	<0.05
Cobalt (TR)	mg/L as Co	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	3	<0.1	0.0	<0.1	<0.1
Cobalt (D)	mg/L as Co	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	3	<0.1	0.0	<0.1	<0.1
Copper (TR)	mg/L as Cu	---	---	---	---	5.0	0.5	1	0.04	0.01	0.02	0.06	1	0.04	0.02	0.02	0.06	4	<0.5	0.2	0.003	<0.5
Copper (D)	mg/L as Cu	0.034	0.021	5.2	---	---	---	1	0.03	0.01	<0.02	**0.04**	1	**0.04**	0.017	<0.02	**0.06**	4	<0.5#	0.2	0.006	<0.5#
Iron (TR)	mg/L as Fe	---	---	---	---	---	---	1	<0.1	0.04	<0.1	0.2	1	0.1	0.04	<0.1	0.2	4	<0.3	0.1	<0.1	<0.3
Iron (D)	mg/L as Fe	---	---	---	---	---	---	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	4	0.205	0.1	0.019	<0.3
Lead (TR)	mg/L as Pb	---	---	---	---	10.0	0.1	1	0.006	0.001	<0.005	0.008	1	0.006	0.002	<0.005	0.01	4	0.007	0.003	0.0031	0.049
Lead (D)	mg/L as Pb	0.197	0.008	---	---	---	---	1	<0.005	0.000	<0.005	<0.005	1	0.010	0.009	<0.005	0.026	4	0.005	0.0003	0.0005	<0.005
Manganese (TR)	mg/L as Mn	---	---	19.6	---	10.0	---	1	0.03	0.01	<0.02	0.05	1	0.08	0.09	0.02	0.24	4	0.046	0.02	0.007	0.08
Manganese (D)	mg/L as Mn	---	---	---	---	10.0	---	1	0.03	0.004	<0.02	0.03	1	0.07	0.08	0.02	0.2	4	0.036	0.01	0.005	<0.05
Mercury (TR)	mg/L as Hg	---	---	0.042	0.0006	---	0.01	1	<0.001#	0.000	<0.001#	<0.001#	1	<0.001#	0.000	<0.001#	<0.001#	4	<0.001#	0.0002	<0.0006	<0.001#
Mercury (D)	mg/L as Hg	0.0024	0.00001	---	---	---	---	1	<0.001#	0.000	<0.001#	<0.001#	1	<0.001#	0.000	<0.001#	<0.001#	4	<0.001#	0.0002	<0.0006#	<0.001#
Molybdenum (TR)	mg/L as Mo	---	---	---	---	---	---	1	0.01	0.002	<0.005	0.01	1	0.02	0.010	<0.005	0.03	4	0.012	0.010	<0.001	0.027
Molybdenum (D)	mg/L as Mo	---	---	---	---	---	---	1	<0.01	0.002	<0.005	<0.01	1	0.01	0.006	<0.005	0.02	4	0.015	0.007	<0.001	0.026
Nickel (TR)	mg/L as Ni	---	---	2.8	0.73	---	---	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	4	<0.1	0.01	<0.005	<0.1
Nickel (D)	mg/L as Ni	2.5491	0.2834	---	---	---	---	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	4	<0.1	0.01	<0.005	<0.1
Selenium (TR)	mg/L as Se	0.02	0.002	0.7	9.0	0.02	0.05	1	<0.005#	0.000	<0.005#	<0.005#	1	<0.005#	0.000	<0.005#	<0.005#	4	<0.005#	0.001	<0.0005	<0.005#
Selenium (D)	mg/L as Se	---	---	---	---	---	---	1	<0.005	0.000	<0.005	<0.005	1	<0.005	0.000	<0.005	<0.005	4	<0.005	0.001	<0.0005	<0.005
Silver (TR)	mg/L as Ag	---	---	---	---	---	---	1	<0.01	0.00	<0.01	<0.01	1	<0.01	0.00	<0.01	<0.01	4	<0.005	0.001	<0.0005	<0.01
Silver (D)	mg/L as Ag	0.013	---	---	---	---	---	1	<0.01	0.00	<0.01	<0.01	1	<0.01	0.00	<0.01	<0.01	4	<0.005	0.002	<0.0005	<0.01
Thallium (TR)	mg/L as Tl	---	---	0.012	0.041	---	---	1	<0.1#	0.0	<0.1#	<0.1#	1	<0.1#	0.0	<0.1#	<0.1#	4	<0.1#	0.04	<0.002	<0.1#
Thallium (D)	mg/L as Tl	0.70	0.15	---	---	---	---	1	<0.1	0.04	<0.005	<0.1	1	<0.1	0.04	<0.005	<0.1	4	<0.1	0.04	<0.002	<0.1
Zinc (TR)	mg/L as Zn	---	---	42.0	22.0	10.0	25.0	1	<0.04	0.00	<0.04	<0.04	1	<0.04	0.00	<0.04	<0.04	4	0.1	0.03	0.009	0.1
Zinc (D)	mg/L as Zn	0.21	0.19	---	---	---	---	1	<0.04	0.00	<0.04	0.04	1	<0.04	0.00	<0.04	<0.04	4	<0.1	0.03	0.01	<0.1
Radionuclides																						
Gross Alpha Activity	pCi/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2	6.5	6	<2	11
Gross Beta Activity	pCi/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2	12	8	6	17
Radium 226+228	pCi/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

(1) Data are for surface water monitoring station PC-3.
(2) Data are for surface water monitoring station PC-5.
(3) Data are for surface water monitoring stations PC-7, PC-7.5, PC-8, and PC-10.
(4) Value based on field measurements of pH and water temperature.

n = Number of surface water monitoring stations included in summary
AVG = Spatial average: computed average of the mean concentration for each surface water monitoring station
SD = Spatial standard deviation computed for multiple surface water monitoring stations or temporal standard deviation of the mean concentration for a single surface water monitoring station
MIN = Minimum analysis result: range includes all samples at each surface water monitoring station
MAX = Maximum analysis result: range includes all samples at each surface water monitoring station
TR = Total recoverable fraction
D = Dissolved fraction
A&Ww = Aquatic wildlife (warm water fishery)
FBC = Full body contact
FC = Fish Consumption
AgI = Agricultural Irrigation
AgL = Agricultural livestock watering

Notes:
Detection level data are treated as values at the reported level of detection when combined with detection values for average and standard deviation calculations (e.g., <1 mg/L and 3 mg/L has an average of 2 mg/L).
Water quality standard or criterion exceedance values are bolded; detection levels above the standard or criterion are indicated with a "#."

Source: GWRC (1996)

Table C1-2. Powers Gulch and Haunted Canyon Surface Water Quality Summary

Constituent	Units	Standards: A & Ww Acute	Standards: A & Ww Chronic	Standards: FBC	Standards: FC	Standards: AgI	Standards: AgL	Powers Gulch Upstream of Proposed Heap Leach Pad and Rock Dumps (1) n	AVG	SD	MIN	MAX	Powers Gulch Downstream of Proposed Heap Leach Pad and Rock Dumps (2) n	AVG	SD	MIN	MAX	Haunted Canyon Below Confluence with Powers Gulch (3) n	AVG	SD	MIN	MAX
Physical and Aggregrate Properties																						
Conductivity	umhos/cm @ 25 C	---	---	---	---	---	---	1	80	0	80	80	1	130	0	130	130	1	443	87	310	520
Discharge	Ft3/sec (cfs)	---	---	---	---	---	---	1	0.16	0.00	0.16	0.16	1	2.35	0.00	2.35	2.35	1	0.21	0.175	0.0108	0.38
Total Dissolved Solids	mg/L @ 180 C	---	---	---	---	---	---	1	110	0	110	110	1	124	0	124	124	1	326	59	270	420
Total Hardness	mg/L as CaCO3	---	---	---	---	---	---	1	29	0	29	29	1	60	0	60	60	1	217	25	191	243
Total Suspended Solids	mg/L @ 103 C	---	---	---	---	---	---	1	144	0	144	144	1	5	0	5	5	1	2.4	2.7	<0.1	7
Turbidity	NTU	50	50	50	---	---	---	---	---	---	---	---	---	---	---	---	---	1	0.8	0.0	0.8	0.8
Water Temperature	Deg. C	+3.0	+3.0	---	---	---	---	1	9	0	9	9	1	5.5	0.0	5.5	5.5	1	17	4	12	22
Major Cations																						
Calcium	mg/L as Ca	---	---	---	---	---	---	1	9.0	0.0	9.0	9.0	1	15.3	0.0	15.3	15.3	1	59.9	5.36	53.4	65.4
Magnesium	mg/L as Mg	---	---	---	---	---	---	1	1.7	0.0	1.7	1.7	1	4.8	0.0	4.8	4.8	1	15.5	3.78	10.4	19.34
Potassium	mg/L as K	---	---	---	---	---	---	1	<5	0	<5	<5	1	<5	0	<5	<5	1	7	3.5	<5	13
Sodium	mg/L as Na	---	---	---	---	---	---	1	10.5	0.0	10.5	10.5	1	11.6	0.0	11.6	11.6	1	13.7	1.72	11.8	15.9
Major Anions																						
Bicarbonate	mg/L as HCO3	---	---	---	---	---	---	1	22	0	22	22	1	45	0	45	45	1	223	35	171	268
Chloride	mg/L as Cl	---	---	---	---	---	---	1	<5	0	<5	<5	1	<5	0	<5	<5	1	8.6	1.1	7	10
Sulfate	mg/L as SO4	---	---	---	---	---	---	1	16.7	0.0	16.7	16.7	1	21.3	0.0	21.3	21.3	1	52.1	20.3	31	73.8
Inorganic Nonmetallics																						
Boron	mg/L as B	---	---	12.6	---	1.0 TR	---	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.05	0.001	<0.1
Cyanide	mg/L as CN	0.041 TR	0.0097 TR	2.8 TR	210 TR	---	0.2 TR	1	<0.1#	0.0	<0.1#	<0.1#	1	<0.1#	0.0	<0.1#	<0.1#	1	<0.1#	0.03	<0.04#	<0.1#
Dissolved Oxygen	mg/L as O2	6.0	---	---	---	---	---	1	8.85	0.00	8.85	8.85	1	9.86	0.00	9.86	9.86	1	**4.7**	0.0	**4.7**	**4.7**
Fluoride	mg/L as F	---	---	8.4	---	---	---	---	---	---	---	---	---	---	---	---	---	1	0.2	0.0	0.2	0.2
Nitrate	mg/L as N	---	---	224	---	---	---	1	<4.4	0.0	<4.4	<4.4	1	<4.4	0.0	<4.4	<4.4	1	1.2	1.3	<0.4	3.5
Nitrite	mg/L as N	---	---	14	---	---	---	---	---	---	---	---	---	---	---	---	---	1	<0.1	0.0	<0.1	<0.1
Nitrogen, Kjeldahl	mg/L as N	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	0.3	0.2	0.2	0.41
Orthophosphate	mg/L as P	---	---	---	---	---	---	1	<0.5	0.0	<0.5	<0.5	1	<0.5	0.0	<0.5	<0.5	1	<0.5	0.0	<0.5	0.5
pH	std. units	6.5 - 9.0	6.5 - 9.0	6.5 - 9.0	---	4.5 - 9.0	6.5 - 9.0	1	7.8	0.0	7.8	7.8	1	7.3	0.0	7.3	7.3	1	7.5	0.3	7.0	7.7
Silica	mg/L as SIO2	---	---	---	---	---	---	1	17.4	0.0	17.4	17.4	1	18.1	0.0	18.1	18.1	1	50.4	5.9	43.7	59.2
Sulfide	mg/L as S	0.1	---	---	---	---	---	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1
Total Ammonia	mg/L as N	(4)	---	---	---	---	---	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1
Total Phosphorus	mg/L as P	1.00	0.12	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	<0.5#	0.0	<0.5#	<0.5#

(1) Data are for surface water monitoring station PG-1.
(2) Data are for surface water monitoring station PG-4.
(3) Data are for surface water monitoring station HC-2.
(4) Value based on field measurements of pH and water temperature.

n = Number of surface water monitoring stations included in summary
AVG = Spatial average: computed average of the mean concentration for each surface water monitoring station
SD = Spatial standard deviation computed for multiple surface water monitoring stations or temporal standard deviation of the mean concentration for a single surface water monitoring station
MIN = Minimum analysis result: range includes all samples at each surface water monitoring station
MAX = Maximum analysis result: range includes all samples at each surface water monitoring station
TR = Total recoverable fraction
D = Dissolved fraction
A&Ww = Aquatic wildlife (warm water fishery)
FBC = Full body contact
FC = Fish consumption
AgI = Agricultural irrigation
AgL = Agricultural livestock watering

Notes:
Detection level data are treated as values at the reported level of detection when combined with detection values for average and standard deviation calculations (e.g., <1 mg/L and 3 mg/L has an average of 2 mg/L).
Water quality standard or criterion exceedance values are bolded; detection levels above the standard or criterion are indicated with a "#."

Source: GWRC (1996)

Table C1-2. Powers Gulch and Haunted Canyon Surface Water Quality Summary (continued)

Constituent	Units	Standards						Powers Gulch Upstream of Proposed Heap Leach Pad and Rock Dumps (1)					Powers Gulch Downstream of Proposed Heap Leach Pad and Rock Dumps (2)					Haunted Canyon below Confluence with Powers Gulch (3)				
		A & Ww																				
		Acute	Chronic	FBC	FC	AgI	AgL	n	AVG	SD	MIN	MAX	n	AVG	SD	MIN	MAX	n	AVG	SD	MIN	MAX
Metals																						
Aluminum (TR)	mg/L as Al	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	<2	0	<2	<2
Aluminum (D)	mg/L as Al	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	<2	0	<2	<2
Antimony (TR)	mg/L as Sb	---	---	0.056	0.14	---	---	1	<0.005	0.000	<0.005	<0.005	1	<0.005	0.000	<0.005	<0.005	1	<0.2#	0.08	<0.004	<0.2#
Antimony (D)	mg/L as Sb	0.088	0.300	---	---	---	---	1	0.011	0.000	0.011	0.011	1	<0.005	0.000	<0.005	<0.005	1	<0.2#	0.10	<0.004	<0.2#
Arsenic (TR)	mg/L as As	---	---	0.05	1.45	2.0	0.2	1	<0.005	0.000	<0.005	<0.005	1	<0.005	0.000	<0.005	<0.005	1	0.006	0.002	0.004	0.008
Arsenic (D)	mg/L as As	0.360	0.190	---	---	---	---	1	<0.005	0.000	<0.005	<0.005	1	<0.005	0.000	<0.005	<0.005	1	0.006	0.002	0.003	0.008
Barium (TR)	mg/L as Ba	---	---	---	---	---	---	1	<1	0	<1	<1	1	<1	0	<1	<1	1	<1	0.5	<0.01	<1
Barium (D)	mg/L as Ba	---	---	9.8	---	---	---	1	<1	0	<1	<1	1	<1	0	<1	<1	1	<1	0.5	<0.01	<1
Beryllium (TR)	mg/L as Be	---	---	0.004	0.00021	---	---	1	<0.1#	0.0	<0.1#	<0.1#	1	<0.1#	0.0	<0.1#	<0.1#	1	<0.1#	0.04	<0.00021	<0.1#
Beryllium (D)	mg/L as Be	0.065	0.0053	---	---	---	---	1	<0.1#	0.0	<0.1#	<0.1#	1	<0.1#	0.0	<0.1#	<0.1#	1	<0.1#	0.05	<0.0005	<0.1#
Cadmium (TR)	mg/L as Cd	---	---	0.07	0.041	0.05	0.05	1	<0.003	0.000	<0.003	<0.003	1	<0.003	0.000	<0.003	<0.003	1	<0.005	0.002	<0.0005	<0.005
Cadmium (D)	mg/L as Cd	0.053	0.002	---	---	---		1	<0.003#	0.000	<0.003#	<0.003#	1	<0.003#	0.000	<0.003#	<0.003#	1	<0.005#	0.002	<0.0005	<0.005#
Chromium (VI) (TR)	mg/L as Cr	---	---	0.7	3.4	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Chromium (VI) (D)	mg/L as Cr	0.016	0.011	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Chromium (total) (TR)	mg/L as Cr	---	---	---	---	1	1	1	<0.03	0.00	<0.03	<0.03	1	<0.03	0.00	<0.03	<0.03	1	<0.05	0.02	<0.005	<0.05
Chromium (total) (D)	mg/L as Cr	---	---	---	---	---	---	1	<0.03	0.00	<0.03	<0.03	1	<0.03	0.00	<0.03	<0.03	1	<0.05	0.02	<0.005	<0.05
Cobalt (TR)	mg/L as Co	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	<0.1	0.0	<0.1	<0.1
Cobalt (D)	mg/L as Co	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	<0.1	0.0	<0.1	<0.1
Copper (TR)	mg/L as Cu	---	---	---	---	5.0	0.5	1	0.02	0.00	0.02	0.02	1	<0.02	0.00	<0.02	<0.02	1	<0.5	0.2	<0.001	<0.5
Copper (D)	mg/L as Cu	0.034	0.021	5.2	---	---	---	1	<0.02	0.00	<0.02	<0.02	1	<0.02	0.00	<0.02	<0.02	1	<0.5#	0.2	0.002	<0.5#
Iron (TR)	mg/L as Fe	---	---	---	---	---	---	1	0.6	0.0	0.6	0.6	1	0.4	0.0	0.4	0.4	1	<0.3	0.1	0.031	<0.3
Iron (D)	mg/L as Fe	---	---	---	---	---	---	1	0.5	0.0	0.5	0.5	1	0.1	0.0	0.1	0.1	1	<0.3	0.1	0.017	<0.3
Lead (TR)	mg/L as Pb	---	---	---	---	10.0	0.1	1	0.005	0.000	0.005	0.005	1	0.005	0.000	0.005	0.005	1	0.008	0.006	0.003	0.018
Lead (D)	mg/L as Pb	0.197	0.008	---	---	---	---	1	0.007	0.000	0.007	0.007	1	**0.094**	0.000	**0.094**	**0.094**	1	0.004	0.002	0.0007	0.007
Manganese (TR)	mg/L as Mn	---	---	19.6	---	10.0	---	1	0.03	0.00	0.03	0.03	1	0.02	0.00	0.02	0.02	1	<0.05	0.02	0.001	<0.05
Manganese (D)	mg/L as Mn	---	---	---	---	10.0	---	1	<0.02	0.00	<0.02	<0.02	1	<0.02	0.00	<0.02	<0.02	1	<0.05	0.02	0.003	<0.05
Mercury (TR)	mg/L as Hg	---	---	0.042	0.0006	---	0.01	1	<0.001#	0.000	<0.001#	<0.001#	1	<0.001#	0.000	<0.001#	<0.001#	1	<0.001#	0.0002	<0.0006	<0.001#
Mercury (D)	mg/L as Hg	0.0024	0.00001	---	---	---	---	1	<0.001#	0.000	<0.001#	<0.001#	1	<0.001#	0.000	<0.001#	<0.001#	1	<0.001#	0.0002	<0.0006#	<0.001#
Molybdenum (TR)	mg/L as Mo	---	---	---	---	---	---	1	<0.01	0.00	<0.01	<0.01	1	<0.01	0.00	<0.01	<0.01	1	<0.1	0.042	<0.001	<0.1
Molybdenum	mg/L as Mo	---	---	---	---	---	---	1	<0.01	0.00	<0.01	<0.01	1	<0.01	0.00	<0.01	<0.01	1	<0.005	0.002	<0.001	<0.005
Nickel (TR)	mg/L as Ni	---	---	2.8	0.73	---	---	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.04	<0.005	<0.1
Nickel (D)	mg/L as Ni	2.5491	0.2834	---	---	---	---	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.04	<0.005	<0.1
Selenium (TR)	mg/L as Se	0.02	0.002	0.7	9.0	0.02	0.05	1	<0.005#	0.000	<0.005#	<0.005#	1	<0.005#	0.000	<0.005#	<0.005#	1	<0.005#	0.002	<0.0005	<0.005#
Selenium (D)	mg/L as Se	---	---	---	---	---	---	1	<0.005	0.000	<0.005	<0.005	1	<0.005	0.000	<0.005	<0.005	1	<0.005	0.002	<0.0005	<0.005
Silver (TR)	mg/L as Ag	---	---	---	---	---	---	1	0.01	0.00	0.01	0.01	1	<0.01	0.00	<0.01	<0.01	1	<0.01	0.003	<0.0005	<0.01
Silver (D)	mg/L as Ag	0.013	---	---	---	---	---	1	<0.01	0.00	<0.01	<0.01	1	<0.01	0.00	<0.01	<0.01	1	<0.01	0.004	<0.0005	<0.01
Thallium (TR)	mg/L as Tl	---	---	0.012	0.041	---	---	1	<0.1#	0.0	<0.1#	<0.1#	1	<0.1#	0.0	<0.1#	<0.1#	1	<0.1#	0.04	<0.002	<0.1#
Thallium (D)	mg/L as Tl	0.70	0.15			---	---	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	1	<0.1	0.04	<0.002	<0.1
Zinc (TR)	mg/L as Zn	---	---	42.0	22.0	10.0	25.0	1	<0.04	0.00	<0.04	<0.04	1	<0.04	0.00	<0.04	<0.04	1	0.059	0.03	0.014	0.1
Zinc (D)	mg/L as Zn	0.21	0.19	---	---	---	---	1	<0.04	0.00	<0.04	<0.04	1	<0.04	0.00	<0.04	<0.04	1	<0.1	0.03	0.016	<0.1
Radionuclides																						
Gross Alpha Activity	pCi/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	6	0	6	6
Gross Beta Activity	pCi/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	1	15	0	15	15
Radium 226+228	pCi/L	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

(1) Data are for surface water monitoring station PG-1.
(2) Data are for surface water monitoring station PG-4.
(3) Data are for surface water monitoring station HC-2.
(4) Value based on field measurements of pH and water temperature.

n = Number of surface water monitoring stations included in summary
AVG = Spatial average: computed average of the mean concentration for each surface water monitoring station
SD = Spatial standard deviation computed for multiple surface water monitoring stations or temporal standard deviation of the mean concentration for a single surface water monitoring station
MIN = Minimum analysis result: range includes all samples at each surface water monitoring station
MAX = Maximum analysis result: range includes all samples at each surface water monitoring station
TR = Total recoverable fraction
D = Dissolved fraction
A&Ww = Aquatic wildlife (warm water fishery)
FBC = Full body contact
FC = Fish consumption
AgI = Agricultural irrigation
AgL = Agricultural livestock watering

Notes:
Detection level data are treated as values at the reported level of detection when combined with detection values for average and standard deviation calculations (e.g., <1 mg/L and 3 mg/L has an average of 2 mg/L).
Water quality standard or criterion exceedance values are bolded; detection levels above the standard or criterion are indicated with a "#."

Soruce: GWRC (1996)

C-2

Water Supply Well and Spring Inventories

Table C2-1. Water Supply Well Inventory

Well Number	Well Name	Registration Number	Owner	Date Completed	Total Borehole Depth (ft below land surface)	CASING Diameter (inches)	CASING Depth Interval (ft below land surface)	CASING Open Interval (ft below land surface)	Static Water Level (ft below land surface)	Well Yield (gpm)
A-1-13										
14dcc	Peak 26	612301	Magma	09/23/77	550	12	0-505	465-505	23	445
23aa	#3 Seep Caisson	623199	Magma	--/--/81	16	72	0-16	---	6	300
23aad	Peak 29	612300	Magma	10/07/77	950	10	0-950	700-900	20	90
25ba	PV-SX	623211	Magma	--/--/81	180	6	0-180	---	60	40
25dbc	Peak 37	500797	Magma	07/30/81	775	8	0-20	20-775	74	70
25dc	#1 Seep Caisson	623215	Magma	--/--/81	24	72	0-24	---	8	300
A-1-14										
30ccc	Domestic #1	640808	Magma	03/--/73	300	10	0-300	---	---	25
30dd	Shop Site #1	640814	Magma	06/--/76	150	8	0-150	---	32	40
30ddc	Shop Site #2	612354	Magma	11/--/78	1,510	6	0-1,510	---	65	45
31bba	CDX-4	---	Magma	10/--/66	630	7	0-595	---	72	35
31bdc	Miller Springs #2	612310	Magma	--/--/77	750	6	0-750	---	93	50
31bdd	Domestic #2	---	---	10/--/44	455	6	0-435	---	---	40
31ccd	Cactus 131	640813	Magma	09/--/72	383	20	0-341	---	14	45
32cdb	Miller Spring #3	---	Magma	---	---	---	---	---	---	---
D-1-13										
02dca		609691	ASARCO	04/--/71	1306	7	0-1,306	---	867	35
11dbd		609688	ASARCO	---	1353	---	---	---	390	35
12		534002	Westmont Mining	03/09/92	70	---	---	---	---	---
12		534003	Westmont Mining	02/06/92	120	---	---	---	---	---
12		644585	Kilpatrick	---	215	8	0-8	---	60	11
12		644586	Kilpatrick	---	150	8	---	---	---	---
12		644587	Kilpatrick	---	450	6	0-450	---	150	8
12		644984	Wheeler	---	110	6	0-110	---	25	---
12		649696	Hoff	--/--/73	120	6	0-10	---	50	---
12		650390	Ezell	08/11/66	335	4	0-100	---	60	20
12		650391	Ezell	10/24/66	400	4	0-200	---	50	40
12		803359	Wheeler	--/--/79	114	6	0-114	---	25	---

Source: GWRC (1994)

Table C2-1. Water Supply Well Inventory (continued)

Well Number	Well Name	Registration Number	Owner	Date Completed	Total Borehole Depth (ft below land surface)	CASING			Static Water Level (ft below land surface)	Well Yield (gpm)
						Diameter (inches)	Depth Interval (ft below land surface)	Open Interval (ft below land surface)		
D-1-13 (Continued)										
12d		800366	George	09/19/73	437	8	0-4	---	50	6
12dad		519951	Hoff	01/18/88	345	7	0-20	---	---	"trace"
12dba		646283	Gardner	---	200	6	0-20	---	30	5
12dbb		509072	Gardner	08/14/84	300	5	0-300	---	100	10
12dca		646282	Gardner	---	200	6	0-20	---	30	5
12dcc		646281	Gardner	---	200	6	0-20	---	30	5
12dcd		634775	Norbeck	03/10/71	160	6	0-100	---	40	10
12dcd		634776	Norbeck	03/18/74	140	6	0-60	---	60	---
12dd		645706	Moore	---	120	6	0-25	---	---	---
12dd		645707	Moore	---	---	6	0-30	---	---	10
12dd		645708	Moore	---	165	6	0-20	---	---	10
12dd		645709	Moore	---	200	4	0-200	---	---	10
12ddc		506663	Dalton	---	134	6	---	---	30	---
12ddc		514166	Dalton	06/01/86	250	6	0-20	---	134	2
12ddc		645498	Dalton	---	215	6	0-80	---	120	---
12ddd		514167	Dalton	06/10/86	300	6	0-20	---	200	9
12ddd		514168	Dalton	06/05/86	200	6	0-20	---	---	5
12ddd		518712	Jackson	08/07/87	210	7	0-210	---	80	2
12ddd		646620	McClen-don	11/--/67	200	8	0-180	---	30	10
13		805443	Zobel	12/31/78	22	7	0-22	---	7	---
13aa		645501	Dalton	--/--/29	40	12	0-40	---	12	10
13aa		645502	Dalton	02/--/79	180	6	0-180	---	60	4
13aa		645505	Dalton	--/--/64	200	6	0-200	---	86	4
13aa		645506	Craib	---	100	5	---	---	---	12
13aa		645507	Craib	---	100	6	---	---	---	---

Source: GWRC (1994)

Table C2-1. Water Supply Well Inventory (continued)

Well Number	Well Name	Registration Number	Owner	Date Completed	Total Borehole Depth (ft below land surface)	CASING Diameter (inches)	CASING Depth Interval (ft below land surface)	CASING Open Interval (ft below land surface)	Static Water Level (ft below land surface)	Well Yield (gpm)
D-1-13 (Continued)										
13aaa		501372	TOW Properties	11/13/81	100	6	0-34	---	20	2
13aaa		804557	Clark	---	110	6	---	---	---	---
13aab		528291	Dalton	06/21/90	150	6	0-150	---	80	---
13ab		645495	Dalton	--/--/68	400	6	0-60	---	80	10
13ab		645496	Dalton	08/--/67	210	6	0-210	---	80	10
13ab		645497	Dalton	--/--/65	186	8	0-26	---	86	10
13ab		645499	Dalton	--/--/26	30	6	0-30	---	15	4
13ab		645500	Dalton	--/--/60	230	6	0-30	---	80	12
13ab		645503	Dalton	--/--/67	180	6	0-180	---	86	27
13aba		645504/512554	Dalton	07/06/85	333	4	0-333	50-333	40	17
13ba		802241	O'Neal	01/07/80	210	6	0-201	---	---	---
13bda		609854	Skousen	---	---	---	---	---	---	---
13cbb		602157	Cox	09/10/73	100	10	0-50	---	12	30
13cbd		609855	Zobel	---	---	---	---	---	---	---
13dab		632244	Henderson	08/29/73	125	6	0-12	---	15	4
13dbb		528515	Zobel	07/07/90	420	6	0-120	120-420	30	---
13dbc		537257	Clary	---	---	---	---	---	---	---
14ad		634020	Little	---	600	---	---	---	---	---
14bdd		650560	Reynolds	---	400	---	---	---	350	4
14da		643157	Little	---	600	6	0-30	---	250	---
14daa		528594	Wiley	07/12/90	325	9	0-200	---	80	30
14daa		528857	Buckridge	07/26/90	380	2	0-220	---	110	21
14daa		602399	Barte	01/15/79	100	8	0-41	---	15	---
14daa		609857	Skousen	---	1,050	---	---	---	650	---
14dab		530335	Wilson	07/25/91	1,002	6	0-1,002	---	622	5

Source: GWRC (1994)

Table C2-1. Water Supply Well Inventory (continued)

Well Number	Well Name	Registration Number	Owner	Date Completed	Total Borehole Depth (ft below land surface)	CASING			Static Water Level (ft below land surface)	Well Yield (gpm)
						Diameter (inches)	Depth Interval (ft below land surface)	Open Interval (ft below land surface)		
D-1-13 (Continued)										
14dab		635005	Ray	---	100	8	---	---	15	10
14dab		635006	Ray	---	31	8	---	---	20	10
14dac		537254	Clary	---	---	---	---	---	---	---
14dac		609853	Skousen	---	---	---	---	---	---	---
14dad		532150	Skousen	11/04/91	400	8	0-400	---	10	30
14dad		609852	Skousen	---	---	---	---	---	---	---
14dad		609856	Clary	---	760	---	---	---	---	---
14dbd		526188	ASARCO	10/20/89	545	6	0-545	---	180	8
14dbd		609684	ASARCO	---	20	48	0-20	---	8	35
14dbd		609685	ASARCO	--/--/80	100	8	0-18	---	8	15
14dc		642833	Knight	05/30/67	14	44	0-14	---	10	2
14dc		642834	Knight	---	335	6	0-15	---	200	3
14dca		609686	ASARCO	--/--/14	18	36	0-18	---	6	15
14dca		609687	ASARCO	--/--/12	18	60	0-18	---	6	5
14dcd		532468	Bratcher	12/20/92	600	7	0-600	---	520	---
14dda		527977	Skousen	05/30/90	400	11	0-190	---	110	10
14dda		528196	Rotz	05/31/90	325	6	0-205	---	110	20
14dda		602156	Cox	09/12/70	65	10	0-45	---	12	35
14dda		805984	Rotz	12/31/30	22	14	0-22	---	10	---
14ddb		645201	Buckridge	03/--/74	40	8	0-40	---	30	25
D-1-14										
7bca		519636	Magma	12/02/87	800	7	0-80	---	80	---
7ccb		805689	Hoff	12/31/47	26	6	0-15	---	---	10
7dcc		525052	Austin	12/20/89	195	6	0-20	20-195	80	1

Source: GWRC (1994)

C-3

Aquifer Test and Water Level Data

Table C3-1. Summary of Aquifer Tests Conducted on the Carlota Copper Project Site (Excluding Well Field)

Well No.	Geologic Units In Test Interval	Well Completion Depth[1]	Depth To Pre-Pumping Water Level[1]	Depth To Bottom Of Surface Seal[1]	Estimated Saturated Thickness (ft) Tested	Average Pumping Rate (gpm)	Pumping Period (hours)	Bulk Transmissivity (gpd/ft)	Bulk Hydraulic Conductivity (gpd/sq ft)
BMW-4	Pinal Schist	150	7	28	122.0	2.3	2.2	2.75	0.024
BMW-5	Diabase	185	8.3	63.7	121.3	NA	2	0.14	0.001
BMW-6	Pinal Schist	160.9	44.38	18	116.5	NA	4	UTA	<0.005
BMW-7	Diabase	158.3	107.3	18	51.0	NA	0.6	0.16	0.003
BMW-8	Diabase Pioneer Shale Pinal Schist	120.5	6.1	22	98.5	NA	1	0.41	0.004
BMW-9	Pinal Schist	198.8	12	17.6	181.2	3.6	1.1	0.02	0.0001
BMW-11	Shultze Granite	158.2	28.3	13	129.9	4.3	4	380	9.5
MW-1/BMW-	Cactus Breccia Pinal Schist	300	67.66	20	232.3	5	6	200	0.7
MW-3	Dacite Vitrophyre Cactus Breccia Pinal Schist	575	11.86	20	555.0	94	6	380	0.7
MW-4	Cactus Breccia Pinal Schist	300	105.78	20	194.2	5	6	240	1.2
MW-5	Dacite Cactus Breccia Pinal Schist Diabase	555	64.42	20	490.6	6.1	6	80	0.2
MW-6	Diabase	320	84.84	20	235.2	19	6	180	0.8
MW-7	Cactus Breccia Fault Gouge Pinal Schist	380	11.2	20	360.0	1	4.5	UTA	UTA
MW-8	Cactus Breccia Fault Gouge Pinal Schist Granite Pinal Schist	600	35.19	20	564.8	7.1	1.9	80	0.1
MW-9	Cactus Breccia Pinal Schist	620	0	40	580.0	2.4	6	10	0.03
MW-10	Cactus Breccia Fault Gouge Pinal Schist	340	56.78	20	283.2	2.3	2	10	0.04
PG-1	Diabase	200	14.52	20	180.0	4.5	3.3	5.7	0.3
PG-2	Diabase Pioneer Shale	200	2.9	20	180.0	29	6	234	1.3
PG-3	Pinal Schist Diabase	200	32.6	20	167.4	2	1.2	UTA	UTA

[1]Depth below land surface (ft)
UTA - Unable To Analyze
NA - Not Available
Source: GWRC (1994)

a210/feis/tables/appendc/tbc3-1.xls 06/03/97

Table C3-2. Summary of Water Level Fluctuations in Monitoring Wells

Area	Well	Type[1]	Monitoring Period	Minimum[3]		Maximum[3]		Fluctuation
				Depth (feet)	Date Recorded	Depth (feet)	Date Recorded	
Pinto Creek	AMW-13	A/B	3/93-12/95	-2.80	3/24/93	-12.59	8/8/94	9.79
Pinto Creek	AMW-14	B	3/93-12/95	-3.67	3/24/93	-12.51	10/23/95	8.84
Pinto Creek	AMW-15	A/B	3/93-12/95	-3.05	2/8/94	-10.61	7/11/94	7.56
Pinto Creek	BMW-1	B	10/91-12/95	-55.86	7/24/95	-67.72	11/21/91	11.86
Pinto Creek	BMW-2	B	10/91-12/95	-151.00	6/3/92	-153.67	1/5/94	2.67
Pinto Creek	BMW-4	B	7/93-12/95	-7.56	2/27/95	-12.75	8/8/94	5.19
Pinto Creek	BMW-5	B	7/93-12/95	-3.24	3/28/95	-10.00	11/28/95	6.76
Pinto Creek	MW-10	B	12/91-12/95	-16.63	7/24/95	-56.40	12/9/91	39.77
Pinto Creek	MW-11	B	12/91-12/95	-67.72	6/30/93	-76.32	12/17/91	8.60
Pinto Creek	MW-3	B	10/91-12/95	-0.83	3/23/93	-13.22	10/30/91	12.39
Pinto Creek	MW-4	B	11/91-12/95	-97.23	7/1/93	-105.64	11/21/91	8.41
Pinto Creek	MW-5	B	11/91-12/95	-9.15	3/23/93	-88.80	8/8/94	79.65
Pinto Creek	MW-6	B	12/91-12/95	-25.88	3/25/93	-84.65	2/12/92	58.77
Pinto Creek	MW-7	B	12/91-12/95	-3.19	3/28/95	-16.34	12/9/91	13.15
Pinto Creek	MW-8	B	12/91-12/95	-19.95	4/24/95	-45.72	12/9/91	25.77
Pinto Creek	MW-9	B	12/91-12/95	-0.17	1/5/94	-2.96	8/25/93	2.79
Powers Gulch	AMW-12	A/B	8/92-12/95	-0.49	8/25/92	-8.82	7/2/93	8.33
Powers Gulch	AMW-17	A/B	8/93-12/95	-13.60	5/31/95	-24.33	12/27/95	10.73
Powers Gulch	AMW-18	A/B	8/93-12/95	-3.45	12/27/94	-14.95	8/8/94	11.50
Powers Gulch	BMW-11	B	7/93-12/95	-79.32	7/7/93	-83.35	11/28/95	9.03
Powers Gulch	BMW-6	B	7/93-12/95	-44.38	7/8/93	-46.72	12/27/95	2.34
Powers Gulch	BMW-7	B	7/93-12/95	-110.00	9/10/93	-122.82	4/13/94	12.82
Powers Gulch	BMW-8	B	8/93-12/95	-4.65	8/25/93	-16.87	8/8/94	12.22
Powers Gulch	BMW-9	B	8/93-12/95	-13.82	3/28/95	-18.39	8/8/94	4.57
Powers Gulch	PG-1	B	2/92-12/95	-8.77	3/22/93	-40.01	12/27/94	31.31
Powers Gulch	PG-2	B	2/92-12/95	+1.5[2]	4/15/92 5/26/92	-200.00[4]	8/28/95; 9/25/95; 10/23/95; 11/28/95; 12/27/95	200.00
Powers Gulch	PG-2A	A/B	2/92-12/95	-2.27	3/23/93; 2/8/94	-10.37	12/27/95	8.10
Powers Gulch	PG-4	B	4/92-12/95	-32.64	4/17/92	-35.36	8/3/92	2.72
Powers Gulch	PG-5	B	4/92-12/95	-2.33	3/23/93	-20.11	12/27/95	17.78
Powers Gulch	PZ-1	B	8/93-12/95	-42.51	8/5/93	-46.68	12/27/95	4.17
Pinto Creek	AMW-21	A	9/93-12/95	-5.50	9/15/94	-9.31	11/1/93	3.81
Pinto Creek	AMW-22	A/B	8/93-12/95	-5.56	4/26/95	-12.59	7/26/95	7.03
Haunted Canyon	AMW-23	A/B	8/93-12/95	-3.13	2/1/95	-9.25	10/26/94	6.12

[1] A = alluvium, B = bedrock, A/B = both alluvium and bedrock
[2] Well flowing at the surface
[3] All measurements referenced from top of surface casing
[4] Well was reported dry; total completion depth was 200 feet

a210/feis/tables/appendc/tbc3-2.doc 06/03/97

C-4

Ground Water Quality Data

Table C4-1. Bedrock Ground Water Quality Summary

Constituent	Units	Standards: Arizona (1)	Standards: Federal MCL	Pinto Creek (4) n	AVG	SD	MIN	MAX	Powers Gulch (5) n	AVG	SD	MIN	MAX	Well Field (6) n	AVG	SD	MIN	MAX	Private Wells (7) n	AVG	SD	MIN	MAX
Physical and Aggregrate Properties																							
Conductivity	umhos/cm @ 25 C	---	---	4	527	142	290	880	5	647	307	280	1500	3	419	68	325	580	4	925	341	440	1240
Total Alkalinity	mg/L as CaCO3	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2	178	105	103	252
Total Dissolved Solids	mg/L @ 180 C	---	500(3)	4	348	106	182	**552**	5	472	247	200	**1250**	3	309	33	254	356	4	**683**	298	310	**1040**
Total Suspended Solids	mg/L @ 103 C	---	---	4	7.3	5.5	<0.1	14	5	16.7	15.9	<0.1	37	3	3.3	1.8	1.0	5.5	---	---	---	---	---
Water Temperature	Deg. C	---	---	4	19	1	13	22	5	17.9	0.9	15.5	21	3	26.8	2.6	23.5	31	---	---	---	---	---
Major Cations																							
Calcium	mg/L as Ca	---	---	4	54.1	35.7	2.8	114	5	51.4	29.5	13.7	119	3	54.5	11.9	39.6	70.6	4	123	54.9	48	180
Magnesium	mg/L as Mg	---	---	4	6.6	3.2	0.6	9.9	5	31.9	33.2	3.5	98.2	3	11.2	5.4	6.77	19.4	4	13.2	5.2	5.8	17.3
Potassium	mg/L as K	---	---	4	5.6	0.6	<0.1	9	5	5.9	0.9	1.7	14	3	4.9	0.6	3.2	6	4	1.8	0.14	1.7	2
Sodium	mg/L as Na	---	---	4	48.6	40.2	7.4	134	5	48.3	18.7	6.5	97.8	3	23.0	10.6	13.2	40	4	49	15	28	61
Major Anions																							
Bicarbonate	mg/L as HCO3	---	---	4	239	21	173	310	5	275	143	94	561	3	272	18	237	306	4	238	88	126	310
Chloride	mg/L as Cl	---	250(3)	4	19.8	9.7	6.9	46.6	5	25.9	9.2	7.2	83	3	10.5	0.4	9	11	4	76.1	35.8	23.4	103
Sulfate	mg/L as SO4	---	250(3)	4	49.6	59.8	<1	174	5	107	95.3	7.6	**416**	3	15	8.5	8	28	4	108	35	62	138
Inorganic Nonmetallics																							
Boron	mg/L as B	---	---	4	0.2	0.16	<0.1	0.6	5	0.1	0.04	<0.1	0.3	3	<0.1	0.0	<0.1	<0.1	4	0.49	0.36	0.16	0.98
Cyanide	mg/L as CN	0.2	0.2(2)	4	<0.1	0.001	<0.04	<0.1	5	0.1	0.01	<0.04	**0.32**	3	<0.1	0.0	<0.1	<0.1	---	---	---	---	---
Fluoride	mg/L as F	4.0	4.0(2)/2.0(3)	4	2.0	2.5	<0.1	**10**	5	0.5	0.2	0.2	1.1	3	0.28	0.06	0.22	0.37	---	---	---	---	---
Nitrate	mg/L as N	10	10(2)	4	3.9	0.6	<0.4	5.8	5	1.3	0.5	<0.1	9.9	3	4.0	2.5	<0.4	5.8	---	---	---	---	---
Nitrate + Nitrite	mg/L as N	10	10(2)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	2	5.9	5.0	2.3	9.3
Nitrite	mg/L as N	1	1(2)	4	0.3	0.01	<0.1	<0.5	5	<0.5	0.01	<0.1	<0.5	2	<0.1	0.0	<0.1	<0.1	---	---	---	---	---
Nitrogen, Kjeldahl	mg/L as N	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Orthophosphate	mg/L as P	---	---	4	0.7	0.2	<0.5	1	5	0.9	0.7	<0.5	2.3	3	<0.5	0.0	<0.5	<0.5	---	---	---	---	---
pH	std. units	---	6.5-8.5(3)	4	7.5	0.3	6.8	8.4	5	7.3	0.3	**6.1**	8	3	7.3	0.2	6.8	7.8	4	6.8	0.3	6.5	7.1
Silica	mg/L as SIO2	---	---	4	21.7	11.5	2.8	38.2	5	37.7	15.4	9.9	71.4	3	44.6	13.1	25.3	56	4	55.3	6.2	47	62
Sulfide	mg/L as S	---	---	---	---	---	---	---	---	---	---	---	---	3	<0.1	0.0	<0.1	<0.1	2	2.3	1.9	1	3.7
Total Ammonia	mg/L as N	---	---	4	0.2	0.1	<0.1	0.6	5	0.14	0.0	<0.1	0.33	3	0.1	0.0	<0.1	0.1	---	---	---	---	---
Total Phosphorus	mg/L as P	---	---	4	<0.5	0.0	<0.5	<0.5	5	0.6	0.1	<0.5	0.8	---	---	---	---	---	---	---	---	---	---

(1) Arizona Aquifer Water Quality Standard.
(2) Federal primary maximum contaminant level (MCL) for drinking water.
(3) Federal secondary maximum contaminant level (MCL) for drinking water.
(4) Data are for monitoring wells BMW -1, BMW-2, BMW-4, and BMW-5.
(5) Data are for monitoring wells BMW -6, BMW-7, BMW-8, BMW-9, and BMW-11.
(6) Data are for monitoring wells TW-1, TW-2, and TW-3.
(7) Wells monitoring in the Top-of-the-World area in Upper Powers Gulch.
(8) Action level for treatment technique requirement.

Source: GWRC (1996)

n = Number of monitoring wells included in summary
AVG = Spatial average: computed average of the mean concentration for each monitoring well
SD = Spatial standard deviation computed for multiple monitoring wells or temporal standard deviation for a single monitoring well
MIN = Minimum analysis result: range includes all samples at each monitoring well
MAX = Maximum analysis result: range includes all samples at each monitoring well

Notes:
Detection level data are treated as values at the reported level of detection when combined with detection values for average and standard deviation calculations (e.g., <1 mg/L and 3 mg/L has an average of 2 mg/L).
Water quality standard or criterion exceedance values are bolded; detection levels above the standard or criterion are indicated with a "#."

Table C4-1. Bedrock Ground Water Quality Summary (continued)

Constituent	Units	Standards		Pinto Creek (4)					Powers Gulch (5)					Well Field (6)					Private Wells (7)				
		Arizona (1)	Federal MCL	n	AVG	SD	MIN	MAX	n	AVG	SD	MIN	MAX	n	AVG	SD	MIN	MAX	n	AVG	SD	MIN	MAX
Dissolved Metals																							
Aluminum	mg/L as Al	---	0.05-0.2(3)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Antimony	mg/L as Sb	0.006	0.006(2)	4	<0.005	0.000	<0.004	<0.005	5	0.005	0.0002	<0.004	0.005	3	<0.2#	0.0	<0.2#	<0.2#	---	---	---	---	---
Arsenic	mg/L as As	0.05	0.05(2)	4	0.005	0.001	<0.001	0.007	5	0.007	0.002	<0.001	0.013	3	0.014	0.004	0.01	0.021	4	0.002	0.001	<0.002	0.0033
Barium	mg/L as Ba	2	2(2)	4	<1	0	<1	<1	5	<1	0	<1	<1	3	<1	0.23	<0.01	<1	4	<0.1	0.0	<0.1	<0.1
Beryllium	mg/L as Be	0.004	0.004(2)	4	<0.1#	0.004	<0.0009	<0.1#	5	<0.1#	0.00	<0.0009	<0.1#	2	<0.1#	0.0	<0.1#	<0.1#	---	---	---	---	---
Cadmium	mg/L as Cd	0.005	0.005(2)	4	<0.005	0.00002	<0.003	<0.005	5	<0.005	0.00002	<0.003	<0.005	3	<0.005	0.0005	<0.003	<0.005	4	<0.005	0.000	<0.005	<0.005
Cobalt	mg/L as Co	---	---	4	<0.1	0.0	<0.1	<0.1	5	<0.1	0.0	<0.1	<0.1	---	---	---	---	---	---	---	---	---	---
Chromium (VI)	mg/L as Cr	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Chromium (total)	mg/L as Cr	0.1	0.1(2)	4	<0.05	0.0002	<0.03	<0.05	5	<0.05	0.0002	<0.03	<0.05	3	<0.05	0.010	<0.003	<0.05	4	<0.01	0.00	<0.01	<0.01
Copper	mg/L as Cu	---	1.3(2)(8)/1.0	4	<0.5	0.01	<0.02	<0.5	5	<0.5	0.01	<0.02	<0.5	3	<0.1	0.04	<0.02	<0.1	4	0.015	0.015	<0.010	0.037
Iron	mg/L as Fe	---	0.3(3)	4	**0.5**	0.4	<0.1	**2.4**	5	0.2	0.03	<0.1	**0.4**	3	**0.5**	0.4	<0.1	**1.8**	4	<0.05	0.00	<0.05	<0.05
Lead	mg/L as Pb	0.05	0.015(2)(8)	4	0.006	0.0003	<0.005	0.014	5	0.006	0.001	<0.005	**0.02**	3	<0.005	0.000	<0.005	<0.005	4	<0.005	0.003	<0.005	0.0076
Manganese	mg/L as Mn	---	0.05(3)	4	**0.30**	0.28	<0.02	**1.1**	5	**0.15**	0.19	<0.02	**1.26**	3	**0.05**	0.02	<0.02	**0.09**	4	0.01	0.02	<0.01	0.042
Mercury	mg/L as Hg	0.002	0.002(2)	4	<0.001	0.000004	<0.0006	<0.001	5	<0.001	0.000004	<0.0006	<0.001	3	<0.001	0.000	<0.001	<0.001	4	<0.0002	0.0000	<0.0002	<0.0002
Molybdenum	mg/L as Mo	---	---	4	0.066	0.082	<0.001	0.3	5	0.01	0.004	<0.001	0.031	3	0.005	0.001	<0.001	0.01	2	<0.01	0.00	<0.01	<0.01
Nickel	mg/L as Ni	0.1	0.1(2)	4	<0.1	0.0	<0.1	<0.1	5	<0.1	0.0	<0.1	<0.1	2	<0.1	0.0	<0.1	<0.1	---	---	---	---	---
Selenium	mg/L as Se	0.05	0.05(2)	4	0.006	0.0003	<0.001	0.02	5	<0.02	0.0004	<0.001	<0.02	3	0.001	0.000	<0.001	0.001	4	<0.002	0.000	<0.002	<0.002
Silver	mg/L as Ag	---	0.1(3)	4	0.01	0.0001	<0.005	0.01	5	<0.01	0.0001	<0.005	<0.01	3	<0.01	0.00	<0.01	<0.01	4	<0.01	0.00	<0.01	<0.01
Thallium	mg/L as Tl	0.002	0.002(2)	4	<0.1#	0.007	<0.002	<0.1#	5	<0.1#	0.05	<0.002	<0.1#	3	<0.1#	0.0	<0.1#	<0.1#	---	---	---	---	---
Zinc	mg/L as Zn	---	5.0(3)	4	0.08	0.05	<0.04	0.54	5	0.09	0.03	<0.04	0.8	3	0.12	0.08	<0.04	0.42	4	**5.5**	10.6	<0.01	**21.4**
Radionuclides																							
Gross Alpha Activity	pCi/L	15	15(2)	4	3	2	<2	6	5	4	4	<2	11	3	8	10	<2	**19**	---	---	---	---	---
Gross Beta Activity	pCi/L	4 mrem/yr	50(2)	4	7	6	<3	16	5	7	8	<3	21	3	7	7	<3	15	---	---	---	---	---
Radium 226+228	pCi/L	5	5(2)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

(1) Arizona Aquifer Water Quality Standard.
(2) Federal primary maximum contaminant level (MCL) for drinking water.
(3) Federal secondary maximum contaminant level (MCL) for drinking water.
(4) Data are for monitoring wells BMW -1, BMW-2, BMW-4, and BMW-5.
(5) Data are for monitoring wells BMW -6, BMW-7, BMW-8, BMW-9, and BMW-11.
(6) Data are for monitoring wells TW-1, TW-2, and TW-3.
(7) Wells monitoring in the Top-of-the-World area in Upper Powers Gulch.
(8) Action level for treatment technique requirement.

Source: GWRC (1996)

n = Number of monitoring wells included in summary
AVG = Spatial average: computed average of the mean concentration for each monitoring well
SD = Spatial standard deviation computed for multiple monitoring wells or temporal standard deviation for a single monitoring well
MIN = Minimum analysis result: range includes all samples at each monitoring well
MAX = Maximum analysis result: range includes all samples at each monitoring well

Notes:
Detection level data are treated as values at the reported level of detection when combined with detection values for average and standard deviation calculations (e.g., <1 mg/L and 3 mg/L has an average of 2 mg/L).
Water quality standard or criterion exceedance values are bolded; detection levels above the standard or criterion are indicated with a "#".

Table C4-2. Alluvium Ground Water Quality Summary

Constituent	Units	Standards: Arizona (1)	Standards: Federal MCL	Pinto Creek (4) n	AVG	SD	MIN	MAX	Powers Gulch (5) n	AVG	SD	MIN	MAX	Well Field (6) n	AVG	SD	MIN	MAX
Physical and Aggregrate Properties																		
Conductivity	umhos/cm @ 25 C	---	---	2	1431	769	360	2750	1	2935	799	1700	4000	2	519	98	150	980
Total Dissolved Solids	mg/L @ 180 C	---	500(3)	2	**1428**	932	252	**2840**	1	**2522**	665	**1560**	**3340**	2	366	78	156	**670**
Total Suspended Solids	mg/L @ 103 C	---	---	2	141	77	32	404	1	1330	0	1330	1330	2	1.5	0.5	1	2
Water Temperature	Deg. C	---	---	2	17	2.8	13	22	1	16	2	13	19	2	16	0.06	7	23
Major Cations																		
Calcium	mg/L as Ca	---	---	2	292	180	41.7	684	1	252	79	155	381	2	70.2	14.4	19.4	121
Magnesium	mg/L as Mg	---	---	2	48	27	7.6	105	1	151	38	93	205	2	16.4	2.0	5.1	26.1
Potassium	mg/L as K	---	---	2	9	2	2.5	17	1	11	7	<5	28	2	7.0	1.8	<0.1	22
Sodium	mg/L as Na	---	---	2	51	17	13.9	103	1	300	81	166	381	2	14.0	1.7	5.3	24.2
Major Anions																		
Bicarbonate	mg/L as HCO3	---	---	2	203	61	115	297	1	572	129	244	703	2	228	18	127	323
Chloride	mg/L as Cl	---	250(3)	2	38.5	19.9	8.7	74.8	1	141	63	72.4	**295**	2	10.3	2.3	<5	22
Sulfate	mg/L as SO4	---	250(3)	2	**748**	545	87.6	**1624**	1	**1186**	335	**691**	**1610**	2	80	35	18.6	219
Inorganic Nonmetallics																		
Boron	mg/L as B	---	---	2	<0.1	0.01	<0.1	0.2	---	<0.1	0.0	<0.1	<0.1	1	<0.1	0.03	<0.01	<0.1
Cyanide	mg/L as CN	0.2	0.2(2)	2	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	2	<0.1	0.0	<0.1	<0.1
Fluoride	mg/L as F	4.0	4.0(2)/2.0(3)	2	0.7	0.1	0.51	1.0	1	**3.6**	0.8	1.54	**4.9**	2	<0.5	0.1	0.2	<0.5
Nitrate	mg/L as N	10	10(2)	2	3.3	0.5	<0.4	5.3	1	4	2.2	<0.4	7.5	2	<5.0	2.2	<0.4	<5.0
Nitrite	mg/L as N	1	1(2)	2	<0.5	0.01	<0.1	<0.5	1	0.4	0.3	<0.1	<1	2	<0.5	0.2	<0.1	<0.5
Nitrogen, Kjeldahl	mg/L as N	---	---	2	0.83	0.14	0.69	0.97	---	---	---	---	---	---	---	---	---	---
Orthophosphate	mg/L as P	---	---	2	<0.5	0.05	<0.5	0.6	1	<0.5	0.0	<0.5	<0.5	2	<0.5	0.0	<0.5	<0.5
pH	std. units	---	6.5-8.5(3)	2	6.8	0.1	6.4	7.4	1	7.1	0.3	6.5	7.5	2	7.1	0.1	6.5	7.6
Silica	mg/L as SIO2	---	---	2	38.6	3.1	17.8	49.9	1	40.2	6.8	30.4	49.8	2	44.5	2.4	22.7	63.4
Sulfide	mg/L as S	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Total Ammonia	mg/L as N	---	---	2	<0.1	0.005	<0.1	0.2	1	<1	0.27	<0.1	<1	2	<0.1	0.01	<0.1	0.2
Total Phosphorus	mg/L as P	---	---	2	<0.5	0.0	<0.5	<0.5	1	<0.5	0.0	<0.5	<0.5	2	<0.5	0.0	<0.5	<0.5

(1) Arizona Aquifer Water Quality Standards.
(2) Federal primary maximum contaminant level (MCL) for drinking water.
(3) Federal secondary maximum contaminant level (MCL) for drinking water.
(4) Data are for monitoring wells AMW-12 and AMW-15.
(5) Data are for monitoring well AMW-17.
(6) Data are for monitoring wells AMW-21 and AMW-23.
(7)Action level for treatment technique requirement.

Source: GWRC (1996)

n = Number of monitoring wells included in summary
AVG = Spatial average: computed average of the mean concentration for each monitoring well
SD = Spatial standard deviation: computed standard deviation of the mean concentration for each monitoring well
MIN = Minimum analysis result: range includes all samples at each monitoring well
MAX = Maximum analysis result: range includes all samples at each monitoring well

Notes:
Detection level data are treated as values at the reported level of detection when combined with detection values for average and standard deviation calculations (e.g., <1 mg/L and 3 mg/L has an average of 2 mg/L).
Water quality standard or criterion exceedance values are bolded; detection levels above the standard or criterion are indicated with a "#."

Table C4-2. Alluvium Ground Water Quality Summary (continued)

Constituent	Units	Standards: Arizona (1)	Standards: Federal MCL	Pinto Creek (4) n	AVG	SD	MIN	MAX	Powers Gulch (5) n	AVG	SD	MIN	MAX	Well Field (6) n	AVG	SD	MIN	MAX
Dissolved Metals																		
Aluminum	mg/L as Al	---	0.05-0.2(3)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Antimony	mg/L as Sb	0.006	0.006(2)	2	<0.2#	0.01	<0.004	<0.2#	1	0.006	0.003	<0.004	**0.009**	2	0.005	0.0003	<0.004	**0.007**
Arsenic	mg/L as As	0.05	0.05(2)	2	<0.005	0.0001	0.001	<0.005	1	<0.005	0.002	<0.001	<0.005	2	0.007	0.0004	0.003	0.014
Barium	mg/L as Ba	2	2(2)	2	<1	0	<1	<1	1	<1	0	<1	<1	2	<1	0.1	<0.01	<1
Beryllium	mg/L as Be	0.004	0.004(2)	2	<0.1#	0.002	<0.0009	<0.1#	1	<0.1#	0.05	0.0014	<0.1#	2	<0.1#	0.05	<0.0009	<0.1#
Cadmium	mg/L as Cd	0.005	0.005(2)	2	0.005	0.001	<0.003	**0.019**	1	**0.006**	0.01	<0.003	**0.034**	2	<0.005	0.0001	<0.003	<0.005
Chromium (VI)	mg/L as Cr	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Chromium (total)	mg/L as Cr	0.1	0.1(2)	2	<0.05	0.001	<0.03	<0.05	1	<0.05	0.01	<0.03	<0.05	2	<0.05	0.001	<0.03	<0.05
Cobalt	mg/L as Co	---	---	2	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	2	<0.1	0.0	<0.1	<0.1
Copper	mg/L as Cu	---	1.3(2)(7)/1.0(3)	2	<0.5	0.02	<0.02	<0.5	1	<0.5	0.1	<0.02	<0.5	2	<0.5	0.001	<0.02	<0.5
Iron	mg/L as Fe	---	0.3(3)	2	**0.6**	0.4	<0.1	**1.9**	1	<0.3	0.06	<0.1	<0.3	2	<0.3	0.1	<0.1	<0.3
Lead	mg/L as Pb	0.05	0.015(2)(7)	2	0.006	0.0004	<0.005	0.012	1	0.005	0.001	<0.005	0.009	2	0.007	0.001	<0.005	**0.017**
Manganese	mg/L as Mn	---	0.05(3)	2	**0.70**	0.68	<0.02	**2**	1	**0.71**	1.18	<0.02	**3.3**	2	**0.05**	0.02	<0.02	**0.1**
Mercury	mg/L as Hg	0.002	0.002(2)	2	<0.001	0.00001	<0.0006	<0.001	1	<0.001	0.0001	<0.0006	<0.001	2	<0.001	0.0001	<0.0006	<0.001
Molybdenum	mg/L as Mo	---	---	2	0.03	0.004	<0.001	0.09	1	0.02	0.02	<0.001	0.05	2	0.007	0.001	<0.001	0.012
Nickel	mg/L as Ni	0.1	0.1(2)	2	<0.1	0.0	<0.1	<0.1	1	<0.1	0.0	<0.1	<0.1	2	<0.1	0.0	<0.1	<0.1
Selenium	mg/L as Se	0.05	0.05(2)	2	<0.005	0.0002	<0.001	<0.005	1	<0.02	0.004	<0.005	<0.02	2	<0.005	0.002	<0.001	<0.005
Silver	mg/L as Ag	---	0.1(3)	2	<0.01	0.0002	<0.005	<0.01	1	<0.01	0.002	<0.005	<0.01	2	<0.01	0.002	<0.005	<0.01
Thallium	mg/L as Tl	0.002	0.002(2)	2	<0.1#	0.05	<0.002	<0.1#	1	<0.1#	0.04	<0.002	<0.1#	2	<0.1#	0.01	<0.002	<0.1#
Zinc	mg/L as Zn	---	5.0(3)	2	0.07	0.01	<0.04	0.22	1	0.09	0.04	<0.04	0.14	2	0.06	0.01	<0.04	0.13
Radionuclides																		
Gross Alpha Activity	pCi/L	15	15(2)	2	3.5	2.1	<2	5	1	14	0	14	14	2	4	1.4	3	5
Gross Beta Activity	pCi/L	4 mrem/yr	50(2)	2	7	5.7	<3	11	1	7	0	7	7	2	9.5	5.0	6	13
Radium 226+228	pCi/L	5	5(2)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

(1) Arizona Aquifer Water Quality Standards.
(2) Federal primary maximum contaminant level (MCL) for drinking water.
(3) Federal secondary maximum contaminant level (MCL) for drinking water.
(4) Data are for monitoring wells AMW-12 and AMW-15.
(5) Data are for monitoring well AMW-17.
(6) Data are for monitoring wells AMW-21 and AMW-23.
(7)Action level for treatment technique requirement.

Source: GWRC (1996)

n = Number of monitoring wells included in summary
AVG = Spatial average: computed average of the mean concentration for each monitoring well
SD = Spatial standard deviation: computed standard deviation of the mean concentration for each monitoring well
MIN = Minimum analysis result: range includes all samples at each monitoring well
MAX = Maximum analysis result: range includes all samples at each monitoring well

Notes:
Detection level data are treated as values at the reported level of detection when combined with detection values for average and standard deviation calculations (e.g., <1 mg/L and 3 mg/L has an average of 2 mg/L).
Water quality standard or criterion exceedance values are bolded; detection levels above the standard or criterion are indicated with a "#."

Table C4-3. Spring Water Quality Summary

Constituent	Units	Standards: Arizona (1)	Standards: Federal MCL	Mule Spring: n	AVG	SD	MIN	MAX	Grizzly Bear Spring (5): n	AVG	SD	MIN	MAX
Physical and Aggregrate Properties													
Conductivity	umhos/cm @ 25 C	---	---	1	233	42	190	290	1	610	0	610	610
Total Dissolved Solids	mg/L @ 180 C	---	500(3)	1	223	31	188	263	1	470	0	470	470
Total Hardness	mg/L as CaCO3	---	---	1	94.8	14.9	85.6	112	---	---	---	---	---
Total Suspended Solids	mg/L @ 103 C	---	---	1	<0.1	0.0	<0.1	<0.1	---	---	---	---	---
Water Temperature	Deg. C	---	---	1	15	10	5	29	---	---	---	---	---
Major Cations													
Calcium	mg/L as Ca	---	---	1	27.5	3.3	24.8	32.1	1	94	0	94	94
Magnesium	mg/L as Mg	---	---	1	6.32	0.94	5.57	7.65	1	10.1	0.0	10.1	10.1
Potassium	mg/L as K	---	---	1	<5.0	2.1	<0.1	<5.0	1	4.5	0.0	4.5	4.5
Sodium	mg/L as Na	---	---	1	18.1	2.0	15.3	20	1	27	0	27	27
Major Anions													
Bicarbonate	mg/L as HCO3	---	---	1	158	14	146	178	1	290	0	290	290
Chloride	mg/L as Cl	---	250(3)	1	6.5	1.4	5	8.4	1	9.5	0.0	9.5	9.5
Sulfate	mg/L as SO4	---	250(3)	1	6.8	1.9	4.3	9	1	86	0	86	86
Inorganic Nonmetallics													
Boron	mg/L as B	---	---	1	<0.1	0.05	<0.001	<0.1	---	---	---	---	---
Cyanide	mg/L as CN	0.2	0.2(2)	1	<0.1	0.0	<0.1	<0.1	---	---	---	---	---
Fluoride	mg/L as F	4.0	4.0(2)/2.0(3)	---	---	---	---	---	1	0.2	0.0	0.2	0.2
Nitrate	mg/L as N	10	10(2)	1	1.5	1.5	<0.4	3.5	---	---	---	---	---
Nitrite	mg/L as N	1	1(2)	1	<0.1	0.0	<0.1	<0.1	---	---	---	---	---
Nitrogen, Kjeldahl	mg/L as N	---	---	1	0.9	0.0	0.9	0.9	---	---	---	---	---
Orthophosphate	mg/L as P	---	---	1	<0.5	0.0	<0.5	<0.5	---	---	---	---	---
pH	std. units	---	6.5-8.5(3)	1	7.9	0.2	7.6	8.2	1	8.0	0.0	8.0	8.0
Silica	mg/L as SIO2	---	---	1	73.4	7.5	66.2	83.8	1	66	0	66	66
Sulfide	mg/L as S	---	---	1	<0.1	0.0	<0.1	<0.1	---	---	---	---	---
Total Ammonia	mg/L as N	---	---	1	<0.1	0.0	<0.1	<0.1	---	---	---	---	---
Total Phosphorus	mg/L as P	---	---	---	---	---	---	---	---	---	---	---	---

(1) Arizona Aquifer Water Quality Standard.
(2) Federal primary maximum contaminant level (MCL) for drinking water.
(3) Federal secondary maximum contaminant level (MCL) for drinking water.
(4) Action level for treatment technique requirement.
(5) Montgomery & Associates, Inc. (1993) data.

Source: GWRC (1996)
Montgomery & Associates, Inc. (1993)

n = Number of monitored springs included in summary
AVG = Temporal average: computed average of the mean concentration for each monitored spring
SD = Temporal standard deviation of the mean concentration for each monitored spring
MIN = Minimum analysis result: range includes all samples at each monitored spring
MAX = Maximum analysis result: range includes all samples at each monitored spring

Notes:
Detection level data are treated as values at the reported level of detection when combined with detection values for average and standard deviation calculations (e.g., <1 mg/L and 3 mg/L has an average of 2 mg/L).
Water quality standard or criterion exceedance values are bolded; detection levels above the standard or criterion are indicated with a "#."

