BOARD OF SUPERVISORS AGENDA ITEM SUMMARY

Requested Board Meeting Date: September 4, 2001

ITEM SUMMARY, JUSTIFICATION &/or SPECIAL CONSIDERATIONS:

Environmental Assessment and Mitigation Report (EAMR) for Cortaro Farms Road from the Union Pacific Railroad (UPRR) to Thornydale Road, Work Order #4TCFIT, CIP Project Number TR-97-018, Bond Number DOT-18.

The proposed improvements will widen Cortaro Farms Road to a four-lane divided highway from Hartman Lane to Thornydale Road and a six-lane divided highway from UPRR to Hartman Lane.

The widening of Cortaro Farms Road will begin implementation of a key feature of the Metropolitan Transportation Plan and provide the necessary roadway capacity to accommodate the increase in traffic volume anticipated as a result of continuing residential and commercial development in the Northwest area of Tucson and the Town of Marana.

The Community Advisory Committee has given their endorsement of the project as indicated in the attached letter to the Board of Supervisors approving the EAMR.

CONTRACT NUMBER (If applicable): 16-04-M-127876-0030

STAFF RECOMMENDATION(S):

Staff recommends approval of the EAMR. This recommendation is endorsed by the Community Advisory Committee.

CLERK OF BOARD USE ONLY: BOX M.G._____

ITEM NO._____

PIMA COUNTY COST: $21.8 _____and/or REVENUE TO PIMA COUNTY:$_____

FUNDING SOURCE(S):_____
(i.e. General Fund, State Grant Fund, Federal Fund, Stadium D. Fund, etc.)

Advertised Public Hearing:

[X] YES [ ] NO

Board of Supervisors District:

1 [ ] 2 [ ] 3 [X] 4 [ ] 5 [ ] All [ ]

IMPACT:

IF APPROVED:

Proceed with the design of the project improvements.

IF DENIED:

The improvements will not go forward or the EAMR will be returned to staff for modifications and re-submitted for further consideration.

DEPARTMENT NAME: Transportation and Flood Control

DEPARTMENT DIRECTOR: Benjamin H. Goff, P. E., Deputy Director

PROJECT MANAGER: John Rumbaugh

CONTACT PERSON: John Rumbaugh TELEPHONE NO.: 740-6632

Dear Members of the Board of Supervisors:

The Cortaro Road/I-10 to Thornydale Road Community Advisory Committee met on May 16, 2001 to discuss the Environmental Assessment and Mitigation Report. We feel that this is a well written and thorough document. The following are the Committee's comments and concerns along with the comments received from the general public at the open house held on April 26, 2001:

Comments were made regarding the access points of side streets and driveways. The design team responded by agreeing to look at different typical sections, six lane divided, four lane divided and five lane continuous left turn to provide as many access points as possible. They will also meet with Pima County Transportation to study the need and safety of the various sections.

Members of the Committee asked the County representatives to look at reducing the amount of property acquisition. The design team assured us that they have been looking into ways to reduce the impact on adjacent properties by using a narrower typical section in some areas and by shifting the centerline to the south.

The committee would like to see as much native vegetation and desert preserved as possible. The County representatives have agreed to implement several mitigation measures to accomplish this. As much natural vegetation as possible will be preserved and in disturbed areas the vegetation will be replaced with native species.

The Committee expressed concerns regarding sidewalks and multi-use lanes. Some felt that sidewalks were necessary and should be provided with an artistic and nature trail appeal. Some felt that it was unsafe to walk along a high speed roadway. The committee would also like to see continuous multi-use lanes. The County representatives explained the necessity of having sidewalks as an important safety feature needed for pedestrians to access schools, subdivisions and parks along Cortaro Road. These will be set back from the roadway to provide as much safety as possible. Multi-use lanes will be provided for the entire length of the project.

The committee asked about the locations of the signalized intersections and the need for some of these signals. The County representatives have assured us that this will be addressed during the design phase of the project and that a Traffic Engineering Report has been written and shows the warrant for these signals.

The committee expressed the need for sound barrier walls. The County representatives explained that a noise mitigation report is being prepared for the necessity of walls, and that options are being studied for the most effective and aesthetically pleasing walls, berms, etc.

The committee would like to see all the utilities placed underground. The County representatives said that their intention is to underground all the utilities where feasible.

As the County representatives have addressed all the concerns of the Committee and we feel that the document was well written, the Committee approves the Environmental Assessment and Mitigation Report for Cortaro Road/I-10 to Thornydale Road.

Sincerely

Dan Brader

Dan Brader (For the members of the CAC)

800 E. Wetmore Road
Suite 110
Tucson, AZ 85719
Telephone (520) 292-2300
1-800-441-5875
Fax (520) 292-1290

MMLA
McGovern MacVittie Lodge & Associates, Inc.

July 13, 2001

John Rumbaugh
Pima County Department of Transportation
201 North Stone Avenue, Third Floor
Tucson, Arizona 85701

Re: W.O. #4TCFIT: Cortaro Farms Road; SPRR to Thornydale Road
Public Opinion Survey Responses
MMLA #99067-01-3.02

Dear Mr. Rumbaugh:

Pursuant to your request, I have reviewed the responses received from the Public Opinion Survey, sent out after the Open House Meeting held on April 26, 2001. The following is a summary of the written comments received:

General

Total number of surveys sent out	2669
Total number of written comments received	122
Number of comments expressing general approval for the project	17
Number of comments expressing general disapproval for the projec·	0
Number of comments requesting Cortaro Farms Road be constructed with six lanes	3
Number of comments requesting improvements to UPRR crossing and I-10 interchange	15
Number of comments requesting improvements to adjacent roadways	2

Impacts

Number of comments concerned about noise, or requesting noise walls	24
Number of comments concerned about air pollution	1
Number of comments concerned about light pollution (from streetlights)	9
Number of comments requesting streetlights	14

Traffic and Safety

Number of comments expressing concern about increased traffic in adjacent neighborhoods	9

Number of comments requesting right turn lane at intersections, especially I-10	7
Number of comments requesting speed humps in front of Quail Run School	1
Number of comments direct access to adjacent neighborhoods	17
Number of comments concerned about pedestrian safety at school crossings	8
Number of comments concerned about proximity of new road to homes	3
Number of comments about traffic signals	19
Number of comments about sight visibility concerns with dense landscaping	4

Aesthetics

Number of comments expressing concern of appearance of noise walls and general appearance	11
Number of comments requesting plant preservation/desert landscaping	14

Environment

Number of comments expressing general concern about negative impacts to native plants and animals	5

Design

Number of comments requesting multi-use lanes and sidewalks	22
Number of comments requesting no sidewalks	6
Number of comments requesting separation of sidewalk and multi-use lanes from roadway	3
Number of comments requesting meandering sidewalks	3
Number of comments requesting reduction in width of multi-use lanes	2
Number of comments requesting center turn lane instead of median	5
Number of comments expressing concern about drainage improvements	13
Number of comments requesting bus stops and access	8
Number of comments requesting no bus access	4
Number of comments requesting overhead utilities be relocated underground	3
Number of comments expressing concern about length of construction	2
Number of comments requesting accelerated development and construction	26
Number of comments requesting handicapped accessibility	1
Number of comments requesting limited widening east of Quail Run School	1

Please feel free to call me if you have any questions regarding this information.

Sincerely,

MMLA, Inc.

Tom McGovern
Vice President, Strategic Planning
tmcgovern@mmla.com
Attachment

ENVIRONMENTAL ASSESSMENT & MITIGATION REPORT

CORTARO FARMS ROAD

UNION PACIFIC RAILROAD TO THORNYDALE ROAD

ENVIRONMENTAL ASSESSMENT & MITIGATION REPORT

CORTARO FARMS ROAD

UNION PACIFIC RAILROAD TO THORNYDALE ROAD

WORK ORDER NO. 4TCFIT

Prepared for:

Pima County Department of Transportation and Flood Control District

Engineering Division
Public Works Building
201 N. Stone Avenue
Tucson, Arizona 85701

Registered Professional Engineer (Civil)
CERTIFICATE NO. 11700
THOMAS P. McGOVERN
DATE SIGNED 8/3/01
ARIZONA U.S.A.

July 23, 2001

Prepared by:

MMLA, INC.
800 E. WETMORE ROAD, SUITE 110
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(520) 292-2300

MMLA

MMLA Project Number: 99067-01

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CHAPTER 1: INTRODUCTION

RECOMMENDATION AND FINDINGS OF TRANSPORTATION ACTION PLAN

The Cortaro Farms Road Transportation Action Plan (TAP) recommends that improvements to Cortaro Farms Road extend from the Union Pacific Railroad tracks (UPRR) to Thornydale Road, a distance of approximately 2.4 miles (Exhibit 1). A four lane divided roadway section with a curbed median is proposed for a majority of the project. In addition to curb and gutter, improvements would include a storm water drainage system, existing cross culvert extensions, new cross drainage structures, multi-purpose lanes, and pedestrian walkways (Exhibit 4). Enhancements to this roadway would include median and right-of-way landscaping and public art. Improvements to the intersection of Cortaro Farms Road with the following streets will be included in this project: Cerius Stravenue, Hartman Lane, Camino de Oeste, and Oldfather Road.

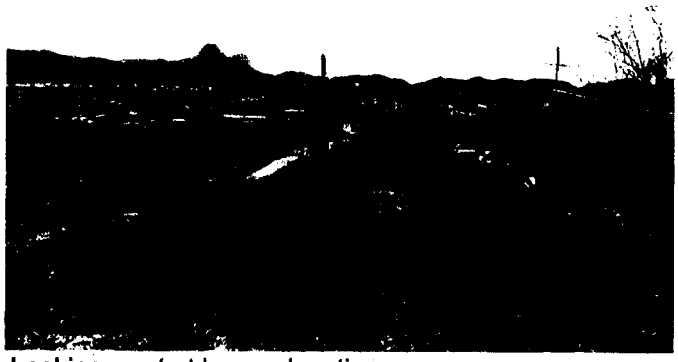
DIRECTION BY THE PIMA COUNTY BOARD OF SUPERVISORS

The Pima County Board of Supervisors approved the Cortaro Farms Road Transportation Action Plan with a vote of 5 to 0 on November 14, 2000. The Board of Supervisors' approval of the TAP allowed planning activities to advance to the publication of this Environmental Assessment and Mitigation Report (EAMR). A Location Report was not required due to the constraints of the available right-of-way.

CHAPTER 2: INVENTORY OF EXISTING CONDITIONS

ENVIRONMENTAL

Topography


Looking west at lower elevations

The topography along Cortaro Farms Road ranges from an elevation of 2160 feet above sea level at the project beginning to 2360 feet at Thornydale Road, the eastern end of the project. The right of way is relatively flat on both sides of the road for about one half mile from the UPRR. The grade then increases quickly from 2200 to 2300 feet above sea level in the center portion of the project, with associated grade changes on both sides of the roadway. The grade changes along the road are relatively minor for the next mile, ending at Thornydale Road. This portion of the roadway is flat on both sides of the road as well.

Drainage

No major named watercourses impact this project, but there are eight Pima County-regulated minor watercourses (2,000 cfs > Q_{100} > 100 cfs) impacting the project. Since there is no downstream water surface controlling the starting water surface elevation of these watercourses, the floodplains were generated by use of a Manning's normal depth hydraulic analysis. Under existing conditions,

this runoff is conveyed across Cortaro Farms Road via existing culverts, roadway dip crossings, or a combination of the two. The drainage area contributing to these watercourses is limited by Hardy Wash, which is approximately ½ mile north of Cortaro Farms Road and runs roughly parallel to this roadway. Hardy Wash conveys runoff toward the Santa Cruz River. The western limit of the Cortaro Farms Road improvement is approximately seven tenths of a mile east of the Santa Cruz River.

A 92 acre watershed (Q_{100} = 486 cfs) drains along Hartman Lane and impacts Cortaro Farms Road at the intersection of these two roadways. There are no existing drainage facilities that accommodate this discharge. Instead, this discharge is conveyed west along the existing right of way, impacting properties on both the north and south sides of Cortaro Farms Road. With the development of the Cortaro Ranch subdivision northwest of this intersection, future flooding from this watershed will primarily impact the existing developments south of Cortaro Farms Road.

Along the western project limits, Cortaro Farms Road is impacted by drainage from the North Ranch Basin of the Tortolita Mountain watersheds, of which the aforementioned 92 acre watershed is a small part. The North Ranch Basin includes Hardy Wash and represents the southern-most drainage from the Tortolita Mountains. This basin starts approximately two miles north of Moore Road and ends at Interstate10 (I-10), encompassing approximately 14.5 square miles. The

Looking west towards the UPRR

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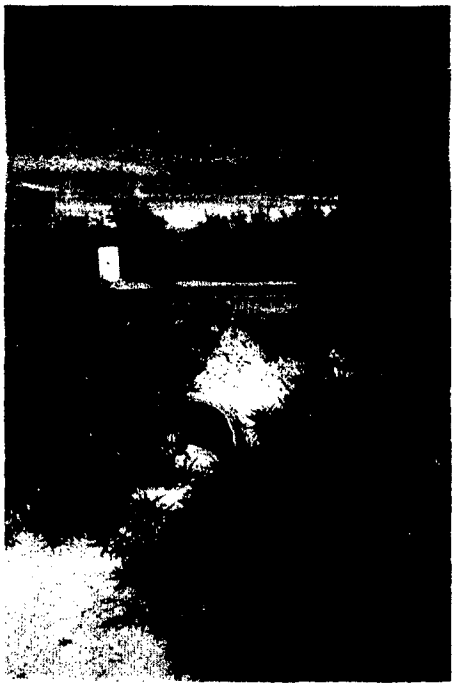
intersection of Cortaro Farms Road and I-10 is located in the upper third of this basin. Arroyo Engineering, Inc. (Arroyo), as part of the development of the Town of Marana Stormwater Master Plan, has performed detailed hydrologic analysis of this drainage basin. One observation in this document is that the Union Pacific Railroad tracks east of I-10 serve as an embankment that impedes the North Basin runoff. Once the culvert capacities of the UPRR structures are exceeded, ponding occurs against the embankment. This discharge travels along the UPRR embankment in a northwesterly direction until runoff additions increase the ponding depth such that flows will weir over the embankment and continue on course to the Santa Cruz River. As a result, from Cerius Stravenue to the western project limit, shallow ponding impacts this project during the 100 year event, as indicated on the FEMA Flood Insurance Rate Maps.

Refer to the *Preliminary Hydrology Report* (MMLA Hydro-1) for a more complete discussion of drainage. To summarize the draft report, existing cross drainage structures vary from an eighteen inch diameter corrugated metal pipe to a three cell, eight by four foot reinforced concrete box culvert. Table 1 lists the existing drainage structures and provides a brief description of their condition. The station numbers in the table refer to the approximate centerline stationing of the preliminary alignment.

TABLE 1 – Existing Drainage Structures (Refer to Exhibit 8)

Approximate Station	Type	Size	Condition
145+00	CMP	1-18"	Clear
149+50	CMP	3-30"	Partially Silted
160+00	CMP	2-24"	Entrance Crushed. Partially Silted
169+70	RCP	1-36"	Clear
175+40	RCP	1-24"	Clear
179+70	RCP	1-24"	Clear
182+20	RCBC	3-8'X4'	Clear
189+50	RCP	2-24"	Clear
196+60	CMP	1-24"	Partially Silted
198+20	CMP	1-24"	Partially Silted
212+70	CMP	3-36"X22"	Clear



Existing CMP near Sta 149+50

Existing box culvert near Sta 182+50

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Vegetation

The project area supports vegetation within the Arizona Uplands Subdivision of the Sonoran Desert. Within the project area, vegetation is divided into three categories based on value to wildlife species:

1. *Undisturbed*
2. *Disturbed*
3. *Washes*

Undisturbed: Undisturbed areas are comprised of two native plant communities representative of Sonoran Desertscrub (Turner 1974, Turner and Brown 1982). Sonoran Desertscrub and all other significant vegetation within the project area are described below and illustrated in Exhibit 11.

Undisturbed desert

Existing vegetation identified as significant in Exhibit 11 includes; protected native plants as identified on Pima Counties Protected Native Plants and Arizona Safeguarded Species lists (Tables 18.72.040-1 and 18.72.040-1B of the Native Plant Preservation Ordinance), species protected under Arizona Native Plant Law, vegetation with habitat value as defined by the U.S. Fish and Wildlife Service, and exotic ornamentals that are significant in size, maturity and/or function.

Areas of vegetation within the limits of the project are located within federally designated critical habitat for the cactus ferruginous pygmy owl (Appendix B). No regulatory floodplains, floodways and erosion hazard areas have been

identified by Pima County Flood Control or the Federal Emergency Management Agency (FEMA) within the project limits. There is no riparian habitat as defined in the Watercourse and Riparian Habitat Protection and Mitigation Ordinance within the limits of the project.

Sonoran Desertscrub

The presence of two Associations of Sonoran Desertscrub are found within the study area. The Palo Verde Mixed Cacti ("Arizona Upland") Series and the Creosote Bursage Series. (Turner 1974, Turner and Brown 1982)

Protected vegetation in these areas consist primarily of foothill palo verde and ironwood with co-dominant presence of Carnegiea gigantea (Saguaro). Saguaro found within the limits of the project are predominately large single and multi-armed saguaro ranging from ten feet (10') to thirty feet (30') in height. One specimen of the desert night blooming cereus was identified within the project limits (Refer to Appendix B – Biological Evaluation).

Many other protected tree, shrubs and cacti are also present including blue palo verde, velvet mesquite, whitethorn and catclaw acacia, desert hackberry, fishhook barrel and others. The quantity of protected native species are anticipated to number between four hundred to six-hundred (400-600) throughout the study area immediately adjacent to and within the right-of-way.

Disturbed: Disturbed areas may include the presence of scattered protected species including, velvet mesquite, ironwood, blue palo verde, saguaro, and barrel. The non-native plant buffer areas consist primarily of desert spoon, date palm, oleander and non-native mesquite and acacia species. Planting in the buffer areas is widely spaced and not mature or dense enough to effectively function as a visual screen. Ground cover species, when present, are dominated

by weeds including Russian thistle *(Salsola tragus)* and pigweed *(Amaranthus* spp.*)*. Large areas within the disturbed portions of the ROW consist of bare ground. Although vegetation within newly landscaped areas adjacent to developments contains native plants, these areas generally fail to mimic the surrounding vegetation.

Washes: Several minor washes cross Cortaro Farms Road in a northeast-to-southwest orientation. A channeled wash crosses the project area east of Hartman Lane where the elevation begins to climb. The wash supports vegetation typically found in an area that has been previously disturbed. Larger washes cross Cortaro Farms Road near Camino de Oeste, Quail Run Elementary School, and Thornydale Road. These washes provide biological connection to the larger Hardy Wash located approximately one half mile north of the project area. Hardy Wash, through a complex system of washes, provides connectivity between the Santa Cruz River and the Tortolita Mountains north of Oro Valley.

Wildlife

Correspondence with the state and federal natural resource agencies [Arizona Game and Fish Department (AGFD) and U.S. Fish and Wildlife Service (USFWS)] concluded that nine special status species have the potential to occur within or adjacent to the project area. These nine species are addressed in the biological evaluation (Appendix B) and results are summarized in Table 2.

TABLE 2 – Special Status Species

cactus ferruginous pygmy-owl	*Glaucidium brasilianum cactorum*	LE, WC
California leaf-nosed bat	*Macrotus californicus*	SC, S^2, WC
cave myotis	*Myotis velifer*	SC, S^2
fulvous whistling-duck	*Dendrocygna bicolo*	SC, S^2
Pima Indian mallow	*Abutilon parishii*	SC, S^1, SR
Sonoran desert tortoise	*Gopherus agassizii*	SC, WC
sparseleaf hermannia	*Hermannia pauciflora*	S^1
Tucson Mountain spiderling	*Boerhavia megaptera*	S^1
Tumamoc globeberry	*Tumamoca macdougalii*	SR, S^1, S^2

Status Definitions

LE: Listed Endangered. Species identified by the USFWS under the Endangered Species Act as being in imminent jeopardy of extinction.

WC: Wildlife of Special Concern in Arizona. Species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the AGFD's listing of Wildlife of Special Concern in Arizona (WSCA, in prep.). Species included in WSCA are currently the same as those in Threatened Native Wildlife in Arizona (1988).

S^1: Sensitive. Species classified as "sensitive" by the Regional Forester when occurring on lands managed by the U.S.D.A. Forest Service.

S^2: Sensitive. Those taxa occurring on Bureau of Land Management (BLM) Field Office Lands in Arizona which are considered "sensitive" by the Arizona State Office of the BLM.

SC: Species of Concern. The terms "Species of Concern" or "Species at Risk" should be considered as terms-of-art that describe the entire realm of taxa whose conservation status may be of concern to the USFWS, but neither term has official status (currently all former C2 species).

SR: Salvage Restricted. Those Arizona native plants not included in the Highly Safeguarded Category, but that have a high potential for theft or vandalism, as described by the Arizona Native Plant Law (1993).

Of these nine special status species, the project area supports habitat for two species; the cactus ferruginous pygmy-owl, and the Sonoran desert tortoise. The project area is within federally designated critical habitat (unit 4) for the pygmy-owl. The remaining seven species will not be impacted by the project.

Cactus ferruginous pygmy-owl: The site is within unit 4 of federally designated critical habitat for the cactus ferruginous pygmy-owl. Pygmy-owl territories have been documented north and south of the Cortaro Farms Road since 1995 with a single male territory first identified in 2000 and confirmed again in 2001. Several of the territories are within 1/3 mile of the project area, thus the pygmy-owl

territories have a potential to overlap with the project boundaries. AGFD and the USFWS have expressed concerns over maintaining connectivity of the wash systems after completion of the roadway improvement project. Connectivity is necessary to allow dispersal and movement of cactus ferruginous pygmy-owls from and within areas supporting suitable habitat. USFWS and AGFD suggested enhancing the existing vegetation within the adjacent wash crossings and landscaping the medians with large native trees and shrubs (See Exhibit 12). Surveys for the pygmy-owl were conducted during the spring 2001 survey period with subsequent surveys scheduled for spring 2002 and 2003. AGFD located a pygmy-owl in February 2001 south of Cortaro Farms Road and west of Thornydale Road.

Sonoran desert tortoise: Desert tortoise occur primarily on rocky slopes and bajadas in the Arizona Upland and Lower Colorado River Valley subdivisions of the Sonoran Desert. Boulders, outcrops, and natural cavities are important substrate components of the habitat as shelter sites. Sonoran desert tortoise surveys are recommended prior to construction activities.

ViewSheds

Cortaro Farms Road from UPRR to Magee Road is designated as a Scenic Major Route per the Major Streets and Scenic Routes Plan Ordinance. This stretch of roadway provides significant scenic value, with views of the Tucson Mountains to the west, the Santa Catalina Mountains to the east, and to a lesser extent the Tortolita Mountains to the north. These mountain views are dominant and help to justify the Scenic Route designation.

Eight locations (a through h) were surveyed for their visual attributes, and visual quality of the immediate foreground (up to 150'), foreground (151' to 1000'), middle ground (1001' to 2.5 miles), and background (beyond 2.5 miles). See

Exhibit 5. The following descriptions address the existing visual quality from within the project area looking east and west down the roadway, from the roadway looking north and south, and from adjacent property looking across the roadway to off-site views.

a. Looking east from Cortaro Farms Road and Hartman Lane intersection, the topography of the roadway and surrounding landscape climbs steadily. The Santa Catalina Mountains are in view with dense native vegetation silhouetting on the hilltops ahead, and large Mesquites are in the right-of-way in the foreground and middle ground. A two-story light industrial facility in the foreground and large Mesquites blocks northeast views. Looking south and southeast, a low- density mobile home community is visible in the foreground, partially blocked by mistletoe-infested mesquites in the right-of-way and beyond, with palms and other exotics near the dwellings. No middle ground or background is visible looking this direction. Looking west, the right-of-way is cleared, and the elevated interstate and adjacent commercial developments are visible ahead with a portion of the Tucson Mountains visible behind. A two-story residential community, currently under construction, partially blocks northwest views of the Tucson Mountains. Looking southwest, vegetation and topography block south of the roadway. A small sliver of the Tortolita Mountains is visible looking north up Hartman Lane.

b. Looking east the right-of-way is partially cleared, and traffic signals are in view ahead, with Foothills Palo Verde - Ironwood – Mixed Scrub vegetative community visible in the foreground and middle ground north of the roadway and beyond, and the right-of-way has been cleared south of the roadway. Looking south and southwest, the topography drops and the native vegetative community mentioned is visible in the foreground and middle ground. Also in the middle ground looking southwest, rooftops

within Continental Ranch are visible, with a full view of the Tucson Mountains in the background. The interstate is visible looking west. As shown on Exhibit 5, Sheets 2 & 3 of 3, a majority of the project length (except for Vantage Points C & E and west of Hartman Lane) views from the roadway looking north and from north of the project looking south, are currently blocked by topography or vegetation in the north right-of-way shoulder.

c. This vantage point has views similar to B, described above, but it is at a higher elevation and further east, thus the Santa Catalina Mountains are more visible. Also, the Tortolita Mountains are partially visible looking north up Camino de Oeste.

d. The topography and vegetation near this vantage point allow for a full view of the Santa Catalina Mountains while the view of the Tucson Mountains and their foothills are diminished and partially obstructed. North is a residential development, partially screened by native vegetation in the right-of-way and a screen wall. Quail Run Elementary School is in partial view looking northeast.

e. The views from this vantage point are similar to those described for D, above, but the Tortolita Mountains come into view in the background to the north (one of only a few places in the project area) because the topography to the north is lower than the roadway. Also to the north, lush native vegetation is visible in the immediate foreground, the foreground and the middle ground below. To the northwest, Quail Run Elementary School is in full view below. The western views are diminished because of topography and vegetation.

f. This vantage point is within a residential corridor, and views are enclosed with narrow, partial background views to the mountain ranges east and west. This is so because large, mature native vegetation has been left in place, close to the roadway edge, blocking views of the middle ground and background north and south. A screen wall at the right-of-way and the residential units beyond occupy the foreground. Large non-native exotic landscape vegetation is visible within the residential areas north and south.

g. Similar to vantage point F above, views from this area are also enclosed with the same narrow, partial background mountain views east and west, except that the vegetation close to the roadway that blocks views north and south is part of the designated cactus ferruginous pygmy owl habitat that crosses the roadway at this point via a shallow wash. The lush vegetation here is within a Foothills Palo Verde – Ironwood – Mixed Scrub vegetative community, and is of special value as not only a natural habitat, but also as a scenic resource.

h. This vantage point shows the commercial nature of the intersection, with gas station and retail on all corners except the northwest, where thick native vegetation blocks views beyond the foreground. The right-of-way has been cleared from the intersection to 200'-300' west of the intersection. Background views of the Tucson Mountains to the west are partially blocked by the native vegetation in the foreground and middle ground. Looking east and northeast, middle ground views are blocked and background views of the Santa Catalina Mountains are partially blocked by the commercial development in the foreground northeast of the intersection.

Historical, Cultural, and Archaeological

Desert Archaeology, Inc. completed archival research and field investigations to identify significant cultural resources that may be affected by the Cortaro Farms Road project. Twelve previously recorded archaeological sites are located within one mile of the project area. Four of the sites, AZ AA:12:285 (ASM), AZ AA:12:774 (ASM), AZ AA:12:780 (ASM), AZ EE:3:53 (ASM), are located within the Area of Potential Effects (36 CFR 800.4) of the project.

An overview of historical resources was compiled for the project area and surrounding property during the Northern Tucson Basin Survey (Stein 1993). This study identified few historical properties in the vicinity of Cortaro Farms Road. These consist primarily of isolated homesteads, which date from around the end of the nineteenth century into the 1920s. Stein (1993) found that many historic-period properties identified through archival research have been removed from the archaeological record by modern agriculture and development.

Looking south on Cerius Stravenue

Lands in the project area were patented between 1862 and 1932. However, neither features nor sites associated with these patents were identified through archival research or fieldwork. Archival research identified three historic-period roads that crossed the project area. The roads predate 1895, but evidence for the roadways is no longer preserved in the project area. Additionally, the project area lies in the Cortaro Farms Irrigation Project that began in 1916. It was one of the first large-scale irrigation projects based on ground water pumping (Mabbutt and

Wilson 1980). Many of the historic-period canals identified in and around the project area likely relate to this enterprise.

Numerous cultural resources surveys have been completed within and around the project area. The majority of the project area has been previously evaluated by linear and block surveys. In the vicinity of the project area, Cortaro Farms Road, Thornydale Road, Camino de Oeste, the Interstate 10 (I-10) corridor, and the Union Pacific Railroad right-of-way were intensively investigated prior to Desert Archaeology's study. Systematic archaeological survey of the project area identified one isolated occurrence (IO) and relocated previously recorded archaeological sites. New significant cultural resources were not identified in the project area.

Four archaeological sites are documented within the Area of Potential Effects (36 CFR 800.4) of the Cortaro Farms Road project. AA:12:285 and AZ AA:12:774 meet eligibility requirements for inclusion in the National Register of Historic Places (NRHP). AA:12:780 and EE:3:53 are linear sites that do not meet NRHP eligibility requirements within the project area. It is possible that they meet NRHP eligibility requirements outside of the project limits.

AA:12:285 is an extensive habitation site located north of Cortaro Farms Road between Hartman Lane and the Union Pacific Railroad tracks. It contains copious evidence for stratified preceramic and ceramic occupations and is arguably one of the most significant sites in the Tucson (Fish et al. 1992; Madsen et al. 1993). Previous archaeological testing has securely identified buried cultural deposits immediately north of the proposed Cortaro Farms Road right-of-way.

AA:12:774 is located south of Cortaro Farms Road and extends from near the I-10 interchange to Cerius Stravenue. The site contains evidence for ceramic and preceramic occupations. Archaeological testing at the site has demonstrated that

buried cultural stratigraphy is preserved at this site, immediately south of the project area.

AA:12:780 is a historic canal segment that runs between Hartman Lane and Cortaro Farms Road. It was identified as the Cañada Canal, which was constructed in 1919. Although it is recorded as being immediately adjacent to the project area, the integrity of the site has been compromised in and near the Cortaro Farms Road project area. The canal is visible south of Cortaro Farms Road beyond the proposed right-of-way and continues southeast for an unknown distance.

Within Arizona, tracks and associated features of the Southern Pacific Railroad have been recorded as EE:3:53 (Woodall 1996). This rail line followed the same alignment as the extant Union Pacific tracks that abut the project area. Segments of the Southern Pacific transcontinental railroad were first constructed as early as 1880, while tracks in the project area were laid after 1892. Evidence for the historic-period railroad grade has been destroyed within the Cortaro Farms Road project area.

Fieldwork identified a single isolated occurrence (IO) in the project area. IO 1 is a modern roadside memorial marker. It is located south of Cortaro Farms Road, east of Hartman Lane. Dates listed on the marker indicate it was constructed following December 2000. The memorial cannot be considered a significant cultural resource, but it is nonetheless a noteworthy modern feature that carries cultural value. The caretaker of the memorial has been identified as Ms. Sylvia Cupis of 7301 South Camino Vahcom, Tucson, Arizona, 85746.

Air Quality

The National Ambient Air Quality Standards (NAAQS), were enacted by the Federal Clean Air Act of 1970, and amended in 1977 and 1990. Ozone, sulfur

dioxide, carbon monoxide, nitrogen dioxide, lead, and particulate matter equal to or smaller than 10 microns in diameter, known as PM_{10}, had standards established by the NAAQS and are presented in Table 3 on the next page.

The Pima County Department of Environmental Quality (PCDEQ) measures and documents air quality in the vicinity of the study area. The nearest test point, which measures particulate matter, is near Orange Grove and Camino de La Tierra. The western portion of the project area (T12S, R12E) is in the Rillito PM_{10} Nonattainment Area. The PCDEQ maintains a website at www.deq.co.pima.az.us that contains recent air pollution data for the Tucson area.

TABLE 3 – National Ambient Air Quality Standards (EPA)

Pollutant	Averaging Time	Primary	Secondary
Carbon Monoxide	1-hour	35 ppm	**
	8-hour	9 ppm	**
Nitrogen Dioxide	Annual	100 $\mu g/m^3$	100 $\mu g/m^3$
Ozone	1-hour	0.12 ppm	0.12 ppm
	8-hour	0.08 ppm	0.08 ppm
PM_{10}	24-hour	150 $\mu g/m^3$	150 $\mu g/m^3$
	Annual	50 $\mu g/m^3$	50 $\mu g/m^3$
$PM_{2.5}$	24-hour	65 $\mu g/m^3$	65 $\mu g/m^3$
	Annual	15 $\mu g/m^3$	15 $\mu g/m^3$
Sulfur Dioxide	3-hour	**	1300 $\mu g/m^3$
	24-hour	365 $\mu g/m^3$	**
	Annual	80 $\mu g/m^3$	**
Lead	Calendar Quarter	1.5 $\mu g/m^3$	1.5 $\mu g/m^3$

Key:
ppm = parts per million
$\mu g/m^3$ = approximate equivalent concentration in micrograms per cubic meter
** = No standard

Water Quality

There is no evidence of any ground water contamination or hazardous materials. The website of the Arizona Department of Environmental Quality was searched with regard to Superfund sites, identified RCRA registered generators of hazardous waste, leaking underground storage tanks (LUST) and underground storage tanks (UST). There are no Superfund sites, RCRA generators or LUSTs in the study area. Two USTs are located on the Diamond Shamrock property, at the southwest corner of Cortaro Farms Road and Thornydale Road. Pima

County Department of Environmental Quality was contacted with the following results: no air quality or hazardous waster permits are currently issued in this area; several notices of violation for wildcat dumping have been issued in the past few years, and compliance has been achieved in all cases.

Two groundwater wells are located within the study area. The Cortaro-Marana Irrigation District operates a well at the southwest quadrant of the Cortaro Farms Road and Cerius Stravenue intersection at 5601 W. Cortaro Farms Road. The date of the original drilling of this irrigation well was April 1922, and the existing depth is 249 feet. The average output is 1683 GPM.

The second well is operated by Tucson Water and is located near the southwest quadrant of Cortaro Farms Road and Gatekeeper Drive at 4275 West Cortaro Farms Road. This production well, which was drilled in February 1996, is 1000 feet deep with an average output of 1200 GPM and meets all drinking water standards as shown in Table 4 on the next page.

Referring to Table 4, Maximum Discharge Limits (MDLs) are the maximum allowable concentrations of constituents that would be found in a sample of groundwater. The MDLs are classified as either hazardous or non-hazardous.

TABLE 4 – Tucson Water Well Z-018A

Parameter	Sample Date	Reading	MDL (mg/l)
Hazardous Constituents			
Arsenic (mg/l)	10/13/2000	.002 mg/l	.002 mg/l
Benzene (ug/l)	3/3/00	.0005 mg/l	.0005 mg/l
Vinyl Chloride (ug/l)	3/3/00	.0005 mg/l	.0005 mg/l
Carbon Tetrachloride (ug/l)	3/3/00	.0005 mg/l	.0005 mg/l
1,2-Dichloroethane (ug/l)	3/3/00	.0005 mg/l	.0005 mg/l
1,4, Dechlorobenzene (ug/l)	3/3/00	.0005 mg/l	.0005 mg/l
Non-Hazardous Constituents			
Flouride (mg/l)	4/27/00	.1 mg/l	.24 mg/l
Nitrate, as Nitrogen	4/27/00	.25 mg/l	1.3 mg/l

Source: Tucson Water
Tucson, AZ. Feb, 2001

"MDL" is the Maximum
Discharge Limit

MMLA

Cortaro-Marana Irrigation District Well

Tucson Water Production Well

NEIGHBORHOOD

Adjoining Land Use and Property Values

The land uses within the study area are primarily residential and vacant land. There are five single family subdivisions, as well as mobile homes and single family homes on large lots. Other land uses include a church, an elementary school, a middle school, a telecommunications building, two restaurants, and a gas station/convenience store.

Qwest Facility

The significant land uses adjacent to the proposed right of way include the elementary school and the telecommunications building. The commercial site on the south side of Cortaro Farms Road, at the west end of the study area, has recently been developed with a Wendy's restaurant and a Chevron gas station/convenience store. A new restaurant, International House of Pancakes, is currently under construction at the northwest corner of Cerius Stravenue and Cortaro Farms Road. Property values for the residentially developed properties are low to moderate; while the

Commerical establishments west of Cerius Stravenue

values for vacant land are moderate as compared to median values for the Tucson metropolitan area.

Most of the study area lies within unincorporated Pima County and thus is governed by Pima County zoning. The properties at the western end of the study area adjacent to the UPRR, on both sides of Cortaro Farms Road, lie within the Marana Town Limits. On the north side of Cortaro Farms Road, Town of Marana zoning extends to Hartman Lane.

More than 50% of the existing zoning on both sides of the proposed right of way is low density residential, Suburban Ranch (SR). The remaining zoning is medium density residential, Mixed Dwelling (CR-4) and Multiple Residence (CR-5) in Pima County. Village Commercial (VC) and Single Family Residential (R-8) are the prevalent zoning designations in the Town of Marana.

There was one proposed zoning change on the south side of Cortaro Farms Road, about ¾ mile east of the railroad. This 65 acre site would be rezoned from SR and Suburban Homestead (SH) to CR-4 for 130 single-family homes. The rezoning case, Los Arboles, was submitted to the Pima County Planning Department in 2000, but was withdrawn by the applicant in February 2001.

Cortaro Farms Road is designated as a Scenic Major Route by the Pima County Major Streets and Routes Plan. As such, development standards for building heights, setbacks, landscaping, building and wall finishes, and signs apply to properties within 200 feet of the future right of way line. These standards apply to new development, including expansions of existing development.

Sunset Point Neighborhood Park

Recreation

Recreational facilities include two schools and two parks. Quail Run Elementary School is located on the north side of Cortaro Farms Road, while Tortolita Middle School is about one quarter mile north of Cortaro Farms Road. Sunset Point Neighborhood Park, located 700 feet north of Cortaro Farms Road, has baseball fields, as well as ramadas and other picnic areas. Arthur Pack Regional Park is one half mile north of the existing roadway.

Hardy Wash Trail, which meanders about one half mile north of the existing roadway, is designated Trail #160 on the Eastern Pima County Trail System Master Plan. This Plan classified the trails within Pima County by their relationship to major trails and by their priority for acquisition. Hardy Wash Trail is a second priority local trail linking the Santa Cruz River with the Canada del Oro Wash. The trail turns south along Joplin Road at the western end of the study area. A very short portion of the trail follows Cortaro Farms Road west to the UPRR. The Pima Trails Association (PTA) has issued an official written response confirming that the PTA no longer considers this trail as part of the current trail system in Pima County.

Roadway Access

Median openings: Cortaro Farms Road is an existing two lane roadway with dirt shoulders throughout most of the study area. Designated left turn lanes exist at the Camino De Oeste intersection for eastbound traffic, at the Oldfather intersection for westbound traffic, and at the Thornydale intersection for

Looking east at the Oldfather Road intersection

eastbound traffic. A three lane section with a continuous left turn lane (CLTL) is developed at two locations. The first section begins approximately one quarter mile west of Quail Run Elementary School and continues east through the limits of the school. The second section begins approximately one quarter mile west of Oldfather Road and continues east to the Oldfather Road intersection. Currently, there are no medians throughout the project limits along Cortaro Farms Road from the UPRR to Thornydale Road. In a separate project, the Town of Marana is planning to construct a median in Cortaro Farms Road from the west-bound frontage road to a location 100 feet east of the UPRR.

Subdivision access

Subdivision Access: Vehicular access from Cortaro Farms Road is provided through one to three intersecting streets per subdivision. There is no pedestrian, bicycle, transit or handicapped access from Cortaro Farms Road to any neighborhoods, institutions and businesses adjacent to the proposed roadway. There are no pedestrian walkways, bicycle lanes or bus routes on Cortaro Farms Road. Within existing subdivisions, pedestrian access is provided with walkways on one or both sides of residential streets.

Driveway Access

Some driveways are paved with slopes and cross drainage, while others have an unimproved dirt surface. Eight residential lots on the south side of Cortaro Farms Road between Cerius Stravenue and Freeman Lane have direct driveway access to a frontage road parallel to Cortaro Farms Road. Six residential lots on the north side of the roadway throughout the project length have direct driveway access to Cortaro Farms Road. Each of these properties have long driveways, with the dwelling unit set back on a large property. Quail Run Elementary School has two access points from Cortaro Farms Road. Diamond Shamrock has one access point from Cortaro Farms Road and another from Thornydale Road. The Wendy's/Chevron commercial site has two access points from Cortaro Farms Road.

Single family residence access

Character

The character of the study area is actively urbanizing. The long-range views of the mountains to the west, north and east are dominant features. About half the property on the south side of the road is undeveloped and remains in a

Single family residence

natural desert state. The older residential areas are generally rural, while the more recent developments of subdivisions are suburban in density. Many of the dwelling units on the large properties are not visible from the roadway. Architecture along the roadway is primarily low scale residential. The majority of the dwellings/buildings are one story and face away from Cortaro Farms Road. Other than the pitched roofs found throughout, the styles of the homes vary from midwestern to red-tiled southwestern designs. Landscape along the corridor consists primarily of indigenous desert trees and cacti. Where subdivisions have been developed, the existing desert areas remain in undeveloped right-of-way. The only hardscape visible from the road are parking lots and privacy walls at various locations, with no public art throughout the project limits.

Utilities

The following table summarizes the names of utility companies and their respective facilities within the study area. Analysis of locations and prior rights is presently being conducted for each utility.

TABLE 5 – Utility Companies with Existing Facilities in the Study Area:

Company	Facility
ACSI	Fiber Optic
Arizona Department of Transportation	Drainage, Traffic
Comcast	CATV
Cortaro-Marana Irrigation	Irrigation Water
Kinder Morgan Energy	Petroleum
Level3 Com	Fiber Optic
MCI	Fiber Optic
Metro Water District (East of Thornydale)	Potable Water
Oro Valley Water Utility	Potable Water
Pima County Wastewater Management	Sanitary Sewer
Qwest	Fiber Optic
Southwest Gas	Gas
Sprint	Fiber Optic
Tucson Electric & Power Co.	Electric
Town of Marana	Potable Water
TRICO	Electric
Tucson Water Department	Potable Water, Reclaimed Water
US West	Fiber Optic & Cable
Williams	Fiber Optic

Traffic

Existing traffic conditions include the following. Refer to the *Cortaro Farms Road Draft Traffic Engineering Report* written by DMJM, Inc. in February, 2001.

- There is one traffic signal (excluding the project termini) within the project limits, at the Camino de Oeste intersection.
- There are 14 unsignalized intersections that are controlled by a stop sign.
- The intersection with Oldfather Road is striped for an exclusive left turn lane (for southbound movements).
- A paved frontage road exists from Cerius Stravenue to Spanish Bayonet Drive.
- Accident data from January 1, 1997 to December 31, 1999 for Cortaro Farms Road from I-10 to Thornydale Road resulted in the following. Sixty-one accidents occurred on roadway segments and 146 occurred at intersections, for a total of 207 accidents.
- Level of service "F" conditions exist on Cortaro Farms Road near the western terminus of the project, at the Camino de Oeste intersection, at the Oldfather Road intersection, and at the eastern terminus of the project for peak hours of the day. Level of service "F" represents the worst level of service, and is characterized by more than a one minute delay per vehicle at an intersection.
- Posted speed limit is 45 mph.

Noise

Existing Noise Levels: Field Measured & Modeled: The existing noise environment of the project area was measured by RECON during January 2001 at twelve representative locations, using a calibrated Larson-Davis 720 sound meter. Traffic counts and mixes were recorded at the same time the noise level measurements were taken. The field-measured sound level data downloaded from the meter and converted to a spreadsheet to calculate the average noise levels for each location. The average noise levels were then adjusted to reflect the current peak-hour traffic volumes that were provided by DMJM, Project Traffic Engineers (Table 6).

Valley Baptist Church

Traffic data, the existing roadway alignment, and the noise measurement locations were entered into the Federal Highway Department's STAMINA 2.0/OPTIMA traffic noise computer model. The model was adjusted to accurately reflect the adjusted measured levels. Additional receiver locations were added to represent the range of conditions at adjacent residential properties. The approximate heights and locations of existing walls that currently attenuate noise at sensitive receiver locations were added to the model.

Locations that were identified in the study area adjacent to Cortaro Farms Road as potentially sensitive to traffic noise include existing residences, Quail Run Elementary School and Valley Baptist Church.

Summary of Existing Noise Environment: The existing peak-hour noise levels at the receiver locations range from 56 to 66 dBA. Noise level differences can be attributed to differences in proximity and relationship to the roadway, to the presence or lack of noise-attenuating elements and to the varying traffic volumes attributed to the four roadway segments. Noise levels at the entry courtyards to the church and to the school are 60 and 57 dBA, respectively. Noise levels in yards with masonry walls range from 56 to 63 dBA. These current noise levels are below the federal levels for noise attenuation.

TABLE 6 – Traffic Data (Reference: DMJM-1)

Peak-Hour Traffic Volumes

	Number of Vehicles per hour (two-way traffic)	
Roadway Segments:	**Current (Year 2000)**	**Future (Design Year 2020)**
I-10 to Hartman Lane	1865	3422
Hartman Lane to Camino De Oeste	1602	3100
Camino De Oeste to Old Father Road	1621	2948
Oldfather Road to Thornydale Road	1470	3199

Future Traffic Mix

Automobiles:	92%
Medium-Heavy Trucks:	4%
Heavy Trucks:	4%

Future Traffic Speed

Future roadway design speed assumed for this study is 50 miles per hour with a posed speed limit of 45 mph. From the public participation process, there have been requests and recommendations to use a posted speed of 40 mph. This recommendation has also been discussed by the design team throughout the planning process. This recommendation will continue to be evaluated during the design stages of the project.

ALTERNATIVE MODES

Bicycling, pedestrian movements, equestrian and bus travel are included as alternative modes of transportation within the study area. Cortaro Farms Road presently has no multi-use lanes, an unpaved shoulder, and no sidewalks. Footpaths through the desert meander along the roadway right-of-way. There are no mass transit routes in the study area.

CHAPTER 3: DETAILED ENVIRONMENTAL IMPACT ASSESSMENT

ENVIRONMENTAL

Topography

No-Action Alternative: No change in topography would be expected.

Preferred Alternative: The proposed roadway alignment will necessitate excavations of up to 6 feet and fills of up to 10 feet to achieve proper roadway grades. The most dramatic cuts and fills will occur at the location where the topography transitions from the lower floodplain elevations to the higher elevations east of Hartman Lane (See Exhibit 8). In regards to cross-drainage channel slopes, some changes may be necessary to allow drainage to be captured and conveyed under the new roadway.

Drainage

No-Action Alternative: The existing drainage crossings along Cortaro Farms Road would be maintained, perpetuating the lack of all-weather access for this major arterial roadway. Watercourses upstream and downstream of Cortaro Farms Road between Thornydale Road and Hartman Lane typically do not have sufficient capacity to convey the calculated 100 year discharges, leading to breakouts and sheet flooding problems throughout the 1.5 mile reach.

Because there are no existing flood control improvements along Cortaro Farms Road west of Hartman Lane, the existing discharges that concentrate in this area will still create flooding hazards. Due to the development of the Cortaro Ranch subdivision, the properties south of Cortaro Farms Road will continue to be

impacted under the *No-Action Alternative*. The flooding along this roadway and the subsequent ponding along the UPRR tracks would not be abated, continuing current flooding problems for ADOT, UPRR, Pima County, the Town of Marana, and private property owners in the area.

Preferred Alternative: All discharges impacting Cortaro Farms Road between Thornydale Road and Hartman Lane during the 100 year or less frequent storm events will be contained within culvert crossings, thereby providing all-weather access along the improved roadway. A two cell eight foot by four foot box culvert is recommended along Cortaro Farms Road from Hartman Lane to the western project limits. This improvement will alleviate existing flooding both within the Cortaro Farms ROW and around the properties south of the roadway. The impacts of providing additional conveyance structures include destruction of existing vegetation and an increased potential of erosion downstream of the structures.

Vegetation

No-Action Alternative: No additional impacts are expected.

Preferred Alternative: Protected native plants identified as significant (refer to Exhibit 11) immediately adjacent to and within the right-of-way are likely to be impacted by the proposed project improvements. Species in these areas are protected by the Pima County Native Plant Protection Ordinance (NPPO), the Sonoran Desert Protection Plan, the saguaro and night blooming cereus are protected by both the Pima County NPPO and State of Arizona Native Plant Law.

Project improvements are expected to impact critical pygmy owl habitat and will require mitigation per Pima County consultation with the Fish and Wildlife Service as prescribed under Section 7 of the Endangered Species Act. The project

impacts on the saguaro will affect losses of mature single and multi-armed saguaro. These losses are anticipated to be long-term but mitigatable. The project will affect mitigatable short-term temporary impacts to night blooming cereus with no losses expected (Refer to Appendix B). Any losses or impacts to ironwood, palo verde and other protected species within and adjacent to the right-of-way are anticipated to be short-term and mitigatable.

The proposed project improvements are not expected to impact any significant exotic ornamental vegetation.

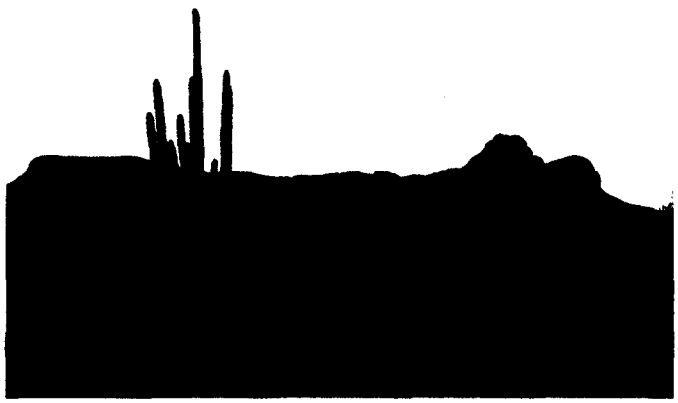
Wildlife

No-Action Alternative: No additional impacts are expected.

Preferred Alternative:

Cactus ferruginous pygmy-owl: The Arizona population of the pygmy-owl was federally listed by the USFWS as endangered in March, 1997, (USFWS 1997) and critical habitat was designated in July, 1999, (USFWS 1999). In southern Arizona 731,712 acres of riverine, riparian, and upland habitat were designated as critical habitat, with 260,883 of those acres in Pima County. Under the designation of critical habitat, protected blocks of land, or units, were created. The units represent areas in need of protection because of the current presence of pygmy-owls, or future potential use by pygmy-owls to use the lands for breeding or dispersal.

The northern ROW of Cortaro Farms Road is the southern recorded boundary of Unit 4, which encompasses lands with the highest known population of pygmy-owls in northwest Tucson. Based on communications with USFWS and AGFD (informal Section 7 consultation with the USFWS, 4 January, 2001), we have been advised to treat both the northern and southern ROW the same, as though both are in critical habitat. AGFD has identified pygmy-owls north and south of the roadway widening project. AGFD confirmed an occupied territory south of Cortaro Farms Road and west of Thornydale Road in February, 2001. USFWS delineated the areas of concern; ¼ mile west of Thornydale Road and from the Camino de Oeste alignment west to Spanish Bayonet. The delineation incorporates all areas that support undisturbed, native vegetation on both sides of Cortaro Farms Road, washes, and areas with large stands of trees. (Exhibit 12)


Southern right-of-way

The proposed Cortaro Farms Road improvement project contains foraging and breeding habitat for the cactus ferruginous pygmy-owl. The project would impact a maximum of 9.41 acres of critical habitat. Because a pygmy-owl has been located near the intersection of Cortaro Farms and Thornydale roads in 2001, and the general area has a documented history of pygmy-owl occupation since 1995; the project may affect and is likely to adversely affect both the pygmy-owl and its habitat.