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Table C4-3. Spring Water Quality Summary (continued)

Constituent	Units	Standards		Mule Spring					Grizzly Bear Spring (5)				
		Arizona (1)	Federal MCL	n	AVG	SD	MIN	MAX	n	AVG	SD	MIN	MAX
Dissolved Metals													
Aluminum	mg/L as Al	---	0.05-0.2(3)	---	---	---	---	---	---	---	---	---	---
Antimony	mg/L as Sb	0.006	0.006(2)	1	<0.2#	0.1	<0.01#	<0.2#	---	---	---	---	---
Arsenic	mg/L as As	0.05	0.05(2)	1	0.003	0.0002	0.0026	0.003	1	0.0034	0.0000	0.0034	0.0034
Barium	mg/L as Ba	2	2(2)	1	<1	0.5	0.03	<1	1	<0.1	0.0	<0.1	<0.1
Beryllium	mg/L as Be	0.004	0.004(2)	1	<0.1#	0.05	<0.0005	<0.1#	1	<0.01#	0.00	<0.01#	<0.01#
Cadmium	mg/L as Cd	0.005	0.005(2)	1	<0.003	0.001	<0.0005	<0.003	1	<0.005	0.000	<0.005	<0.005
Chromium (VI)	mg/L as Cr	---	---	---	---	---	---	---	---	---	---	---	---
Chromium (total)	mg/L as Cr	0.1	0.1(2)	1	<0.03	0.01	<0.005	<0.03	1	<0.01	0.00	<0.01	<0.01
Cobalt	mg/L as Co	---	---	---	---	---	---	---	---	---	---	---	---
Copper	mg/L as Cu	---	1.3(2)(4)/1.0(3)	1	<0.1	0.04	0.003	<0.1	1	<0.01	0.00	<0.01	<0.01
Iron	mg/L as Fe	---	0.3(3)	1	<0.1	0.02	0.057	<0.1	1	<0.05	0.00	<0.05	<0.05
Lead	mg/L as Pb	0.05	0.015(2)(4)	1	<0.005	0.002	0.0012	<0.005	1	<0.005	0.000	<0.005	<0.005
Manganese	mg/L as Mn	---	0.05(3)	1	0.04	0.02	0.011	**0.06**	1	<0.01	0.00	<0.01	<0.01
Mercury	mg/L as Hg	0.002	0.002(2)	1	<0.001	0.000	<0.001	<0.001	1	<0.0002	0.0000	<0.0002	<0.0002
Molybdenum	mg/L as Mo	---	---	1	<0.005	0.002	<0.001	<0.005	---	---	---	---	---
Nickel	mg/L as Ni	0.1	0.1(2)	1	<0.1	0.04	<0.005	<0.1	1	<0.05	0.00	<0.05	<0.05
Selenium	mg/L as Se	0.05	0.05(2)	1	<0.001	0.0004	<0.0005	<0.001	1	<0.002	0.000	<0.002	<0.002
Silver	mg/L as Ag	---	0.1(3)	1	<0.01	0.004	<0.0005	<0.01	1	<0.01	0.00	<0.01	<0.01
Thallium	mg/L as Tl	0.002	0.002(2)	1	<0.1#	0.0	<0.1#	<0.1#	---	---	---	---	---
Zinc	mg/L as Zn	---	5.0(3)	1	<0.04	0.01	0.021	<0.04	1	<0.01	0.00	<0.01	<0.01
Radionuclides													
Gross Alpha Activity	pCi/L	15	15(2)	1	4	0	4	4	1	3	0	3	3
Gross Beta Activity	pCi/L	4 mrem/yr	50(2)	1	12	0	12	12	---	---	---	---	---
Radium 226+228	pCi/L	5	5(2)	---	---	---	---	---	---	---	---	---	---

(1) Arizona Aquifer Water Quality Standard.
(2) Federal primary maximum contaminant level (MCL) for drinking water.
(3) Federal secondary maximum contaminant level (MCL) for drinking water.
(4) Action level for treatment technique requirement.
(5) Montgomery & Associates, Inc. (1993) data.

n = Number of monitored springs included in summary
AVG = Temporal average: computed average of the mean concentration for each monitored spring
SD = Temporal standard deviation of the mean concentration for each monitored spring
MIN = Minimum analysis result: range includes all samples at each monitored spring
MAX = Maximum analysis result: range includes all samples at each monitored spring

Notes:
Detection level data are treated as values at the reported level of detection when combined with detection values for average and standard deviation calculations (e.g., <1 mg/L and 3 mg/L has an average of 2 mg/L).
Water quality standard or criterion exceedance values are bolded; detection levels above the standard or criterion are indicated with a "#."

Source: GWRC (1996)
Montgomery & Associates, Inc. (1993)

C-5

Water Quality Data Associated with Environmental Consequences

Table C5-1. Carlota/Cactus Pit Lake Water Chemistry MINTEQA2 Model Results at Water Level Equilibrium (125 yrs)

Constituent	Units	Arizona Aquifer Standard (1)	Federal MCL	Pinto Creek Water Quality Standard FBC	Pinto Creek Water Quality Standard AgL	MINTEQA2 Modeling Input (5)	MINTEQA2 Modeling Result (5)
Physical and Aggregate Properties							
TDS	mg/L @ 180°C	---	500 (3)	---	---	---	**687 (3)**
Major Cations							
Calcium	mg/L as Ca	---	---	---	---	124	20
Magnesium	mg/L as Mg	---	---	---	---	23	23
Sodium	mg/L as Na	---	---	---	---	117	117
Potassium	mg/L as K	---	---	---	---	9.4	9.4
Major Anions							
Bicarbonate	mg/L as CaCO3	---	---	---	---	322	127
Chloride	mg/L as Cl	---	250 (3)	---	---	44	44
Sulfate	mg/L as SO4	---	250 (3)	---	---	**275**	**275**
Inorganic Nonmetallics							
Boron	mg/L as B	---	---	12.6	---	0.0580D	0.0580D
Fluoride	mg/L as F	4.0	4.0(2)/2.0(3)	8.4	---	**4.36**	**4.36**
Nitrate	mg/L as N	10	10 (2)	224	---	0.54	0.54
pH	S.U.	---	6.5-8.5 (3)	6.5-9.0	6.5-9.0	---	8.4
Silica	mg/L as SiO2	---	---	---	---	32.8	32.8
Metals							
Aluminum	mg/L as Al	---	0.05-0.2 (3)	---	---	**0.3700D**	0.0462D
Arsenic	mg/L as As	0.05	0.05 (2)	0.05TR	0.2TR	0.0081D	<0.0001D
Barium	mg/L as Ba	2	2 (2)	9.8D	---	0.0086D	0.0086D
Chromium	mg/L as Cr	0.1	0.1 (2)	---	1TR	0.0006D	0.0005D
Copper	mg/L as Cu	---	1.3(2,4)/1.0(3)	5.2D	0.5TR	0.1687D	0.0583D
Iron	mg/L as Fe	---	0.3 (3)	---	---	**2.5725D**	0.0005D
Lead	mg/L as Pb	0.05	0.015 (2,4)	---	0.1TR	0.0066D	0.0018D
Manganese	mg/L as Mn	---	0.05 (3)	19.6TR	---	**0.2992D**	<0.0001D
Selenium	mg/L as Se	0.05	0.05 (2)	0.7TR	0.05TR	0.0055D	0.0055D
Silver	mg/L as Ag	---	0.1 (3)	---	---	0.0073D	0.0073D
Strontium	mg/L as Sr	---		---	---	1.9075D	1.9092D
Zinc	mg/L as Zn	---	5.0 (3)	42.0TR	25.0TR	1.5116D	1.2716D

(1) Arizona Aquifer Water Quality Standard.
(2) Federal primary maximum level (MCL) for drinking water.
(3) Federal secondary MCL for drinking water.
(4) Action level for treatment technique requirement.
(5) Exceedances to standards are given in bold type.

D = Dissolved fraction
TR = Total recoverable fraction
FBC = Full body contact
AgL = Agricultural livestock watering

a210/eis/tables/appendc/tbc-5-1.xls 6/3/97

Table C5-2. Mine Rock Area Meteoric Water Mobility Test Results Tonnage Weighted to Rock Type

Constituent	Units	Arizona Aquifer Standard (1)	Federal MCL	Pinto Creek (and its Tributaries) Water Quality Standard						Rock Area (4)		
				A & Ww								
				Acute	Chronic	FBC	FC	AgI	AgL	Main	South West	Eder
Physical and Aggregate Properties												
Alkalinity	mg/L as CaCO3	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	45.5	77.1	57.1
TDS	mg/L @ 180°C	- - -	500 (3)	- - -	- - -	- - -	- - -	- - -	- - -	100.3	110.7	210.5
Major Cations												
Calcium	mg/L as Ca	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	5.0	5.7	11.1
Magnesium	mg/L as Mg		- - -	- - -	- - -	- - -	- - -	- - -	- - -	0.3	0.3	1.6
Potassium	mg/L as K	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	10.8	3.0	14.2
Sodium	mg/L as Na	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	19.7	24.5	29.3
Major Anions												
Chloride	mg/L as Cl	- - -	250 (2)	- - -	- - -	- - -	- - -	- - -	- - -	7.1	10.9	8.3
Sulfate	mg/L as SO4	- - -	250 (2)	- - -	- - -	- - -	- - -	- - -	- - -	18.8	17.4	50.8
Inorganic Metallics												
Boron	mg/L as B	- - -	- - -	- - -	- - -	12.6	- - -	1.0TR	- - -	0.0468	0.0843	0.0599
Fluoride	mg/L as F	4.0	4.0 (2)/2.0 (3)	- - -	- - -	8.4	- - -	- - -	- - -	1.54	1.13	1.25
pH	S.U.	- - -	6.5-8.5 (3)	6.5-9.0	6.5-9.0	6.5-9.0	- - -	4.5-9.0	6.5-9.0	- - -	- - -	- - -
Metals												
Aluminum	mg/L as Al	- - -	0.005-0.2 (3)	- - -	- - -	- - -	- - -	- - -	- - -	**0.1923**	**0.4878**	**0.1873**
Antimony	mg/L as Sb	0.006	0.006 (2)	0.088D	0.030D	0.056TR	0.41TR	- - -	- - -	<0.1	<0.1	<0.1
Arsenic	mg/L as As	0.05TR	0.05 (2)	0.360D	0.190D	0.05TR	1.45TR	2.0TR	0.2TR	<0.01	<0.01	<0.01
Barium	mg/L as Pb	2	2 (2)	- - -	- - -	9.8D	- - -	- - -	- - -	0.0062	0.0062	0.0242
Beryllium	mg/L as Sb	0.004	0.004 (2)	0.065D	0.0053D	0.004TR	0.00021TR	- - -	- - -	<0.005	<0.005	<0.005
Cadmium	mg/L as Co	0.006	0.005(2)	0.053D	0.002D	0.07TR	0.41TR	0.05TR	0.05TR	<0.005	<0.005	<0.005
Chromium	mg/L as Cr	0.1	0.1 (2)	- - -	- - -	- - -	- - -	1TR	1TR	<0.01	<0.01	<0.01
Cobalt	mg/L as Co	- - -		- - -	- - -	- - -	- - -	- - -	- - -	<0.03	<0.03	<0.03
Copper	mg/L as Cu	- - -	1.3 (2,5)/1.0 (3)	0.034D	0.021D	9.8D	- - -	5.0TR	0.5TR	0.0196	**0.0514**	0.0115
Iron	mg/L as Fe	- - -	0.3 (3)	- - -	- - -	- - -	- - -	- - -	- - -	0.0672	0.0706	0.0255
Lead	mg/L as Pb	0.05	0.015 (2,5)	0.197D	0.008D	- - -	- - -	10.0TR	0.1TR	<0.05	<0.05	<0.05
Manganese	mg/L as Mn	- - -	0.05TR (3)	- - -	- - -	- - -	19.6	10.0	- - -	<0.01	<0.01	**0.0805**
Mercury	mg/L as Hg	0.002TR	0.002TR (2)	0.0024D	0.00001D	0.012TR	0.0006TR	- - -	0.01TR	<0.0003	<0.0003	<0.0003
Molybdenum	mg/L as Mo	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	0.2942	0.0428	0.0255
Nickel	mg/L as Ni	0.1	0.1 (2)	2.5491D	0.2834D	2.8TR	0.73TR	- - -	- - -	<0.01	<0.01	<0.01
Selenium	mg/L as Sb	0.05TR	0.05TR (2)	0.02TR	0.002TR	0.7TR	9.0TR	0.02TR	0.05TR	<0.01	<0.01	<0.01
Silver	mg/L as Ag	- - -	0.1 (3)	0.013D	- - -	- - -	- - -	- - -	- - -	<0.01	<0.01	<0.01
Strontium	mg/L as Sr	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	0.0488	0.0505	0.0905
Thallium	mg/L as Tl	0.002	0.002 (2)	0.70D	0.15D	0.012TR	0.004TR	- - -	- - -	- - -	- - -	- - -
Vanadium	mg/L as V	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	0.0252	0.0266	<0.05
Zinc	mg/L as Zn	- - -	5.0TR (3)	0.21D	0.15D	42.0TR	22.0	10.0TR	25.0TR	<0.01	<0.01	<0.01

(1) Arizona Aquifer Water Quality Standard.
(2) Federal primary maximum contaminant level (MCL) for Drinking Water.
(3) Federal secondary MCL for Drinking Water.
(4) Exceedances for standards are given in bold type.
(5) Action level for treatment requirement.

D = Dissolved fraction
TR = Total recoverable fraction
A&Ww = Aquatic and wildlife (warm water fishery)
FBC = Full body contact
FC = Fish consumption
AgI = Agricultural irrigation
AgL = Agricultural livestock watering

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Table C5-3. Pregnant Leachate Solution (PLS) Water Chemistry

Constituent	Units	Arizona Aquifer Standard (1)	Federal MCL	Pinto Creek (and its Tributaries) Water Quality Standard: A &Ww Acute	A &Ww Chronic	FBC	FC	AgI	AgL	Minimum Detection Limit	Result (4)
Physical and Aggregate Properties											
Alkalinity	mg/L as CaCO3									5	<5
Conductivity	umhos/cm @ 25°C									1	23400
Total Hardness	mg/L as CaCO3									1	2450
Total Dissolved Solids	mg/L @ 180°C		500 (3)							10	**29600**
Major Cations											
Calcium	mg/L as Ca									5	285
Magnesium	mg/L as Mg									1	422
Potassium	mg/L as K									50	90
Sodium	mg/L as Na									10	50
Major Anions											
Bicarbonate	mg/L as CaCO3									5	<5
Carbonate	mg/L as CaCO3									1	<1
Chloride	mg/L as Cl		250 (3)							1	29
Hydroxide	mg/L as OH									1	<1
Sulfate	mg/L as SO4		250 (3)							10	**24700**
Inorganic Nonmetallics											
Boron	mg/L as B					12.6		1.0TR		5	<5
pH	S.U.		6.5-8.5 (3)	6.5-9.0	6.5-9.0	6.5-9.0		4.5-9.0	6.5-9.0	---	**1.4**
Fluoride	mg/L as F	4.0	4.0 (2)/2.0 (3)			8.4				2	**27**
Nitrate + Nitrite	mg/L as N	10	10 (2)			14				0.05	---
Nitrogen Kjeldahl	mg/L as N									1	2
Metals											
Aluminum	mg/L as Al		0.05-0.2 (3)							5	747
Antimony	mg/L as Sb	0.006	0.006 (2)	0.088D	0.030D	0.056TR	0.14TR			1	<1
Arsenic	mg/L as As	0.05	0.05 (2)	0.360D	0.190D	0.05TR	1.45TR	2.0TR	0.2TR	0.05	**0.23**
Barium	mg/L as Ba	2	2 (2)			9.8D				0.1	<0.1
Beryllium	mg/L as Be	0.004	0.004 (2)	0.065D	0.0053D	0.004TR	0.00021TR			0.05	**0.36**
Cadmium	mg/L as Cd	0.005	0.005 (2)	0.053D	0.002D	0.07TR	0.041TR	0.05TR	0.05TR	0.05	**0.07**
Chromium	mg/L as Cr	0.1	0.1 (2)					1TR	1TR	0.1	**0.7**
Cobalt	mg/L as Co									0.3	4.2
Copper	mg/L as Cu		1.3 (2,5)/1.0 (3)	0.034D	0.021D	5.2D		5.0TR	0.5TR	5	**2190**
Iron	mg/L as Fe		0.3 (3)							20	**3560**
Lead	mg/L as Pb	0.05	0.0015 (2,5)	0.197D	0.008D			10.0TR	0.1TR	0.5	**1**
Manganese	mg/L as Mn		0.05 (3)			19.6TR		10.0		0.1	**44.8**
Mercury	mg/L as Hg	0.002	0.002 (2)	0.0024D	0.00001D	0.042TR	0.0006TR		0.01TR	0.0003	<0.0003
Nickel	mg/L as Ni	0.1	0.1 (2)	2.5491D	0.2834D	2.8TR	0.73TR			0.4	**3.6**
Selenium	mg/L as Se	0.05	0.05 (2)	0.02TR	0.002TR	0.7TR	9.0TR	0.02TR	0.05TR	0.1	<0.1
Silver	mg/L as Ag		0.1 (3)	0.013D						0.0002	0.009
Strontium	mg/L as Sr									0.1	1.2
Titanium	mg/L as Ti									0.5	7.7
Uranium	mg/L as U									0.001	0.3
Vanadium	mg/L as V									0.5	1
Zinc	mg/L as Zn		5.0 (3)	0.21D	0.19D	42.0TR	22.0TR	10.0TR	25.0TR	0.1	**16.5**
Radionuclides											
Gross Alpha Activity	pCi/L	15	15 (2)							146	**179**
Radium 226	pCi/L	5	5 (2)							0.5	1.1
Radium 228	pCi/L	5	5 (2)							2.4	<2.4

(1) Arizona Aquifer Water Quality Standard.
(2) Federal primary maximum contaminant level (MCL) for Drinking Water.
(3) Federal secondary MCL for Drinking Water.
(4) Exceedances to standards are given in bold type.
(5) Action levels for treatment technique requirement.

Source: Knight Piesold and Company (1993)

D = Dissolved fraction
TR = Total recoverable fraction
A&Ww = Aquatic and wildlife (warm water fishery)
FBC = Full body contact
FC = Fish consumption
AgI = Agricultural irrigation
AgL = Agricultural livestock watering

Table C5-4. Water Quality of Pinal Creek Alternative Water Supply, Miami Wash Area

Constituent	Units	Arizona Aquifer Standard (1)	Federal MCL	Pinto Creek (and its Tributaries) Water Quality Standard A & Ww Acute	A & Ww Chronic	FBC	FC	AgI	AgL	Miami Wash Alluvium (4) AVE.	RANGE
Physical and Aggregate Properties											
Alkalinity	mg/L as CaCO3	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	39.3	<1 - 335
Conductivity	umhos/cm@25°C	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	5010	505 - 12100
Total Dissolved Solids	mg/L @ 180°C	- - -	500 (3)	- - -	- - -	- - -	- - -	- - -	- - -	**4640**	340 - **20700**
Total Hardness	mg/L as CaCO3	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	1690	146 - 3140
Water Temperature	Deg. Celcius	- - -	- - -	+3.0	+3.0	- - -	- - -	- - -	- - -	18	12 - 27
Major Cations											
Calcium	mg/L as Ca	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	440	22.3 - 720
Magnesium	mg/L as Mg	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	160	3.9 - 700
Potassium	mg/L as K	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	10.8	<0.5 - 27.1
Sodium	mg/L as Na	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	112	20.0 - 410
Major Anions											
Chloride	mg/L as Cl	- - -	250 (3)	- - -	- - -	- - -	- - -	- - -	- - -	99.1	<1 - **654**
Sulfate	mg/L as SO4	- - -	250 (3)	- - -	- - -	- - -	- - -	- - -	- - -	**3400**	31 - **19700**
Inorganic Nonmetallics											
Fluoride	mg/L as F	4.0	4.0 (2)/2.0 (3)	- - -	- - -	8.4	- - -	- - -	- - -	**12.7**	0.35 - **35**
pH	S.U.	- - -	6.5-8.5 (3)	6.5-9.0	6.5-9.0	6.5-9.0	- - -	4.5-9.0	6.5-9.0	**4.8**	**3.1** - 8.1
Silica	mg/L as Si	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	38.2	3.3 - 102
Dissolved Metals											
Aluminum	mg/L as Al	- - -	0.05-0.2 (3)	- - -	- - -	- - -	- - -	- - -	- - -	60.1	<0.2 - **403**
Beryllium	mg/L as Cd	0.004	0.004 (2)	0.065D	0.0053D	0.004TR	0.00021TR	- - -	- - -	**0.132**	**0.036 - 0.249**
Cadmium	mg/L as Cd	0.005	0.005 (2)	0.053D	0.002D	0.07TR	0.004TR	0.05TR	0.05TR	**0.035**	<0.005 - **0.280**
Cobalt	mg/L as Co	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	0.907	0.179 - 1.63
Copper	mg/L as Cd	- - -	1.3 (2,5)/1.0 (3)	0.034D	0.021D	5.2D	- - -	5.0TR	5.0TR	**33.3**	<0.02 - **270**
Iron	mg/L as Fe	- - -	0.3 (3)	- - -	- - -	- - -	- - -	- - -	- - -	**704**	<0.1 - **6640**
Manganese	mg/L as Mn	- - -	0.05 (3)	- - -	- - -	19.6TR	- - -	10.0	- - -	**42.0**	**0.2 - 124**
Nickel	mg/L as Ni	0.1	0.1 (2)	2.5491D	0.2834D	2.8TR	0.73TR	- - -	- - -	**1.49**	**0.16 - 2.58**
Strontium	mg/L as Sr	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	1.06	0.673 - 1.50
Vanadium	mg/L as V	- - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	0.420	0.069 - 0.835
Zinc	mg/L as Zn	- - -	5.0 (3)	0.21D	0.19D	42.0TR	22.0TR	10.0TR	25.0TR	**3.98**	<0.01 - **20.1**

(1) Arizona Aquifer Water Quality Standard.
(2) Federal primary maximum contaminant level (MCL) for Drinking Water.
(3) Federal secondary MCL for Drinking Water.
(4) Exceedances to standards are given in bold type.
(5) Action level for treatment techniques requirement

Source: Hydro Geo Chem, Inc., (1989) Envirologic Systems, Inc. (1983)

D = Dissolved fraction
TR = Total recoverable fraction
A&Ww = Aquatic and wildlife (warm water fishery)
FBC = Full body contact
FC = Fish consumption
AgI = Agricultural irrigation
AgL = Agricultural livestock watering

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Table C5-5. Water Quality Data of Possible Mitigation Water Sources for Pinto Creek and Haunted Canyon

CONSTITUENT	UNITS	PINTO CREEK (AND ITS TRIBUTARIES) WATER QUALITY STANDARDS						Pinto Creek Below Haunted Canyon	Haunted Canyon	Well Field Average Values	
		A & Ww									
		Acute	Chronic	FBC	FC	Agl	AgL	(PC-7 & 7.5 Avg.)	(HC-2 Avg.)	Alluvium	Bed-Rock
Physical Variables											
Dissolved Oxygen	mg/L as O2	6.0	---	---	---	---	---	7.4	4.7	---	---
Total Dissolved Solids	mg/L @ 180°C	---	---	---	---	---	---	1093	326	366	309
Total Hardness	mg/L as CaCO3	---	---	---	---	---	---	829	217	---	---
Turbidity	NTU	50	50	50	---	---	---	---	0.8	---	---
Water Temperature	Deg. Celcius	+/- 3.0	+/- 3.0	---	---	---	---	16.7	17	16	26.8
Major Cations											
Calcium	mg/L as Ca	---	---	---	---	---	---	247	59.9	70.2	54.5
Magnesium	mg/L as Mg	---	---	---	---	---	---	47.1	15.5	16.4	11.2
Potassium	mg/L as K	---	---	---	---	---	---	6	7	7.0	4.9
Sodium	mg/L as Na	---	---	---	---	---	---	42.3	13.7	14.0	23.0
Major Anions											
Bicarbonate	mg/L as CaCO3	---	---	---	---	---	---	209	223	228	272
Chloride	mg/L as Cl	---	---	---	---	---	---	38.8	8.6	10.3	10.5
Sulfate	mg/L as SO4	---	---	---	---	---	---	495	52.1	80	15
Inorganic Nonmetals											
Boron	mg/L as B	---	---	12.6	---	1.0TR	---	<0.1	<0.1	<0.1	<0.1
Cyanide	mg/L as CN	0.041TR	0.0097TR	2.8TR	210TR	---	0.2TR	<0.04	<0.1	<0.1	<0.1
Fluoride	mg/L as F	---	---	8.4	---	---	---	0.6	0.2	<0.5	0.28
Nitrate	mg/L as N	---	---	22.4	---	---	---	<0.4	1.2	<5.0	4.0
Nitrite	mg/L as N	---	---	---	---	---	---	<0.1	<0.1	<0.5	<0.1
pH	S.U.	6.5-9.0	6.5-9.0	6.5-9.0	---	4.5-9.0	6.5-9.0	7.3	7.5	7.1	7.3
Sulfides	mg/L as S	0.1	---	---	---	---	---	<0.1	<0.1	---	<0.1
Total Nitrogen	mg/L as N	2.00	0.60	---	---	---	---	---	---	---	---
Total Phosphorus	mg/L as P	1.00	0.12	---	---	---	---	<0.5	<0.5	<0.5	---
Metals											
Aluminum	mg/L as Al	---	---	---	---	---	---	---	<2D/<2TR	---	---
Antimony	mg/L as Sb	0.088D	0.030D	0.056TR	0.14TR	---	---	<2.0D/<2.0TR	<0.2D/<0.2TR	0.005	<0.2
Arsenic	mg/L as As	0.360D	0.190D	0.05TR	1.45TR	2.0TR	0.2TR	<0.004D/<0.004TR	0.006D/0.006TR	0.007	0.014
Barium	mg/L as Ba	---	---	9.8D	---	---	---	<1.0D/<1.0TR	<1D/<1TR	<1	<1
Beryllium	mg/L as Be	0.065D	0.0053D	0.004TR	0.00021TR	---	---	<0.0009D/<0.0009TR	<0.1D/<0.1TR	<0.1	<0.1
Cadmium	mg/L as Cd	0.053D	0.002D	0.07TR	0.041TR	0.05TR	0.05TR	<0.005D/0.011TR	<0.005D/<0.005TR	<0.005	<0.005
Chromium	mg/L as Cr	---	---	---	---	1TR	1TR	<0.05D/<0.05TR	<0.05D/<0.05TR	<0.05	<0.05
Cobalt	mg/L as Co	---	---	---	---	---	---	<0.1D/<0.1TR	<0.1D/<0.1TR	<0.1	---
Copper	mg/L as Cu	0.034D	0.021D	5.2D	---	5.0TR	0.5TR	<0.5D/<0.5TR	<0.5D/<0.5TR	<0.5	<0.1
Iron	mg/L as Fe	---	---	---	---	---	---	<0.3D/<0.3TR	<0.3D/<0.3TR	<0.3	0.5
Lead	mg/L as Pb	0.197D	0.008D	---	---	10.0TR	0.1TR	<0.005D/<0.005TR	0.004D/0.008TR	0.007	0.008
Manganese	mg/L as Mn	---	---	19.6TR	---	10.0	---	<0.05D/0.7TR	<0.05D/<0.05TR	0.05	0.05
Mercury	mg/L as Hg	0.0024D	0.00001D	0.042TR	0.0006TR	---	0.01TR	<0.0006D/<0.0006TR	<0.001D/<0.001TR	<0.001	<0.001
Molybdenum	mg/L as Mo	---	---	---	---	---	---	0.021D/0.021TR	<0.005D/<0.1TR	0.007	0.005
Nickel	mg/L as Ni	2.5491D	0.2834D	2.8TR	0.73TR	---	---	<0.1D/<0.1TR	<0.1D/<0.1TR	<0.1	<0.1
Selenium	mg/L as Se	0.02TR	0.002TR	0.7TR	9.0TR	0.02TR	0.05TR	<0.005D/<0.005TR	<0.005D/<0.005TR	<0.005	0.001
Silver	mg/L as Ag	0.013D	---	---	---	---	---	<0.005D/<0.005TR	<0.01D/<0.01TR	<0.01	<0.01
Strontium	mg/L as Sr	---	---	---	---	---	---	---	---	---	---
Thallium	mg/L as Tl	0.70D	0.15D	0.012TR	0.041TR	---	---	<0.002D/<0.002TR	<0.1D/<0.1TR	<0.1	<0.1
Zinc	mg/L as Zn	0.21D	0.19D	42.0TR	22.0TR	10.0TR	25.0TR	<0.1D/0.1TR	<0.1D/0.059TR	0.06	0.12
Radionuclides											
Gross Alpha Activity	pCi/L	---	---	---	---	---	---	---	6	4	8
Gross Beta Activity	pCi/L	---	---	---	---	---	---	---	15	9.5	7
Radium 226 + 228	pCi/L	---	---	---	---	---	---	---	---	---	---

D = Dissolved fraction
TR = Total recoverable fraction
A&Ww = Aquatic and wildlife for (warm water fishery)
FBC = Full body contact
FC = Fish consumption
Agl = Agricultural irrigation
AgL = Agricultural livestock watering

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Table C5-6. Comparison of Haunted Canyon Stream Water Quality and Well Field Bedrock Water Quality with Arizona Stream Standard

Constituent	Units	Standards						Haunted Canyon Below Confluence with Powers Gulch (3)					TW-1 Well Field Well		TW-2 Well Field Well		TW-3 Well Field Well	
		A & Ww																
		Acute	Chronic	FBC	FC	Agf	AgL	n	AVG	SD	MIN	MAX	8/26/93	1/21/94	8/26/93	11/3/93	9/29/93	12/6/93
Physical and Aggregrate Properties																		
Conductivity	umhos/cm @ 25 C	---	---	---	---	---	---	1	443	87	310	520	371	368	419	438	337	479
Discharge	Ft3/sec (cfs)	---	---	---	---	---	---	1	0.21	0.175	0.0108	0.38	---	---	---	---	---	---
Total Dissolved Solids	mg/L @ 180 C	---	---	---	---	---	---	1	326	59	270	420	286	254	300	311	356	344
Total Hardness	mg/L as CaCO3	---	---	---	---	---	---	1	243	29	176	243	161	160	204	208	185	174
Total Suspended Solids	mg/L @ 103 C	---	---	---	---	---	---	1	2.4	2.4	<0.1	7	1.0	---	3.5	---	5.5	---
Turbidity	NTU	50	50	50	---	---	---	1	0.8	0	0.8	0.8	---	---	---	---	---	---
Water Temperature	Deg. C	+/- 3.0	+/- 3.0	---	---	---	---	1	17	7	12	22	25	28.5	24	23.5	29	31
Major Cations																		
Calcium	mg/L as Ca	---	---	---	---	---	---	1	59.9	5.36	53.4	65.4	53.5	52.4	69.0	70.6	42.1	35.6
Magnesium	mg/L as Mg	---	---	---	---	---	---	1	15.5	3.78	10.4	19.34	6.77	7.1	7.68	7.8	19.4	18.3
Potassium	mg/L as K	---	---	---	---	---	---	1	7	3.5	<5	13	<5	3.2	<5	<5	<5	6
Sodium	mg/L as Na	---	---	---	---	---	---	1	43.7	1.72	11.8	15.9	16.3	16.3	13.6	13.2	40.0	35.6
Major Anions																		
Bicarbonate	mg/L as HCO3	---	---	---	---	---	---	1	223	35	171	268	237	266	261	274	285	306
Chloride	mg/L as Cl	---	---	---	---	---	---	1	8.8	1.1	7	10	[illegible]	11	10	11	11	11
Sulfate	mg/L as SO4	---	---	---	---	---	---	1	52.1	20.3	31	73.8	8	12	8	8	29	28
Inorganic Nonmetallics																		
Boron	mg/L as B	---	---	12.6	---	1.0 TR	---	1	<0.1	0.05	0.001	<0.1	<0.1	<0.1	<0.1	---	<0.1	---
Cyanide	mg/L as CN	0.041 TR	0.0097 TR	2.8 TR	210 TR	---	0.2 TR	1	<0.1#	0.03	<0.04#	<0.1#	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Oxygen	mg/L as O2	6.0	---	---	---	---	---	1	4.7	0.0	4.7	4.7	---	---	---	---	---	---
Fluoride	mg/L as F	---	---	8.4	---	---	---	1	0.2	0.0	0.2	0.2	---	0.25	---	0.22	---	0.37
Nitrate	mg/L as N	---	---	224	---	---	---	1	1.2	1.3	<0.1	3.5	[illegible].6	5.8	5.8	5.3	<0.4	<0.1
Nitrite	mg/L as N	---	---	14	---	---	---	1	<0.1	0.0	<0.1	<0.1	---	---	---	<0.1	---	<0.1
Nitrogen, Kjeldahl	mg/L as N	---	---	---	---	---	---	1	0.3	0.2	0.2	0.41	---	---	---	---	---	---
Orthophosphate	mg/L as P	---	---	---	---	---	---	1	<0.5	0.0	<0.5	[illegible]	<0.5	---	<0.5	---	<0.5	---
pH	std. units	6.5 - 9.0	6.5 - 9.0	6.5 - 9.0	---	4.5 - 9.0	6.5 - 9.0	1	7.5	0.3	7	7.7	7.0	7.3	6.8	7.8	7.4	7.8
Silica	mg/L as SiO2	---	---	---	---	---	---	1	50.4	5.9	43.7	559.2	53.8	50.6	54.8	56.0	25.3	27.2
Sulfide	mg/L as S	0.1	---	---	---	---	---	1	<0.1	0.0	<0.1	<0.1	<0.1	---	<0.1	---	<0.1	---
Total Ammonia	mg/L asN	-4	---	---	---	---	---	1	<0.1	0.0	<0.1	<0.1	0.1	<0.1	0.1	<0.1	<0.1	<0.1
Total Phosphorus	mg/L as P	1.00	0.12	---	---	---	---	1	<0.5#	0.0	<0.5#	<0.5#	---	---	---	---	---	---

(1) Data are for surface monitoring station HC-2 for samples collected 6-30-93, 10-28-93, 1-9-94, and 10-24-95.

(2) Reported value (0.023 mg/L as Pb) was rejected because duplicate analyses (0.007 mg/L as Pb) were outside of quality control limits established by the USEPA.

n = Number of surface water monitoring stations included in summary
AVG = Spatial average: computed average of the mean concentration for each surface water monitoring station
SD = Spatial standard deviation computed for multiple surface water monitoring stations or temporal standard deviation of the mean concentration for a single water surface monitoring station
MIN = Minimum analysis result: range includes all samples at each surface water monitoring station
MAX = Maximum analysis result: range includes all samples at each surface water monitoring station
TR = Total recoverable fraction
D = Dissolved fraction
A&Ww = Aquatic wildlife (warm water fishery)
FBC = Full body contact
FC = Fish consumption
Agl = Agricultural irrigation
AgL Agricultural livestock watering

Notes:
Detection level data are treated as values at the reported level of detection when combined with detection values for average and standard deviation calculations (e.g., < 1mg/L and 3 mg/L has an average of 2 mg/L).
Water quality standard or criterion exceedance values are bolded, detection levels above the standard or criterion are indicated with a "#."

Table C5-6. Comparison of Haunted Canyon Stream Water Quality and Wellfield Bedrock Water Quality with Arizona Stream Standard (continued)

Constituent	Units	Standards: A & Ww Acute	Standards: A & Ww Chronic	Standards: FBC	Standards: FC	Standards: Agl	Standards: AgL	Haunted Canyon Below Confluence with Powers Gulch (1): n	AVG	SD	MIN	MAX	TW-1 Well Field Well: 8/26/93	TW-1: 1/21/94	TW-2 Well Field Well: 8/26/93	TW-2: 11/3/93	TW-3 Well Field Well: 9/29/93	TW-3: 12/6/93
Metals																		
Aluminum (TR)	mg/L as Al	---	---	---	---	---	---	1	<2	0	<2	<2	---	---	---	---	---	---
Aluminum (D)	mg/L as Al	---	---	---	---	---	---	1	<2	0	<2	<2	---	---	---	---	---	---
Antimony (TR)	mg/L as Sb	---	---	0.056	0.14	---	---	1	<0.2#	0.08	<0.004	<0.2#	<0.2#	---	<0.2#	---	<0.2#	---
Antimony (D)	mg/L as Sb	0.088	0.[illegible]00	---	---	---	---	1	<0.2#	0.10	<0.004	<0.2#	<0.2#	---	<0.2#	---	<0.2#	---
Arsenic (TR)	mg/L as As	---	---	0.05	1.45	2.0	2.8	1	0.006	0.002	0.004	0.002	0.012	---	0.012	---	0.024	---
Arsenic (D)	mg/L as As	0.360	0.190	---	---	---	---	1	0.006	0.002	0.003	0.002	0.010	0.013	0.010	0.012	0.021	0.018
Barium (TR)	mg/L as Ba	---	---	---	---	---	---	1	<1	0.[illegible]	<0.01	<1	<1	---	<1.0	---	<1	---
Barium (D)	mg/L as Ba	---	---	5.2	---	---	---	1	<1	0.[illegible]	<0.01	<1	<1	<1	<1.0	<0.01	<1	<1
Beryllium (TR)	mg/L as Be	---	---	0.004	0.00021	---	---	1	<0.1#	0.04	<0.00021	<0.1#	<0.1#	---	<0.1#	---	<0.1#	---
Beryllium (D)	mg/L as Be	0.065	0.0053	---	---	---	---	1	<0.1#	0.05	<0.0005	<0.1#	---	---	<0.1#	---	<0.1#	---
Cadmium (TR)	mg/L as Cd	---	---	0.07	0.041	0.05	0.05	1	<0.005	0.002	<0.0005	<0.005	<0.003#	---	<0.003#	---	<0.008#	---
Cadmium (D)	mg/L as Cd	0.053	0.008	---	---	---	---	1	<0.005#	0.002	<0.0005	<0.005#	<0.003#	<0.003#	<0.003#	<0.005#	<0.003#	<0.003#
Chromium (VI)(TR)	mg/L as Cr	---	---	2.8	2.8	---	---	---	---	---	---	---	---	---	---	---	---	---
Chromium (VI)(D)	mg/L as Cr	0.016	0.011	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Chromium (total)(TR)	mg/L as Cr	---	---	---	---	1	1	1	<0.05	0.02	<0.005	<0.05	<0.03	---	<0.03	---	<0.03	---
Chromium (total)(D)	mg/L as Cr	---	---	---	---	---	---	1	<0.05	0.02	<0.005	<0.05	<0.003	<0.03	<0.03	<0.05	<0.03	<0.03
Cobalt (TR)	mg/L as Co	---	---	---	---	---	---	1	<0.1	0.0	<0.1	<0.1	---	---	---	---	---	---
Cobalt (D)	mg/L as Co	---	---	---	---	---	---	1	<0.1	0.0	<0.1	<0.1	---	---	---	---	---	---
Copper (TR)	mg/L as Cu	---	---	---	---	0.5	0.5	1	<0.5	0.[illegible]	<0.001	<0.5	<0.02	---	<0.02	---	0.08	---
Copper (D)	mg/L as Cu	0.0[illegible]	0.021	5.2	---	---	---	1	<0.5#	0.[illegible]	0.002	<0.5#	---	<0.1#	<0.02	<0.02	<0.02	<0.02
Iron (TR)	mg/L as Fe	---	---	---	---	---	---	1	<0.3	0.1	0.031	<0.3	0.6	---	0.4	---	2.1	---
Iron (D)	mg/L as Fe	---	---	---	---	---	---	1	<0.3	0.1	0.017	<0.3	0.4	<0.1	<0.1	<0.1	1.8	<0.1
Lead (TR)	mg/L as Pb	---	---	---	---	10.0	2.8	1	0.008	0.006	0.003	0.018	<0.005	---	<0.005	0.023(2)	0.014	---
Lead (D)	mg/L as Pb	0.197	0.006	---	---	---	---	1	0.004	0.002	0.0007	0.007	<0.005	<0.005	<0.005	---	<0.005	<0.005
Manganese (TR)	mg/L as Mn	---	---	10.0	---	10.0	---	1	<0.05	0.02	0.001	<0.05	0.06	---	0.02	---	0.14	---
Manganese (D)	mg/L as Mn	---	---	---	---	10.0	---	1	<0.05	0.02	0.003	<0.05	0.08	<0.02	0.03	<0.02	0.09	0.06
Mercury (TR)	mg/L as Hg	---	---	0.012	0.0006	---	0.07	1	<0.001#	0.0002	<0.0006	<0.001#	<0.001#	---	<0.001#	---	<0.001#	---
Mercury (D)	mg/L as Hg	0.0024	0.00001	---	---	---	---	1	<0.001#	0.0002	<0.0006#	<0.001#	<0.001#	<0.001#	<0.001#	<0.001#	<0.001#	<0.001#
Molybdenum (TR)	mg/L as Mo	---	---	---	---	---	---	1	<0.1	0.002	<0.001	<0.1	0.04	---	0.01	---	<0.005	---
Molybdenum (D)	mg/L as Mo	---	---	---	---	---	---	1	<0.005	0.002	<0.001	<0.005	0.04	<0.001	<0.005	<0.001	<0.005	<0.005
Nickel (TR)	mg/L as Ni	---	---	2.8	0.73	---	---	1	<0.1	0.04	<0.005	<0.1	<0.1	---	<0.1	---	<0.1	---
Nickel (D)	mg/L as Ni	2.5491	0.2834	---	---	---	---	1	<0.1	0.04	<0.005	<0.1	---	---	<0.1	---	<0.1	---
Selenium (TR)	mg/L as Se	0.02	0.002	0.7	2.0	0.02	0.05	1	<0.005#	0.002	<0.0005	<0.005#	<0.001	---	<0.001	---	<0.001	---
Selenium (D)	mg/L as Se	---	---	---	---	---	---	1	<0.005	0.002	<0.0005	<0.005	<0.001	<0.001	<0.001	0.001	<0.001	<0.001
Silver (TR)	mg/L as Ag	---	---	---	---	---	---	1	<0.01	0.003	<0.0005	<0.01	<0.01	---	<0.01	---	<0.01	---
Silver (D)	mg/L as Ag	0.013	---	---	---	---	---	1	<0.01	0.004	<0.0005	<0.01	<0.01	<0.01#	<0.01	<0.01	<0.01	<0.01
Thallium (TR)	mg/L as Tl	---	---	0.012	0.041	---	---	1	<0.1#	0.04	<0.002	<0.1#	<0.1#	---	<0.1#	---	<0.1#	---
Thallium (D)	mg/L as Tl	0.70	0.70	---	---	---	---	1	<0.1	0.04	<0.002	<0.1#	<0.1#	---	<0.1#	---	<0.1#	---
Zinc (TR)	mg/L as Zn	---	---	10.0	22.0	10.0	25.0	1	0.059	0.03	0.014	0.1	0.04	---	0.04	---	<0.04	---
Zinc (D)	mg/L as Zn	0.21	0.19	---	---	---	---	1	<0.1	0.03	0.016	<0.1	0.04	**0.42**	<0.04	0.02	0.06	0.06

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TR = Total recoverable fraction
D = Dissolved fraction
A&Ww = Aquatic wildlife (warm water fishery)
FBC = Full body contact
FC = Fish consumption
Agl = Agricultural irrigation
AgL Agricultural livestock watering

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C-6

Monitoring and Mitigation Requirements

Table C6-1. Target Analytes for Surface Water and Ground Water Monitoring

Target Analytes	Surface Water	Frequency of Measurement	Ground Water	Frequency of Measurement
Trace Metals				
Aluminum	X	Quarterly[1]	X	Quarterly[1]
Antimony	X	Quarterly[1]	X	Quarterly[1]
Arsenic	X	Quarterly[1]	X	Quarterly[1]
Barium	X	Quarterly[1]	X	Quarterly[1]
Beryllium	X	Quarterly[1]	X	Quarterly[1]
Boron	X	Quarterly[1]	X	Quarterly[1]
Cadmium	X	Quarterly[1]	X	Quarterly[1]
Chromium	X	Quarterly[1]	X	Quarterly[1]
Cobalt	X	Quarterly[1]	X	Quarterly[1]
Copper	X	Quarterly[1]	X	Quarterly[1]
Iron	X	Quarterly[1]	X	Quarterly[1]
Lead	X	Quarterly[1]	X	Quarterly[1]
Manganese	X	Quarterly[1]	X	Quarterly[1]
Mercury	X	Quarterly[1]	X	Quarterly[1]
Nickel	X	Quarterly[1]	X	Quarterly[1]
Silver	X	Quarterly[1]	X	Quarterly[1]
Selenium	X	Quarterly[1]	X	Quarterly[1]
Thallium	X	Quarterly[1]	X	Quarterly[1]
Zinc	X	Quarterly[1]	X	Quarterly[1]
General Minerals				
Calcium	X	Quarterly[1]	X	Quarterly[1]
Magnesium	X	Quarterly[1]	X	Quarterly[1]
Potassium	X	Quarterly[1]	X	Quarterly[1]
Sodium	X	Quarterly[1]	X	Quarterly[1]
Bicarbonate	X	Quarterly[1]	X	Quarterly[1]
Carbonate	X	Quarterly[1]	X	Quarterly[1]
Chloride	X	Quarterly[1]	X	Quarterly[1]
Sulfate	X	Quarterly[1]	X	Quarterly[1]
Fluoride	X	Quarterly[1]	X	Quarterly[1]
Nitrate	X	Quarterly[1]	X	Quarterly[1]
Nitrite	X	Quarterly[1]	X	Quarterly[1]
Total Nitrogen	X	Quarterly[1]	X	Quarterly[1]
Total Phosphorus	X	Quarterly[1]	X	Quarterly[1]
Sulfides	X	Quarterly[1]	X	Quarterly[1]
Cyanide	X	Quarterly[1]	X	Quarterly[1]
Hardness as $CaCO_3$	X	Quarterly[1]	X	Quarterly[1]
Physical Parameters				
Temperature	X	Quarterly[1]	X	Quarterly[1]
pH	X	Quarterly[1]	X	Quarterly[1]
Specific Conductance	X	Quarterly[1]	X	Quarterly[1]
Dissolved Oxygen	X	Quarterly[1]	X	Quarterly[1]
Turbidity	X	Quarterly[1]	X	Quarterly[1]
TDS	X	Quarterly[1]	X	Quarterly[1]
TSS	X	Quarterly[1]	X	Quarterly[1]

[1]Quarterly for one year
Source: GWRC (1996a)

APPENDIX D

ACID DEPOSITION AND OZONE ANALYSIS

APPENDIX D

ACID DEPOSITION AND OZONE ANALYSIS

Introduction

This appendix evaluates the potential effects of air emissions from the Carlota project on air quality affected resources, including air quality related values (AQRV) in Class I wildernesses and air quality affected resources on Class II National Forest System Lands. The Superstition Wilderness and the Sierra Ancha Wilderness are Class I areas located approximately 5 kilometers to the west and 45 kilometers to the north-northeast of the Carlota project area, respectively. Tonto National Monument is located approximately 28 kilometers to the north of the project area. The impacts to visibility (an important AQRV) are described and assessed in Section 3.1 - Air Resources. This appendix describes potential effects of the proposed project on terrestrial ecosystems (terrestrial biota) and acid-sensitive or biota-critical waters (aquatic biota). A screening methodology was developed to examine potential impacts relative to the baseline conditions for the existing resources (see Section 3.3 - Water Resources and Section 3.5 - Biological Resources for a complete description of baseline conditions).

Terrestrial Biota

An evaluation was conducted to estimate the potential for the Carlota Copper Project's air emissions to affect terrestrial resources within the Superstition and Sierra Ancha wildernesses, the Tonto National Monument, and the Carlota Copper Project area, including impacts to the Arizona hedgehog cactus. Of interest were the potential effects on terrestrial flora and fauna caused by increased ozone concentrations and acid deposition. Although these effects were difficult to quantify, the Forest Service used a screening tool (USDA Forest Service 1989) to help predict the potential impacts on terrestrial resources caused by ambient ozone concentrations and the deposition of atmospheric sulfur and nitrogen. The methodology includes thresholds of acceptable (Green Line), unacceptable (Red Line), and intermediate (Yellow Line) levels of pollution and is useful for evaluating impacts on terrestrial and aquatic resource AQRVs. Pollutant doses less than the Green Line numbers could be judged permissible (no significant impact), while doses above the Red Line numbers would likely cause at least one AQRV to be adversely impacted. Specific AQRVs that are impacted by doses above the Red Line numbers could not be identified since the screening tool was designed to provide guidelines for general use rather than formulas for specific applications. Exact effects on a particular AQRV would need to be evaluated on the basis of site-specific limits of acceptable change (LAC).

Potential impacts to terrestrial AQRVs and other terrestrial air quality affected resources could result from increased ambient air pollutant concentrations or increased acid deposition from atmospheric sulfur oxides (SO_x) and nitrogen oxides (NO_x). Wet and dry deposition of atmospheric SO_x and NO_x, as well as direct deposition of suspended sulfuric acid mist, could affect terrestrial resources primarily by lowering pH levels in soils, precipitation, surface runoff, and receiving waters. Plant species are known to accumulate sulfuric acid and sulfide ion. These substances are known to cause changes to vegetation primarily by damaging tissue, reducing photosynthesis, and leaching essential elements from plants. NO_x appear to be less damaging to certain plants, such as grasses, than are sulfuric acid, sulfur dioxide, or ozone (Barker and Tingey 1992, Smith 1990, Lauenroth and Preston 1984, Winner et al. 1985).

Ozone is a strong oxidant that injures plant tissue and reduces growth; most injury occurs internally after uptake (Musselman et al. 1994). Research has shown that plants show greater response to ozone as the concentration increases. The duration of the ozone exposure is important in the ability of vegetation to maintain ozone repair mechanisms. Exposure descriptors that give greater weight to peak concentrations and those that account for cumulative exposure show the closest relationship to actual plant response (Musselman et al. 1994).

Ozone combined with sulfide ions can reduce photosynthesis, but research suggests that toxic levels are extremely species-specific (Barker and Tingey 1992, Smith 1990, Lauenroth and Preston 1984, Winner et al. 1985). In the absence of additional data, the combined effect of these pollutants on AQRVs within the Class I Wildernesses and air quality affected resources in the Class II National Forest System Lands can only be hypothesized based on the existing research and therefore remains uncertain.

For the Superstition and Sierra Ancha wildernesses, several ecosystems have been identified as containing terrestrial AQRVs. The ecosystems include the sonoran, grassland, chaparral, woodland, riparian, ponderosa pine, and mixed conifer (Blankenship 1991). Adverse effects on any of these ecosystems caused by changes in air quality would be considered an impact to terrestrial AQRVs. Riparian species are especially sensitive to ozone and sulfates. Injuries to paloverde located nearby in Superior, Arizona, have been linked to sulfur deposition. The Green Line/Red Line screening procedure was used to evaluate potential impacts to these AQRVs. This procedure was also applied to assess impacts to air quality affected resources at the Carlota Copper Project site and the Tonto National Monument. The terrestrial environment of special concern within and near the Carlota Copper Project site is the interior chaparral ecosystem, which supports the Arizona hedgehog cactus (Echinogereus trichlochidiatus), listed by the U.S. Fish and Wildlife Service as Endangered under the Endangered Species Act.

Potential Impacts to AQRVs in Class I Areas. Terrestrial Green and Red Line screening numbers were available for the Superstition Wilderness (USDA Forest Service 1989). Since no other screening numbers were available, these numbers were also used to analyze impacts in the Sierra Ancha Wilderness. Green and Red Line screening numbers represent total pollution loading (current conditions plus proposed new source contributions) and are provided separately for sulfur deposition, nitrogen deposition, and ambient concentrations of ozone. An equation was available from the Forest Service (USDA Forest Service 1987) to estimate the total deposition of sulfur and nitrogen. This equation was applied to predicted ambient air concentrations, a range of deposition velocities (Sehmel 1980), and estimated contributions of wet and dry deposition (USDA Forest Service 1987). The results indicated a wide range of possible deposition amounts for sulfur and nitrogen. Screening numbers and deposition amounts are reported in terms of sulfur (S) and nitrogen (N) and include all forms of SO_x and NO_x, respectively. It is not assumed that the SO_x or NO_x actually react to become elemental sulfur or nitrogen. This method of reporting is used to simplify comparative analysis since results appear as a single value representing all SO_x or NO_x species. Considering the most probable contributions of wet and dry deposition (USDA Forest Service 1987) and the deposition velocities most likely to occur in the region (Sehmel 1980), the Forest Service equation was used to calculate deposition numbers for screening. Total deposition (background plus Carlota Copper Project) amounts of sulfur and nitrogen in terrestrial ecosystems of the Superstition Wilderness were calculated to be 33 Kg S/HA-yr and 8 Kg N/HA-yr, respectively (*Table D-1*). The sulfur deposition value exceeds the terrestrial Red Line number of 20 Kg S/HA-yr. As *Table D-1* indicates, the background sulfur deposition value in the Superstition Wilderness exceeds the terrestrial Red Line number. The Carlota project is projected to produce a 1 Kg S/HA-yr increase in deposition. The nitrogen deposition value falls below the terrestrial Red Line number of 15 Kg N/HA-yr. However, this represents a 60 percent increase from present levels for nitrogen.

Total deposition amounts of sulfur and nitrogen in terrestrial ecosystems of the Sierra Ancha Wilderness were calculated to be 32 Kg S/HA-yr and 5 Kg N/HA-yr, respectively (*Table D-1*). This sulfur deposition value also exceeds the terrestrial Red Line number of 20 Kg S/HA-yr. The nitrogen deposition value falls on the Green Line number of 5 Kg N/HA-yr. As *Table D-1* indicates, the Carlota project is predicted to increase sulfur and nitrogen deposition in the Sierra Ancha Wilderness by less than 1 Kg S/HA-yr and 1 Kg N/HA-yr, respectively. The background sulfur deposition value of 32 Kg S/HA-yr calculated for the Sierra Ancha Wilderness is likely higher than actual conditions at this site as it is based on SO_2 monitoring data collected at sites being impacted by local smelters and other anthropogenic sources of SO_2. Although air emissions from these sources likely impact air quality in the Superstition Wilderness, the Sierra Ancha Wilderness is located far enough away so as to not be substantially impacted by these same sources. Therefore, the sulfur deposition rate for the Sierra Ancha Wilderness is very conservative.

Table D-1. Ozone Concentrations and Calculated Sulfur and Nitrogen Deposition Affecting Terrestrial Ecosystems in Class I Wilderness Areas

Pollutant	Unit	AQRV Screening No[1]		Background Deposition	Background + CarlotaDeposition	
		Green Line	Red Line[2]		Superstition Wilderness	Sierra Ancha Wilderness
SO_2	Kg S/HA-yr	7[3]	20[3]	32	33	32
NO_x	Kg N/HA-yr	5[3]	15[3]	5	8	5
H_2SO_4	Kg H_2SO_4/HA-yr	NA	NA	NA	NA	NA
Ozone	ppb	75[4]	110[4]	40[5]	42[5]	40[5]

NA = Not Applicable
[1]Source: USDA Forest Service (1989)
[2]Exceedances of Red Line values are given in bold type.
[3]Nitrogen and sulfur deposition are total values, including all forms, wet and dry.
[4]Second highest 1-hour average ambient air concentration in a year.
[5]Estimated maximum 1-hour average ambient air concentration.

Based on these calculations, potential impacts to at least one terrestrial AQRV caused by acid deposition in the Superstition Wilderness and possibly the Sierra Ancha Wilderness would be expected. However, this equation is a screening tool, and Red Line numbers are not regionally specific. This screening procedure focuses on the terrestrial effects of acid deposition on soil and not on the direct effects to vegetation, The Superstition Wilderness is located in an SO_2 non-attainment area and, as a result, has experienced sulfur deposition for a significant period of time. It is not known whether soil in this region is able to accept additional sulfur deposition without adverse affects to vegetation. Background concentrations of sulfur dioxide were estimated to be at levels where sulfur deposition would already exceed the terrestrial Red Line number (background deposition amounts of sulfur were calculated to be 32 Kg S/HA-yr in both wilderness areas, exceeding the Red Line number of 20 Kg S/HA-yr). The 10-year National Acid Precipitation Program (NAPAP) summary cites injury to paloverde caused by sulfur deposition in nearby Superior, Arizona (NAPAP 1991). Background concentrations of NO_x were estimated to be at levels equal to the terrestrial Green Line number (background deposition amounts of nitrogen were calculated to be 5 Kg N/HA-yr in both wilderness areas, equaling the Green Line number of 5 Kg N/HA-yr). With these estimated background depositions, impacts to terrestrial AQRVs from acid deposition may already exist in the Superstition and Sierra Ancha wildernesses. Additional studies of Class I wildernesses (Blankenship 1990) suggest that, for the protection of AQRVs, the limit of acceptable change of atmospheric deposition concentrations is "no statistically significant change from baseline conditions." It is difficult to predict if the projected increases in atmospheric deposition constitute a statistically significant change from baseline conditions since current baseline conditions are not clearly defined. In assessing the magnitude of the potential impacts from the proposed project to terrestrial AQRVs in the Class I wilderness areas, it should be noted that (1) background concentrations of sulfur oxides could be substantially less than assumed at the Sierra Ancha Wilderness(Carlota 1994e), and (2) predicted increases in deposition were calculated using very conservative methods and input concentration estimates; therefore, assessments of deposition amounts could be overstated.

Background SO_2 concentrations are based on the average annual concentration recorded at the Nolan Ranch monitoring station located near Miami, Arizona (approximately 10 kilometers to the east of the project site), from 1991 through 1994. Since no NO_2 monitoring has been conducted in the vicinity of the project site, background NO_x levels are based on the mean of maximum annual averages for six monitoring locations at Springerville, Arizona (a similar rural site), from 1990 through 1995. The *Air Quality Related Values Wilderness Area History Report* (Earth Resource Consultants 1990) states that "sulfate deposition rates may approach 10 to 12 kg/ha and nitrate deposition may be slightly greater" in the Superstition Wilderness. The background deposition rates assumed in this analysis are somewhat higher for sulfur and lower for nitrogen than those reported in this report. As a note, the planned implementation of mitigation measures by Carlota at the project site would reduce SO_2 emissions from 112 tons per year to 10 tons per year. The sulfur deposition rate calculations were based on dispersion modeling that used an emissions inventory with SO_2 emissions more than double those that would occur with the actual project.

Ozone monitoring data are not available for the project site. However, background ozone levels were estimated to be 0.040 ppm (40 ppb). This estimate represents the median of the range of daily 1-hour maximum background ozone concentrations during the summertime in the United States (EPA 1996). In addition, EPA's PLUVUE II visibility model uses 0.040 ppm as its default background ozone concentration for portraying clean areas in the western U.S. Consequently, the value of 40 ppb (0.040 ppm) was used for this analysis (see *Table D-1*). Ozone formation occurs over significant periods of residence time of precursor pollutants in the atmosphere and over significant distances (20 to 30 km) downwind from the source(s) of the precursor emissions. Near-site contributions of precursor emissions from the proposed project to ozone formation are difficult to determine with available modeling techniques. Dispersion modeling predicts that the project would produce downwind (20 to 30 km to the northwest of the project) NO_x concentrations of less than 1 $\mu g/m^3$ (annual average). A simplifying assumption for approximating NO_x conversion to ozone is that all available NO_x will have sufficient VOC concentrations and sunlight to convert to ozone. It is likely that the project would produce VOCs in large enough quantities to promote the conversion of all NO_x emissions into ozone. As a result, a 1 $\mu g/m^3$ increase in NO_x concentrations downwind from the project would result in a 1 $\mu g/m^3$ increase in ozone levels. Dispersion modeling for the Carlota project predicted maximum annual average NO_x impacts of 3.3 $\mu g/m^3$ and 0.03 $\mu g/m^3$ for the Superstition and Sierra Ancha wildernesses, respectively. A 1 $\mu g/m^3$ increase in ozone is equivalent to a 0.5 ppb (0.0005 ppm) increase. Therefore, the maximum 1-hour ozone concentration (impact plus background) at the Superstition Wilderness that results from NO_x emissions from the Carlota project is expected to be 42 ppb (based on the model-predicted increase in the annual average NO_x concentration). The Carlota project is not likely to cause changes in ozone levels in the Sierra Ancha Wilderness. Applying the same methodology described above, dispersion modeling predicts an increase of only 0.02 ppb in the maximum 1-hour ozone concentration in the Sierra Ancha Wilderness (see *Table D-1*).

With an estimated background ozone concentration of 40 ppb (below the Green Line value of 75 ppb), impacts to terrestrial AQRVs from ozone would not be anticipated in the Superstition and Sierra Ancha wildernesses. The estimated increase to ozone concentration in the Superstition Wilderness represents a 5 percent increase over estimated background concentration, and the resulting ozone concentration (approximately 42 ppb) is still below the Green Line level. Additional studies of Class I wilderness areas (Blankenship 1990) suggest that, to protect AQRVs, the limit of acceptable change of ozone concentration is "no statistically significant change from baseline conditions." Predicted increases in ozone concentrations are relatively small, but whether or not these increases constitute a statistically significant change from baseline conditions is not known. It is not clear whether these increases will result in adverse impacts to AQRVs. It should be noted that no data were available to assess the exposure of vegetation to peak levels of ozone, which are significant as an indicator of terrestrial effects.

Using the stated estimates and assumptions and the Red Line screening tool, impacts to AQRVs are not likely to result from increased ozone concentrations from the proposed project. In assessing the magnitude of the potential ozone-related impacts from the proposed project to terrestrial AQRVs in the Class I wilderness areas, it should be taken into account that (1) conservative estimates and methods were used in the analysis, (2) predicted increases in ozone concentrations from precursors are uncertain, and (3)average incremental increases of ozone concentrations in the wilderness areas would be small relative to average background concentrations.

Assumptions and methods used in the terrestrial AQRV analysis are described below:

- Estimates of 1-hour average ozone concentrations were used.

- Estimates of potential suspended sulfuric acid mist concentrations were not included in atmospheric sulfur deposition calculations.

- Because of the sufficient distance between the Carlota Copper Project site and the wilderness areas, direct deposition of sulfuric acid mist was not significant.

- Dry deposition was calculated using the equation (USDA Forest Service 1987):
  Dry Deposition = C x V_d x F x R x 315.36

where:

C = Concentration of SO_2 or NO_x as appropriate in $\mu g/m^3$.

V_d = Deposition velocity (A realistic estimate of sulfur dioxide deposition velocity was equal to 0.01 meters per second (m/sec). All NO_x gases were assumed to be nitrogen dioxide; a realistic estimate of deposition velocity was equal to 0.005 m/sec (Air Sciences Inc. 1996b).

F = Frequency of occurrence of the maximum concentration ("1" for an annual average concentration: "0.075" for a 24-hour average concentration).

R = Sulfur or nitrogen ratio of element to total compound weight.

315.36 = Conversion factor.

Example: Dry Deposition of Background SO_2 =
$(10 \mu g/m^3)$x(0.01 m/sec)x(1)x(32/64)x(315.36) = 16 Kg S/HA-yr
(where the appropriate sulfur dioxide ambient air concentration was taken from *Table D-2*)

- Total deposition was calculated using the equation (USDA Forest Service 1987):
  Total Deposition = 2 x Dry Deposition

Table D-2. Background Concentrations and Maximum Predicted Increases to Ambient Air Concentrations of Selected Pollutants

Pollutant	Unit	Averaging Frequency	Overall Background	Predicted Increase: Superstition Wilderness	Sierra Ancha Wilderness	Tonto Natl. Monument	Carlota Site[1]
SO_2	$\mu g\ SO_2/m^3$	Annual	10[2]	0.3	negligible	0.01	4.5
NO_x	$\mu g\ NO_2/m^3$	Annual	5.5[3]	3.3	0.03	0.2	67.7
H_2SO_4	$\mu g\ H_2SO_4/m^3$	24-hour	1.3[4]	NA	NA	NA	22.8
Ozone	ppb	1-hour	40[5]	3[6]	negligible	negligible	negligible

NA = Not Applicable
Value in shaded cell used in example calculation above.
[1]Maximum on-site concentration.
[2]Average annual SO_2 concentration between Nolan Ranch and Jones Ranch (1991-94). It is likely that the background SO_2 levels are lower in the Sierra Ancha Wilderness and the Tonto National Monument.
[3]Based on the highest annual NO_2 concentration measured among six monitoring sites in the Springerville, Arizona, area between 1990 - 1995.
[4]Estimated based on H_2SO_4 impact modeling for the Carlota Copper Project.
[5]O_3 background concentration default value for PLUVUE-II visibility model, median of the range of daily 1-hour maximum background ozone levels in the U.S. during the summer.
[6]Estimated 1-hour average concentration increase.
Source: Air Sciences Inc. (1996a, 1996b)

- Screening numbers used were 100 percent of the calculated sulfur and nitrogen deposition.
- SO_2 deposition rates and ambient concentrations were based on dispersion modeling that did not incorporate the additional mitigation measures Carlota plans to implement, as described in the *Revised Emissions Inventory for Mitigation Measures Planned for the Carlota Copper Project* (AEC 1996a). These mitigation measures reduce annual SO_2 emissions from 25.88 TPY to 10.07 TPY. Therefore, the sulfur deposition totals are very conservative and likely overestimate impacts by a factor of two.

Potential Impacts to Air Quality Affected Resources in the Tonto National Monument. Acid deposition amounts were calculated for the Tonto National Monument. Total sulfur and nitrogen deposition numbers for terrestrial screening were calculated to be 32 Kg S/HA-yr and 6 Kg N/HA-yr, respectively (*Table D-3*). The calculated deposition amounts of atmospheric gases were compared to the Green and Red Line numbers established for the Class I areas. The terrestrial deposition number exceeds the Red Line number for sulfur (20 Kg S/HA-yr) but remains in the Yellow Zone for nitrogen (between 5 and 15 Kg N/HA-yr).

Table D-3. Ozone Concentrations and Calculated Sulfur and Nitrogen Deposition Affecting Terrestrial Ecosystems in Non-Class I Areas

Pollutant	Unit	AQRV Screening No[1] Green Line	AQRV Screening No[1] Red Line	Background Deposition	Background Plus Carlota Deposition: Tonto Natl. Monument	Background Plus Carlota Deposition: Carlota[2] Site
SO_2	Kg S/HA-yr	7[3]	20[3]	32	32	46
NO_x	Kg N/HA-yr	5[3]	15[3]	5	6	70
H_2SO_4	Kg H_2SO_4/HA-yr	NA	NA	0.6	NA	11
Ozone	ppb	75[4]	110[4]	40[5]	43[5]	40[5]

NA = Not Applicable
Source: USDA Forest Service (1989)
[1]Only applicable to Class I areas, but provided here for reference.
[2]Maximum on-site deposition.
[3]Nitrogen and sulfur deposition are total values, including all forms, wet and dry.
[4]Second highest 1-hour average ambient air concentration in a year.
[5]Estimated maximum 1-hour average ambient air concentration.

Although, the Tonto National Monument is not a Class I area, the Red Line levels used in the AQRV analysis remain useful for identifying deposition levels when damage to terrestrial resources can occur. As described for the Superstition and Sierra Ancha wildernesses, background concentrations of sulfur dioxide were estimated to be at levels already exceeding the terrestrial Red Line number (background deposition amounts of sulfur were conservatively calculated to be 32 Kg S/HA-yr at the Tonto National Monument, exceeding the Red Line number of 20 Kg S/HA-yr). Background concentrations of NO_x (5 Kg N/HA-yr) fell on the Green Line (5 Kg N/HA-yr). In assessing the magnitude of the potential impacts from the proposed project to terrestrial resources in Tonto National Monument, it should be taken into account that (1) background concentrations of sulfur oxides are likely significantly less than those assumed for the Superstition Wilderness due to its distance from the sources affecting the background SO_2 monitoring stations and the Superstition Wilderness (Carlota 1994e); (2) predicted increases in deposition were calculated using very conservative methods and input concentration estimates, and assessments of deposition amounts could be overstated; and (3) incremental increases in sulfur and nitrogen deposition would be small relative to background concentrations.

Ozone concentrations in the Tonto National Monument were predicted to be similar to those given for the Class I areas (*Table D-3*). Therefore, potential impacts from increased ozone concentrations in the monument area would also be similar to those determined for the Class I areas.

Assumptions and methods used in the Tonto National Monument deposition analysis are described below:

- Calculations, assumptions, and Red and Green Line numbers used for deposition of atmospheric sulfur and nitrogen were the same as those used in the AQRV analysis of Class I areas.

- Because of the sufficient distance between the project site and the Tonto National Monument, direct deposition of sulfuric acid mist was not significant.

Potential Impacts to Air Quality Affected Resources at the Carlota Copper Project Site. For the Carlota Copper Project site, two forms of acid deposition were evaluated: total dry deposition of atmospheric sulfur and nitrogen, and direct deposition of sulfuric acid mist. As stated previously, while the Red Line numbers for sulfur (20 Kg S/HA-yr) and nitrogen (15 Kg N/HA-yr) are designed as criteria for AQRVs in Class I areas, they serve as useful guidelines to indicate levels at which damage to air quality affected terrestrial resources could occur (although these guidelines do not include criteria for sulfuric acid deposition). The Carlota project is located within a non-attainment area for sulfur dioxide.

Total atmospheric sulfur and nitrogen deposition amounts for terrestrial screening were calculated (USDA Forest Service 1987) to be 46 Kg S/HA-yr and 70 Kg N/HA-yr, respectively (*Table D-3*). In addition to the deposition of atmospheric sulfur and nitrogen, the maximum predicted amount of sulfur deposited directly as sulfuric acid in the project area was calculated to be 11 Kg H_2SO_4/HA-yr (from a maximum predicted 24-hour average ambient concentration of 22.8 µg H_2SO_4/m^3 [*Table D-3*]). Because of the differences in deposition chemistry, sulfuric acid deposition amounts cannot be compared to or combined with atmospheric sulfur deposition. Deposition of sulfuric acid mist would primarily occur on and adjacent to the project site. Because the project site elevation is generally lower than areas south of the site and because of the direction of the prevailing winds, areas south of the project site (Top-of the-World) are not anticipated to be affected by the mist.

Increases to ozone concentrations in the project area, as discussed in the ozone analysis of the Class I areas, were predicted to be negligible. Therefore, potential impacts from increased ozone concentrations in the project area would not be anticipated.

Assumptions and methods used in the Carlota Copper Project site deposition analysis are described below:

- Calculations, assumptions, and Red and Green Line numbers used for deposition of atmospheric sulfur and nitrogen were the same as those used in the AQRV analysis of Class I areas.

- Deposition velocity used for sulfuric acid was 0.02 m/sec (default value for controlled sources based on guidance found in CAPCOA's *Air Toxics "Hot Spots" Program Revised 1992 Risk Assessment Guidelines*, October 1993 [as referenced in Air Sciences, Inc. 1996a]).

Potential impacts from the deposition of sulfuric acid mist is of special concern because of the oxidizing strength, hydrophilic nature (strong affinity for water), and corrosive characteristics of the concentrated acid. Since it was difficult to assess potential impacts on terrestrial resources, it was necessary to limit the impact evaluation to special resources of concern, namely species listed as endangered by the U.S. Fish and Wildlife Service. The only listed species surveyed as having permanent residence in the Carlota Copper Project area was the Arizona hedgehog cactus (this survey included the Arizona agave, lesser long-nosed bat, American peregrine falcon, and bald eagle [Cedar Creek Associates, Inc. 1994d]). The majority of cacti surveyed are located in interior Chaparral ecosystems in the western and southern portions of the project area. No specimens were located within the project area east of the Pinto Creek Valley channel (Cedar Creek Associates, Inc. 1994d). The majority of cacti are located in soils composed of dacitic parent material (Apache Leaf Tuff), a rock type that underlies a large portion of the western and northern project area, as well as in Schultze granite in the southern portion of the project area. Analyses of the parent rock indicates a fair amount of acid-neutralizing potential (Knight Piésold 1993a), suggesting significant buffering capacity. Because of the soil's anticipated ability to neutralize acidic deposition, potential impacts to the Arizona hedgehog cactus from soil or subsurface water acidification would not be expected.

Possible affects to the Arizona hedgehog cactus (Echinocereus triglochidiatus) from sulfuric acid mist are addressed by Cedar Creek Associates, Inc. 1994d:

> According to Applied Environmental Consultants, Inc.'s (1993) modeling results, worst-case sulfuric acid plume concentrations at any Arizona hedgehog receptor would be approximately 20 micrograms/cubic meter for the 1-hour standard and less than 2 micrograms/cubic meter for the 24-hour standard. No known research has been done on the effects of sulfuric acid mist on the Arizona hedgehog cactus. Lang (1978) indicated that injury to plants occurred following exposure to "high concentrations of sulfuric acid aerosol (100-200 micrograms/cubic meter) for short times of 4 to 16 hours." Assuming that the threshold of effects to Arizona hedgehog cactus would be within the range of the plants in Lang's study, no detectable adverse effects to receptor Arizona hedgehog cactus would be anticipated at the worst-case acid concentrations. Lang indicates that "injury to vegetation caused by sulfuric acid aerosol is similar to that caused by gaseous fluoride and is characterized by marginal and tip necrosis of foliage...[which] is distinctly different from that which has been attributed to acidic precipitation." Therefore, in order for Arizona hedgehog to be injured by sulfuric acid emissions from project facilities, the emissions would have to be in the range of ten times greater than the emissions predicted for the worst-case scenario.

Since the actual concentrations of acid that would begin to affect the Arizona hedgehog cactus can only be hypothesized from existing research, it is recommended that a statistically significant number of cacti (approximately 30) that are expected to receive the greatest acid concentrations be visually monitored throughout the operation of the tank house (see Section 3.5.4.1, Biological Resources - Terrestrial Resources). The potential combined effects to the Arizona hedgehog cactus from sulfuric acid mist, atmospheric sulfur and nitrogen deposition, and ozone are also uncertain. Because of this uncertainty, monitoring for potential impacts to the Arizona hedgehog cactus would include (1) directly observing individual plants in areas determined to be at risk, and (2) monitoring soil pH around selected cacti in high risk areas.

If adverse effects are identified in individual plants or soils surrounding the plants, mitigation measures would be implemented. Mitigation measures to limit potential impacts to the Arizona hedgehog cactus could include (1) transplanting specimens in harms way to new habitat locations (this procedure has been performed successfully in the past [Cedar Creek Associates, Inc. 1994d]), (2) expanding the known distributional limits of the cactus, (3) prohibiting public access in the project area during and following mining, and (4) modifying the electrowinning (EW) process or exhaust system to reduce sulfuric acid emissions.

Aquatic Biota

An evaluation was conducted to estimate the potential for the proposed project's air emissions to affect aquatic resources within the Superstition and Sierra Ancha wilderness areas, the Tonto National Monument, and the Carlota Copper Project area. Of interest were the potential effects on surface water acidification and aquatic flora and fauna caused by increased acid deposition. Although these effects were difficult to quantify, the Forest Service provided a screening tool (USDA Forest Service 1989) to help predict the potential impacts on aquatic resources in Class I wilderness areas caused by the deposition of atmospheric sulfur and nitrogen. The screening tool evaluates potential impacts on AQRVs, which are terrestrial and aquatic resources in Class I areas that could be adversely affected by changes in air quality. The framework includes thresholds of acceptable (Green Line), unacceptable (Red Line), and intermediate (Yellow Line) levels of pollution. Pollutant doses less than the Green Line numbers could be judged permissible (no significant impact), while doses above the Red Line numbers would likely cause at least one AQRV to be adversely affected. Specific AQRVs affected by doses above the Red Line numbers could not be identified since the screening tool was designed to provide guidelines for general use rather than formulas for specific applications. Exact effects to a particular AQRV would need to be evaluated on the basis of site-specific limits of acceptable change.

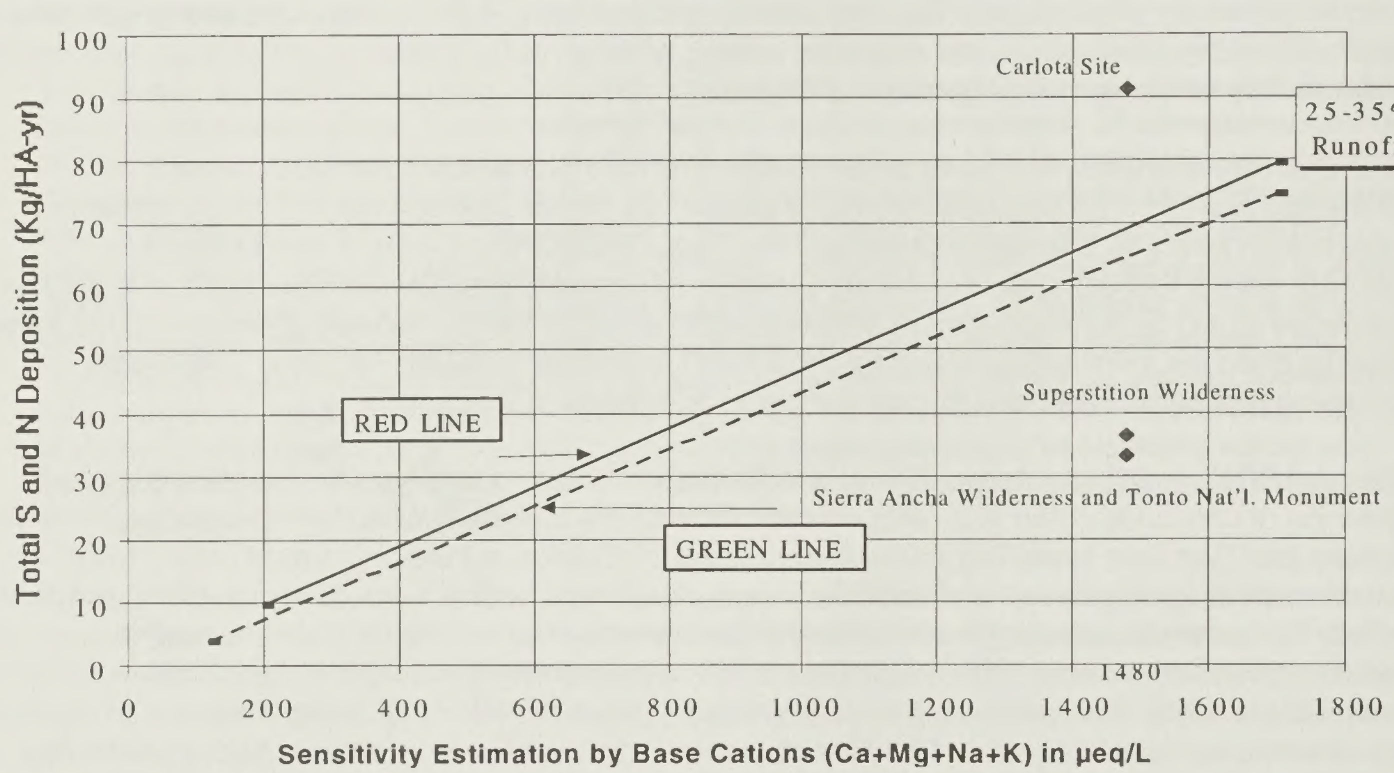
Potential impacts to the aquatic AQRVs and the air quality affected I aquatic resources in Class II National Forest System Lands could result from increased acid deposition from atmospheric sulfur and NO_x. Wet and dry deposition of atmospheric sulfur and NO_x, as well as direct deposition of suspended sulfuric acid mist, could affect aquatic resources and AQRVs primarily by changing pH levels in soils, precipitation, surface runoff, and receiving waters. Lowering the pH could adversely affect aquatic life, both directly and indirectly. A direct effect of pH change could be caused by the toxicity of acidified deposition and receiving waters, while an indirect effect of pH change could result from the increased solubility of heavy metals because of decreased pH.

For the Superstition and Sierra Ancha wilderness areas (Class I areas), several ecosystems have been recommended as aquatic AQRVs. The ecosystems include perennial streams and springs that are potentially sensitive to acid deposition (such as Campaign Creek and the West Fork of Pinto Creek in the Superstition Wilderness), temporary waters that are critical to the life cycles or habitat of potentially sensitive biota, and riparian area vegetation sensitive to wet or dry deposition of pollutants (Blankenship 1991). Adverse effects on any of these ecosystems caused by changes in air quality would be considered an impact to aquatic AQRVs. The Green Line/Red Line screening procedure was used to evaluate potential impacts to these AQRVs.

Potential Impacts to AQRVs in Class I Areas. Green and Red Line screening numbers for aquatic ecosystems represent a comparison of combined sulfur and nitrogen deposition to the sensitivity or buffering capacity of affected surface waters. Green and Red Line screening numbers represent total pollution loading (current conditions plus proposed new source contributions). Based on Forest Service methodology (USDA Forest Service 1989), a good measure of sensitivity for surface waters is the sum of the concentrations of base cations (calcium, magnesium, potassium, and sodium ions) in the water. For surface waters with a carbonate/bicarbonate water chemistry, this approximation seems reasonable. It is assumed that surface waters within the relatively undisturbed watersheds of the wilderness areas would contain a carbonate/bicarbonate water chemistry. Since water quality data within the two wilderness areas were limited, a surface water sample from Powers Gulch in the proposed project area was used as a representative water quality analysis (Section 3.3, Water Resources). The water chemistry was primarily bicarbonate with a total dissolved solids (TDS) concentration of 100 mg/L. Surface waters in the wilderness areas would be expected to have an analogous water chemistry and similar or higher TDS concentrations. The sum of the base cations for the representative sample was 1,480 micro equivalents per liter (μeq/L). This concentration was used to determine Green and Red Line numbers for potentially affected aquatic ecosystems (*Figure D-1*).

In addition, an equation was available from the Forest Service (USDA Forest Service 1989) to estimate the total deposition of sulfur and nitrogen. This equation was applied to predicted ambient air concentrations, a range of deposition velocities (Sehmel 1980), and estimated contributions of wet and dry deposition (USDA Forest Service 1987). The results indicate a wide range of possible deposition amounts for sulfur dioxide and nitrogen dioxide. Screening numbers and deposition amounts are reported in terms of combined sulfur and nitrogen and include all forms of SO_x and NO_x, respectively. This method of reporting is done to simplify comparative analysis since results appear as a single value representing all sulfur and NO_x species. Considering the most probable contributions of wet and dry deposition (USDA Forest Service 1987) and the deposition velocities most likely to occur in the region (Sehmel 1980), total combined sulfur and nitrogen deposition amounts calculated for aquatic ecosystems were 35 Kg/HA-yr in the Superstition Wilderness and 33 Kg/HA-yr in the Sierra Ancha Wilderness. These numbers were below the estimated aquatic Green Line number (65 Kg/HA-yr) for the assumed receiving water chemistry (*Table D-4*); therefore, impacts to aquatic AQRVs caused by acid deposition would not be anticipated.

Additional studies of Class I wilderness areas (Blankenship 1991) provide limits of acceptable change for water quality/water chemistry for perennial streams and temporary waters affected by atmospheric deposition. Limits of acceptable change for constituents associated with these waters include values of acceptable change for pH, acid neutralizing capacity, and sulfate concentration. Since potential changes in the value of these constituents from the estimated increases in atmospheric deposition cannot be predicted, impacts to AQRVs cannot be evaluated using these limits.



Source: Extrapolated from USDA Forest Service (1989)

Figure D-1. Green and Red Line Values for Effects of Deposition on Fresh Water Systems

Table D-4. Calculated Sulfur and Nitrogen Deposition Affecting Aquatic Ecosystems in Class I Wilderness Areas

Pollutant	AQRV Screening No[1]		Background Deposition	Background Plus CarlotaDeposition	
	Green Line	Red Line		Superstition Wilderness	Sierra Ancha Wilderness
Combined SO_2 and NO_x (Kg/HA-yr)	65	69	33[2]	35	33
H_2SO_4 (Kg H_2SO_4/HA-yr)	NA	NA	NA	NA	NA

NA = Not Applicable
[1]Source: Extrapolated from USDA Forest Service (1989)
[2]It is likely that background sulfur deposition is substantially lower in the Sierra Ancha Wilderness because of its increased distance from anthropogenic sources of SO_2.

Assumptions and methods used in the aquatic AQRV analysis are described below:

- Ozone did not affect aquatic ecosystems (USDA Forest Service 1989).
- Estimates of potential suspended sulfuric acid mist concentrations were not included in atmospheric sulfur deposition calculations.

- Because of the sufficient distance between the project site and the wilderness areas, direct deposition of sulfuric acid mist was not significant.

- Dry deposition was calculated, and wet deposition = dry deposition; therefore, total deposition = 2 x dry deposition (USDA Forest Service 1987).

- A realistic estimate of sulfur dioxide deposition velocity was equal to 0.01 m/sec.

- All NO_x gases were assumed to be nitrogen dioxide; a realistic estimate of deposition velocity was equal to 0.005 m/sec (Air Sciences Inc. 1996b).

- Screening numbers used consisted of 100 percent of the calculated sulfur and 25 percent of the calculated nitrogen deposition (USDA Forest Service 1989). Although the Forest Service report suggests using this percentage mixture only for base cation concentrations below 50 µeq/L, this procedure was used in this analysis to determine the most conservative estimates.

- Green and Red Line numbers were taken from USDA Forest Service 1989. Green and Red Line numbers for aquatic ecosystems were extrapolated using the 25 to 35 percent runoff plots. This runoff plot percentage was chosen because it represents a conservative approach resulting in the greatest adverse effect from acid deposition in aquatic environments.

- The water chemistry of receiving surface waters was estimated to be the same as the water chemistry of a Powers Gulch sample taken within the project study area (TDS concentration = 100 mg/L).

Potential Air Quality-Related Impacts to the Tonto National Monument. An acid deposition amount was calculated for the Tonto National Monument. The total combined deposition of sulfur and nitrogen for aquatic ecosystems was calculated to be 33 Kg/HA-yr (*Table D-5*). The calculated amount of deposition from atmospheric gases was compared to the Green and Red Line numbers established for the Class I areas, and the deposition amount was below the Green Line number (65 Kg/HA-yr). The Tonto National Monument is not a Class I area; however, because of the screening results, impacts to aquatic ecosystems from sulfur and nitrogen deposition at the Monument would not be anticipated.

Table D-5. Calculated Sulfur and Nitrogen Deposition Affecting Aquatic Ecosystems in Non-Class I Areas

Pollutant	AQRV Screening No[1]		Background Deposition	Background Plus Carlota Deposition	
	Green Line	Red Line		Tonto Natl. Monument	Carlota Site
Combined SO_2 and NO_x (Kg/HA-yr)	65	69	33[2]	33	91
H_2SO_4 (Kg H_2SO_4/HA-yr)	NA	NA	0.6	NA	11

NA = Not Applicable
Source: Extrapolated from USDA Forest Service (1989)
[1]Only applicable to Class I Areas but provided here for reference.
[2]It is likely that background sulfur deposition is substantially lower in the Tonto National Monument because of its increased distance from anthropogenic sources of SO_2.

Assumptions and methods used in the Tonto National Monument deposition analysis are described below:

- Calculations, assumptions, and Red and Green Line numbers used for deposition of atmospheric sulfur and nitrogen were the same as those used in the AQRV analysis of Class I areas.

- Because of the sufficient distance between the project site and the Tonto National Monument, direct deposition of sulfuric acid mist was not significant.

Potential Air Quality-Related Impacts to the Carlota Project Site. For the Carlota Copper Project site, two forms of acid deposition were considered for evaluation: total deposition of atmospheric sulfur and nitrogen, and direct deposition of sulfuric acid mist. Criteria do not exist for direct sulfuric acid deposition into aquatic ecosystems. Potential impacts from sulfuric acid mist and atmospheric sulfur and nitrogen deposition were difficult to evaluate with the data available. Red Line numbers for total combined sulfur and nitrogen deposition (69 Kg/HA-yr, *Table D-5*) provide atmospheric deposition criteria for AQRV analysis in Class I areas. These areas usually have very pristine aqueous conditions (surface waters in the project area have buffering capacity approximation values 10 times greater then those developed for Class I area Red Line/Green Line screening).

Total combined atmospheric sulfur and nitrogen deposition at the project site for aquatic ecosystems was calculated to be 63 Kg/HA-yr (*Table D-5*). In addition to the deposition of atmospheric sulfur and nitrogen, the maximum amount of sulfur deposited directly as sulfuric acid was calculated to be 11 Kg H_2SO_4/HA-yr ([*Table D-5*] from a maximum predicted 24-hour average ambient concentration of 22.8 µg H_2SO_4/m^3) in the project area. Because of the differences in deposition chemistry, sulfuric acid deposition amounts cannot be compared to or combined with atmospheric sulfur deposition.

Major rock units that outcrop in the project area include the Pinal Schist, Schultze Granite, Apache Leap Tuff, Diabase, and Gila Conglomerate. Analyses of these rock types has indicated a fair to high amount of acid-neutralizing potential (Knight Piésold 1993), which suggests significant buffering capacity. These rock types combine as parent material to form soils and sediment deposits across the project area. Surface waters on the project site exist as perennial, intermittent, ephemeral, or overland flows and have the potential to pass over each of these rock types. Because of the anticipated ability of the parent material and associated soils and sediment deposits to neutralize acidic deposition, potential acidification of infiltrating, subsurface, and overland flows would not be expected.

The capacity of surface waters to assimilate acid deposition and, therefore, potential impacts to aquatic ecosystems, was difficult to calculate. Some insight, however, is available through the water chemistry observed in Pinto Creek. In the project area, Pinto Creek exhibits higher TDS and sulfate concentrations than its headwaters or other streams in the project area less influenced by pre-existing mining activity. Certain tributaries to Pinto Creek (the Gibson Mine tributary, 005 Gulch, Cottonwood Gulch, and Miller Spring) seem to contribute a significant amount to the TDS and sulfate concentrations measured in the project area of Pinto Creek. Because of the mineralogy and pre-existing mining processes that are most likely producing the high sulfate concentrations, low pH waters would normally be expected in these tributaries. However, at sites where these tributaries and Pinto Creek have been sampled for water quality, they do not exhibit low pH values (a minimum pH of 6.4 standard units measured in Gibson Mine Tributary and a minimum pH of 7.2 standard units measured in Pinto Creek at PC-3 [see Section 3.3, Water Resources]). Measurements of consistently high pH values (7.5 to 8.5 standard units for most surface waters in the project area) under varying water chemistry conditions suggest a significant amount of available buffering capacity for aqueous systems. Therefore, potential impacts to aquatic ecosystems caused by pH changes from acid deposition would not be anticipated.

Assumptions and methods used in the Carlota Copper Project site deposition analysis are described below:

- Calculations, assumptions, and Red and Green Line numbers used for deposition of atmospheric sulfur and nitrogen were the same as those used in the AQRV analysis of Class I areas.

- The deposition velocity used for sulfuric acid was 2.0 cm/sec (default value for controlled sources based on guidance found in *CAPCOA's Air Toxics "HotSpots" Program revised 1992 Risk Assessment Guidelines*, October 1993, as referenced in Air Sciences, Inc. 1996a).

Summary

These analyses indicate that sulfur deposition levels would likely be above terrestrial Red Line screening levels at the Superstition Wilderness, Sierra Ancha Wilderness, Tonto National Monument, and the Carlota project site. Thus, some impacts to terrestrial AQRVS and other air quality affected terrestrial resources could occur. However, the increase in sulfur deposition caused by the project is expected to be minimal at all of these locations, except the actual Carlota project site, and background sulfur deposition rates were calculated to already be above the terrestrial Red Line value. Nitrogen deposition rates were calculated to be in the Yellow Line range at all Class I areas (Superstition and Sierra Ancha wildernesses) and other National Forest System Lands, except at the Carlota project site, where the rate exceeded the Red Line number. Ozone concentrations at all sites were less than the Green Line screening number.

These analyses also show that is unlikely that aquatic biota AQRVs in the Class I areas and aquatic biota air quality affected resources in the National Forest System Lands will be adversely impacted by the proposed project. All impacts, with the exception of those at the Carlota project site, were calculated to be at levels below the AQRV Green Line screening values.

APPENDIX E

WELLFIELD MITIGATION PROGRAM

WELLFIELD MITIGATION PROGRAM

The Carlota Copper Company's proposed water supply wellfield is located near the confluence of Haunted Canyon and Pinto Creek. Both streams contain reaches of perennial flow that support valuable aquatic and riparian resources. Base flow in these streams appears to be sustained primarily by ground water discharged from a leaky confined aquifer that is penetrated by wells within the proposed wellfield. Pump test results have demonstrated that operation of the wellfield will reduce stream flow in Haunted Canyon and possibly Pinto Creek. It is possible that pumping of the wellfield will lower the piezometric surface of the aquifer below the bed of the Haunted Canyon and Pinto Creek channels. This effect could eliminate the ground water discharge that sustains base flow in both systems. Maintaining this component of stream flow is critically important for sustaining water dependent resources, particularly during the summer and fall when stream flow is composed almost entirely of base flow.

Mitigation of the effects of the wellfield on stream flow consists of four elements. These elements are defined as follows:

- o Trigger Flow-a flow value that initiates discharge of mitigation water.
- o Mitigation Flow-a discharge rate that represents the quantity of water Carlota would be responsible for releasing to the streams.
- o Resource Maintenance Flow-a flow value that represents stream flow that should be maintained in the stream to protect water dependent resource values.
- o Cap Flow-a maximum discharge rate that Carlota could release to the stream to ensure provision of resource maintenance flows.

To implement the mitigation program flow measurements are needed at both the location of mitigation flow discharge points and at various locations within the channels. The elements of the mitigation plan that would be measured in the stream would include the trigger flows to initiate mitigation and the resource maintenance flow values that should be maintained in the stream. The flow elements measured at the discharge points from the mitigation pipeline would include the mitigation flows discharged to maintain either trigger flow or resource maintenance flow values and the cap on mitigation flows that represents the maximum amount of water that could be used to maintain resource maintenance flows.

TRIGGER FLOW

Trigger flow values represent estimated stream flow rates that are important for maintaining the water dependent resources of Haunted Canyon and Pinto Creek. The trigger flow identifies the flow where mitigation should begin. Once the wellfield begins to operate discharge of mitigation water to the creeks would be initiated when stream flow falls below the identified trigger values.

Trigger flows are identified on a monthly basis and are derived from three sources. These include: flows needed to sustain desert sucker habitat from January through March, median monthly flows (based on correlation with the USGS weir at PC-10) from April through September and on conservative estimates of baseflow from October through December. Trigger flows by month for Haunted Canyon at HC-2 are listed in the table below.

Trigger Flows at HC-2

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
cfs	1.25	1.25	1.25	1.0	0.7	0.45	0.35	0.23	0.21	0.2	0.21	0.3
gpm	560	560	560	449	316	204	158	103	94	90	94	135

MITIGATION FLOW

Mitigation flows represent the quantity of water Carlota would be required to discharge to the creeks to mitigate the impact of the wellfield on stream flow. Mitigation flows represent an estimate of base flow in the creek plus 25 percent. Mitigation flows by month are listed in the table below.

Mitigation Flows at HC-2

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
cfs	0.41	0.38	0.34	0.3	0.26	0.24	0.21	0.2	0.2	0.2	0.21	0.3
gpm	186	166	149	133	119	106	94	90	90	90	94	135

RESOURCE MAINTENANCE FLOW

Resource maintenance flow values are the same as the mitigation flow values and were derived with the same procedure but represent flows in the stream rather than as measured at the outlet from the mitigation pipeline. These flows represent minimum values that the mitigation program attempts to maintain in the stream at all times.

CAP FLOW

The cap flow value represents a limit on the absolute quantity of water Carlota would be required to discharge from the mitigation pipeline. Water in excess of the mitigation flow would only be necessary if discharge of this quantity of water failed to maintain resource maintenance flow values in the stream. The maximum discharge, or cap, that could be used to maintain resource maintenance flow would be .41 cfs (186 gpm). The quantity of water represented by the mitigation flow is included as a component of the cap flow. The maximum flow that could be discharged above and beyond the mitigation flow to reach the limit represented by the cap is .21 cfs (96 gpm) which could occur from August through October.

STREAM FLOW MITIGATION PROCEDURES

Implementation of the wellfield mitigation program would require comparison of stream flows at Haunted Canyon with the monthly trigger values. Mitigation would not be required until stream flows drop below the trigger values. Once stream flow drops below the trigger values Carlota would discharge sufficient water from the mitigation pipeline to maintain trigger flow rates in the stream. The quantity of mitigation flow discharged to the stream to maintain trigger flows could be increased until the full mitigation flow quantity is discharged from the pipeline. If stream flow declines below trigger flows, even with discharge of the full mitigation flow, no further increase in mitigation flow discharge would be required until stream flow declined to resource maintenance flow values. If stream flow continued to decline below resource maintenance flow values the Forest could request that additional water be discharged from the mitigation pipeline to maintain these values. A maximum of .41 cfs (186 gpm) could be discharged to the creek to maintain resource maintenance flows. As stream flows increase above resource maintenance flow values discharge above the full mitigation flow quantity could be reduced to maintain resource maintenance flows. As stream flows continue to increase above trigger flows, mitigation discharges would be reduced to maintain trigger flows. If stream flow increases above trigger flow values without the need for mitigation discharge then no mitigation is necessary.

Trigger and resource maintenance flow values identified in the mitigation program are mean daily flow values that should be maintained each day of the month. Stream flow recorded at the continuous stream flow monitoring gages installed by Carlota and the U.S. Geological Survey would be used to compare mean daily flows in the streams with trigger and resource maintenance flow values. Mitigation flows would be adjusted on a weekly basis unless review and analysis of monitoring data suggests more frequent adjustments are warranted.

Evapotranspiration by riparian vegetation has significant diurnal effects on stream flow beginning from early to mid May and continuing through early to mid October. To remove this complicating factor from the mitigation program, the need to adjust the quantity of mitigation flow necessary to maintain targetted trigger or resource maintenance flow values should be evaluated at the time of day of the daily mean flow. The diurnal streamflow monitoring study conducted by Groundwater Resources Consultants (GWRC, 1995) suggests daily mean flow occurs just after midnite and near noon each day. Comparison of stream flow at these times with the monthly trigger or resource maintenance values that the mitigation program intends to maintain would serve as a basis for adjusting mitigation flows.

MITIGATION FLOW DISCHARGE LOCATIONS

Locations for discharge of mitigation water in Haunted Canyon tentatively include: 1) Powers Gulch above its confluence with Haunted Canyon 2) Haunted Canyon above its confluence with Powers Gulch and 3) Haunted Canyon below HC-2. Goals for water flow would be to maintain the resource maintenance flows listed for HC-2 at HC-3 as well. Below HC-4 the goal would be to maintain water in the pools that provide desert sucker habitat.

To maintain stream flow objectives in Pinto Creek a discharge point could be located near AMW-23 and evaluated for compliance at PC-7.

PINTO CREEK

Base flow in the reach of perennial flow in Pinto Creek is believed to be sustained primarily by ground water discharged into Haunted Canyon that also maintains perennial flow in Haunted Canyon. Mitigation of the potential impact of the Carlota wellfield on stream flow in Haunted Canyon may also maintain base flow in Pinto Creek. PC-7 is considered an important point of compliance for the mitigation program because the reach of perennial flow in Pinto Creek supports valuable riparian and aquatic resources and the impacts of the wellfield on stream flow in this reach are not well known. Resource maintenance flows are listed in the table below.

Resource Maintenance Flows at PC-7

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
cfs	0.41	0.41	0.41	0.41	0.41	0.31	0.25	0.21	0.21	0.21	0.21	0.4
gpm	186	186	186	186	186	139	112	95	95	95	95	180

A maximum discharge of .41 cfs (186 gpm) would be used to maintain these stream flows. The release of .41 cfs (186 gpm) represents the cumulative total that would be released to maintain flow in both Haunted Canyon and Pinto Creek in the vicinity of the wellfield.

The Forest Service and Carlota would meet at least annually to review the results of the monitoring data and the performance of the mitigation program. Adjustments to the mitigation program could occur based on the the results of these reviews.

APPENDIX F

U.S. FISH AND WILDLIFE SERVICE BIOLOGICAL OPINION

United States Department of Agriculture | Forest Service | Tonto National Forest | 2324 E. McDowell Road
Phoenix, AZ 85006
602 225-5200

File Code: 1950/2670

Date: May 16, 1996

Mr. Robert Walish
Vice President and General Manager
Carlota Copper Company
P.O. Box 1009
Miami, AZ 85539-0806

RE: U.S. Fish & Wildlife Service Biological Opinion - Carlota Copper Project

Dear Mr. Walish:

A biological opinion on the effects of the Carlota Copper Project in accordance with section 7 of the Endangered Species Act was issued on April 26, 1996. A copy is enclosed for your files.

The information documented in the opinion, specifically that described in the Incidental Take Statement, Conservation Recommendations and Reinitiation sections will be used to revise the final Environmental Impact Statement and the Biological Mitigation Plan.

Please contact Project Coordinator Paul Stewart should you have any questions regarding the opinion at this time.

Sincerely,

for CHARLES R. BAZAN
Forest Supervisor

Enclosure

cc: w/Enclosure
Marjorie Blaine, U.S. Army Corps of Engineers, Los Angeles District
Regulatory Branch
Valerie Randall, Riverside Technology, inc.
Frank Reichenbacher, Southwestern Field Biologists
Globe District Ranger

cc: w/o Enclosure
Duane Bollig, Carlota Copper Company, Englewood, CO.
Roy Faverty, Faverty and Associates

United States Department of the Interior
Fish and Wildlife Service
Arizona Ecological Services Field Office
2321 W. Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
(602) 640-2720 Fax (602) 640-2730

In Reply Refer To:
AESO/SE
2-21-92-F-419

April 26, 1996

Mr. Charles R. Bazan
Forest Supervisor
Tonto National Forest
2324 E. McDowell Road
Phoenix, Arizona 85006

The U.S. Fish and Wildlife Service has reviewed the biological assessment and evaluation (BA&E) for the proposed Carlota Copper project. Your February 6, 1995, request for formal consultation was received on February 7, 1995. This document represents the Service's biological opinion on the effects of the Carlota Copper project on the endangered lesser long-nosed bat (*Leptonycteris curasoae yerbabuenae*) and Arizona hedgehog cactus (*Echinocereus triglochidiatus* var. *arizonicus*) in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended, (16 U.S.C. 1531 *et seq.*).

This biological opinion is based on information provided in the BA&E (Cedar Creek Associates, Inc., 1994/1996), the "Draft Environmental Impact Statement Carlota Copper Project" (DEIS) (Tonto National Forest, January 1995), Spill Control and Hazardous Material Management Plan (SCHMMP), Revision 1 (Carlota Copper Company, January 1996), Carlota Copper Project Final Design of Heap Leach Pad and Ancillary Facilities (Knight Piesold, 1995/1996), Draft Biological Mitigation Plan for the Carlota Copper Project on the Tonto National Forest (Cedar Creek Associates, Inc., March 1996), Conservation Assessment and Plan for the Arizona Hedgehog Cactus (*Echinocereus triglochidiatus* var. *arizonicus*) (Tonto National Forest, 1996), technical memoranda, and various other reports, meetings, and information submitted to the Service. A complete administrative record of this consultation is on file in this office.

It is the Service's biological opinion that the Carlota Copper Project, as proposed, is not likely to jeopardize the continued existence of the lesser long-nosed bat or Arizona hedgehog cactus. No critical habitat has been designated for these species, therefore, none will be affected.

CONSULTATION HISTORY

The Service has been informally consulting on this project since April, 1992. The 90-day formal consultation period began on February 7, 1995, the date your request was received by the Arizona Ecological Services Field Office. Notice of that receipt was sent to you in a letter dated

February 15, 1995. A request to add the lesser long-nosed bat and the bald eagle (*Haliaeetus leucocephalus*) to the formal consultation for the Carlota Copper project was received by the Service on April 25, 1995. On May 11, 1995, the Department of the Interior submitted comments to the Forest Service on the DEIS. The DOI concluded that the DEIS was inadequate and recommended that it be supplemented prior to issuance of a final Environmental Impact Statement. On May 11, 1995, the Service submitted comments regarding the Army Corps of Engineers' November 9, 1994, public notice 94-40899-KLR. The Service's comments regarding the permit issuance for public notice 94-40899-KLR concluded that the proposal would result in substantial and unacceptable impacts to aquatic resources of national importance. The Service also stated that the notice had not clearly demonstrated that alternatives to the project did not exist.

On June 16, 1995, the Service received notice that the Forest Service was withdrawing its request to include the bald eagle in the formal consultation. The Forest Service made the determination that the proposed Carlota Copper project may affect but is not likely to adversely affect the bald eagle. The Service concurs with the Forest Service's finding under the following conditions:

1) The Service will be contacted within 2 working days in the event of a spill or leak, and

2) A completed baseline bioaccumulation study is forwarded to the Service before the heap leach pad is put into operation. This study was completed by W.J. Miller and Associates (Miller, 1995).

On June 19, 1995 (day 132 of the consultation), the Forest Service and Carlota Copper Company requested the consultation be put on hold until additional information could be collected and incorporated into a more comprehensive mitigation plan for the Arizona hedgehog cactus. On April 24, 1996, a draft biological mitigation plan, conservation assessment and plan for the Arizona hedgehog cactus, revised spill plan, and changes to the project description was formally received by the Service and the consultation was resumed.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The following summary of the proposed action is drawn from project descriptions in the BA&E, DEIS, and additional changes provided by the Forest Service and Carlota Copper Company. The Carlota Copper Company is proposing to mine and process copper with facilities that include three open pits, three surface mine rock disposal areas, two heap-leach pads, a pregnant leachate solution (PLS) pipeline, a solvent-extraction/electrowinning (SX/EW) processing plant, a well field, raffinate pond, water pipeline, mine shop, warehouse, crusher/conveyor/stockpile and secondary crushing areas, administration building, laboratories, parking, sewage treatment/disposal systems, access/haul/miscellaneous roads, powerlines, stormwater drainage control ditch, sediment control structures, permanent diversion channels in both Pinto Creek and Powers Gulch and water, fuel, and reagent tanks. A total of 1,428 acres will be disturbed within a 3,050-acre project area over a 23-year period. Reclamation activities will include closure of the leach pad in compliance with Federal and State regulations, removal of structures, partial pit backfill, protection of natural stream channels and diversion channels, and recontouring and revegetation of disturbed areas. Mine closure will be completed within two to three years following the end of operations and reclamation. The mine's operations are scheduled to conclude in approximately 2010.

The proposed project consists of open-pit mining using conventional techniques including blasting, truck hauling from the pit to the crusher, and conveyor transport from the crusher to the leach pads. Ore processing includes "curing" with sulfuric acid and leaching to produce a copper-bearing solution. The raffinate (barren solution) is applied to the leach pad, collected in an internal pond, and then pumped to the SX/EW plant for production of high quality copper cathodes.

The Carlota/Cactus pit will be located on the east side of the proposed project area and oriented in a southeast-northwest direction. The placement of this pit spans Pinto Creek and requires the diversion of the natural channel. The pit dimensions will be 5,000 feet long by 3,200 feet wide, and the ultimate pit-bottom elevation will range from approximately 2,950 to 2,850 feet above mean sea level(ft-amsl) or 500 to 650 feet below the present elevation of Pinto Creek (approximately 3,520 ft-amsl). Additionally, the Eder South pit, and Eder North pit will be smaller and cut into the side of the hill slope that forms the west side of Powers Gulch.

The proposed Carlota/Cactus pit is scheduled to be mined in five phases, the Eder South pit in at least three phases, and the Eder North pit in a single phase. Mining will begin in the Cactus area comprising the southeast portion of the pit and will move in a northwest direction in the subsequent phases. Ore mining in the Carlota/Cactus pit will be completed at the end of year 13, with production from the Eder pits beginning in year 8 of the project. A total of 100 million tons of ore and annual copper production of 33,000 tons is expected for the life of the mine.

Preproduction stripping occurs during construction and Project Year 1 will be the first full year of ore mining and copper production. The schedule was developed at a nominal production rate of 7 million tons of ore per year, with adjustments up and down to attempt to stabilize copper production at approximately 33,000 annual tons. The 7 million tons of ore per year equate to a daily production rate of approximately 20,000 tons. Total material moved during the first 8 project years averages 25 million tons per year (an average of 69,000 tons per day) and increases to 26 million tons per year in project years 9 and 10.

The Carlota/Cactus pit spans Pinto Creek, and development of the pit requires diverting the creek around the east and north of the Cactus side of the pit. The design of the first phase of the pit includes additional stripping to push back the pit wall in order to place the diversion channel on a bench in the pit. The diversion channel conveys both flood waters and sediments around the east and north side of the Cactus portion of the pit. The diversion will be approximately 5,250 feet long and contain a series of engineered grade control structures and alluvium. The elevation of the channel inlet at the south end of the pit will be approximately 3,560 ft-amsl, and the elevation of the channel outfall will be approximately 3,480 ft-amsl. The slope of the diversion channel will be similar to that of the existing Pinto Creek drainage, averaging approximately 1.5 percent. Approximately 5,400 feet of Pinto Creek will be permanently displaced by the Carlota/Cactus pit. The diversion channel will be placed on a bench up to approximately 150-feet wide within the pit. The channel itself will have a minimum bottom width of 60 feet and channel side slopes at 0.5H:1V. As much of the channel as possible will be placed in competent Pinal Schist bedrock to provide a permanent stable base for the diversion, and a soil cement lining will be provided on the channel bottom and sides as necessary to afford scour protection. The lining will be a maximum of four feet on the channel bottom and eight feet on the sides. This diversion will be the permanent alignment of Pinto Creek through the pit area after mining is concluded. Designs and modifications will be evaluated and implemented as necessary to ensure long-term post-closure functioning. The southeast portion of the pit, around which the diversion channel flows, will be backfilled and buttressed with mine rock from later phases of the Carlota/Cactus pit. This backfill material will buttress the channel and slopes upward to a top elevation of approximately 3,600 ft-amsl. A wetland area also will be created at the head end of the Pinto Creek diversion.

There will be three surface mine rock disposal areas and partial backfill of the Carlota/Cactus and Eder pits during the life of the mining operation. The disposal areas for the Carlota/Cactus mine rock will be the Main mine rock disposal area in the drainage area north west of the pit with the capacity of 115 million tons and a final elevation of 4,160 ft-amsl, and the Cactus Southwest mine rock disposal area in a small drainage southwest of the pit with a capacity of 27.5 million tons with an elevation of 4,360 ft-amsl. The Cactus pit backfill in the eastern end of the Carlota\Cactus pit will have a capacity of 51.5 million tons and an elevation of 3,600 ft-amsl. The Eder mine rock disposal area, located on the slope between the Eder North and South pits will have a capacity of 17.1 million tons with an elevation of 4,240 ft-amsl. The backfill material will be placed in the eastern portion of the mined-out pit along the western side of the Pinto Creek diversion channel. The backfill buttresses the in-pit side of the diversion channel and reduces the amount of material otherwise destined for the Main rock dump. A partial backfilling of the Eder pits in the last two years of the project using material from the Eder rock dump will be part of the project reclamation.

Open-pit mining will be conducted with hydraulic shovels and trucks to haul the ore to a crusher site and the mine rock to the disposal areas. The ore crushing facilities include a gyratory primary crusher and a cone secondary crusher capable of handling the entire 7 million tons per year of ore. The gyratory crusher will be located adjacent to the pit with an overland conveyer to transport the primary-crushed ore to a coarse-ore stockpile. The primary-crushed ores will be claimed from the coarse-ore stockpile and secondary crushed prior to placement on the heap-leach pad. The ore from the Eder pits will be primary-crushed at a portable crushing facility temporarily located at the mouth of the Eder South pit and either conveyed or trucked and dumped on the leach pad.

Dewatering of the pits may be required throughout the life of the mining operation. The ground water that exists in the pit areas tends to be fault-and fracture-controlled. Dewatering wells and mine pit sumps will both be used to control ground water in the pits. The heap-leach facilities were designed based on an annual production of 7 million tons per year of ore with a total reserve of 100 million tons and an ore density of 110 pounds per cubic foot.

The leach facilities include two valley-leach pads with internal PLS ponds, a raffinate pond location adjacent to the SX/EW plant, and the associate diversion channels. The main heap-leach pad will be constructed in two stages (Stages 1 and 2) and the north heap-leach pad will be constructed in Stage 3. Stage 1 will have adequate storage capacity for the first 2 years of operation and Stage 2 will require completion of construction of the main pad. Stage 3 construction of the north pad will start anytime after Stage 2 and may begin as late as year 9 of operations.

Areas within the pads that do not typically impound process fluids will have a liner system consisting of 12 inches of prepared subgrade overlain by a 60-mil high-density polyethylene (HDPE) liner. In areas where process fluids will be impounded, the liner system will consist of 12 inches of prepared subgrade overlain by a leachate collection and recovery system (LCRS) consisting of 12 inches of -1/2 inch crushed drain gravel sandwiched between 60 mil HDPE primary and secondary liners.

In areas of heavy traffic and/or where the heap is higher than 350 feet, a 12-inch protective layer consisting of mill tailing will be placed on the 60-mil HDPE primary liner. An 8-ounce (oz) non-woven geotextile will be placed on top of the protective layer to act as a fines barrier.

A spine drain system consisting of central spine and finger drains will be placed under the HDPE liner system to lower the phreatic surface of the local alluvial groundwater for both the main and north heap leach pads. The central spine and finger drains will consist of an open french drain system augmenting the existing gravels and alluvium in the main drainage of the pads. The in situ alluvial drain gravel will be left in place as much as possible. The central spine drain will be augmented with an 8-inch diameter perforated corrugated polyethylene tube (CPT) and the finger drains with a 4-inch diameter perforated CPT. Each drain will be encased in geotextile to prevent migration of fines into the drain and the in situ drain gravel replaced around the drain pipe may be screened, if necessary, to remove excess fines. Flow carried by the underdrain system will be transmitted under the leach pad (PLS) embankments via a concrete-encased outlet pipe to the underdrain collection pond.

The central spine drain for both pads will be located in the topographic low of Powers Gulch and the main drainage of the north pad. The central spine drain will extend along the entire length of the drainage within the basin of each pad. The finger drains will augment the central spine drain and will be located in side depressions which currently convey runoff into the main drainage of each pad.

The inlet control structure, located on the south side of the main heap leach pad, will be constructed with a cutoff trench founded in competent bedrock. This structure will minimize seepage of alluvial flows found in Powers Gulch, upstream of the main heap leach pad, thus preventing upstream alluvial flow from entering the spine drain system. In the unlikely event seepage is emitted from the inlet control structure or head of the diversion channel, the central spine drain will collect and transmit the flow to the underdrain collection pond for collection and monitoring. The central spine drain for the north pad extends to the head of its main drainage and no alluvial flow will be conveyed through the central spine drain from outside of the pad.

A 60-mil HDPE lined underdrain collection pond will be constructed downstream of the terminal embankments for the north and main pad facilities. These ponds will allow collection and monitoring of flow from the central spine and finger drains. In the event flow is transmitted to the underdrain collection ponds, the water will be pumped back to the heap leach pad for containment. As a protective measure, limestone will be placed on the downstream face of the main and north PLS embankment random fill zones, along the downstream face of the embankment foundation excavations, and at the spillway outlet of the underdrain collection ponds.

The solution collection system within the pad will consist of crushed ore, 6-inch or 2-inch minus material, with an internal drainage pipe network which will be placed directly over the protective layer/geotextile and the primary liner. The overliner material will be placed to enhance drainage immediately above the liner system. Solutions collected from the heap leach pad will be transmitted to the PLS ponds in the existing main drainages located in the center of the pads. All solution will flow by gravity directly to reclaim sumps (perforated HDPE pipe) located in reclaim structures immediately upstream of the main and north pad embankments. Process solutions from the PLS ponds will be pumped to the plant for copper extraction or will be recycled to the raffinate pond and back to the pad for pregnant solution building.

The PLS ponds are located at the lower end of the leach pads immediately upstream of the terminal embankments. The main pad embankment is sited in Powers Gulch drainage and the north embankment is sited within the north pad main drainage, which eventually meets with the Powers Gulch drainage downstream of the main embankment. Both ponds have been designed to optimize available space and to allow gravity solution flow from the leach pad to the pond. The PLS ponds will handle the required operational volumes, determined from the water balance, and the 100-yr/24-hr precipitation event with a 6-hour draindown. Both ponds will be double-lined, however, the double liner will only be deployed to an elevation equal to the average of 30 maximum operational volumes of the pond.

The embankments are designed as zoned earthfill/rockfill structures. Each embankment has a minimum crest width of 20 feet and upstream and downstream slopes of 2.5H:1V. The main PLS embankment has a maximum elevation of 3,824 feet, a maximum height of 103 feet and may impound up to 124.4 million gallons of process solutions and stormwater, excluding freeboard (3 feet). The north PLS embankment has a maximum elevation of 3,859 feet and a maximum height of 98 feet. Excluding freeboard, the north PLS embankment can impound up to 32.5 million gallons of process solutions and stormwater.

The raffinate pond is located south of and below the plant site and above the heap leach pad. It will be a double-lined pond with and LCRS. An embankment has been sited in the bottom of one of the tributary drainages of Powers Gulch adjacent to the proposed plant site. Excluding freeboard, the pond will be able to contain 2.5 million gallons of process solutions. The embankment is a zoned rockfill/earthfill embankment with crest elevation of 3,897 feet, maximum height of 37 feet, a maximum crest width of 20 feet, an upstream slope of 2.5H:1V, and a downstream slope of 2H:1V.

The plant PLS/SX pond is also south and downgradient of the plant site and upgradient of the heap-leach pad and will act as a surge pond for plant feed. It will store approximately one million gallons of process solutions, excluding freeboard. The plant PLS/SX pond is located in the bottom of the tributary drainage which houses the raffinate pond. It is situated upstream of the raffinate pond which adds a level of solution control redundance to the overall design by providing potential downstream surge in the event of failure in the raffinate pond and ultimately in the pad. In the unlikely event of failure of the plant PLS/SX pond embankment, solutions would be routed to the raffinate pond and to the main pad PLS pond. The plant PLS/SX pond embankment is a zone earthfill/rockfill structure, with a crest elevation of 3,918 feet, maximum embankment height of 33 feet, a crest width of 40 feet, and upstream and downstream slopes of 2.5H:1V.

All embankments for all ponds have a synthetically-lined face followed by a 12-foot clay/silt seal zone which is keyed into the bedrock in the embankment foundation. The chimney drains for the main and north PLS pond embankments will consist of a 2-foot-wide layer consisting of pit-run gravels. Also, 8-oz. non-woven geotextile will be placed on the upstream and downstream sides of this zone to prevent piping. The chimney drain for the raffinate and plant PLS/SX pond will consist of 4-inch-diameter perforated CPT spaced on 30-foot centers wrapped in geotextile. To prevent piping at the raffinate and plant PLS/SX pond embankment, a layer of geotextile will be placed between random fill and seal zone materials. All embankments will have a random fill zone consisting of mine waste or rockfill obtained from borrow excavations.

As described above, all ponds have been designed as double-lined facilities with an LCRS. The LCRS in each pond terminates in a collection trench located along the toe of the respective embankments. This collection trench meets with an LCRS sump (10-inch-diameter solid HDPE pipe) which will act as an annulus for submersible pump insertion should the need arise. Both the raffinate and plant PLS/SX ponds are double-lined throughout.

The double-liner system for the main and north PLS ponds consists of a 60 mil HDPE secondary liner overlain by 12 inches of -1/2 inch drain gravel and a 60 mil HDPE primary liner. The liner system described will be placed on 12 inches of prepared subgrade. The double-liner system for the raffinate and plant PLS/SX ponds consists of a 40 mil HDPE secondary liner overlain by a geonet and a 60 mil HDPE primary liner. This liner system will also be placed on 12 inches of prepared subgrade.

Process solution contained within the main PLS pond will be delivered to four 48-inch-diameter HDPE sumps (one of which will act as a dedicated backup). The north PLS pond will have the process solutions delivered to two 48-inch-diameter HDPE sumps (one of which will as a dedicated backup). The sumps are located within reclaim structures located slightly upstream of the PLS embankments. The reclaim structures will consist of highly permeable crushed ore with minimal fines (less than 5 percent passing the No. 200 sieve). A siltation trap has been included at the base of each sump. Each sump will be equipped with a submersible pump which has a design capacity of 3,300 gpm for the main PLS pond and a 1,100 gpm capacity for the north PLS pond. The maximum design flow for the main pond is 9,000 gpm, and 1,650 gpm for the north pond. The solution will be pumped to the plant PLS/SX pond for processing back to the pad, depending upon pregnant solution building requirements.

The solution recovery system for the raffinate and plant PLS/SX ponds consists of five horizontal centripetal pumps sited downstream of the raffinate embankment. Each pump will be capable of pumping 3,300 gpm. Both ponds will have two pumps in operation at all times. The additional pump will provide standby pump capacity in the event of mechanical failure. Solutions from the raffinate ponds will be applied to the heap and plant PLS solutions will be pumped back to the SX/EW plant for processing.

Runoff from undisturbed areas upgradient of the leach pad and process ponds will be diverted around the heap-leach facility. Diversion channels will be built during initial construction of the leach pad and ponds. All diversion channels within the heap-leach facility are designed to pass the runoff from the 100-yr/24-hr storm event. The main diversion consists of a channel and an inlet control structure. As designed, flows will be routed through the inlet control structure and directed to the main channel which carries diverted flows for a distance of approximately 6,700 feet, along the west side of Powers Gulch adjacent to the heap-leach pad, and discharges this flow to the existing drainage downstream of the facility. The channel has been designed as a trapezoidal-shaped, shotcrete/bedrock-lined structure. In conjunction with the inlet control structure, the channel has the capacity to safely pass the 100-yr/24-hr storm event runoff, and the low flow channel may pass up to 56 cfs.

All ore mined from the Carlota/Cactus pit will be processed through the primary crusher site, the secondary crusher site and eventually transferred to the heap. Ore on the pad will be leached by raffinate pumped from the raffinate pond. The resulting PLS will be collected and processed through the SX/EW plant for copper cathode production (See DEIS for more specifics on ore processing). The mine facilities and warehouse area will be located on a leveled pad 750 ft by 350 ft, directly north of the Carlota/Cactus pit and to the west of the primary crushing facility. The building will be a pre-engineered steel structure and will accommodate the mine equipment warehouse, additional process plant warehouse space, mine operation and engineering offices, field storage and distribution, and equipment ready line. The overall process area which includes the SX/EW plant, raffinate pond, and buffer areas will cover 29 acres. The administration building will be located east of the Carlota/Cactus pit and adjacent to the main access road to the project site. Privately-owned employee vehicles will not be allowed beyond the employee parking lot and employees will be picked up at the administration building area in company vans or buses and transported to their work areas in the mine or process areas. Information regarding additional facilities necessary for the project including sanitary and solid waste disposal facilities can be found in the DEIS.

The sediment and stormwater control plan will meet Federal and State requirements for the protection of water quality. The waste rock dumps will be constructed so that rainwater will temporarily contained on the top surface and not allowed to discharge until it meets state and federal discharge criteria. Various ditches and berms will direct rainwater falling on the sides of the sides of the waste dumps to control structures such as sediment ponds or silt fences and not allow discharge until it meets state and federal discharge criteria. Specific diversion designs will be reviewed and approved by the Forest Service for these configurations during project permitting and construction.

To minimize the potential for increased sediment yield that may be attributed to areas of disturbance, all or a combination of the following basic erosion and sediment control best management practices (BMP's) will be used. In addition to recontouring and revegetation, these measures include (1) sloping mine access and haul roads into the hillside to prevent erosion of the fill embankment and to promote deposition of road sediments within the roadway grader ditches; (2) installing sediment barriers to intercept and retain sediment immediately downslope from the disturbance site (typical examples include barriers of brush, straw bales, and silt fences); (3) constructing temporary diversion dikes that can divert surface runoff away from the unprotected slopes of disturbed areas; (4) designing and constructing perimeter berms at the top of the rock dumps to maintain a limited ponding capacity at those locations; and (5) installing temporary sediment traps or basins that can be sized to accommodate sediment discharge from one or more subbasins. Mine facility areas will be graded to minimize erosion and limit surface runoff. These areas will be maintained on an as-needed basis to provide continued effective drainage control. On primary roads, a series of ditches and culverts will be established to collect and convey surface runoff.

The mine will require approximately 750 gallons per minute (gpm) of water during its operation (1,210 acre-feet per year) with a peak demand of 1,200 gpm during dry months. The water will be obtained from three sources; pit dewatering, well field and low-quality water from the Pinal Creek Remediation Group. The pit dewatering will initially produce little water but as the pit deepens, an estimated 200 gpm may be produced. The water will be obtained from sump pumps and/or wells adjacent to the Carlota/Cactus pit. The well field is located about 1-2 miles north of the mine along the lower portion of Haunted Canyon and along Pinto Creek. It is about 8 acres in size and consists of 3 to 5 production wells, pipelines, pump station, powerline and access road. Currently, 3 exploration wells have been drilled to a depth of about 1,000 feet and field tests indicated pumping rates of 75-600 gpm per well were achievable. Pump tests also indicated a potential interconnection between surface water and the wells. Completion of the well field will be conducted in a manner which minimizes potential impacts to surface flow. To satisfy make-up water needs with the least impact on clean water in the watershed, Carlota is entering into an agreement with the Pinal Creek Remediation Group to acquire up to 1,000 gpm of low-quality water from the Cottonwood Pond at BHP-Magma's Pinto Valley Mine. This water is pumped from Pinal Creek under a State-approved plan to remediate historic contamination of groundwater by mining in the Glove-Miami area. A pipeline will be constructed from the pond, around the Cottonwood Tailings Dump at the Pinto Valley Mine and the Carlota/Cactus Pit to the raffinate pond at the Carlota Mine. This water will be used based on need and availability.

In addition to the water wells, monitor wells will be constructed as required in the Groundwater and Surface Water Monitoring Plan of the DEIS for the project. These wells will be used to monitor water quality under State permits and to determine impacts from pit dewatering and well field pumping on ground and alluvial water level elevations and to provide data for monitoring potential impacts to surface water.

Ground water will be pumped from the wells into a header or collection pipe that conveys the water to a holding tank near the confluence of Pinto Creek and Haunted Canyon. A booster pump located near the holding tank will pump water uphill to the SX/EW plant (a total elevation difference of approximately 700 feet). The header piping will be approximately 0.6 mile long while the main water supply pipeline from the booster pump to the SX/EW plant will cover a straight-line distance of approximately 1.3 miles. Because of the elevation difference and intervening terrain, the main water line will follow a longer circuitous path. The pipeline corridor will cross Haunted Canyon in the vicinity of the southernmost water well and proceed to the south, up a small drainage that starts at the junction of Pinto Creek and Haunted Canyon. The head of this small drainage is directly adjacent to the northwest boundary of the Main rock dump. The pipeline will proceed to the SX/EW plant area, through the Main rock dump area (either buried under one of the upper lifts or routed along one of the benches and along the ridge that divides Pinto Creek from Powers Gulch). A 320,000-gallon water storage tank will be located on a ridge northwest of the Main mine rock disposal area, and will store adequate water for normal operations and reserve water in case of fire. For further information on access roads and placement see DEIS. In addition, a power line will be installed that will result in the disturbance of 6 acres (See DEIS for specifics).

During the operational life of the mine, Carlota will need current, a NPDES Stormwater Pollution Prevention Plan (SWPPP) as required by the Clean Water Act and an Aquifer Protection Permit (APP) approved by the Arizona Department of Environmental Quality. The SWPPP will require Best Management Practices to minimize soil erosion using measures such as rock check dams, straw bales and siltation fences. At closure, sediment ponds will be replaced with appropriate non-water retaining controls. The APP will require Best Available Demonstrated Control Technology to prevent contamination of subsurface aquifers and will require a final Closure Plan for the operation. The Forest Service will incorporate a Reclamation and Closure Plan (RCP) as part of the final approved Plan of Operations. The RCP requires that salvageable soil will be removed from areas to be developed. Salvage will be from slopes up to 40% with consideration of equipment safety. The salvaged soil will be stored in stockpiles located out of the way of future disturbance, stabilized, and seeded to protect is from wind and water erosion and to retain soil microbes. The RCP will be reviewed and updated annually. During the life of the mine, areas where operations have been completed will be reclaimed. Revegetation will be with native plant species as long as success criteria can be met. A reclamation bond will be posted by Carlota Copper Company as required by Forest Service regulations and the State will require financial assurances as part of their APP permit. The closure and reclamation costs for which financial guarantees are required are estimated to be in excess of $10,000,000.

As part of the proposed action, a "Biological Mitigation Plan for the Carlota Copper Project on the Tonto National Forest" is included within the project description. This plan describes various actions to avoid, minimize, and/or mitigate project related impacts to the environment, and are required aspects of the implementation of the proposed project. This plan identifies specific mitigation actions which include establishing baseline data points and subsequent monitoring requirements, and criteria for determining effects of project impacts and/or the effectiveness of the mitigation actions. The mitigation plan provides a detailed account of these actions. An additional document, "Wetlands and Waters of the U.S. Compensatory Mitigation Plan for the Carlota Copper Project" will detail, when available, the monitoring/mitigation requirements under the Clean Water Act, section 404.

Following is a brief summary of the primary components of the mitigation plan, with emphasis on Arizona hedgehog cactus.

Biological Mitigation Plan for the Carlota Copper Project on the Tonto National Forest

1) Measures for Other Resources which Affect Biota

Use of BADCT for leach pad design.
Development and implementation of a SCHMMP.
Measures to mitigate air quality impacts.
Measures to mitigate water resources impacts.

2) Measures for Arizona Hedgehog Cactus

Monitor for adverse sulfuric acid effects.

Identify and monitor cacti susceptible to sulfuric acid emissions from either the heap leach pad or the SX/EW plant facilities.

Observational and photo data will be collected for the 33 cacti potentially subjected to the greatest sulfuric acid mist concentrations. Data will be recorded for these cacti and a control group which will document chronic evidence of necrotic tissue, pitting, burning, or discoloration due to effects of sulfuric acid deposition. This monitoring will occur year 0 through year 5. Monitoring will end year 6 if no effects have been observed.

Erect and monitor disturbance area markers.

The perimeter of the clearing limits in Arizona hedgehog cactus occupied habitat must be marked and occasionally inspected during operations to ensure that the integrity of a protected area (buffer) is maintained.

Prior to ground disturbing activities, supervisory and construction personnel will be instructed as to the intent and importance of these markers and that any activity beyond their limits is prohibited.

Periodically inspect Arizona hedgehog cactus proximal to disturbances.

A group of at least 151 cacti have been identified within 200 feet of the proposed Eder pits, Powers Gulch diversion, or within 100 feet of proposed roads. These cacti must be periodically monitored to determine if additional losses occur as a result of indirect impacts.

Each plant will be inspected once each year only for those years in which blasting has occurred within 200 feet of the specimens.

Arizona hedgehog cactus test plots.

Where avoidance of specimens is not possible, Arizona hedgehog cactus will be removed and transplanted to test plots designed to determine the optimum reestablishment habitat for the taxon. Monitoring should occur during the test plot phase and surviving plants and their progeny would be used to repopulate previously occupied habitat, post-mining. Any surplus plants recovered from the proposed disturbance area which are deemed unnecessary for reclamation testing will be provided to researchers or botanical gardens approved by the U.S. Fish and Wildlife Service.

Develop conservation plan.

Assist the Tonto National Forest in the development of a Conservation Plan for the Arizona hedgehog cactus which leads to the identification of verified "safe areas" where the taxon can be protected until it is determined that such protection is no longer necessary.

Redesign facilities to avoid Arizona hedgehog cactus.

Prior to construction, those facilities other than pits, will be reviewed and redesigned to the extent possible, to minimize losses of Arizona hedgehog cactus plants.

Develop and initiate a plan for an Arizona hedgehog cactus "Conservation Area."

Develop and initiate a plan designed to identify a loci of sufficient size of Arizona hedgehog cactus occupied habitat which can then be subjected to mineral withdrawal actions for the protection from future mining impacts. This activity would be considered compensation for the area of occupied habitat and lost individuals as a result of Carlota's proposed mining operations.

Carlota has made a commitment by letter (signed by Robert C. Walish, March 12, 1996) to hold a group of eleven mining claims, totalling 186 acres with approximately 700 Arizona hedgehog cacti, on the fringe of the Carlota project area adjacent to the proposed "Five-point Mountain Safe Area" until they can be withdrawn from mineral entry by the Federal government. At that time Carlota will relinquish interest in these claims.

Acquire grazing permit - Bellevue Allotment.

Acquire one grazing permit for lands within occupied Arizona hedgehog cactus habitat and initiate "non-use" of the permit to reduce a documented threat to the species over a portion of its range. At the conclusion of mining, the disposition of the permit would be dependant upon Forest Service allotment management plans. This action would also include identification, and initiation of non-use, of the Powers Gulch Pasture.

3) Measures for Riparian Areas

Arnett Creek/Picketpost Mountain Analysis Area fencing.
Retirement of Powers Gulch Pasture - Bellevue Allotment.
Acquire grazing permit - Bellevue Allotment.
Monitor and maintain natural riparian conditions in Haunted Canyon.

4) Measures for Upland Habitats

Revegetation of 938 acres of upland disturbance.
Maintain six existing wildlife watering sources in the Brushiest Allotment.
Identification and preservation of alternate bat roosts.
Arnett Creek/Picketpost Mountain Analysis Area fencing.
Retirement of Powers Gulch Pasture - Bellevue Allotment.
Acquire grazing permit - Bellevue Allotment.
Road closure.

5) Measures for Aquatic Habitats

Arnett Creek/Picketpost Mountain Analysis Area fencing.
Retirement of Powers Gulch Pasture - Bellevue Allotment.
Acquire grazing permit - Bellevue Allotment.
Avoid adverse sedimentation.
Monitor aquatic habitat in Pinto Creek and Haunted Canyon.