Sonoran desert tortoise: The proposed Cortaro Farms Road improvement project contains potential habitat for the Sonoran desert tortoise. The vegetation within the site consists of the paloverde-mixed cacti association preferred by

desert tortoise. The site also contains rock outcrops, boulders and natural cavities that could be used as shelter sites. During our site visit we looked for signs of desert tortoise, such as scat or active burrows. No scat or other visible evidence of Sonoran desert tortoise was evident. Completion of the road-widening project will not adversely affect the Sonoran desert tortoise or its habitat. However, we recommend that pre-construction tortoise surveys be conducted to reduce impacts to desert tortoise and their habitat within the project area.

Viewsheds

No-Action Alternative: No additional impacts are expected.

Preferred Alternative: The analysis of scenic value and character of this project revealed two dominant view categories: the view of the vegetation in the foreground, and the view of the distant mountain ranges in the background. Thus, areas along Cortaro Farms Road where view sheds will be impacted are those areas where foreground vegetation will be removed or disturbed, and areas where background open views may be blocked or interrupted by new noise walls, screen walls or new landscaping, as part of the roadway improvements. Refer to Exhibit 9 for noise wall locations.

The existing vegetation provides high scenic value where large, dense native vegetation has been left in place adjacent to residential development. The impact to these areas is of high visual concern because the vegetation currently provides a visual screen and buffer between the housing and the roadway, while providing a softening green-belt character to the area. The vegetation in the pygmy owl habitat (see wildlife sections and exhibits) and undeveloped areas where vegetation remains in the right-of-way is also of high scenic value providing more green space to view, thus is also of high visual concern. These

areas of high visual concern occur mainly along the central third of the project length, and toward the east end of the project for the pygmy owl habitat.

Since these areas of dense vegetation currently block background views, specifically distant mountain views, there will be no impact to background views in these areas.

The areas where visual quality will be impacted are mitigatable. It is anticipated that the placement of new walls and landscaping in the right-of-way will not adversely impact background views provided that care is taken in their placement in a few key areas. On the other hand, these features could improve the visual quality of the foreground views by providing a visual buffer between the roadway and adjacent development.

Historical, Cultural, and Archaeological

No-Action Alternative: No additional impacts are expected.

Preferred Alternative: As proposed, the widening and refurbishment of Cortaro Farms Road will result in direct, adverse effects to National Register-eligible sites AA:12:285 and AA:12:774. Any disturbance to these sites has the potential to destroy intact subsurface cultural deposits and features. Archaeological testing and data recovery programs have been completed adjacent to the proposed Cortaro Farms Road right-of-way that have demonstrated the existence of buried cultural stratigraphy.

AA:12:780 and EE:3:53 will also be affected by the improvement of Cortaro Farms Road. Although other segments of these sites may maintain adequate integrity for inclusion in the National Register of Historic Places, portions within the Cortaro Farms Road project area do not meet eligibility requirements.

Because their integrity was compromised previously, the project will not result in an adverse effect to these sites.

Unless steps are taken to avoid impacting the feature, the proposed project will destroy the memorial marker recorded as IO 1.

Air Quality

The roadway improvement project is not anticipated to degrade the air quality levels below the standards set forth by the EPA's NAAQS.

Water Quality

No-Action Alternative: No impacts are expected.

Preferred Alternative: Storm-water runoff will be managed by water harvesting in the roadway medians, by cross drainage structures, and by a parallel drainage system. The runoff is not expected to alter the water quality in the project area.

NEIGHBORHOOD

Looking east at the Camino de Oeste intersection

Adjoining Land Use & Property Values

No-Action Alternative: No additional impacts are expected.

Preferred Alternative: The Pima County Comprehensive Plan identifies most of the corridor area as low and

medium intensity urban residential. Rezoning of vacant properties from low-density residential (SR zoning) to medium density residential (R-3 or R-4 zoning) might result after the roadway is improved. Both the northwest and southwest corners of Thornydale Road and Cortaro Farms Road are designated Community Activity Centers. While the intersection of Camino de Oeste on both the north and south sides of Cortaro Farms Road, on the east side of Camino de Oeste, is designated a Neighborhood Activity Center. The use of these properties as commercial would require rezoning, which might follow after the traffic issues are resolved with the roadway improvements.

Any potential changes in property values are difficult to predict. There may or may not be an increase in values for the SR lots. Additional roadway capacity may attract development of commercial parcels. Homes closest to the road within the developed subdivisions may experience a decline in property values due to the reduced separation from the improved roadway.

Recreation

No-Action Alternative: Pedestrian and bicycle access to recreation facilities will continue to be limited due to safety concerns on Cortaro Farms Road.

Quail Run Elementary School

Preferred Alternative: Quail Run Elementary School is the only recreational facility with direct access from Cortaro Farms Road. The roadway improvements will provide better pedestrian and bicycle access to the facilities. Other

recreation facilities previously identified are further from Cortaro Farms Road and are unlikely to experience any impact. However, the improved bicycle access and pedestrian walkways along Cortaro Farms Road will allow for safer travel to these facilities.

The segment of the Hardy Wash trail along the Cortaro Farms Road near the western end of the project area will be affected by the road improvements (Exhibit 10). The portion of the right-of-way near the western terminus will shift to the north as will be discussed in Chapter 5. The trail segment could remain in the current location or be in a new location along the road right-of-way. Regardless of any roadway realignment, the short trail segment along Cortaro Farms Road will continue to connect the Hardy Wash trail with the Santa Cruz River trail.

Various forms of dispersed, undeveloped recreation such as walking, bicycling, and jogging will increase due to corridor development. Roadway improvements with multi-use lanes and pedestrian walkways will provide a safer environment for such individual recreational activities.

Frontage Road at Spanish Bayonet Dr.

Access

No-Action Alternative: Turning movements into driveways and neighborhoods will continue to be unsafe and may increase traffic congestion.

Preferred Alternative: Improvements to Cortaro Farms Road will improve access for surrounding neighborhoods. Left turn lanes into neighborhoods will make turning movements safer. Traffic along the corridor will

be able to flow more efficiently, possibly reducing traffic through adjacent neighborhoods. Along with the Thornydale Road improvements, traffic will more likely stay on main roadways instead of utilizing neighborhood side streets. The properties that now have access to the frontage road between Cerius Stravenue and Spanish Bayonet would enter Cortaro Farms Road directly.

Character

No-Action Alternative: The character of the corridor will remain more rural, excluding the congested streets.

Preferred Alternative: The rural character of the corridor will change to an overall suburban quality, with the addition of more lanes, pedestrian walkways, landscaping and public art. The natural vegetation in the right-of-way will be replaced by desert landscaping where subdivisions have already been developed. Vacant, undeveloped properties and portions of the area that are already developed as low density residential will retain their rural character. In addition, the long-range views of the mountain setting will remain.

Utilities

No-Action Alternative: Utilities would not be affected.

Preferred Alternative: Utilities will be relocated within the shoulder area of the proposed roadway. Some utilities will be re-routed underground if cost effective. A more precise description of the extent of utility relocation will be addressed in the Design Concept Report (DCR) which will succeed this report.

Traffic

No-Action Alternative: Traffic congestion will continue without the roadway improvements.

Preferred Alternative: An increase in roadway capacity may cause an increase in traffic volume that will cause an increase in traffic noise. A wider roadway would impact the vegetation and wildlife. A median would alter access for adjacent properties.

Noise

No-Action Alternative: The volume of traffic noise will continue to increase. Existing walls do provide some level of mitigation but noise levels will increase (even at these walled yards) above the threshold 67 dBA.

Preferred Alternative:

Future Noise Levels Modeled: Future noise levels were predicted using the STAMINA 2.0/OPTIMA model. DMJM provided projected future (design year 2020) peak-hour traffic volumes. The traffic data and the "pre-design" roadway alignment (as reflected by the +-15% complete roadway drawings provided by MMLA) were input into the computer model. The noise measurement locations and receiver locations modeled for existing conditions were included along with the approximate heights and locations of existing walls.

Summary of Future Noise Environment: Future peak-hour traffic noise levels predicted for the modeled receiver locations range from 65 to 74 dBA. Future increases are due to increased traffic volumes; an increase in the percentage of medium and heavy trucks, increased speeds, and, in some cases, a raised vertical alignment. As mentioned above, the differences in noise levels at the various receiver locations reflect differences in distance from the roadway, vertical relationship of the receiver to the roadway, the presence or lack of noise-attenuating elements, and varying traffic volumes attributed to the four roadway segments. The highest noise levels predicted are 73-74 dBA, at receivers R8 and R10, locations that are at or near the right-of-way line (Exhibit 9, Page 7 of 9). These particular locations are not considered sensitive receivers.

Looking west at the Oldfather Road intersection

The two receivers representing the school have future noise levels of 65 dBA. All of the receivers representing the church and residential locations have future noise levels predicted to be 65 dBA and greater. Noise levels in residential yards with existing masonry walls range from 65 to 69 dBA.

Impacts: In accordance with FHWA noise standards, traffic noise impacts occur when traffic noise levels approach or exceed the noise abatement criteria (Table 1.), or when the predicted peak-hour traffic noise levels substantially exceed (i.e., by 10-12 dBA or more) the existing noise levels. The noise standards give primary consideration to exterior use areas when determining and abating traffic noise

impacts. Abatement measures should be considered for exterior locations where frequent human use occurs and a lowered noise level would be of benefit.

TABLE 7 – FHWA Noise Abatement Criteria (Reference: FHWA)

Activity Category	dBA L_{eq}*	Description of Activity Category:
A	57 (exterior)	Lands on which serenity and quiet are of extra-ordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, schools, churches, libraries, and hospitals.
C	72 (exterior)	Developed lands, properties, or activities not included in Activity Categories A or B above.
D	N.A.	Undeveloped lands.

*L_{eq} represents the average noise level during a given period.

In the vicinity of Cortaro Farms Road, the 67 dBA criteria level *is* approached or exceeded by future conditions at sensitive receiver locations. Therefore, noise mitigation barriers were modeled and evaluated for their effectiveness.

ALTERNATIVE MODES

No-Action Alternative: No improvements to alternative modes are expected.

Preferred Alternative: Pedestrian walkways and the multi-use lanes will improve the safety of pedestrian and bicyclist travel along Cortaro Farms Road. There are no plans at this time to start a mass transit route along the roadway.

CHAPTER 4: PROPOSED DESIGN FEATURES AND MITIGATION MEASURES

ENVIRONMENTAL

Topography

Slope stability measures and/or retaining walls may be incorporated to support the proposed cut and fill slopes of the hillsides east of Hartman Lane. Multi-level retaining walls with landscape planting beds may enhance the aesthetics of the walls and may provide a refuge for pygmy owl movements across Cortaro Farms Road.

Drainage

As a result of the proposed improvements to Cortaro Farms Road, discharges that were once conveyed across this roadway in graded dip sections must be contained in culverts. Consequently, at least six new culvert crossings are recommended, in addition to the five existing culvert crossings that should be upgraded in order to accommodate existing 100 year discharges. The concentration of runoff at the designated drainage crossings will result in increased flow velocities observed in the watercourses downstream of Cortaro Farms Road. If necessary, erosion protection will be provided at the newly designed culvert outlets. The final design velocities will dictate what methods will be sufficient at reducing the scour potential at the culvert outlets. It is anticipated that a 404 Permit will not be required for this project.

Looking west at drainage channel

A culvert is also recommended to convey the existing 100 year discharge of 486 cfs that collects at the intersection of Cortaro Farms Road and Hartman Lane. This discharge will be conveyed west to the Union Pacific Railroad tracks. As part of the ongoing improvements to Cortaro Farms Road, Stantec Consulting Inc. has been designing the section of the roadway between the I-10 frontage roads and Cerius Stravenue, a distance of approximately 1500 feet. Per a meeting between MMLA, Inc. and Stantec, Inc. in January, 2001, several drainage issues were discussed. These issues centered on the findings in the approved Town of Marana Stormwater Master Plan prepared by Arroyo Engineering, Inc. Per this report, 1,313 cfs impacts the I-10 and Cortaro Farms Road Intersection and is primarily conveyed between the UPRR tracks and the westbound frontage road, with 244 cfs splitting off and being conveyed west down Cortaro Farms Road beneath the interstate.

At the meeting, MMLA, Inc. was informed by Stantec, Inc. that under the direction of the Town of Marana, the drainage issues for the roadway section were not a concern, even though the new roadway proposed by Stantec fills in the existing drainageway between the railroad and the frontage road. To provide positive drainage, Stantec is proposing two 24 inch pipes to be constructed beneath their section, but does not address any other drainage issues. MMLA, Inc. acknowledges the fact that the Arizona Department of Transportation may remedy this problem during future I-10 improvements, but believes that an interim solution is required. MMLA, Inc. will present possible solutions to this issue in the Design Concept Report.

Vegetation

Any anticipated loss of significant vegetation is required to be mitigated with native protected species-specific vegetation under the Federal, State and Local regulations. It is anticipated that any impacts can be mitigated for a long-term beneficial effect through

provisions for salvage, transplant and additional planting within the limits of the project and within the right-of-way. Refer to Appendix B for salvage and transplant mitigation requirements for the night blooming cereus. Supplemental water will be required for all salvage and transplanted plant material throughout the construction and maintenance phases of the project.

Wash east of Quail Run Elementary

The Arizona Department of Agriculture will need to be notified of intent to clear at least 60 days prior to construction. Special provisions will be required during construction to protect native plant species affected by the project. Construction documents will need to include provisions for preservation in place, salvage and transplant within the project limits. Any losses of native species will require additional species specific mitigation at ratios required by Pima County Native Plant Ordinance and as determined through the Section 7 consultation process with the US Fish and Wildlife Service.

Wildlife

Cactus Ferruginous Pygmy-owl: The goals of the conservation measures are to minimize the amount of suitable habitat removed from the project site and not to create a dispersal barrier. Exhibit 12 shows the locations desired to provide the necessary connectivity within the areas supporting suitable habitat. At the time of construction, a current (that spring season) survey should be conducted to verify if any owls are in the ROW or immediately adjacent to it. A formal Section 7 consultation, as required by the Endangered Species Act, will be initiated when adequate information is available to present to the USFWS regarding project design and construction elements. Pima County

met informally with the USFWS officials to discuss the proposed project, and the consensus at that meeting was to postpone the formal consultation on the project impacts to pygmy owl habitat until the design plans were finalized. Possible strategies to meet the conservation goal include, but are not limited to:

a. Utilizing already cleared area for road placement.
b. Maintaining tall vegetation (defined as trees greater than 20 feet in height, no farther apart than 40 feet) on either side of the ROW.
c. Placing utilities in shoulder and under pedestrian walkway, so that less vegetation is cleared.
d. Narrowing road in areas where there is existing undisturbed vegetation.
e. Planting vegetation as close to shoulder as feasible.
f. Utilizing a wider median, if feasible.
g. Re-creating the surrounding plant community in median. Utilize tall native trees with mature canopies and understory plants to create plantings with structural diversity (groundcover, shrubs, tall trees).
h. Placing noise-walls/retaining walls in areas adjacent to existing residential and school use. Try to avoid the use of noise-walls/retaining walls in areas where there is undisturbed vegetation.
i. Utilizing lighting at signalized intersections only.
j. There should be no noise disturbance from heavy equipment (e.g., grading, paving, cutting, filling, hauling, heavy earthwork, clearing, grubbing, work in culverts/storm drains) during the breeding season (February 1- July 31).
k. At the time of construction, if pygmy-owls are located to the south of the ROW or immediately adjacent to it (as defined by AGFD and/or USFWS), the construction time-frame will be re-examined so that dispersal to the north will not be jeopardized.
l. The contractor should not undertake any activity which results in traffic congestion or delays one hour before, during, or one hour after sunrise and sunset to reduce noise.

m. Destroyed potential habitat will be mitigated at 4:1 (for every one acre lost, four acres of suitable habitat will be purchased). The potential habitat is 9.41 acres. Consequently the mitigation amount would be 37.64 acres if all of this potential habitat were destroyed.

Sonoran Desert Tortoise: The Arizona Game and Fish Department has published guidelines for handling tortoises encountered on development projects (AGFD 1996). These guidelines should be made available to all construction managers and foremen associated with the project (Appendix B). In summary, the guidelines restrict the distance and ambient air temperature that a desert tortoise can be moved from its burrow. If possible, a substitute burrow (determined by a qualified biologist) should be located prior to moving a tortoise, especially if the ambient air temperature is above 105 degrees Fahrenheit. A tortoise should only be moved during extreme temperatures if the specimen is in imminent danger. Avoidance is preferred. For long term development projects (such as this one) AGFD should be notified for guidance and assistance in placing salvaged tortoise in a AGFD regulated adoption program.

Viewsheds

Since the proposed roadway improvements will affect a majority of the roadway cross-section, care must be taken to provide visual mitigation that minimizes long-term adverse effects. Areas anticipated to require visual mitigation are at noise barrier wall locations, cut and fill slopes, and areas where existing vegetation will be removed.

Noise Barrier Walls: Walls recommended for noise mitigation will also serve to visually mitigate the roadway where adjacent to residential development. To minimize adverse visual impacts the walls may present, their placement could meander and have appropriate artist elements incorporated into their design. Natural textures, colors, materials and finishes could soften the walls visually and help to maintain the rural feel of

the area. In addition, landscape design will include the use of large specimen transplanted Ironwoods, Palo Verdes, Mesquites and Saguaros to soften the effects of these built features.

Cut and Fill Slopes, Areas of Vegetation Disturbance: Slopes and areas of disturbance will require revegetation with native plant materials and seed mixes of species similar to those in surrounding areas, for a congruent natural appearance and to mitigate for the loss of vegetation. Mitigation with large plant materials will help to mitigate for the loss of visual screening that the existing vegetation currently provides, and where duplication of existing plant densities is not possible due to imposed roadway constraints. Where feasible, the roadway alignment can be placed to avoid exceptionally large specimens or groups of trees and cacti, especially near the pygmy owl habitat.

Historical, Cultural & Archaeological Sites

The proposed demolition and reconstruction of Cortaro Farms Road will adversely affect the integrity of sites AA:12:285 and AA:12:774. Avoidance of these two sites is unlikely to be a feasible option because of existing development and infrastructure, and the density of the National Register-eligible sites that abut the western margin of the project area. Previous archaeological research in the western portion of the project area has clearly demonstrated the ubiquity of intact, subsurface cultural stratigraphy underlying a modest surface manifestation (Slawson et al. 1986; Bernard-Shaw et al. 1988; Bernard-Shaw 1991; Altschul and Huber 1995; Deaver 1996; Terzis et al. 1997; Wellman, ed. 2000).

Desert Archaeology, Inc. recommends that the project area west of Hartman Lane to the Union Pacific Railroad be subject to additional archaeological investigation prior to any ground disturbing activities. In the western portion of the project area, where the proposed alignment deviates from the existing roadbed, lands between the southern Cortaro Farms right-of-way and the northern limit of the proposed alignment should be included within the scope of this additional archaeological work. Desert Archaeology, Inc. recommends that appropriate archaeological data recovery plan be developed, approved, and implemented to mitigate impacts of the proposed construction.

Additionally, the modern memorial marker recorded as IO 1 should be avoided by the proposed construction project. The feature will not be affected if it is moved about 25 m (82 ft) south of its present location. It is recommended that Pima County and/or MMLA contact the caretaker of the memorial to discuss appropriate preservation alternatives.

AA:12:780 and EE:3:53 are also located within the Area of Potential Effects of the project. These sites have been modified in the project area by prior construction and do not maintain sufficient integrity to qualify for inclusion in the National Register of Historic Places. Therefore, no additional archaeological work is recommended at these sites prior to construction in the project area.

Significant archaeological sites were not identified east of Hartman Lane during this or other previous surveys. Therefore, it is recommended that the project proceed in this area without further archaeological investigations. However, if cultural materials are encountered unexpectedly during construction, work should be temporarily halted until the nature and significance of these remains can be assessed by a professional archaeologist.

Air Quality

A larger capacity roadway may reduce peak-hour traffic congestion, which may reduce vehicular emissions near the major intersections along the project. Traffic signal timing will also help to reduce traffic emissions.

Water Quality

During the construction of the roadway, a Stormwater Discharge Permit will be required. One requirement of the permit is the development of a Stormwater Pollution Prevention Plan. Water harvesting in the roadway medians will help to reduce surface water runoff from the project.

NEIGHBORHOOD

Adjoining Land Use & Property Values

The design of the roadway will include facilities for pedestrian and bicycle use. In addition, underground utilities will be relocated within the shoulder area, if possible, to minimize disruption of vegetative screening. Noise walls will be used where necessary. These aspects, as well as increased safety and the introduction of public art, may mitigate any adverse impacts on adjoining land use and property values.

Recreation

The addition of pedestrian walkways and multi-use lanes will enhance recreational uses in the area and provide safer access to existing recreational facilities.

Access

Medians, left turn storage bays, and multi-use lanes will provide safer turning movements to side streets and driveways. Access will be designed to Pima County Standards.

The Hartman Lane and Camino de Oeste intersection improvements will be included in the project, which should improve access to many neighborhoods north of Cortaro Farms Road.

Looking north from Camino de Oeste intersection

Character

Native landscaping in the right-of-way and in medians will mitigate the visual impacts caused by the increased amount of pavement of the improved roadway. Walls could be enhanced with public art treatments and terraced with landscaping treatments. The improved flow of traffic and increased safety for pedestrians, bicycles and vehicles, particularly during peak hours, will also enhance the character of the area.

Utilities

Utilities will be placed underground when possible and within the shoulder area of the roadway.

Traffic

Based on the recommendations of the Traffic Engineering Report, some of the proposed traffic design features follow.

- It is recommended that Cortaro Farms Road be widened to six through lanes from the I-10 interchange to the Hartman Lane intersection and four through lanes from Hartman Lane to Thornydale Road.

- New traffic signals are recommended at the Cerius Stravenue, Hartman Lane and the Oldfather Road intersections. The existing signal at Camino de Oeste will be upgraded.

- Preparation of a future intersection with Camino de Oeste to the south will include curbed corners, underground conduits, signal pole foundations, and pedestrian refuge in medians.

- Improvements to the west driveway of Quail Run Elementary School are recommended for roadway access.

Noise

Need for Mitigation: In the vicinity of Cortaro Farms Road, the FHWA 67 dBA criteria level *is* approached or exceeded by future conditions at sensitive receiver locations. Therefore, noise mitigation barriers were modeled and evaluated for their effectiveness.

Noise Barriers: Noise barrier walls were modeled at locations shown on maps in Exhibit 9. Initially, wall heights of six feet were modeled at certain locations along the right-of-way where no walls currently exist. Seven and eight foot height walls were then modeled at locations where the existing walls or the new six foot height walls did not lower noise levels to 67 dBA or under. Where existing walls currently exist, this would require replacing walls unless the wall heights could be raised. The results of the noise modeling, with and without mitigation to attenuate noise, are shown on Table 8.

At location R3 (Exhibit 9, Page 4 of 9), a residence exists at a level significantly higher than the roadway. At this location a wall at a lower elevation has limited effectiveness. A wall at a higher elevation and nearer to the residence would be much more effective at reducing nois levels. A wall at the higher elevation was modeled for the purposes of comparison and was found to reduce noise levels to 61 dBA.

At location R12 (Exhibit 9, Page 1 of 9) a six foot high noise barrier wall was modeled on the assumption that the new residences soon to be built in that area will have developer-built patio walls for all back yards facing Cortaro Farms Road. The property is zoned "commercial"; but it would allow residential uses, and if residential development occurred, the noise walls would be needed.

TABLE 8 – Existing and Future Traffic Noise Levels[1]

Receiver/ Measurement Numbers[2]	Land Use	Distance From Future Centerline	Exist. Wall Y/N	Current Peak-Hour Noise Levels	Future 2020 Peak-Hour Noise Levels[3] Unmitigated	Future 2020 Peak-Hour Noise Levels Mitigated with New Walls[4]			
						6' ht.	7' ht.	8' ht.	Other
R1/M1	Residence	150' S	N	66	70	67	66	66	n./a.
R2/M2	Church	270' N	N	60	68	65	n./a.	n./a.	n./a.
R3/M3	Residence	140' N	N	63	71	68	67	n./a.	61
R4/M4	School	260' N	N	57	65	63	n./a.	n./a.	n./a.
R5/M5	School	330' N	N	57	65	64	n./a.	n./a.	n./a.
R6/M6	Burke Dr.	275' N	N	58	67	n./a.	n./a.	n./a.	n./a.
R7/M7	Burke Dr.	150' N	N	61	70	n./a.	n./a.	n./a.	n./a.
R8/M8	Burke Dr.	75' N	N	65	74	n./a.	n./a.	n./a.	n./a.
R9/M9	Residence	110' S	Y	58	66	n./a.	n./a.	n./a.	n./a.
R10/M10	Basin	100' N	N	65	73	70	n./a.	n./a.	n./a.
R11/M11	Vacant	150' S	N	61	71	n./a.	n./a.	n./a.	n./a.
R12/M12	Vacant	100' N	N	61	66	65	n./a.	n./a.	n./a.
R13	Residence	150' N	Y	63	67	n./a.	66	n./a.	n./a.
R14	Residence	150' S	N	65	71	68	67	66	n./a.

1 Noise levels, predicted by the Stamina/Optima Traffic Noise Model, are shown in decibels, dBA L_{eq}, peak hour. Peak-hour L_{eq} is the standard used by the federal government in assessing potential traffic noise impacts.

2 Locations M1-M12 were field measured; locations R1-R21 were modeled.

3 With existing walls where they occur, but with no new walls added.

4 See Exhibit 9 for locations of new noise barrier walls to mitigate traffic noise to these levels.

MMLA

R15	Residence	150' S	N	64	71	67	67	67	n./a.
R16	Residence	100' N	Y	58	66	n./a.	n./a.	n./a.	n./a.
R17	Residence	150' N	N	60	69	65	n./a.	n./a.	n./a.
R18	Residence	150' N	N	60	69	65	n./a.	n./a.	n./a.
R19	Residence	150' N	N	60	69	67	66	n./a.	n./a.
R20	Residence	110' S	Y	56	65	n./a.	n./a.	n./a.	n./a.
R21	Residence	150' N	Y	60	69	n./a.	68	67	n./a.