STATUS OF THE SPECIES

LESSER LONG-NOSED BAT

The lesser long-nosed bat (bat) was listed (originally, as Sanborn's long-nosed bat) as endangered on September 30, 1988 (53 FR 38456). No critical habitat has been designated for this species. The lesser long-nosed bat is a small leaf-nosed bat. It has a long muzzle and a long tongue. These features are adaptations to collect nectar from the flowers of columnar cactus, such as the saguaro and organ pipe, and from paniculate agaves (Hoffmeister, 1986). This migratory species is found throughout its historic range from southern Arizona, through western Mexico, and south to El Salvador. It occurs in southern Arizona from the Picacho Mountains southwest to the Agua Dulce Mountains and southeast to the Chiricahua Mountains and south to Mexico. Arizona roosts are occupied from late April to September (Cockrum and Petryszyn, 1991). Adult females, most of which are pregnant, and their recent young are the first to arrive, and they form maternity colonies at lower elevations near concentrations of flowering columnar cacti. After the young are weaned, these colonies disband in July and August; some females and young move to higher elevations, primarily in the southeastern parts of Arizona near concentrations of blooming paniculate agaves. Adult males are known mostly from the Chiricahua Mountains but also occur with adult females and young of the year at maternity sites (Fleming, 1994).

ARIZONA HEDGEHOG CACTUS

The Arizona hedgehog cactus (*Echinocereus triglochidiatus* var. *arizonicus* Rose ex Orcutt) was listed as an endangered species on November 26, 1979 (44 FR 61556). No critical habitat has been designated for this cactus. At the time of the listing, Arizona hedgehog cactus was only known from the general vicinity of the type locality, a limited area along the Gila/Pinal county boundary in central Arizona, roughly between the towns of Miami and Superior. Recent surveys and other studies have added information to further define the range of the species to include the Pinal, Dripping Springs, Superstition, and Mescal mountains. Within this distribution, Cedar Creek Associates (*in* Tonto National Forest, 1996), using all available distribution and ecological data, has estimated that Arizona hedgehog cactus occupies approximately 18,900 acres (30 square miles) of habitat. Cacti displaying similar morphological characters as Arizona hedgehog cactus have been reported from east-central and south-central Arizona. Work by Bellsey et al. (1995) determined that the plants from south-central Arizona are not related to *E. triglochidiatus* var. *arizonicus* from the type locality. The taxonomic determination for the east-central Arizona specimens is currently uncertain, but until such time that the taxonomy is resolved, or these plants can be morphologically distinguished from Arizona hedgehog cactus, they will be considered as the listed entity pursuant to requirements of the ESA. However, the species status and environmental baseline included within this opinion only considers *E. triglochidiatus* var. *arizonicus* as known from the general vicinity of the type locality.

Arizona hedgehog cactus is a robust, succulent perennial, with dark green cylindroid stems that occur singly, or most often, in clusters of a few to approximately ten stems (Benson, 1982).

Occasionally, a plant may have over 100 stems (Tonto National Forest, 1996). Stems arise from the base of the plant and are large, typically 9 to 16 inches high and 3 to 4 inches in diameter. Specimens as large as approximately 24 inches in height have been recorded (Tonto National Forest, 1996). Each stem has strong, tuberculate ribbing. The number of ribs per stem has been given as approximately ten (Benson, 1982; Earle, 1980). However, the most common number of ribs in the vicinity of the type locality is nine, followed by eight and then ten ribs (Tonto National Forest, 1996). There are 1 to 3 gray or pinkish central spines with the largest one deflexed. The 5 to 11 radial spines are short, slightly curved, and robust. However, there is considerable variability in spine characteristics. Flowers erupt along sides of the stem and are a brilliant scarlet to deep red color. The flower is broad, about 2 inches in diameter (Arizona Game and Fish Department, 1994).

Arizona hedgehog cactus habitat consists of exposed bedrock or boulders within Interior Chaparral, Madrean Evergreen Woodland, and Desert Grassland plant communities in an elevation range of approximately 3,400 to 5,300 ft. This habitat is characterized by rugged, steep-walled canyons, and boulder pile ridges and slopes. Typically, the cactus is scattered on open, rocky exposures, rooting in shallow soils and narrow crevices among the boulders (Phillips *et al.*, 1979; USDOI, 1979; USFWS, 1985). Arizona hedgehog cactus may be found beneath the understory of shrubs, but moderate to high shrub densities and associated deeper soils tend to preclude the cactus (Tonto National Forest, 1996). Substrates on which Arizona hedgehog cactus are normally found include Orthoclase-rich granite of late Cretacaceous age, primarily Schultze Granite. Also found in mid-Tertiary age Dacite, and to a lesser extent in Pinal Schist (AGFD, 1994; Tonto National Forest, 1996).

Arizona hedgehog cactus begins to produce flower buds in early April with anthesis (flowering) from late April to mid-May. Weather conditions can hasten, prolong, or delay flowering by several weeks (AGFD, 1994). The pollination ecology of the species is largely unknown, but it is an obligate outcrosser. Likely pollinators include insects, primarily bees, and perhaps hummingbirds (Ferguson, 1989). Fruits are present from May through June. Approximately 100 small seeds are produced per fruit with several fruits often occurring per plant. The amount of variation in annual seed production, and seed viability and longevity are unknown (Phillips, 1985). Seed dispersal is expected to be by birds and mammals (Tonto National Forest, 1996). Germination can occur in mid-summer. The seeds do not appear to require after-ripening or have other special germination requirements in addition to protection from extended direct sunlight and extreme temperatures [above 43^{0}C (110^{0}F)] (Phillips, 1985). Natural insect predators include borers and leaf-foot bugs (Coreidae) which attack the stems. Also, rodents may gnaw on stems and eat the fruits (which may contribute to dispersal). Root rot may also be an important cause of mortality (Crosswhite, 1976; Phillips *et al.*, 1979).

Threats to the Arizona hedgehog cactus include habitat destruction by mining, mineral exploration, road construction, power-line construction and utility corridors, off-road vehicle use and other recreational activities, rangeland improvements including water developments, trampling by livestock, and illegal collecting. Additional potential threats to the cactus include wildfire, herbicide and pesticide application, and insect predation (USDOI, 1979; USFWS, 1985; AGFD, 1994).

The taxonomic status of Arizona hedgehog cactus is currently under debate. Different investigators have assigned the entity from the type locality (vicinity of Globe, Arizona) to different species of cacti and at different taxonomic levels (species or variety). The specimens from east-central Arizona which have recently and tentatively been assigned to *E. triglochidiatus* var. *arizonicus* adds another challenge to the taxonomic situation. Those who have contributed to these investigations include: D. Ferguson (1989); S. Mills (SWCA, Inc., Tucson, AZ); D. Mount (University of Arizona, Tucson, AZ); B. Parfitt (Missouri Botanical Garden, St. Louis, MO); Parfitt and Christy (1991); D. Pinkava (Arizona State University, Tempe, AZ); F. Reichenbacher (Southwestern Field Biologists, Tucson, AZ); S. Viert (Cedar Creek Associate, Fort Collins, CO) and A. Zimmerman. However, until there is a general consensus within the scientific community with published literature, the Service continues to consider Arizona hedgehog cactus as a valid and unique variety of plant that merits endangered species designation and full protection of the Act.

ENVIRONMENTAL BASELINE

LESSER LONG-NOSED BAT

Loss of roost and foraging habitat, as well as direct taking of individual bats during animal control programs, particularly in Mexico, have contributed to the current status of the species. Suitable day roosts and suitable concentrations of food plants, are the two resources that are critical for the lesser long-nosed bat (Fleming, 1994). As indicated above, the lesser long-nosed bat consumes nectar and pollen of paniculate *Agave* flowers and the nectar, pollen, and fruit produced by a variety of columnar cacti. Caves and mines are used as day roosts. The factors that make roost sites usable have not yet been identified; narrow or specialized requirements may not be necessary for day roosts. Whatever the factors are that determine selection of roost locations, the species appears to be sensitive to human disturbance. Instances are known where a single brief visit is sufficient to cause a high proportion of lesser long-nosed bats to temporarily abandon their day roost and move to another. Perhaps most disturbed bats return to their preferred roost in a few days. However, the sensitivity suggests that the presence of alternate roost sites may be critical when human disturbance occurs. Interspecific interactions with other bat species may also influence lesser long-nosed bat roost requirements.

Known major roost sites include 16 large roosts in Arizona and Mexico (Fleming, 1994). According to surveys conducted in 1992 and 1993, the number of bats estimated to occupy these sites was greater than 200,000. Twelve major maternity roost sites are known for Arizona and Mexico. According to the same surveys, the maternity roosts are occupied by over 150,000 lesser long-nosed bats. The numbers above indicate that although there may be relatively large numbers of these bats known to exist, the relative number of known large roosts is small. Disturbance of these roosts and the food plants associated with them could lead to the loss of the roosts. The limited numbers of maternity roosts may be the critical factor in the survival of this species.

ARIZONA HEDGEHOG CACTUS

The Tonto National Forest, Globe Ranger District, manages approximately 90 percent of the known occupied habitat of Arizona hedgehog cactus. This cactus also occurs on Arizona State Land Department trust lands, Bureau of Land Management administered lands, and private lands. A substantial population of Arizona hedgehog cactus is found within the Superstition Mountain Wilderness Area (Tonto National Forest, 1996). Direct access to a large portion of the cactus' range is very limited due to the rugged topography and remote nature of these habitats. Cedar Creek Associates (1994; and *in* Tonto National Forest, 1996) has estimated that there are over 250,000 individual Arizona hedgehog cactus plants. This estimate is considered to be conservative because it does not include up to several thousand plants occurring in satellite populations disjunct from the main distribution of the species and actual sample counts tend to under-count smaller plants.

Arizona hedgehog cactus has horticultural value and is commercially available from cactus and succulent dealers. Illegal collection of Arizona hedgehog cactus plants has been identified as a primary threat to the species (USDOI, 1979). Removal of plants may occur for landscaping or for suspected hallucinogenic purposes. The extent of possible collection pressures remains uncertain. Comparisons of isolated and roadside populations suggest there may be diminished population levels at easily accessible sites. Those plants most susceptible to collection would be those that could be easily dislodged from the soil rather than those growing within the rock matrix. However, as part of the intensive surveys conducted within the project area by Cedar Creek Associates (1994; and *in* Tonto National Forest, 1996), including portions of the Highway U.S. 60 corridor, reduced densities along the highway were not discernable when compared with plant densities from more remote locations. Seed collection is also a potential threat. Any effect collecting of plants and seeds may have on the long-term reproduction and survival of Arizona hedgehog cactus is not known (USFWS, 1985). However, any effects would be expected to be site-specific. If there is a major change in the market demands for Arizona hedgehog cactus, either for landscaping or hallucinogenic purposes, it could result in substantive impacts to the cacti.

Construction of Highway U.S. 60 and its later realignment destroyed Arizona hedgehog cactus and its habitat. Cedar Creek Associates (1994) estimated that 2,348 cacti were lost from approximately 67 acres of presumed occupied habitat, and an additional 85 acres of presumed unoccupied but potential habitat was eliminated by highway construction. These estimates were based on habitat characteristics, including vegetation type, topography, and parent geologic material of adjacent sites and the recorded densities if Arizona hedgehog cactus in similar habitats. The construction of powerlines parallel to the highway and the Silver King substation for the Salt River Project resulted in the loss of an additional 18 acres of occupied habitat. (Cedar Creek Associates, 1994). Six plants were removed and transplanted by Boyce Thompson Arboretum in 1978 to permit construction of the Silver King substation (Phillips *et al.*, 1979).

Livestock grazing may lead to impacts to Arizona hedgehog cactus due to direct trampling of plants and/or through habitat degradation. Physical damage to cacti by livestock has been documented (Tonto National Forest, 1996). However, Cedar Creek Associates (1994) notes that plants damaged by livestock are observed primarily in those areas most accessible to livestock, and, in active pastures, occur at a rate of approximately one out of every 400 to 500 plants observed. Habitat degradation due to livestock grazing which resulted in impacts to Arizona hedgehog cactus have not been documented. Damage and direct herbivory by javelina appears to be frequent and widespread (Tonto National Forest, 1996).

The greatest threat to Arizona hedgehog cactus are mining and related activities (USDOI, 1979). Within the Globe-Miami-Superior area, major mining operations in or adjacent to Arizona hedgehog cactus habitat are currently being conducted by Magma, Cyprus, and Carlota Copper. Other smaller mines and mining claims occur within and at the periphery of the range of the cactus. Although the surface geology of the habitat is not well mineralized, potential subsurface mineral deposits may warrant test drilling. In certain locations within occupied habitat, mining claims have been filed. Roads to provide exploration access and exploratory drilling for underlying deposits are a threat to the species even though these roads often detour around the prime Arizona hedgehog cactus habitat of rocky outcrops. The amount of potential disturbance from mining is dependent on whether a mine is open pit or shaft, and how much surface area (of occupied or potential habitat) will eventually be covered by tailings (USFWS, 1985). Cedar Creek Associates (1994) estimated that the Magma and Cyprus operations eliminated approximately 2,195 acres of potential habitat. There is no evidence, based on post-project surveys, that either plants or occupied habitat was directly lost to either of these mining operations.

Effects of the Action

LESSER LONG-NOSED BAT

The project area is just east of what is considered to be the known range of the lesser long-nosed bat. However, the Forest Service has recognized that the range delineation is based on roost records and that roosts of lesser long-nosed bats are difficult to find, that lesser long-nosed bats can travel up to 30 miles from their day roost while foraging, that the project area contains potential foraging habitat of the bat, and that the project area may occur within the foraging range of the bat (Cedar Creek Associates, 1994). The closest record of lesser long-nosed bats is from Picacho Peak, which is approximately 50 miles from the project site.

Surveys for lesser long-nosed bats and evaluations of their habitat were conducted in the project area in April and July of 1992, and in May-June and July of 1993. Abandoned mine adits in the project area were considered potential roost sites, but no individuals of this species or their sign were discovered. Mist-netting at surface water and riparian corridors within the project area was conducted, although the focus of this effort was on surveying for other bat species. This effort also did not reveal the presence of lesser long-nosed bats in the project area.

Vegetation in the vicinity of the project area includes a small pocket of saguaros near the project area that was deemed insufficient to solely support lesser long-nosed bat foraging. The golden-flowered agave (*Agave chrysantha*) is present in the project area to the extent that they could be used by foraging lesser long-nosed bats. Five "habitats" were defined for the project area. Agaves on three (interior chaparral, juniper grassland, and riparian) of those were rare or nonexistent. Density of agaves on the other two (rubbleland chaparral and dry-slope desert brush) were determined. Densities in rubbleland chaparral ranged from 0 to 2.6 agaves (mean = 0.6) with flower stalks and 3.2 to 16.0 agaves (mean = 7.6) without flower stalks per acre. Densities in dry-slope desert brush ranged from 0.4 to 1.8 agaves (mean = 1.1) with flower stalks and 11.5 to 28.9 agaves (mean = 20.2) without flower stalks per acre. The Forest Service concluded that the golden-flowered agave is present in sufficient densities in these two habitat types within the project area to provide summer foraging habitat for the lesser long-nosed bat.

No disturbance of the rubbleland chaparral will occur. Development of the proposed project would result in loss of 353 acres of dry-slope desert brush which would be a 40 percent loss of such habitat within the project area. The Forest Service concluded this loss could result in a minor reduction in potential summer foraging habitat for lesser long-nosed bats in the region of the Pinal Mountains.

The lesser long-nosed bat could be affected by the loss of potential foraging habitat. Noise and vibration from construction and operation could also be impacts if there are unknown roosts nearby. The heap leach pads and the acid solution ponds may affect lesser long-nosed bats. The odor (fumes) may alter the bats' normal behavior and perhaps even interfere with their detection of food plants.

ARIZONA HEDGEHOG CACTUS

The Carlota Copper project primarily impacts Arizona hedgehog cactus along the periphery of the cactus' distribution. However, implementation of the proposed action will result in various direct, indirect, temporary, and permanent effects to the species.

Excavation of the Eider pits, associated access roads, and Powers Gulch leach pad and diversion outfall structure will eliminate an estimated 217 cacti and 23.94 acres of occupied habitat. Also, approximately 238 acres of currently unoccupied habitat will be lost (Cedar Creek Associates, 1994). An additional 149 cacti are within 200 feet of proposed pits, within 100 feet of proposed roads, or are immediately adjacent to the Powers Gulch diversion. These 149 cacti do not currently overlap planned disturbances, but are situated close enough to mine-related facilities that actual construction or future modifications of operations may cause additional losses from among these 149 specimens (Cedar Creek Associates, 1994). Other mine related actions which may affect Arizona hedgehog cactus include potential breach of the large leach pad retention facilities which would result in the loss of "a few" cacti occurring downgradient of the leach pad. Up to 33 cacti are potentially exposed to concentrated sulfuric acid mist plumes due to their proximity to the tankhouse vents. The closest cacti to the tankhouse is approximately 700 feet away (Cedar Creek Associates, 1994).

Assessment of project related impacts is not strictly an evaluation of numbers of individuals lost and acres of habitat converted. Other indirect aspects of potential project related impacts are often more difficult to assess, but are, nonetheless, very important to the long-term survival and/or recovery of the species. These include any aspects of the project which could compromise the ecological integrity of Arizona hedgehog cactus populations or the functions and processes of the ecosystem of which it is a part. The Carlota Copper project will include gross alterations of topography over large areas. Of this, only a small portion provides habitat (occupied and unoccupied) for the cactus. However, these project impacts will have drastic effects to certain aspects of the ecosystem. The long-term ramifications of these ecosystem perturbations to Arizona hedgehog cactus are largely unknown. The way in which facilities development, mine operations, and large-scale habitat alterations will affect the cactus depends, in part, on how project implementation and habitat fragmentation will affect population dynamics (population structure, abundance, mortality, and fecundity), pollination ecology, and seed dispersal mechanisms. Many aspects of Arizona hedgehog cactus life history, including pollination ecology, are poorly understood. How various aspects of the proposed project may effect invertebrate populations and any potential pollinators are unknown.

To address these various uncertainties, the development of the "Conservation Assessment and Plan for the Arizona Hedgehog Cactus" was critically important. This plan provided important information to assess the ramification of potential impacts to Arizona hedgehog cactus from the proposed action. Equally important, the Conservation Plan addressed how the survival and recovery of Arizona hedgehog cactus could be supported by: 1) identifying those areas which presently exhibit ecologically viable populations and reduced impact potential which could then be managed as "safe zones" for the species; and 2) develop management goals and objectives for these "safe areas" which would maximize the long-term protection of the species. In this way, the proposed mitigation efforts for the cactus not only addresses specific project impacts but also contributes, in a meaningful way, toward recovery objectives for the species. Without the Conservation Plan, effective mitigation and compensation for project impacts could not have been identified.

The Biological Mitigation Plan identifies a variety of actions needed to avoid, minimize, or mitigate the various project related impacts. However, the impacts to Arizona hedgehog cactus from the Carlota Copper project remain a serious concern as it could possibly delay successful recovery of the species. Due only to the thoroughness of the efforts of Cedar Creek Associates and Tonto National Forest in assessing the current status of the species, evaluating existing threats, and developing management goals and objectives for the species as part of the Conservation Plan, that, with full implementation of all aspects of the Mitigation Plan for Arizona hedgehog cactus, could project related impacts be accommodated without substantial compromise to the recovery of the species.

The relationship of the Conservation Plan to the Mitigation Plan for the proposed action is especially apparent in the identification of "safe areas." "Safe areas" are intended to represent logical ecological units represented across the species' distribution where the Federal government can manage land uses and activities in the interest of protecting the long-term health and well being of the species. "Safe areas" are to be ecologically defensible sites where the ecological integrity of the system can be maintained and threats to the cactus minimized. These areas are to represent some of the better (or best) Arizona hedgehog cactus habitat, as demonstrated by appropriate population densities and age classes, and the presence of healthy specimens (Cedar Creek Associates, 1996). Potential threats to the species within these areas are minimal, or have been/should be reduced or eliminated. Any land management actions within "safe areas" should not compromise the management priority of Arizona hedgehog cactus. The process leading to the identification of "safe area" locations is detailed in the Conservation Plan. Field verification that these proposed locations meet "safe area" requisites, and establishing baseline demographic monitoring plots are an important part of the process to validate the "safe areas."

Impacts due to mining activities have been identified as one of the principle threats to Arizona hedgehog cactus (USDOI, 1979). These threats are, in part, being realized through the Carlota Copper project. Providing habitat protection from similar threats is one aspect identified within the Mitigation Plan to address the loss of cactus individuals and habitat. Carlota has committed to relinquish mining claims for an area of appropriate size and cactus population to directly compensate, in part, for project related impacts. Further, for this protection to balance the permanent impacts to the species with a long-term benefit, the area afforded protection from the threat of mining must be within an ecologically defensible area with a viable population of cactus. To these ends, the "safe area" concept was implemented. Carlota has identified a group of eleven mining claims, totalling 186 acres, along the fringe of the Carlota project area. Approximately 700 cacti occur within these claims; this also includes the Arizona hedgehog cactus type locality (the location of the collection of the specimen from which the taxon was described). This area is adjacent to the proposed "Five-point Mountain Safe Area." Carlota has committed by letter (signed by Robert C. Walish, March 12, 1996) to relinquish interest in theses claims at such time as they are withdrawn from mineral entry by the Federal government. Though these eleven claims are on lands managed by Tonto National Forest, and any potential adverse impacts to the species occurring under these claims would still require formal consultation with the Service, eliminating the threat of future mining at this site provides an important level of protection to the species and adds to the integrity of the proposed "Five-points Mountain Safe Area."

It is imperative that all aspects of the Mitigation Plan be implemented for the endangered Arizona hedgehog cactus. As this Plan is part of the project description, all identified actions to avoid, minimize, or mitigate impacts to the cactus are considered as part of the overall evaluation of project related impacts to the species. Special note is made of the efforts by Carlota to avoid impacts to individual cactus in designing project facilities. Continued avoidance of impacts to cacti, as identified in the Mitigation Plan through flagging of sensitive areas, education of construction personnel, and design considerations, is required.

Included as part of this consultation is the evaluation of effects to Arizona hedgehog cactus from all direct and indirect impacts resulting from the implementation of the proposed action as described in the project description, including the application of all associated mitigation measures. The Mitigation Plan includes ways in which various indirect effects of the action can be monitored, assessed, and quantified. The Service recognizes that despite intensive field work, the actual number of individual cacti which will be impacted may differ slightly from that projected in the DEIS. By considering many of the potential indirect effects and "pessimistic" estimates as presented in the DEIS and BA&E, this consultation provides for some level of uncertainty of impacts within the scope of the projected project impacts and implemented conservation actions, while also providing for increased management flexibility to the Forest and Carlota.

Impacts considered within the scope of this consultation include:

1) Loss of 23.94 acres of occupied habitat and 217 Arizona hedgehog cactus directly impacted by pit excavation and facilities development. Due to the difficulty in counting all plants during survey efforts, the loss of up to 54 additional plants within this identified acreage is included.

2) Sub-lethal impacts to the 185 cacti (149 + 33 + "a few") identified as being in close proximity to mine-related activities. Direct loss of up to 92 of these individuals are included provided all measures of the Mitigation Plan are implemented to avoid losses were possible.

3) Loss of an additional 2.5 acres of occupied habitat immediately adjacent to habitat considered as part of the preceding 23.94 acres. Any loss of plants within this additional acreage is expected to be those accounted for above as cacti in close proximity to mine-related activities.

4) Loss of approximately 238 acres of currently unoccupied habitat to mine operations. An additional 120 acres of unoccupied habitat is included provided that the area is surveyed to verify that it is unoccupied habitat.

Reinitiation of consultation with the Service would be required if/and when the number of Arizona hedgehog cactus or acreage of habitat impacted exceeds that detailed above. Any change to mine development plans or operations which result in loss of cacti and/or occupied habitat disjunct from the projected impact areas (not adjacent to identified pits, facilities, or roads) would also require reinitiation of consultation with the Service. If, at any time, any appropriate cactus protective measure identified in the Mitigation Plan is not implemented, it would constitute an impact not considered within the consultation and so would require reinitiation of consultation.

Cumulative Effects

Cumulative effects include the effects of future State, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of ESA.

LESSER LONG-NOSED BAT

The amount of land disturbance from mining is expected to increase in the foreseeable future as the existing mines expand their operations (Tonto National Forest, 1995). The amount of additional disturbance in the Globe-Miami Mining District is difficult to estimate and will partially depend on the existence, extent, and grade of ore, as well as economic conditions. Cyprus Miami Mining Corporation has recently upgraded its smelter facility and plans to expand leaching facilities at the Cyprus Miami Mine on its patented mining claims and public lands administered by the Bureau of Land Management and the Forest Service. The proposed expansion includes adding new leach pads, an overburden deposition area, stormwater impoundments, solution collection and transfer facilities, and supporting roadways and power installations. Magma Pinto Valley Mining Company needs to expand its mine rock disposal areas, tailings dams, and miscellaneous facilities over approximately 1,200 additional acres. Preliminary plans for expansion of the Ray Mine have been submitted to Pinal County. However, information is not available on details of the expansion. Other mines and mining projects continue to operate in the area. The only definitive proposal for a new mining project in the general area for the foreseeable future is for the Magma Copper Florence Project. A pre-feasibility study is being conducted by Magma Copper Company for an open-pit or in situ copper mine near Florence. The size of the proposed project area would be small for the in situ process and approximately 1,220 to 1,900 acres for an open-pit mine.

The increased demand for electrical power will continue for ongoing and future mining activities and other commercial and residential development in the Globe-Miami Mining District. The only other proposed energy project is the Salt River Project Power Line Upgrade. This project would involve reliability maintenance improvements on a section of a 115-kv transmission line that runs between Superior and Ray.

Future improvements are in the planning stages for State Highway 88 from the Tonto National Monument to the U.S. Highway junction. The Arizona Department of Transportation has also proposed improvements to the U.S. Highway 60-70 system.

The development of undisturbed private land for residential or commercial purposes is occurring in several areas, including the areas around Top-of-the-World, Globe, Superior, the San Carlos Indian Reservation, and smaller parcels of land such as those near Roosevelt Lake.

ARIZONA HEDGEHOG CACTUS

Approximately 90 percent of all Arizona hedgehog cactus habitat is found on Federal lands. Consequently, most potential projects occurring in cactus habitat would require separate consultations under section 7 of the ESA. However, certain future state, local, or private actions may affect Arizona hedgehog cactus. Cyprus Miami Mining Corporation has proposed expanding their operations which may impact approximately 620 acres of presumably unoccupied Arizona hedgehog cactus habitat (Cedar Creek Associates, 1994). Improvements and expansion of highway U.S. 60 by Arizona Department of Transportation between Superior and Globe could destroy plants and habitat. Illegal collection of Arizona hedgehog cactus may be occurring at an unknown magnitude. Certain mineral explorations on Federal lands do not require separate permit and as such may be occurring unregulated with undocumented impacts to plants and habitat.

CONCLUSION

After reviewing the current status of lesser long-nosed bat and Arizona hedgehog cactus, the environmental baseline for the action area, the effects of the proposed Carlota Copper Project, and the cumulative effects, it is the Service's biological opinion that the Carlota Copper Project, as proposed, is not likely to jeopardize the continued existence of the lesser long-nosed bat and Arizona hedgehog cactus. No critical habitat has been designated for these species, therefore, none will be affected.

INCIDENTAL TAKE STATEMENT

Sections 4(d) and 9 of ESA, as amended, prohibit taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed species of fish or wildlife without a special exemption. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Harass is defined as actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is any take of listed animal species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or the applicant. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered a prohibited taking provided that such taking is in compliance with the terms and conditions of this incidental take statement.

Sections 7(b)(4) and 7(o)(2) of ESA do not apply to the incidental take of listed plant species. However, protection of listed plants is provided to the extent that ESA requires a Federal permit for removal or reduction to possession of endangered plants from areas under Federal jurisdiction, or for any act that would remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any regulation of any State or in the course of any violation of a State criminal trespass law.

AMOUNT OR EXTENT OF TAKE

The Service does not anticipate that the proposed action will result in the incidental take of any lesser long-nosed bats.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of ESA directs Federal agencies to utilize their authorities to further the purposes of ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The recommendations provided here relate only to the proposed action and do not necessarily represent complete fulfillment of the agency's section 7(a)(1) responsibility for these species.

LESSER LONG-NOSED BAT

1) The loss of potential foraging habitat for the lesser long-nosed bat from any and all aspects of the project should be minimized to the greatest extent possible.

2) Transplantation of agaves from the areas of greatest density to similar densities in appropriate habitat should be conducted according to methods that are recognized as successful. The transplanting effort should be monitored to determine its success.

3) The leaching solutions containing reagents such as sulfuric acid should be retained in a closed system, or ponds and ditches containing the solutions should be covered with netting or sheeting. These measures should be initiated to preclude any contact of wildlife with the leaching solutions.

4) Additional surveys for lesser long-nosed bat roosts should be conducted in the vicinity of the proposed project. Reports of the surveys should be provided to the Service.

ARIZONA HEDGEHOG CACTUS

1) Continue implementation of the Conservation Plan. This plan provides appropriate management direction through the "Species and Habitat Management Objectives" which may lead to downlisting of Arizona hedgehog cactus.

2) Continue long-term demographic monitoring. This provides essential data to determine project related impacts and also provides basic information required to support downlisting the species.

3) Provide special management area designations or other means to formalize specific management guidelines which establish management priorities for Arizona hedgehog cactus "safe areas."

4) Complete the mineral withdrawal process for claims relinquished by Carlota for the protection of Arizona hedgehog cactus. Pursue withdrawal of adjacent mineral claims, if vacant, within the "Five-points Mountain Safe Area" and other identified "safe areas."

5) Pursue resolution of potential conflicts of management actions with Arizona hedgehog cactus within identified "safe areas."

6) As opportunities arise, pursue acquisition of private lands with Arizona hedgehog cactus habitat, especially adjacent to the "Five-points Mountain Safe Area."

7) Closely monitor the implementation of the Carlota Copper Project Mitigation Plan. Maintain tallies of Arizona hedgehog cactus plants and acres of habitat impacted by project related activities. Provide summary reports to the Service periodically (annually, if possible) on the status of the implementation of the Mitigation Plan, numbers of plants and acres of habitat impacted, and efforts taken to avoid, where possible, impacts to Arizona hedgehog cactus.

In order for the Service to be kept informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION - CLOSING STATEMENT

This concludes formal consultation on the actions outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

In future communications on this project, please refer to consultation number 2-21-92-F-419. If we may be of further assistance, please contact Bill Austin or Angie Brooks.

Sam F. Spiller

Sam F. Spiller

Attachment

cc: Chief, Fish and Wildlife Service, Arlington, VA (DES)
Regional Director, Fish and Wildlife Service, Albuquerque, NM (GM:AZ, ARW)
Plant Program Manager, Arizona Department of Agriculture, Phoenix, AZ
Director, Arizona Game and Fish Department, Phoenix, AZ

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APPENDIX G

PUBLIC COMMENTS AND RESPONSES TO THE DRAFT EIS

Letter 1

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

May 18, 1995

RECEIVED TONTO N.F. MAY 22 1995

OFFICE OF THE REGIONAL ADMINISTRATOR MAY 24 1995

FS DFS R&W RECW L&M AFT PIO ENG LMP WCSA — ACTION X — INFO V — ENC REC — AO CAP B&F C&P PM TSS LE CS CCPY COPY REC

Charles R. Bazan, Forest Supervisor
Tonto National Forest
2324 E. McDowell Road
Phoenix, AZ 85006

Dear Mr. Bazan:

The U.S. Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (DEIS) for the **Carlota Copper Project**, Gila and Pinal Counties, Arizona. Our comments are provided pursuant to the National Environmental Policy Act (NEPA), the Council on Environmental Quality's NEPA Implementation Regulations at 40 CFR 1500-1508, and Section 309 of the Clean Air Act.

The Carlota Copper Company has proposed to construct, operate, and reclaim an open-pit copper mining and processing facility. The project would include open pit excavation (435 acres), a heap leach pad and solvent extraction/electrowinning plant (342 acres), and mine rock/overburden piles (400 acres). Stream diversions, groundwater supply wells, haul roads, crushing facilities, and other ancillary facilities would also be constructed. The project would disturb a total of approximately 1,428 acres and would be operated for approximately 20 years.

Our involvement with the proposed project began in 1992. We provided written comments on your Notice of Intent to prepare an Environmental Impact Statement (EIS) for the proposal. Subsequently, EPA staff members have visited the site and have discussed the project with members of your staff on several occasions. In August 1994, we provided comments on the Preliminary Draft EIS (PDEIS), indicating that the proposed project appeared to pose significant impacts to groundwater and surface water quality and that the DEIS should provide additional information.

After completing our review of the DEIS, we believe certain design aspects of the project have the potential for adverse impacts that would be unsatisfactory from the standpoint of environmental quality. Specific concerns relate to the potential for ground and surface water impacts which may result in adverse
1-1 affects on aquatic life and riparian habitat. Furthermore, the proposal lacks adequate mitigation measures and other contingencies which we believe are necessary to provide safeguards against potential short- and long-term acidic releases and violations of Clean Water Act regulations. We find

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Response to Letter 1

1-1 The proposed action incorporates numerous design features and monitoring and closure approaches that will reduce the likelihood of acid releases to the environment. In addition, mitigation measures are provided in the FEIS to minimize the potential for acid releases to the environment. Redundant collection and monitoring systems,

Response to Letter 1

emergency pumps and power supply, alarms, and revised liner specifications (see response to comment 1-20) have been added as part of the proposed action (FEIS Section 2.1.3) or as mitigation measures. The system, as designed, would accommodate the combination of maximum monthly operational pool levels, severe precipitation, and stormwater runoff (one-half the probable maximum flood) without discharging process solutions.

The mitigation measures presented in the FEIS provide for extensive agency involvement, monitoring, and review throughout the project life. Additional site assessments and component specifications that address pollution prevention and site stability have been developed during the environmental review process; these have been incorporated to the degree possible in the FEIS. Revisions incorporated into the FEIS include mitigation measures recommended by the EPA. Carlota has committed to regulatory compliance and incorporation of appropriate emerging control technologies during the development and closure of the Carlota Copper Project, which are reflected in the FEIS.

1-2 unacceptable the proposal to pump process water from a well field in Pinto Creek downstream from the mining facilities without fully exploring alternative sources which could lessen the potential for significant impacts to aquatic and riparian habitat. We are also concerned that the geologic information
1-3 available to us indicates it is conceivable that pit dewatering and blasting could have significant adverse effects on residential water supply wells at Top-of-the-World. Our review comments, attached, identify and discuss specific details of these and other important issues such as air quality impacts and potential environmental justice aspects which the Forest Service should fully address.

1-4 Our review of the DEIS also indicates that many of the issues we raised previously remain inadequately addressed to provide the public and decisionmakers with 1) an appropriately detailed evaluation of the project's impacts, 2) a thorough analysis of alternatives which appear to be reasonably available and could significantly lessen potential environmental impacts, and 3) a complete documentation of mitigation measures and commitments to further offset such impacts.

Accordingly, we have rated the Draft Environmental Impact Statement **EU-3** (Environmentally Unsatisfactory - Inadequate Information). The attached "Summary of Rating Definitions and Follow-Up Actions" defines EPA's policy and procedures for
1-5 assigning ratings. The Agency's rating of the DEIS as EU-3 indicates that our review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of environmental quality. Further, we do not believe that the DEIS adequately assessed potentially significant environmental impacts as detailed in our attached comments. EPA's review is based on its best professional judgment of the information presented in the DEIS. We believe that the document should be formally revised and made available for public comment in a revised or supplemental DEIS. Because of the potentially significant impacts involved and the need for additional information, if these issues are not corrected in the Final EIS this proposal could be a candidate for referral to the Council on Environmental Quality as provided in Section 309 of the Clean Air Act.

On April 27, 1995, EPA staff met with members of the Tonto National Forest, Carlota Copper Company, and their consultants to discuss the concerns we identified in having reviewed the DEIS.
1-6 It was evident that some of our concerns specifically relating to the project's design could be offset by design modifications brought forth by the proponent at the meeting. We have not, however, had the opportunity to review these proposed changes, nor has the public. One function of the National Environmental Policy Act is to provide the public and decisionmakers with full disclosure of proposed projects and their environmental impacts.

1-2 FEIS Sections 2.2.1.4 and 2.2.2.5 describe a range of water supply alternatives that have been evaluated or eliminated from detailed consideration. The intent of evaluating alternative sources was to assure a viable water supply for the mine while avoiding or minimizing impacts to aquatic and riparian resources. Carlota has an agreement in principle with Cyprus Miami Mining Company and BHP Copper to purchase water from BHP Copper's Cottonwood storage pond (Carlota 1995b). The water in this pond comprises water from both Cyprus Miami's operations and BHP Copper's operations, including water originating from the Pinal Creek remediation site. The water agreement would provide up to 1,000 gallons per minute (gpm), provided the water would not be required for BHP Copper's Pinto Valley operations or Cypress Copper Company's Miami operations (see FEIS Section 2.2.1.4). The low quality water would be suitable for use on the leach pad. Carlota is also continuing to evaluate the Gibson Mine as another source of low quality water. Use of these water sources would reduce reliance on the well field and the potential for impacts of well field operation on surface flows in Haunted Canyon and Pinto Creek. Additionally, a well field mitigation program has been developed (FEIS Appendix E) to minimize the potential effects of well field pumping on aquatic and riparian habitat.

1-3 Numerical modeling and analytical solutions indicate that pit dewatering is unlikely to cause significant impacts to water supply wells at Top-of-the-World; however, due to uncertainty, these impacts cannot be entirely ruled out. A discussion of the potential impacts from blasting has been added to Section 3.2.2.1 in the FEIS. No adverse impacts to water wells from blasting are anticipated.

FEIS Section 3.3.4.1 describes monitoring that would be implemented to detect impacts to ground water at Top-of-the-World. Mitigation measure WR-1 describes mitigation that would be implemented if impacts were detected. Carlota has prepared a comprehensive ground water and surface water monitoring plan (GWRC 1996a) that describes the monitoring program intended to detect impacts to Top-of-the-World.

1-4 Comment noted. Responses to more specific comments concerning impact analyses, alternatives feasibility, and mitigation are addressed in subsequent responses to this letter.

1-5 Recommendations that the Forest Service issue a revised draft or a supplement to the draft were considered. The decision not to issue a supplemental DEIS was based on the following: (1) the proposed

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action has not substantially changed with regard to scope, intent or siting of facilities; (2) new circumstances and information are consistent with NEPA guidance on modification of alternatives, including the proposed action, and analysis based on response to comments on the DEIS; (3) suggested new alternatives recommended for analysis either were outside the scope (purpose and need) of the proposed action; (4) information identified as being incomplete was identified in the DEIS as being unavailable because of the exorbitant cost to collect such information or because methodologies were not available that would significantly increase the level of knowledge; (5) concerns about air conformity analysis were addressed through a separate, mandated, notification process; and (6) NEPA also mandates "reducing paperwork" and "reducing delay." The FEIS addresses the issues raised in comments on the DEIS.

1-6 New project design information has been submitted to the EPA for review on a continuous basis during the preparation of the FEIS. The Forest Service has been working closely with the EPA since the issuance of the DEIS to address the concerns identified in the EPA's comment letter. Through meetings and other communications, additional information has been conveyed to the EPA relative to additional data collection and analysis, changes in the project design, additional information regarding the project alternatives, and incorporation of additional mitigation measures. Changes that supplement or improve the design in response to comments do not have to be reviewed continually by the public prior to preparing the FEIS.

Letter 1 Continued

1-7 We believe that without the proponent's proposed design modifications and absent a thorough alternatives analysis, the DEIS lacks adequate information, analyses, evaluation and mitigation of impacts and has thus not met NEPA's full disclosure objective.

We commend the Tonto National Forest personnel for their efforts to involve EPA in the NEPA process and for their ongoing commitment to protect the environment. Based on the meetings between EPA, Forest Service, Carlota, and the Army Corps of Engineers, it appears that there are practicable, feasible ways to reduce the adverse environmental impacts of the project and concurrently attain the project's purpose. We would like to work with the Forest Service and Carlota in preparing a revised or supplemental DEIS and developing a project that meets the requirements of environmental laws and reduces the potential for significant environmental impacts. This is also in keeping with EPA's responsibility to comply with NEPA for the purpose of issuing a new-source National Pollutant Discharge Elimination System (NPDES) permit and ensuring compliance with Clean Water Act §404. By adequately addressing our issues at this time, the Forest Service and Carlota can facilitate the NPDES permitting process.

If you have any questions, please call John Wise, Deputy Regional Administrator at (415) 744-1002, or have your staff contact David Farrel, Chief, Office of Federal Activities, at (415) 744-1584.

Yours,

John Wise

Felicia Marcus for
Regional Administrator

1644/95-034

Enclosures

cc: Don Metz, U.S. Fish & Wildlife Service
Marjorie Blaine, U.S. Army Corps of Engineers
Prabhat Bhargava, ADEQ
Mike Wood, ADEQ
Arizona Game & Fish Department
Bob Wallish, Carlota Copper Co.
Katie McGinty, Council on Environmental Quality
Dick Sanderson, EPA HQ, OFA
Bob Wayland, EPA HQ, OWOW

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1-7 Additional information that meets disclosure objectives has been included in the FEIS based upon comments received on the DEIS. Responses to specific comments on disclosure are addressed in subsequent responses to those substantive comments. The Forest Service believes the disclosure objectives of NEPA have been fully met in the FEIS.

Letter 1 Continued

SUMMARY OF RATING DEFINITIONS AND FOLLOW-UP ACTION

Environmental Impact of the Action

LO-Lack of Objections

The EPA review has not identified any potential environmental impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC-Environmental Concerns

The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO-Environmental Objections

The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU-Environmentally Unsatisfactory

The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of environmental quality, public health or welfare. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommend for referral to the Council on Environmental Quality (CEQ).

Adequacy of the Impact Statement

Category 1-Adequate

EPA believes the draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2-Insufficient Information

The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3-Inadequate

EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From: EPA Manual 1640, "Policy and Procedures for the Review of Federal Actions Impacting the Environment."

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General Comments

Our review of the DEIS indicates that the proposed project could result in significant adverse impacts if not effectively mitigated.

1-8 We believe that the heap leach pad proposed in the DEIS does not appear to be adequately designed to prevent releases of contaminants to groundwater and surface water.

1-9 In addition, the impacts to surface waters from pit dewatering, stream diversions, and pumping supply wells are not well defined in the DEIS, but they appear to potentially be severe.

1-10 Because hydrogeologic conditions in the project vicinity are not well understood and impacts are not well defined, the potential success of some of the measures identified to avoid or mitigate those impacts is not known. In fact some of the identified mitigation measures are unacceptable.

1-11 Furthermore, in the Superstition Wilderness (a Class I airshed), the Prevention of Significant Deterioration increment for particulates would likely be exceeded and visibility would noticeably be reduced as a result of the proposed project. These impacts are unacceptable, and adequate mitigation is not proposed in the DEIS.

1-12 We believe that a revised or supplemental should be prepared, which better describes and/or quantifies the the environmental impacts of the proposed project and substantiates projections for mitigation success.

1-13 Furthermore, we believe that environmentally preferable alternatives for some of the project's elements may be reasonably available and the alternatives analysis should be expanded to address these in much greater detail.

Alternatives Analysis

We strongly recommend that the analysis of project alternatives be substantially expanded in the revised or supplemental DEIS. For the purposes of NEPA, all reasonable alternatives must be rigorously analyzed. Furthermore, Clean Water Act Section 404 Guidelines require that the preferred alternative be the least environmentally damaging practicable alternative to achieve the

1-14 basic project purpose. The DEIS dismisses several alternatives citing "lack of information" as the rationale for their consideration. In many cases, we believe that this analysis is inadequate, and that information needs to be obtained and the alternatives analyzed.

1-15 For example, regarding the alternative of piping low-quality water from the Copper Cities and Oxhide pits to the Carlota mine, the DEIS states that the information regarding soil and geologic conditions along the potential pipeline route is not available (p. 227). We believe that this alternative should be rigorously explored. We are extremely concerned that pumping groundwater

1-8 The heap leach pad liner, ponds, and associated drainage/monitoring systems have been modified in the proposed action, and mitigation measures have been added to protect against contaminant releases over the short and long term; see FEIS Section 2.1.3.1. While the overall design of the pad remains the same as originally proposed, modifications have been made in response to agency and public comments. These changes primarily pertain to pad construction and LCRS materials and are discussed in the FEIS in Section 2.1.3. On January 21, 1997, the ADEQ issued an Aquifer Protection Permit based on the modified design that authorized Carlota to operate the facility.

1-9 Comment noted. Responses to more specific comments regarding surface water hydrology are addressed in subsequent responses to this letter. Monitoring in the project area continues at present and will continue throughout the operational and closure phases. Results will be used to further characterize potential effects or modify mitigation measures, if necessary, as the project progresses.

1-10 Ongoing monitoring will further define hydrologic relationships in the project area, particularly in the Haunted Canyon vicinity. Carlota installed three recording stream gaging stations and one additional alluvial well in Haunted Canyon in the spring of 1996. Subsequently, the USGS installed a recording stream gage on Pinto Creek downstream from its confluence with Haunted Canyon. Additional monitoring wells will be installed in the well field area (see Mitigation Measure WR-1 in FEIS Section 3.3.4.1). These data will be analyzed in conjunction with future well field pump test data to better define relationships between surface water and ground water. Monitoring results will be used in combination with the latest available technology to ensure that specified requirements are effective in mitigating identified impacts. See also the revised text in Section 3.3.4.

1-11 The air quality impact analysis has been revised; please see Section 3.1.2 of the FEIS. The analysis reflects EPA's guidance relative to the visibility analysis and the incorporation of the EPA's recommended protocol for visibility modeling.

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1-12 Comment noted. Responses to more specific comments regarding the analysis of the proposed project and the recommended mitigation measures are addressed in subsequent responses to this letter. Please see also the response to comment 1-5.

1-13 The Forest Service identified and analyzed alternatives considered reasonable for the Carlota Copper Project. As described in FEIS Section 2.2.2, additional alternatives were initially considered but were subsequently eliminated due to their technical, environmental, or economic infeasibility. To specifically address this concern, the Forest Service and the COE entered into discussions with EPA to identify other potential alternatives. Additional documentation has been added to Section 2.3.3 and Appendix A to show this wider scope of alternatives. The documentation shows that these alternatives were screened early in the process and were determined to be technically, legally, or economically infeasible and would offer little to no environmental advantage over the alternatives analyzed in detail.

1-14 Please see the response to comment 1-13. Where appropriate, particularly for Clean Water Act Section 404 and water sources, the impact assessment has been expanded to incorporate additional information. However, no new, feasible alternatives were identified as a result of comments on the DEIS, input from other agencies, or rescreening after inclusion of additional information.

1-15 Please see the response to comment 1-2.

from the proposed well field in Pinto Creek would result in reduced instream flows and degradation of high quality aquatic and riparian habitat in and along Pinto Creek and Haunted Canyon.

We acknowledge the Forest Service's strong commitment to finding effective mitigation for impacts related to water resources. However, finding and implementing effective mitigation measures after impacts have occurred could prove difficult. We therefore urge the Forest Service to explore and evaluate water supply alternatives such as siting supply wells in locations which would not affect surface flows or other water supply sources and/or pretreating imported low-quality water for use as process water. Mitigation should be well defined before the project moves forward. A detailed analysis should be provided in the revised or supplemental DEIS. [1-16]

[1-17] We also believe that other alternatives for location and design of the heap leach facility should be rigorously explored and that mitigation measures should be better defined. Carlota proposes to locate the heap leach facility in a vulnerable site -- an intermittent stream channel underlain by highly fractured bedrock and upstream of valuable aquatic and riparian habitat. [1-18] The DEIS discusses several on-site alternatives, including a smaller project, larger project, Eder side-hill leach pad, leach pad/mine rock pile switch, two smaller leach pads, and existing Magma Pinto Valley tailings impoundment. EPA's evaluation of these on-site alternatives found that the DEIS does not provide adequate information to justify eliminating all but one as being impracticable. The revised or supplemental DEIS should provide more detail on why a smaller project is uneconomical and should discuss the various engineering designs that could be utilized on the Eder side-hill alternative to achieve the project purpose. The revised or supplemental DEIS should include more information on why the mine rock disposal/leach pad switch or the Magma tailings impoundment would not work and should explain the numerous disadvantages of the two smaller pads. The revised or supplemental DEIS should also discuss an alternative suggested by EPA in August, 1994, which would involve putting the mine rock/overburden on top of the existing Magma Pinto Valley tailings and relocating the leach pad out of Powers Gulch.

Water Quality

We believe that the proposed project could significantly affect groundwater quality and designated beneficial uses (i.e, full body contact, aquatic and wildlife) for a significant stretch of Pinto Creek, Powers Gulch, and Haunted Canyon. The revised or supplemental DEIS should address the following comments.

1-16 Carlota implemented a water supply exploration program prior to selecting the location of the proposed water supply wells in Haunted Canyon; no feasible alternative sites were located (see the response to comment 1-2). The Forest Service and Carlota have negotiated a program (see the Wellfield Mitigation Program in FEIS Appendix E) to mitigate the impacts of well field pumping on streamflow in Haunted Canyon and Pinto Creek. This plan is discussed in Section 3.3.4.1 of the FEIS.

1-17 As part of the evaluation of project alternatives, a mining engineer reviewed sites within and adjacent to the project area to locate feasible leach pad sites. The Forest Service then examined several alternatives for the heap leach pad, including alternative designs and locations. Please see also the response to comment 1-13.

1-18 This alternative could only be implemented by reducing the amount of ore to be mined. As indicated in the economic analysis (FEIS, Appendix A), this alternative would mine only 40 percent of the ore and recover only 30 percent of the copper available in the proposed action. This volume of copper recovery would not represent enough to pay for the required capital investment; therefore, the alternative was not considered economically feasible. For the Forest Service to recognize this as a viable alternative could constitute a "taking" of Carlota's rights under the General Mining law of 1872, which declared "all valuable mineral deposits in lands belonging to the United States...to be free and open to exploration and purchase."

Preliminary engineering analyses were conducted for this alternative and indicated four primary concerns: (1) the overall slope stability is marginal and requires tremendous toe berms to maintain only minimum factors of safety for the facilities, representing a greater risk of slope failure impacting the heap during operation and closure than the proposed action; (2) the Powers Gulch diversion would not be necessary, but approximately 2,100 feet of the existing Powers Gulch channel would need to be realigned to protect the heap embankments from erosion; (3) the reclaimed heaps would occupy more acreage,

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with longer slopes and less flat surfaces than under the proposed action, and erosion and sediment yield would be expected to increase; (4) the steep side-slope configuration could pose a greater potential for impact to waters of the U.S. than the proposed action due to possible heap slope failures into Powers Gulch or release of heap leach solutions. Because the preliminary engineering analysis indicated major concerns regarding the design of this alternative and greater potential for impacts to surface waters than the proposed action, it was felt that further engineering analysis was not warranted.

Additional rationale for elimination of this alternative has been added to the FEIS. Preliminary engineering analysis indicated that (1) the site of the proposed Main mine rock disposal area provided poor slope stability for installation of the liner system; (2) it would necessitate division of the solution collection systems into two areas with as many as six process ponds based on the steep topography and natural watershed divides, increasing the difficulty of management and monitoring; and (3) it did not eliminate impacts to Powers Gulch as the Main mine rock disposal area would occupy the natural channel and also require a diversion system. These design concerns clearly indicated that this alternative lacked an environmental advantage over the proposed action, and it was eliminated from further consideration.

Additional rationale for elimination of these alternatives has been added to the FEIS. Based on a preliminary engineering analysis, the risk of settlement within the tailings from loading a deep ore heap indicates that this alternative is infeasible. Unpredictable settling would occur due to the unconsolidated nature of the tailings material and would result in liner and slope failures within the heap leach facility. This alternative would also require Carlota to utilize land owned by another party, BHP Copper, which neither party was willing to consider. The Forest Service has no authority to force implementation of an alternative which would require interference with another mining operation. Based on preliminary findings and numerous disadvantages over the proposed action, it was determined that this alternative should not be considered in further detail.

Relocation of the mine rock overburden on BHP Copper tailings would create the same disadvantages that would exist relative to placing the heap leach pad on tailings. Slope stability of the overburden would be unpredictable due to the magnitude of settling within the tailings, and failures could result in impacts to surface waters. If this relocation were combined with relocation of the heap leach facility out of Powers Gulch and to the proposed Main mine rock disposal site, this would also create the same disadvantages as discussed in the alternative Leach Pad and Main Mine Disposal Area Switch (FEIS, Section 2.2.2.3). Since the alternative of both placing the mine rock overburden on BHP Copper tailings and the leach pad on the proposed Main mine rock disposal area is a combination of alternatives that have singularly been considered but eliminated, it does not represent a viable alternative to include in the EIS.

Heap Leach Facility

The potential for acidic releases to groundwater and surface water and their impacts on the water quality are of great concern to us. According to the DEIS (p. 217), any release to the environment could result in significant impacts to localized surface water and groundwater quality. Any releases that exceed water quality standards could adversely affect beneficial uses in Powers Gulch and Pinto Creek. According to the DEIS (p. 218),

> "the spent ore would be acid-generating and toxic, with a pH of approximately 2.8 and elevated heavy metals concentrations that would exceed Arizona Stream Water Quality Standards for Powers Gulch and downstream receiving waters, Arizona aquifer standards, and Federal Primary and Secondary MCLs....There is no known economically practical technology currently available for rinsing acid-leached copper ore to neutralize its acidic pH and reduce heavy metal concentrations to levels that do not have the potential to degrade waters of the U.S."

In addition, according to the DEIS, the potentiometric surface is above the ground surface in Powers Gulch and there is a connection between surface flows and the alluvial and bedrock aquifers. **1-19** In light of the topography and hydrogeology of the gulch and the proposed design of the leach pad, we believe that a release of contaminants from the facility is a very real long-term risk if the leach pad remains unneutralized. It should not be presumed that a technically feasible, economically practical method to adequately neutralize the leach heap will be developed prior to completion of this project.

Given the project's potential risk to surface water and groundwater, as stated in the DEIS, we question how the heap leach pad, as proposed, is designed to adequately safeguard water quality. We believe that several modifications should be made to the pad design to reduce the potential for leakage from the heap leach facility. In our April 27 meeting with the Forest Service and Carlota, Carlota's consultant identified some design elements which we believe are necessary to reduce water quality impacts, but which are not identified in the DEIS. Our comments here are based on our review of the project as proposed in the DEIS and should be addressed in the revised or supplemental DEIS.

1-20 We recommend that the synthetic high-density polyethylene (HDPE) leach pad, raffinate pond, and pregnant leach solution primary pond liners be 80 to 100 millimeters thick. A 60-millimeter thickness may not be adequate to prevent puncture or tearing.

1-19 The EIS has not assumed that a neutralization method would be developed prior to the closure of the leach pad. Currently, there is no proven technology to neutralize the residual material created by leaching oxide copper ore. The EIS has analyzed the potential impacts associated with the construction, operation, and closure of the leach pad without neutralization of the leach residue material within the pad. Carlota has proposed a plan that would drain the heap and recontour and reclaim the surface in order to minimize infiltration and enhance surface runoff and evapotranspiration. The effect of this closure plan would be to encapsulate the facility and prevent any buildup of water at topographic lows within the heap. Ground water would remain separated from the heap by the permanent spine and finger drain system under the liner. Carlota has also committed to full-scale testing of closure and reclamation alternatives on the north heap, which will begin closure prior to the main heap. If new heap closure techniques, such as neutralization, are developed over the life of the project as a result of research by Carlota or others working in the mining field, then they will be examined for applicability to augment or replace the current heap closure and reclamation approach.

1-20 Based on installation factors, a thicker liner of 80 or 100 mil would not be advantageous. Thicker geosynthetics are stiffer and more brittle, creating installation problems on irregular topographic surfaces. In addition, sections of 80 and 100 mil do not weld together as successfully as 60 mil. Liner descriptions have been modified in the

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FEIS (Section 2.1.3.1) to reflect the current liner designs. In areas where process fluids would not be impounded and where lateral flow would occur, the liner system would consist of a 60-mil HDPE liner underlain by a prepared earthen subgrade. In areas where process fluids would be impounded, the leach pad liner design includes 12 inches of prepared subgrade overlain by a leachate collection and recovery system consisting of 12 inches of minus 0.5-inch crushed drain gravel between a 60-mil HDPE secondary liner and a 60-mil HDPE primary liner. In areas of heavy traffic and/or where the heap is higher than 350 feet, a 12-inch cushion layer of suitable mill tailings would be placed above the primary liner. Non-woven geotextile would be placed on the cushion layer to prevent migration of fines into the overliner materials (see Figure 2-6, Leach Pad Liner System).

The plant PLS/SX and raffinate ponds (FEIS Section 2.1.3.2) would use liner systems consisting of 12 inches of prepared subgrade overlain by a 40-mil HDPE secondary liner, geonet/geotextile composite, and a 60-mil HDPE primary liner. The main and north PLS ponds would have double-liner systems consisting of 60-mil HDPE primary and secondary liners placed on a prepared subgrade. Primary and secondary liners would be separated by a 12-inch layer of minus 0.5-inch drain gravel. Further detail about liner design is presented in the Final Design of Heap Leach Pad and Ancillary Facilities (Knight Piésold 1995a).

1-21 All portions of the pad should be provided with a secondary liner with a permeability of no greater than 10^{-6} cm/second. It is unclear that the proposed subgrade could be compacted to provide this permeability uniformly through a 12-inch thickness and deemed a secondary liner for purposes of capturing leakage from the HDPE primary liner. Extensive laboratory testing would be needed to determine whether local soils could be compacted to a uniform permeability of no greater than 10^{-6} cm/second. It may be necessary to use some other material to ensure adequate uniform permeability.

The proposed placement of minus 2-inch crushed ore directly on the HDPE liner could result in liner puncture if the screens are not properly maintained or wear out. In this case, very large or relatively long rocks might be placed on the liner. Screens must be properly maintained to prevent this problem. 1-22 The revised or supplemental DEIS should discuss options that were assessed to determine the optimal material for this layer.

1-23 Automatic pumps should be installed in the 10,000- and 7,900- gallon pregnant leach solution sumps to prevent overflow in case of liner failure. 1-24 The sumps should be double-lined. All pregnant leach solution, raffinate, and process pumps should be provided with standby diesel electrical power supplies.

According to the DEIS, an upward hydraulic gradient seasonally occurs in Powers Gulch, resulting in surface discharge of groundwater. In our discussions with Carlota, the company has suggested that this may be the result of a well screened in a confined aquifer and not a natural seep. 1-25 However, we understand that other seeps may also be present in the gulch. If this is the case, the underdrain system beneath the heap leach pad would need to be effective in perpetuity. It is unclear how the underdrain system could be designed to accommodate that need. Breakdown and/or clogging of the piping could render it useless. Carlota should be required to operate and maintain the underdrain system to ensure that it is functional until it can be unquestionably demonstrated that there is no potential for contamination from the heap leach facility. The spine drain system design should ensure prevention of plugging and include cleanout points.

1-26 The revised or supplemental DEIS should describe how the leachate collection piping would be placed on the leach pad's HDPE liner and how it would be kept in place.

1-21 The current design and proposed construction techniques comply with ADEQ heap leaching approaches under the individual BADCT application process. ADEQ has issued a Aquifer Protection Permit for the proposed project. Since the DEIS was issued, additional on-site investigations have indicated the presence of suitable earth materials that may be used for a low-permeability subgrade. Mitigation has been added to the FEIS (Section 3.3.4, Measure WR-9) to require Forest Service approval of Carlota's construction quality assurance/quality control plan prior to the start of leach pad construction with regard to the target permeability, testing, and placement of subgrade materials.

1-22 Monitoring of the materials used for the crushed ore overliner is addressed in the QA/QC Program for Heap Leach Pad Construction, Appendix G of the Final Design of Heap Leach Pad and Ancillary Facilities (Knight Piésold 1995a). The particle sizes of crushed ore overliner materials would be tested every 5,000 cubic yards according to ASTM D422. In addition, a 12-inch protective layer of mill tailings would be placed over the primary liner in areas of heavy traffic or where the heap height would be greater than 350 feet.

1-23 The design of the heap leach facility has been modified in the FEIS to accommodate a larger stormwater volume. The entire heap leach facility system, including the heap leach and PLS embankments, the raffinate and plant PLS/SX ponds, and the diversion channels and inlet control structure (FEIS Section 2.1.3.1) would operate in conjunction with one another to safely accommodate the operational volumes plus the peak flows and volumes resulting from one-half the probable maximum flood. Backup pumps to the main pumps would be included at both the main and north PLS ponds (Section 2.1.3.2).

1-24 The proposed action includes diesel-powered backup electrical generation to operate pumps at the main and north PLS ponds, the raffinate pond, and the plant PLS/SX pond. Reference to these backup systems can be found in FEIS Sections 2.1.3.2, 2.1.6.2, 3.1.2.1, and 3.3.2.1.

1-25 The central spine drains and associated finger drains would consist of an open trench drain system augmenting the existing gravels and alluvium in the main drainages under the pad. In situ alluvial gravels would be left in place to the extent possible. Drain pipes would be encased in a non-woven geotextile to prevent migration of fines into the system. Native gravel replaced around the drain pipes may be screened, if necessary, to remove excess fines. A concrete-encased outlet pipe would transport any underdrain flows to a collection pond

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downgradient of both PLS embankments. Mitigation has been added to the FEIS (Section 3.3.4, Measure WR-16) to require that the main and north embankments have a seal zone keyed into bedrock. If the alluvium below the spine drain and above the bedrock is greater than 1 foot, Carlota would be required to install a monitoring well on the upstream side of the embankment. The monitoring well would be used to demonstrate that no PLS has leaked through the liner, and in the event leakage does occur, to pump the PLS out of the alluvium.

Monitoring well data indicate that little ground water would flow into the underdrain. The very limited ground water flowing into the underdrain would not present a potential for clogging since the native soils are not gap-graded or unstable, and insufficient flow exists to move the particles. Additionally, the ground water must flow through a non-woven geotextile that would clog before the pipe or the gravel. The non-woven geotextile would be selected so that its clogging potential would be minimal, and the drain gravel would be properly compacted to push the geotextile into the fine soil that it filters. Typically, the geotextile would clog only if the native soils are gap-graded or unstable, or the ground water is alkaline or contains a high level of hardness, and sufficient flow exists to move soil fines. None of these potential clogging conditions exist at the site. However, as a precautionary measure, mitigation has been added to the FEIS (Section 3.3.4, Measure WR-14) to require an upstream access port on the main PLS pond central spine drain to provide an opening that could be used for clean out, flushing, or inspection.

1-26 Placement of leachate collection piping is described in detail in the Final Design of Heap Leach Pad and Ancillary Facilities (Knight-Piésold, 1995a). Pipe networks would be installed by hand or by other careful methods to avoid damage to the liner system or pipe materials. Pipe installation and LCRS backfill QA/QC are described in the technical specifications of the design report (Appendix F).

Letter 1 Continued

1-27 A pH meter probe with an alarm system needs to be installed in Powers Gulch to detect any unauthorized discharges. An instant electronic dialing and notification system should be included as part of the alarm system.

1-28 We understand that the Forest Service will require that groundwater collected in the leach pad underdrain system be released to Powers Gulch. However, any subdrain water contaminated with leachate should be pumped back onto the heap to contain any pregnant leach solution that may have entered the groundwater due to a punctured liner. In addition, pumpback wells should be installed at the toe of the heap leach pad to recover any seepage from the pad. The revised or supplemental DEIS should indicate this and discuss whether and how the reduced flows in Powers Gulch would be mitigated.

1-29 According to the DEIS (p. 235), mitigation of adversely affected surface water quality or degradation from uncontained leachate would include correcting the source of release. The revised or supplemental DEIS should describe how a leaking leach pad liner would be repaired.

Other Project Facilities

1-30 According to the DEIS (p. 38), the Powers Gulch diversion ditch would not be lined, but includes erosion protection "where necessary to stabilize channel sides." We believe that lining the diversion with material similar to that used for the Pinto Creek diversion is preferable to reduce the potential for erosion to undermine the heap leach pad.

1-31 The revised or supplemental DEIS should describe the 100-year and 500-year thunderstorm events used for design of the diversion channels.

1-32 To prevent unauthorized discharges, conveyor systems used to move ore should be provided with catchments to contain ore and dust that falls off of the belt. Discharges such as this could take place during storm events. Cyprus Sierrita's unauthorized discharge of crusher dust is a recent example.

1-33 Piping which carries process solutions should be provided with secondary containment, leak detection and shutdown systems or other methods to prevent spills to waterways. ASARCO, Inc. Ray Complex has had several pipeline breaks resulting in spills to Mineral Creek.

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1-27 Section 3.3.4.1, Water Quality, of the FEIS has been modified to incorporate this feature as a monitoring and mitigation measure (Measure WR-9).

1-28 The leach pad design contains redundant protective features in the solution collection system to avoid leakage from the system. This includes a leak collection and recovery system beneath all of the pond areas that would handle any process fluids that might pass through the primary liner. Monitoring wells immediately downgradient of the heap facility are included in the monitoring program for the project. These wells could be used as pumpback wells if a release of process solution would occur.

1-29 The leach pad design contains redundant protective features to avoid leakage from the system. In the event that a significant leak is detected outside of the containment systems, part of the pad could be shut down while processing continued in other sections. If necessary, a close-order topographic survey could be conducted of the liner surface prior to heap loading in order to increase the potential for successful stabilization measures at closure.

1-30 The Powers Gulch diversion has been designed as a shotcrete/bedrock-lined structure, and the FEIS has been modified to reflect this design; see FEIS Section 2.1.3.3. The toe of the heap parallel to the Powers Gulch diversion would be riprapped to prevent heap material from eroding in the unlikely event of overtopping of the diversion channel.

1-31 The events are described in Simons, Li & Associates' hydrology report and its associated appendices (SLA 1993, John C. Halepaska and Associates 1994), which have been incorporated by reference into the FEIS. These documents are available for public review at Tonto National Forest Supervisor's Office in Phoenix. FEIS Section 3.3.1.2 summarizes the methods used to determine the magnitude of storm events and the 1-, 6-, and 24-hour rainfall estimates (Table 3-38).

1-32 Ore conveyors will be fully covered and chutes will be used at drop points to reduce particulate emissions.

1-33 As explained in Sections 2.1.3.1 and 2.1.3.2 of the FEIS, an LCRS would be built as part of the leach pad design. Further details of the system and its collection sumps are presented in the pad design report by Knight-Piésold (Knight Piésold 1995a), which is incorporated by reference into the FEIS. Secondary containment and shutdown systems for most piping and process components are described in the SCHMM Plan (SCHMM) (Carlota 1996a). All process piping would be located within the heap-leach facility footprint. Any leaks from process solution piping would be totally contained within the heap-leach facility.

Letter 1 Continued

We understand that Carlota intends to ensure that all runoff from mine rock disposal areas would be kept on site. The revised or supplemental DEIS should indicate where on site the runoff would be discharged and what action would be taken if the discharge became contaminated. **1-34**

1-35 A National Pollutant Discharge Elimination System (NPDES) permit will be required for this facility. Carlota Copper Company should submit an application for an NPDES permit to EPA Region 9 as soon as possible. **1-36** In addition, the revised or supplemental DEIS should discuss Carlota's Stormwater Pollution Prevention Plan.