Summary & Conclusions: The existing peak-hour noise levels predicted for the modeled receiver locations range from 56 to 66 dBA. Noise level differences can be attributed to differences in proximity and relationship to the roadway, to the presence or lack of noise-attenuating elements and to the varying traffic volumes attributed to the four roadway segments. Noise levels at the entry courtyards to the church and to the school are 60 and 57 dBA, respectively. Noise levels in yards with masonry walls range from 56 to 63 dBA. These current noise levels are below the federal levels for noise attenuation.

Future peak-hour traffic noise levels predicted for the modeled receiver locations range from 65 to 74 dBA. Future increases are due to increased traffic volumes, an increase in the percentage of medium and heavy trucks, increased speeds, and in some cases a raised vertical alignment. The highest noise levels predicted are 73-74 dBA, at receivers R8 and R10 (Exhibit 9, Page 7 of 9), locations that are at or near the right-of-way line. The two receivers representing the school have future noise levels of approximately 65 dBA. All of the receivers representing the church and residential locations have future noise levels predicted to be 65 dBA and greater. Noise levels in yards with existing masonry walls range from 65 to 69 dBA.

New noise barrier walls of six, seven and eight feet heights were modeled at locations along the future right-of-way line. Based on the information available for this study, a combination of these wall heights would reduce noise levels to 67 dBA or less at all sensitive receiver locations. At locations where existing walls of lower heights currently exist, this would probably require replacing existing walls with new ones of greater heights. At certain residential locations, noise levels may not be effectively attenuated below the 67 dBA level without noise walls exceeding eight feet in height. The potential height and the replacement of walls should be carefully considered and balanced with the degree of attenuation achieved by such efforts.

At this time, the roadway plans are very preliminary and have not been finalized. The analysis performed for this study is based on plans that are estimated to be approximately 15% complete. RECON recommends that a review and re-modeling of the roadway reconfiguration and affected residences be performed once the roadway design and vertical and horizontal alignments have been reviewed and finalized. At that time, we can review the locations of any retaining walls that may be required, final slope configuration, and any changes in the horizontal and vertical alignment, all factors that affect noise levels. The final roadway data will enable a more accurate prediction of future noise levels, assessment of impacts to adjacent residences, and identification of noise walls and heights that may be warranted.

The placement and design of noise barrier walls should be considered during the roadway design process in order to coordinate with the roadway grading, drainage and hydrology, driveway access, safe sight visibility and the future landscape treatment. Wall alignment may need to respond to the need of preserving specimen trees or cacti in-place. Landscaping, and the integration of art and design elements (e.g., varied materials, forms, line, colors, and textures) will serve to reduce the visual impact of noise walls. Ideas for the aesthetic appearance of walls should be incorporated into their design. Vegetation provides a negligible amount of noise reduction; however, it does provide a visual screen, which is usually considered to be a significant positive benefit to residents along roadways.

Importantly, the design and location of noise barrier walls should take into consideration the movement of sensitive wildlife species, particularly the cactus ferruginous pygmy owl. Research to date indicates wide roadways and barrier walls could negatively affect their flight pattern. A task force has been appointed by Pima County to develop a workable roadway cross-section in response to this concern.

CHAPTER 5: PROPOSED PRELIMINARY ROAD DESIGN

The Cortaro Farms Road roadway design is based on the Pima County Roadway Design Manual, 1st Edition, September, 1998 and Addendum of March, 2000.

Typical Sections (Refer to Exhibit 4): Three sections will be considered, namely, a five-lane section, a four-lane divided section, and a six-lane divided section. A four-lane divided environmentally sensitive section is also being developed by the design team with consultation from the AFGD, USFWS, and PCDOT. All sections will be evaluated to provide the best design possible for all parties involved.

Continuous Two-Way Left Turn Lane: The fifth lane of the five-lane option will allow turning movements to and from Cortaro Farms Road. The width will be 14 feet.

Medians: The standard median width is 24 feet and a minimum width is 20 feet. Due to the desire to provide safe refuge for the pygmy owl while it may cross the roadway, median widths may be increased where possible. Also, medians may be inverted at a slope of 3:1 to harvest rainwater whenever possible.

Looking north along Cerius Stravenue

Travel Lanes: Three travel lanes in each direction will start at the project western terminus and transition into two travel lanes in each direction near Hartman Lane. From there, two travel lanes in each direction will continue to the project eastern terminus. The proposed width of the

inner lane is 14 feet (12 feet for the 5 lane section), while the outer lane width would be 12 feet. Travel lane cross slopes would be designed with cross slopes (typically 2%) in order to remove storm water from the roadway as quickly and safely as possible.

Pavement Section: The future geotechnical analysis of the project soil conditions will determine the possible need for multiple types of pavement sections. The preliminary pavement structural section is 6-inches of Asphaltic Concrete on 12-inches of Asphaltic Base Course on a graded and compacted subgrade.

Multi-Use Lanes: Lane widths will be 10 feet (or 6 feet in the six-lane section). Cross slopes will be -4% toward the gutter.

Curb & Gutter: Pima County Standard Detail Number 209 Type 1(G) will be used in the design of the curb and gutter. The height of curb (H) above the finished roadway surface will typically be 6 inches.

Shoulders: A 12 foot shoulder with a -2% cross slope towards the roadway will be the typical design. The shoulder will include a pedestrian walkway designed to Pima County Standard Detail 200, which uses a 4 foot wide concrete walkway.

Foreslopes & Backslopes: Foreslopes will typically be designed at a 4:1 slope. Where physical constraints prohibit use of the 4:1 slope, slopes 2:1 or greater will require the use of roadside barrier protection.

Horizontal Alignment: Early in the project planning process a preliminary alignment was modeled by following the existing centerline of Cortaro Farms Road. After discussions with the USFWS, the Arizona Game and Fish Department, the CAC, and with public participation, it was determined that the preliminary alignment would cause a significant impact to the adjacent critical

habitat and property. The preliminary alternative was abandoned in favor of an alignment that was shifted to the south.

Cut section

The second alignment maximizes the use of previously cleared land in the southern right-of-way and minimizes impacts to the critical habitat to the north of the roadway. The pygmy owl sensitive habitat (Exhibit 12) depicts the preferred alignment and impacts to the habitat.

At the western terminus of the project (See Exhibit 8), the horizontal alignment will shift to the north of the existing alignment to match the alignment of the adjacent Cortaro Farms Road/I-10 traffic interchange improvement project that has been approved for construction by the Town of Marana.

Vertical Alignment: In order to minimize impacts to the topography, the proposed vertical alignment has been designed to closely match the existing vertical alignment of Cortaro Farms Road. Several vertical alignment design controls have also been considered, some of which include:

- Maintain proper vertical clearance of the roadway above the 100 year storm event runoff that may collect at the western 2600 feet of the project.
- Maintain a reasonable transition slope from the mainline roadway alignment to the vertical alignment of driveways.
- Maintain safe transitions from the mainline alignment to intersecting street alignments.
- Allow for adequate cover above proposed cross drainage structures.

Right-of-Way: The initial estimate of the right-of-way required for the project is 75 feet to either side of the existing right-of-way centerline. Some right-of-way acquisition is necessary to achieve these dimensions, but no structures appear to be affected by the proposed improvements. At the western terminus of the project, the proposed roadway shifts to the north to match the construction centerline of the Town of Marana Cortaro Farms Road project, and the 150 foot right-of-way corridor shifts with it, as is seen in Exhibit 8.

Access Control: Access control design standards will adhere to the Pima County Roadway Design Guidelines.

Retaining Walls and Slope Stability: Retaining walls and slope stability measures may be used to limit the surface area needed to construct the proposed alignment, which may reduce impacts to adjacent property and the environmentally sensitive habitat.

Conceptual Striping: Striping will adhere to the standards set forth by the County. Striping design will be investigated in the Design Concept Report.

Noise Walls: Noise walls will be applied to mitigate traffic noise with the consent of property owners and/or neighborhood associations.

CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

Summary of Proposed Mitigation Measures

The following table catalogs the primary environmental impacts and proposed mitigation measures.

TABLE 9 – Proposed Mitigation Measures

Potential Impact	Mitigation Measure
Hillside Excavation	• Landscape • Use retaining walls
Storm water runoff	• Install storm drain system • Install erosion controls at culvert termini
Impacts to native vegetation	• Provide high density landscaping with native plant species. Both a mature canopy and understory plants would compose the landscape palette • Salvage cacti, Paloverde and Ironwood • Transplant in medians and along roadway ROW • Plant larger trees proximal to washes
Viewshed degradation	• Re-vegetate • Create public art as an enhancement • Sidewalks to be offset from the roadway as much as possible • Utilities up to 14 kV to be placed underground
Traffic Noise	• Install noise attenuation measures that include noise barriers and/or an AR-ACFC pavement wearing course
Encroachment on wildlife habitat	• Alter proposed roadway alignment and/or roadway cross sections to avoid habitat • Widen medians at specific locations to enable dense median landscaping • Stop heavy construction equipment noise from February 1 to July 31
Right-of-way takes	• Application of roadway cross section standards that will cause the least impacts

Conceptual Cost Estimate

The conceptual cost estimate of the project is $23.6 million with the following cost breakdown:

Engineering	$2,187,000
Utilities	$1,100,000
Right-of-Way	$2,000,000
Construction	$13,160,000
Contingencies	$2,742,000
Public Art	$188,000
Construction Administration	$2,187,000
Total Project Cost	$23,564,000

CORTARO FARMS ROAD
4TCFIT

ENVIRONMENTAL ASSESSMENT AND MITIGATION REPORT

SIGN OFF SHEET FOR APPROVAL

Reviewed and Recommended for Approval:

Ruben Y. Lacandola, P.E.
Engineering Division Manager

Date: 7/24/01

Approved:

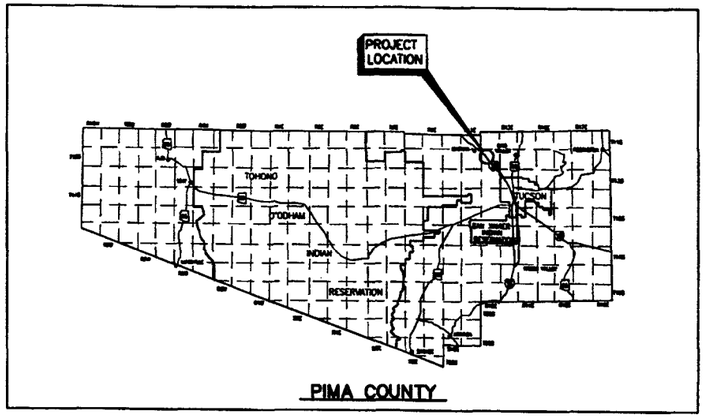
Benjamin H. Goff, P.E.
Deputy Director

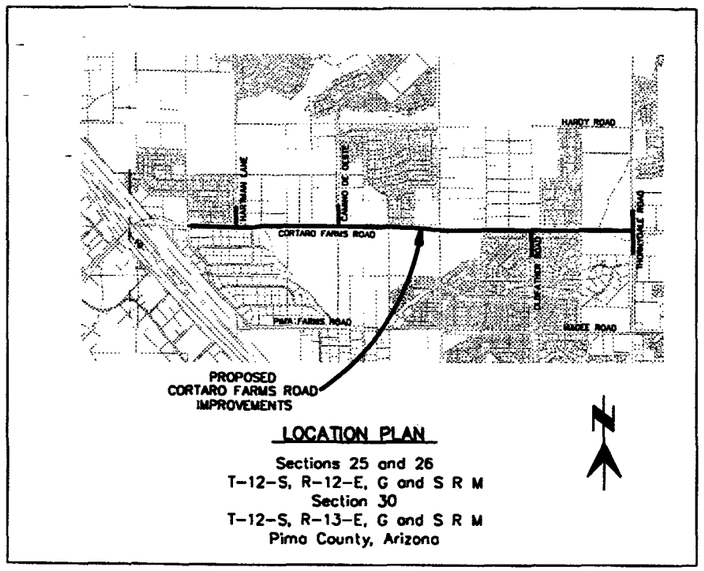
Date: 7/29/01

MMLA

EXHIBIT 1

Project Location Map





MMLA
McGowan MacWhinnie Lodge & Associates, Inc.

EXHIBIT 1
PROJECT LOCATION MAP
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 1 of 1

EXHIBIT 2

Project Aerial Photo

N.T.S.

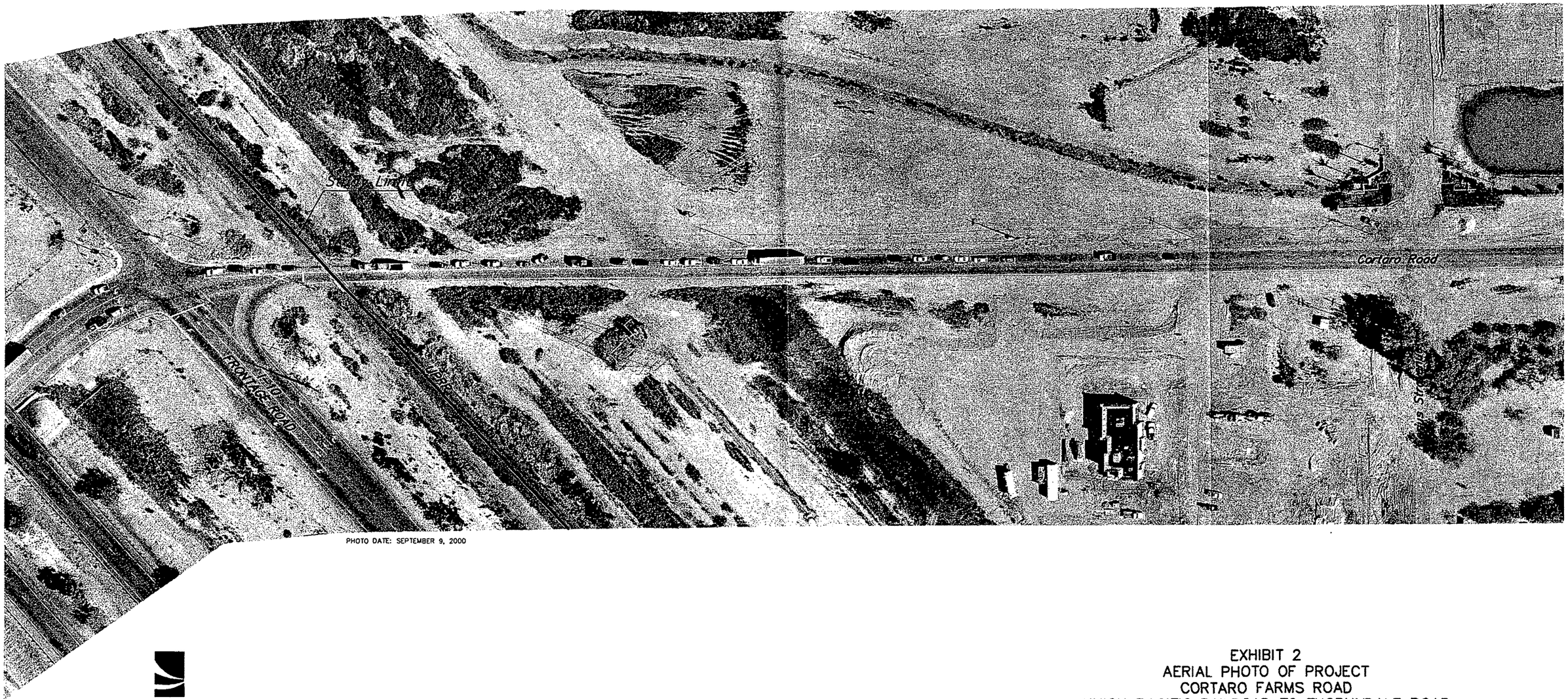


PHOTO DATE: SEPTEMBER 9, 2000

MMLA
McGovern MacWise Lodge & Associates, Inc.

EXHIBIT 2
AERIAL PHOTO OF PROJECT
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 1 of 9

N.T.S.

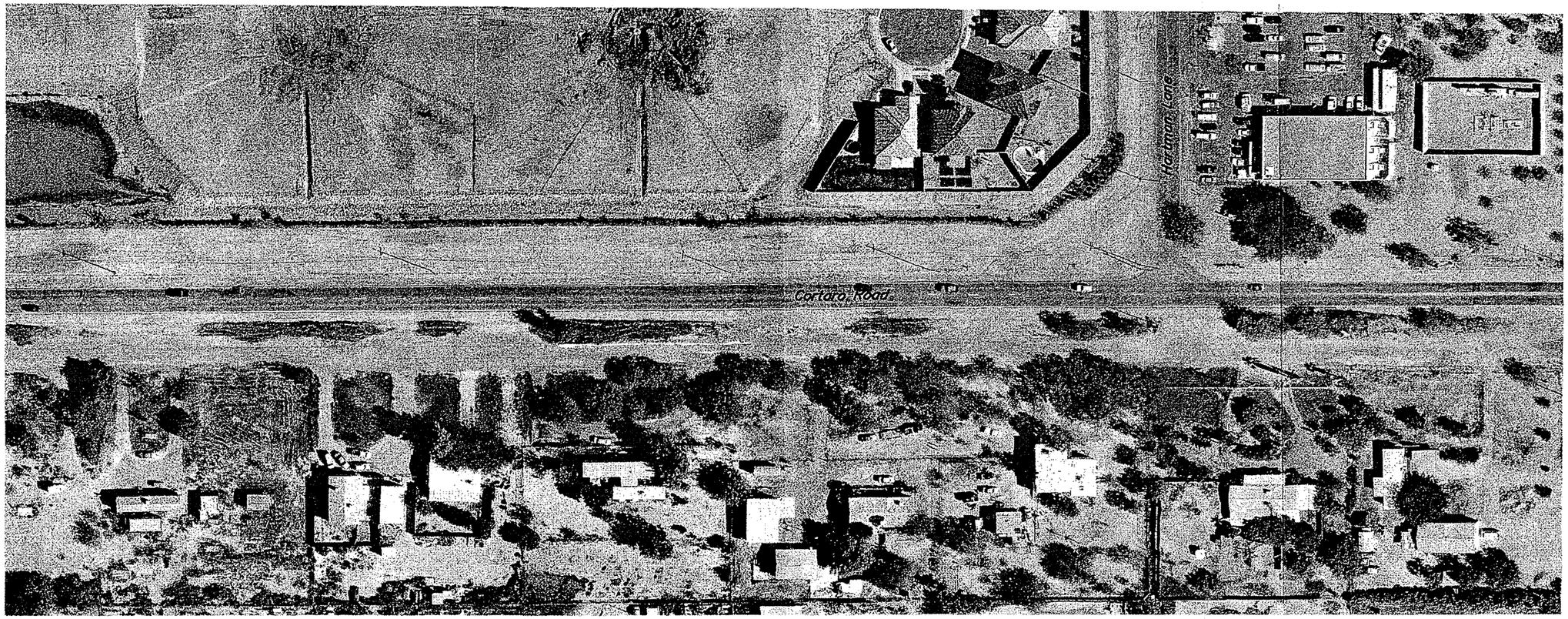


PHOTO DATE: SEPTEMBER 9, 2000

MMLA
McGovern MacWhite Lodge & Associates, Inc.

EXHIBIT 2
AERIAL PHOTO OF PROJECT
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 2 of 9

N.T.S.

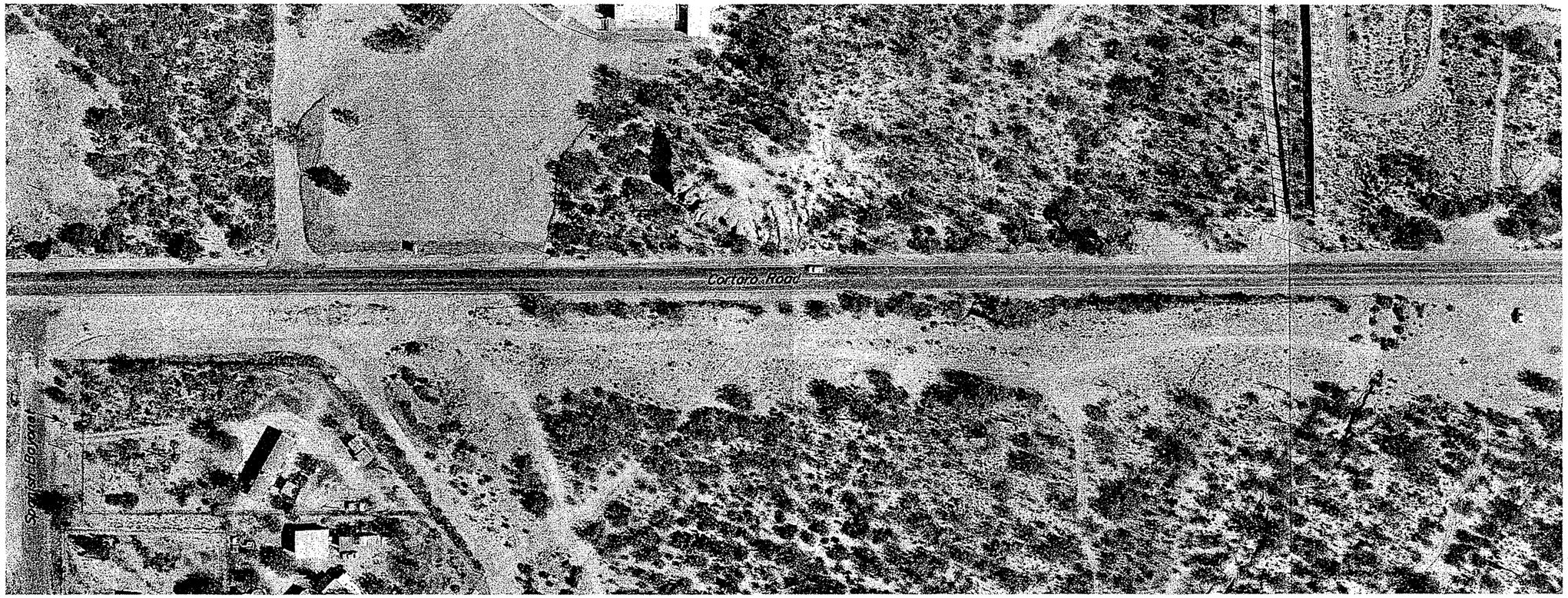


PHOTO DATE: SEPTEMBER 9, 2000

MMLA
McGovern MacWhirter Lodge & Associates, Inc.

EXHIBIT 2
AERIAL PHOTO OF PROJECT
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 3 of 9

N.T.S.

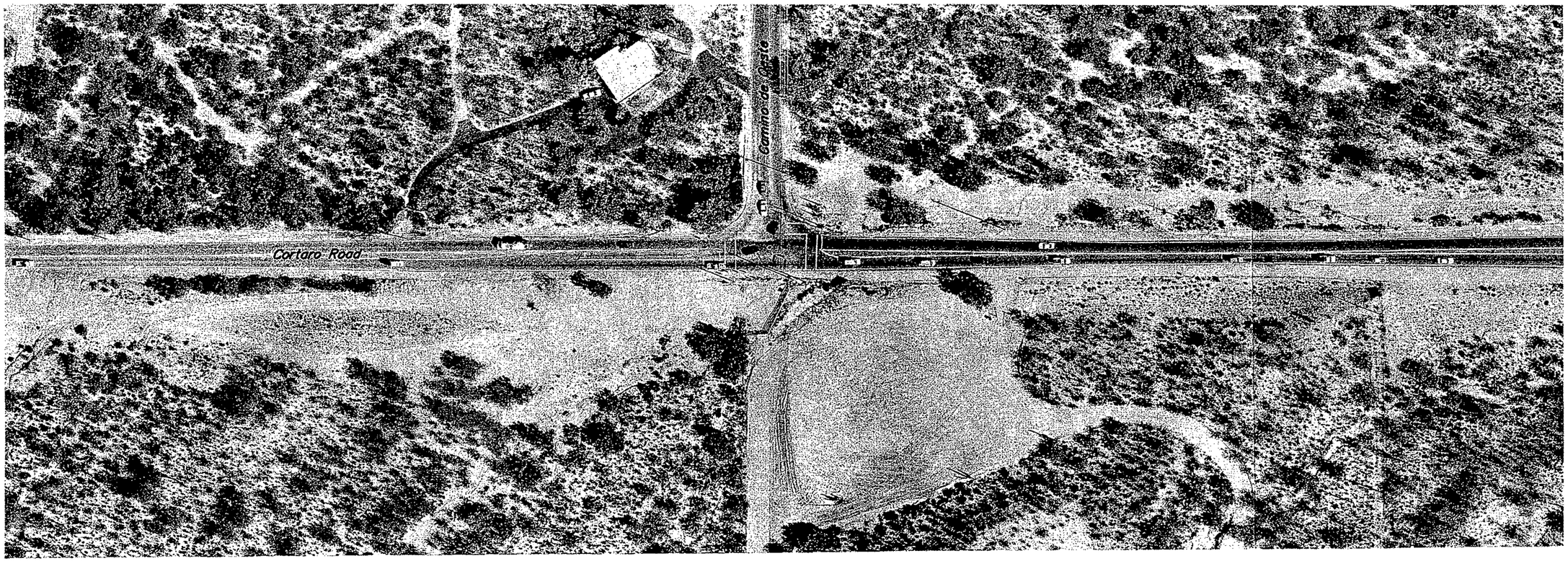


PHOTO DATE: SEPTEMBER 9, 2000

MMLA
McGovern MacVittie Lodge & Associates, Inc.

EXHIBIT 2
AERIAL PHOTO OF PROJECT
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 4 of 9

N.T.S.

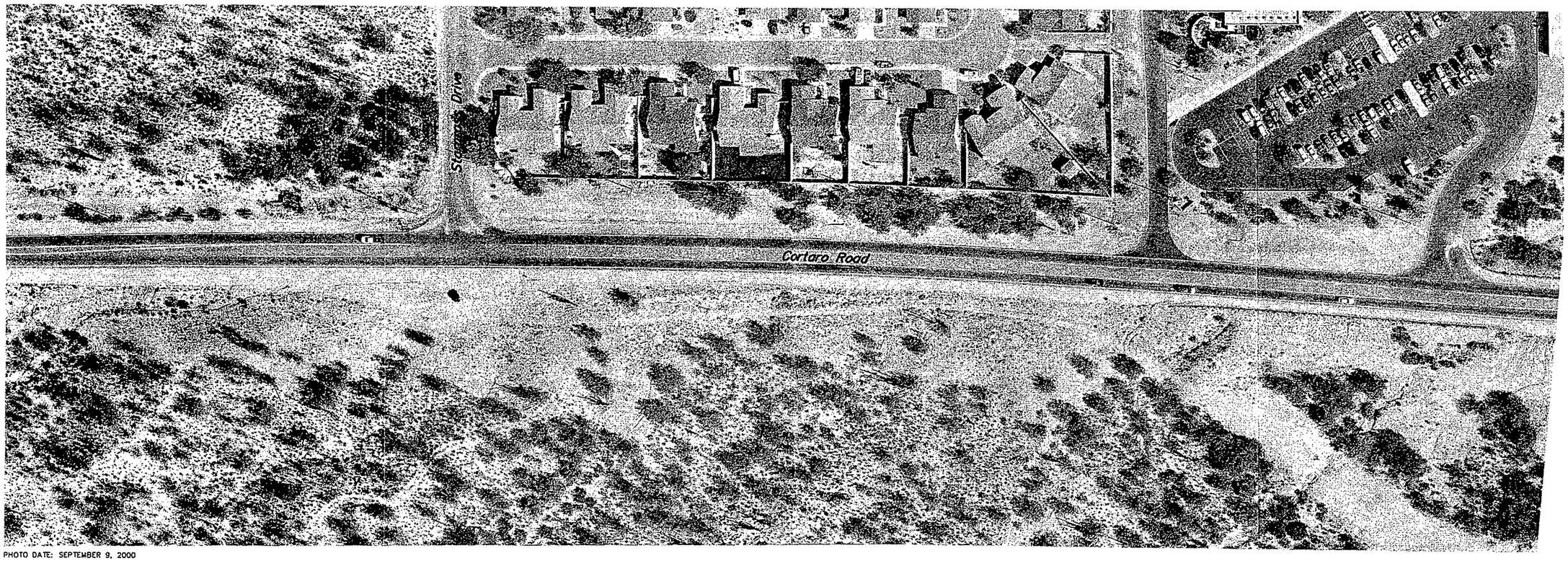


PHOTO DATE: SEPTEMBER 9, 2000

MMLA
McGovern MacVittie Lodge & Associates, Inc.

EXHIBIT 2
AERIAL PHOTO OF PROJECT
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 5 of 9

N.T.S.

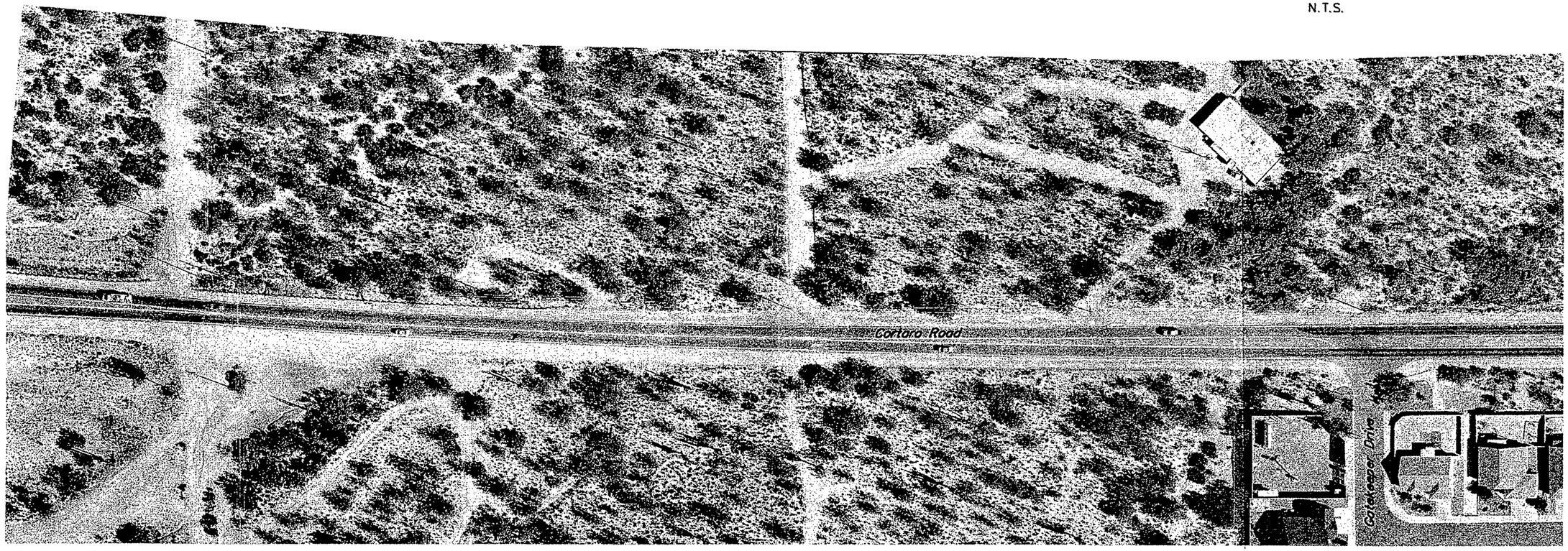


PHOTO DATE: SEPTEMBER 9, 2000

MMLA
McGovern MacWhite Lodge & Associates, Inc.

EXHIBIT 2
AERIAL PHOTO OF PROJECT
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 6 of 9

N.T.S.

PHOTO DATE: SEPTEMBER 9, 2000

MMLA
McGovern MacWhite Lodge & Associates, Inc.

EXHIBIT 2
AERIAL PHOTO OF PROJECT
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 7 of 9

N.T.S.

PHOTO DATE: SEPTEMBER 9, 2000

MMLA
McGovern Macintosh Lodge & Associates, Inc.

EXHIBIT 2
AERIAL PHOTO OF PROJECT
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 8 of 9

N.T.S.

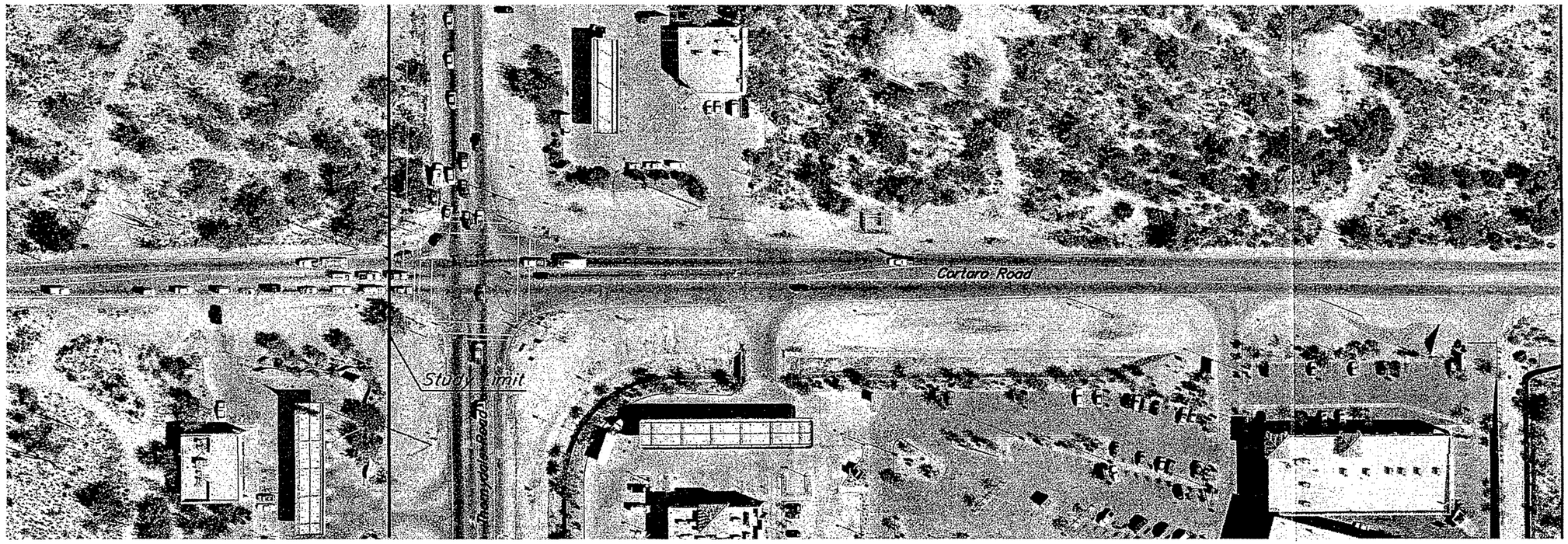


PHOTO DATE: SEPTEMBER 9, 2000

MMLA
McGovern MacWhite Lodge & Associates, Inc.

EXHIBIT 2
AERIAL PHOTO OF PROJECT
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUTNY W.O.# 4TCFIT

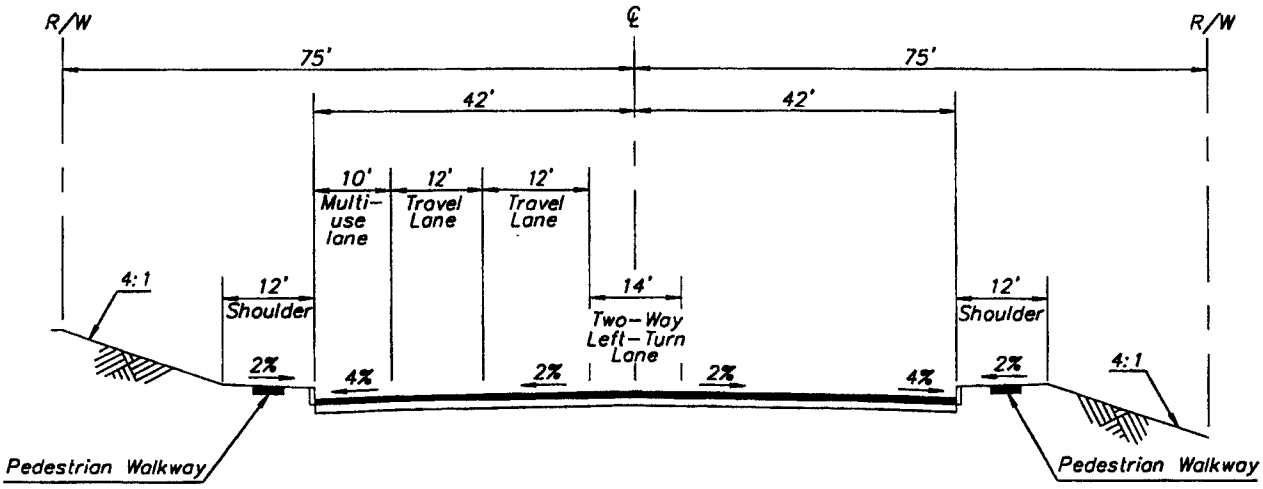
SHEET 9 of 9

EXHIBIT 3

Not Used

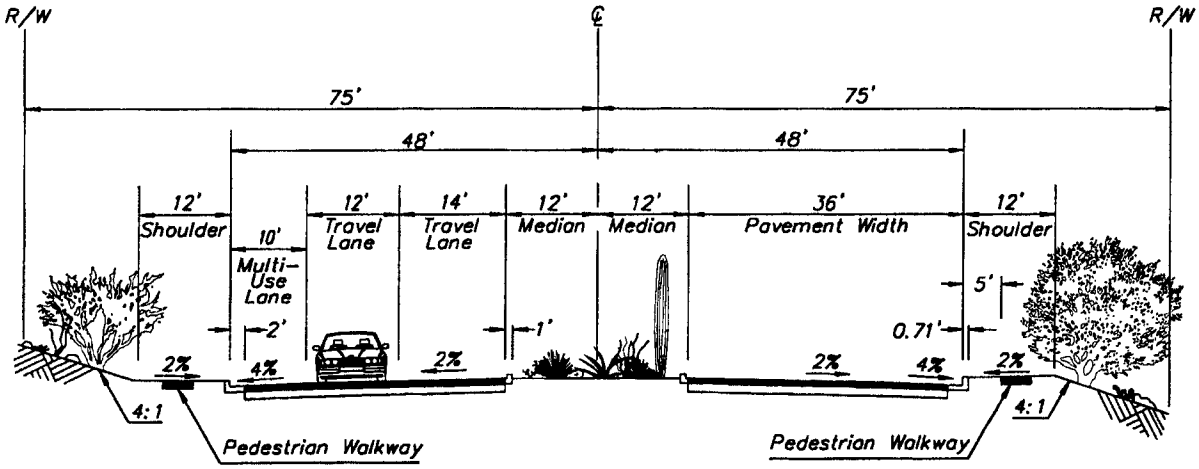
EXHIBIT 4

Typical Roadway Cross Sections



Five Lane Typical Section

NTS



Four Lane Divided Typical Section

NTS

THE SEAL OF PIMA COUNTY ARIZONA

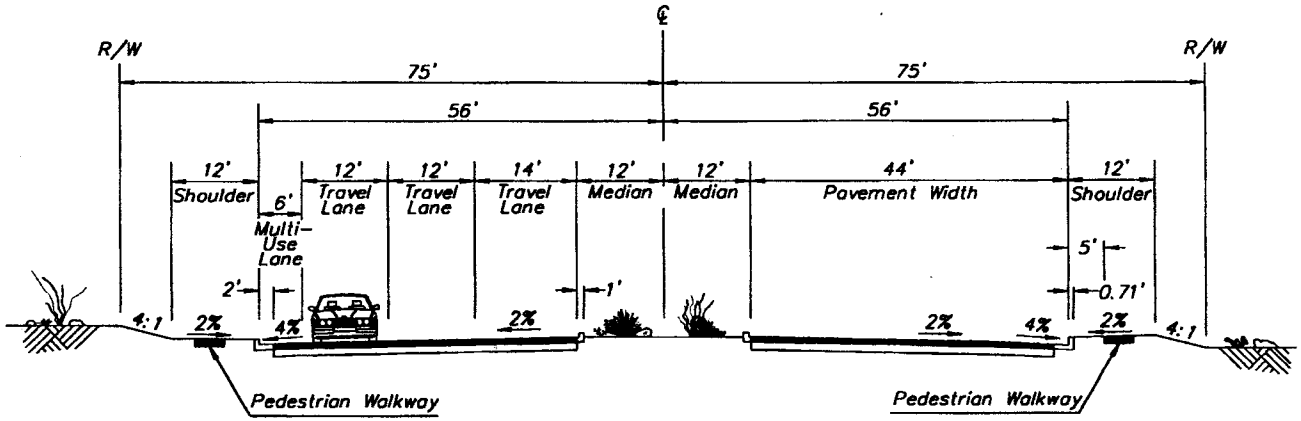
EXHIBIT 4

Sheet 1 of 3

MMLA

McGovern MacVittie Lodge & Associates, inc

Engineering ◆ Planning ◆ Environmental ◆ Surveying ◆ Water Resources



Six Lane Divided Typical Section

NTS

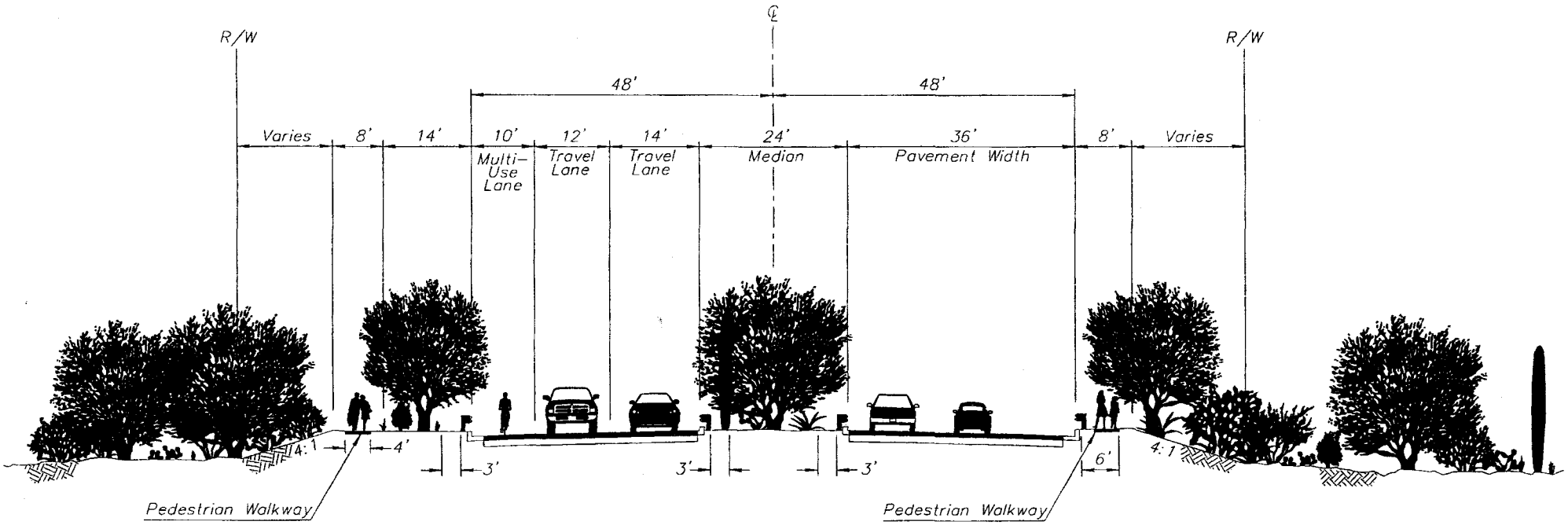
EXHIBIT 4

Sheet 2 of 3

MMLA

McGovern MacVittie Lodge & Associates, Inc.

Engineering ◆ Planning ◆ Environmental ◆ Surveying ◆ Water Resources



Four Lane Divided Typical Section
Environmentally Sensitive Treatment

NTS

THE SEAL OF PIMA COUNTY ARIZONA

EXHIBIT 4

Sheet 3 of 3

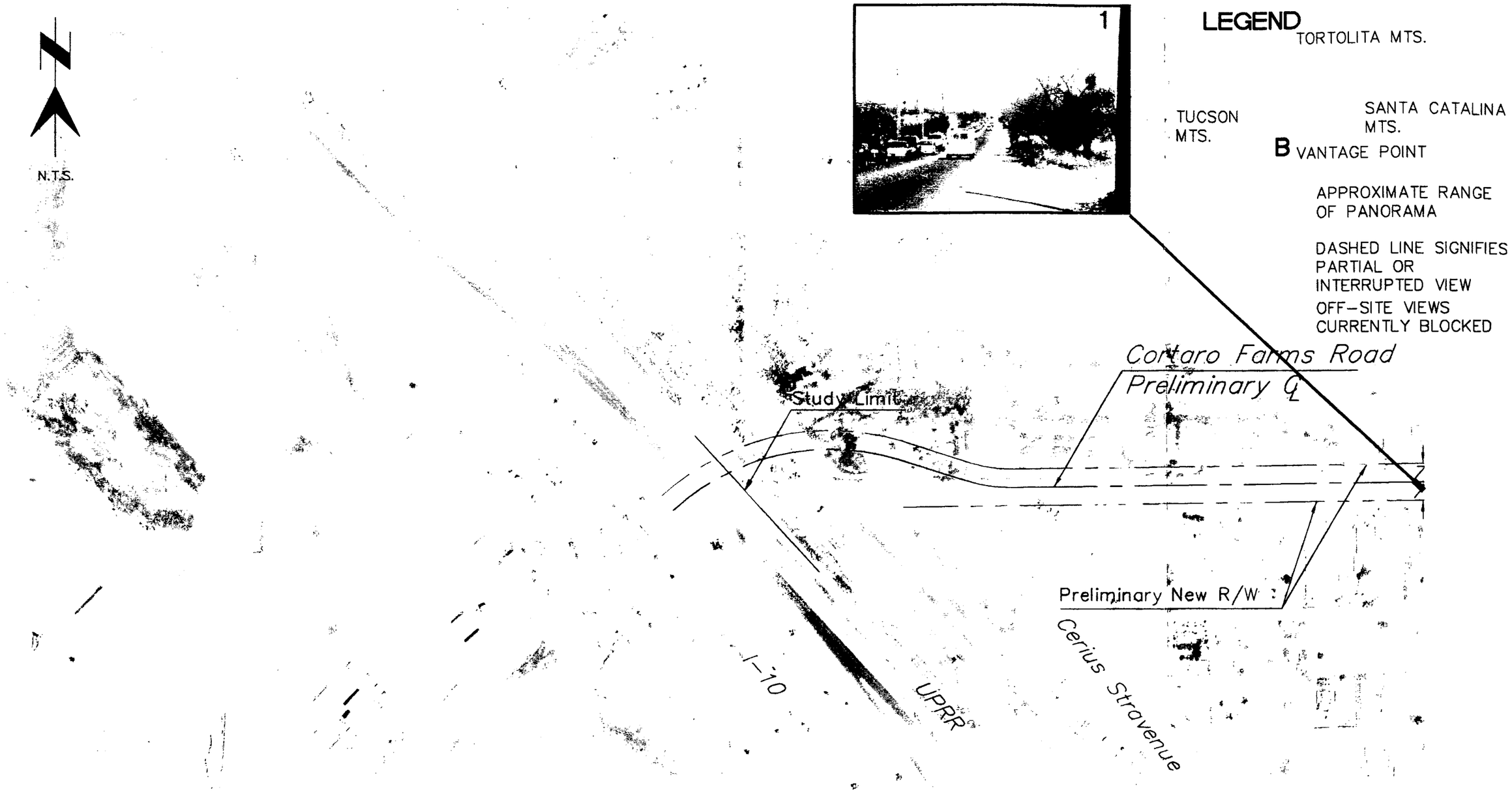
MMLA

McGovern MacVittie Lodge & Associates, Inc

Engineering ◆ Planning ◆ Environmental ◆ Surveying ◆ Water Resources

EXHIBIT 5

Visual Inventory and Analysis



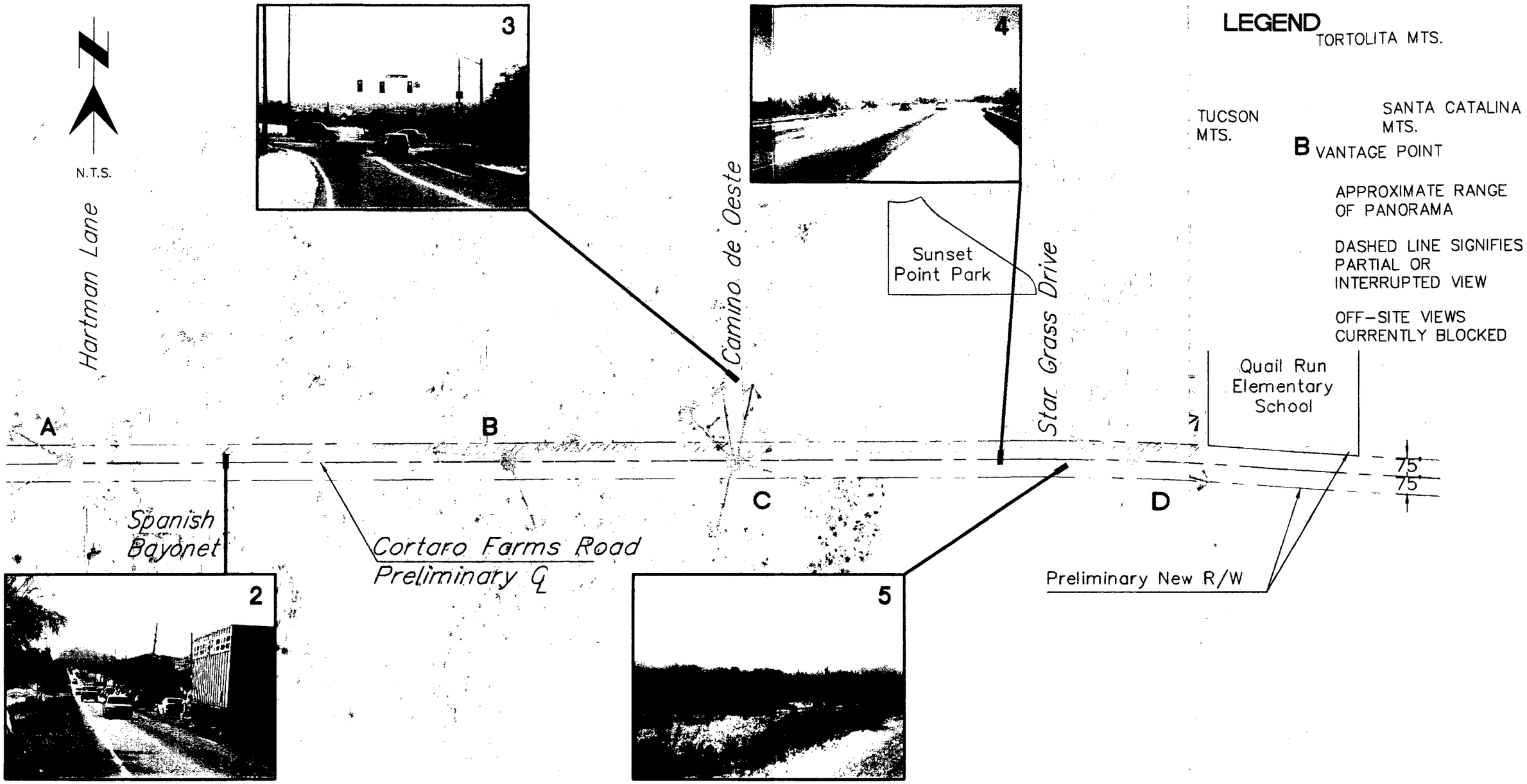
DESCRIPTIONS

View Sheds
PICTURE NO. 1
Looking east, the Santa Catalina Mountains are dominant in the background, partially obstructed by power poles along the roadway, native vegetation north and south of the roadway, and a few palms within the residential developments north of the project area. The rising elevation of the roadway and adjacent topography are seen ahead with a large cut slope north of the roadway.