<u>Other Water Quality Issues</u>

1-37 The revised or supplemental DEIS should include an area-wide contingency plan for immediate response to unintentional releases of contaminants (e.g., acid drainage, leached ore, heavy metals, process solutions) from the site.

1-38 The DEIS (p. 212) states that, regardless of the final pit lake water quality, no impacts to groundwater would occur because net outflow of water from the pit lake is not predicted to occur. The revised or supplemental DEIS should substantiate this statement.

1-39 The revised or supplemental DEIS should identify the sources of existing water quality standards exceedences (for copper and thallium) in Pinto Creek (e.g., are these indicative acid drainage from old or existing mining operations?)

1-40 The revised or supplemental DEIS should identify the best management practices that would be required by the Forest Service for erosion and sedimentation control on the project site.

<u>Clean Water Act §404</u>

EPA has provided separate comments to the Army Corps of Engineers on its Public Notice (PN) concerning Carlota's application for a permit under Clean Water Act §404.

The proposed project will directly affect approximately one-mile segments of both Pinto Creek and Powers Gulch as a result of diversions. Pinto Creek is a perennial stream that flows into Roosevelt Lake. A stretch of Pinto Creek five miles below the project is considered eligible for Wild and Scenic River designation with high ecological values. Powers Gulch, an intermittent stream which is fed by groundwater, feeds into Pinto Creek and is proposed to be filled with a leach pad.

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1-34 Surface runoff from the Cactus Southwest mine rock disposal area would be permanently directed toward the Carlota/Cactus pit during mining and after mine closure. Carlota proposes to prepare the mine rock disposal areas to minimize surface water runoff erosion and sedimentation from the disposal sites (CWA Section 402 Permit Application 1994). As described in the SWPP plan and the NPDES permit application, the mine rock disposal areas would have upgradient interceptor ditches to convey runoff from undisturbed areas to natural drainages. The tops of the disposal areas would be graded away from the embankment crests to prevent surface runoff from flowing down the rock face. Storm runoff from the tops of the disposal areas would be temporarily detained on the tops of the disposal areas. Sediment basins and/or the sediment-control BMPs constructed downgradient of the mine rock disposal areas would control excess sediment runoff originating on the disposal areas. An NPDES permit would be required for any water discharged from the sediment basins as a result of precipitation events less than the 100-year, 24-hour recurrence. The NPDES permit would require approval and issuance by the EPA. The ADEQ would also be involved in the approval process through issuance of the 401 Certification for the permit. Discharge from the basins would be required to comply with the water quality limits set in the NPDES permit, and therefore would not violate any water quality standards in Pinto Creek or Powers Gulch.

1-35 Carlota understands that an NPDES permit would be required for the project and has submitted a permit application to the EPA and ADEQ. The FEIS has been modified to reflect this permit application in Section 2.1.5.5.

1-36 The Stormwater Pollution Plan discussion has been expanded in Section 2.1.5.5 of the FEIS. The plan has been incorporated by reference and is available for public review at the Tonto National Forest in Phoenix.

1-37 The discussion in Section 2.1.5.5 of the FEIS has been expanded to include the SCHMM Plan (Carlota 1996a), which addresses the procedures for responding to contaminant releases. The plan is incorporated by reference and is available for public review at the Tonto National Forest Supervisor's Office in Phoenix. It will be included in the Plan of Operations and amended as the project progresses.

1-38 An additional discussion of the pit lake water balance calculations has been added to Section 3.3.2.1 of the FEIS to substantiate the conclusion that no ground water outflow is anticipated from the pit lake. In summary, a mass balance approach was used to determine the final pit lake elevation once mining operations cease. The water level in the lake would depend on the amount of water entering the pit through ground water inflow, surface runoff from the pit walls, and direct precipitation onto the lake surface, as well as the amount of water lost from the lake surface through evaporation. The pit lake water balance used conservative (high) estimates for initial ground water inflow, and conservative (high) estimates of surface water runoff, both of which would tend to increase the predicted final lake level. Even using these conservative assumptions, the relatively high evaporation rates result in a final pit lake level that is estimated to stabilize at approximately 3,345 ft-amsl, which is approximately 150 feet below the premining ground water level in Pinto Creek and several hundred feet below the pre-mining water level in the bedrock ridges adjacent to Pinto Creek. Since the elevation of the lake surface is predicted to be considerably below the surrounding unaffected water levels (both during filling and at hydraulic steady state) in the bedrock and alluvial system, the pit lake is anticipated to act as a sink whereby the ground water gradient in all directions would be toward the pit. Ground water gradients sloping toward the pit should prevent ground water outflow from the pit lake.

1-39 Existing water quality standard exceedances (acute and chronic aquatic and wildlife) for copper were found in Pinto Creek upstream and downstream of the proposed Carlota/Cactus Pit (see Table C1-1). The source of copper at these stream sites is likely the natural mineralized geologic material associated with the Carlota/Cactus ore body. Disturbances associated with historic and ongoing mining operations are another potential, but unsubstantiated, source of water quality exceedances. In reference to thallium, the FEIS has been revised to indicate that detection levels for this constituent were not sufficiently sensitive to evaluate concentrations with respect to applicable water quality standards.

1-40 FEIS Section 1.6.1, Table 1-1 identifies regulatory requirements of different government agencies. Regulatory permits or approvals that include BMPs as part of the requirement include the U.S. EPA's NPDES Storm Water Discharge Permit, the COE Clean Water Act Section 404 Permit, and the ADEQ's 401 certification of both the NPDES and 404 permits. FEIS Section 2.1.5.5 identifies BMPs already committed to by Carlota for controlling sediment. FEIS Sections 3.3.4.1 and 3.4.4.1 identify mitigation measures (which include BMPs) necessary to minimize erosion and sedimentation. Other BMPs would be implemented when identified as necessary by Forest Service project administrators.

Letter 1 Continued

The project area contains riparian habitat consisting of Arizona Sycamore, Arizona Black Walnut, Fremont Cottonwood, Arizona Alder, Gooding's Willow. Pinto Creek and Huanted Canyon in the project area also contain as much as 86% riffle and pool complexes which are vital for aquatic species and are considered special aquatic sites by EPA. These riffle and pool complexes would be more infrequent not only in the project area, but in reaches below the project as a result of the proposed project. Moreover, numerous seeps and springs, and wetlands would also be affected.

The Clean Water Act §404(b)(1) Guidelines "Guidelines" require that the permitted project be the least environmentally damaging practicable alternative to achieve the basic project purpose [40 CFR 230.10(a)]. The Guidelines interpret the basic purpose of a project as the broad function of the proposed activity. From information provided thus far (for the Section 404 permit) the 1-41 project purpose is to mine copper in Arizona. For permitting purposes, the applicant must clearly demonstrate that the preferred alternative is the least environmentally damaging practicable alternative. In making this demonstration, the applicant must consider a range of alternatives. We do not believe that the applicant has made this demonstration. Also please refer to our comments regarding alternatives analysis on pages 1 and 2 of these comments.

There is also the potential for acidic releases to groundwater and surface water. The impacts on water quality and aquatic habitat from such releases are of great concern to us. The Guidelines require that the permitted activity must not cause or contribute to violation of any applicable State water quality standards. We are concerned that the proposed project will affect designated beneficial uses (i.e, full body contact, aquatic and wildlife) for a significant stretch of Pinto Creek, Powers Gulch, and Haunted Canyon. We are also concerned about potential water quality impacts downstream from the proposed heap 1-42 leach facility and pit dewatering. The revised or supplemental DEIS should describe how the proponent proposes to avoid the discharge of contaminants and the anticipated downstream effects should such a discharge occur.

1-43 The Guidelines require that the permitted activity must not cause or contribute to significant degradation of waters of the United States [40 CFR 230.10(c)]. From information provided in the DEIS we believe that the proposed project would adversely affect important aquatic resource values. The DEIS states in several areas that seeps/springs, riffle and pools, wetlands, and riparian areas would be directly, indirectly and cumulatively affected. EPA considers these areas as having high wildlife

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1-41 Please see the response to comment 1-13 regarding the selection and evaluation of alternatives. The EPA and COE will determine the "least environmentally damaging practicable alternative" for the Section 404 permit. Please see also the response to comment 2-1.

1-42 FEIS Section 1.6.1, Table 1-1 identifies permits or approvals required from county, state, and federal agencies. These include a Clean Water Act 404 Permit from the COE, 401 certifications and an Aquifer Protection Permit from the ADEQ, and an NPDES Permit from the EPA. These permits, along with mitigation requirements of the Forest Service, are intended to protect water quality and aquatic resources from degradation. A discussion of contaminant containment is presented in Sections 2.1 and 3.3 of the DEIS and FEIS.

1-43 The Forest Service notes this concern relative to potential impacts to these resources. Responses to more specific comments are addressed in subsequent responses to this letter.

1-43 values and that the proposed project would cause significant degradation.

1-44 The DEIS does not discuss the full effects of groundwater drawdown and how this would affect the numerous springs, seeps, and wetlands, as well as baseflow and the structure of pools and riffles (see also our comments in the section titled "Water Quantity"). The DEIS states that ground water withdrawal caused by proposed mine dewatering and well field development would create cones of depression that would potentially affect 1) a decline in water levels in bedrock water supply wells located in the vicinity of the open pit and at Top of the World; 2) reduction or elimination of flows in some natural springs; 3) a reduction in surface flow and alluvial underflow in Powers Gulch, Haunted Canyon, and Pinto Creek; 4) a loss of Pinto creek alluvial interflow into the pit; and 5) pit lake water losses.

The Guidelines require that all practicable measures be taken to mitigate unavoidable project impacts to the aquatic environment [40 CFR 230.10(d)]. 1-45 The applicant should first establish that project related impacts are unavoidable (see above). If unavoidable impacts are determined, a detailed plan to mitigate should be prepared.

1-46 EPA is concerned that the applicant has not proposed to mitigate for the direct impacts to riffles and pool complexes and wetlands from the stream diversions. 1-47 Moreover, the DEIS does not identify all the project's impacts, including indirect and cummulative impacts, to the aquatic environment.

<u>Water Quantity</u>

We are greatly concerned with water quantity issues because of its relation to water quality, including designated beneficial uses. The streams in the project vicinity have valuable aquatic habitat (including riffle and pool complexes) and riparian habitat which would be significantly affected by the proposed project.

1-48 The DEIS does not contain adequate information regarding hydrogeologic conditions to reliably predict impacts to groundwater and surface water supplies or the success of measures to mitigate these impacts. The DEIS states in several places that the hydrogeology is complex and precise boundaries of drawdowns are not possible. However it also states that impacts from pit dewatering appear to be restricted to areas immediately surrounding the pit. The DEIS states with more certainty that after pit dewatering ceases, flows and water quality conditions in springs will return to pre-mining conditions (p.210). The

1-44 Potential impacts to seeps and springs and streamflow from pit dewatering and well field pumping are discussed in detail in Section 3.3.2.1 of the FEIS. Impacts from pit dewatering or well field pumping are not likely to have a significant effect on the riffle/pool structure in Pinto Creek, Haunted Canyon, or in downstream reaches of Powers Gulch. Generally, the primary influences on channel geometry (including riffles and pools) are floods, such as the mean annual event or less frequent events. Pit dewatering or well field pumping may decrease the baseflow component of such storm hydrographs. However, this component is usually a smaller part of the overall channel-forming discharge, especially in quickly-responding watersheds, such as the one in which the project area lies. To address well field pumping impacts, Carlota, the Forest Service, and ADWR have agreed to a well field Mitigation program, which is discussed in Section 3.3.4.1 and Appendix E of the FEIS.

1-45 Under the proposed action, potential impacts to local surface and ground water resources from pit excavation and dewatering and well field development are considered unavoidable. A detailed plan to mitigate potential changes in streamflow conditions has been agreed to by the Forest Service and Carlota, and is summarized in Section 3.3.4.1 and included as Appendix E of the FEIS. Additional details regarding mitigation for potential impacts to the water resources in Pinto Creek and Haunted Canyon are provided in Section 3.3.4 of the FEIS. Please see also the response to comment 1-46.

1-46 Riffle/pool mitigation measures have been developed by Carlota in cooperation with the COE and the Forest Service as part of Clean Water Act (CWA) permitting. Riffle/pool structures along the reaches of Pinto Creek and Powers Gulch to be replaced by the diversions would not be reconstructed at their present locations because of the long-term need for hydraulic performance of the diversions after closure. The Wetland and Waters of the U.S. Compensatory Mitigation Plan for the Carlota Copper Project (Aquatic and Wetland Consultants, Inc. 1996a) identifies mitigation for riffle/pool complexes and wetlands displaced by the stream diversions (FEIS Section 3.5.2.1). Please see also the responses to comments 1-44 and 1-45.

1-47 These measures are identified in detail in the Wetland and Waters of the U.S. Compensatory Mitigation Plan for the Carlota Copper Project (Aquatic and Wetland Consultants, Inc. 1996a). The measures are summarized in Section 3.5.4 of the FEIS.

Letter 1 Continued

1-48 revised or supplemental DEIS should substantiate this. It also appears likely that surface and near-surface flows in Haunted Canyon and Pinto Creek could be significantly affected by pumping in the proposed well field. 1-49 The revised or supplemental DEIS should include the water balance calculations used to determine potential impacts of the proposed project.

The DEIS identifies measures to mitigate impacts from groundwater drawdown, such as monitoring, watering with trucks, pumping groundwater to replace surface flows, enhancing springs/seeps, purchasing grazing allotments on Forest Service property, fencing, and acquiring other parcels. 1-50 However, it is unclear from the DEIS whether the mitigation measures identified in the DEIS would successfully offset these impacts. The Forest Service should 1) quantify all the impacts associated with the proposed groundwater pumping, then 2) develop mitigation measures that would fully offset impacts. A natural, self-sustaining system is desired for mitigating impacts to surface water flows. A system maintained by artificial means is often unsuccessful. Furthermore, augmenting surface flows using water that violates water quality standards would not be acceptable.

According to the DEIS (p. 233), mitigation for reduced surface water flows as a result of groundwater pumping could include piping water from the well field or mine dewatering system or drilling a well(s) near the affected stream segment. However, well field bedrock groundwater may exceed water quality standards for antimony and arsenic. If surface water standards would not be met, another source of supplemental water would be needed. In addition, supplemental water may still be needed by affected streams long after the mine dewatering system is turned off. 1-51 The revised or supplemental DEIS should thoroughly explore all options for supplemental water in order to determine the best option in terms of environmental standards and impacts, as well as economic and physical feasibility.

The DEIS (p. 192) states that the bedrock receives some recharge seasonally from the alluvial aquifer and directly from stream flow, and the alluvial aquifer receives recharge from stream flow and the bedrock aquifer. Although these processes may vary seasonally, there appears to be a strong connection between surface flow and the alluvial and bedrock aquifer. However, regarding the leach pad area the DEIS (p. 207) states that the interaction between surface and ground water is minimal due to water chemistry results. 1-52 The revised or supplemental DEIS should identify when the water chemistry data were taken and discuss whether groundwater/surface water interaction would be "minimal" at all times during the year. This does not appear likely based on the statement on page 203 that in early spring there is "an

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1-48 Excluding the area immediately surrounding the open pits, it is anticipated that following mining, ground water levels in the bedrock complex would eventually reestablish to near premining levels. Considering that the fracture system should not be altered by the proposed action, the few identified springs that could potentially be affected are likely to return to premining conditions. Although there is no way to substantiate this assumption, it is a likely scenario considering the known hydrogeologic conditions in the area.

1-49 Water balance calculations are included within the numerical flow model that was incorporated by reference in the FEIS (GWRC 1994). Potential impacts to surface and near-surface flows in Haunted Canyon and Pinto Creek are based on measured changes in surface flow and alluvial water levels during long-term aquifer tests. During the periods of little or no precipitation, typically late summer and early fall, all of the flow in Haunted Canyon is typically derived from ground water discharge.

1-50 The revised monitoring and mitigation measures presented in Section 3.3.4.1 of the FEIS were developed to offset anticipated ground water pumping impacts. In complex geologic settings, such as the Carlota Copper Project site, it is not technologically feasible to precisely predict or quantify all impacts. The existing data and analysis are sufficient to evaluate the potential magnitude of impacts to water resources from estimated maximum pit dewatering rates (150 gpm) and maximum well field pumping rates (1,200 gpm). In accordance with CEQ 1502.22, the uncertainty associated with the existing data and analysis is clearly stated in the FEIS. Specifically, the FEIS provides a discussion of the area and general magnitude of potential impacts to water resources. The impact analysis is based on environmentally conservative interpretations of pump test results, analytical solutions, and computer modeling.

Comment noted. This issue is acknowledged in Section 3.16.3 of the FEIS. Please see the response to comment 1-50. Although the future success of some mitigation measures cannot be predicted with certainty, operational monitoring would determine the effectiveness of mitigation measures and would provide information to modify these measures, if necessary.

On April 24, 1996, the ADEQ adopted revisions to its surface water quality standards that are applicable to an evaluation of potential standards violations for Pinto Creek and its tributaries (e.g., Haunted Canyon). The three well field wells are completed in bedrock aquifers and have been considered as potential sources for augmenting surface water in Haunted Canyon and Pinto Creek. Available water quality data from the three well field wells (GWRC 1996) do not indicate that any violations of stream water quality standards would occur in Pinto Creek or Haunted Canyon (see FEIS Table C4-1). However, mitigation has been added (WR-4) to assure protection of surface water quality from augmentation flows.

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upward hydraulic gradient" in the leach pad area. Also on page 207 the DEIS states that there is a potential for flow from surface to bedrock. This interaction between groundwater and surface water increases the potential for contamination of the bedrock aquifer at the leach pad site.

1-53 Pit dewatering projections are provided in the DEIS. These yield calculations are unreliable because of the complexity of geologic conditions in the site vicinity. In addition, the DEIS (p. 229) states that impacts to groundwater levels and to groundwater quality have not been technically evaluated for the Top-of-the-World community.

1-54 The potential impacts to groundwater and surface water for Top-of-the-World and any other nearby residents, as well as any Tribal uses of water, should be evaluated thoroughly. We suggest that piezometer or wells not only be monitored between the project site and Top-of-the-World, but that residents' wells also be monitored for baseline water quality and groundwater levels. These wells should also be monitored at intervals during project operations. Given the complex geology of the bedrock in this area, production wells could be affected by blasting and drawdown in a non-uniform

1-55 pattern. Mitigation for impacts to water supplies in wells include deepening or replacing wells. Carlota should commit to compensating well owners for any increases in pumping or operating costs that such mitigation would involve.

Magma's Pinto Valley Mine water supply consists of over 50 production wells, some of which are located within the Carlota

1-56 Project's zone of influence. Magma's well pumping data have not been analyzed for this EIS, but we understand that the data are available. Analysis of current and past pumping rates and groundwater levels are necessary for determining cumulative impacts as well as setting up a baseline to be used in the future to determine mitigation methods and parties responsible for that mitigation. The revised or supplemental DEIS should discuss how impacts from the Carlota project would be distinguished from those resulting from other sources and how responsibility for mitigation would be assigned.

Mitigation measure WR-4 indicates that water conservation measures would be implemented during dry periods or if

1-57 significant reductions in stream baseflows were observed. The revised or supplemental DEIS should identify specific water conservation measures that would be implemented for the project and should describe how those measures would affect operations at the facility.

The DEIS (p. 182) states that for Pinto Creek, "stream flows respond rapidly to intense precipitation" and that this provides

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1-51 Please see the responses to comments 1-2 and 1-16.

1-52 The text of the FEIS has been revised; water level data indicate there is a potential for surface water and ground water interaction. The water quality in the vicinity of the proposed leach pad is summarized in Table 3-45 of the FEIS for the stream reaches and Table 3-46 for the bedrock and alluvial ground water. Ground water/surface water interactions for Powers Gulch, which include the proposed leach pad area, are discussed in Section 3.3.1 of the FEIS. The water quality database is limited with respect to temporal changes (e.g., year-round) in ground water/surface water interactions, but does indicate minimal spatial ground water/surface water interactions.

1-53 In Section 3.3.2.1, the DEIS and FEIS clearly outline the uncertainties regarding the predicted yield and drawdown pattern associated with dewatering for the open pits. However, the description of potential impacts associated with dewatering (i.e., "the drawdown impacts would not extend farther than 1 to 2 miles from the perimeter of the Carlota/Cactus Pit") is based on conservative assumptions regarding the general overall hydrogeologic conditions in the vicinity of the open pits.

1-54 Residents' wells in the Top-of-the-World community are used for domestic water supply and are therefore pumped on an irregular, as-needed basis. It would be very difficult, or perhaps impossible, to separate drawdown from domestic pumping and drawdown from the mining activities. The objective of the monitoring program is to track the margin of the cone of depression created by pit dewatering before any impacts occur to water levels in the community. Monitoring a set of piezometers placed between the residential wells and the mine dewatering wells (as outlined in Section 3.3.4.1 of the FEIS) is intended to accomplish this goal. No change in water quality is anticipated to the Top-Of-the-World wells. No Tribal water are known to exist within the surrounding area.

1-55 Carlota has indicated a willingness to mitigate impacts to private well owners caused by their operations. The Forest Service included this information in mitigation measure WR-7 to show the intent as expressed by Carlota. The Forest Service has no authority to mitigate impacts occurring off National Forest System lands. The analysis has indicated this impact is speculative, rather than predicted. The Forest Service has addressed this issue by requiring the monitoring plan to track the margin of the cone of depression to keep well owners informed of conditions.

1-56 Available information on water supply wells, pumping, and pit dewatering activities at BHP Copper's Pinto Valley Mine is summarized in Section 3.3.3. of the FEIS.

1-57 FEIS Section 2.1.4.2 identifies methods for applying leach solution to

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the leach pad, including the use of drip lines during dry periods to reduce water requirements. Design features included in the proposed action and mitigation measures for protection of air quality (FEIS Section 3.1.4) would reduce the mine's water requirements through the addition of dust palliatives (such as magnesium chloride) on the unpaved mine roads, which would reduce the amount of water required for dust control. Additionally, floating covers on SX/EW tanks intended to reduce S04 emissions would also reduce evaporative losses. In FEIS Section 3.3.4.1, mitigation measure WR-8 identifies that the mine will submit a water conservation plan that includes the features identified above for approval by the Forest Service.

1-58 "high-energy conditions for sediment transport". Because flows in Pinto Creek would suffer a reduction in flow (p. 215), deposition of sediments in the channel may pose a problem for potential mitigation measures and future flows. The revised or supplemental DEIS should address this.

1-59 The DEIS (p. 219) states that the channel dynamics for Pinto Creek would remain "relatively unaffected" by the proposed diversion. This should be substantiated in the revised or supplemental DEIS. The flow regime would be changed, and this would alter channel dynamics.

Mine Rock Characterization and Disposal

1-60 Acid drainage from mine sites is of great concern to EPA because it can severely degrade water quality. The revised or supplemental DEIS should discuss in further detail the results of the acid generation/neutralization tests for overburden and pit walls. An adequate number of samples should be analyzed using static and, if needed, kinetic tests. Data from these tests should be provided in the revised or supplemental DEIS, as well as any relevant information from past mining in the area. Geologic characterization with respect to acid potential/neutralization potential is necessary in order to predict potential impacts and develop a mine rock handling and disposal plan and a closure/reclamation plan for the site. For example, mines with only one percent acid-generating mine rock have caused acid mine drainage problems in groundwater and surface water. Forest Service oversight and enforcement of a sound mine rock characterization and disposal plan are critical to ensure protection of water quality if there is acid potential at this site. However, we are also concerned that, without accurate **baseline** data at this stage of the project regarding the acid potential of mine rock, appropriate design of the mine rock piles could be neglected. For example, if mine rock would potentially be acid-generating, lining a dedicated mine rock pile with appropriate material (e.g., crushed limestone) to preclude infiltration into groundwater could be needed, particularly in light of the complex hydrogeologic conditions.

1-61 We understand that the Forest Service would not approve the Plan of Operation (POO) until a thorough mine rock characterization and disposal plan has been completed and incorporated into the POO. The revised or supplemental DEIS should include the mine rock characterization and disposal plan as well.

The plan should specifically prescribe and discuss the frequency and type of mine rock sampling, testing methods to be used, criteria for determining when different methods are appropriate,

1-58 The channel system in the Carlota project area has excess sediment transport capacity in relation to the sediment supply (Simons Li and Associates 1993). Sediment transport and deposition over most of these channel cross-sectional areas would not be significantly affected by any baseflow reductions, and low-flow channel sections would be incorporated into the design. There are concerns about sediment transport, aggradation, and flow conditions in the proposed diversions, but these are primarily diversion design issues at high flows, for which mitigation is recommended in the FEIS (WR-13). Flow reductions are not likely to create adverse transport or conveyance conditions along natural portions of the streams.

1-59 This statement indicates that "with adequate hydraulic design and implementation, the diversion hydraulics would remain similar to existing conditions as would the sediment transport capacity." Past studies (SLA 1993) demonstrate the achievability of such adequate design and implementation. However, diversion designs are not yet finalized; therefore, mitigation is recommended to ensure implementation of a reliable final design (WR-13).

1-60 Section 3.3.4 of the FEIS has been modified (mitigation measure WR-10) to include Carlota's commitment to sample and test mine rock materials during mining and to develop materials handling plans as specified under the ADEQ's Aquifer Protection Permit. Continual testing as mining proceeds and development of appropriate handling strategies should further minimize potential impacts to surface or ground water. Please see the response to comment 3-10.

1-61 Carlota's commitment to mine rock characterization and materials handling plans has been added to the FEIS, as stated in the response to comment 1-60.

Letter 1 Continued

and requirements for reporting test results. Acid-generating mine rock should be completely surrounded and well mixed with neutralizing material. The plan should describe how the appropriate mixing ratio of neutralizing rock to acid-generating rock would be determined for complete isolation/ neutralization of acid-generating rock.

1-62 The revised or supplemental DEIS should discuss in greater detail the backfilling of the Cactus/Carlota and the Eder pits. Specifically, the revised or supplemental DEIS should identify the groundwater equilibrium elevations in the pits and final mine rock backfilling depths. The revised or supplemental DEIS should discuss the potential for groundwater contamination resulting from acidic conditions and/or heavy metals associated with the submerged portion of the mine rock disposed of in the pits. The mine rock characterization and disposal plan should identify any specific methods for disposing of mine rock in the Eder pits.

1-63 According to the DEIS (p. 60), surfaces would be contoured to encourage infiltration and discourage ponding. However, if significant amounts of acid-generating mine rock are disposed of in mine rock piles, we recommend that the mine rock piles be situated and contoured to minimize infiltration of meteoric water, including during the period of operation. The cap should be of low permeability (with a hydraulic conductivity of no more than 1×10^{-6}cm/second) and adequate thickness beneath the growth medium layer. If mine rock is improperly placed in the dumps so that acid drainage is generated, maintenance of the mine rock dump, cap, or collection and treatment facilities could be required indefinitely.

Monitoring

Groundwater flow pathways in the project vicinity are complicated by a broad variation of bedrock types, a complex pattern of fracturing, and numerous fault zones. According to the DEIS (p. 192), "the hydraulic properties within each monitoring well are undoubtedly heterogeneous (different from one segment of the well to another) and strongly anisotropic (different in different directions)." Furthermore, Figure 3-15 (DEIS, p. 195):

> "indicates that the hydraulic potential exists for ground water to flow from the higher elevation ridges toward, and down the axis of, the principal drainage features (Pinto Creek and Powers Gulch). This implies, however, that the bedrock unit behaves as a single hydrogeologic unit, which may or may not be the case....Observations during drilling also provide evidence that the bedrock complex may be

Response to Letter 1

1-62 The evaluation of pit water quality presented in Section 3.3.2.1 of the FEIS includes an evaluation of potential releases of constituents from submerged backfill.

1-63 The stormwater control system discussion in the FEIS (Section 2.1.5.5) has been modified to incorporate the BMPs for controlling surface runoff that are proposed in the SWPP, the SCHMM, and the NPDES permit application. The mine rock disposal areas would have upgradient interceptor ditches to convey runoff from undisturbed areas to natural drainages. The tops of the mine rock disposal areas would be graded away from embankment crests to prevent runoff from flowing over and infiltrating into disposal area faces. Although limited temporary ponding may occur on the tops of the disposal areas, the compacted nature of the tops of the mine rock disposal areas would not encourage infiltration. Reclamation of the mine rock disposal areas would include ripping the flattened top surfaces to a depth of 4 feet and recontouring to form a roughened seedbed. This would discourage water from ponding and encourage infiltration of rainfall (meteoric water) into the upper 4 feet of material to enhance revegetation. This activity would not encourage infiltration beyond the upper 4-foot zone.

compartmentalized and may not behave as a single continuous bedrock aquifer."

We believe that the water quality of such a bedrock aquifer could prove extremely difficult to monitor with reliability. Contaminated groundwater could also prove difficult to clean up. 1-64 The revised or supplemental DEIS should discuss how groundwater in the project vicinity would be reliably monitored and effectively cleaned up should the facility leak.

1-65 A detailed water quality monitoring program, including a quality assurance project plan, is needed for the proposed Carlota mine. The plan should be provided in the revised or supplemental DEIS. EPA will work with the Forest Service to develop a plan consistent with the NPDES requirements.

The plan should describe procedures for monitoring and reporting on the functioning of the mine rock dumps in controlling contact between mine rock and surface or meteoric water (e.g., maintenance of runon/runoff channels and collection areas at base of dumps; ponding on top of dump; etc.).

The plan should describe water quality monitoring and reporting requirements, as well as the Forest Service's implementation monitoring procedures and enforcement mechanisms should Carlota fail to properly follow the mine rock characterization and disposal plan. We believe that routine Forest Service oversight of Carlota operations is critical to proper implementation of the plan.

1-66 The revised or supplemental DEIS should discuss the type of monitoring would be conducted at the 10,000- and 7,900-gallon sumps to assure that they do not overflow.

Air Quality

1-67 The draft EIS contains a discussion of General Conformity but this discussion does not satisfy the general conformity requirements as detailed in 58 Federal Register 63214 (November 30, 1993). The conformity determination can be attached to the EIS as an appendix or it can be a separate document. The draft conformity determination should contain a detailed quantification of the annual emissions for those pollutants or pollutant precursors that are subject to conformity determinations (i.e. those pollutants or pollutant precursors for which the geographic area does not meet the National Ambient Air Quality Standards). If the annual level of emissions are equal to or exceed the de minimis levels in the rule (see section 93.153(b)) or are regionally significant (see section 93.152), then a conformity

1-64 A solution recovery pumpback system and a leak detection system are part of the proposed action, as discussed for the process ponds in Section 2.1.3.2 of the FEIS and Section 3.2.3 of the SCHMM Plan (Carlota 1996a). The FEIS text has been revised in regard to collecting and recirculating alluvial underflows beneath the leach pad, in accordance with the SCHMM Plan, (Carlota 1996a). A ground water monitoring plan has been developed by Carlota (GWRC 1996a) in coordination with the Forest Service and ADEQ, and contains conditions regarding water monitoring locations and frequency, alert levels, and contingency response. Current closure and post-closure approaches are spelled out in Sections 2.1.9, 3.3.2, 3.3.4, and 3.4.2 of the FEIS, and in the Plan of Operations and Reclamation and Closure Plan. In addition, development of detailed closure and postclosure plans to eliminate any reasonable probability of discharge or exceedances is a requirement of ADEQ's Aquifer Protection Permit. Also, see response to comment 1-81.

1-65 Water quality monitoring is specified in the ADEQ Aquifer Protection Permit requirements and in the water monitoring plan developed by Carlota (GWRC 1996a). Water quality monitoring also would be specified for discharges of runoff from mine rock areas in an NPDES permit. The monitoring program is summarized in Section 3.3.4.1 of the FEIS. Construction is addressed in the heap leach pad design report and associated appendices (Knight Piésold 1996a). Project reporting and enforcement would be addressed as part of construction and permitting requirements. The final Plan of Operations would include a project QA/QC protocol.

1-66 As described in the ADEQ Aquifer Protection Permit, all operational pump systems would be inspected on a weekly basis to ensure they are in proper operating condition and that there is no evidence of leakage.

1-67 The Conformity Determination has been revised and formalized, and has undergone the appropriate level of public and agency review.

Letter 1 Continued

determination must be made before a Federal agency can take action on a project.

1-68 The draft conformity determination must be made available for comment to EPA, the state air quality agency, any relevant local air quality agency, and any affected Federal Land Managers. A public notice also needs to be made to inform interested parties that a draft conformity determination is available for review (see sections 93.155 and 93.156). These agencies and the public have up to 30 days to provide comments on the draft determination. It is the responsibility of the Federal agency taking the action to respond in the final conformity determination to all comments received. Once a final determination has been made, the Federal agency must notify the appropriate air quality agencies and EPA regional office, as well as the general public, within 30 days. As mentioned above, a final conformity determination must be made before a Federal agency can take action on a project.

According to the DEIS (p. 139), it was estimated that the 24-hour Prevention of Significant Degradation (PSD) increment for particulates would be exceeded in the Superstition Wilderness, a

1-69 Class I airshed, as a result of project emissions. The DEIS discussion (p. 139) of PSD impacts from particulates is confusing. It is unclear how particulate concentration estimates were calculated. Furthermore, the reasons why "actual particulate impacts should be lower than estimated values and could be lower than the PSD particulate increment" are unclear (DEIS, p. 139). The revised or supplemental DEIS should provide a detailed discussion of the modelling analysis for particulates in the Superstition Wilderness. In Class I areas, the 24-hour PM10 increment is 8 $\mu g/m^3$, and the annual PM10 increment is 4 $\mu g/m^3$. The modelling analysis and the revised or supplemental DEIS should address increments in terms of PM10 rather than particulates.

The State Implementation Plan (SIP) requires that Arizona Department of Environmental Quality protect national standards and PSD increments. If PM10 emissions from the project would result in exceedences in the Superstition Wilderness, the SIP may require the State to mitigate these impacts through more stringent emission reductions from this project or others that are affecting the Class I area. EPA will recommend that the State address the increment exceedences by requiring additional reductions to the Carlota project or other sources in the area.

1-70 The Forest Service should work with Carlota and ADEQ to develop additional mitigation measures to ensure that PSD increments are not exceeded in Superstition Wilderness. The revised or supplemental DEIS should describe and discuss the additional

Response to Letter 1

1-68 Please see the response to comment 1-67.

1-69 PSD increments do not apply to the Carlota Project (the source is classified as a minor source under the PSD regulations).

The comparison of expected air quality impacts at the Superstition Wilderness to the PSD increments is presented in the FEIS as a method of assessing the significance of impacts from the project (e.g., this comparison is not a strict regulatory requirement). For this comparison, expected impacts are compared directly with Class I increments (i.e., background concentrations are not included in the comparison). No Class I increments were exceeded.

The emissions inventory and modeling analyses developed for the Carlota Project meet federal technical requirements, and the results of these technical analyses are presented accurately and completely in the FEIS.

1-70 Please see the response to comment 1-69.

1-70 mitigation measures that would be required to reduce impacts such that the PSD increment is not exceeded.

Air Quality-Related Values (AQRVs) are those special attributes of a Class I area that deterioration of air quality may adversely affect. Visibility is a sensitive AQRV in the Superstition Wilderness and directly related to particulate emissions. According to the DEIS, modelling showed the project could adversely affect visibility in the Superstition Wilderness, a Class I airshed. Visibility by Observer 4 (as depicted in Figure B2-4), located in the Superstition Wilderness, could be reduced by 0.5 to 18 percent, which we believe is a significant impact. However, it appears that visibility could be reduced even further 1-71 depending on the observer's location and orientation. Mitigation measures should be required to reduce visibility degradation to below a level of perceptibility.

1-72 The revised or supplemental DEIS should substantiate the assumption for a 38 percent pit retention of PM10 emissions which is indicated in the notes at the bottom of Table 3-17 (p. 138).

The DEIS indicates that H_2SO_4 impacts at the Top-of-the-World subdivision (approximately 4 km south of the tank house) are expected to be below the health-based Ambient Air Quality 1-73 Guideline levels. The revised or supplemental DEIS should discuss whether there are receptor sites closer than 4 km to the heap leach pad or tank house and, if so, provide estimated emissions at those receptor sites.

1-74 According to the DEIS (p. 135), emissions of sulfuric acid from the leach pad would be reduced by conducting the ore conditioning in a shrouded area, which should reduce wind effects to negligible levels. Table 3-14 indicates that the efficiency of the shrouds is unknown. The revised or supplemental DEIS should describe how the area would be shrouded.

Closure, Reclamation and Post-Closure Care

1-75 We agree with the Forest Service that the closure plan should have the ability to be modified as new technologies for closing mine facilities and controlling releases are developed. However, we believe that it is important that the closure plan approved at this stage of the project assume reasonable closure scenarios (i.e., they would plan for complications such as the need for leachate treatment) so that closure costs are realistic. 1-76 We concur with the DEIS that additional closure and reclamation bonding is necessary. The revised or supplemental DEIS should include a discussion of the revised bonding estimates. In addition, we agree that financial assurance must be made for

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1-71 Visibility impacts have been remodeled and reassessed. In addition, mitigation measures and monitoring have been required in order to ensure that visibility impacts from the proposed project meet the Forest Service Region 3 Limits of Acceptable Change and the Tonto National Forest's visibility objective (see Section 3.1.2 of the FEIS).

1-72 Pit retention was not included in the revised modeling analysis for the FEIS and, as a result, PM_{10} impact estimates are more conservative in nature.

1-73 In the FEIS, the discussion of impacts from H_2SO_4 emissions from the project includes impacts at the maximum receptor as well as at other receptors of interest (including Top-of-the-World).

Note: There is no NAAQS for H_2SO_4. See Section 3.1 of the FEIS for applicable regulations/standards that apply to H_2SO_4 emissions from the proposed project.

1-74 Emissions of sulfuric acid from the ore conditioning would be reduced by using a fully covered conveyor belt that should reduce wind effects to negligible levels. In addition, a concentrated acid solution with low-pressure sprays would be used to minimize the potential for acid mist to escape the ore conditioning system.

1-75 The bond would reflect the most current, reasonable closure scenario. The Forest Service has the authority to revise bonding requirements throughout the life of the project, if necessary.

1-76 The bond estimates will be determined through definition of specific measures and the associated costs. The bond will be adjusted if any reclamation or closure objectives change throughout the life of the project. Please see mitigation measure SR-8.

Letter 1 Continued

long-term operation and maintenance of permanent project features. 1-77 If the heap cannot be adequately neutralized at the time of closure, the Forest Service should have provisions in place that require post-closure monitoring and operation and maintenance of the heap, pumpback and/or treatment system, diversion channels, underdrain system, and other necessary facilities in perpetuity. Based on our experience with inactive and abandoned mines in Arizona, we believe it is critical that these systems be maintained to prevent structural failure and a release of contaminants into the environment.

1-78 There is a strong potential for release of contaminants to the environment during operations and after closure. It would be Carlota's responsibility to control and remediate such a release, and we believe it is essential that a trust fund be obtained by the Forest Service **at the beginning of the project** for this contingency. In order to develop the appropriate bond amount, an engineering analysis of potential releases and appropriate remedial action is necessary. The chemistry of potential leachate releases from the leach pad and other site facilities and projected water balance calculations are necessary for this analysis. For example, if pumpback systems would be used, the potential exists for a surplus of water to be handled. If leachate would be treated and discharged, type of treatment would need to be determined. The alternatives for remediation should be assessed and costs should be estimated in the revised or supplemental DEIS. This is an operational cost that must be factored into Carlota's overall project budget. The POO and revised or supplemental DEIS should include a commitment that this bond would be obtained. We urge the Forest Service to require the fund to be secured up front rather than in installments during operations. Should the project close prematurely because of environmental releases, the entire fund may be needed for remediation.

1-79 According to the DEIS (p. 64), performance monitoring would be conducted for one year following the end of plant operations. It is unclear what this performance monitoring addresses. We believe that monitoring could be required for a much longer period (possibly in perpetuity) particularly in light of the uncertainties associated with post-closure impacts and the need for indefinite post-closure maintenance.

According to the DEIS soil erosion rates on the reclaimed leach heap would be extremely high. Erosion rates on reclaimed leach heap side slopes could reach 20 to 30 tons per acre per year. If capping and covering the leach heap is a primary means of precluding meteoric water from the heap and preventing acid drainage and metals contamination from entering groundwater and

Response to Letter 1

1-77 A revised monitoring and mitigation program for surface water and ground water is summarized in Section 3.3.4 of the FEIS. As stated in the FEIS, water quality monitoring would continue in the postmining period until it has been demonstrated that potential risks from the project have been minimized. Mitigating any release of leachate from the heap is also addressed in Section 3.3.4 of the FEIS and would be the same regardless if the release occurred during operation or after mining ceases. Also, see the response to comment 1-65.

1-78 Based on Forest Service regulations, only certain bonding instruments are acceptable for reclamation. These include corporate sureties, deposited securities, cash, irrevocable letters of credit, or assignments of savings accounts.

The chemistry of pregnant leachate solution is presented in Appendix C of the DEIS and FEIS. The postclosure water balance for the heap was estimated using the Hydrologic Evaluation of Landfill Performance (HELP) model (Carlota 1994) and is incorporated by reference into the FEIS in Section 3.3.2.

1-79 Please see the response to comment 1-77.

surface water, erosion of the cap/cover would be unacceptable. 1-80 The revised or supplemental DEIS should include appropriate measures to mitigate for high erosion rates.

The reclaimed leach heap would be capped and covered with a 12-inch "restrictive layer" of low-permeability material, three feet of mine rock, and 12 inches of topsoil, and reseeded with grasses and shrubs. 1-81 The revised or supplemental DEIS should discuss the makeup and permeability requirements of the "restrictive layer." If this layer is to preclude infiltration of meteoric water, we recommend that the permeability of the cap have a hydraulic conductivity of no greater than 1 x 10^{-7} cm/second. 1-82 In addition, the revised or supplemental DEIS should discuss how infiltration potential would be affected by tap roots, burrowing animals, or other forces over time. 1-83 However, the revised or supplemental DEIS should analyze how this cap would be compatible with a pumpback system should one be needed after project closure.

1-84 The settling bowls on the lower edges of the leach heap (discussed on page 64 of the DEIS) should be designed to preclude any infiltration of standing water into the spent ore.

1-85 The revised or supplemental DEIS should include revegetation success criteria and contingency measures for reclamation of the leach heap. Vegetation success should be monitored for at least five years before the bond is released for this activity.

Biological Resources

The proposed project would result in significant impacts to the Arizona Hedgehog Cactus (Federally endangered). We understand that the Biological Opinion, in preparation by the U.S. Fish and 1-86 Wildlife Service, is due to be released at the end of June. We recommend that the revised or supplemental DEIS include the biological opinion as an appendix and that all reasonable and prudent measures for protecting the Arizona Hedgehog Cactus be fully discussed.

Cultural Resources

According to the DEIS (p. 313), the proposed project would result in significant impacts to cultural resources. Eighty-seven prehistoric and historic sites were recorded in the Carlota Project area, which encompasses a distinct prehistoric and historic settlement area centered around Pinto Creek and Powers Gulch. Numerous sites are currently being evaluated for National 1-87 Historic Preservation Act applicability. However, mitigation measures are vague in the DEIS, and it is unclear whether the impacts could be mitigated. The revised or supplemental DEIS

1-80 Erosion protection, monitoring, and maintenance for leach pad reclamation are addressed under mitigation measures SR-4 and SR-14 in the FEIS. Determining the adequacy of revegetation and protection measures to function in the long term is one of the objectives of the monitoring and maintenance measures identified.

1-81 The restrictive layer is described in the Reclamation and Closure Plan to the Plan of Operations (Carlota 1994). The FEIS has been revised to include more detail of the restrictive layer. Hydraulic conductivity would be approximately $1x10^{-5}$ cm/sec in flat areas of the pad, varying slightly on the steeper areas of the pad due to greater runoff coeffiecients in those areas. Current specifications are presented in the heap leach pad final design document, Appendix F (Knight Piésold 1996). Such an approach to closing the leach pad represents the best technology currently available. Please also see Section 2.1.9 of the FEIS.

It should be noted that the purpose of placing additional materials on the surface of the leach pad at final closure is twofold. First, additional materials would protect process materials from rainfall energy and would substantially limit the deep percolation of free-draining meteoric water. Second, they would provide a growth medium and root zone for revegetation. Through evapotranspiration, established revegetation species would further limit the deep percolation of meteoric water into processed materials. With successful revegetation and the thickness and nature of the proposed protective layers, the amount of meteoric water at depth would be small, and it would probably be tightly held in the soil at high tensions. The plan for these materials is that they would serve as a restrictive layer, rather than as an impermeable cap.

1-82 It is possible (but improbable) that the restrictive layer could be affected by tap roots and burrowing animals; however, the extent of such an effect would likely be small. The nature of the restrictive layer and materials below it would present discouraging conditions for roots or animals. Mitigation measures are included in the FEIS to monitor and maintain the condition of the heap until reclamation is deemed successful. Any effects from plant roots or burrowing animals would be monitored during this period.

1-83 First, it is not indicated that a pumpback system other than that described in the FEIS would be necessary after closure. If, after postclosure monitoring, it is determined that additional pumpback and evaporation capabilities are necessary, they can easily be designed to

Response to Letter 1

be compatible with other heap closure features with a minimum of disturbance.

1-84 Section 2.1.9.2 of the FEIS has been modified to reflect this comment. A free-draining topography would be created in the area using suitable fill materials (e.g., suitable mine rock).

1-85 Provisions for these concerns are included in the FEIS in mitigation measures SR-10 and SR-14. A testing program, and monitoring and maintenance programs have been identified as mitigation to ensure that success criteria and contingency measures are established.

1-86 The U.S. Fish and Wildlife Service Biological Opinion is included in Appendix F of the FEIS, and mitigation measures are discussed in Section 3.5.4 of the FEIS.

1-87 As stated in the FEIS, the results of the cultural resource survey indicated that the Carlota Copper Project area encompasses a distinct prehistoric and historic settlement area that centers around the Pinto Creek/Powers Gulch area. It was also determined that all of the project alternatives would result in significant impacts to this settlement area. The Forest, in consultation with the Arizona State Historic Preservation Office, determined that archaeological mitigation measures would have to address the impacts to this settlement area rather than to the individual sites in the project area.

As a result, archaeological mitigation measures have been developed to recover information important to the understanding of the settlement system. To do this, an Historic Context Development Area (HCDA) was defined, and an overview of the heritage resource within these boundaries was prepared. The purpose of this overview was to analyze available heritage resource information to develop historic contexts important in understanding the settlement area. As described in Section 3.6.2 of the FEIS, five historic contexts were identified as being important to understanding the prehistoric settlement area, and four historic contexts were identified as being important to the understanding of the historic period settlement area. These contexts formed the basis for the National Register of Historic Places (NRHP) eligibility testing at the sites.

This testing was undertaken to determine which sites in the settlement area contained data important in understanding the historic contexts. These data had to be found in sufficient quality and quantity to be useful in understanding the contexts. Those sites found to contain

Letter 1 Continued

1-87 should discuss the status of these sites and how they would be avoided and/or mitigated.

Social and Economic Impacts

In keeping with Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (EO 12898), 1-88 the revised or supplemental DEIS should describe the measures taken by the Forest Service to: 1) fully analyze the environmental effects of the proposed federal action on minority communities and low-income populations, and 2) present opportunities for affected communities to provide input into the NEPA process. 1-89 The revised or supplemental DEIS should state whether the analysis meets requirements of your agency's environmental justice strategy.

The DEIS refers to the demographic makeup of the area on page 323. 1-90 The revised or supplemental DEIS should geographically define the "area." The location must be more specific to judge whether the significant impacts are disproportionally high or adverse for certain communities. The revised or supplemental DEIS needs to specifically identify the populations near the proposed facility, including poor and minority populations, including the Fort Apache and San Carlos tribes.

According to the DEIS (p. 341), the indirect employment resulting from the project would be 84 new jobs, representing a two percent increase in total services and trade sector employment in the Gila County area. 1-91 However, the production status of other mining projects in the area is not discussed. Therefore, it is unknown whether total direct and indirect employment would actually increase at all for the project duration. 1-92 In addition, it is unclear why only the "Gila County area" is addressed here. The Carlota site is also located in Pinal County and is close to Maricopa County as well. The revised or supplemental DEIS should address economic impacts to the appropriate area.

Response to Letter 1

such information were deemed to be eligible for the NRHP. Those sites found to contain these data classes and where those data have not been fully retrieved during the eligibility testing will be subjected to a final phase of data recovery to recover all important data classes. Table 3-63 of the FEIS has been revised to include each site's current NRHP status.

1-88 A specific section addressing Executive Order 12898 has been added to the FEIS that analyzes effects to minority communities or low income populations. Effects on low income and minority populations are discussed in Section 3.7.2.1 of the DEIS in the subsection entitled Employment and Economy. The San Carlos Indian Reservation is discussed in this section. The Fort Apache Indian Reservation is outside the study area.

FEIS Chapter 4.0 has been expanded to include additional information from the public scoping process and the Scoping Report of July, 1993 which was sent to the entire Carlota mailing list at that time. The Tonto National Forest maintains a media mailing list of approximately 350 contacts. Press releases on the public scoping and DEIS comment period meetings were distributed to the list. The list includes the Indian Development District of Arizona, the Navajo Times, KTVW-TV Spanish language station, the Asian American News, Fenix de Arizona, Prensa Hispanica, the Fort Apache Scout, Hopi Tutu-Veh-Ni, and the Moccasin of Globe. In addition, a separate Tribal Government consultation list used for the scoping process, which was unintentionally omitted from the DEIS, has been included in Chapter 4.0 of the FEIS.

1-89 The Forest Service is currently following USDA strategy, which is to meet the intent of the Executive Order using Council on Environmental Quality's Draft Guidance, which was issued in May 1996. The Forest Service is also monitoring the ongoing process in the development of Guidance for Incorporating Environmental Justice into EPA's NEPA process which was issued July 12, 1996. The analysis has attempted to meet the guidance as it has been developing.

1-90 A definition of the study area has been incorporated in Section 3.7.1 of the FEIS.

1-91 The production status of other mining operations is dictated by the market value of the commodity produced. Copper prices may fluctuate dramatically; therefore, making assumptions on the future productivity of these mines is misleading. Sections 1.6 and 3.7.3 of the FEIS address the anticipated economic and employment activity related to other mines in the area.

1-92 It is anticipated that most of the direct and indirect workers would locate in Gila County, which has a larger population base and is considered a regional trade center. There is limited housing, services,

Response to Letter 1

and facilities in Pinal County (Superior and Top-of-the-World). Therefore, most of the direct economic impacts would occur in Gila County. Additional direct and indirect economic impacts are discussed in Section 3.7.2.1 of the FEIS in the subsection entitled Government and Public Finance; this section addresses more specific economic impacts by area.

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

4 FEB 1986

REPLY TO ATTENTION OF:

DAEN-CWO-N

SUBJECT: Memorandum of Agreement (MOA) on Solid Waste Management

SEE DISTRIBUTION

1. The purpose of this letter is to provide you a copy of the recently signed MOA on the interim regulation of solid waste discharges under the Clean Water Act (CWA). The agreement takes effect 23 April 1986. The intent is for the mechanism described in the MOA to continue in effect until the criteria governing implementation of Subpart D of the Resource Conservation and Recovery Act (RCRA) are revised at which time the responsibility of the program becomes the sole purview of the Environmental Protection Agency (EPA) and the affected states.

2. The primary mechanism for controlling both proposed and unpermitted discharges of solid waste into waters of the United States will be an EPA-issued administrative order or complaint under Section 309 of the Clean Water Act (paragraphs B.1. and 2.). We are committed to assisting EPA in developing appropriate conditions for their administrative orders, especially when the principal effect of the discharge is physical (e.g., changes in hydrology or land form).

3. In the limited situations where it is necessary to process a permit application (paragraph B.3.), the MOA requires a case-by-case determination of whether the discharge is regulated more appropriately under Section 402 or 404 of the CWA. The MOA is built upon the premise that the districts and regions can and will cooperate in an effective manner. The 402/404 determination will be based on consideration of the factors listed in paragraphs 4 and 5 of Part B of Section 309 of the CWA. Summarizing paragraph 4, it is clear that a decision will lean towards the 404 process when a discharge is a "mixed-bag" of wastes and the principal effects are physical in nature. Conversely, the 402 process is more applicable under paragraph 5 when the waste is homogeneous in consistency (e.g., fly ash and mining wastes) and the principal concern for the environment centers around contamination of ground and surface water supplies .

4. We encourage you to begin discussing the implementation of this MOA with your counterparts in the regional EPA offices. The MOA itself will be published in the Federal Register notice section in the near future. We

DAEN-CWO-N
SUBJECT: Memorandum of Agreement (MOA) on Solid Waste Management

intend to develop a regulatory guidance letter dealing with this MOA and welcome any views you have on points that need clarification. In the interim, questions should be directed to Bob Pierce of this Headquarters (DAEN-CWO-N) (272-1786).

FOR THE COMMANDER:

Encl

PATRICK J. KELLY
Brigadier General, USA
Deputy Director of Civil Works

DISTRIBUTION:
(see page 3)

January 17, 1986

MEMORANDUM OF AGREEMENT BETWEEN THE
ASSISTANT ADMINISTRATORS FOR EXTERNAL AFFAIRS AND WATER
U.S. ENVIRONMENTAL PROTECTION AGENCY
AND THE ASSISTANT SECRETARY OF THE ARMY FOR CIVIL WORKS
CONCERNING REGULATION OF DISCHARGES OF
SOLID WASTE UNDER THE CLEAN WATER ACT

A. Basis of Agreement

1. Whereas the Clean Water Act has as its principal objective the requirement "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters; and,

2. Whereas Section 301 of the Clean Water Act prohibits the discharge of any pollutant into waters of the United States except in compliance with Sections 301, 302, 306, 307, 318, 402, and 404 of the Act; and

3. Whereas EPA, and States approved by EPA, have been vested with authority to permit discharges of pollutants, other than dredged or fill material, into waters of the United States pursuant to Section 402 of the Clean Water Act that satisfy the requirements of the Act and regulations developed to administer this program promulgated in 40 CFR 122-125; and

4. Whereas the Army, and States approved by EPA, have been vested with authority to permit discharges of dredged or fill material into waters of the United States that satisfy the requirements of the Act and regulations developed to administer this program promulgated in 33 CFR 320 et seq. and 40 CFR 230 et seq.; and

5. Whereas the definitions of the term "fill material" contained in the aforementioned regulations have created uncertainty as to whether Section 402 of the Act or Section 404 is intended to regulate discharges of solid waste materials into waters of the United States for the purpose of disposal of waste; and

6. Whereas the Resource Conservation and Recovery Act Amendments of 1984 (RCRA) require that certain steps be taken to improve the control of solid waste; and

7. Whereas interim control of such discharges is necessary to ensure sound management of the Nation's waters and to avoid complications in enforcement actions taken against persons discharging pollutants into waters of the United States without a permit;

8. The undersigned agencies do hereby agree to use their respective abilities cooperatively in an interim program to control the discharges of solid waste material into waters of the United States.

B. Procedures

1. When either agency is aware of a proposed or an unpermitted discharge of solid waste into waters of the United States, the agency will notify the discharger of the prohibition against such discharges as provided in Section 301 of the Clean Water Act. Such notice is not a prerequisite for an enforcement action by either agency.

2. Normally, if an activity in B.1 above warrants action, EPA will issue an administrative order or file a complaint under Section 309 to control the discharge.

3. In issuing a notice of violation or administrative order or in filing a complaint, it is not necessary in order to demonstrate a violation of Section 301(a) of the Clean Water Act to identify which permit a permitless discharge should have had. However, after an enforcement action has commenced, a question may be raised by the court, discharger, or other party as to whether a particular discharge having the effect of replacing an aquatic area with dry land or of changing the bottom elevation of a water body meets the primary purpose test for "fill material" in the Corps definition (33 CFR 323.2(k)). For example, such question may be raised in connection with a defense, or it may be relevant to the relief to be granted or the terms of a settlement.

4. To avoid any impediment to prompt resolution of the enforcement action, if such a question arises, a discharge will normally be considered to meet the definition of "fill material" in 33 CFR 323.2(k) for each specific case by consideration of the following factors:

a. The discharge has as its primary purpose or has as one principle purpose of multi-purposes to replace a portion of the waters of the United States with dry land or to raise the bottom elevation.

b. The discharge results from activities such as road construction or other activities where the material to be discharged is generally identified with construction-type activities.

c. A principal effect of the discharge is physical loss or physical modification of waters of the United States, including smothering of aquatic life or habitat.

d. The discharge is heterogeneous in nature and of the type normally associated with sanitary landfill discharges.

5. On the other hand, in the situation in paragraph B.3., a pollutant (other than dredged material) will normally be considered by EPA and the Corps to be subject to Section 402 if it is a discharge in liquid, semi-liquid, or suspended form or if it is a discharge of solid material of a homogeneous nature normally associated with single industry wastes, and from a fixed conveyance, or if trucked, from a single site and set of known processes. These materials include placer mining wastes, phosphate mining wastes, titanium mining wastes, sand and gravel wastes, fly ash, and drilling muds. As appropriate, EPA and the Corps will identify additional such materials.

6. While this document addresses enforcement cases, prospective dischargers who apply for a permit will be encouraged to use the above criteria for purposes of project planning. If a prospective discharger applies for a Section 404 permit based on the considerations in paragraph B.4., or for a Section 402 permit based on the considerations in paragraph

B.5., the application will normally be accepted for processing. If a prospective discharger applies for a 404 permit for discharge of materials that might be hazardous, he shall be advised that discharges of wastes to waters of the United States that are hazardous under RCRA are unlikely to comply with the Section 404(b)(1) Guidelines. To facilitate processing of applications for permits under Sections 402 or 404 for discharges covered by this agreement, an application for such discharge shall not be accepted for processing until the applicant has provided a determination signed by the State or appropriate interstate agency that the proposed discharge will comply with applicable provisions of State law including applicable water quality standards, or evidence of waiver by the State or interstate agency. As mandated under the Clean Water Act, neither a 402 nor a 404 permit will be issued for a discharge of toxic pollutants in toxic amounts. Prospective applicants for Section 402 permits shall be advised that the proposed discharge will be evaluated for compliance with the Act, in particular with Sections 101(a), 301, 303, 304, 307, 402, and 405 of the Act.

C. Determination of Permit

1. In enforcement cases, where a question arises under paragraph B.3 as to which permit would be required for a permitless discharge, the enforcing agency will determine whether the criteria in paragraph B.4 or B.5, if either, have been satisfied, with concurrence from the other agency. If the enforcing agency concludes that neither set of the criteria has been met and additional analysis is required to determine which Section applies, or if the necessary concurrence is not forthcoming promptly, the Division Engineer and the Regional Administrator (or designees) will consult and determine which permit program is applicable.

2. In non-enforcement situations, the agency receiving an application shall determine whether it meets the criteria in paragraphs 4 or 5, as the case may be. If the agency determines that the criteria applicable to its permit program have not been met, it will ask the other agency to determine whether the criteria for the latter's permit program have been met.

Letter 1 Continued

EPA/Corps of Engineers MOA on Solid Waste

° The MOA provides a mechanism for controlling proposed and unpermitted discharges of solid waste into Waters of the United States.

° It takes effect on April 23, 1985, and continues in effect until criteria governing implementation of Subtitle D of RCRA are revised (State and Regional Solid Waste Plans). At that time the responsibility goes to EPA or to States with delegated RCRA authority.

° Discharges will be covered under either §402 or §404 of the Clean Water Act according to the following criteria:

<u>404</u>

- The primary purpose (or a principal purpose of a multi-purpose activity) is to replace Waters of the United States with dry land, or raise the bottom elevation.
- The discharge results from construction activities.
- A principal effect is physical loss or physical modification of a Water of the United States.
- The discharged material is heterogeneous in nature, and of the type normally associated with sanitary landfills.

<u>402</u>

- The discharged material is in a liquid, semi-liquid, or suspended form.
- The discharged material is solid and homogeneous in nature, is normally associated with a single industry, and is from a fixed conveyence (or trucked from a single site).
- Examples include various mining wastes, sand and gravel wastes, fly ash, and drilling muds.

° If there is no agreement on which type of permit is required, the Division Engineer and the Regional Administrator consult and make a determination. There is no provision for elevating a dispute beyond this point.

Letter 2

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
600 Harrison Street, Suite 515
San Francisco, California 94107-1376

May 11, 1995

ER 95/92

Mr. Paul M. Stewart
Tonto National Forest
2324 E. McDowell Road
Phoenix, AZ 85006

Dear Mr. Stewart,

Department of the Interior has reviewed draft Environmental Impact Statement (EIS) for Carlota Copper Project and offers comments and recommendations for your use in preparing further EIS documents.

GENERAL COMMENTS

Fish and Wildlife Service (Service) has several concerns
2-1 regarding this draft EIS: (1) Alternatives presented do not adequately represent reasonable alternatives to proposed action;
2-2 (2) alternatives eliminated from further study are dismissed as unreasonable without adequate explanation;

2-3 3) specific endangered species information is missing from
2-4 analysis; (4) explanations regarding many impacts are generalized or incomplete; and (5) indirect and cumulative effects are not
2-5 thoroughly addressed.

2-6 Therefore, we recommend this draft EIS be supplemented and distributed for public review and comment prior to issuing final EIS.

Purpose and need for any proposal establishes necessary foundation for complete scope of analysis and framework for alternatives. Alternatives are required by both National Environmental Policy Act (NEPA) and section 404 of Clean Water Act.

If purpose or scope of an action is too narrowly defined, alternatives ultimately analyzed become severely limited or absent. By stating in Purpose and Need for Action section that "From the perspective of the COE, the overall project purpose is

Response to Letter 2

2-1 Please see the response to comment 1-13. As stated in Section 2.2 of the FEIS, the alternatives analyzed in detail in the EIS were selected to (1) focus on the issues and concerns identified during the scoping process, (2) be technically and economically feasible, and (3) provide an environmental advantage. Because of the topography and sensitive environmental resources in the project area (e.g., threatened or endangered species, valuable surface water resources, etc.), there are limited sites available for project facilities. A mining engineer reviewed the entire project area to identify technically feasible sites for individual facilities; these sites are described in Section 2.2.2 of the FEIS. Please see also the response to comment 2-38 regarding Carlota's right to mine under the General Mining Law of 1872.

2-2 As stated in the response to comment 2-1, the physical and biological characteristics of the site limited the feasibility of implementing certain alternatives. The discussion of the individual alternatives in Section 2.2.2 has been expanded and summarizes the rationale for their elimination.

2-3 Baseline data on threatened or endangered species are provided in Section 3.5.1.1 for terrestrial species and 3.5.1.2 for aquatic species of the FEIS. The impacts to sensitive species are identified in Section 3.5.2.1 of the FEIS. The U.S. Fish and Wildlife Service Biological Opinion is included in Appendix F of the FEIS.

Letter 2 Continued

to mine and process copper in Arizona using a hydrometallurgical process to produce copper cathodes...", latitude for consideration of alternatives becomes very restricted.

As first sentence in this section indicates, purpose of this project is to mine copper. Service believes this is actual purpose of project, not Corps of Engineers' (Corps) more restrictive project purpose to mine and process copper in Arizona using a hydrometallurgical process.

2-7 This broader scope allows alternatives to be considered for mining copper anywhere worldwide using other processes that could be less environmentally damaging.

2-8 Document should include substantive and concise conclusions regarding both certain and uncertain impacts. Such conclusions should be documented by appropriate methodologies and sufficient analyses which predict, within a specified level of certainty, likelihood that an impact will or may occur.

Many impact conclusions are presently based solely on supposition and conjecture. Some are unclear or fail to indicate how an environmental attribute or component would be affected.

Cumulative impacts from other mining activities near project area have resulted in contamination and sedimentation which have degraded adjacent aquatic environments. Pinal and Mineral Creeks are examples of cumulative degradation of desert aquatic systems. Nearby mining activities have also resulted in extensive terrestrial wildlife habitat loss.

Groundwater depletion in Pinto Creek ecosystem may be directly affected by existing and proposed mining activities. Addition of contaminant discharges from adjacent mining activities has already adversely impacted Pinto Creek. Further mining activities on this aquatic system would increase the probability of long-term degradation.

Powers Gulch drainage would be completely lost due to placement of heap leach fill and would impact wildlife use and movement in this area. Location of heap leach pad is also of concern because riparian resources in Haunted Canyon are located directly downstream of heap leach pad.

Predicted changes in water quantity as a result of this project are considerable. Combined water quantity reductions due to ground water pumping near Haunted Canyon, pit dewatering, and adjacent mining facilities would likely result in detrimental effects to stream habitats outside proposed project area.

Mitigating or supplementing these flow reductions may be largely ineffective because added volume would not necessarily fully

Response to Letter 2

2-4 Where additional information has become available since the preparation of the DEIS, the analysis of impacts has been expanded for individual resources in the FEIS. More specific comments regarding these issues are addressed in subsequent responses to this letter.

2-5 Several commentors wanted the EIS to disclose more specific or quantified impacts considered in the cumulative impact analysis. The Globe-Miami and Superior areas constitute one of the major mining areas in the U.S. with activity occurring for over 100 years. A considerable number of companies have conducted, or are currently conducting, operations in this area. The Forest Service interdisciplinary team sought all relevant and available information from regulatory, permitting, and public sources. However, specific information is not always available for proprietary or other legal reasons. It is not reasonably possible to provide a complete accounting for all potential impacts from the other interrelated projects. This disclosure of the limits of available information is consistent with NEPA. The cumulative impact analysis is an informed and reasonable analysis of the probable effects.

2-6 Comment noted. Please see the response to comment 1-5.

2-7 Off-site alternatives are outside the scope of the decision to be made on this proposed action. Carlota has proposed a process about which it is knowledgeable and has experience. It is not reasonable for the EIS to consider alternative copper processing technologies about which Carlota has neither a conceptual design nor experience.

2-8 The Forest Service has documented the specific methodologies upon which the impact analyses were based, where applicable, and the level of certainty associated with the prediction of impacts.

compensate for reductions in surface flows. Moreover, contaminant effects on this ecosystem resulting from short- or long-term pollutant discharges are a concern.

Although it appears measures have been taken to prevent discharge of pollutants, it seems unlikely that a 50-year liner would safely contain numerous toxic processing by-products long-term.

This proposed mining activity would have significant, adverse impacts on valuable terrestrial and aquatic biological resources, including special aquatic sites (i.e., riffle and pool complexes) as defined by Environmental Protection Agency (EPA) 404(b)(1) Guidelines (Guidelines).

According to these Guidelines, mining is not a water-dependent activity, and accordingly, they state that practicable alternatives that do not involve special aquatic sites are presumed to be available, unless clearly demonstrated otherwise.

Furthermore, Guidelines stipulate that no permit shall be issued if a proposal causes or contributes to violations of any applicable State water quality standards or results in significant degradation.

Service has consistently expressed these concerns to Forest Service and Corps staff throughout our involvement in this proposed project. To date, we believe that Carlota has yet to clearly demonstrate lack of practicable alternatives to proposed mining activity in Pinto Creek.

An example of a site alternative, according to Appendix A, draft EIS, is "Negotiations with the lessor of the White Mesa property are continuing, and a formal offer has been accepted pending
2-9 renegotiation of the terms of the current lease."

If it is clearly demonstrated that proposed project would not cause or contribute to violation of any applicable State water quality standard or result in significant degradation, and that practicable alternatives that do not involve special aquatic sites are not available, Service would work cooperatively to assist in development and implementation of an appropriate mitigation plan.

Although draft EIS identifies specific mitigation measures for certain impacts, others are unclear or absent. DEIS addresses mitigation of fish and wildlife losses in concept only.

2-10 A mitigation plan, acceptable to Service and Arizona Game and Fish Department, should be developed and incorporated into draft EIS. We are particularly concerned with structure to be devised to assure that long-term monitoring of impact mitigation is funded and accomplished, and this site is adaptively managed.

3

2-9 Please see the responses to comments 2-1 and 2-39 regarding the analysis of alternatives.

2-10 The aquatic and wildlife mitigation described in Section 3.5.4 of the FEIS is a summary of the complete Biological Monitoring and Mitigation Plan for the Carlota Copper Project (Cedar Creek Associates, Inc. 1996a), which is incorporated by reference and is available for review at the Tonto National Forest Supervisor's Office.

Please see the responses to comments 1-45 and 1-46.

Letter 2 Continued

Responsibility to fund, continue, and use monitoring results and make changes in mitigation over time as needed should be spelled out in some detail. We would be pleased to work with you specifically on these issues should you desire.

DEIS indicates that endangered Arizona hedgehog cactus (*Echinocereus triglochidiatus* var. *arizonicus*) would be adversely affected by proposed action.

In a letter dated April 24, 1995, Forest Service determined that endangered lesser long-nosed bat (*Leptonycteris curasoae verbabuenae*) and endangered bald eagle (*Haliaeetus leucocephalus*) may be affected by proposed action and asked that these species be added to formal consultation currently in progress.

2-11 Results of above referenced section 7 consultation should be incorporated into document.

2-12 Paragraph 4, page 305. DEIS states, "That riparian loss associated with dam modifications has been mitigated and has resulted in improvements to riparian habitat." This is not documented in draft EIS.

2-13 Section 404, Alternatives Analysis, Appendix A. DEIS identifies alternatives in this appendix as unreasonable. Document does not clearly or thoroughly discuss rationale for this decision. It is essential to demonstrate why these alternatives are not practicable under Guidelines.

Since Corps perceives a much narrower "overall" project purpose for proposal, it becomes much simpler to dismiss alternatives which would fulfill "basic" project purpose.

According to Appendix A, there are at least four potential practicable alternatives; White Mesa, Coppercrete, Little Hills, and Shakespeare properties. Furthermore, it is our understanding that applicant owns and intends to develop all of these holdings.

The National Park Service has concerns about proposed project's potential adverse environmental effects and irreversible and irretrievable commitments of resources.

2-13A There are potential air quality impacts to Tonto National Monument, downstream of the proposed project. Analysis indicates that project has potential to violate National Ambient Air Quality Standards for fine particulate matter (PM-10) at Tonto National Monument.

Response to Letter 2

2-11 The U.S. Fish and Wildlife Service Biological Opinion is included in Appendix F of the FEIS.

2-12 Mitigation of riparian loss associated with dam modifications relates to Roosevelt Dam on the Salt River north of the project area. Please refer to Section 3.5.3 for a complete description of the interrelated actions considered in the cumulative impact analysis.

2-13 Section 4.0 of Appendix A of the DEIS describes the rationale for alternative locations for the Carlota/Cactus open pit, leach pad, and mine rock disposal areas as they relate to Section 404 Dredge or Fill issues. Section 5.0 summarizes the rationale for each alternative.

2-13a The DEIS presented a modeled exceedance of the PM_{10} NAAQS at the project area boundary. PM_{10} impacts at the Tonto National Monument were shown to be significantly below the NAAQS at the Monument. Furthermore, the project has been remodeled, and compliance with NAAQS at the project boundary has been demonstrated. See also the response to comment 5-3

2-13B It will also cause a violation of Prevention of Significant Deterioration (PSD) Class I PM-10 increment at nearby Forest Service Superstition Wilderness Area.

2-14 Visibility analysis was performed using EPA PLUVUE II model. PLUVUE II model is appropriate for a coherent plume impact, but not appropriate for addressing regional haze.

To address regional haze impacts, we recommend EIS apply Workgroup on Air Quality Modeling (IWAQM) Phase 1 Report: Interim Recommendation for Modeling Long Range Transport and Impacts on Regional Visibility (EPA-454/R-93-015, April 1993).

In IWAQM regional haze calculations PM-10, sulfur dioxide, and sulfuric acid mist impacts should be used. Sulfuric acid mist will likely form sulfate particles when transported downwind.

NPS considers any deciview change greater than 1.0 to have a noticeable change on visual range and is generally unacceptable.

2-15 Since mining activity will be a 24-hour operation, we urge that effects on night sky be addressed. These impacts can be mitigated through use of shielded lighting, low pressure sodium vapor lamps, and other measures.

Further information on reducing light pollution to dark skies can be obtained through International Dark-Sky Association, Tucson, Arizona.

Pinto Creek, from north of Layton Ranch to lower end of Pinto Box, is listed on Nationwide Rivers Inventory (NRI).

NRI includes rivers selected on basis of degree to which they are free-flowing, degree to which rivers and their corridors are undeveloped, and outstanding natural, cultural and recreational characteristics of rivers and their immediate environments.

Purpose of NRI is to provide information to assist with balanced decisions regarding utilization of nation's river resources, to assist and encourage state, local and private efforts to conserve rivers, and to identify rivers which could be included in National Wild and Scenic Rivers System.

Pinto Creek was included in NRI because of its outstanding scenic, riparian and ecological values.

President issued a directive on August 2, 1979, which requires Federal agencies to avoid or mitigate adverse effects to rivers identified in NRI as part of their normal planning and environmental review process.

2-13b Please see the response to comment 1-69.

2-14 The visibility analysis has been revised on the basis of revised protocols developed and approved by the Forest Service. The Forest Service has determined that the PLUVUE-II analysis is the most appropriate model for assessing plume impacts from the proposed project. In addition, there is no strict requirement for a regional haze assessment under NEPA or any other permitting requirement. Moreover, in assessing visibility impacts for the proposed project, the Forest Service is primarily concerned with ground-level plumes (as opposed to regional haze issues) given the nature of the emission sources at the project site. (For assessing potential degradation of visibility conditions, the PLUVUE-II model predicts a reduction in Standard Visual Range (SVR). The model runs predicted no exceedances of the Forest Service Region 3's Limits of Acceptable Change threshold for SVR.)

2-15 The adjacent Pinto Valley Mine currently has night lighting that is more extensive than that proposed for the Carlota mine. The additional lighting proposed represents a westward extension of existing conditions rather than creation of night lighting in an area where none currently occurs. The stipulation of mitigation measure VR-2, which directs that all night lighting be shielded and directed downward (consistent with safety considerations), should result in a negligible incremental increase in night lighting in this area.

Letter 2 Continued

Concerns about proposed Carlota Copper Project include potential impacts on riparian community from groundwater drawdown and reduced streamflow, as well as water quality impacts of possible catastrophic flood or mine operation events.

2-16 Based on information provided in Draft EIS, we find this project, as proposed, may significantly impact resources for which Pinto Creek was listed. Draft EIS does not demonstrate how Carlota Copper Project will adequately safeguard these resources.

Administrative policy issued by Executive Branch over last two decades has consistently reaffirmed government-to-government relationship between Indian Tribes and Federal Government.

Department of the Interior responsibilities for Indian Trust lands are now being addressed by pertinent documents, and have to date been addressed by Order No. 3175, as well as others.

Departments of Agriculture and Defense have similar directives regarding relationships with Native American Tribes across the country. In this project however, affected Tribes were apparently not included in the analysis process to the extent "government-to-government" policy would suggest.

2-17 Specifically, potentially affected Tribes were not contacted directly during scoping process nor were they mailed copies of DEIS as identified in Chapter 4.0 under Consultation and Coordination.

Courtesy of involving potentially affected parties should be extended to Tribes just as it is to other government entities.

Lack of Tribal involvement may be most evident in Cultural Resource section of Chapter 3, Affected Environment.

2-18 Traditional Cultural Properties (TCPs) are not discussed or otherwise mentioned.

Although San Carlos Reservation is some distance from project area, documented prehistoric and historic use of area by Western Apache and Yavapai Indians may point to presence of TCPs.

Consultation with potentially affected Tribes could adequately address this question.

Should you have any questions regarding this subject, please contact Bureau of Indian Affairs' Area Environmental Quality Services at (602) 379-6750.

Response to Letter 2

2-16 Please see the revised mitigation measures in Section 3.3.4 of the FEIS and the impact analysis discussion in 3.10.2.

2-17 The Forest Service has consulted with nine Tribal governments regarding the Carlota Copper project: the San Carlos Apache Tribe, the White Mountain Apache Tribe, the Tonto Apache Tribe, the Yavapai Apache Nation, the Prescott Yavapai Tribe, the Fort McDowell Indian Community, the Salt River Pima-Maricopa Indian Community, the Hopi Tribe, and the Pueblo of Zuñi. This consultation has taken the form of letter correspondence, telephone calls, multimedia presentations to Tribal government representatives, and field visits with Tribal representatives. In addition, all nine Tribes have been provided copies of all survey reports and testing and data recovery plans for their review and comment, including work plans for conducting ethnohistoric surveys to identify TCPs. When completed, all nine Tribes will be provided with copies of all final reports.

2-18 The Forest Service consulted with all nine potentially affected Tribes to identify their concerns regarding the possible presence of TCPs in the project area. Based on these consultations, an ethnohistoric survey was conducted for the project to identify such properties. This study included an extensive review of the ethnographic literature, informant interviews with knowledgeable Tribal members, and field visits with Tribal representatives and elders. Because of the sensitive nature of some of these properties, portions of the documentation that resulted from this study have been kept confidential, as per Section 304 of the NHPA. Those TCPs associated with archaeological sites would be treated by the same mitigation program designed for the recovery of data from those sites. Those TCPs not associated with archaeological sites did not meet the necessary criteria of eligibility for the NRHP and are thus not mitigable under the NHPA. Nevertheless, the Forest Service will continue to consult with the affected Tribes regarding possible ways to alleviate the impacts to these sites.

Letter 2 Continued

<u>Summary Comments</u>

2-19 Issues not addressed in draft EIS include adequate description and analysis of alternatives, description of impacts and mitigation planning, and identification and quantification of direct and cumulative effects. We recommend this draft EIS be modified or supplemented and circulated for public review and comment before statement is made final.

<u>Specific Comments</u>

2-20 <u>Summary Section.</u> This section should provide references (i.e., page number) where reader can examine source of information in draft EIS for a particular paragraph in summary. Also, changes in summary section should be reflected in affected environment section of the draft EIS, when applicable.

2-21 <u>Summary Section, paragraph 7, page ix, and elsewhere.</u> Aside from direst loss of habitat due to construction, there is no discussion of effects of heap leach pad and associated ponds on wildlife in document. We assume that surface of the pad and ponds would be open and uncovered. If so, they would be available to bats, birds, and perhaps other wildlife.

2-22 Sulfuric acid, heavy metals, and other hazardous materials are mentioned throughout document. Discussion of ponds, in section 3.14, indicates that ponds would contain acidic leachate and/or refortified sulfuric acid. If wildlife have access to pad, ponds, and perhaps other sections of facility, what would be effects of those structures and processes on wildlife?

2-23 <u>Summary Section, paragraph 3, page xii.</u> Draft EIS implies that Pinto Creek diversion channel would not impair instream aquatic conditions. Service disagrees with this conclusion. Although these structures may simulate conveyance functions (transport water and sediment) of a natural stream channel, it should not be implied that they would have same function as, or replace, natural stream channel.

2-24 <u>Summary Section, paragraph 4, last sentence, page xii.</u> Eliminate, "...potential for...," and replace "would" with "might."

2-25 <u>Summary Section, paragraph 5, page xii, and page 222.</u> Sediment yield should be reported in tons per acre or other units, rather than as a percentage.

2-26 <u>Summary Section, paragraph 5, last sentence, page xii.</u> Add "direct project impacts."

7

Response to Letter 2

2-19 Please see the responses to comments 1-5 and 1-13.

2-20 The summary is designed to follow the organization of the EIS (that is, issues are presented by discipline in the order in which they occur in the EIS). However, in response to this request, section number references have been added to the Summary where appropriate. In addition, the Table of Contents and the Index (Section 9) provide page number references to specific technical sections and topics in the FEIS.

2-21 An analysis regarding the potential for wildlife exposure to contaminated surface water sources has been added to Section 3.5.2 of the FEIS.

2-22 The ponds that contain acidic leachate are not designed or intended to support aquatic biota. These off-channel ponds are not expected to become occupied by aquatic organisms. The monitoring plan would detect any effects from leakage or spills from these features (see Section 3.5.4.2 of the FEIS) Also, please see the response to comment 2-21.

2-23 The summary does not state that aquatic conditions would not be impaired. It states that from a hydraulics perspective, the proposed mitigation should provide similar channel hydraulics and sediment transport. The change in aquatic conditions is discussed with reference to aquatic biota in the Aquatic Biology section of the summary. Additionally, aquatic biomonitoring and mitigation plans designed specifically to compensate for changes in aquatic conditions are provided in Section 3.5.4.2 of the FEIS.

2-24 The text has been revised in response to this comment.

2-25 As stated on page 222 of the DEIS, the average annual sediment yield increase is estimated at approximately 0.12 acre-foot immediately downstream of the Pinto Creek/Haunted Canyon confluence, below all major land disturbance associated with the project. The 0.12 acre-foot increase represents sediment yield increase before implementation of BMPs. Once BMPs are implemented, sediment yield increases should be negligible. Percentages were used to indicate the relative changes in sediment yield from the estimates for current conditions; this comparison is more meaningful in a NEPA document than stand-alone rates. The summary section presents the findings in a concise manner that is meaningful to a lay reader. No changes to the FEIS are necessary.

2-26 The text has been revised in response to this comment.

Letter 2 Continued

2-27 Summary Section, last paragraph, last sentence continued on xiii, page xii. In statement, "Reclamation efforts of other areas may aid in the restoration of vegetative cover of...," the word "would" should be replaced by "may." Service does not agree that reclamation would necessarily result in restoration of affected habitats.

2-28 Many reclamation/rehabilitation efforts are unsuccessful or ineffective. Service recommends if proposed action is approved, a comprehensive reclamation/mitigation plan for all features of project be prepared.

2-29 Summary Section, paragraph 4, first sentence, page xiii. Replace "removed" with "lost." How this loss would be mitigated or compensated should be explained. This paragraph may be more appropriate under the Aquatic Biology Section where it can be integrated with paragraph number 7.

2-30 Summary Section, paragraph 5, page xiii. Last sentence should be eliminated. A preferred statement is that Forest Service is working with Service to avoid or ameliorate effects to this endangered species.

2-31 Summary Section, paragraph 7, last sentence, page xiii. This sentence implies that diversion structures would be ecologically similar to Pinto Creek, thereby providing components necessary to sustain aquatic community. Service questions this conclusion and needs additional information to support such a conclusion.

2-32 Summary Section, paragraph 8, last sentence, page xiii. Replace "would" with "may." Service questions whether significant surface flow supplementation would necessarily result in reduction of severity or "level" of impacts.

2-33 Summary Section, paragraph 9, last sentence, page xiii. This sentence should read, "Adverse water quality effects could result from construction and operation of activities...," and replace last sentence with, "Operations at facility could result in toxicity and/or acidity to aquatic organisms and their environment, should discharges (leaks or spills) from leach pad or mining solutions occur. Other designated uses could be affected similarly."

2-34 Summary Section, paragraph 10, first sentence, page xiii. Eliminate, "Habitat for...", and replace "... would potentially be..", with "...could be adversely..."

2-35 Summary Section, Recreation, page xiv. This section should include, under adverse impacts, any indirect reduction or loss of recreational opportunities resulting from adverse operational incidents or accidents associated with project (see impacts associated with aquatic environment). It also appears that recreational access to portions of Pinto Creek, Powers Gulch, and Haunted Canyon would be restricted or eliminated.

Response to Letter 2

2-27 The existing statement is adequate. Mitigation Measure SR-10 calls for establishing reclamation success standards, as well as monitoring and maintenance as part of the bonded reclamation program to be implemented by Carlota with cooperation and approval from the Forest Service.

2-28 The Plan of Operations, which includes the reclamation and closure plan combined with reclamation and mitigation measures called for in the FEIS and measures and ongoing modifications required as part of project permits, comprises a comprehensive program.

2-29 The word "remove" has been replaced with "lost"; however, the paragraph remains where it was because it relates to surface waters more closely than to aquatic biology.

2-30 The text has been revised in response to this comment.

2-31 The statement is made that aquatic communities would recolonize the new diversion segments within several years. The intent of mitigation of riparian/aquatic habitat impacts is to restore an evolving ecosystem over time. Standards, monitoring, and maintenance are identified as mitigation components to achieve this purpose. Please also see the response to comment 3-1.

2-32 The existing wording is appropriate within the context of environmental measures presented in the FEIS.

2-33 The text has been revised in response to this comment.

2-34 The text has been revised in response to this comment.

2-35 Mitigation measures R-1 and T-1 of the FEIS address the elimination of horseback access to Powers Gulch and Haunted Canyon. Additional information is included in Section 3.13.4 regarding potential alternative routes to Haunted Canyon.

2-36

<u>Summary Section, Wilderness, Wild and Scenic Rivers, page xiv.</u> First paragraph should be split and portions moved to both visual resources and noise resources sections on following page. Second paragraph should be revised to read, "The scenic, riparian, and ecological values in segment of Pinto Creek, being considered for scenic designation, is not expected to be adversely affected.

However, accidental habitat loss resulting from substrate changes; degradation of water quantity resulting from groundwater pumping; degraded water quality resulting from pollutant discharge; decreased organic material resulting from loss of riparian vegetation and upland sources; loss of aquatic organisms (both fish and invertebrates) resulting from loss of habitat or contamination; decreased ground water recharge resulting from the concrete channels and ground water pumping; or other factors could lead to significant degradation.

In 1977, Lewis reported his conclusions regarding the influence mining activities had on Pinto Creek, 'Like aquatic insects, fish diversity and density were related to permanence of surface flow, distance from mining area, and the discharge of toxic metal ions.'"

2-37

<u>Section 1.3, first paragraph, page 1.</u> Corps makes distinction between "basic project purpose" and "overall project purpose." This distinction becomes very important in examination of practicable alternatives under Guidelines, subpart B "Compliance with the guidelines" at 40 CFR 230.10 (a)(2). Service believes that a broad, singular project purpose would suffice for both NEPA and Section 404 (b)(1) decisions.

2-38

<u>Section 2.2.1.6, No Action Alternative, page 81.</u> According to draft EIS, "The Forest Service does not have the authority to reject or deny Plans of Operations (POO) submitted under Federal Forest Regulations 36 CFR 228." Service suggests intent of these regulations is clearly to protect nonmineral surface resources, not to regulate mineral withdrawal.

Forest Service can and should reject POO's which would result in significant and substantial deterioration of surface resources or violate other laws, such as Clean Water Act (See 36 CFR 228.8). No action alternative should also embrace Corps' "no-federal-action (denial)" alternatives (See 33 CFR 325, App. B. 9.(5)(a)).

<u>Section 2.2, Projects Alternatives, page 65.</u> DEIS states that following project alternatives were selected for analysis and considered in detail:

- o Mine Rock Disposal Alternatives
- o Leach Pad Alternatives
- o Stream Diversion Alternatives

9

2-36 The text has been revised in response to this comment.

2-37 Comment noted. Agency policies and legal decisions, as well as professional experience, lead to different approaches for defining purpose and need. One statement for both the lead and cooperating agencies was the goal, but agency direction led to separate, focused purposes.

2-38 The General Mining Law of 1872 declared "all valuable mineral deposits in lands belonging to the United States...to be free and open to exploration and purchase." On September 1, 1974, the U.S. Department of Agriculture made effective regulations (36 CFR Part 228) that were designed to cover prospecting, exploration, and mining activities on National Forest System lands by persons operating under the General Mining Law of 1872, as amended. Although these regulations do not constitute a permit to explore or mine, as that is already a statutory right under the General Mining Law of 1872, they do provide that such exploration and mining activities be conducted so as to minimize adverse environmental impacts on the National Forest System lands. The 36 CFR regulations give the Forest Service the authority and direction to manage locatable mineral resource-related activities in order to minimize adverse impacts, prevent avoidable impacts, repair or reclaim those impacts that do occur, and impose reasonable conditions that do not materially interfere with lawful operations under the General Mining Law of 1872.

If a Plan of Operations clearly would violate a law, the Forest Service would ask that the plan be modified to address the potential violation. If analysis in the FEIS indicates a violation of a law, the Forest Service would not issue a ROD to approve the plan. The analysis in this FEIS indicates all potential violations can be prevented through stated mitigation and permitting by various agencies responsible for administering the environmental laws.

Letter 2 Continued

- o Water Supply Alternatives
- o Alternative Water Supply Well Field Access Road

2-39 Service believes that these are not alternatives as required by NEPA. These are "sub-alternatives" or modifications to proposed action required by NEPA to mitigate (avoid, minimize, rectify, release, compensate) adverse environmental impacts [40 CFR 1502.14(f), 1502.16(h)].

Thank you for the opportunity to comment on this document.

Sincerely,

Patricia S Port

Patricia Sanderson Port
Regional Environmental Officer

cc:

Director, OEPC, with original incoming
Regional Director, NPS, WR
Area Director, BIA, Phoenix
Regional Director, FWS, Albuquerque
State Director, BLM, Arizona

Response to Letter 2

2-39 Because the proposed action is generated by an assertion of a claim under the General Mining Law of 1872, the range of alternatives is limited to how the mine is proposed (and the NEPA-required No Action) rather than when or where a mine is developed. The alternatives that were considered or developed were modifications of the proposed Plan of Operations, which offered, or potentially offered, environmental advantages over the initially proposed plan. Additional text has been added to Section 2.2 of the FEIS to clarify the Forest Service approach to development of alternatives.

Letter 3

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor   Edward Z. Fox, Director

May 11, 1995

Mr. Paul M. Stewart
U.S.D.A. Forest Service
Tonto National Forest
2324 E. McDowell Road
Phoenix, Arizona 85006

Dear Mr. Stewart:

Thank you for the opportunity to review the draft Environmental Impact Statement (EIS) for the Carlota Mine. This document, as well as pending Air Quality Control and Aquifer Protection Permits, have generated many discussions between representatives of the Arizona Department of Environmental Quality (ADEQ) and Carlota. ADEQ believes that the environment would be better served if the following issues were addressed in the final EIS:

General Comments:

3-1 1) The Pinto Creek Bypass Channel must have a low flow channel to connect the natural sections of Pinto Creek with a chain of micro-invertebrates. The low-flow channel should be approximately two-feet deep and six-feet wide, and filled with rocks and boulders salvaged from the bypassed portion of Pinto Creek. If Carlota is required to supply makeup water to Pinto Creek as a result of stresses observed downstream in the Pinto Valley ecosystem, the water should be added at the upstream end of the low-flow channel.

3-2 2) There should be a detention basin at the upstream end of the Powers Gulch bypass channel. The discharge from this outlet basin should be capable of draining the pond by gravity flow into the bypass channel. The discharge orifice should be a vertical slot, with the means to restrict the flow if there is a problem in the bypass channel. The purpose is to prevent an overflow from the bypass channel into the leach pad, if the bypass channel becomes plugged due to a seismic event, or a storm causes the release of material above the channel.

3-3 3) The two leach dams proposed to be located internally within the leach pad would be constructed within a watercourse. To avoid a degradation of water quality, ADEQ proposes that pods of crushed limestone be placed downstream of the dams, prior to the confluence with Powers Gulch. The pods should be placed between a series of small dams, with an impervious liner to hold leaking fluids in contact with limestone.

3033 North Central Avenue, Phoenix, Arizona 85012, (602)207-2300

Response to Letter 3

3-1 The Pinto Creek diversion (bypass) channel has been designed with a low-flow channel, an 8-foot depth of imported natural substrate, a sequence of riffles and pools, and habitat improvements for the stream channel and adjacent riparian areas. The specifics of these measures are described in the Wetland and Waters of the U.S. Compensatory Mitigation Plan for the Carlota Project (Aquatic and Wetlands Consultants, Inc. 1996a). This document has been reviewed by the Forest Service, EPA, ADEQ, ADFG, USFWS, and COE, and agency review comments have been incorporated into the plan.

3-2 An inlet control structure has been incorporated into the proposed action according to the revised leach pad and diversion design document of June 1995 (Knight Piésold 1995). Section 2.1.3.3 of the FEIS has been modified to incorporate this component.

3-3 Section 2.1.3.2 of the FEIS has been modified to include this feature.

Letter 3 Continued

Mr. Paul Stewart
May 11, 1995
Page 2

3-4 4) Carlota must prioritize their water usage with their operating schedule. They should have several water sources besides the well in Pinto Creek. The priority list should show all available water sources and water volumes for the operation of the mine. The use of water already impacted by mining should be top priority.

3-5 5) The Pinto Creek subsurface aquifer will flow into the Carlota mining pit as it is deepened, and must be prevented from being drained to the open pit. To accomplish this, a grout curtain or slurry trench should be constructed across Pinto Creek near the bypass channel. As the pit is deepened, the method utilized for controlling seepage should be repeated, as new drainage areas are observed on the pit walls.

Specific Comments:

3-6 6) Page 17 - There is reference to a leach pad capacity of "approximately 100 million tons." Will the Forest Service be restricting the height or footprint of the pad or the final total capacity?

3-7 7) Page 26 - This page references loading of the heap, using either truck or conveyor loading of the heap pad. This seems to be in conflict with the design engineer's recommendation that the pad be conveyor loaded. Knight Piésold makes the following statement in their *Design for Heap Leach Pad and Ancillary Facilities, Best Available Demonstrated Control Technology Design*, April 1, 1993, submitted to Cambior USA, Inc.: "It should be noted that heap loading is expected to be accomplished using conveyor stacking, therefore equipment traffic on the heap should not be a common event." The final EIS should address this change in loading method.

3-8 8) Page 35 - Discharges from the under drain system to Powers Gulch below the embankment will provide high probability that this discharge will contain pollutants. Any fluids should be contained in order to allow for monitoring of both volume and quality, prior to discharge to Powers Gulch. Construction of a containment pond would require an Aquifer Protection Permit (APP) from ADEQ.

3-9 9) Page 35 - It is stated that an LCRS would "provide for the detection and recovery of solution should leakage occur through the primary liner." Please state the action leakage rate that is proposed to determine whether there has been a leak in the primary liner, and the frequency of monitoring.

3-10 10) Page 35 - The statement that "a 1-foot layer of a prepared subgrade would be consistent with the definition of an in-situ soil liner for Best Available Demonstrated Control Technology (BADCT) by the ADEQ," is contingent on the liner having a permeability specification of $1x10^{-6}$ or less. Because no permeability requirements have been specified by Carlota, the ADEQ has specifically stated that the subgrade at the Carlota Project will

Response to Letter 3

3-4 Comment noted.

3-5 A cutoff wall through the alluvium (on Pinto Creek upstream of the pit) to intercept alluvial subflow was proposed as mitigation measure WR-5 of the DEIS. However, for the FEIS, the feature was incorporated into the proposed action (see Section 2.1.2.5 of the FEIS). Monitoring of potential impacts to Pinto Creek would be conducted and, if necessary, additional mitigation would be required, such as an additional grout cutoff wall on the downstream end of the Pinto Creek diversion (WR-5).

3-6 The description of the proposed action is provided in Chapter 2.0 of the FEIS. The Forest Service considered pad height and footprint area in developing both alternatives and mitigation. The Forest Service may not arbitrarily limit total leaching capacity for the operation; however, any expansion in size and capacity from that proposed would require additional environmental review and agency approval.

3-7 As stated in Section 2.1.4.1 of the FEIS, ore from the Carlota and Cactus orebodies would be transported by either truck or conveyor from the crusher to the leach pad. Ore from the Eder pits would be transported either by truck or conveyor, depending on access, equipment availability, and economics. Heap loading procedures would curtail damage to the process fluid management system.

3-8 Underdrain collection ponds are included as part of the revised proposed action (FEIS section 2.1.3.1). If the underdrains collect any fluids, they would be conveyed to the collection ponds, which would be located immediately below the main and north PLS pond embankments. The collection ponds would be lined with 60-mil HDPE and would have engineered embankments and silt/clay seals on a prepared foundation. Flow meters would be installed at collection pond inlets; any flows would be monitored according to an approved monitoring plan, and any fluid collected during operations would be pumped back to the heap leach pad.

3-9 Any process fluids that might pass through the primary liner would be handled by the LCRS as described in the SCHMM Plan (Carlota 1996a). Action (alert) levels and monitoring requirements for detecting and remediating any process fluid releases to ground water are addressed in the Arizona Aquifer Protection Permit. The ground water downgradient of the heap leach pad is monitored on a quarterly basis. Alert levels are determined after reviewing the first eight quarters of ambient water sampling data for the monitoring wells.

3-10 Modifications have been made to Section 2.1.3.1 of the FEIS to address this comment.

Mr. Paul Stewart
May 11, 1995
Page 3

3-11 not meet the definition of a liner for BADCT determination. Carlota has accepted this determination and has stated that the subgrade is not intended to be a liner but only a subgrade. To be consistent with the APP application, any reference to the subgrade being a liner component, and any project determinations based on the assumption that the subgrade is a liner should be revised accordingly in the final EIS.

3-12 11) Page 36 - The last paragraph of Section 2.1.3.1 conflicts with statements made on page 26, regarding loading of the heap. Proper loading of the heap is critical to its stability. As previously stated, discrepancies regarding how the heap is to be loaded must be resolved.

3-13 12) Page 36 - Section 2.1.3.2 references two PLS ponds, although the Carlota APP application contains three proposed PLS ponds in the current facility design. The third pond is to be located adjacent to the raffinate pond and will serve as a surge tank for pumping to the SX/EW plant. Although no specific design information has been submitted to ADEQ to date, if the third PLS pond is to be included in the APP, it should be referenced in the final EIS.

3-14 13) Page 36 - Section 2.1.3.2 references a pond liner system consisting of a "12-inch prepared subgrade with a maximum permeability of $1x10^{-6}$ centimeters per second." Carlota has been unwilling to commit to any permeability specifications regarding subgrade preparation in their APP application. Please confirm this permeability with Carlota, and if confirmed, request that Carlota similarly commit to this specification in the APP application (although documentation that it had been achieved during construction would still have to be provided later).

3-15 14) Page 55 - Section 2.1.8 - A rigorous Quality Assurance/Quality Control plan should be implemented for construction of all facilities. Please indicate whether this will occur, which should be provided by an independent qualified third party.

3-16 15) Page 63 - Following closure of the heap, maintenance of the under drain system may be necessary to insure that it functions properly to minimize potential for liner failure. Please describe contingencies for insuring this maintenance.

3-17 16) Page 64 - Reference is made to neutralization of slimes in the PLS and raffinate ponds and burial in place. This action will necessitate long term post-closure monitoring of the facilities, unless remediated to levels established by rule, in conformance with Arizona Revised Statutes (ARS) § 49-152. As defined in ARS § 49-151, remediation means either the treatment or removal of contaminated soils to predetermined risk levels or site specific risk levels, or as determined by a risk assessment.

3-11 Please see the response to comment 3-10.

3-12 Please see the response to comment 3-7.

3-13 Section 2.1.3.1 of the FEIS has been modified to include the plant PLS/SX pond in Chapter 2 to incorporate this feature.

3-14 The current design meets ADEQ individual BADCT requirements. Ongoing investigations in the leach pad area indicate that low permeability materials would be available to adequately construct the subgrade. Please also see the response to comment 1-21.

3-15 A QA/QC plan for the heap has been included in the heap leach design report (Appendix G, Knight Piésold [1996]). QA/QC and facility testing would be implemented on other components as a normal course of construction and start-up. The involvement of an independent third-party QA Engineer, registered in the State of Arizona, is a requirement of ADEQ's Aquifer Protection Permit. In addition, the Forest Service would maintain on-site personnel during construction. If necessary, additional specialists may be present during construction phases at the request of Carlota or the Forest Service.

3-16 The proposed spine drain system has been developed to augment the naturally-occurring alluvial gravels that would remain in place as a drainage feature under the leach pad. The purpose of the spine drain is to direct infrequent ground water flow through the pad area. Small

Letter 3 Continued

Mr. Paul Stewart
May 11, 1995
Page 4

3-18 17) Page 223 - The Knight Piésold report referenced in the EIS only analyzed 26 waste rock samples for acid-base accounting. This number of samples cannot be viewed as representative of approximately 200 million tons of waste rock to be generated at the site. A waste rock characterization, handling, and disposal plan is referenced in Section 3.3.4.2. This should be an ongoing management plan for Carlota to implement during mining. Specific details of the plan should be approved by the Forest Service and ADEQ, and will be a requirement for issuance of an APP from ADEQ.

If you have any questions regarding the general comments, please contact Jim Matt, Surface Water Engineering Review & Permits Unit, at (602) 207-4502, or for the specific comments, please contact Michael Wood, Mining Unit, at (602) 207-4585. Please address the final EIS and all future environmental submittals required by NEPA, that are sent to ADEQ for review and comment, to the Ombudsman, Office of Customer Service & External Affairs. In our attempt to meet your deadlines and serve you better, this office is the central coordinating point for all such environmental reviews.

Sincerely,

Edward Z. Fox
Director

EZF:ALR:ilp

cc: Alan Roesler, Ombudsman
James Matt, Surface Water Quality Section
Michael Wood, Aquifer Protection Program Section

Response to Letter 3

amounts of such flow were noticed during the exceptionally wet winter of 1993-1994; these conditions are believed to be uncommon that do not occur on the site in general.

The potential for the system to clog would be minimal due to the redundancy of design features. These features would minimize or eliminate maintenance needs and would provide a drainage contingency via the natural alluvial gravels in the main drainage under the leach pad. These materials would remain in place as much as possible. The spine drain would consist of perforated corrugated tubing 8 inches in diameter with a drain gravel formation stabilizer (less than 5 percent passing the No. 200 sieve) approximately 3-feet square in cross section. The tubing would be encased in non-woven geotextile. Migration of fines into the tubing would be minimal, and as a redundancy, the drain has been designed using minimum permissible velocities to pass the naturally-occurring sediments in the Powers Gulch locale (Knight-Piésold 1995a). In the unlikely event that a portion of this system should clog, the adjacent natural drain gravels (which may be screened to remove excess fines during construction) would provide a contingent flow path for the infrequent ground water flows that may occur under the pad. Please also see the response to comment 1-25.

3-17 Section 2.1.9.2 of the FEIS has been modified to indicate that the pond liners, and any slime and residual materials remaining in the ponds, would be excavated and placed on the leach pad (Carlota 1995a). However, under mitigation measure HM-5 in Section 3.14.4 of the FEIS, any slimes and residual materials remaining in the lined ponds containing process solutions (excluding the PLS ponds within the leach pad) would be tested, and if necessary, the material would be disposed of in accordance with the ADEQ Aquifer Protection Permit and applicable state and federal regulations. (Note that Arizona Revised statutes 49-151 and 49-152 refer to contaminated soils. "Soils" as defined under the ADEQ Soils Remediation Rules Adopted March 96 does not appear to include materials that accumulate within lined facilities, such as the plant PLS/SX and raffinate ponds.)

3-18 Please see the responses to comments 1-60 and 1-61.

Letter 4

FAX Received 5/11/95

THE STATE OF ARIZONA

GAME & FISH DEPARTMENT

2221 West Greenway Road, Phoenix, Arizona 85023-4399 (602) 942-3000

Governor
Fife Symington

Commissioners:
Chairman, Arthur Porter, Phoenix
Nonie Johnson, Snowflake
Michael M. Golightly, Flagstaff
Herb Guenther, Tacna
Fred Belman, Tucson

Director
Duane L. Shroufe

Deputy Director
Thomas W. Spalding

May 10, 1995

RECEIVED TONTO N.F. MAY 15 1995

Mr. Charles R. Bazan
Forest Supervisor
Tonto National Forest
2324 East McDowell Road
Phoenix, Arizona 85006

Re: Draft Environmental Impact Statement; Carlota Copper Project

Dear Mr. Bazan:

The Arizona Game and Fish Department (Department) has reviewed the Draft Environmental Impact Statement for the Carlota Copper Project and the following comments are provided.

Specific comments are provided as an attachment to this correspondence. The anticipated impacts to fish and wildlife resources that may occur as a result of the proposed project appear to be significant. The Department recommends the following elements be included in the record of decision for this action:

4-1 - A detailed Mitigation Plan must be developed and should include a rigorous monitoring program for surface and subsurface flows in Pinto Creek and Haunted Canyon, and for the condition and quantity of aquatic, wetland, and riparian habitats. Mitigation should include actions to fully compensate for losses of functions and values of aquatic and riparian habitats. In addition, actions to compensate for impacts to functions and values of upland habitats should be included in the plan. The Mitigation Plan should also include contingency arrangements and success criteria.

4-2 - The Reclamation Plan should be enhanced to meet the objectives of restoring public lands to their previous uses once mining operations have ceased.

4-3 - That the Department of Interior's Habitat Evaluation Procedures (HEP) be used to quantify values for habitats lost and replaced. This methodology will enable project proponents and decision makers to view impacts and compensation measures for the action in empirical terms, therefore ensuring that mitigation measures are neither deficient, nor in excess of full compensation.

An Equal Opportunity Reasonable Accommodations Agency

Response to Letter 4

4-1 A summary of the monitoring program for biological resources is described in Section 3.5.4 of the FEIS. Specifics on mitigation and monitoring for protecting the riparian and aquatic resources in Haunted Canyon and Pinto Creek are provided in the Wellfield Mitigation Program (Appendix E), Section 3.3.4 of the FEIS, and the Biological Monitoring & Mitigation Plan (Cedar Creek Associates, Inc. 1996a).

4-2 Sections 3.4.1.3 and 3.4.2.1 of the FEIS adequately display the intent of the reclamation portion of the Plan of Operations to return the land to a productive postmining land use compatible and supportive of premining uses. The reclamation and closure portions of the revised Plan of Operations would be modified into a final Plan of Operations following approval of the ROD and prior to project implementation. The final Plan of Operations would reflect the additions or changes to reclamation generated by the analysis and also would provide a means for the Forest Service to strengthen the inadequacies from the original submission.

Letter 4 Continued

Thank you for the opportunity to comment on this project. We look forward to continued consultation on mitigation and other issues.

Sincerely,

Duane L. Shroufe
Director

DLS:rh

cc: Jim Matt, Arizona Department of Environmental Quality
Sam Spiller, U.S. Fish and Wildlife Service, Phoenix
Cindy Lester, U.S. Army Corps of Engineers, Phoenix
Col. Michal Robinson, U.S. Army Corps of Engineers, Los Angeles, CA
James Romero, U.S. Environmental Protection Agency, San Francisco, CA

Enclosure

AGFD# 2-2-95(10)

Response to Letter 4

4-3 The Forest Service considered using USDI's HEP analysis during multi-agency meetings. However, there was no consensus that this methodology would provide an analysis any more consistent with laws, regulations, and policies that are applicable to this project than the methodology used. In addition, using HEP requires that habitat models appropriate for the species and habitats in the project area be available. There are currently few, if any, species models available for use in the region that includes this project area.

Arizona Game and Fish Department Comments
Draft Environmental Impact Statement
Carlota Copper Project
May 10, 1995

General Comments:

AREA RESOURCE VALUES

The Carlota Copper Project represents an extension of mining development to the west of current mine operations, into relatively unimpacted areas. Habitat and wildlife values both within the project area, as well as in the vicinity of the project, may be significantly degraded as a result of this project.

Wildlife:

Aquatic resources were well documented in the *Pinto Creek Aquatic Biology Report* prepared by William Miller and Associates. Pinto Creek and Haunted Canyon support populations of longfin dace (Agosia chrysogaster) and desert sucker (Pantosteus clarki) as well as a number of non-native fish species. Both of these native species are Candidate Category 2 species for listing under the auspices of the Endangered Species Act. Although not particularly rare in their habitats, habitats that support these species are becoming increasingly rare.

Terrestrial wildlife present in the area were well documented in the *Terrestrial Wildlife Technical Memorandum*, and the *Endangered, Threatened, Candidate and Sensitive Species Technical Memorandum*, as well as in the Draft Environmental Impact Statement (EIS). We have previously reviewed and commented on these reports to the U.S. Forest Service.

Habitat:

Habitats that will be directly impacted within the project footprint include a total of 1,423 acres of upland habitats (815 acres of interior chaparral, 490 acres of dry slope desert brush, and 118 acres of juniper grassland), and 29 acres of riparian habitats along Pinto Creek and Powers Gulch. Over a mile of stream habitat along Pinto Creek will be removed and replaced with a cement lined diversion channel.

Upland habitat areas have overall moderate value to a wide variety of wildlife species. Game species include mule deer, Coues white-tailed deer, and javelina. This is a popular area for white-tailed deer hunting in particular, as well as for javelina and mule deer. Large predators include black bear and mountain lion. Other species include a variety of reptiles, birds, and small mammals. Presently, most of the upland areas have moderate value for wildlife due to their relatively undisturbed nature, and inherent habitat qualities.

Letter 4 Continued

The reach of Pinto Creek that will be diverted carries surface water for most of the year, but becomes intermittent during the summer. Riparian vegetation is dominated by Arizona sycamore, salt cedar, and some Goodding's willow along the downstream section. Use of the area by deer, javelina and other terrestrial wildlife for free water, forage, cover, and as a movement corridor is high in spite of a history of past disturbance. During the summer months, water remaining in pools provides drinking water for wildlife during a period of high need, and refuge for native fish, lowland leopard frogs and Arizona toads.

Pit dewatering and the well field in Pinto Creek, as shown in the well tests, will likely decrease surface and subsurface flows in Pinto Creek and Haunted Canyon. Flows in Pinto Creek downstream of the diversion and in Haunted Canyon are permanent in most reaches. The riparian plant community along these reaches of Pinto Creek to Blevins Wash and Haunted Canyon are of fairly high quality with greater plant species diversity, cover and foliage height diversity. Haunted Canyon, in particular, has high habitat values as do certain reaches of Pinto Creek. The aquatic habitats of Pinto Creek and Haunted Canyon are of relatively high quality.

Special status terrestrial wildlife species that may be impacted by contamination, elimination or degradation of riparian habitats along Pinto Creek or Haunted Canyon include Arizona toad, lowland leopard frog, common blackhawk, and yellow-billed cuckoo.

General impacts to the area's habitats as a result of the project include:

- Interruption of travel corridors along Pinto Creek and Powers Gulch
- Loss of breeding cover
- Loss of nesting areas (both terrestrial and aquatic)
- Loss of foraging habitat (both terrestrial and aquatic)
- Loss of access to free water
- Temporal loss of all values for the period between beginning of impact and maturity of the compensation site (both terrestrial and aquatic)

HABITAT COMPENSATION

4-4 The Arizona Game and Fish Commission's policy A2.16, *Wildlife and Wildlife Habitat Compensation*, delineates compensation for losses of wildlife habitat. This policy designates resource categories for habitats of different value.

Response to Letter 4

4-4 Please see the response to comment 4-5.

Letter 4 Continued

Riparian habitats associated with permanent water in Haunted Canyon, Mule Spring, and areas of Pinto Creek downstream of the proposed action are considered to be Resource Category I areas. Habitats in this category are of the highest value to Arizona wildlife and are unique and/or irreplaceable on a statewide or ecoregion basis. The compensation goal is no loss of existing in-kind habitat value.

The riparian and aquatic habitats of intermittent portions of Pinto Creek and Powers Gulch are considered to be Resource Category II areas. Habitats in this category are of high value for Arizona wildlife and are relatively scarce or becoming scarce on a statewide or ecoregion basis. The compensation goal for these habitats is no net loss of existing habitat value, while minimizing loss of in-kind value.

Upland habitats (1,423 acres) are considered to be Resource Category III areas. Habitats in this category are of high to medium value for Arizona wildlife species, and are relatively abundant on a statewide basis. Mitigation goal is no net loss of habitat value.

4-5 The Department recommends that riparian, wetland and aquatic habitats that will be directly or indirectly impacted by the mine be compensated pursuant to this policy.

4-6 The Department also asks that upland habitat losses that cannot be adequately mitigated by effective and successful mine reclamation be compensated for by replacement of values in-kind, or by substitution of higher value habitats (riparian or desert stream aquatic), or by increased management of replacement habitats so that no net loss of habitat values occurs.

4-7 The Department recommends that impacts and compensation for impacts be determined through use of the Habitat Evaluation Procedures method, developed by the Department of Interior. This method identifies and quantifies key habitat values and uses this information to measure value and acreage of lands to be used as replacement of losses. This methodology will objectively determine appropriate replacement for habitat losses and present determinations in a fashion that will assist decision makers.

Mitigation Plan:

4-8 No detailed mitigation plan was included in the Draft EIS. It is not possible to evaluate the net impacts of this project without examining the specifics of mitigation and compensation for losses of habitat. Any mitigation plan should include mitigation and compensation for upland impacts as well as impacts to riparian and aquatic habitats. Monitoring for and mitigation of unforeseen impacts to riparian and aquatic resources as a result of groundwater depletion should be specified.

Response to Letter 4

4-5 The Forest Service has tried to meet the intent of Arizona Game and Fish Department policy consistent with Forest Service policy. Forest Service regulations for managing surface resources in connection with operations under the General Mining Law of 1872 and habitat management policy do not require or provide for compensation for predicted habitat loss unless threatened and endangered species laws or regulations or viable population concerns apply.

4-6 Applicable regulations and policy do not require or specifically authorize direct compensation for loss of habitat. An attempt is made in the mitigation plan to reasonably maintain and protect habitat where feasible and rehabilitate habitat by reclamation where practicable (consistent with regulations for extracting locatable minerals on National Forest System lands) and to protect wildlife and fisheries habitat (consistent with regulations and policy for managing habitat for wildlife values).

4-7 Please see the response to comment 4-3.

4-8 Please see the response to comment 4-1.

Letter 4 Continued

PREDICTED IMPACTS

Pinto Creek Diversion Channel:

The proposed Pinto Creek and Powers Gulch Diversion Channels would not replace the aquatic or riparian habitat values that currently exist. Although it is expected that some invertebrates would recolonize the diversion channel, we anticipate use by fish would be minimal. In addition, placement of the mine directly on Pinto Creek would decrease the value of the creek as a movement corridor for wildlife.

Pit Dewatering and Groundwater Pumping:

Removing water from the Pinto Creek system by pit dewatering and pumping from the Pinto Creek well field, will decrease flows downstream and reduce instream habitat quality. We do not feel the relative impact of groundwater pumping on surface flows in Pinto Creek and Haunted Canyon were accurately depicted in the Draft EIS. Pump tests showed a connection between deep groundwater, and some surface flows. Reduction in flows would affect aquatic as well as riparian habitats downstream.

4-9 Using figures provided in the Draft EIS, if the alternative is selected in which the proposed mine will obtain all operating water from pit dewatering and the well field in Pinto Creek, the mine will use between 750-1200 gallons per minute from the creek aquifer. The projected annual water use is 1,210 acre-feet/year. This is 56% of the mean annual discharge for the Upper Pinto Creek subwatershed. Given the well pumping data presented in the Draft EIS, and the correlation to decreases in surface flows, instream habitat quality may decrease below the biological threshold for sustainability.

Our preliminary analysis indicates the impact of pumping will be greatest during the summer when surface flows are lowest, and demands of riparian vegetation and wildlife are highest. To illustrate, we compared the estimated water use by the mine in June to discharge for that month at the Magma Weir (PC10). This site is downstream of the well field and also carries the flows from Haunted Canyon, West Fork of Pinto Creek, Horrel Creek and Upper Pinto Creek.

June is generally one of the hottest, driest months (Tables 3-24, 3-26, and 3-27). Using Figure 3-9, the average sampled flow for PC10 in June is 7 cubic feet per second (cfs). The Draft EIS states that during the driest months, water use by the mine will be as high as 1,200 gallons per minute, or approximately 2.7 cfs, representing approximately 39% of the volume of water passing through PC10 during June. It seems apparent that the amount of water used by the mine is a significant part of the water budget of
4-10 the Pinto Creek watershed. Removing groundwater upstream will most likely impact surface flows downstream, although the relationship

Response to Letter 4

4-9 The potential exists for loss of aquatic habitat and aquatic organisms due to the proposed extraction of ground water in this drainage. Section 3.5.4.2 of the FEIS describes a biomonitoring plan that would detect the changes in habitat and existing aquatic life that can be attributed to mining activities. The monitoring should detect changes prior to a decrease below any biological threshold; mitigation would then be implemented.

Water requirements of the mine have been revised since publication of the DEIS due to adoption of water conservation measures by the mine. Annual water needs have been reduced to approximately 950 acre-feet per year. The agency preferred alternative includes the use of low quality water on the leach pad. This water can provide up to 59 percent of the mine's water needs. Use of low quality water would reduce impacts to the Pinto Creek basin water resources. In addition, a well field mitigation program (see Appendix E) has been developed to mitigate impacts to surface flows and alluvial water levels in the well field area.

4-10 Please see the response to comment 1-44.

4-10 between groundwater pumping and surface flows is not clearly presented in the Draft EIS. Even if this is mitigated by augmenting surface flows at the well field through supplemental pumping, the net result is decreased water availability, especially with long-term pumping.

4-11 The amount of water Magma is, or will be, pumping from the Pinto Creek area is unknown and was not considered in the Draft EIS. The cumulative impacts of both mines obtaining water from the Pinto Creek basin may have significant detrimental effects on the riparian and aquatic habitats along Pinto Creek.

Pump tests were only conducted for 24 days. In Figure 3-19, it appears that surface flows at HC-2 and head height at AMW-21 were still progressing downward at the end of the 24 day pump test, indicating that the full range of impact has yet to be determined.

Reclamation:

4-12 The Reclamation Plan was not presented in the Draft EIS. However, we have had the opportunity to review this document. In our opinion, the proposed reclamation is inadequate to meet the objectives of returning the site to its previous uses once the mining operation concludes.

Long Term Water Quality:

It appears the mine has taken reasonable practicable measures to monitor and prevent any discharges of pollutants from the mine during the period of operation. However, long-term effects of the leach pad on water quality in the Pinto Creek and Salt River watersheds, and the ultimate effect this may have on fish and wildlife resources is an important issue. Even assuming that no pollutants escape from the leach pad during the mine's operation, the long-term outlook is less certain. Contaminants such as metals and acid will remain in the leach pad for extended periods. It is our understanding that the leach pad liner has a design life of 50 years, well past the planned life of the mine. It is, however, likely that leaks will eventually begin to occur and without significant effort will result in pollutant discharges.

The primary long-term protective feature of the leach pad is the cap, composed of low-permeability soil. Eventually, without significant maintenance, the leach pad cap may begin to erode discharging pollutants into Powers Gulch and thus into Roosevelt

4-13 Lake. Long-term maintenance of this cap and erosion prevention is not addressed in the Draft EIS.

<u>ALTERNATIVE PREFERENCES</u>

Of the alternatives presented in the Draft EIS, the following are those preferred by the Department.

Section 3.3.2.1 of the FEIS describes the impacts of pumping on shallow ground water and streamflows. Section 3.3.4.1 of the FEIS, mitigation measure WR-3 identifies that a Wellfield Mitigation Program has been developed to mitigate the impact of ground water pumping from the well field on surface flows in Haunted Canyon and in Pinto Creek near the PC-7 gage site. Appendix E of the FEIS provides a description of the Wellfield Mitigation Program. Below the reach of perennial flow at PC-7, streamflow does not become perennial again until just above the PC-10 gage site, approximately 5 miles downstream of the well field. FEIS Section 3.3.1.2 discusses the origins of streamflow at the reach beginning near PC-10. The watershed area at this reach is almost triple that at the well field. Major tributaries between PC-7 and PC-10 include the west fork of Pinto Creek and Horrel Creek. The origin of perennial base flow at the PC-10 gage site is thought to be near surface ground water surfacing from an alluvial basin just upstream of the gage.

The relationship between deep ground water intercepted by the wells at the well field and surface flows at the PC-10 gage site is not known and is not practicable to obtain given the complex geology, the distance downstream from the well field, and the complicating effects of BHP Copper's Pinto Valley Mine.

Carlota also continues to investigate other water sources that could potentially supplement Carlota's water supply (please see the response to comment 1-2). The Forest Service will continue to encourage, and it is to Carlota's advantage to find, additional water supplies throughout the life of the mine.

4-11 Please see the response to comment 1-56. Section 1.6.2 identifies that it is reasonably foreseeable that BHP will close the Pinto Valley Mine and cease pumping water by the year 2007.

4-12 Please see the response to comment 4-2.

4-13 Please see the responses to comments 1-80 and 1-81.

Letter 4 Continued

Leach Pad:

4-14 The Department favors the Eder side-hill leach pad. This alternative would eliminate the need for the Powers Gulch diversion, and reduce the chance of erosion of the leach pad should the diversion fail. Further, it would make remediation of any spills or discharge from the leach pad possible before discharge occurs into Powers Gulch.

Water Supply:

Because use of water from the Pinto Creek well field will likely affect flows downstream of the mine in Haunted Canyon, Pinto Creek, 4-15 and springs occurring in the project area, we recommend selection of the Low Quality Water alternative from Pinal Creek, Gibson Mine, or other sources for all but domestic water needs.

Well Field Access Roads:

4-16 The Department recommends selection of the upland access road from the west off of Forest Road 287 (Access Road Alternative B).

<u>**Specific Comments:**</u>

p. xii; Terrestrial Biology; The text states "Reclamation of other areas would restore vegetative cover of chaparral, grassland, and 4-17 riparian habitats". This general statement is not supported by the Draft EIS. A final mitigation plan has not been developed, and little evidence is provided that indicates restoration of upland habitats.

4-18 **p. xiii; Terrestrial Biology;** The statement "Mitigation measures designed to protect base flows would minimize both short- and long-term impacts to riparian vegetation" is not substantiated. It is unclear how much impact there will be to riparian habitat as a result of groundwater pumping. Page 215 includes the statement "Although these data indicate that the stream flows and water stored in the alluvium would be affected by the proposed well field, it is not possible to determine with certainty the magnitude and areal extent of the impacts".

4-19 **p. xiii; Aquatic Biology;** The statement "Aquatic communities would recolonize the new stream diversion segments within several years" should be modified. Although there may be colonization of some components of aquatic communities, it is unlikely that the diversions will develop communities similar to those that currently exist in stream segments unless diversion channel designs provide the necessary habitat elements.

4-20 **p. xiv; Land Use;** We believe the statement "There is a small potential for a reduction in surface water flow in the Pinto Creek segment" minimizes the potential impacts to Pinto Creek.

Response to Letter 4

4-14 The Forest Service acknowledges the Arizona Game and Fish Department's preferred alternative. For the reasons identified in Section 2.4 of the FEIS, the Forest Service has identified the proposed leach pad location as its preferred alternative.

4-15 The Forest Service has incorporated the low-quality water alternative in the Agency Preferred Alternative, as described in Section 2.4 of the FEIS.

4-16 This recommendation is noted. The Forest Service decision in selecting Alternative A (see Section 2.4 of the FEIS) considered the significance of new disturbance areas, reclamation potential, and monitoring efficiency.

4-17 As developed in the Biological Monitoring & Mitigation Plan (Cedar Creek Associates,Inc. 1996a), the mitigation measures for uplands include revegetation of 938 acres of upland habitat, maintenance of 6 existing wildlife water sources in the Brushiest Allotment, fencing to exclude livestock from the Arnett Creek/Picketpost Mountain Analysis Area, retirement of the Powers Gulch Pasture - Bellevue Allotment, recontouring and revegetation of 10 acres of exploration roads, and acquisition of the grazing permit for a portion of the Bellevue Allotment. Monitoring and maintenance for each of these activities is included either in the plan or the FEIS. Carlota must provide evidence to support or indicate successful restoration or compensation of upland habitat disturbances. The Biological Monitoring & Mitigation Plan and its proposed activities have been referenced in Section 3.5.4.1 of the FEIS.

4-18 Section 3.3.4 of the FEIS identifies additional monitoring requirements for detecting impacts to streamflow and alluvial water levels. Additional specifics on mitigation and monitoring for protecting the riparian and aquatic resources in Haunted Canyon are provided in Section 3.3.4 of the FEIS, the Wellfield Mitigation Program (Appendix E) and the Biological Monitoring & Mitigation Plan (Cedar Creek Associates, Inc. 1996a). The Wellfield Mitigation Program was developed to preclude any adverse impacts related to possible depletions of surface and alluvial water flow from well field pumping. The Biological Monitoring & Mitigation Plan details additional biological monitoring procedures designed to ensure that there are no residual impacts to the aquatic and riparian system in Haunted Canyon. Monitoring recommended in Section 3.3.4 also is intended to detect impacts to riparian systems by monitoring alluvial water levels.

4-19 Most specimens encountered within the project area are early colonizers, and since the current stream channels in these areas are recolonized annually after periods of zero flow, it is likely that many of these taxa would be among the first to colonize the diversions. Please see also the response to comment B-11.

4-20 A detailed mitigation plan for Haunted Canyon and Pinto Creek should minimize impacts to surface flows. Please see the response to comment 1-45, FEIS section 3.3.4, and FEIS Appendix E for details.

Letter 4 Continued

Carlota Copper Project Page 7

4-21 **p. xix; Water Resources** We believe the statement "The use of low-quality water would reduce the need for ground water pumping and would result in a **slight** reduction in water withdrawal from the Pinto Creek drainage" is not supported by the Draft EIS. Page 227 includes the statement that "these low-quality sources could provide up to 62 percent of the project's water requirements".

4-22 **p.230; WR-2;** Mitigation for impacts to springs: Constructing catchment basins or ponds to capture runoff would require water rights.

4-23 **p.233; WR-3;** Avoidance of impacts to Pinto Creek should be pursued before seeking to mitigate impacts by improving other nearby stream reaches, wetlands, or riparian corridors.

4-24 **p. 248; Reclamation;** Although the Department has reviewed the proposed "riparian/wetland mitigation plan", this document was not developed in concert with the Department as stated in the text. We expressed concerns about the feasibility and adequacy of some aspects of the plan. We are eager to help develop a suitable version, but until such a document is completed the text of the EIS should be revised.

p. 255; Restoration of Productive Postmining Land Uses; This section states that the "commitment to reclaim all patented lands to the same level as public lands within the project area is not specifically defined in Carlota's *Plan of Operations* documents". The text of this section implies that an undetermined amount of Forest Service land may be patented, and that reclamation may not

4-25 be performed on all of these lands following closure. It is difficult to evaluate the impacts of the project when it is unclear how much of the project site will be reclaimed. Inadequate reclamation on patented land may impact downstream resources. We suggest that the project proponent make a firm commitment to a reclamation plan regardless of land ownership at closure.

4-26 **p. 277; Wildlife:** Big game surveys have been conducted in Unit 24B since the 1940s.

p. 294 and 295; Vegetation. This section describes the loss of 815 acres of interior chaparral, 490 acres of dry-slope desert brush, and 118 acres of juniper/grassland as "relatively small" or "very small" compared to the amount of these habitat types occurring in the vicinity. Although these habitat types are common in the area, loss of 1,423 acres of upland wildlife habitat is not an

4-27 insignificant loss. The minimization of the loss of upland habitat presented in this section is inconsistent with the statement on p. 296 in the Wildlife section that states that "Numerous species of wildlife ... would be directly affected (by loss of habitat)". These sections should be rewritten to more accurately describe the loss in terms of quantity of fairly common habitat.

Response to Letter 4

4-21 The word "slight" in the summary has been replaced by "substantial" for consistency.

4-22 Carlota has acquired a water right for 75 acre-feet per year for the impact to surface flow detected during the pump test. Carlota has agreed to apply for additional water rights if the well field withdraws more appropriable water than is accounted for in their existing right.

4-23 Section 2.2.1.6 of the FEIS identifies that the Forest Service does not have the authority to disapprove a Plan of Operations for a mining operation provided the plan does not propose actions that would be in violation of applicable federal and state laws and regulations. The ore body Carlota proposes to mine lies directly beneath the main stem of Pinto Creek. It is not possible to avoid impacting this reach of Pinto Creek if Carlota is to have a viable mining operation. This impact is identified as an unavoidable adverse impact in Section 3.16.3 of the FEIS. See also Section 2.2.2.1, Smaller Scale Project.

The reach of Pinto Creek in the vicinity of the PC-7 gage site (DEIS Figure 3-8) is the other reach of Pinto Creek potentially impacted by Carlota's operations. Impacts to this reach have been mitigated by the Wellfield Mitigation Program described in Appendix E of the FEIS.

4-24 Comment noted. The text has been revised in Section 3.5.4 of the FEIS in response to this comment.

Section 3.4.2.1 of the FEIS adequately displays the major components of the proposed reclamation portion of the Plan of Operations. Rather than include the reclamation portion of the Plan of Operations in the FEIS for review, interested parties should focus on the FEIS analysis, development of alternatives, and the subsequent decision. Final reclamation objectives and procedures are often a product of the analysis process and will differ from the reclamation portion of the initial Plan of Operations. The Reclamation Plan has been designed to be flexible over the life of the operation to the extent that Game and Fish has the opportunity to provide input.

4-25 On lands administered by the Forest Service, the Plan of Operations, which includes detailed specifics on how the project site would be reclaimed, is Carlota's commitment under 36 CFR 228. Carlota would be required to sign and comply with the approved Plan of Operations and post a reclamation bond as a financial assurance that reclamation would be completed.

Response to Letter 4

The commitment on patented lands falls under the jurisdiction of the Arizona State Mine Inspector's Office and Arizona's Mined Land Reclamation Act. This act and associated statutes would require Carlota to provide notice, obtain approval of a reclamation plan, and obtain a separate financial assurance mechanism before creating surface disturbance on patented lands.

On lands administered by the Forest Service, funding and responsibility for cleanup and restoration (i.e., reclamation) is borne by the operator. The Plan of Operations, which includes specific details and methods to conduct cleanup and restoration, is required from any person or company proposing to conduct operations that might disturb surface resources (36 CFR 228.4). As indicated in 36 CFR 228.8, the operator shall comply with requirements for environmental protection, which includes reclamation. The responsibility to conduct reclamation is further reinforced by requiring the operator to post a reclamation bond that provides financial assurance that the reclamation will be completed.

4-26 The text has been modified in Section 3.5.1.1 to indicate that big game surveys have been conducted since the 1940s.

4-27 The comparison of the relative amounts of habitat loss in relation to the total amount available in the general vicinity was not an attempt to minimize the effects of habitat loss to local wildlife populations. Rather, the discussion of habitat loss in these terms was provided to indicate that most disturbance would be in habitats that are extensive and not unique in the region. We agree that the initial loss of 1,404 acres (corrected value based on latest operations plan) of upland habitat is not insignificant, and as indicated in the wildlife discussion, a number of wildlife populations would be adversely affected. However, most wildlife populations associated with affected upland acreages are common in the region, and population viability would not be at risk. In addition, most habitat losses would be relatively short-term since the majority would be reclaimed at the end of project operations.

Letter 4 Continued

Carlota Copper Project Page 8

p. 296; Wildlife; The end of this section lists the loss of big game based on density estimates and acreage of habitat lost. These figures only reflect the estimated number of individuals that exist 4-28 at one point in time. This text should be revised to note that there will be a loss of future generations of these animals, as well as nongame wildlife, through time until the habitat value of the site is restored.

4-29 **p. 301; Low-Quality Water, Water Supply Wells, and Dewatering Wells;** We believe this section does not adequately describe or quantify the differences in impacts to aquatic and riparian resources between the proposed action and this alternative. A much more detailed analysis of relative impacts needs to be developed to adequately judge the two alternatives.

4-30 **p. 306; Monitoring;** The Forest Service riparian monitoring guidelines are not designed to detect degradation of riparian habitat due to groundwater depletion. We suggest that a more rigorous monitoring protocol be developed to detect and quantify changes in the riparian community.

p. 306; Mitigation; The Department is concerned with the uncertainness of mitigation listed for losses of riparian habitat. 4-31 Until a detailed mitigation plan is developed that the project proponent is committed to, it is difficult to evaluate the potential long-term impacts associated with this project.

p. 308; Aquatic Resources; Mitigation; One of the highest value habitats that will be lost as a result of this project is aquatic 4-32 habitat. Mitigation measures presented do not address replacement of functions and values of aquatic habitat that will be lost. Replacement of aquatic habitat with riparian habitat would not be consistent with the Department's habitat compensation policy.

4-33 **p. 355; Recreation;** This section does not discuss impacts the mine will have on nonconsumptive wildlife use or hunting in the area.

Response to Letter 4

4-28 The text in Section 3.5.2.1 has been modified to reflect this comment.

4-29 Detailed analyses of the impacts of the water alternatives to aquatic and riparian resources are included in Section 3.5.2.2 of the FEIS.

4-30 Please see the response to comment 4-18.

4-31 Please see the response to comment 4-18.

4-32 Mitigation measures for aquatic habitat are discussed in Section 3.5.4.2 of the FEIS. The intent of these measures is to replace lost habitat with habitat of similar function and values.

4-33 The text has been revised in Section 3.9.2.1 of the FEIS to more adequately discuss the impacts to non-consumptive wildlife use and hunting.

THE STATE OF ARIZONA
GAME & FISH DEPARTMENT
2221 West Greenway Road, Phoenix, Arizona 85023-4399 (602) 942-3000

Governor
Fife Symington
Commissioners:
Chairman, Arthur Porter, Phoenix
Nonie Johnson, Snowflake
Michael M. Golightly, Flagstaff
Herb Guenther, Tacna
Fred Belman, Tucson
Director
Duane L. Shroufe
Deputy Director
Thomas W. Spalding

May 10, 1995

Colonel Michal R. Robinson, Commander
Los Angeles District
U.S. Army Corps of Engineers
Attn: CESPL-DE
300 North Los Angeles Street
Los Angeles, California 90012

Re: Public Notice 94-40899-00-KLR; Carlota Copper Company

Dear Colonel Robinson:

The Arizona Game and Fish Department (Department) has reviewed Public Notice 94-40899-00-KLR, and the following comments are provided.

The anticipated impacts to fish and wildlife resources that may occur as a result of the proposed project appear to be significant. Pit dewatering and groundwater pumping will threaten the area's riparian and aquatic resources. Diversion of Pinto Creek and Powers Gulch will remove 9.4 acres of aquatic habitat and 0.34 acres of jurisdictional wetlands, including over a mile of Pinto Creek. At the current time, it is unclear to what degree mitigation will offset these impacts. Further, a commitment by the project proponent to restore aquatic habitats should be included in the mitigation plan as a requirement of the Section 404 permit.