LANDSCAPE ARCHITECTURE

EXHIBIT 5
VISUAL INVENTORY AND ANALYSIS
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 1 of 3



DESCRIPTIONS

PICTURE NO. 2
This view downhill to the west shows the interstate and adjacent commercial development about 1 mile ahead at the end of the project area. The right-of-way and area north of the roadway is cleared for a one and two story residential development, currently under construction. Utility poles on the roadway shoulder and rooftops and screen walls within the new development are visible north of the roadway and mixed native and non-native vegetation are seen south of the roadway. The Tucson Mountains are visible in the background.

PICTURE NO. 3
This view from Camino de Oeste looking south shows the traffic signals, utility poles, street lights and signage at the Cortaro Farms Road intersection ahead, with mixed residential and commercial development visible in the valley floor behind, and the south end of the Tucson Mountains as a backdrop. The native Palo Verde-Saguaro-Ironwood vegetative community west of Camino de Oeste blocks any views to the southeast.

PICTURE NO. 4
This view looking east and northeast shows a full panorama of the Santa Catalina Mountains, with only undisturbed, lush native vegetation visible outside the roadway, except for the south shoulder of the roadway, which has been cleared. A few Saguaros, large Ironwoods and Mesquites, and utility poles obscure the skyline.

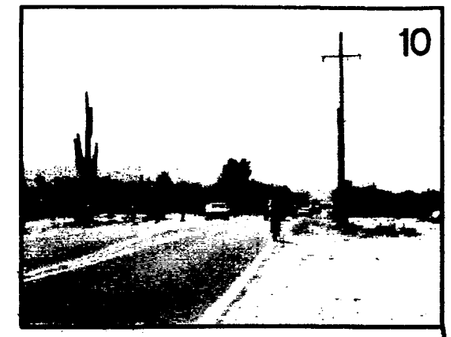
PICTURE NO. 5
This view to the west-southwest shows a few native shrubs and grasses as recovery plants on the previously disturbed south roadway shoulder, with the lush native Foothills Palo Verde / Ironwood mixed scrub vegetative community south of the roadway, and a backdrop of the Tucson Mountains. A glimpse of the Tucson Mountain foothills is visible through the trees.

LANDSCAPE ARCHITECTURE

EXHIBIT 5
VISUAL INVENTORY AND ANALYSIS
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 2 of 3

Tortolita Middle School



LEGEND

TORTOLITA MTS.

TUCSON MTS.

SANTA CATALINA MTS.

B VANTAGE POINT

APPROXIMATE RANGE OF PANORAMA

DASHED LINE SIGNIFIES PARTIAL OR INTERRUPTED VIEW

OFF-SITE VIEWS CURRENTLY BLOCKED

Cortaro Farms Road
Preliminary ℄

Preliminary New R/W

75'
75'

E

Gatekeeper Drive

Freshwater Lane

Delta Avenue

Bayou Drive

F

G

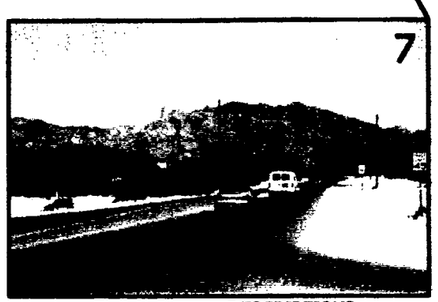
H

END OF PROJECT

Study Limit

Thornydale Road

Oldfather Road



DESCRIPTIONS

PICTURE NO. 6
This view to the north shows one of the only views of the Tortolita Mountains along Cortaro Farms Road within the project limits. The topography adjacent to the roadway drops relative to the road at this location allowing this view. Native vegetation is adjacent to the roadway allowing only a glimpse of a residence a few hundred feet away. Saguaros provide skyline silhouettes.

PICTURE NO. 7
This view is similar to that described for picture number 4, but provides a closer view of the Santa Catalina Mountains, and portions of the north roadway shoulder have been cleared.

PICTURE NO. 8
This view to the east and southeast shows a residential community partially screened by native vegetation in the right-of-way and large non-native landscape within the neighborhood. Where the roadway shoulder has been cleared, masonry screen walls and rooftops are visible. Large neighborhood trees such as Eucalyptus, Pine, and Ash dominate the skyline.

PICTURE NO. 9
This enclosed view to the west shows a sliver of the Tucson Mountains, framed by the lush native vegetation in the right-of-way and beyond. Because of the flat topography of the adjacent landscape relative to the roadway, Large Palo Verde, Mesquite, Ironwood and Saguaros block views north and south. Large non-native skyline trees are visible within the residential area south of the project, and as is typical along the entire project length, utility poles down the right-of-way silhouette on the skyline.

PICTURE NO. 10
This view looking west from the east end of the project shows the diversity of landscape and view sheds within the project vicinity. The Tucson Mountains are in view, partially blocked by dense mixed vegetation in the right-of-way and residential areas ahead. Large Saguaros, PaloVerdes and Ironwoods, as well as tall exotics such as Eucalyptus, Pine, Italian Cypress and Palms appear on the skyline south of the roadway, while native trees and utility poles dominate the skyline north of the roadway. The right-of-way is cleared along this stretch of the project. A cyclist traveling west is visible in the foreground.

LANDSCAPE ARCHITECTURE

EXHIBIT 5
VISUAL INVENTORY AND ANALYSIS
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 3 of 3

EXHIBIT 6

Existing Land Uses and Recreational Facilities

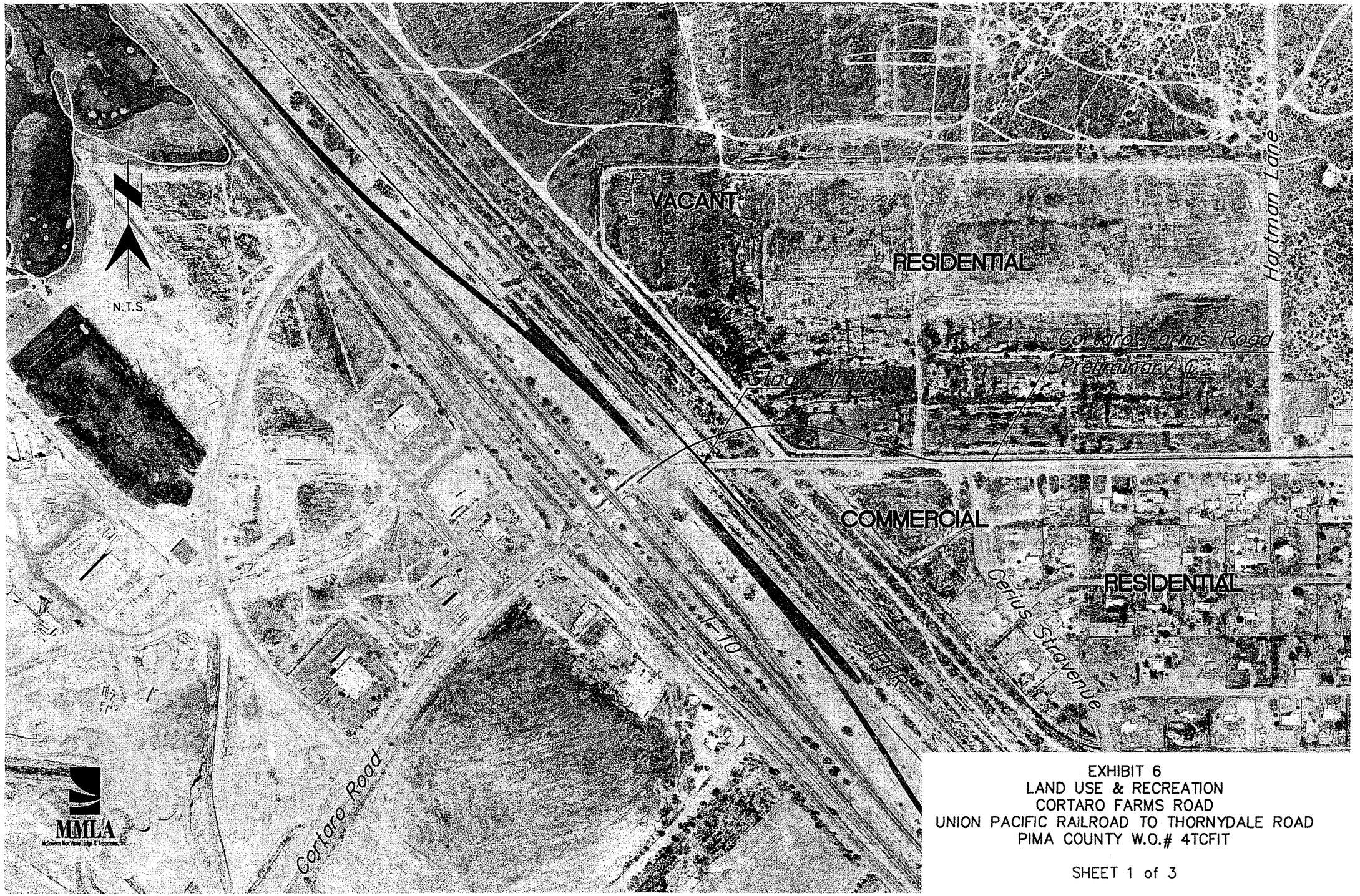


EXHIBIT 6
LAND USE & RECREATION
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 1 of 3

PHOTO DATE: 1998

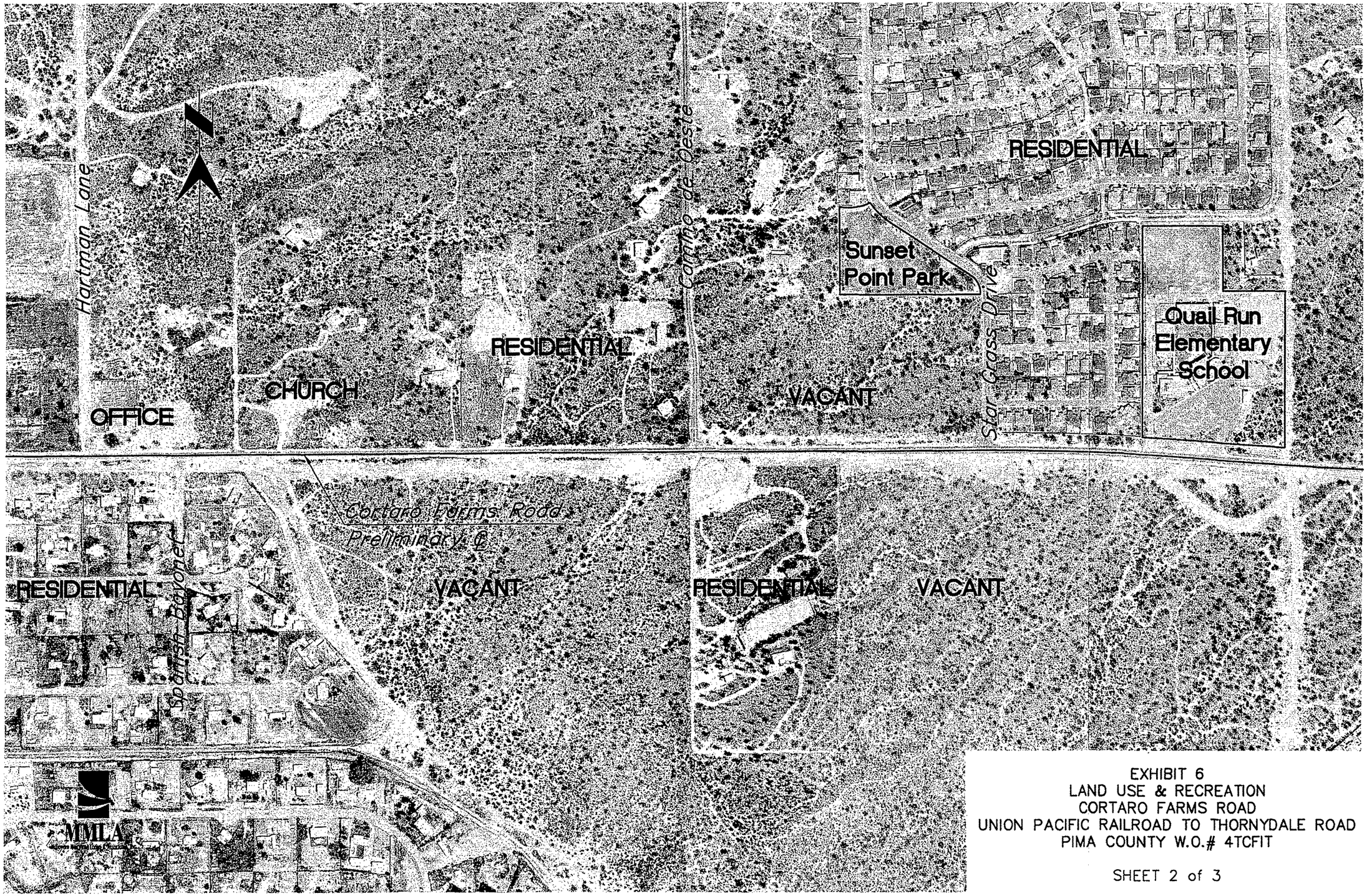


PHOTO DATE: 1998

EXHIBIT 6
LAND USE & RECREATION
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 2 of 3

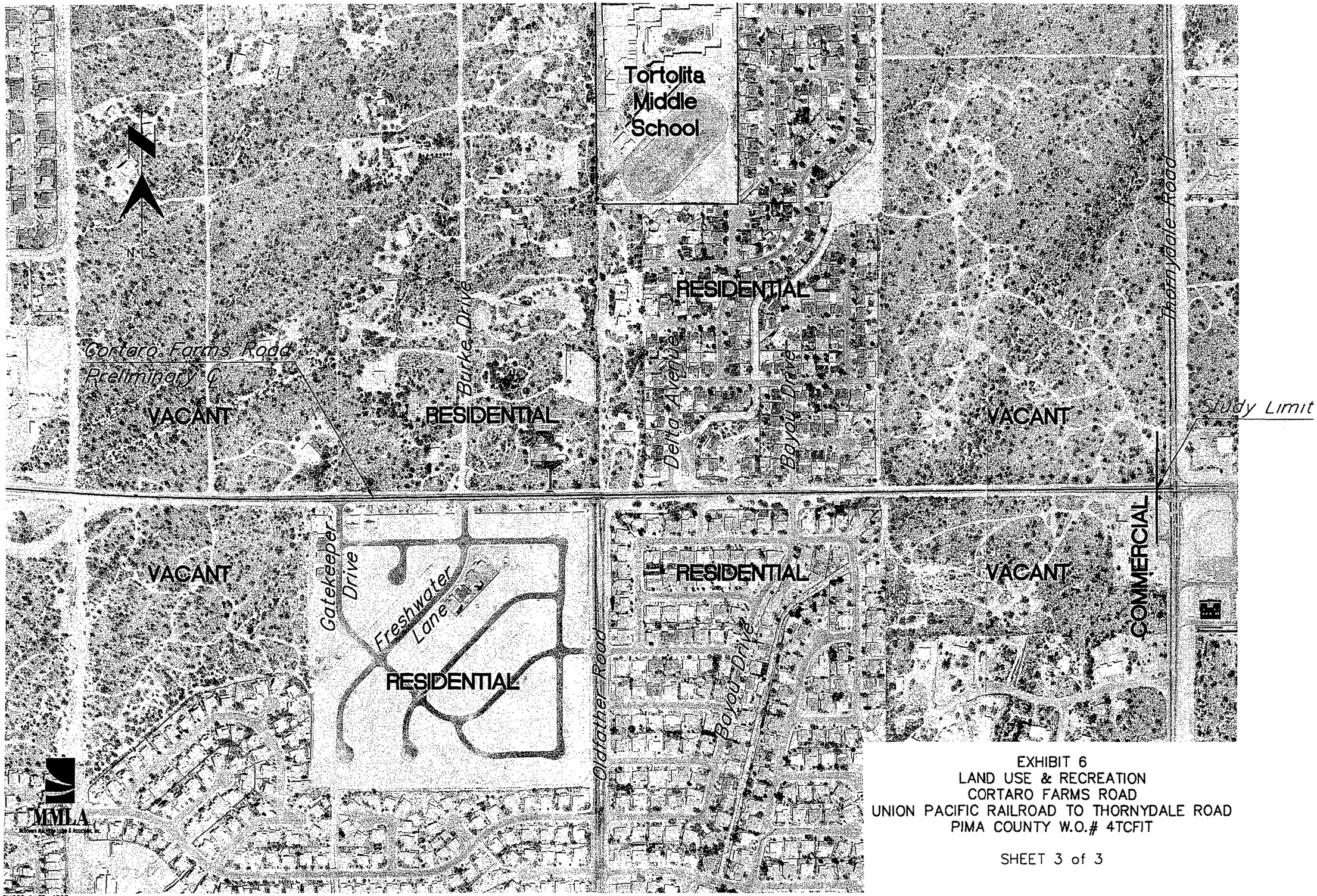


EXHIBIT 6
LAND USE & RECREATION
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 3 of 3

EXHIBIT 7

Existing Zoning and Neighborhoods

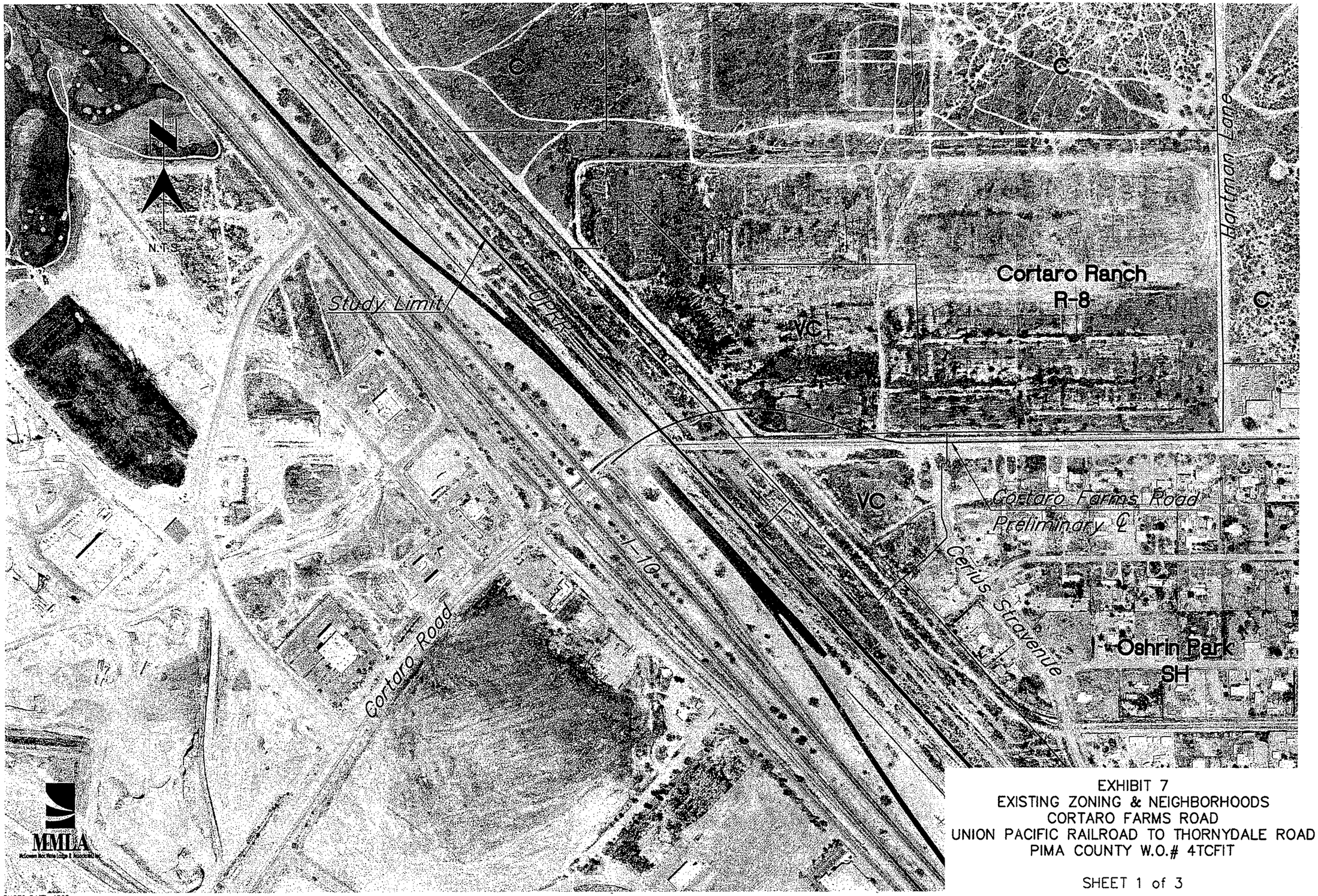


PHOTO DATE: 1998

EXHIBIT 7
EXISTING ZONING & NEIGHBORHOODS
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 1 of 3

PHOTO DATE: 1998

EXHIBIT 7
EXISTING ZONING & NEIGHBORHOODS
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 2 of 3

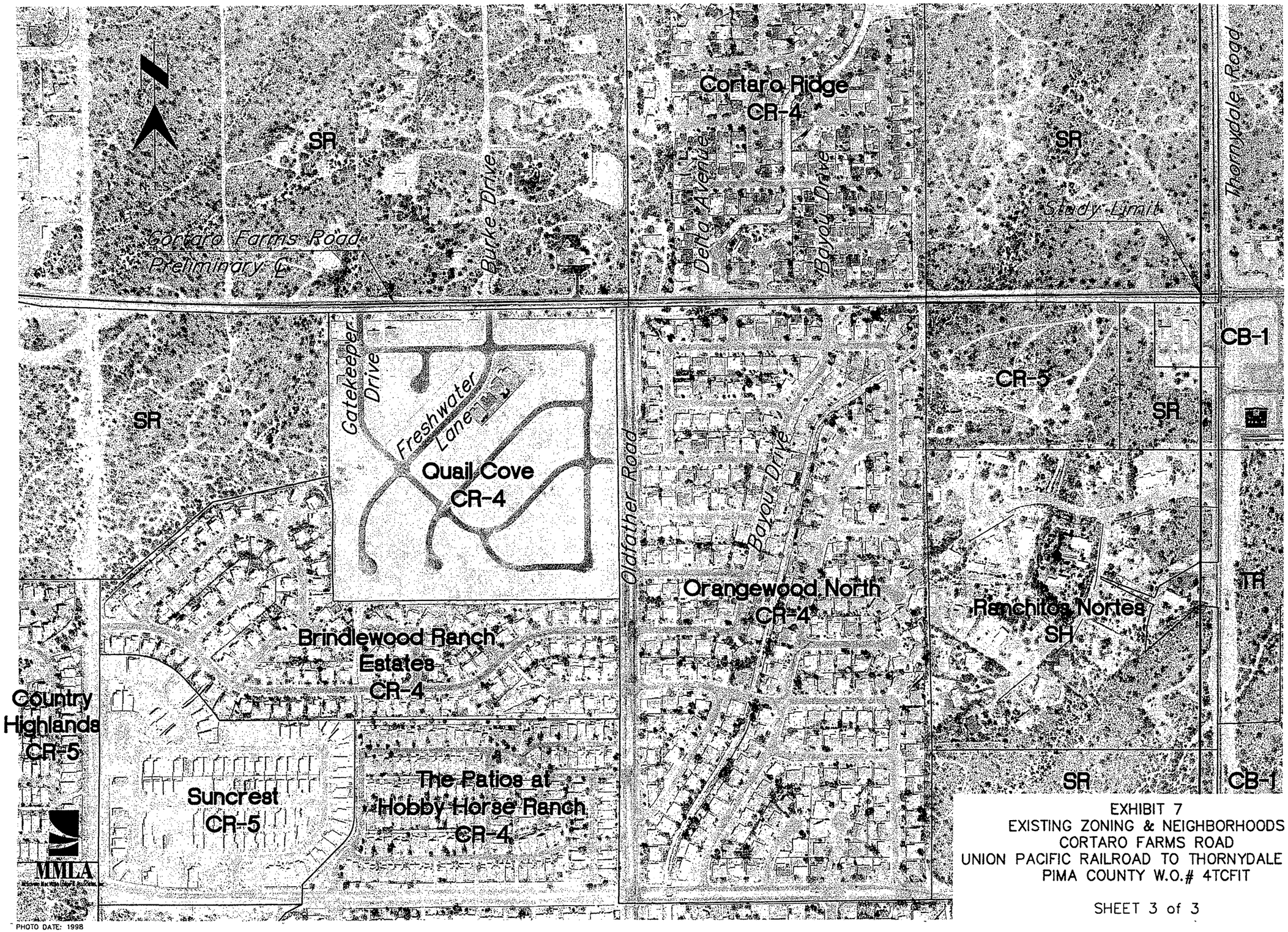


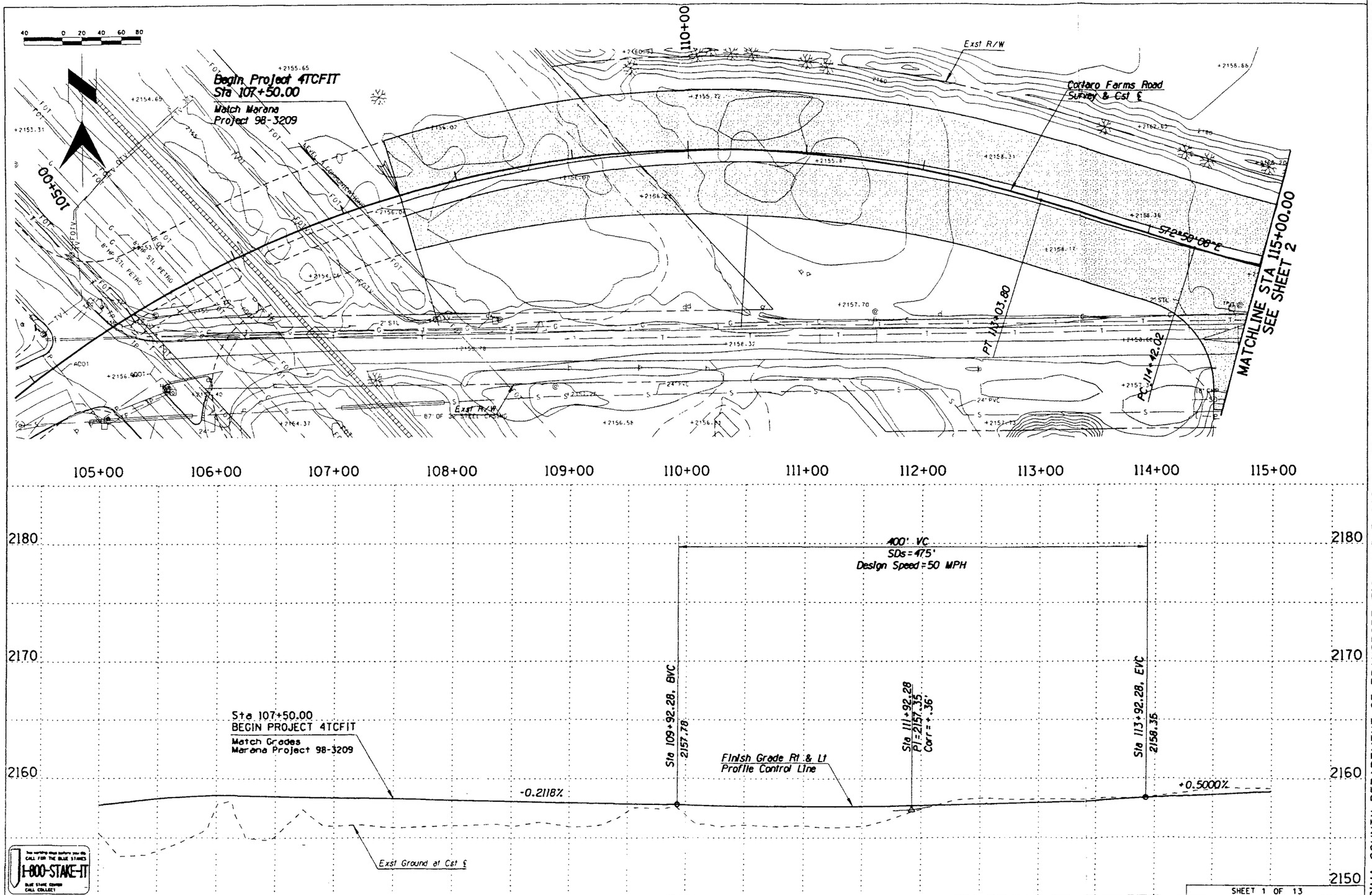
PHOTO DATE: 1998

EXHIBIT 7
EXISTING ZONING & NEIGHBORHOODS
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 3 of 3