The Department recommends that the following stipulations be included as requirements and conditions of the Section 404 permit:

- The project proponent should be required to compensate for impacts to riparian, aquatic and upland habitats in accordance with the Arizona Game and Fish Commission's Wildlife and Wildlife Compensation policy I2.3, as described in earlier correspondence.

- The project proponent must provide a detailed Mitigation Plan that should include a rigorous monitoring program for surface and subsurface flows in Pinto Creek and Haunted Canyon, and for the condition and quantity of aquatic, wetland, and riparian habitats. Mitigation should include

actions to fully compensate for losses of functions and values of aquatic and riparian habitats. In addition, actions to compensate for impacts to functions and values of upland habitats should be included in the plan. The Mitigation Plan should also include contingency arrangements and success criteria.

- The Reclamation Plan should be enhanced to meet the objectives of restoring public lands to their previous uses once mining operations have ceased.

- That the Department of Interior's Habitat Evaluation Procedures (HEP) be used to quantify values for habitats lost and replaced. This methodology will enable project proponents and decision makers to view impacts and compensation measures for the action in empirical terms, therefore ensuring that mitigation measures are neither deficient, nor in excess of full compensation.

As an attachment to this correspondence, we are providing the Department's comments to the U.S. Forest Service in response to the Draft Environmental Impact Statement for this proposed action.

Thank you for the opportunity to comment on this permit application. We look forward to continued consultation on this project.

Sincerely,

T. W. Spalding
ACTING
Duane L. Shroufe
Director

DLS:rh

cc: Charles R. Bazan, Tonto National Forest, Phoenix
Cindy Lester, U.S. Army Corps of Engineers, Phoenix
Jim Matt, Arizona Department of Environmental Quality
Sam Spiller, U.S. Fish and Wildlife Service, Phoenix
James Romero, U.S. Environmental Protection Agency,
San Francisco, CA

Enclosure

AGFD# 11-4-94(06)

Letter 5

United States Department of the Interior

NATIONAL PARK SERVICE
Tonto National Monument
HC02 Box 4602
Roosevelt, Arizona 85545

IN REPLY REFER TO:

L7615

May 8, 1995

Tonto National Forest
Paul M. Stewart
2324 East McDowell
Phoenix, Arizona 85006

Dear Mr. Stewart,

Mr Stewart, the monument staff appreciated you taking time early in this process to provide us with a brief overview of the Carlota project. As you know from this visit Tonto National Monument was established by Presidential Proclamation on December 19, 1907, to protect "prehistoric ruins of great ethnologic, scientific and educational interest". Monument boundaries were significantly expanded on April 1, 1937 as required for proper care, management and protection of all resources. Both proclamations expressly warn against injury or destruction of monument features and resources. With this in mind and after reviewing the draft EIS for the Carlota Project and attending the public meetings held on March 8, 1995, we wish to express concerns and list questions on the overall project.

-NEPA Process; I understand this EIS process is not easy for your entity to pursue, but it is also very difficult to understand especially for those of us not familiar with mining operations. I attended your public hearing attempting to gain an overall understanding of the project but came back with less than anticipated. The 9 resource stations were helpful, but it was difficult to obtain more than just answers to our specific questions. This process required us to be more prepared that what I or most individual in attendance were. It would have been beneficial for all to provide speaker with necessary skills to introduce the project. I understand the goal was to prevent conflict, but this can be accomplished also through proper communication and direction. It becomes personal with most folks in these cases and difficult to maintain responses positive, but since it's such a major process, you owe this to those involved and the NEPA process. By the way there was only one copy of the EIS draft available to all in attendance for immediate referral! **5-1**

5-2 -Air Resources; Based on the analysis stated, emissions are "not expected to exceed" NAAQS. Is there a plan for when these levels are exceeded, or even worse will anyone document it or care? In evaluating this project this phrase is difficult to comprehend

Response to Letter 5

5-1 Because no single format will please all interested parties, there are different formats for public meetings. The format chosen was a consensus decision by Forest Service Public Affairs Officers in consultation with the third-party consultant. The format allowed people to come and leave as their time and interests allowed. Stations were set up so there could be one-on-one contact with each resource specialist and so that there could be more opportunity for questions than would be provided by a single presentation. The DEIS was sent to all parties who had requested it a month before the meetings. It is not accurate that only one copy of the DEIS was available.

5-2 The project has been remodeled, and compliance with NAAQS at the project boundary has been demonstrated. See Section 3.1 of the FEIS and the Conformity Determination. PM_{10} monitoring is required in the AIP, and emission reduction measures would be established. If certain levels are reached, NAAQS violations would trigger AIP review.

Letter 5 Continued

because like polls, they can be altered for the specific result deemed necessary. AIP permit requires monitoring pm10 impacts in or near site. The potential impacts from acid deposition on the adobe ruins is of real concern. The compounds sulfur dioxide, nitrogen oxide and hydrosulfuric acid in the air increase the acidity which impacts our cultural resources. With terrestrial resources, Redline Numbers were exceeded for sulfur and nitrogen. The "assumption" derived in the deposition analysis maintain that calculations used were very conservative and "could be" overstated. In some cases they could be understated. The result is we will inherit increase in sulfur and nitrogen deposition, and the magnitude of potential impacts to terrestrial ecosystem from

5-3 deposition amounts exceeding Red Line number is unknown. Therefore if the project is approved, the monument would be a prime candidate for establishing a monitoring program, especially since prevailing winds are shown to be blowing towards the monument approximately 50% of the time.

-Water Resources; Concerns in this avenue stem from the major reroute of Pinto Creek. The monument is deeply concerned with what ends up at Roosevelt Lake especially in the immediate future when the level of the lake will be raised thus immediately neighboring

5-4 our north boundary. Since proposed diversion channel is intended as the permanent alignment of Pinto Creek through the pit area, what happens after the mining operation ends in 18-22 years? Through normal accelerated erosion, the possibility of long term post mining failure seems evident. Need to assure the alternative of backfilling around the portion of Carlota/Cactus pit (large one) around the Pinto Creek diversion, is implemented and then maintain forever! Actually this process should not be an alternative, it needs to be part of the contract. If possible this area should be backfilled as soon as possible to prevent Pinto Creek runoff to enter no-mans pit!

-Blasting Operations; Terrain as we all know affects noise either positively or negatively. Depending on many factors, noise propagation can extend in any direction and for many miles especially in areas where you inherit flat faced rock cliffs such

5-5 as at the monument. With varying prevailing winds in our direction, the quiet setting throughout the monument and especially at the ruins will be victimized with the daily blasting operations. The potential for impacts to the culture resources (ruins/alcoves) is imminent. These resources are very susceptible to damage from vibrations emitted in this manner. Since these resources are very fragile, increased vibrations could present possibility for loss of life and irreplaceable damage.

-Special Status Species; The Greater Western Mastiff Bat is on the sensitive list. They are year round residents of the monument. They forage for flying insects at considerable distances from roost

5-6 sites which are normally cliffs and canyon walls. The probability exists that bats would be attracted to lights and insects associated with the night operations at the mine site.

Response to Letter 5

5-3 On the basis of the revised model (see Appendix D of the FEIS), redline levels for nitrogen are not expected to be exceeded, but the redline level for sulfur is expected to be exceeded. However, the background concentrations of SO_2 assumed for the wilderness areas create deposition rates of sulfur that exceed the redline level for sulfur. Increases in gaseous concentrations caused by emissions from the Carlota Project are not expected to be statistically significant; therefore, effects on terrestrial resources caused by the project's SO_2 emissions are not expected to be significant. This conclusion is based on small modeled increases in SO_2 impacts (3 percent at the Superstition Wilderness, zero percent at Sierra Ancha and Tonto National Monument), the AIP condition that requires use of low-sulfur (< 0.05 percent sulfur) diesel fuel, and the use of more fuel efficient equipment at the Carlota Project (a visibility impacts mitigation measure).

No significant increases in air quality-related impacts have been predicted to occur at the Tonto National Monument as a result of the proposed Carlota Project. However, AIP is requiring PM_{10} monitoring at the project site. In addition, a visibility monitoring program is specified in the FEIS (see Section 3.1).

5-4 A partial backfilling of the Carlota/Cactus pit, which is designed to protect the diversion channel, is part of the proposed action. Maintenance of the Pinto Creek diversion channel is provided for throughout the project life and a post-closure monitoring period, as presented in Sections 2.1.2.5 and 3.3.4 of the FEIS. The long-term postclosure functioning of the Pinto Creek diversion is addressed as a mitigation measure in Section 3.3.4 of the FEIS.

5-5 A discussion on impacts from blasting has been added to Section 3.2.2.1 of the FEIS. No impacts are anticipated to any structures located in Top-of-the-World, which is approximately 4,200 feet south of the nearest pit. The USBM and OSMRE criteria are sufficiently conservative to provide protection for all structures regardless of repair. Considering that these criteria would not be exceeded at this site or at Top-of-the-World, and that the ruins at Tonto National Monument are located approximately 19 miles north of the site, there is virtually no potential for blasting at the Carlota project site to adversely affect any ruins at the Tonto National Monument.

5-6 The FEIS documents the presence of the Greater Western Mastiff Bat at the Monument and also discloses that there have been no sightings closer to the project area. The Final Biological Assessment & Evaluation for the Carlota Copper Project on the Tonto National Forest (Cedar Creek Associates, Inc. 1994b) states that surveys in 1992 and 1993 resulted in no captures and no calls heard despite the fact that the surveys were conducted adjacent to the night-lighted operation at the Pinto Valley Mine. The assessment indicates that there would be no impact to the species. The Carlota project would generate less night lighting than the currently operating mines, which are closer or equi-distant to the Monument.

Letter 5 Continued

5-7 -Dust; Dust from blasting operation and trucks hauling material is also a real concern. Process needs to be abated on a daily basis, again with prevailing winds the possibility exists for the monument to be adversely impacted.

5-8 -Night aesthetics; Night illumination from the 24 hour operation will provide us with an overall southerly glow much like you see prior to reaching the city of Phoenix. This will negatively impact the astronomy interpretive talks provided at different intervals throughout the summer months.

-Reclamation Bonding; Briefly mentioned, it should be more than the 2 million dollars that Carlota estimates for closure process. 5-9 Specific schedules should be developed at the onset for each individual arena instead of waiting just prior to closure when they are exiting the door. The incentive will not be as great to comply! The phrase "not economically feasible" should not be an alternative especially when it comes to irreplaceable resources.

-Additional Considerations;

5-10 Reevaluate the statement that revegetation is not feasible for pit walls/area, your neighbor to the east is making one process work.

5-11 Leach pad alternative for Powers Gulch seems to be the best process for that area. Make every effort to minimize accidental contaminant release or leakage! Discharged materials evaluation process to include application of EPA guidelines as required.

5-12 Initiate the plan to utilize low quality water (recycled) using water retention pond. Agree that the alternative to acquire water from Central Arizona Project (Roosevelt Lake) is not feasible.

-Conclusion;

Construction and operation of the Carlota Copper Project will result in irreversible damage to our resources which we have been entrusted with. Mining is hardly a benign activity and those who profit should be assessed for the total impact on resources that 5-13 belong to all. In the long run who pays? In light of U.S Forest Service management standards and guidelines to protect the general public and restoration of resource damage, will we inherit the bill for this process in the future, which will take generations to fulfill? The benefit which reasonably may be expected to occur from the proposal must be balanced against its foreseeable detriments.

-Recommendation;

5-14 Due to cumulative impacts to the monument, we recommend the no **action alternative** for the Carlota project. If for some unimaginable reason the political climate overrules common sense 5-15 and this project materializes, we deeply encourage you to include

Response to Letter 5

5-7 The AIP includes enforceable limits on activities and specific controls on fugitive and process sources of emissions. Additional dust control on principal haul roads is also required as mitigation for potential visibility impacts. See also the response to comment 2-13a.

5-8 Please see the response to comment 2-15.

5-9 Reclamation bonding and schedules are addressed under mitigation measures SR-8 and SR-9 in Section 3.4.4.2 of the FEIS. Adequate bonding is called for in these measures and would be administered throughout the project by the Forest Service and appropriate state agencies.

5-10 Revegetation of pit backfill is part of the proposed action (section 2.1.9.2); however, given the geometry and nature of the materials comprising pit benches and walls, revegetation of these areas is not proposed. The success of efforts at other sites are on tailings surfaces with few similarities with those that would be created at the Carlota pits. However, provisions for adapting innovative reclamation technologies over time are contained in the proposed action.

5-11 The Forest Service believes the Powers Gulch site, which is the proposed action, is the best alternative. Section 2.1.3.1 of the FEIS has been strengthened to emphasize containment of potential contaminants to comply with EPA regulatory requirements.

5-12 FEIS Section 2.1.6.1, Table 2-6, identifies estimated water requirements for mine operation activities. Loss from the leach pad (evaporation, retained moisture, etc.) is the single greatest use of water in the operation, ranging from 240 gpm to 500 gpm. The low-quality water discussed in FEIS Section 2.2.1.4 is suitable for this use. Carlota has reached an agreement in principle with BHP Copper and Cyprus Copper companies to use low-quality water available at BHP Copper's Cottonwood storage area. Carlota is also investigating a second source of low-quality water from the Gibson Mine. If this source is available in sufficient quantity, it would be a supplemental source of water. See also the response to comment 1-2.

5-13 The EIS addresses reasonably foreseeable impacts. Carlota must provide a bond or other financial assurance to the Forest Service for reclaiming surface resources on National Forest System lands, to the COE for mitigating impacts to waters of the U.S., and to the State of

Letter 5 Continued

5-15 the monument in the modeling, quantification and monitoring processes instead of speculating impact and risks from previously designated grid points and information. Pre-through-post monitoring is classified as a minimal process to undertake given the extent of this short term project. Appreciate the opportunity to respond.

With appreciation,

Lee Baiza

Lee Baiza
Superintendent

Response to Letter 5

Arizona for reclaiming private land and protecting the affected aquifer. Carlota also would be subject to an NPDES permit from the EPA to protect surface waters. All agency requirements consider long-term impacts consistent with agency authority.

5-14 Provided Carlota can comply with other existing laws, the Forest Service has no authority under its regulations to deny Carlota its right under the General Mining Law of 1872 to recover the locatable minerals from its claims. The FEIS discusses cumulative impacts to cultural resources in Section 3.6.3 and to other resources in their respective sections. No impacts, direct, indirect, or cumulative, could be identified that would have a measurable effect on the Monument.

5-15 Please see the responses to comments 2-13a and 5-3.

Letter 6

Received Mar 16, '95

ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

Fife Symington, Governor   Edward Z. Fox, Director

ERP: 95-0717

March 14, 1995

Mr. Paul M. Stewart
Tonto Natural Forest
2324 E. McDowell Road
Phoenix, Arizona 85006

Dear Paul:

I have reviewed most of the issues in the Draft EIS for Carlota dealing with water quality. I have had discussions with representatives from ADEQ and Carlota. We believe the environment would be better served if the following issues were addressed in the final EIS.

6-1 1. The Pinto Creek Bypass Channel must have a low flow channel to connect the natural sections of Pinto Creek with a chain of microinvertabrates. A low flow channel should be approximately 2 feet deep and 6 feet wide and filled with rocks and boulders salvaged from the bypassed portion of Pinto Creek. If Carlota is required to supply makeup water to Pinto Creek as the result of stresses observed downstream in the Pinto Valley ecosystem, the water shall be added at the upstream end of the low flow channel.

6-2 2. There should be a detention basin at the upstream end of the Powers Gulch bypass channel. The discharge from this outlet basin should be capable of draining the pond by gravity flow into the bypass channel. The discharge orifice should be a vertical slot with the means to restrict the flow if there is a problem in the bypass channel. The purpose is to prevent an overflow from the bypass channel into the leach pad if the bypass channel becomes plugged due to a seismic event or a storm causes the release of material above the channel.

6-3 3 The two leach dams constructed internally within the leach pad are dams in a watercourse. To avoid a degradation of water quality we propose pods of crushed limestone be placed downstream of the dams prior to the confluence with Powers Gulch. The pods should be placed between a series of small dams with an impervious liner to hold leaking fluids in contact with the limestone.

6-4 4. Carlota must prioritize their water usage for their operating schedule. They should have several water sources besides the wells in Pinto Creek. The priority list should show all available water sources and water volumes for the operation of the mine. The use of water already impacted by mining should be No.1 priority.

3033 North Central Avenue, Phoenix, Arizona 85012, (602)207-2300

Response to Letter 6

6-1 Please see the response to comment 3-1.

6-2 Please see the response to comment 3-2.

6-3 Please see the response to comment 3-3.

6-4 Please see the response to comment 3-4.

Letter 6 Continued

Mr. Paul Stewart
March 14, 1995
Page 2

6-5 5. The Pinto Creek subsurface aquifer will flow into the Carlota Pit as it is deepened. The water flowing in the Pinto Creek aquifer must be prevented from being drained to the Carlota Pit. To accomplish this a grout barrier should be constructed across Pinto Creek near the bypass channel. As the pit is deepened the grouting process should be repeated as new drainage areas are observed on the pit walls.

Sincerely,

Jim Matt, P.E.
Environmental Engineer

Response to Letter 6

6-5 Please see the response to comment 3-5.

Letter 7

MAR 1 4 1995

STATE OF ARIZONA
DEPARTMENT OF MINES AND MINERAL RESOURCES
ARIZONA MINING AND MINERAL MUSEUM
Phone (602) 255-3795 1-800-446-4259 (IN ARIZONA ONLY)
FAX (602) 255-3777

March 9, 1995

Mr. Paul Stewart, Carlota Project Coordinator
Tonto National Forest
2324 E. McDowell
Phoenix, AZ 85006

Dear Mr. Stewart:

RE: Carlota Project

I have reviewed the Draft Environmental Impact Statement on the subject project and have attended the public hearing. I find the project well planned in every respect. It is time for this project and Carlota Copper Company is the right operator. They are experienced and have a reputation for fulfilling their environmental commitments.

I lived at Top of the World for two wonderful years in the mid 1980's. I am still interested in living in the area and the Carlota Project would not change my mind. I have talked to some of the residents in the area who are opposed to the project about buying their property. They are asking prices that are **much** higher than the prices they reported paying to the County Assessor. I suspect their NIMBYism is profit motivated. When Phelps Dodge announced the opening of the Tyrone project in 1966, property prices in Silver City were three times higher than they had been the day before. It is very unlikely that residents in the area will suffer financially from this project one way or the other.

Once the Carlota property is operation I doubt that anyone in the area will be aware of the project. Unless, of course, they are making money from the operation. This is a mining district and there are five other much larger open pit and underground mines working in the same area. Carlota's small contribution is negligible. I wish that I could say the same about surface disturbance in the Phoenix Metro area and that is one of my reasons for wanting to move back to Sutton Summit.

1502 WEST WASHINGTON STREET, PHOENIX, ARIZONA 85007-3210

Response to Letter 7

Letter 7 Continued

It is unreasonable for anyone moving to this area in the last 50 years to be surprised that mining will continue in the area. This area has continued to produce mineral wealth for the enjoyment of society for over 100 years. The history and the industry in this area are identical. All of the current operations in the area and some of the idle ones have initiated programs to reclaim previously disturbed lands. At the end of the Carlota project, the area of lands in the district that have not been reclaimed will be much smaller than it is now.

Suggestions have been made that lands should be removed from mineral entry to mitigate the hedge hog cactus habitat that may be disturbed by the project. This is a guise for a taking of public land. First, because hedge hog cactus prefers steep rocky surfaces. It has even shown a preference for highway road cuts. The Carlota project will provide many times more habitat of this type than it destroys. Second, the federal government has already removed too much land from mineral entry without proper support for their action. Many mineral exploration groups have sought discovery in other countries for this reason.

7-1 If I have any complaint about the Draft Environmental Impact Statement it would be in the permitting process which has been too long, too expensive, too detailed and too many governmental agencies were involved. My complements on surviving to this point.

Sincerely,

H. Mason Coggin, PE & LS
Director

Response to Letter 7

7-1 The permitting process is controlled by the number of federal, state, and local laws and regulations and by the requirements for public involvement. The Forest Service has made its best effort to balance the needs of Carlota and the public to identify and disclose impacts and to produce the basis for an informed decision on a major mining project.

Letter 8

Office of the Mayor

CITY OF GLOBE
ARIZONA 85501

RECEIVED TONTO N.F. MAR 9 1995

March 6, 1995

Charles Bazan
Tonto National Forest
2324 E. McDowell Road
Phoenix, Arizona 85006

RE: Carlota Copper Company

Dear Mr. Bazan:

8-1 As a lifelong resident of the area and as the Mayor of the City of Globe, I can attest to the significance of the enconomic impact the mining industry has on our community. Traditionally, the mining industry creates opportunity for high wage employment, tax revenues for both government entities and school districts, and is the region's major employer.

I have continuously monitored the progress of Carlota Copper Mining and feel confident that they have complied with all environmental regulations to ensure the preservation of the environment. The successful opening of this mine will afford local residents the opportunity of an estimated 300 new jobs.

I strongly urge that Carlota Copper Company be granted, without further delay, the required permits to proceed.

Sincerely,

David A. Franquero

David A. Franquero

cc: City of Globe Council
Steve Stratton - City Administrator
Robert Walish - Carlota Copper Company

Response to Letter 8

8-1 The Forest Service fully understands the significance of a new mine to the economic stability and potential growth of communities in the area; this significance is reflected in Section 3.7 of the FEIS. However, the level of issues and concerns raised by other commentors has necessitated addressing impacts to the physical and biological environment.

Letter 9

United States Department of the Interior

NATIONAL PARK SERVICE
Southern Arizona Group
202 E. Earll Drive Suite 115
Phoenix, Arizona 85012-2623

IN REPLY REFER TO:

L7615

March 2, 1995

RECEIVED
TONTO N.F.
MAR 7 1995

Paul Stewart
Carlota Project Coordinator
Tonto National Forest
2324 East McDowell Road
Phoenix, Arizona 85006

Dear Mr. Stewart,

9-1 We have reviewed the draft EIS for the Carlota Project and have several concerns as to the effects on the surrounding area from this project. Of extreme concern is the potential to impact the prehistorical structures at Tonto National Monument. We can state that increased atmospheric acids would negatively impact the alkaline adobe mortar and plaster in the ruins, weakening the structures. The compounds sulfur dioxide, nitrogen oxides, and hydrosulfuric acid in the atmosphere increase the acidity. The ruins are fragile pieces of the history of the area, and we strongly oppose projects which would have a negative impact on this resource.

9-2 The potential impacts from blasting on the ruins and alcoves in which they are located, is also of great concern to us. The ruins and alcoves are very susceptible to damage from vibrations. There is no way to mitigate the destruction of the structures and natural bedrock formations found at Tonto National Monument. There is a very real possibility that the fragile walls of the ruins and fractured bedrock formations could fail with increased vibrations with devastating loss of life and resources.

9-3 The increase in particulates will decrease the air quality of the area, thus impacting our visitors experiences. The 24 hour a day operation at Carlota Mine will require night lighting; this will impact the entire area with an additional dose of night-time brightness. The aesthetics of the local area will be degraded from this project.

9-4 Losses to riparian habitat and increases in water pollution greatly impact all of us, no matter how small they seem to be on paper. Decreased water quality in Roosevelt Lake will impact the entire region. Wildlife, wildlife habitat, and the quality of the human environment will be damaged or lost as a result of this project. Migration corridors will be affected. Is the short term economic gain really worth the damage caused?

Response to Letter 9

9-1 The impact analysis in the FEIS shows a 4 percent increase in NOx concentration and a 0.1 percent increase in SO_2 concentration. Appendix D of the FEIS shows a slight (4 percent) increase in nitrogen deposition and a zero percent increase in sulfur deposition resulting from these increases in gaseous NO_x and SO_2 concentrations. From these results, the Forest Service expects no impacts on prehistoric structures at Tonto National Monument from the Carlota Project.

H_2SO_4 emissions are in the form of liquid droplets emitted either at points of sulfuric acid application to the ore or at the tankhouse associated with the SX/EW plant. These emissions are expected to be directly deposited very close to the emission sources. Because of the significant distance between the emission sources and the Tonto National Monument, direct deposition of sulfuric acid mist onto structures at the Tonto National Monument is not expected to be significant.

9-2 Please see the responses to comments 5-5 and 5-7.

9-3 See the visibility subsection in Section 3.1 of the FEIS for a description of PM_{10} impacts. Also see the Conformity Document for the Carlota Project. See also the response to comment 2-15.

9-4 Roosevelt Lake is located approximately 18 miles downstream of the project area. Measures to ensure that the water quality in Roosevelt

Letter 9 Continued

We implore you to stop this project due to the extreme impacts it will have on the quality of life, natural, and cultural resources of the area. If you can't stop the project, at least establish long-term monitoring programs that will address the impacts on air, water, and
9-5 wildlife. Monitoring air quality does not seem to be addressed in your EIS. Long-term monitoring of all resources is a weakness of this EIS.

Jerry Belson
General Superintendent

cc:
Lee Baiza, Superintendent
Tonto National Monument
HC02, Box 4602
Roosevelt, AZ 85545

Response to Letter 9

Lake would not be impacted include the EPA's NPDES stormwater permit, the ADEQ Aquifer Protection Permit, ADEQ's CWA Section 401 State Water Quality Certification of the COE's CWA Section 404 permit and EPA's NPDES permit, and the SCHMM Plan (for any leaks or releases of process fluids). Monitoring of surface waters downstream of the project area is described in the Groundwater and Surface Water Monitoring Plan, Carlota Copper Project (GWRC 1996a) and in Section 3.3.4 of the FEIS.

9-5 For air quality, PM_{10} monitoring is required in the AIP; a visibility monitoring program also is required (see the visibility subsection in Section 3.1 of the FEIS). See also the response to comment 5-13.

Table G-1.
Summary of Non-Agency Comments and Response to Comments

Comment No.	Comment Summary	Response to Comment
Project Design		
PD-1	Discuss the design of the underdrain and postmining maintenance of the underdrain system.	The proposed design of the underdrain system is included in Section 2.1.3.1 of the FEIS. Please also see the response to comments 1-25 and 3-16. A description of the postclosure performance of the subdrain system is presented in the response to comments 1-25 and 3-16.
PD-2	60-mil is not equal to 60 millimeters.	Section 2.1.3.1 of the FEIS has been modified to correct this error.
PD-3	Discuss postclosure monitoring commitment for the LCRS.	Please see the response to comments 1-64, 1-77, and PD-28.
PD-4	Address the impacts from using contaminated water from Pinal Creek.	Potential impacts associated with using contaminated water from the Pinal Creek drainage are addressed in Section 3.3.2.2 of the FEIS.
PD-5	Describe impacts from spraying/sprinkling acid versus using a drip system.	The AIP contains a condition that allows Carlota to use either low-pressure wobblers or a drip system to add sulfuric acid to the leach pad. H_2SO_4 emissions from either system are assumed to be negligible. ADEQ approved this rationale and approach to estimating emissions in the AIP.
PD-6	Provide liner longevity versus life of project comparison.	The proposed primary and secondary liners for the heap leach pad are 60-mil HDPE geomembrane. HDPE liner materials are commonly used throughout the world in both copper and gold heap-leach operations. Geomembrane manufacturers have conducted extensive testing of HDPE to assess its chemical resistance and longevity. With respect to chemical resistance to sulfuric acid, HDPE is rated excellent at both ambient temperatures, 20°C, and elevated temperatures, 50°C. Manufacturers have conducted accelerated-exposure testing to estimate longevity with respect to both a buried application and exposure to ultraviolet (UV) light. Lifetimes are extremely long in a buried application; a typical test, conducted by National Seal Corporation, indicated a minimum of 420 years (and still retaining over 50 percent of the initial material properties). Testing of liner breakdown under exposure to UV, conducted by SLT North America, did not generate a reduction of material properties that would result in liner failure after an equivalent of 50 to 80 years of exposure. Testing of actual installed liner, exposed to UV for 14 years, has not shown a reduction of material properties. The only portion of the Carlota leach pad liner that would be exposed would be the small portion on the leach-pad berms and embankment faces. At the end of the 20-year life of the facility, this portion of the liner would also be buried as part of the leach-pad closure, and UV exposure would be eliminated.

Comment No.	Comment Summary	Response to Comment
PD-7	The leach pad should have a double liner.	Please see response to comment 1-21. The leach pad would have a double liner in the area of solution ponding, an LCRS, protective layers above and below the liner system, and a low-permeability subgrade, as described in Section 2.1.3 of the FEIS and in the *Final Design of Heap Leach Pad and Ancillary Facilities* (Knight Piésold 1995a), which has been incorporated into the FEIS by reference. The double-lined system would be placed under the solution retention area as shown in the design report. The solution retention area was determined using wet-year conditions, and a commitment to maintain minimal PLS volumes in the pad has been made by Carlota as part of the Aquifer Protection Permit. The entire liner system as proposed has been recognized as fulfilling BADCT requirements under the Aquifer Protection Permit issued for the project by ADEQ.
PD-8	The leach pad should use a composite lining of HDPE and clay.	Please see the response to comments PD-7 and 1-20.
PD-9	Evaluate using LDPE instead of VLDPE.	VLDPE is no longer available; the project would use LDPE where VLDPE was previously proposed.
PD-10	Discuss liner durability.	Please see the response to comment PD-6.
PD-11	Describe where the acid solution runoff will go.	Most of the precipitation would be absorbed by the ore; any excess would be routed to the heap, as described in the SPCC.
PD-12	Address where the sulfuric acid will be stored.	Sulfuric acid would be stored in the SX/EW plant (see Table 3-95 of the FEIS).
PD-13	Discuss the probability of wastes getting into Powers Gulch, Haunted Canyon, and Pinto Creek.	No statistical analyses are anticipated for this issue. The heap leach pad and pond system is designed to be a zero-discharge system, with considerable holding capacity and backup provisions for emergency events. Engineered liners and an LCRS would be integral components of the processing system. An SPCC Plan would be in place, as would stormwater management provisions. Water quality monitoring has been conducted prior to project construction and would be conducted during operations and a postclosure monitoring period. These measures would minimize the possibility of acid wastes migrating off the site.
PD-14	Describe how to design and operate a zero-discharge heap.	The descriptions of how to design and operate a zero-discharge heap are provided in Section 2.1.3 of the FEIS, in the Aquifer Protection Permit issued for the project by ADEQ, and in the *Final Design of Heap Leach Pad and Ancillary Facilities* (Knight Piésold 1995a), which has been incorporated into the FEIS by reference.
PD-15	The entire facility should be zero-discharge.	Please see the responses to comments PD-13 and PD-14.
PD-16	Evaluate secondary catchment ponds below leach pad ponds.	Additional ponds are proposed downgradient of the main and north PLS pond embankments to collect any drainage from the spine drain system (see Section 2.1.3.2 of the FEIS). These components would consist of zoned embankments and ponds lined with 12 inches of prepared subgrade overlain by a 60-mil HDPE liner. While not specifically designed as part of the process fluid management system, these ponds would provide a level of redundancy for that system.

Comment No.	Comment Summary	Response to Comment
PD-17	Describe how long-term diversion channel stability will be maintained.	Mitigation measure WR-13 recommends that long-term stability of the channel systems be maintained through adequate design and review of diversion functions at closure, incorporating long-term considerations. Monitoring and maintenance would extend into the postmining phase, with frequency and duration of inspection and maintenance to be determined by the Forest Service and Carlota. Other agencies may be involved as appropriate. If implemented properly, these measures would reasonably ensure the long-term sediment transport and hydrologic functions of the channels.
PD-18	Discuss what financial assurance exists that the diversions will remain intact after closure.	FEIS mitigation measures WR-13, and SR-8 were added or revised to reasonably ensure the postclosure operation of the diversions and to include such activities as necessary to accomplish this in bond estimates and bonding mechanisms for the project.
PD-19	Restore channels to original condition.	Long-term stability of the channel systems is a project objective discussed several times in the FEIS. If implemented properly, the mitigation measures described in Section 3.3.4 would reasonably ensure the long-term functioning of the channels. Restoring the channels to their original topographic conditions is not a feasible or necessary alternative at this time.
PD-20	Describe the quality control program for waste rock disposal.	Please see the response to comment 3-10.
PD-21	Address slope stability and the potential impact to the SX plant on the edge of the pit.	The pit slope stability report for the Carlota/Cactus pit did not identify any adverse geologic conditions in the area of the proposed west pit wall located near the SX/EW plant. However, Section 3.2.2.1 of the FEIS has been revised to acknowledge that there is some potential for future slope instability of the pit wall to damage adjacent facilities. This risk would be minimized by revised mitigation measure GM-3 (Section 3.2.4.1 of the FEIS).
PD-22	Substantiate if and how stormwater runoff will exit the pit.	The FEIS addresses stormwater runoff in Section 2.1.9.2, specifically in regard to backfilling and recontouring the Eder pits. The backfilled materials would be contoured so that any precipitation captured by the pit highwalls and filled areas would flow off these former pit areas as surface runoff. After mine closure, stormwater runoff would be captured within the Cactus/Carlota pit. A pit lake would form from both stormwater runoff and ground water discharge to the pit. At equilibrium, the pit lake would be approximately 135 feet below the Pinto Creek diversion channel outflow from the pit.
PD-23	Discuss whether tailings will be riprapped and revegetated to prevent erosion.	Carlota does not propose to create tailings deposits. Ore processing would consist of heap leaching. Erosion control and revegetation are extensively addressed in the Plan of Operations and Section 2.1.9 of the FEIS.
PD-24	Describe the likelihood of a spill from a raffinate pond.	As described in Chapter 2 of the FEIS, the plant PLS/SX and raffinate ponds, the leach pad, and the internal PLS ponds have been re-designed to contain the runoff from an extremely rare event (based on the 72-hour 1/2 PMP) in addition to the maximum volume of process fluids that would occur during operations. The likelihood of overflow from a system designed to these capacities is extremely low. Please see the response to comment 1-1.
PD-25	Disclose the size and capacity of the raffinate and PLS ponds.	A detailed discussion of process solution pond capacities has been included in FEIS Section 2.1.3.2.

Comment No.	Comment Summary	Response to Comment
PD-26	Discuss mine rock dump channel maintenance and collection; ponding.	Section 2.1.5.5 of the FEIS describes the hydraulic features associated with the mine rock disposal areas.
PD-27	Discuss the bond requirement to ensure water provisions are complied with.	Please see the response to comments 1-75 and 1-78.
PD-28	After closure, there is no commitment to the length of time that discharge from the heap leach pad collected by the LCRS will be monitored. Also, the effectiveness of pumping the leachate back onto the heap after closure, rather than neutralizing or filtering it, is questioned.	At closure, the heap leach pad would cease to function as it did during active operations. The heap would be drained and the surface recontoured and reclaimed to minimize the infiltration of precipitation. The effect of this closure plan would be to encapsulate the facility and prevent any build-up of water at topographic lows within the heap. In other words, the remaining contents of the leach pad would be isolated from adjacent surface and ground waters. For this reason, there would be no need to pump leachate back onto the heap. If new heap closure techniques, such as neutralization, are developed over the life of the project by Carlota or others, they would be examined for applicability to augment or replace the current heap closure and reclamation approach. Monitoring of the leach pad for leakage would continue after closure. This would be facilitated by the permanent spine and finger drain system located under the heap. As stated in Section 3.3.4.2 of the FEIS, the monitoring would continue until it could be demonstrated that any potential risk had been minimized. The ADEQ would also require postclosure monitoring; its Aquifer Protection Permit requires Carlota to monitor for a minimum of 5 years after closure, and longer if warranted.
PD-29	Ensure there is no disturbance to the impermeable cap after closure.	Significant disturbance to the prepared heap surface is not likely after the closure and reclamation period. Plant roots and animals would have to penetrate the soil-rock cover and the low permeability zone to make contact with heap materials. If this were to occur, the heap materials themselves would discourage further penetration. For any man-made disturbances to occur after the reclamation, closure, and monitoring periods, submittal of notifications and plans to the Forest Service and other appropriate agencies would be legally required. Such activities would probably generate additional environmental investigations prior to approval of any disturbances. This would substantially mitigate the potential for future exploration or mining activities to disrupt the integrity of the reclaimed heap and create adverse environmental impacts.
PD-30	The waste rock disposal area should be lined and designed for zero discharge.	Comment noted. Please see the response to comments 1-60, 1-63, and 3-10.
PD-31	Discuss safety once the project begins.	The mining company must conform to the federal MSHA and state regulations. The Arizona State Mine Inspector must make compliance inspections to ensure the mining company meets these regulations.
PD-32	Clarify whether mine areas will be back-filled to support diversion structures for Pinto Creek, or if this is just an alternative.	As stated in Section 2.1.9.2 of the FEIS, the partial backfill is included in the proposed action and is not an alternative to the proposed action. The backfill would act to buttress the in-pit side of the Pinto Creek diversion.

Comment No.	Comment Summary	Response to Comment
Project Alternatives		
A-1	Eliminate Eder pits.	The Forest Service has no authority to prevent Carlota from exercising its rights to recover ore under the General Mining Law of 1872. An alternative to underground mining was considered but eliminated because it was not economically feasible. Impacts from blasting and noise are addressed in Section 3.12.2.1 of the FEIS. Background noise levels at Top-of-the-World are, and would be, dominated by traffic on U.S. Highway 60. Noise levels are estimated to change from "quiet to average residential" to "average residential." As a result, mitigation measures N-1 to N-5 were developed. As a result of comments on blasting, an additional discussion has been added to Section 3.2.2.1 of the FEIS.
A-2	Construct a diversion tunnel around the pit.	The Forest Service is aware of the use of tunnel diversions at other projects. In addition to the cost, the risk of blockage was a major consideration in eliminating the alternative. With the development of in-diversion 404 mitigation and the fact that the only feasible route for a tunnel would be beneath land already occupied by mining activities, no advantages would result from further analysis of a tunnel.
A-3	Line the waste rock disposal area to minimize acid mine drainage.	Please see the response to comments 1-60, 1-63, and 3-10.
A-4	Include a runoff system for the waste rock disposal area.	Please see the response to comment 1-34.
A-5	Use smaller containers to store acid to minimize the volume in case of a leak.	Please see the response to comment 1-37. Carlota is required to design for full containment from leaks around acid storage containers.
A-6	Investigate other alternatives to reduce water use as a dust suppressant.	Carlota and the Forest Service have agreed upon an appropriate water balance for the project. Control requirements in the AIP, haul road dust controls agreed to as a mitigation measure, and control efficiencies assumed in the emission inventory are based upon an appropriate water balance.
A-7	There is no consideration of the No Action alternative or off-site alternative.	Provided Carlota can comply with other existing laws, the Forest Service has no authority under its regulations to deny Carlota its right under the General Mining Law of 1872 to recover the locatable minerals from its claims. The Forest Service determined that an off-site alternative did not satisfy the purpose of and need for the proposed project.
A-8	Fully evaluate a smaller project.	Please see response to comment 1-18. A smaller project was determined to be economically infeasible. Please refer to Appendix A of the FEIS for an evaluation of this alternative.
A-9	Analyze other possible sites for the copper project.	Please see the responses to comments 1-13 and A-7.
Procedural Policy Issues		
P-1	The Forest Service should publish another Notice of Intent in the Federal Register given the changes to the project.	After the initial NOI was published on June 9, 1992, the Forest Service waited until Carlota had made all modifications to its Plan of Operations before revising the NOI. A revised NOI was sent to the Federal Register on December 16, 1994. The Federal Register did not print the NOI until February 16, 1995, the week after the Notice of DEIS availability was printed. The delay had no apparent effect on the opportunity for the public to review or comment on the proposal.

Comment No.	Comment Summary	Response to Comment
P-2	Disclose relationship of Riverside Technology, inc. to Carlota and address potential conflict of interest.	Riverside Technology, inc., a third-party environmental consulting firm, prepared the Carlota Copper Project DEIS under the direct supervision of the Forest Service.
P-3	The Forest Service did not provide a copy of the DEIS to some individuals who had requested it.	When the supply of the initial printing was nearly depleted, the Forest Service suggested that requesters review copies in Forest Service offices and local libraries. Requests were documented, and when a second printing arrived (a delay of about 1 week) all requests were met.
P-4	Analyze net benefits of the project versus negative impacts.	The environmental analysis of individual resources identified both the beneficial and adverse impacts associated with implementing the proposed action or project alternatives. These impacts are identified in Sections 3.1 through 3.15 of the FEIS and are summarized in the Summary; in addition Section 2.3 compares the impacts associated with each of the project alternatives.
P-5	The DEIS is legally inadequate.	NEPA states that draft EISs, must fulfill and satisfy, to the fullest extent possible, the requirements for final statements in Section 102(2) (C) of the Act. The DEIS satisfied these requirements to the extent possible for this project. Also, no legal decision has been, or will be, made based on the DEIS.
P-6	Delay Carlota's project until BHP Copper's Pinto Valley Mine has ceased to operate.	Please see the responses to comments 2-38 and AQ-40 regarding the prioritization of Forest Service review of plans of operations.
P-7	Other agencies should be involved in impacts/monitoring/mitigation.	The Forest Service has coordinated with other federal and state agencies throughout the preparation of the EIS. Please refer to section 4.2 of the FEIS for a list of these agencies.
P-8	Opposition exists to the acquisition of private property for mitigation.	Comment noted. The Forest Service does not have the authority to require an applicant to purchase and/or offer private land for mitigation, although this can be the most effective and economical means to satisfy mitigation requirements.
P-9	Support exists for the acquisition of private property for mitigation.	Please see the response to comment P-8. Plans have been developed to satisfy mitigation requirements without the purchase of private property (land). Carlota has agreed to work with grazing permittees, that exist on the affected allotments, to minimize economic losses. This may or may not result in the acquisition of the grazing permit as other property.
P-10	Focus on significant issues per NEPA.	The DEIS focused on the issues and concerns of potential significance, as identified during the scoping process for the Carlota Copper Project.
P-11	Very little information is presented regarding the project's benefits.	Please see the response to comment P-4 regarding the identification of beneficial impacts to resources.
P-12	The public process was not adequate and does not comply with NEPA.	The public involvement process fully met the requirements of NEPA. Because of the general nature of this comment, a more specific response could not be provided.
P-13	Discuss whether Tonto National Forest will pay for regulatory costs imposed on state/local government since the project is a federally mandated operation.	The response to a plan of operations is mandated by regulation. The operation itself is not federally mandated; the General Mining Law of 1872 enables Carlota to mine. The issue of who pays for regulatory permitting costs is not within the scope of this analysis or decision.

Comment No.	Comment Summary	Response to Comment
P-14	Tonto National Forest has not considered total impacts of expansions or initiations of ALL other operations in the region; therefore, impact evaluations are invalid.	The Forest Service is responsible for a best estimate of reasonably foreseeable activities in a reasonable cumulative effects analysis area. The level of information available from other mining operations is highly dependent upon their notices or applications for regulatory permitting for exploration or development. The Forest Service has broadened the analysis depending upon a reasonable probability of measurable impacts. Air quality impacts were analyzed on a broader scale than vegetation impacts. A failure to consider a project that has minimal to immeasurable cumulative impacts when added to the proposed and adjacent projects does not make a cumulative impact analysis of effects invalid.
P-15	The government should pay Carlota interest on its bond.	In the absence of any default in performing any conditions or requirements bonded, Carlota is entitled to receive the accrued interest on deposited securities. The Federal Reserve Bank having custody of the deposited securities shall pay the interest on any registered bond or note to the registered holder.
P-16	Discuss whether the valley will be restored to its original state after mining, and whether funds will be set aside to pay for restoration.	Please see the response to comment 4-2. 36 CFR Part 228.13 requires the operator to furnish a bond conditioned upon compliance with 228.8(g) prior to approval of such plans of operations.
P-17	Discuss responsibility for reclamation if Cambior goes bankrupt or copper prices drop or are suspended before reclamation is complete.	36 CFR Part 228.13 requires the operator to furnish a bond conditioned upon compliance with 228.8(g) prior to approval of such plans of operations. Should Cambior experience a bankruptcy, action toward the bond can still take place because the bond is not part of the bankruptcy estate.
P-18	Carlota should pay cleanup costs in advance.	As provided in 36 CFR Part 228, the Forest Service has the authority to require a bond from Carlota with respect to reclamation. In determining the appropriate amount of the bond, consideration is given to the estimated cost of stabilizing, rehabilitating, and reclaiming the area of the operation. Costs for prevention, control, and monitoring of potential environmental impacts as identified in the FEIS are calculated and also incorporated in the bond. These measures are developed to prevent the release of contaminants into the environment during operations and after closure. With the correct implementation of these control measures, impacts beyond those addressed in the FEIS are not anticipated.
P-19	Discuss whether Carlota has sufficient resources to operate, monitor, and reclaim the mine, and whether Cambior will be responsible if Carlota defaults.	Please see the response to comment P-17 regarding the bond. Regardless of whether Carlota defaults or whether Cambior has the resources, the reclamation bond is the assurance mechanism that reclamation is accomplished as per the Plan of Operations. The bonding instrument is approved by the Forest Service. Acceptance of the instrument is based on criteria set forth by federal regulation and the Forest Service Bond Approving Officer.
P-20	A supplementary impact statement is needed to require additional studies.	Please see the responses to comments 1-5 and 1-12 regarding preparation of a supplemental DEIS.
P-21	The Forest Service has neglected to acquire information from Magma.	Please see the response to comment 1-56.

Comment No.	Comment Summary	Response to Comment
P-22	It is unclear to what extent Carlota is committed to reclamation responsibilities. Bonding is vague and inadequate.	Please see the responses to comments 4-2, 4-12, and P-17 regarding the bond.
P-23	Describe how the Forest Service will oversee all mitigations proposed.	Forest Service mineral management specialists would administer the Plan of Operations in the field. The final approved Plan of Operations would incorporate all mitigation measures from the EIS Record of Decision. Administration of the final Plan of Operations would ensure that the mitigation measures are implemented.
P-24	The process for distributing information is not conducive to commenting.	Comment noted. Please see the response to comment 5-1.
Miscellaneous		
X-1	No in-situ mining is carried out at the Pinto Valley Mine.	The reference to "in-situ leaching" has been removed in the FEIS.
X-2	Modify the text to clarify that tailings deposits were removed in 1993 and no tailings are present along Pinto Creek below the Pinto Valley Mine.	While a large clean-up effort was undertaken, it was agreed by the agencies involved that it would not be possible to remove all tailings deposited along the stream course without causing substantial damage to the riparian corridor. Therefore, it is the Forest Service position that the statements in the DEIS regarding tailings deposited along Pinto Creek are accurate.
X-3	Note that the Diamond H pit (referenced on page 203 of the DEIS) belongs to Magma not Cyprus.	The Diamond H pit was not mentioned on page 203 of the DEIS; the reference cited could not be located.
Air Quality		
AQ-1	The DEIS states that SO_2 and PM_{10} conform with SIP, yet background levels are unknown.	Background concentrations for PM_{10} are known and presented in the FEIS (Section 3.1). SO_2 background concentrations have been estimated based on representative, nearby, off-site data. The Forest Service considers these data to be representative of the project site. In addition, emissions from the project have been remodeled for the FEIS. Section 3.1 in the FEIS specifically demonstrates that the project is expected to conform with the applicable SIP requirements. The comparison of expected air quality impacts at the Superstition Wilderness to the PSD increments is presented in the Final EIS as a method of assessing the significance of impacts from the project (e.g., this comparison is not a strict regulatory requirement). For this comparison, expected impacts are compared directly with Class I increments (i.e., background concentrations are not included in the comparison). No Class I increments were exceeded. SO_2 background concentrations have been estimated based on representative, nearby, off-site data. The Forest Service considers this data to be representative of the project site.

Comment No.	Comment Summary	Response to Comment
AQ-2	Why have ozone background levels not been measured? Ozone should be analyzed carefully.	No preconstruction air quality monitoring was required for this project because the project is not subject to PSD regulations. Carlota voluntarily collected PM_{10} and meteorological data. Atmospheric ozone is formed from ozone precursors (NO and VOCs) and sunlight. NO and VOC emissions have been estimated for the Carlota Project, and an estimate of ozone impacts is presented in the AQRV section of the FEIS (Appendix D). This background concentration is based on the continental average ozone concentration and is considered by the Forest Service to be representative of the project site. Ozone is typically an urban issue (where the inventory of NO and VOCs from mobile and stationary sources is significant). The Forest Service does not consider ozone attainment issues to be pertinent to the project area nor the Carlota Project.
AQ-3	Fugitive dust emissions may be exceeded in some parts of the project site.	The project has been remodeled, and compliance with NAAQS at the project boundary has been demonstrated. See both Section 3.1 of the FEIS and the Conformity Determination. Compliance with the NAAQS is assessed at and beyond the project area boundary, in accordance with federal regulations, guidance, and the definition of ambient air. In addition, the Carlota project would be subject to workplace air quality standards under MSHA.
AQ-4	The Miami/Hayden area is already designated as a nonattainment area for SO_2. Why add another SO_2 generator?	The project has been remodeled, and compliance with NAAQS at the project boundary has been demonstrated. Conformity with applicable SIP requirements has also been demonstrated. See Section 3.1 the FEIS and the Conformity Determination. Also, ADEQ has considered redesignating all or a portion of the Hayden/Miami area to "attainment" based on updated source emissions inventories and ongoing monitoring data that demonstrate the PM_{10} and SO_2 NAAQS are not being exceeded. Furthermore, ADEQ has petitioned the EPA to redesignate the Miami area portion of the non-attainment area to attainment. This information is available as a part of ADEQ's public record.
AQ-5	Explain why monitoring data was not used in Table 3-17.	The FEIS presents a summary of complete PM_{10} baseline monitoring data set that includes the average 24-hour concentration for the monitoring period and the maximum 24-hour concentration measured at the site. The AIP and the FEIS impact analyses include a description of the technical justification for adding the period average background concentration to the maximum 24-hour impact in order to reasonably estimate maximum concentrations expected. This technical approach has been approved by ADEQ and the Forest Service.
AQ-6	Explain how the project can proceed in violation of NAAQS.	The project has been remodeled, and compliance with NAAQS at the project boundary has been demonstrated.
AQ-7	Address impacts from H_2SO_4 releases to the north.	H_2SO_4 emission estimates are based on a study and calculation method approved by ADEQ. H_2SO_4 emissions have been modeled using a receptor grid that includes receptors to the north of the project. The model results have been presented in Section 3.1 of the FEIS.

Comment No.	Comment Summary	Response to Comment
AQ-8	Address acid mist impacts to soils and other resources. Field experiment plots should have been set up.	Impacts on soils, vegetation, and aquatic systems are presented in Appendix D of the FEIS. Acid rain is a regional problem (as opposed to source-specific issue) resulting from reasonably intense concentrations of large industrial sources of SO_2 emissions; therefore, acid rain is not addressed specifically in the FEIS. Furthermore, the Carlota Project is not expected to be a significant source of SO_2 emissions (low sulfur diesel fuel is a requirement in the AIP). The Forest Service maintains that acid rain is not a pertinent air quality concern for the project area. No preconstruction air quality monitoring was required for this project because the project is not subject to PSD regulations. However, Carlota voluntarily collected PM_{10} and meteorological data. The AQRV analysis presented in the FEIS (Appendix D) is based upon what the Forest Service believes to be the best available information in terms of estimating effects of expected emissions on native plants. There is a plan identified in Appendix D of the FEIS to monitor for potential impact to the hedgehog cactus. This plan includes direct observation of the individual plants in the area determined to be at risk and monitoring soil pH around selected cacti in high risk areas.
AQ-9	H_2SO_4 mist will settle out someplace, and there is a potential for impacts to local vegetation. Health impacts at Top-of-the-World from combined PM_{10} and H_2SO_4 mist, as well as PM_{10} alone, should be evaluated.	Please see the responses to comments AQ-7, AQ-8, and AQ-14. Appendix D of the FEIS describes maximum off-site impacts of H_2SO_4 emissions compared with the applicable AQGs health-based guidelines. The Forest Service is not aware of any unique additive health effects posed by the combination of PM_{10} and H_2SO_4. Impacts from these pollutants are assessed independently in the FEIS.
AQ-10	Quantify more accurate numbers for H_2SO_4.	Carlota has refined the design of the SX-EW plant. The H_2SO_4 emissions and impacts estimates in the FEIS are based upon this refined design and on a study and calculation method approved by ADEQ. H_2SO_4 emissions have been modeled using a receptor grid that includes receptors to the north of the project. The model results have been presented in Section 3.1 of the FEIS. Impacts on soils, vegetation, and aquatic systems are presented in Appendix D of the FEIS.
AQ-11	Analyze heavy metals that have been excluded.	An evaluation of metals and other hazardous air pollutants is included in Section 3.1 of the FEIS. Air quality impacts of these substances are expected to be below applicable Arizona Air Quality Guidelines (AQGs).
AQ-12	Address impacts from chemical dust suppression on ground water. Will there be enough water for dust control?	A mitigation measure that addresses ground water protection has been included in Section 3.3.4 of the FEIS. The mitigation measure requires that all dust palliatives used on the site be approved by the Forest Service to protect ground water resources. Carlota and the Forest Service have agreed upon an appropriate water balance for the project. Control requirements in the AIP, haul road dust controls agreed to as a mitigation measure, and control efficiencies assumed in the emission inventory are based upon this appropriate water balance.

Comment No.	Comment Summary	Response to Comment
AQ-13	Substantiate 90 percent dust control for blasting.	The AIP includes a condition that requires a filter and/or pneumatic flushing control on the drill rigs used for drilling blast holes. This requirement is credited in the emission inventory with a 90 percent control of drilling emissions. There is no control nor control efficiency assumed for dust emissions from blasting operations.
AQ-14	Describe health effects from all emissions impacts, including toxic metals and organics.	AQGs are health-based guidelines. By comparing air pollutant impacts to the NAAQS and AQGs, community health impacts are compared to health-based standards. Therefore, an assessment of potential impacts on human health is implied. The worker health-based regulations under the Federal Mine Safety and Health Act would apply at the Carlota Project; therefore, workplace air quality standards would be protected and enforced under the MSHA. An evaluation of metals and other pollutants for which Arizona has adopted AQGs (including octane, a component of kerosene) is included in the FEIS. AQGs are health-based guidelines. Air quality impacts associated with these substances are expected be below applicable AQGs. The revised AQRV analysis in Appendix D of the FEIS includes an assessment of environmental impacts from emissions from the Carlota Project.
AQ-15	Preliminary background levels need to be established for toxins/organic toxins from kerosene and diesel.	No preconstruction air quality monitoring was required for this project because the project is not subject to PSD regulations. However, Carlota voluntarily collected PM_{10} and meteorological data. An evaluation of metals and other pollutants for which Arizona has adopted AQGs (including octane, a component of kerosene) is included in Section 3.1 of the FEIS. Air quality impacts from these substances are expected to be below applicable Arizona AQGs. Background levels for metals have been estimated and are presented in Table 3-8 of the FEIS. VOC emissions from storing diesel fuel and using kerosene are presented in Section 3.1 of the FEIS.
AQ-16	Reevaluate impacts from all Phoenix area-related pollutants. The statement that air from Phoenix influences visibility and ozone levels near the project but does not contribute significantly to pollution levels near the site is inconsistent.	The Forest Service has used a variety of data sets to characterized background concentrations at the project site. The discussion of background data has been clarified in Section 3.1 of the FEIS. The inconsistency identified in the comment has been resolved.
AQ-17	The EIS should consider cumulative impacts of minor stationary sources. What status would Carlota hold if it expanded?	Large and small sources have been included in both background air quality data and the cumulative impacts discussion of Section 3.1 of the FEIS. Upon expansion, Carlota would have to go through the same applicable environmental requirements (NEPA, PSD, Arizona air quality regulations, etc.) as any other operating and appropriately permitted facility.

Comment No.	Comment Summary	Response to Comment
AQ-18	The DEIS does not address whether Carlota's emissions of SO_2 and PM_{10} exceed the increments of allowable increases for these pollutants in the area.	PSD increments do not apply to the Carlota Project because the source classifies as a minor source under the Prevention of Significant Deterioration regulations. The comparison of expected air quality impacts at the Superstition Wilderness to the PSD increments is presented in the FEIS as a method of assessing the significance of impacts from the project (e.g., this comparison is not a strict regulatory requirement). For this comparison, expected impacts are compared directly with Class I increments (i.e., background concentrations are not included in the comparison). No Class I increments were exceeded. Please see the response to comment 1-69.
AQ-19	Twenty-four hour particulate impacts in the Superstition Wilderness are estimated to be higher than the PSD increment for Class I areas.	Please see the responses to comments 1-69 and AQ-18.
AQ-20	Fugitive emissions should be used to calculate major source status. Only mobile sources for nitrogen oxides are defined in Table 3-12 as stationary combustion sources. CO omitted from diesel vehicles is mobile, not fugitive.	PM_{10} (dust) emissions from haul truck travel over unpaved roads are considered fugitive emissions, and combustion emissions from haul truck tail pipes are considered mobile source emissions. This interpretation of haul truck emissions is consistent with federal regulations, policy, and guidance. There was a typographical error in Table 3-12 of the DEIS. In the FEIS, both stationary and mobile sources of NO_x are identified.
AQ-21	There will be an exceedance of Class I increments.	PSD increments do not apply to the Carlota Project (the source is classified as a minor source under the PSD regulations). In spite of this, the Forest Service considers comparing impacts to increments to be a reasonable way to assess the significance of potential impacts from the project. The project has been remodeled, and impacts in the wilderness areas are compared to Class I increments (see the Section 3.1 of the FEIS).
AQ-22	Visibility will be impaired in the Superstition Wilderness.	The visibility impacts have been remodeled. Impacts have been reassessed. Mitigation measures and monitoring have been required in order for expected visibility impacts from the proposed project to meet the Forest Service Region 3 Limits of Acceptable Change and the Tonto National Forest's visibility objective.
AQ-23	Include atmospheric temperature inversions in evaluating impacts from sulfuric acid mist.	Dispersion modeling uses on-site atmospheric stability data and upper air data from a representative location to estimate impacts. Low wind speed/high stability (stagnant conditions) are accounted for in the impact analysis.
AQ-24	BEEST-X and PLUVUE II predictions are inconsistent.	Particulate impacts have been remodeled using the EPA-approved ISCST3 model. ISCST3 (an "Appendix A" model) and PLUVUE-II (an "Appendix B" model) are EPA-approved models that estimate distinctly different air quality impacts and are not necessarily directly comparable. The Forest Service has attempted, wherever possible, to maintain consistency among the various air quality impact analyses included in the FEIS. The Forest Service considers the particulate, gaseous pollutant, and visibility modeling to be representative and consistent. The Forest Service also considers the impact estimates for the Tonto National Monument to be representative.

Comment No.	Comment Summary	Response to Comment
AQ-25	Reevaluate the statement that increasing wind speed will decrease the pollutant concentration.	By the definition of dispersion algorithms, if all other variables are held constant, a doubling of wind speed will reduce predicted concentrations by a factor of 2.0. Although this statement may not be exactly true for all real-world situations, it is true for theoretical dispersion models – the accepted method for estimating pollutant impacts.
AQ-26	Analyze all wind directions (patterns), not just the predominant ones.	All wind speeds and wind directions are accounted for in the on-site meteorological data set used to run the dispersion models to estimate ambient impacts for NAAQS and AQG pollutants. The data set included low wind speed/high stability (still) conditions, and the receptor grid included receptors in all directions.
AQ-27	Quantify Magma emissions and include them in the analysis.	Emissions from the Pinto Valley Mine are included in background PM_{10} concentrations and are accounted for in the cumulative impacts discussion in Section 3.1 of the FEIS. It is not necessary to clearly distinguish one source's emissions from the other. The impact analyses in the FEIS include impacts from both sources, and the comparisons of impacts to air quality standards assume that both sources are operating.
AQ-28	Re-evaluate acid emissions assumptions for the leach pad.	H_2SO_4 emissions estimates are based on a study and calculation method approved by ADEQ. H_2SO_4 emissions estimates and estimated impacts are presented in the FEIS.
AQ-29	Re-evaluate visibility impacts to the wilderness areas.	Please see the responses to comment AQ-22.
AQ-30	Address health effects and other impacts (PM_{10}) from air emissions, including sulfuric acid mist.	Please see the responses to comments AQ-7, AQ-8, and AQ-14.
AQ-31	Establish PM_{10} remote monitoring points.	PM_{10} monitoring is required in the AIP. A visibility monitoring plan is also included as a mitigation measure in Section 3.1.4 of the FEIS.
AQ-32	The amount of emissions from various sources needs to be presented. Trucks should be considered point sources.	Tables 3-10 and 3-12 in Section 3.1 of the FEIS list the descriptions, categories, and emission estimates for all foreseeable emission sources at the proposed project. PM_{10} (dust) emissions from haul truck travel over unpaved roads are considered fugitive emissions, and combustion emissions from haul truck tail pipes are considered mobile source emissions. This interpretation of haul truck emissions is consistent with federal regulations, policy, and guidance.
AQ-33	Discuss how the 38 percent pit retention number was derived. It would be highly variable and could significantly change maximum numbers for critical pollutants.	Please see the response to comment 1-72.
AQ-34	To what extent will leach pad pretreatment contribute to emissions.	Emissions of sulfuric acid from ore conditioning would be reduced by using a fully covered conveyor belt that should reduce wind effects to negligible levels. In addition, a concentrated acid solution with low-pressure sprays would be used to minimize the potential for acid mist to escape the ore conditioning system. When control efficiencies are unknown, no credit for emissions reductions is assumed. H_2SO_4 emission estimates are based on a study and calculation method approved by ADEQ.

Comment No.	Comment Summary	Response to Comment
AQ-35	Discuss whether damage from pollutants has been considered in fenced areas that fail NAAQS limits.	The project has been remodeled, and compliance with NAAQS at the project boundary has been demonstrated.
AQ-36	The electrowinning process or exhaust system should be set up so that there is minimal sulfuric acid emissions regardless of whether there is a situation that needs to be mitigated.	The design of the SX/EW plant and the exhaust system incorporates elements to minimize off-site impacts. Also, the AIP includes an H_2SO_4 monitoring requirement.
AQ-37	The statement regarding implementing air pollution measures cannot be made for the pollutants listed in Table 3-14 where the efficiency of the control methods is unknown.	All controls to be implemented for the Carlota Project are identified in Section 3.1 of the FEIS; however, for control measures without known control efficiencies, no credit is taken in the emissions inventory.
AQ-38	Discuss impacts to Wilderness Plan visibility standards.	The visibility modeling analysis and interpretation of model results included in the FEIS were based upon appropriate federal agency policy, guidance, and standards. In addition, predicted plume impacts were evaluated against the Forest Service Region 3 visibility objective.
AQ-39	Explain the discrepancy between the maximum predicted 24-hour average ambient concentration of sulfuric acid/cubic meter on p. D-6 and p. 148.	H_2SO_4 impacts are presented in two ways: (1) The ambient impact analysis in Section 3.1 of the FEIS compares modeled impacts at the project area boundary to the Arizona AQG for H_2SO_4. (2) The AQRV analysis (Appendix D of the FEIS) uses an estimate of maximum on-site modeled impacts (within the project area boundary) to estimate impacts on air quality affected resources. The estimated H_2SO_4 impacts that are used for these two analyses are appropriate. Note: The analysis in the DEIS contained a typographical error on p. D-6. Impacts of H_2SO_4 emissions were incorrectly expressed in units of mg/m^3. The correct units ($\mu g/m^3$) are presented in the FEIS.

Comment No.	Comment Summary	Response to Comment
AQ-40	Expansion of the Pinto Valley Mine and Cyprus should be considered when describing cumulative impacts. Discuss who has priority for expansion approval. Also discuss how sources of pollutant violations (NAAQS) will be distinguished if Carlota is allowed to proceed.	The cumulative impact analysis has been revised as information has become available from plans of operation for other mines. The Forest Service cannot prioritize plans of operation approval. Once a plan has been received and accepted, analysis under NEPA and approval must proceed without delay. Emissions from the Pinto Valley Mine were included in background PM_{10} data and were accounted for in the cumulative assessment. Please see Section 3.1 of the FEIS, which includes emissions from all existing and reasonably foreseeable sources (direct and indirect) and meets Forest Service requirements for public disclosure. Furthermore, the project has been remodeled, and compliance with the PM_{10} NAAQS at the project boundary has been demonstrated. When other project expansions are proposed, those projects will be required to meet applicable requirements (including ongoing compliance with the NAAQS).
AQ-41	Describe potential impacts to vegetation from sulfuric acid mist. Will there be damage to hedgehog cactus from air pollutants?	H_2SO_4 emission estimates are based on a study and calculation method approved by ADEQ. The model results have been presented in the FEIS. In addition, a discussion of the potential acid mist impacts on vegetation is provided in Appendix D of the FEIS. Although no adverse effects are anticipated, the actual concentrations of acid that would begin to affect vegetation, such as the Arizona hedgehog cactus, can only be hypothesized from existing research. Therefore, a monitoring program is recommended in Appendix D and in Section 3.5.4.1, Biological Resources–Terrestrial Resources. This plan will include direct observation of the individual plants in the area determined to be at risk and monitoring soil pH around selected cacti in high risk areas.
AQ-42	When wind blows toward Top-of-the-World, health concerns are an issue.	The NAAQS are health-based standards. Demonstrated compliance with the NAAQS implies protection of human health. The impact analyses in the FEIS are typically summarized by comparing maximum expected impacts to applicable standards. If standards are not exceeded at the maximum receptor, then impacts at all locations are considered to be within standards. See also the response to comment AQ-13.
AQ-43	Carlota will be responsible for more air pollution than is discussed in DEIS because the DEIS does not consider emissions from sources other than the processing facilities.	The emissions inventory and modeling analyses developed for the Carlota Project meet federal technical requirements. Section 3.1 of the FEIS includes tables that list the descriptions, categories, and emissions estimates for all foreseeable emission sources at the proposed project. The results of the technical analyses are presented accurately and completely in the FEIS.

Comment No.	Comment Summary	Response to Comment
AQ-44	What will be the impact from NO_x, SO_2, and H_2SO_4 on pre-historical structures at Tonto National Monument? Will the adobe be weakened?	The impact analysis in the FEIS shows a 4 percent increase in NO_x concentration and 0.1 percent increase in SO_2 concentration. Appendix D of the FEIS shows a slight (4 percent) increase in nitrogen deposition and a zero percent increase in sulfur deposition resulting from these increases in gaseous NO_x and SO_2 concentrations. Based on these results, no impacts on pre-historical structures at Tonto National Monument are expected from emissions of SO_2 and NO_x from the Carlota Project. With regard to H_2SO_4 emissions, these emissions would occur in the form of liquid droplets emitted either at points of sulfuric acid application to the ore or at the tankhouse associated with the SX/EW plant. These emissions are expected to be directly deposited very close to the emission sources. Because of the significant distance between the emissions sources and the Tonto National Monument, direct deposition of sulfuric acid mist onto structures at the Tonto National Monument is not expected to occur in significant amounts.
AQ-45	If it is thought that the Superstition Wilderness and Sierra Ancha Wilderness are already being impacted by acid deposition, it is unwise to allow additional projects.	The AQRV analysis presented in Appendix D of the FEIS includes a characterization of existing conditions in the wildernesses. The Forest Service believes this characterization to be representative of existing conditions. The AQRV analysis also describes estimates of the effects of emissions on resources within the wildernesses. The Forest Service maintains that emissions from the project would be mitigated to levels that produce impacts within the Limits of Acceptable Change for acid deposition. This conclusion is based on (1) a small modeled increase in SO_2 impacts (3 percent at the Superstition Wilderness, 0 percent at the Sierra Ancha Wilderness and the Tonto National Monument), (2) the AIP condition that requires the use of low-sulfur diesel fuel (less than 0.05 percent sulfur), and (3) the use of more fuel-efficient equipment at the project site (a visibility impacts mitigation measure).
AQ-46	The DEIS fails to provide alternative designs for the project that would reduce dust emissions.	Alternatives are discussed and changes in emissions are identified in Section 3.1 of the FEIS. The FEIS also includes additional dust control measures that will be employed at the project site to mitigate potential impacts to visibility conditions. The Forest Service and Carlota evaluated a number of emission control alternatives in the process of selecting mitigation measures to protect visibility resources.
AQ-47	One-hour maximum PM_{10} concentrations were not modeled in the DEIS.	All applicable averaging periods for all regulated pollutants expected to be emitted at the project site have been considered in the FEIS impact analysis. There are no applicable 1-hour PM_{10} standards, thus the 1-hour averaging period is not considered.
Geology and Minerals		
G-1	Discuss impacts to homes and wells from blasting and area seismology.	The potential impacts from blasting, including impacts to wells, have been evaluated and added to Section 3.2.2.1 of the FEIS. In summary, based on monitoring and research conducted by the U.S. Bureau of Mines and the site-specific conditions (the proposed blasting design and distance between the blasting sites and residential wells,) no significant impacts are anticipated. Impacts to area homes from earthquakes are outside of the scope of this EIS.
G-2	Discuss the potential impact of seismic activity on the heap leach pad.	Stability of the heap leach embankments and pad during seismic loading was evaluated by Knight Piésold (1995a). The analyses indicates that the heap leach facility would be stable under seismic loading.
G-3	Address and disclose the geologic stability of all the mine facilities.	Stability of the major mine facilities is summarized in Section 3.2.2.1 of the FEIS. Detailed slope stability analyses are incorporated by reference in this section.

Comment No.	Comment Summary	Response to Comment
G-4	Describe the subsidence potential over existing shafts and workings.	The potential for subsidence is addressed in Section 3.2.2.1 of the FEIS. With proper backfilling of the workings, the risk of subsidence should be minimal.
G-5	Discuss whether the earthquakes in the area were on recognized faults.	The historic earthquakes that have been recorded in the area have not been associated with any recognized active or potentially active fault (fault displaying evidence of surface-ground rupture in the geologically recent past). Although the earthquakes were generated by fault movement, the movement likely occurred at considerable distance below the ground surface and did not propagate to the ground surface. It is common for small and moderate earthquakes (M less than or equal to 5) not to be associated with any surface fault rupture or surface traces.
G-6	Provide assurance that the integrity of the liner will not be compromised during seismic events.	Please see the response to comment G-2.
G-7	Demonstrate that all mine facilities will be able to withstand M4 earthquakes.	Please see the response to comment G-2 regarding the stability of the heap leach facility. For the mine rock disposal facilities, as stated in mitigation measure GM-6 (Section 3.2.4.2 of the FEIS), the final design of the mine rock facilities would be approved by the Forest Service and would include demonstrations that the facilities would be stable under seismic loading.
G-8	Substantiate stability of the Cactus Breccia and Cactus fault in the vicinity of the diversion.	During the preliminary design, the Pinto Creek diversion was moved toward the east to avoid potential slope stability problems associated with weak zones within the Cactus Breccia and Cactus Fault. According to the design, the diversion avoids areas underlain by the potentially unstable material associated with the Cactus Breccia and Cactus Fault.
G-9	Explain how a Modified Mercalli intensity of VI was determined.	The published reference for the reported Modified Mercalli Intensity values is cited as a footnote to Table 3-24 of the FEIS.
G-10	Structural geology needs to be completely understood before the project is approved because of potential contaminant transport.	As presented in Section 3.3.4.1 of the FEIS, Carlota has proposed a network of monitoring wells to monitor potential changes in ground water quality. This monitoring plan has been included in the ADEQ Aquifer Protection Permit. The location and design of the monitoring system was based on hydrogeologic characterization data that considered the influence of geologic structures on the flow of ground water.

Comment No.	Comment Summary	Response to Comment
G-11	The FEIS contains an inadequate discussion of whether the adit/shaft backfilling proposed is appropriate. Provide assurance that the drain and the shafts will be properly backfilled and that the subdrain system will operate effectively through operations and postclosure.	The adequacy of the adit and shaft backfill was discussed in 3.2.2.1 of the DEIS. Also, please see the response to comment G-12. The shafts would be backfilled in accordance with mitigation measure GM-1 and specifications defined in the final approved design of the heap leach pad (Knight Piésold 1995a). The QC Engineer, as defined in the specifications, would be responsible for all geotechnical work related to constructing the heap-leach facility, including proper shaft backfilling. Postclosure performance and maintenance requirements for the heap spine drain system are discussed in the responses to comments 1-25 and 3-16. Decommissioning shafts and drifts would proceed in accordance with the QA/QC program described in Appendix F, Section 3.3 of the *Final Design of Heap Leach Pad and Ancillary Facilities* (Knight Piésold, 1995a). Backfill and sealing methods and specifications are presented in that document. Please see the responses to comments 1-25 and 3-16 for information regarding subdrain operation and maintenance. Mitigation has been added to the FEIS (Section 3.3.4, mitigation measure WR-14) to require an upstream access port on the main PLS pond central spine drain to provide an opening that could be used for clean out, flushing, or inspection (please see the response to comment 1-25).
G-12	Evaluate the use of sand to close off adits/shafts.	Clean, well-graded, coarse sand would be a good alternative backfill material for adits and shafts. Backfilling with rip rap (large rock) or coarse sand does not require mechanical compaction and should minimize settlement. However, rock is typically specified for backfilling shafts, slopes, and subsidence features (see the General Bid Specifications, Colorado Inactive Mine Reclamation Program, State of Colorado, Division of Minerals and Geology, 1993) since it is readily available at most hard rock mine sites. Clean, coarse, sand for backfill would probably have to be imported to the site and would be more expensive.
G-13	Put the project on hold until it is feasible to mine the entire deposit.	Essentially all of the delineated copper deposit that is economically feasible to mine would be mined under the proposed action. As in most open-pit, hard-rock mining projects, a portion of the delineated mineral deposit would remain below the pit floors since these zones are not currently economically feasible to mine. These relatively small portions of the mineral deposits to remain are not economically recoverable because of the low grade of the material and the increased stripping required to enlarge the pit to extract the ore.
G-14	Describe how seismic activity will affect the aging liner during postclosure?	There are no known active or potentially active faults that occur beneath or near the heap-leach facility. Therefore, the risk of future ground rupture from active faulting is considered minimal. The heap leach facility is designed to remain stable even under loading from the maximum design earthquake event (Knight-Piésold 1995a).
Water Resources		
WR-1	No mitigations are proposed for wells in Top-of-the-World.	Please see the Monitoring Program subsection and mitigation measure WR-1 in Section 3.3.4.1 of the FEIS.

Comment No.	Comment Summary	Response to Comment
WR-2	Impacts to ground water levels have not been technically evaluated for the Top-of-the-World community. Discuss the basis for stating that the proposed action will have minimal impacts on ground water quantity.	Potential impacts to the wells in Top-of-the-World are technically evaluated in Section 3.3.2.1 of the FEIS. The statement referenced was in error and has been modified to reflect this comment.
WR-3	Substantiate potential water quality infringement on Top-of-the-World wells.	Please see the response to comment 1-54.
WR-4	Describe how blasting will affect wells.	Please see the response to comment G-1.
WR-5	Discuss whether Carlota owns water rights to allow for the loss of 134 million gallons per year.	Section 2.1.6.1 of the FEIS discusses Carlota's water requirements. Carlota has acquired a water right permit (Application No. 33-96423) for 75 acre-feet per year for its well field. Carlota will apply for additional water rights if the Arizona Department of Water Resources determines that Carlota's well field is removing a greater quantity of appropriable water than is provided for in the original application. The full impact of the well field on surface flows would be better understood following completion of a full-scale pump test identified in Section 3.3.4.1 of the FEIS. Ground water in the location of the proposed mine facilities is not subject to appropriation under the State's water code. Ground water essentially belongs to the overlying land owner and can be removed as long as its use does not unreasonably affect adjoining water users.
WR-6	Carlota should establish a water company to provide water to Top-of-the-World.	Please see the response to comment 1-55. The Forest Service has no authority to require Carlota to form a water utility.
WR-7	Evaluate Magma water supply well pumping data.	Please see the response to comment 1-56.
WR-8	Describe the mechanism for developing springs to replace those that are difficult to repair.	Springs can be developed or improved using several techniques. The actual techniques employed would depend on the site-specific circumstances and would need to be developed on a site-specific basis. For example, near-horizontal drill holes can be drilled to tap ground water and create a gravity-fed, no-maintenance spring source. Other spring areas can be improved by reducing damage from cattle grazing. Springs for wildlife have been successfully improved or created using storage tanks, rainwater catchment devises, spring boxes, and troughs, etc.
WR-9	Describe the flow levels Carlota will be required to retain.	Please see Appendix E of the FEIS for details on mitigation flow rates.
WR-10	Explain the usefulness of piping water from the well field.	Available information indicates that baseflow in Haunted Canyon is sustained by discharge from the ground water system. Therefore, discharging a small percentage of the ground water pumped from the well field to augment flows in the stream would replicate the natural system. In addition, measurements taken during a 24-day aquifer test indicate only a small percentage of the water withdrawn from the well field would be required to maintain minimum flows and habitat in Haunted Canyon.

Comment No.	Comment Summary	Response to Comment
WR-11	Discuss whether the Forest Service is going to donate water rights to Carlota.	The Forest Service will not donate water rights to Carlota. The Wellfield Mitigation Program described in Appendix E of the FEIS should protect existing Forest Service water rights within the project area and downstream.
WR-12	Identify a source of replacement or supplemental water.	The sources of supplemental water are discussed in Section 3.3.4.1 of the FEIS.
WR-13	Provide detailed water resource mitigation measures.	A detailed well field mitigation program for Haunted Canyon and Pinto Creek is provided in Appendix E of the FEIS.
WR-14	Explain why there would still be impacts to baseflow even with the low-quality water alternative.	Even with the low-quality water alternative, pumping from the well field would be necessary to provide for mine uses that require good quality water; therefore, some impacts to baseflow are still anticipated with this alternative.
WR-15	Describe the combined effects of pumping from the Pinto Valley Mine and the Carlota mine.	Please see the response to comment 1-56.
WR-16	Flow augmentation to Pinto Creek will only compound the loss of water to Pinto Creek.	Comment noted.
WR-17	Describe the impacts to baseflows in Pinto Creek. Discuss whether gaging data for the lower Pinto Creek subwatershed is important for calculating discharge in the watershed.	Impacts to baseflows are discussed in Section 3.3.2.1 of the FEIS. There are a number of alluvial drainages in the lower reach of Pinto Creek below the Pinto Valley weir. Among these are Apache Canyon, Blevens Wash, Campaign Creek, Little Campaign Creek, Quail Springs Wash, Spring Creek, and Wildcat Creek. All of these drainages, plus additional drainages above the weir, contribute flows to lower Pinto Creek. The drainages below the weir could have a similar relationship between annual discharge and watershed area as those above the weir, but this is not known for certain. There would be baseflow contributions from tributaries downstream of the project, but the quantity would be unknown. The Pinto Valley weir was used as a data point where potential impacts to surface water quantities (from upstream activities) could be assessed. The potential for project effects on surface water quantity is very likely to decrease below the weir as additional tributaries flow into Pinto Creek. For these reasons, gaging lower Pinto Creek is unnecessary.
WR-18	The Forest Service failed to disclose relevant available (pump) test results, and has not conducted any tests to determine impacts downstream of the well field or to Top-of-the-World.	The relevant pump test data results are presented in Figure 3-20 (Section 3.3.2.1) and are incorporated by reference (GWRC 1994) in accordance with 40 CFR 1502.21. Impacts to downstream flows in Pinto Creek were monitored and are reported in Section 3.3.2.1 of the FEIS. Wells located between the well field and Top-of-the-World that were monitored during the pump test indicate that pumping the well field is not anticipated to affect water levels in Top-of-the-World.

Comment No.	Comment Summary	Response to Comment
WR-19	Discuss why a 6-month to 1-year pump test was not conducted.	The 24-day pump test length is considered a long aquifer test. Conducting a 6-month or 1-year aquifer test may not have resulted in any significant new conclusions. The exorbitant cost and logistical problems associated with conducting such a long-term test outweigh any benefits gained by the additional data. As part of the proposed monitoring and mitigation presented in the FEIS (Section 3.3.4.1), additional pump tests would be performed prior to well field production for operating the mine to replicate peak ground water withdrawals. This information would be used to refine the monitoring and mitigation program.
WR-20	What are the combined effects of pumping from the Pinto Valley Mine and the Carlota mine?	Please see the response to comment 1-56.
WR-21	Mitigate extraction of flows above the baseflow to ensure that all reductions in flows are properly mitigated.	The Wellfield Mitigation Program presented in Appendix E of the FEIS details mitigation for impacts to surface flows when they drop below 1.23 cfs in the winter and median monthly flows in the summer and fall low-flow periods when water-dependent resources are most vulnerable to reduced flow. Mitigation of impacts to streamflow when flows are greater than the trigger flows identified in the mitigation program was not considered necessary for protecting Forest Service resources.
WR-22	The Forest Service is not disclosing all available water information.	Please see the response to comment WR-18.
WR-23	Re-evaluate values in Figure 3-9 regarding the streamflow rates, precipitation, and flow versus precipitation relationship.	Comment noted. A Wellfield Mitigation Program, including trigger flow rates, has been developed by Carlota and the Forest Service to address these concerns; see Appendix E of the FEIS.
WR-24	There are no true aquifers present in the area.	To avoid any confusion, where appropriate, the phrase "aquifer" is replaced by "hydrostratigraphic unit" except where the unit is used for water supply.
WR-25	Discuss metals accumulation in the process ponds and the heap.	The Aquifer Protection Permit issued for the project (ADEQ Permit No. P-102640, June 1996) mandates that ADEQ be notified of impending cessation of activities and stipulates that a closure plan shall be submitted for ADEQ approval within 90 days of such notice. The plan must identify the approximate quantities and the chemical, biological, and physical characteristics of materials to be removed from or to remain at the facility, the destination of materials to be removed, treatment methods, controls on discharges, an implementation schedule for the closure plan and submission of a postclosure plan. The postclosure plan must describe monitoring and maintenance approaches to eliminate any reasonable probability of discharge from the facility or exceedances of applicable water quality standards. The content and timing of these plans is in keeping with standard regulatory practice, and would address the concerns about metals accumulation in the project components, as well as other closure issues. Additional site stabilization, control, and monitoring procedures are identified in the reclamation plan as part of the Plan of Operations (Chapter 2 of the FEIS) and in recommended monitoring and mitigation measures in Sections 3.3, 3.4, and 3.14.

Comment No.	Comment Summary	Response to Comment
WR-26	Describe how the source of contaminants will be identified.	Identifying the source of contaminants is typically a simple matter. To facilitate the identification process associated with a contaminant spill or release, locations where potentially hazardous materials would be kept would be designed for effective containment and would be inspected monthly as described in the SCHMM Plan (Carlota 1996a).
WR-27	Describe how contaminated water can be remediated.	Remediation of contaminated water is described in the SCHMM Plan (Carlota 1996a). Small spills would be remediated through containment and subsequent disposal of contaminated materials, such as soils. Larger spills could require contracting an environmental clean-up firm that is experienced in remediating potentially hazardous materials.
WR-28	Provide assurances that there will be no outflow from the pit lake.	Please see the response to comment 1-38.
WR-29	Narrative water quality standards are not included in the EIS.	ADEQ water quality standards for surface and ground waters are addressed in Sections 3.3.1.2 and 3.3.1.3, respectively.
WR-30	Provide a discussion of the pit lake water balance if the pit slopes fail.	Some sloughing of the pit walls would likely occur over time in the postmining period. However, it is not anticipated that this sloughing would change the pit water balance significantly.
WR-31	Describe how contaminated ground water would be treated.	Treatment of contaminated ground water is discussed in the SCHMM Plan (Carlota 1996a). The procedure discussed in the SCHMM Plan for treating contaminated ground water calls for the Emergency Coordinator to determine the appropriateness of cleanup measures. For large spills that result in a large volume of contaminated ground water, the SCHMM Plan states that an environmental cleanup firm would be contracted to manage the spill. In addition, the ADEQ Aquifer Protection Permit for the Carlota project dictates that contingency actions (Part II.F.1.e. of the ADEQ Aquifer Protection Permit), including treatment, be taken if the ground water becomes contaminated. Treatment methods are handled on a case-by-case basis as dictated by the ADEQ Aquifer Protection Permit.
WR-32	Discuss an ADEQ variance for augmented flow.	Please see the response to comment 1-50.
WR-33	Provide a meaningful analysis of the potential downstream effects of a spill.	Potential downstream effects of a spill have not been analyzed. The ADEQ Aquifer Protection Permit assumes the mine would be designed and constructed to operate and close with no discharge to the environment. Any spills would be contained and a contingency plan would be implemented as part of the LCRS and the ADEQ Aquifer Protection Permit points of compliance for the duration of operation and the postclosure period.
WR-34	Reduced flow in Pinto Creek from the well field will cause a change in the ambient water temperature of the creek and will violate the water quality standards.	Reduced flows in Pinto Creek resulting from well field pumping would be augmented through the discharge of bedrock ground water to the stream as discussed in Section 3.3.4.1 of the FEIS. Surface water monitoring would be conducted in Pinto Creek upstream and downstream of the well field to evaluate any exceedances of Arizona surface water quality standards, including water temperature, as described in the Groundwater and Surface Water Monitoring Plan, Carlota Copper Project (GWRC 1996a).

Comment No.	Comment Summary	Response to Comment
WR-35	Evaluate a gradual leak of process fluids.	The handling of a gradual leak of process fluids is covered in the SCHMM Plan (Carlota 1996a). The procedure discussed in the SCHMM Plan for treating contaminated soil and ground water is for the Emergency Coordinator to determine the appropriateness of cleanup measures. For leaks that result in a large volume of contaminated soils or ground water, the SCHMM Plan states that an environmental firm would be contracted to manage the cleanup. In addition, the ADEQ Aquifer Protection Permit dictates both routine monitoring and reporting of the entire process fluid circuit, and an LCRS is required for all process fluid ponds. Contingency plans are required as part of the ADEQ Aquifer Protection Permit. Also, all points of leakage must be repaired, and the ADEQ must be notified within 5 days in the event of a process fluid leak, no matter how small.
WR-36	Analyze the impact of a spill in a dry versus a wet year.	Because the potential scenarios of a spill are limitless, the effects cannot be predicted. However, spill management is covered in the SCHMM Plan (Carlota 1996a). The procedure discussed in the SCHMM Plan for treating contaminated soil and ground water is for the Emergency Coordinator to determine the appropriateness of cleanup measures. The SCHMM Plan states that small spills are to be contained, removed, and disposed of according to the hazardous nature of the contaminated materials. For spills that result in a large volume of contaminated soils or ground water, the SCHMM Plan states that an environmental firm will be contracted to manage the cleanup. In addition, the ADEQ Aquifer Protection Permit requires monitoring and reporting of any release of contaminated water to the environment. The ADEQ Aquifer Protection Permit requirements for monitoring, reporting, and contingency planning are designed to ensure that the facility is operated and closed with no discharge to the environment during dry and wet years.
WR-37	Add potential water quality impacts to Table 3-86 (Irreversible, Irretrievable, Short-Term, and Long-Term Commitment of Resources - Proposed Action).	As summarized in Section 3.3.2 of the FEIS, the design of the process components includes engineering controls to prevent a release of contaminants to surface or ground water. Extensive surface and ground water monitoring will be conducted throughout the life of the project and for some period following mine closure (see section 3.3.4 of the FEIS) to verify that surface and ground water resources are not degraded from the Carlota Copper Project. The monitoring plan has been approved by the ADEQ and incorporated as a requirement of the Arizona Aquifer Protection Permit (APP). The monitoring plan covers monitoring requirements for Section 401 certification by ADEQ for NPDES permit compliance, and for Clean Water Act 404 permit compliance. Any significant accidental release would be detected and reported as required by the APP and the other permits. Carlota would be responsible for mitigating any accidental releases as specified in Section 3.3.4 of the FEIS and required by the APP and other state and federal permits. With these procedures in place, significant degradation of surface or ground water resources, which could potentially constitute an irreversible or irretrievable commitment of resources, is not anticipated.
WR-38	Describe cumulative effects caused by existing TDS.	There is no Arizona aquifer water quality standard or Arizona surface water standard for TDS, but there is a federal secondary MCL for TDS of 500 mg/L based on taste. Background TDS concentrations above the federal secondary MCL are presented in Sections 3.3.1.2 and 3.3.1.3 of the FEIS. Elevated background (existing) levels of TDS also have been documented in the FEIS. The effect of these elevated TDS levels is the reduced potability of certain localized aquifers to serve as potential domestic water sources.

Comment No.	Comment Summary	Response to Comment
WR-39	Describe the effect of a major fire on flooding and toxic releases.	In any given year the chances of having a fire extensive enough and in the right location to significantly affect flood peaks at the site are relatively small. In addition, the proposed site components that would need to accommodate storm runoff after such an occurrence, such as the Powers Gulch and Pinto Creek diversions, are designed to withstand extreme flood events. These components should be able to withstand a large storm event on a burned watershed, especially in their postclosure configurations. It is true that fire, especially in steep chaparral watersheds, has a drastic effect on flood peaks and on sediment concentrations transported in the flow. However, this effect rapidly diminishes with time when vegetation regrowth begins after burning. The probability of a simultaneous occurrence of a burned watershed and an extreme rainfall event (e.g., the 500-year storm or larger) has not been calculated for the project region; qualitatively, such conditions are highly unlikely. With the high discharge capacities designed into the diversion structures and the intensive reclamation approaches planned for the project, fire elsewhere in the regional watersheds is not likely to have a significant effect on flooding and toxic releases from the proposed project area. However, a fire directly on the project site at a critical time in vegetation re-establishment could have a detrimental effect on runoff, erosion, and sediment yield from the project area. For this reason, personnel on hand during reclamation and the follow-up monitoring period should have fire training, adequate fire equipment should be available on the site, and personnel should be thoroughly up-to-date on fire notification procedures for fire-fighting organizations. The FEIS has been modified to include this in Section 3.4.4.
WR-40	Discuss the long-term impact of sulfate to water quality.	There is no Arizona aquifer water quality standard or Arizona surface water standard for sulfate, but there is a federal secondary MCL for sulfate of 250 mg/L as SO_4 based on taste and laxative effects from human consumption of elevated levels. Background sulfate concentrations above the federal secondary MCL have been presented in Section 3.3.1.2 of the FEIS. Long-term increases of sulfate in water resources attributable to the Carlota project would be prevented or minimized as a result of federal (NPDES Storm Water Pollution Prevention Plan) and state (ADEQ Aquifer Protection Permit) regulations prohibiting the discharge of water or leachate containing elevated sulfate concentrations.
WR-41	Provide the basis for the statement that levels of metals and pH will be minimized.	The statement that levels of metals and pH would be minimized refers to introducing chemicals to the process fluid to ensure that its heap-leaching capacity is sufficient with the minimum reduction in pH and the minimum leaching of metals other than copper.
WR-42	Analyze potential degradation of ground water quality caused by pit dewatering activities.	Drawdown resulting from dewatering activities would lower the level of the ground water around the pit. Any lowering of the water levels could decrease surface discharge (springs) in areas located within the cone of depression. Although changes in water quality could potentially occur as a result of lowering water levels, it is not possible to accurately predict these changes. If the ground water has essentially the same source water and background chemistry, changes in water levels should not result in significant changes to water quality. However, if the spring or well discharge is composed of mixtures of different water types, and drawdown changes this mixture, then the water quality would change. The overall cost of obtaining information to accurately predict these changes in this hydrogeologic setting would be exorbitant. In addition, the background water quality data suggest that it is unlikely that changes that may occur through this process would significantly degrade surface or ground water sources.

Comment No.	Comment Summary	Response to Comment
WR-43	Baseline concentrations for kerosene in stream water have not been provided. Commentor has visually observed possible organic base contamination in streams.	Baseline water quality databases do not typically include kerosene as an analyte. The noted "organic base contamination" in stream water could result from a variety of natural and/or anthropogenic-occurring organics other than kerosene. Carlota's proposed ground and surface water monitoring plan (GWRC 1996a) requires the analysis of organics during operations, but there is no surface water standard for kerosene to allow for an evaluation of water quality exceedance. However, there are both ground and surface water standards for degradation products from kerosene, which would allow an evaluation of water quality exceedances and any changes in concentrations between baseline conditions and conditions after mining begins.
WR-44	Provide a narrative description of water quality standards.	A narrative description of surface water quality standards is included in the FEIS in Section 3.3.1.2; ground water quality standards are included in Section 3.3.1.3. of the FEIS.
WR-45	Provide assurance that the project can proceed without violating water quality standards.	The Arizona Aquifer Protection Permit addresses potential violations of ground water quality standards. The stormwater pollution prevention measures dictated in the NPDES permit address potential violations from stormwater runoff to surface water. The SCHMM Plan addresses spills or releases that have the potential to violate water quality standards.
WR-46	Technically evaluate impacts to water levels and quality in Top-of-the-World given the combined effects of the Pinto Valley Mine with the proposed action.	Potential impacts to the wells in the Top-of-the-World are technically evaluated in Section 3.3.2.1 of the FEIS. The statement referenced has been changed to reflect this.
WR-47	Address water quality (surface and ground water) with respect to updated MCLs, including a standard for 2µg/l for thallium. Discuss how valid historical monitoring data are given MCL updates.	Updated federal MCLs have been incorporated into Section 3.3 of the FEIS to update evaluations of water quality exceedances and tabular summaries of water quality data (including the new thallium MCL). Specifically, Table 3-44 lists the updated MCLs and Table 3-45 has been revised with respect to water quality criteria exceedances in the baseline database using updated MCLs. The water quality summary tables in Appendix C have also been revised in the FEIS to reflect the updated federal MCLs.
WR-48	Discuss the arsenic and thallium concentrations in the process water.	An arsenic concentration of 0.23 mg/L as As was analyzed for predicted process water quality as presented in Table C5-3 of the FEIS. An analysis of thallium was not performed; however, an analysis of thallium concentrations in process water has been specified in the ADEQ Aquifer Protection Permit. The ADEQ Aquifer Protection Permit dictates quarterly monitoring and reporting of process water quality, including thallium levels, during the first year of operation.
WR-49	The MWMT should include Thallium.	A concentration of thallium in the leachate for the mine rock was erroneously omitted from the water quality analyses. However, analysis of thallium concentrations in mine rock generated during operations has been specified in the ADEQ Aquifer Protection Permit. Section 3.3.4 of the FEIS and the ADEQ Aquifer Protection Permit dictate monitoring and reporting of mine rock at a frequency of 1 sample for every 1 million tons of mine rock for analysis using the EPA's Method 1312, Synthetic Precipitation Leaching Procedure. These monitoring plans include thallium as an analyte.
WR-50	Obtain background data for ground water (i.e., drinking and livestock wells).	Background ground water data from existing wells is included for private wells (drinking water) in Appendix C of the FEIS as a water quality summary table and in Table 3-46 of the FEIS as a water quality criteria exceedance table.

Comment No.	Comment Summary	Response to Comment
WR-51	Describe the expected sediment and toxic loading (from spills) to Roosevelt Lake.	The watershed area for Roosevelt Lake is approximately 4,300 square miles. The watershed area above the Pinto Valley weir is approximately 97 square miles, of which approximately 2 square miles would be directly affected by the proposed project. Carlota has committed to using BMPs to control erosion and sediment yield and also to a detailed reclamation plan. Sediment loading to Roosevelt Lake from the Carlota project would be negligible. Monitoring and mitigation of any releases to surfaces waters are discussed in Section 3.3.4.2 of the FEIS. Mitigation measures include identifying the contaminant source, correcting the source of release, and implementing remedial measures to protect surface water quality. Toxic loading to Roosevelt Lake would be minimized by using BMPs to control erosion and sediment yields as a requirement of the NPDES Storm Water Pollution Prevention Plan for the Carlota project, as approved by the EPA.
WR-52	The statement that water quality impacts are not anticipated in Pinto Creek appears to contradict other text.	The statement refers to the comparison of stream water quality standards for Pinto Creek within the 8.8-mile reach of the Wild and Scenic river system designation, provided there are no uncontrolled releases/spills. The statement on water quality impacts in Pinto Creek has been removed from Section 3.3.3 of the FEIS.
WR-53	Involve the public in locating proposed monitoring wells.	The Forest Service, in consultation with ADEQ, Carlota, and third-party consultants, has identified the location of monitoring wells. Some monitoring wells are a requirement of the ADEQ Aquifer Protection Permit. Other monitoring wells are proposed for monitoring potential impacts identified through the NEPA process. Locations and purposes of the proposed monitoring wells are identified in the ground water and surface water monitoring plan developed by Carlota (GWRC 1996a). The monitoring program is summarized in Sections 3.3.4.1 and 3.3.4.2 of the FEIS.
WR-54	Make monitoring well and gauging station data available to the public.	Data collected from the monitoring network of surface water stations and ground water wells will be provided to the Forest Service and other regulatory agencies on a regular basis (data reporting requirements are described in the ground water and surface water monitoring plan developed by Carlota (GWRC 1996a). These documents will be available for public review.
WR-55	Provide determinations for ground water monitoring, continuous streamflow, and thallium.	Please see Section 3.3.4 of the FEIS for a discussion of monitoring.
WR-56	Describe the trigger level for flow augmentation and discuss from what source the water would come. Ground water pumping to supplement would not work.	Please see the response to comment WR-21. The source of water is discussed in Section 3.3.2.1 of the FEIS. Please see Appendix E for details on the Wellfield Mitigation Program.
WR-57	Streamflow augmentation with well water may exacerbate the impact on streamflow and subflow.	Comment noted.
WR-58	Address potential risks or water chemistry that would result from using the low-quality water source in the leaching process.	The use of low-quality water in the leaching process is not expected to result in any additional risks because typical process fluid is of much lower water quality than the low-quality water from the Pinal Creek area.

Comment No.	Comment Summary	Response to Comment
WR-59	Address the water quality impacts from using dust suppressants.	Both natural water and synthetic (chemical) water would be used as dust suppressants. Runoff from areas with applied dust suppressants is regulated by the NPDES stormwater permit and ADEQ's Section 401 State Water Quality Certification. These regulatory provisions would help to eliminate or mitigate any environmental damage caused by using dust suppressants. Mitigation measure WR-8 has been expanded to address potential impacts from the use of dust suppressants (palliatives).
WR-60	Regarding the statement, "Special protection for the Unique Waters designation...would probably apply to land use activities and not water quality standards," protecting the waters is the most important element.	The statement has been removed from the FEIS.
WR-61	Discuss long-term monitoring/maintenance for diversions.	This issue is addressed in Section 3.3.4, Water Resources, mitigation measures WR-12 and WR-13.
WR-62	There is no reason to use surface water data outside of the wilderness area to evaluate potential aquatic impacts since the water chemistry for streams may not be the same as that of Powers Gulch.	Limited available water quality data for the wilderness dictated the need for substitute sample analyses to evaluate potential aquatic impacts. A discussion of the representativeness of the substitute analyses is provided in Appendix D of the FEIS.
WR-63	Clarify whether livestock are grazed downstream from the proposed project. Horses are especially sensitive to sulfate exposure.	Section 3.8.1 of the FEIS (Land Use) discusses grazing use in the area. Areas downstream of the project are grazed. Section 3.3.2 discusses potential impacts to water quality. No impacts to livestock are predicted.
WR-64	Monitoring wells should be placed in Powers Gulch upstream from the confluence with Haunted Canyon.	Comment noted. See Figure 3-22 in the FEIS for well locations. Monitoring wells are proposed for Powers Gulch upstream from the Haunted Canyon confluence.
WR-65	Discuss how appropriate it would be to have continuous streamflow recording stations on Powers Gulch.	Continuous streamflow recording stations on Powers Gulch are needed to evaluate changes in stream discharge resulting from mining operations. Section 3.3.4 of the FEIS prescribes continuous and instantaneous streamflow monitoring stations in Powers Gulch, both upstream and downstream of project components.
WR-66	Data on thallium should be measured more accurately than less than 01. mg/l (drinking water MCL is 0.002 mg/l).	Thallium analyses of sampled waters would be measured at the more accurate concentration of 0.002 mg/L as Tl (the federal MCL) as described in the Groundwater and Surface Water Monitoring Plan, Carlota Copper Project (GWRC 1996a).

Comment No.	Comment Summary	Response to Comment
WR-67	The proposal to improve nearby stream, wetland, or riparian areas does not compensate for the loss of Pinto Creek.	Most of the water mitigation efforts would be focused on the Pinto Creek drainage and maintaining the valuable riparian areas that already exist. The Wellfield Mitigation Program (Appendix E) would protect critical riparian water-dependent resources. One goal of this program is to maintain median streamflows in Haunted Canyon and Pinto Creek adjacent to the well field during the critical summer months. Most other mitigation measures, such as establishing additional riparian habitat above the Pinto Creek diversion, are also located within the watershed. The use of low-quality water from Pinal Creek would also help minimize any water-associated impacts to the Pinto Creek drainage. The only direct water mitigation outside of the Pinto Creek drainage involves protecting habitat in Arnett Creek, which is also a valuable riparian resource.
WR-68	Discuss the effectiveness of pumping raw discharge back onto the heap rather than neutralizing or filtering it.	Any leachate collected in the leachate collection system would be used in the process, including being pumped back to the heap. This is a relatively standard practice for many heap leach systems in operation in the western United States. The pump back system would function as a part of the zero-discharge control technology during operations and in the closure period. Revisions to the monitoring and mitigation measures for the heap have been made in Section 3.3.4 of the FEIS to provide further detail regarding these concerns. In addition, to address this issue, detailed monitoring plans (including postclosure programs) have been recently developed for the project and are subject to agency approvals.
WR-69	Discuss who can guarantee into perpetuity that pit water won't become polluted with heavy metals and mix with Pinto Creek if the diversion channel fails.	Comment noted. Based on the baseline ground water conditions, geochemistry of the wall rock exposed in the ultimate pit, and the results of geochemical modeling, significant degradation of the pit lake and outflow to Pinto Creek are not anticipated. Also, FEIS Mitigation Measure WR-13 requires that the Pinto Creek diversion would be designed at closure to convey the full probable maximum flood event.
WR-70	Clarify that there was no evidence that a release of tailings and PLS significantly contributed to copper concentrations in Pinto Creek.	It is agreed that there is a lack of evidence supporting the conclusion that a release of tailings and PLS significantly contributed to copper concentrations in Pinto Creek. Section 3.3.1.2 of the FEIS has been modified to address this comment.
WR-71	There is no evidence that flow from the Homestead Spring and West 3 is related to the tailings impoundment.	It is agreed that there is a lack of evidence supporting the conclusion that flow from the Homestead Spring and West 3 is related to the tailings impoundment. Section 3.3.1.3 of the FEIS has been modified to address this comment.
WR-72	Poor well water quality in the alluvium in Pinto Creek near Cottonwood Canyon is naturally occurring and not related to mining activity.	It is agreed that influences from natural mineralization is another possible source of poor well water quality. Section 3.3.1.3 of the FEIS has been modified to address this comment.
WR-73	It is inappropriate to conclude that poor water quality in springs or wells is the product of seepage from the tailings facility simply because of proximity to the facility.	It is agreed that the proximity of a tailings facility to a spring is not sufficient evidence to conclude that the facility is the sole possible source of any poor spring water quality. It is also agreed that mineralization is an additional possible contaminant source. Section 3.3.2.1 of the FEIS has been modified to address this comment.

Comment No.	Comment Summary	Response to Comment
WR-74	The EIS does not give adequate information on what will be done if the water supply or quality of water are affected.	Any discharges to aquifers located beneath or downgradient of the Carlota Copper Project would be regulated by the ADEQ through an Arizona Aquifer Protection permit process that protects the quality of drinking water supplies. Any degradation that may occur to these protected aquifers would be remedied according to an approved Aquifer Protection permit.
WR-75	Include a map of locations of water samples sent to SLV Analytical Laboratory.	Because the water quality analysis results were not provided, they were not evaluated for possible inclusion in the affected environment section of the FEIS.
WR-76	Mitigations outlined in WR-1 to WR-5 are not specifically tied to areas of influence; they are too generic.	Mitigation measure WR-1 has been revised to incorporate Carlota's Ground Water and Surface Water Monitoring Plan (GWRC 1996). DEIS mitigation measure WR-5 has been removed since this measure is now included within the proposed action.
WR-77	Top-of-the-World never had any water to speak of.	Comment noted.
Soils and Reclamation		
SR-1	Discuss potential hazards at proposed stockpile locations.	Mitigation measure SR-2 (Section 3.4.4) contains provisions for stockpile locations, protection, and maintenance.
SR-2	Expand discussion of hazards of the remaining open pit.	The overall paragraph described in this comment includes the development of additional mitigation measures to address the hazards of the remaining open pit. Mitigation measure SR-14 has been expanded in response to this comment (Section 3.4.4 of the FEIS). It should be noted, however, that risks to wildlife and human safety associated with the open pit have not been quantified for this project, and typically have not been quantified for other open-pit mining projects because of the difficulty in quantifying such risks. As with many other activities or occurrences, the chance of the remaining open pit adversely affecting wildlife or human health would not be zero. From a probability standpoint, some risk is inherent in almost all human endeavors and natural phenomena. However, the reclamation activities described for the proposed action and the alternatives and additional monitoring and mitigation measures would minimize the potential impacts associated with this feature.
SR-3	Address inconsistency between the Forest Service policy regarding foundation removal and Carlota's plan for project foundations.	In Section 3.4.2.1 of the FEIS, the proposed action is described with regard to foundations. Contrasting Forest Service requirements are explained, and potential impacts from the proposed action are described in the Public Safety and Demolition/Removal of Facilities and Infrastructure section of Section 3.4.2.1. Mitigation measure SR-7 addresses this issue.
SR-4	Describe impacts on soil communities from acid mist.	Based on air resources analysis (Section 3.1), no significant impacts to soils from acid mist are anticipated. This topic has been addressed in Section 3.4, Soils and Reclamation.
SR-5	Include a detailed sediment control plan.	Please see the response to comment 1-40.
SR-6	Address closure of the Eder pits now rather than waiting until final closure.	Comment noted. The current bond estimate includes an amount for backfilling and reclaiming the Eder pit, which is the most financially conservative reclamation approach.
SR-7	Address compliance with Forest Service reclamation guidelines.	Please see the response to comment SR-3.

Comment No.	Comment Summary	Response to Comment
SR-8	Evaluate using livestock in the revegetation effort.	Comment noted. Carlota has committed to a reclamation program and also to further testing of reclamation approaches as the project progresses. The goal of the reclamation plan, mitigation measures, and ongoing agency involvement during and after mining is effective reclamation. As stated in the FEIS and the Plan of Operations, innovative techniques would be incorporated as appropriate to the site. The use of livestock is a potential part of this program.
Biological Resources		
B-1	Quantify the amount of riparian habitat in Haunted Canyon.	The FEIS notes that approximately 57 acres (1.8 percent of the project area) of riparian habitat occur within the project area. Approximately 16.1 acres are found in Haunted Canyon, a major tributary that enters Pinto Creek below (north of) the project area.
B-2	Dust from roads, blasting, and other sediments could be carried into the aquatic environment and could have detrimental effects on aquatic organisms.	Dust from roads and blasting and other sediments may be carried into the aquatic environment. Pinto Creek and Powers Gulch would be monitored to assess the effects of all contaminants throughout the mining operations; please see Section 3.5.4.2 of the FEIS for a description of the monitoring and mitigation measures for aquatic resources.
B-3	Analyze the impacts to streams from flood events.	An additional discussion on the reaction of the aquatic biota in Pinto Creek to historical natural flood events was added in Sections 3.5.1.2 and 3.5.2.1 of the FEIS. Recovery from the effects of flooding would be determined by biomonitoring (see Section 3.5.4.2 of the FEIS).
B-4	Further monitoring is needed to evaluate the downstream effects of the well field on the ecological values of Pinto Creek and Haunted Canyon.	A biomonitoring plan is proposed that includes sites on Pinto Creek and Haunted Canyon; please see Section 3.5.4.2 of the FEIS. Implementation of this biomonitoring plan would provide baseline information and would enable monitoring of future impacts to aquatic life resulting from the proposed construction and operation. Aquatic data for Haunted Canyon have been added to Tables 3-57, 3-58, and 3-60 in the FEIS.
B-5	Additional baseline data are required for the Arizona hedgehog cactus and the biological resources of Haunted Canyon prior to a project decision.	Regarding the Arizona hedgehog cactus, Carlota conducted a baseline study of this species (in consultation with the U.S. Fish and Wildlife Service) in compliance with Section 7 of the Endangered Species Act. The U.S. Fish and Wildlife Service has issued its Biological Opinion (Appendix F of the FEIS) regarding this species; the Biological Opinion includes specific mitigation measures. In addition, Carlota has developed a conservation assessment and plan for the Arizona hedgehog cactus (Cedar Creek Associates, Inc. 1996b). Additional data on the aquatic resources of Haunted Canyon have been added to Tables 3-57, 3-58, and 3-60 of the FEIS. Please refer to Section 3.5.4.2 of the FEIS for a description of the monitoring and mitigation measures for aquatic resources. As described in Section 3.5.4.2, additional data collection for aquatic resources will be conducted prior to the onset of construction. Carlota has prepared a mitigation plan for wetlands and waters of the U.S. (Aquatic and Wetlands Consultants, Inc. 1996) in consultation with the COE and the Forest Service. This mitigation plan includes riparian mitigation.

Comment No.	Comment Summary	Response to Comment
B-6	Address mitigation for acid mist impacts to cactus.	One of the main conclusions of the analysis in Appendix D was that no adverse effects to populations of the Arizona hedgehog cactus would be associated with air emissions from the Carlota Copper Project. This conclusion was based on the Biological Assessment and Evaluation (Cedar Creek Associates, Inc. 1994d), which analyzed the potential effect of sulfuric acid emissions on vegetation and, especially on the endangered cactus. Based on existing research, emissions at the source would have to be an order of magnitude greater than those projected for the Carlota Project to cause any observable effect on the cactus or other vegetation. The *Biological Monitoring & Mitigation Plan* (Cedar Creek Associates, Inc. 1996a) details additional biological monitoring procedures designed to ensure that there are no adverse effects on Arizona hedgehog cactus from acid mist.
B-7	Mitigation for the Arizona hedgehog cactus could be strengthened by withdrawing lands from mineral entry.	Please see the response to comment B-6.
B-8	A more specific monitoring and mitigation program needs to be established for aquatic habitat and sensitive species within the project vicinity and downstream.	Please see Section 3.5.4.2 of the FEIS for a description of the specific monitoring and mitigation program for aquatic resources.
B-9	Expand the discussion regarding grazing control/mitigation.	Comment noted. Carlota is continuing to negotiate with the Forest Service over the details of the Bellevue Allotment acquisition.
B-10	Quantify the damage to aquatic resources from sedimentation. Provide reference studies/data to support sedimentation impact conclusions.	The effects of sedimentation are discussed in Section 3.5.2.1 of the FEIS. Please also see the response to comment B-2.
B-11	Describe how aquatic organisms would be reestablished/ recolonized.	Colonization rates of aquatic biota are discussed in Section 3.5.1.2 of the FEIS. The aquatic communities within the project area and downstream are currently subject to a wide range of environmental conditions. The segments of the current populations that are eliminated by lack of water or catastrophic events re-establish through colonization from other areas in the stream. The current stream channels within the proposed diversion area are re-colonized annually after periods of intermittent flow. This type of colonization is expected to continue under future conditions. Please see the response to comment B-3 for further information relative to flood events.
B-12	Describe cumulative aquatic effects to the Pinto Creek watershed.	The cumulative effects to the Pinto Creek aquatic system are discussed in Section 3.5.3 of the FEIS.
B-13	Describe the ecological threshold of Pinto Creek.	The results of biomonitoring prior to construction would provide additional information regarding the ecological threshold and the condition of the aquatic community in Pinto Creek and Haunted Canyon. The biomonitoring program is described in Section 3.5.4.2 of the FEIS.

Comment No.	Comment Summary	Response to Comment
B-14	The mapping of cactus locations in Appendix D is wrong.	The wording relating to cactus distribution in Appendix D was incorrect. The text in Appendix D has been revised to more accurately reflect the general distribution of the cactus. This text error has no effect on the EIS analysis since the impact analysis in the Biological Assessment and Evaluation (Cedar Creek Associates, Inc. 1994d) was based on the actual mapping of this species, which has been accepted by the U.S. Fish and Wildlife Service and the Forest Service.
B-15	Mitigation is needed for the impacts from operational leaks or spills on aquatic resources.	The effects of leaks and spills on the aquatic environment would be determined by the biomonitoring procedure described in Section 3.5.4.2 of the FEIS.
B-16	The cumulative analysis fails to address other interrelated activities that may affect biological resources.	The Forest Service identified all known activities with the potential to cumulatively affect biological resources.
B-17	Quantify past and projected cumulative impacts to biological resources.	Data do not exist to precisely quantify the extent of past and present impacts to biological resources.
B-18	Describe whether the aquatic impacts would be adverse or beneficial; the DEIS states both would occur.	There would be both adverse impacts to aquatic resources associated with new disturbance and beneficial impacts associated with restoration of previously impacted resources.
B-19	Unless necessary information is gathered to evaluate downstream effects to riparian/ecological values of Pinto Creek, the project should be rejected or postponed.	The baseline data from existing information and surveys required of Carlota by the Forest Service was sufficient for analyzing probable and possible direct, indirect, short-term, and long-term impacts. The impacts from Carlota to lower reaches of Pinto Creek are speculative; however, monitoring identified in the FEIS would be used to validate the predicted area of impact.
B-20	Describe how aquatic populations and their habitats will be restored, and how they will be affected by spills/leaks. Mitigation is needed for spills/leaks.	As described in Section 3.5.2.1of the FEIS, the aquatic organisms that inhabit the Pinto Creek drainage are mostly representative of those species found in unstable environmental habitats. The existing environmental conditions that currently affect the Pinto Creek drainage include floods, droughts, and high pulses of toxic heavy metal concentrations from existing mining activities. Section 3.5.4.2 describes a biomonitoring plan as part of the mitigation plan designed to detect changes in aquatic populations caused by to the proposed mining activity.
B-21	Discuss where replacements will be found for two Category 2 fish species.	Replacements for the two category 2 fish species would come from within the Pinto Creek Drainage. A catastrophic event with enough magnitude to destroy all category 2 fish within the system is highly unlikely. Please also see the response to comment B-11.
B-22	The Forest Service should be prepared to monitor during the construction period to ensure sedimentation is minimized during spawning periods.	Please see the responses to comments 1-34, 1-35, 1-36, and 1-40.

Comment No.	Comment Summary	Response to Comment
B-23	There is no documentation that the diversion channels would be recolonized within several years.	Please see the responses to comments 4-19 and B-11.
B-24	Spills did not influence the macroinvertebrate community in Pinto Creek and Powers Gulch.	It is agreed that there is no conclusive evidence to support the statement that spills influenced the macroinvertebrate community in Pinto Creek or Powers Gulch. The text in Section 3.5.1.2 of the FEIS has been modified in response to this comment.
B-25	It is not sufficient to substitute subsequent monitoring for analyzing impacts in advance, given endangered species (hedgehog cactus).	Please see the response to comment B-6.
B-26	Clarify how past, present and reasonably foreseeable future actions have the potential to either adversely or beneficially affect riparian and aquatic habitat.	The text in question is referring to past, present, and reasonably foreseeable future actions in the Pinto Creek drainage. As indicated in the subsequent paragraphs, some actions, such as grazing, have resulted in degradation and may continue to degrade riparian habitat. Restoration projects and new systems for grazing management could also restore or enhance riparian habitats. Any of these possibilities are reasonably foreseeable future actions but can only be discussed in general terms since the specific details of future actions have obviously not been formulated.
B-27	Hedgehog cactus are not endangered. Conduct an in-depth evaluation of the environmental impact of transporting Hedgehog cactus to another area.	The Arizona hedgehog cactus (*Echinocereus trichlochidiatus* var. *arizonicus*) is listed by the U.S. Fish and Wildlife Service as endangered. Despite the loss of 23.94 acres of occupied habitat, 217 individual plants, and 237.6 acres of potential habitat as direct effects of project implementation, mitigation measures summarized in Section 3.5.4 and described in detail in the *Biological Monitoring & Mitigation Plan* (Cedar Creek Associates, Inc. 1996a) should compensate for these losses. The *Biological Monitoring & Mitigation Plan* addresses monitoring and mitigation measures for the cactus, including an analysis for transplanting mine area cactus and establishing test plots.
B-28	Discuss the lower water table and dust from blasting and their effects on perennial areas.	Please see response to comment 1-3. The potential impacts to the water table and perennial water resources are addressed in Section 3.3.2.1; impacts to air quality from blasting are addressed in Section 3.1.2.1. See also the response to comment AQ-13.
Cultural Resources		
CR-1	Eligibility of sites (National Register of Historical Places) should be determined and disclosed.	Archaeological investigations to provide information to be used in determining NRHP eligibility have been completed. In consultation with the Arizona State Historic Preservation Office, the Forest Service has determined that all 32 sites dating to the historic period and 21 of the sites dating to the prehistoric period are eligible for the NRHP under Criterion D (the information that they contain is important in understanding history or prehistory). Analysis of the eligibility investigations determined that 24 sites dating to the prehistoric period are not eligible for the NRHP. Tables 3-63 and 3-64 in the FEIS provide a site-by-site listing of these eligibility determinations.
CR-2	There is inadequate/incomplete data to substantiate the cultural resources conclusions.	Comment noted. The cumulative impacts in Section 3.6.3 of the FEIS have been revised based on this comment and additional information that has become available since the DEIS was published.

Comment No.	Comment Summary	Response to Comment
Socioeconomics		
S-1	Address property appraisals and impacts on property values.	A property appraisal of the Top-of-the-World would provide the current value of the properties at the Top-of-the-World. However, to assess the impact of the mine, another appraisal would need to be completed after the mine was developed. Other factors, such as the current economic conditions in the area, housing availability, and the demand for housing, would also affect the future values of these appraisals. It would be difficult to complete a property appraisal that could defensively assess the future value of the property. In addition, it is the professional judgment of the consultant and of several real estate industry representatives that the increasing demand for housing from the project workforce would likely offset potential impacts from the mine itself, assuming all other things remain constant (water availability, etc.).
S-2	Identify where additional employees are coming from.	The Carlota project would absorb some workers who have been laid off from other projects throughout the study area that may be downsizing. Unemployed and underemployed skilled and unskilled workers would also make up the workforce. In addition, some workers would migrate from other locations or from out of state.
S-3	Provide supporting data for the projection of economic increases for ranching/rec.	Section 3.7.2.1 of the FEIS has been revised to clarify that there would be a relative increase in the economic base due to the change from recreation and ranching to mining. Therefore, project development would result in a decrease in the economic opportunities at the project site for both recreation and ranching. The comment related to the adverse impact of the project on tourists from the destruction of a natural resource has been noted.
S-4	Recalculate construction workforce impacts with new assumptions.	Based on discussions with the local Job Service in Globe, local mine operations personnel representatives, and mine construction contractors, it was estimated that 60 percent of the workforce would either commute from their places of residence (possibly the Phoenix metropolitan area) or reside within the study area. In addition, housing is very tight in the Globe/Miami/Superior area, which would probably discourage construction workers from bringing their families to the job site.
S-5	Address the impact of temporary cessation of operations.	The text in Section 3.7.2 of the FEIS has been revised to address the fluctuations in the price of copper and the potential for temporary or permanent cessation of operations because of these fluctuations in price.
S-6	Readdress housing impacts from the influx of new people.	The text in Section 3.7.4 of the FEIS has been changed to indicates that Carlota should encourage permanent housing construction within the project study area.
S-7	Discuss whether the ore grade quality is high enough to be profitable.	Based on the proposed mining and extraction techniques and the grade of the ore, it was determined that the ore could be mined at a profit.

Comment No.	Comment Summary	Response to Comment
Land Use		
L-1	The private property boundaries on the land ownership map are incorrect.	According to representatives of ADOT, county highway signs are not placed at surveyed county boundaries. They are placed at an adequate sighting distance of approximate county boundaries. The Forest Service has reviewed the Pinal County Assessor's records, which contain all records of properties within Pinal County. The records show that all property at the Top-of-the-World is located within Pinal County. The Forest Service also checked the Forest Service land status records, which is based on legal surveys. The records also suggests that all property at the Top-of-the-World is within Pinal County. The property boundary as shown is consistent with topographic features, such as the ridge northeast of Top-of-the-World, which provides a buffer to the mine. Recently, the BLM completed a survey of the boundary of the Top-of-the-World, which will help to validate the correct property boundaries. Minor changes in property boundaries would not change the overall land use impacts discussed for the project.
L-2	Correct the zoning information at Top-of-the-World.	In checking with the Pinal County Planning Department, the 12-parcel Sutton Summit subdivision has no zoning restrictions or covenants. Minor changes have been made to the text.
L-3	The proposed action is inconsistent with the Forest Plan and requires a Plan Amendment.	A number of commentors concluded that the proposed action is not consistent with the Forest Plan because minerals development is not included in the "Management Emphasis" section of the Management Prescription for Area 2F. A management prescription for all management areas, including 2F, states that the Forest Service will respond to mineral operating plans. The project site is open to mineral entry; therefore, the Forest Service must respond, as stated in the Forest Plan. The Plan does not provide for management of locatable mineral resources because that responsibility, by law, does not reside with the Secretary of Agriculture, the Forest Service, or the Tonto National Forest. The Forest Service has responsibility for managing surface resources, such as wildlife habitat, watershed, forage production, and recreation; therefore, these are resources that can be emphasized. These resources were also emphasized in mitigating adverse impacts resulting from the proposed action. Section 3.8.2.1 of the FEIS has been modified to clarify this issue. Several commentors also pointed out that a standard/guideline is to "Avoid channel changes or disturbances of stream channels..." and therefore, the proposed action is inconsistent with the Plan. This item is a guideline that was considered in developing alternatives and mitigating impacts. The impacts on stream channels within the project site also are subject to a Clean Water Act Section 404 Permit from the COE, as disclosed in the FEIS.
L-4	Identify possible inholdings that might be acquired in a land exchange.	A land exchange was suggested as a potential mitigation measure for biological resources; however, the FEIS does not include a land exchange as a mitigation measure. The Forest Service can only respond to proposals for a land exchange; Carlota has not proposed a land exchange.
L-5	After mining, fences and warning signs should be removed and benches, dumps, and leach pads returned to safe and user-friendly condition for recreationists.	Please see the response to comment 4-2. Warning signs, fences, and physical barriers would remain after mine operations cease as required by the Forest Service or state agencies if they are needed to safeguard the National Forest System land users and the general public. Improving public safety is a reclamation objective.

Comment No.	Comment Summary	Response to Comment
L-6	Discuss whether ranchers are at risk of losing land because of the project.	As specified in mitigation measure LU-4 in the FEIS, Carlota would work with the Bellevue and Bohme grazing permittees to develop a plan to minimize any economic loss.
Recreation		
R-1	Describe impacts to Powers Gulch trail and the access road.	Mitigation measures R-1 and T-1 address the elimination of horseback access to Powers Gulch and Haunted Canyon. Additional information is included in Section 3.9.2.1 of the FEIS regarding potential alternative routes to Haunted Canyon.
R-2	Substantiate the no adverse impacts conclusion related to dispersed recreation.	The text has been modified in Section 3.9.2.1 of the FEIS to expand the discussion of the impacts to dispersed recreation.
Wilderness and Wild and Scenic Rivers		
WW-1	Analyze the limits of acceptable change from the Wilderness Plan.	The limits of acceptable change (LAC) concept is used as a guideline for inventorying, evaluating, and monitoring social and resource conditions. If LAC guidelines are approached or exceeded, corrective prescriptions would be developed to reduce or stop the changes. Please refer to Section 3.1.2 for a discussion of potential visibility impacts and Section 3.12.2 for a discussion of noise impacts. Arizona Public Law 98-406 (d) of the Arizona Wilderness Act states, "The Congress does not intend that designation of wilderness areas in the State of Arizona lead to the creation of protective perimeters or buffer zones around each wilderness area. The fact that non wilderness activities or uses can be seen or heard from areas within a wilderness shall not, of itself, preclude such activities or uses up to the boundary of the wilderness area."
WW-2	Analyze "limits of acceptable change" to Wild and Scenic rivers.	Impacts to ground water or surface water would not affect the Superstition Wilderness, so limits of acceptable change would not be exceeded. LAC do not apply to non-designated Wild or Scenic rivers; therefore, they would not apply to Pinto Creek.
WW-3	The distance to the Superstition Wilderness is inaccurate.	The closest facility at the mine site to the wilderness is the well field, which is approximately 3 miles from the Superstition Wilderness.
WW-4	The Wild and Scenic river area is shown at the same location as the weir.	The start of the segment of Pinto Creek being considered for Wild and Scenic designation and the weir are in close proximity. The location has been corrected on all figures.
WW-5	Describe effects on Pinto Creek Wild and Scenic river designation.	Cumulative impacts discussed in this section refer to impacts related to other potential activities ongoing at the time the Carlota Copper Project is under construction or operating. The impacts associated specifically with the proposed Carlota Copper Project are discussed in Section 3.10.2.1. The Forest Service is currently considering a proposal to designate a segment of Pinto Creek as Scenic. As stated in Section 3.10.2.1, impacts related to the project would result from potential ground water withdrawal or a catastrophic event affecting water quality. These potential impacts would also apply to the cumulative analysis. However, Scenic designation would cumulatively affect the future land uses within the area designated Scenic based on management guidelines administered by the Forest Service. It is implied in the impact analysis that if either of the previously mentioned incidents happen (ground water drawdown or a catastrophic event), designation of Pinto Creek as a Scenic river would be potentially affected.

Comment No.	Comment Summary	Response to Comment
Visual Resources		
V-1	Describe impacts to commercial properties at Top-of-the-World.	Section 3.11.2.1 of the FEIS has been revised to indicate limited visibility from a commercial building at Top-of-the-World.
V-2	There may be impacts to undeveloped parcels of land and decreases in value.	Comment noted.
V-3	Evaluate using rock staining for mitigation.	Please see mitigation measure VR-4 (Section 3.11.4) where rock staining is presented as one technique that would be considered to reduce the visual impacts of the Eder pits.
Noise		
N-1	Define what are considered acceptable noise impacts.	The conservative (i.e., worst case) estimate of project-related noise at Top-of-the-World in Year 8 is 5.1 dBA above the existing average (L_{eq}) ambient daytime noise level and 13.8 dBA above the existing average ambient nighttime noise level. For Year 14, the worst-case estimate would be 10.6 dBA above average daytime levels and 19.3 dBA above average nighttime levels (a 10dB increase represents a doubling of the noise level). These noise level increases would result in day-night average sound levels (L_{dn}) below the significance threshold, which was adapted from U.S. Department of Housing and Urban Development standards for residential areas. The projected noise levels would be considered "quiet residential" to "average residential" in Year 8 and "average residential" in Year 14 (Beranek 1971). Also, as noted in the text, the noise level estimates were developed using very conservative assumptions. It is believed, therefore, that project noise would typically be lower than the estimated levels and would only rarely, if ever, reach these levels.
N-2	Discuss noise impacts to the Superstition Wilderness and the wilderness experience.	FEIS Section 3.12.2.1 indicates that estimated noise at the edge of the Wilderness would exceed the significance threshold. Presumably, this would detract from the wilderness experience. As noted above and in the text, however, both the threshold and the estimated levels are conservative. The significance threshold is below the average noise level measured in the Wilderness during a very quiet period, so any perceivable noise would exceed the threshold and would be considered significant. The estimated project-related noise levels apply only to the high ground at the lightly used southeast edge of the Wilderness. Project-related noise levels would be lower in the valleys, and the noise levels at all elevations would decrease at distances farther into the Wilderness. Proposed mitigation and monitoring measures N-1 through N-5 would further reduce estimated impacts. In addition, Congress did not intend to create a prohibitive buffer beyond the boundaries of the Wilderness. The Arizona Wilderness Act states, "The fact that non-wilderness activities can be seen or heard from areas within a wilderness shall not, of itself, preclude such uses or activities or uses up to the boundary."
N-3	The admitted lack of information regarding the location, scale of the project, mining methods, and equipment is an inadequate source from which to draw any noise impact conclusions.	At the time of the analysis, project details for BHP Copper's Florence Project were not available in sufficient detail to permit a quantitative analysis of possible cumulative noise effects. Consequently, a qualitative professional judgment was the best evaluation possible. This judgment determined "... that major adverse cumulative noise effects are unlikely," based on the anticipated location of the Florence Project and experience with numerous mining projects throughout the west. Subsequent information has resulted in deletion of the BHP Florence Project from any consideration regarding cumulative noise effects. The use of professional judgment is acceptable under NEPA.

Comment No.	Comment Summary	Response to Comment
N-4	Inappropriate criteria were used for assessing noise impacts to wilderness.	The criterion for Wilderness noise was selected by the Forest Service; it is the most stringent criterion employed in a mining EIS. Although it is not clear from the comment, it is assumed the authors are suggesting a standard permitting no man-made noise in the Wilderness. From a practical standpoint, such a standard would be impossible to achieve. Man-made noise is currently present in the Superstition Wilderness to varying degrees depending on location, time, and atmospheric conditions. Also, see the response to comment N-2 above.
Transportation		
T-1	Work on Pinto Valley Mine Road will not help Carlota traffic.	The DEIS actually states, "Transportation safety concerns related to the proposed project have been largely eliminated..." This judgment was based on a field evaluation of the intersection of U.S. 60 and Pinto Valley Road together with an analysis of traffic conditions on the two roads. The intersection has ample lane geometrics, sight distances, and stopping distances to function safely with traffic loads at existing levels or at the levels anticipated with development of the proposed project.
T-2	Update traffic volumes on the Tucson Globe Road.	The change in traffic on U.S. 60 is not germane since this calculation is based on national statistics used to estimate probable truck accidents per million miles of travel. In any case, traffic levels were not tracked back 10 years. However, noted in the Section 3.13, traffic levels in recent years have fluctuated both up and down, so it is not necessarily valid to assume an increase.
T-3	There are inadequate data to substantiate transportation conclusions.	At the time of the analysis, project details for BHP Copper's Florence Project were not available in sufficient detail to permit a quantitative analysis of possible cumulative traffic effects. Consequently, the qualitative professional judgment, "that adverse cumulative traffic effects are unlikely," was the best evaluation possible. This approach is acceptable under NEPA. Incidentally, contrary to the implication embedded in this comment, Carlota was not responsible for this analysis. The analysis was conducted by an independent consultant under the direction of the Forest Service
T-4	Discuss the possibility of traffic delays from rock slides.	The mining operation is not anticipated to induce rock sliding along Highway 60. Natural rock slides could occur and delay traffic; however, because this could occur regardless of the project, these impacts were not evaluated.
Hazardous Materials		
HM-1	Define and quantify short-term effects from hazardous waste spills.	Please see Section 3.14.2.2 of the FEIS for an analysis of the impacts associated with spills of hazardous materials or hazardous wastes.
HM-2	Address health concerns associated with the proximity to the mine and processing facilities, (i.e., toxic dust and acid emissions.)	Please see Section 3.1.2 of the FEIS. The air quality impact assessment addresses toxic air emissions associated with the Carlota processing facilities, in compliance with the State of Arizona Ambient Air Quality Guidelines.
HM-3	Include a statistical estimate of an on-site spill or leak.	Please see Section 3.14.2.2 of the FEIS for an analysis of the impacts of on-site storage and use of hazardous materials. This analysis was qualitative since statistics are not available to enable a quantitative analysis.

Comment No.	Comment Summary	Response to Comment
HM-4	Include a statistical estimate of a release into Powers Gulch or Pinto Creek.	There are no statistics upon which to base a quantitative risk assessment of a spill into Powers Gulch or Pinto Creek.
HM-5	Explain the basis for saying that the probability of minor fuel and lubricant spills is high, but the probability of spills of more hazardous materials are low.	Minor equipment lubrication or repair may occur in unconfined areas, such as on haul roads, releasing small quantities of engine oil or hydraulic fluids. The high usage rate of the equipment could result in relatively high rates of small spills. However, the fuel and hazardous materials storage facilities would be designed for containment; therefore, the probability of contamination from a large spill of hazardous materials is relatively low.
HM-6	The probability of a sulfuric acid truck accident should be rounded to 2, not 3. Discuss the upper end of this predicted probability.	Section 3.14.2.2 of FEIS has been revised based on new statistics for two-lane rural roads. The probability of sulfuric acid and diesel releases over the life of the mine are both estimated at 18.8 percent (3.83 spills and 0.22 spills, respectively).
HM-7	Describe the composition of the leach pad liner and specified leakage rate. How will the liner be affected by seismic activity and backfilling of mine shafts?	The primary liner system would consist of a 60-mil HDPE liner with an effective permeability of $1x10^{-11}$. Please see Section 3.2.2.1 for a discussion of the potential impacts associated with seismic activity. In addition, mitigation has been proposed to help ensure the proper backfilling of existing mine shafts and adits (see Section 3.2.4.1 [GM-1] of the FEIS).
HM-8	Discuss the accident rate associated with other projects, expansions, and increased population	There would be an increased, unquantifiable risk associated with a traffic increase in the region during the life of the project.
HM-9	Address the coordination of hazardous waste management and disposal among government agencies.	Please see Section 3.14.2.2 of the FEIS for information on the regulations that pertain to transporting, handling, and storing hazardous materials. These regulations, which also apply to hazardous wastes, outline the response actions and reporting requirements that Carlota and its suppliers must undertake in the event of a release of a hazardous material. A discussion of this issue has been added to Section 3.14.2.2 of the FEIS. Carlota does not have any control over the coordination among regulatory agencies or their promulgation of laws regulating the use of hazardous materials or the disposal of hazardous wastes.
HM-10	Evaluate health and environmental impacts of diesel and kerosene, both on and off the site. Address any photochemical products originating from using these organics.	Hazardous materials, such as diesel and kerosene, are addressed in Section 3.14 of the FEIS. Any spills or releases of diesel or kerosene would be contained and mitigated to prevent health and environmental impacts according to the SCHMM Plan (Carlota 1996a). Photochemical and other degradation products from diesel or kerosene spills/releases would be treated as described in the SCHMM Plan. Environmental effects posed by these substances (via contribution of O_3) are presented in Appendix D of the FEIS. See also the response to comment WR-43.