EXHIBIT 8

Preliminary Plan and Profile Sheets



PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

BENJAMIN H. GOFF, P.E., DEPUTY DIRECTOR

ROADWAY IMPROVEMENT PLANS
FOR
CORTARO FARMS ROAD
PLAN AND PROFILE
STA 105+00.00 - 115+00.00

		DATE
DESIGNED	SAB	04-01
DRAWN	RDM	04-01
CHECKED		04-01
PROJ. ENGR.	SAB	06-01

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

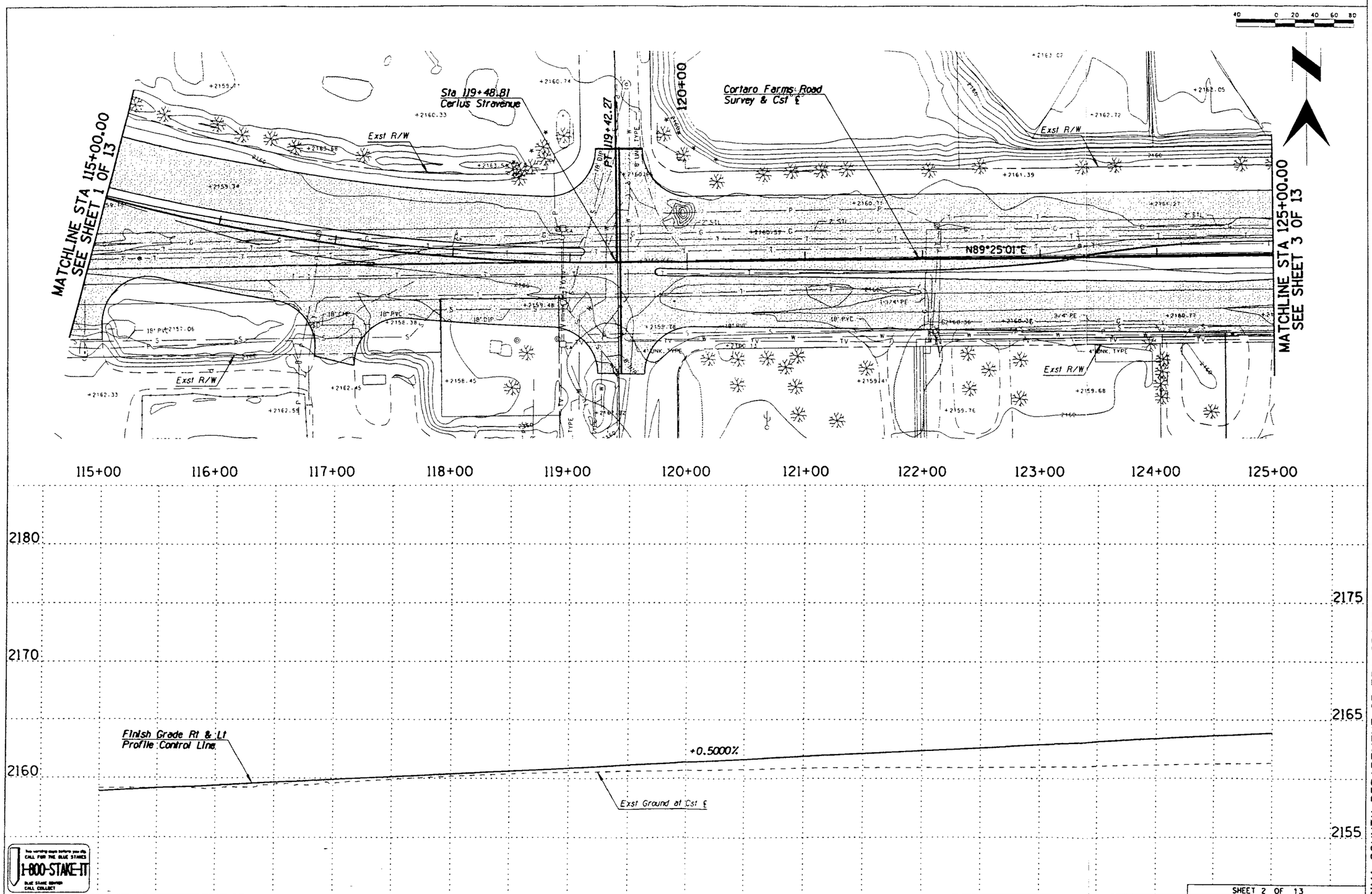
SCHEMATIC
NOT FOR
CONSTRUCTION

MMLA

SCALES HORIZ. VERT.

SHEET 1 OF 13

SHEET OF



SCALES HORIZ. VERT.

SHEET 2 OF 13

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

BENJAMIN H. GOFF, P.E., DEPUTY DIRECTOR

ROADWAY IMPROVEMENT PLANS FOR CORTARO FARMS ROAD

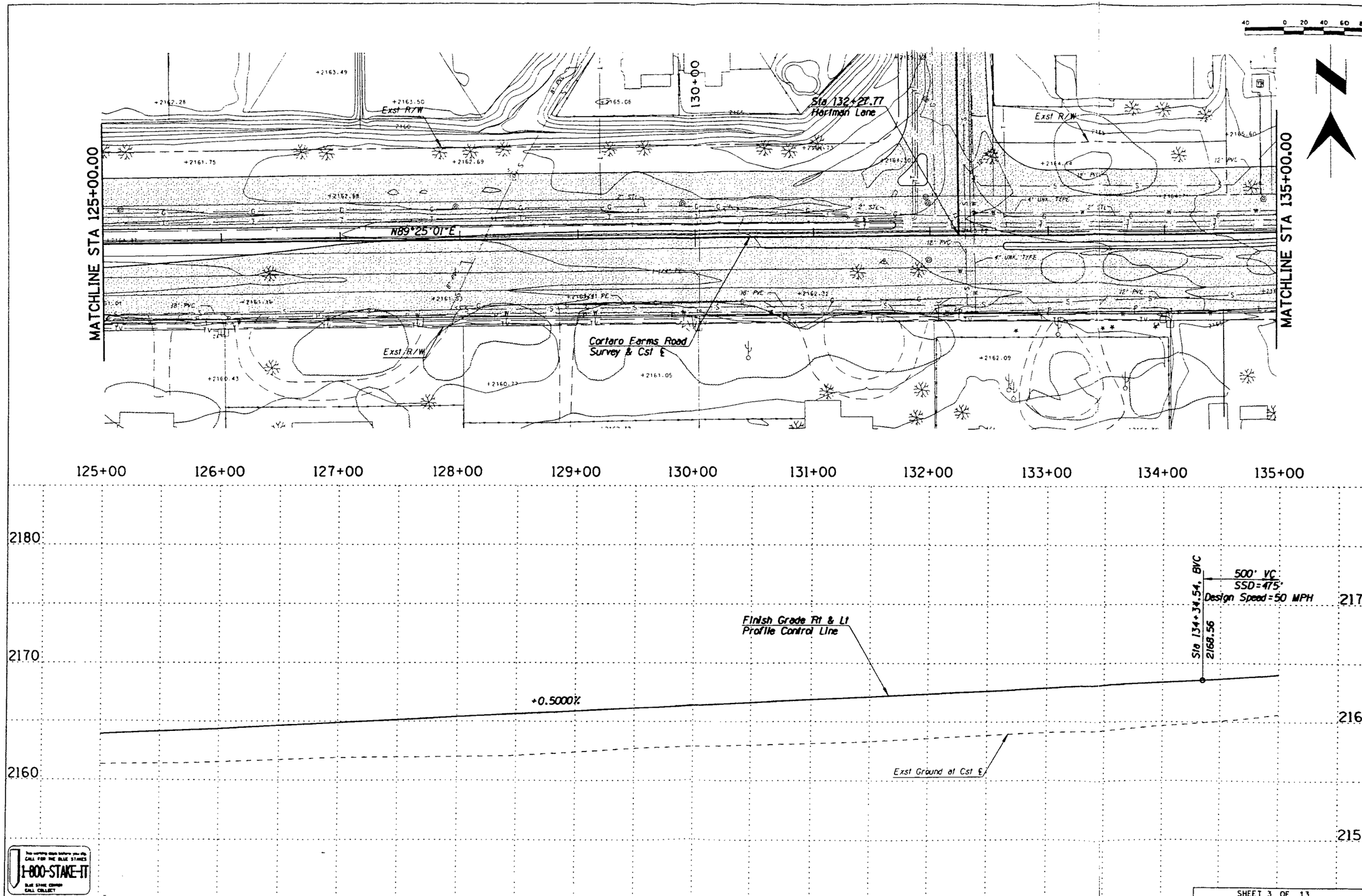
PLAN AND PROFILE STA 115+00.00 - 125+00.00

		DATE
DESIGNED	BAB	04-01
DRAWN	RDM	04-01
CHECKED		
PROJ. ENGR.	BAB	06-01

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

SCHEMATIC NOT FOR CONSTRUCTION

MMLA



SCALES HORIZ. VERT.

SHEET 3 OF 13

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

BENJAMIN H. GOFF, P.E., DEPUTY DIRECTOR

ROADWAY IMPROVEMENT PLANS FOR CORTARO FARMS ROAD

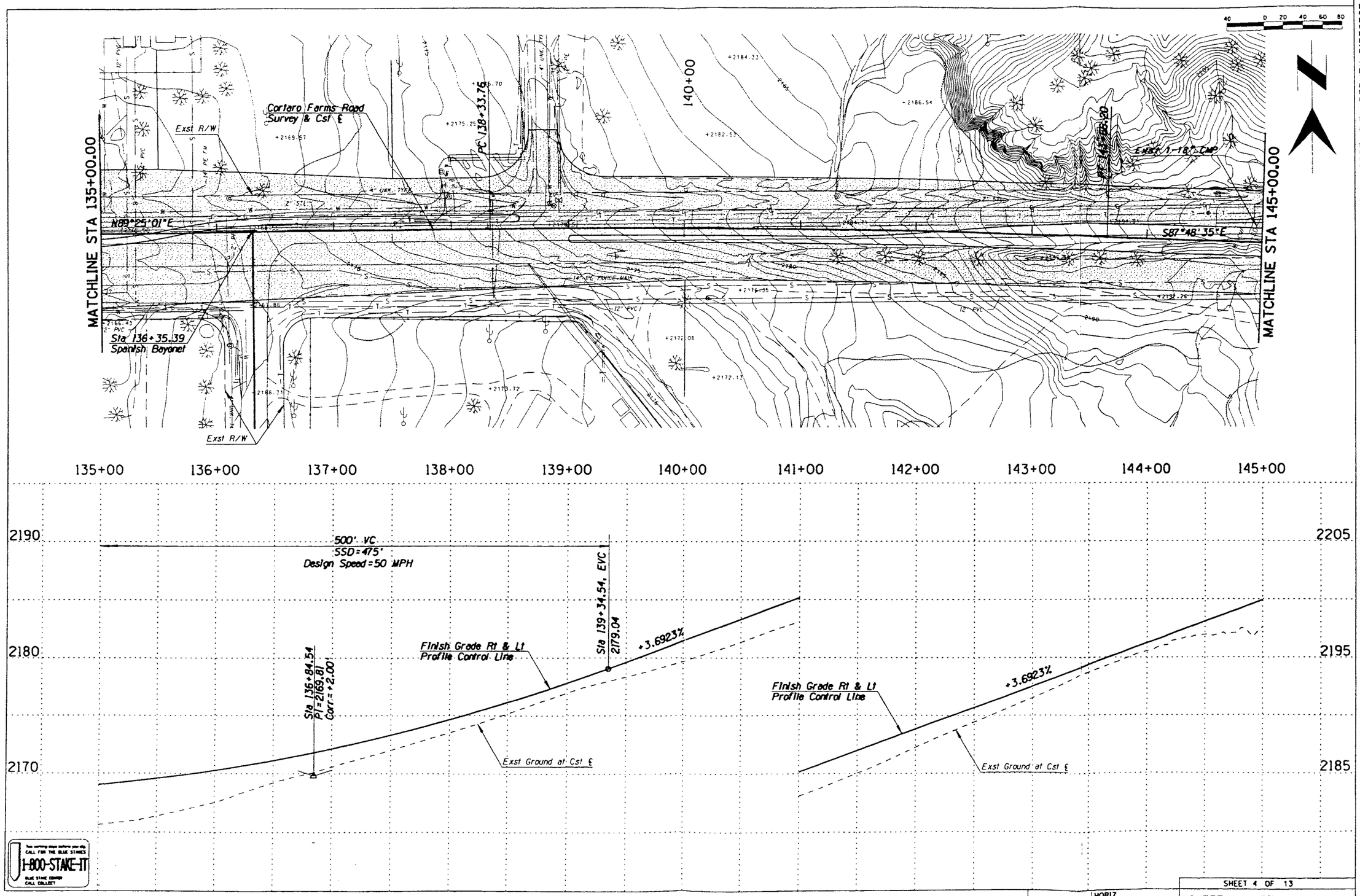
PLAN AND PROFILE STA 125+00.00 - 135+00.00

		DATE
DESIGNED	BAB	04-01
DRAWN	RDM	04-01
CHECKED		
PROJ. ENGR.	BAB	08-01

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

SCHEMATIC NOT FOR CONSTRUCTION

MMLA



SCALES HORIZ. VERT.

SHEET 4 OF 13

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

BENJAMIN H. GOFF, P.E., DEPUTY DIRECTOR

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

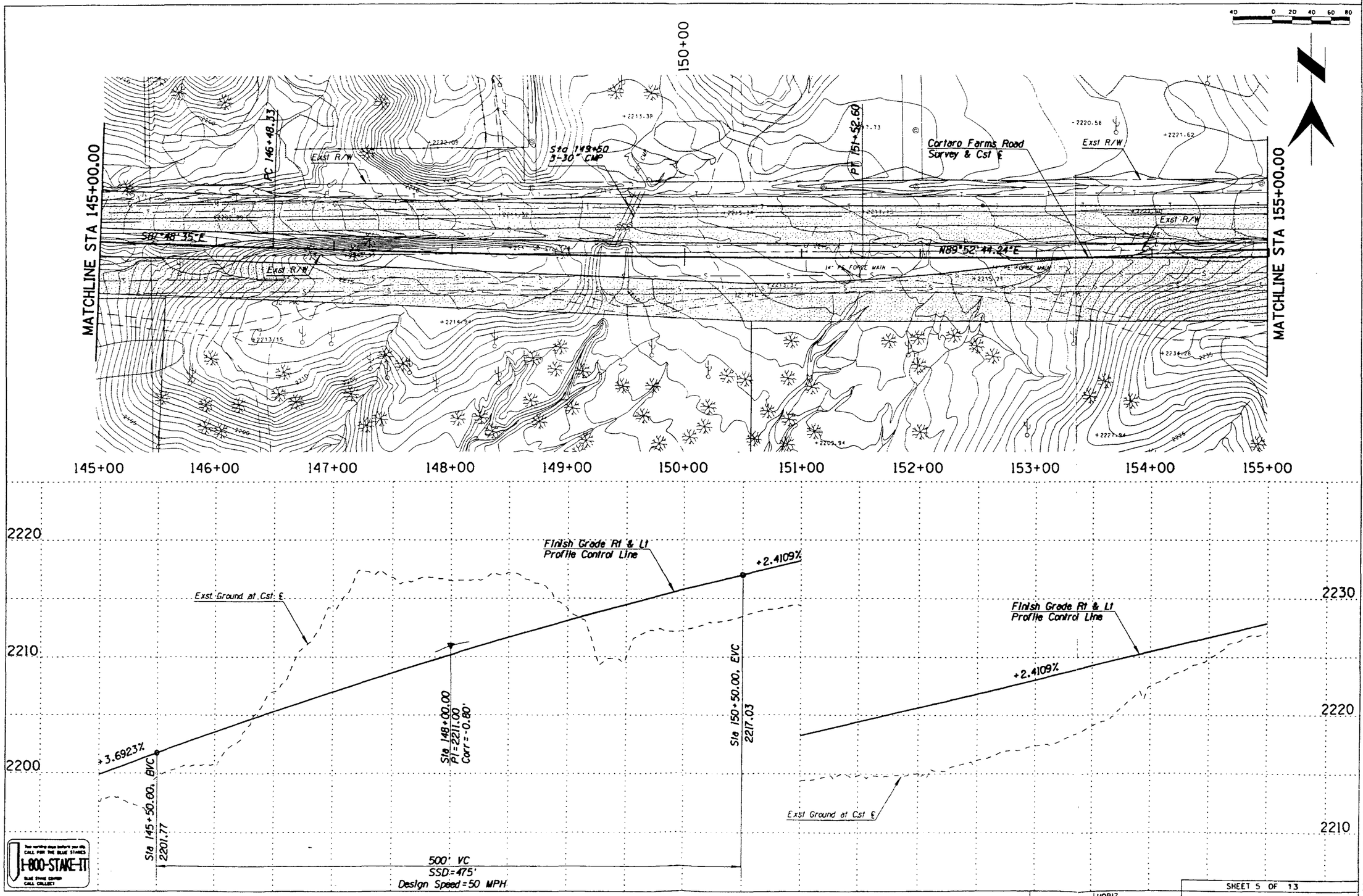
ROADWAY IMPROVEMENT PLANS
FOR
CORTARO FARMS ROAD
PLAN AND PROFILE
STA 135+00.00 - 145+00.00

		DATE
DESIGNED	BAB	04-01
DRAWN	RDM	04-01
CHECKED		
PROJ. ENGR.	BAB	06-01

SCHEMATIC
NOT FOR
CONSTRUCTION

800 East Wetmore Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1290

MMLA



1-800-STAKE-IT

SCALES HORIZ. VERT.

SHEET 5 OF 13

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

BENJAMIN H. GOFF, P.E., DEPUTY DIRECTOR

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

ROADWAY IMPROVEMENT PLANS
FOR
CORTARO FARMS ROAD
PLAN AND PROFILE
STA 145+00.00 - 155+00.00

		DATE
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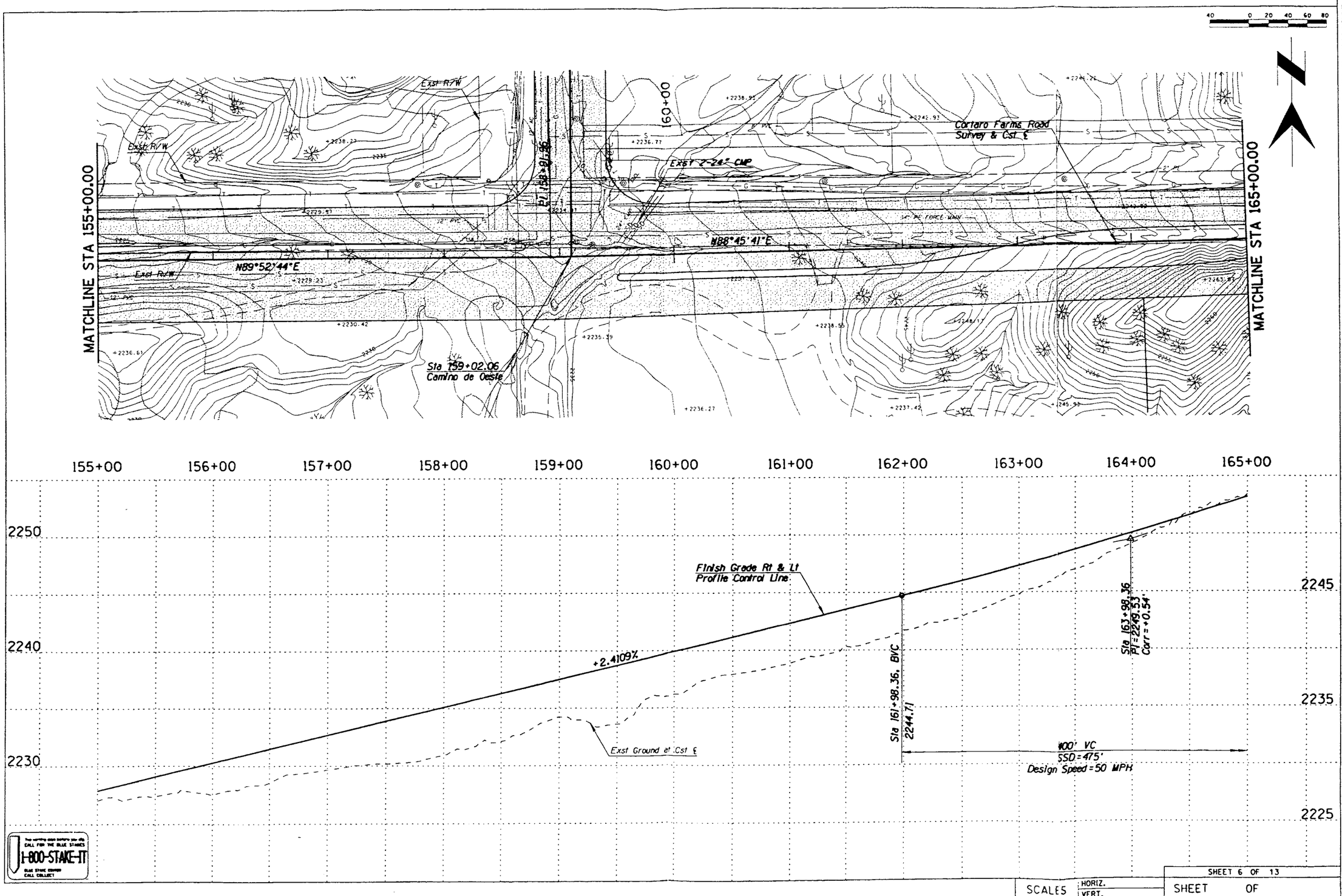
DRAWN	RDM	04-01
CHECKED		
PROJ. ENGR.	BAB	08-01

SCHEMATIC NOT FOR CONSTRUCTION

MMLA



SCALES HORIZ. VERT.

SHEET 6 OF 13

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

BENJAMIN H. GOFF, P.E., DEPUTY DIRECTOR

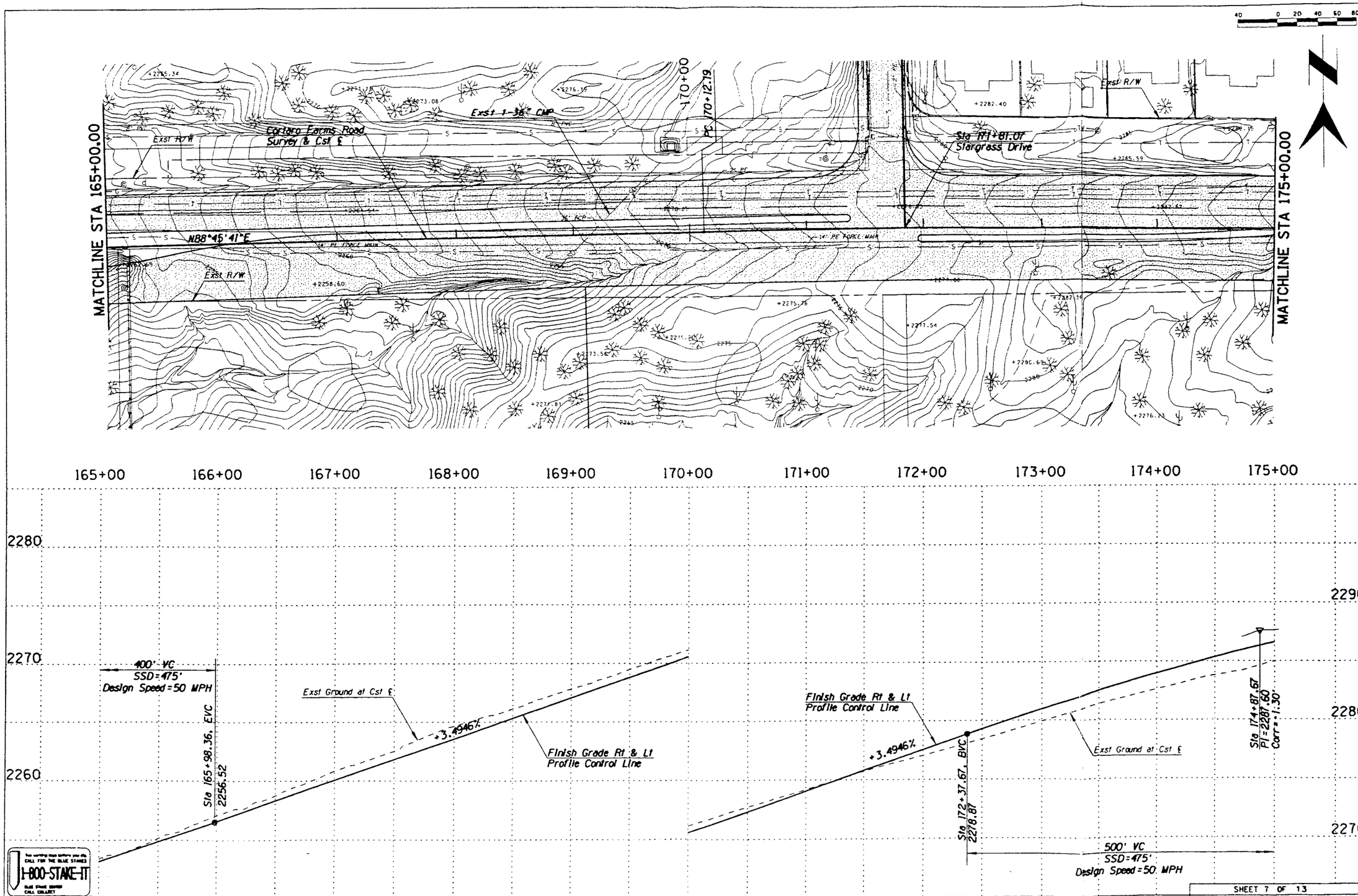
ROADWAY IMPROVEMENT PLANS
FOR
CORTARO FARMS ROAD
PLAN AND PROFILE
STA 155+00.00 - 165+00.00

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

		DATE
DESIGNED	BAB	04-01
DRAWN	RDM	04-01
CHECKED		
PROJ. ENGR.	BAB	04-01

SCHEMATIC NOT FOR CONSTRUCTION

MMLA



SHEET 7 OF 13

SCALES HORIZ. VERT.

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

BENJAMIN H. GOFF, P.E., DEPUTY DIRECTOR

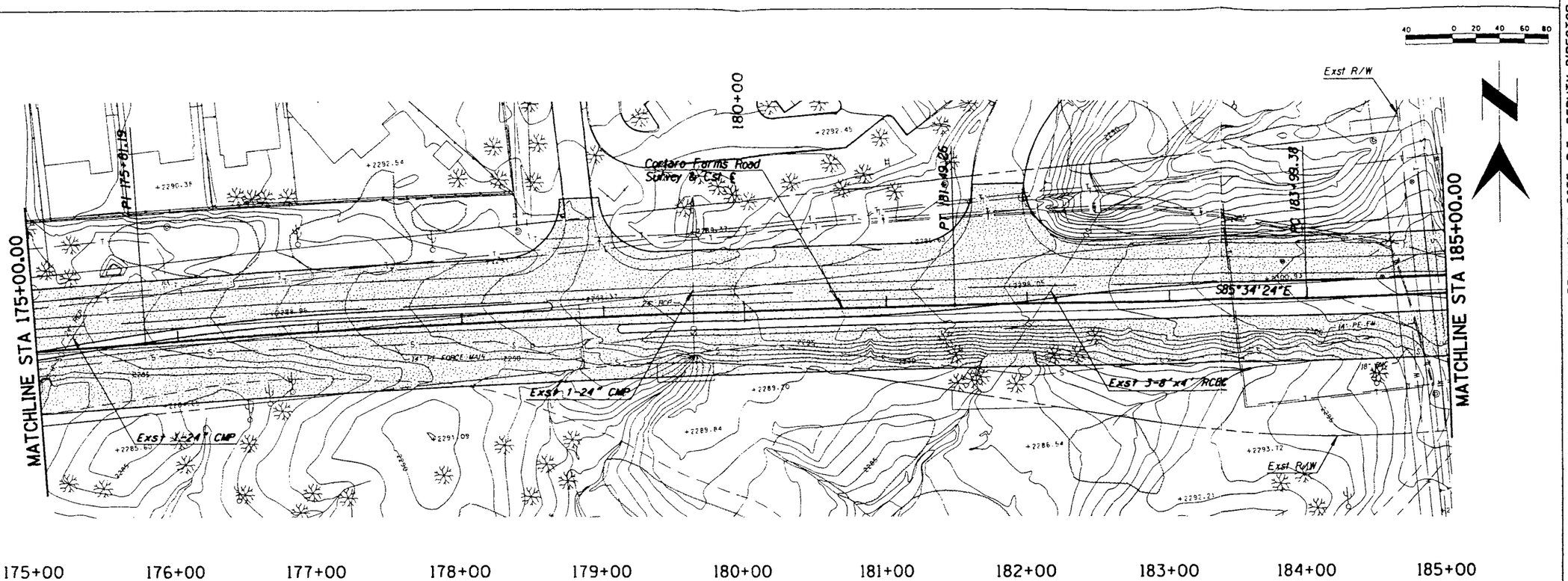
NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

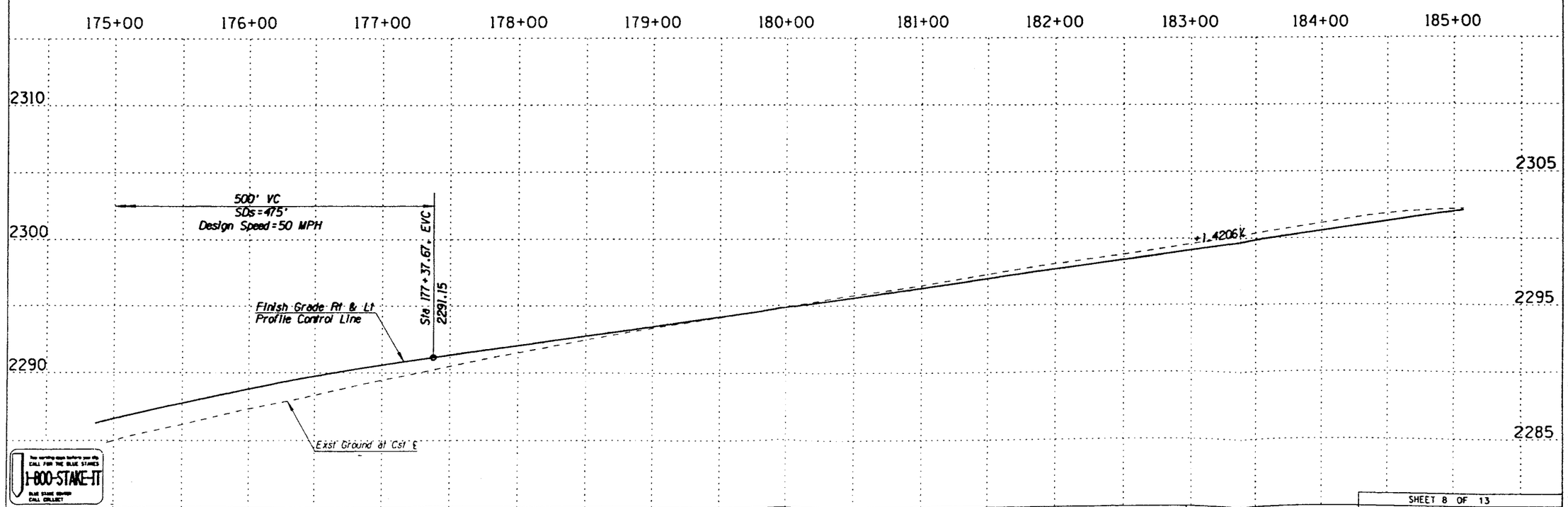
ROADWAY IMPROVEMENT PLANS
FOR
CORTARO FARMS ROAD
PLAN AND PROFILE
STA 165+00.00 - 175+00.00

		DATE
DESIGNED	BAB	04-01
DRAWN	RDM	04-01
CHECKED		
PROJ. ENGR.	BAB	08-01

SCHEMATIC NOT FOR CONSTRUCTION

MMLA





SCALES HORIZ. VERT.

SHEET 8 OF 13

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

BENJAMIN H. GOFF, P.E., DEPUTY DIRECTOR

DESIGNED	BAB
DRAWN	RDM
CHECKED	
PROJ. ENGR.	BAB

	DATE
	04-01
	04-01
	04-01

ROADWAY IMPROVEMENT PLANS
FOR
CORTARO FARMS ROAD
PLAN AND PROFILE
STA 175+00.00 - 185+00.00

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

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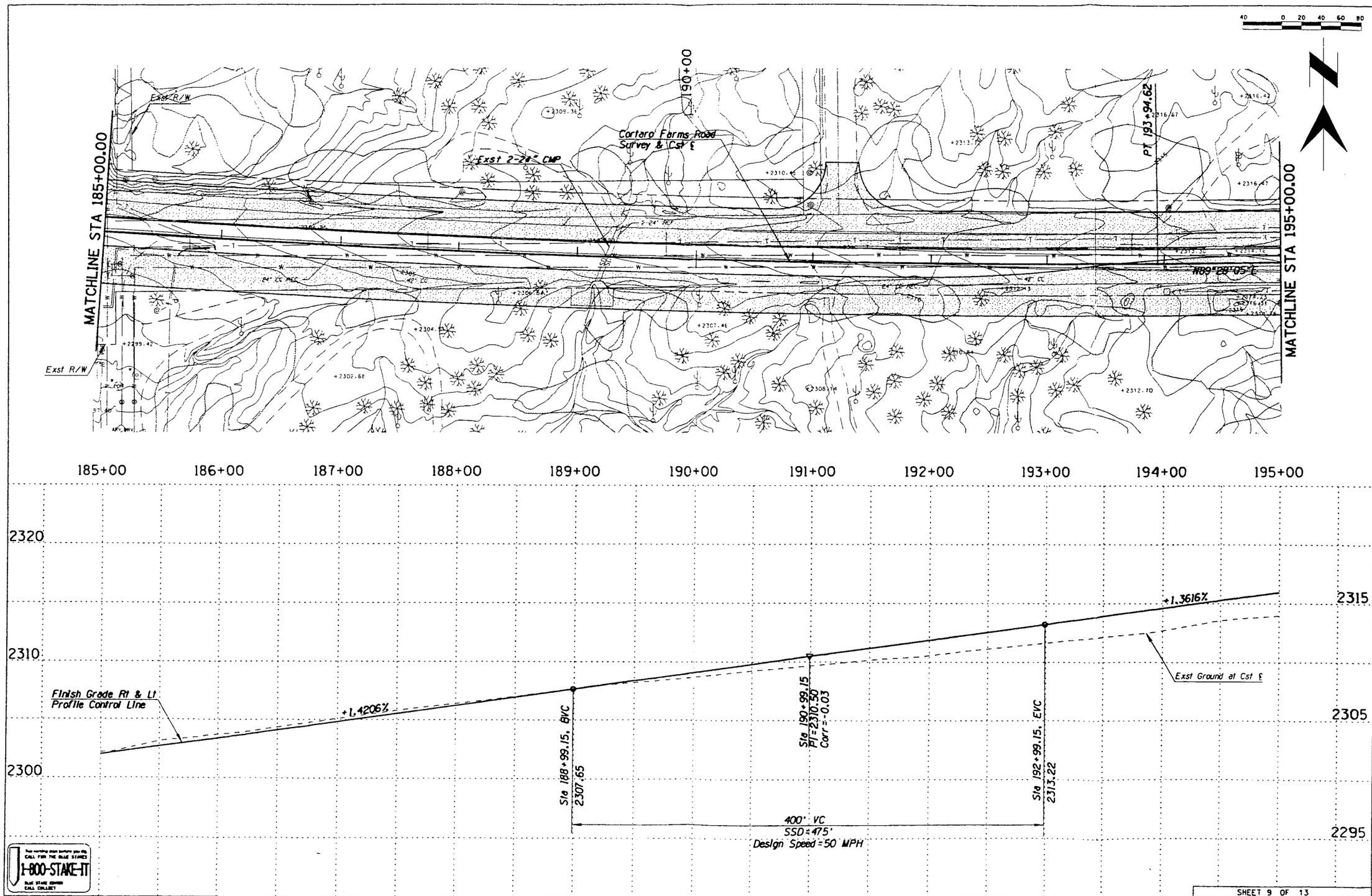
1100 East Wetmore Road, Suite 110
Tucson, Arizona 85719
Telephone (520) 292-2300
Fax (520) 292-1290
MMLA



SCALES HORIZ. VERT.

SHEET 9 OF 13

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

BENJAMIN H. GOFF, P.E., DEPUTY DIRECTOR

ROADWAY IMPROVEMENT PLANS FOR CORTARO FARMS ROAD

PLAN AND PROFILE

STA 185+00.00 - 195+00.00

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

		DATE
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PROJ. ENGR.	BAB	06-01

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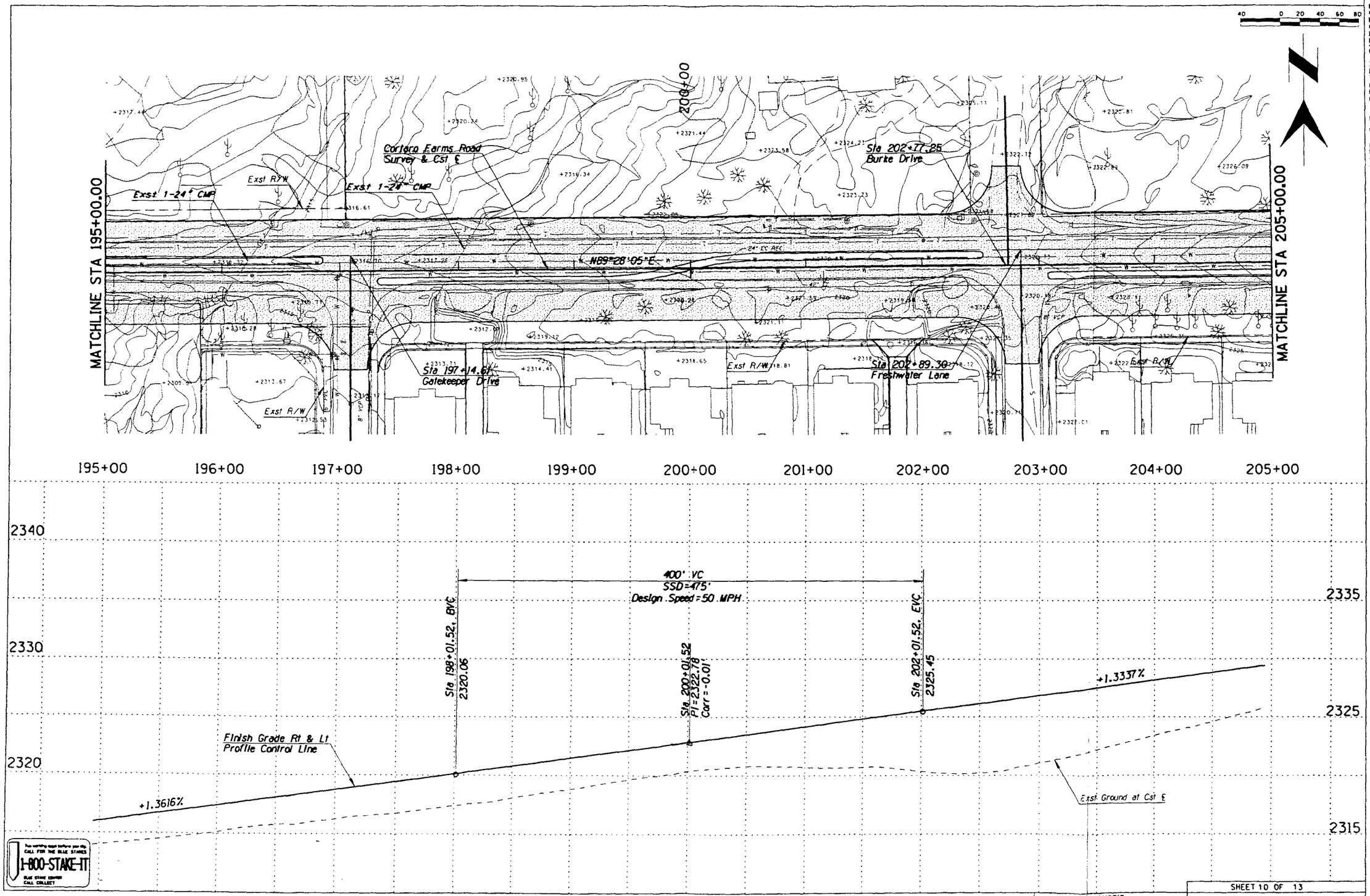

SCALES HORIZ. VERT.

SHEET 10 OF 13

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

BENJAMIN H. GOFF, P.E., DEPUTY DIRECTOR

ROADWAY IMPROVEMENT PLANS
FOR
CORTARO FARMS ROAD
PLAN AND PROFILE
STA 195+00.0 - 205+00.00

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

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PROJ. ENGR.	BAB	08-01

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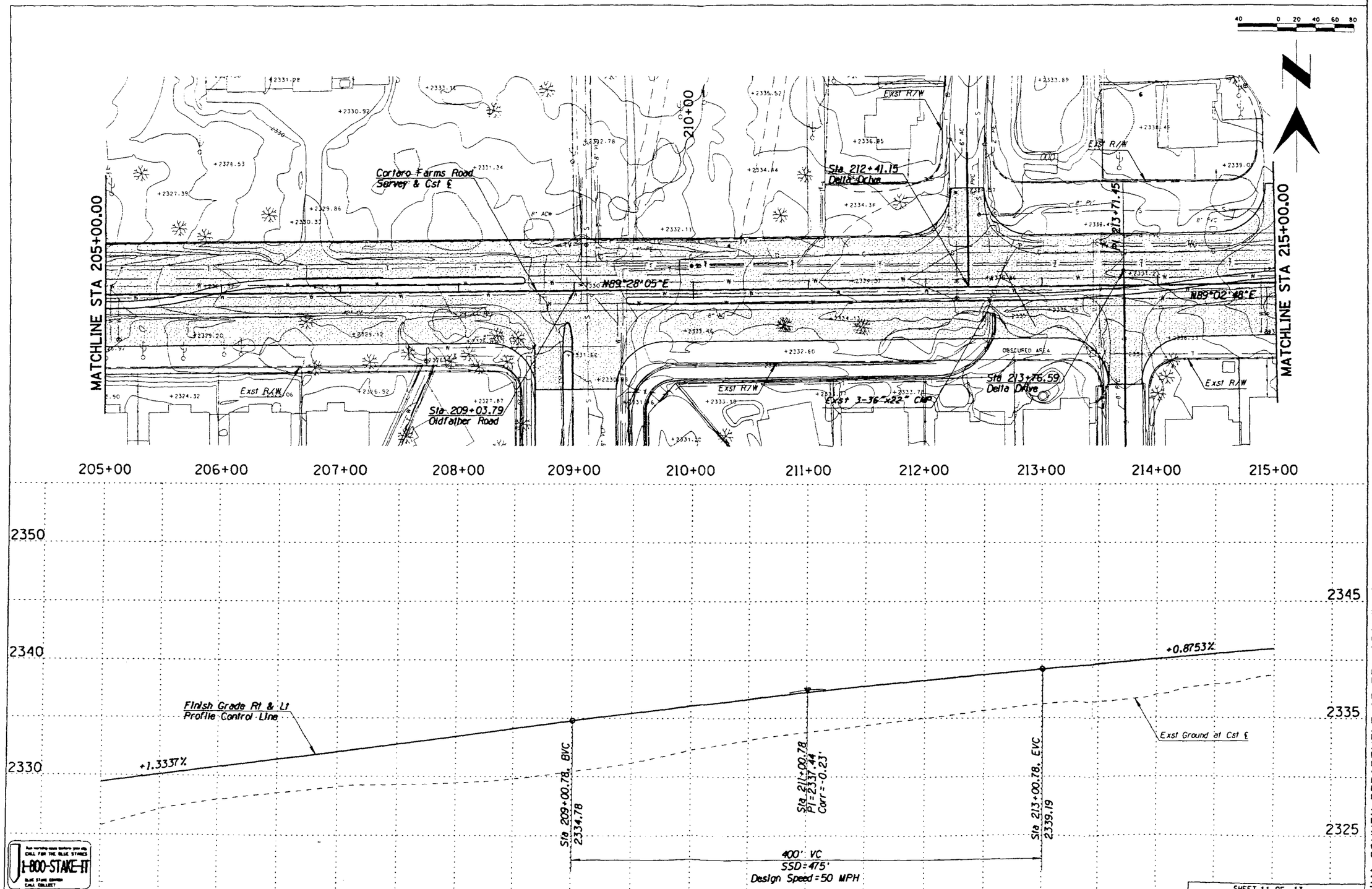

SCALES HORIZ. VERT.

SHEET 11 OF 13

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

BENJAMIN H. GOFF, P.E., DEPUTY DIRECTOR

ROADWAY IMPROVEMENT PLANS
FOR
CORTARO FARMS ROAD
PLAN AND PROFILE
STA 205+00.00 - 215+00.00

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

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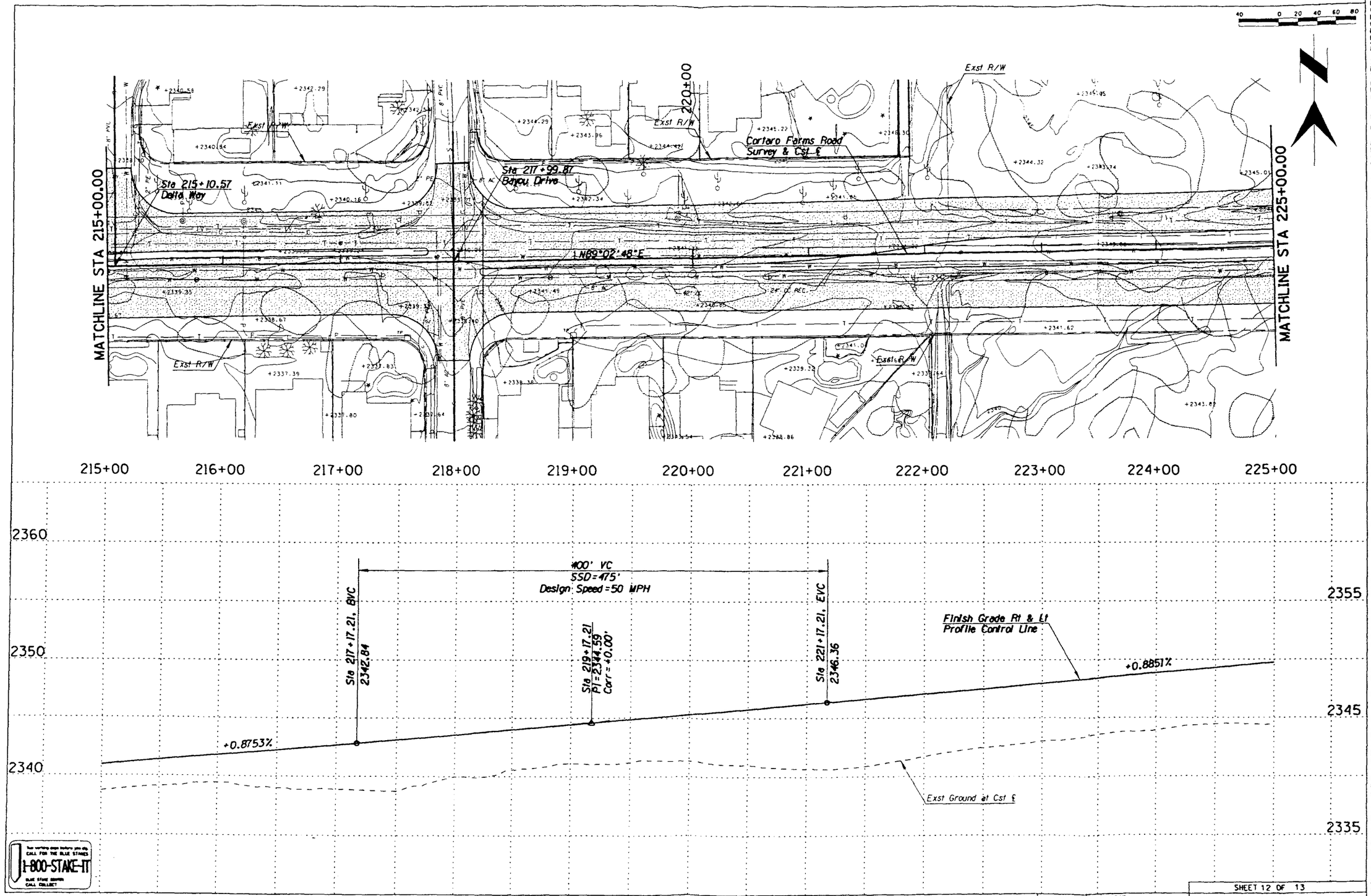

SCALES HORIZ. VERT.

SHEET 12 OF 13

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

BENJAMIN H. GOFF, P.E., DEPUTY DIRECTOR

ROADWAY IMPROVEMENT PLANS
FOR
CORTARO FARMS ROAD
PLAN AND PROFILE
STA 215+00.00 - 225+00.00

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

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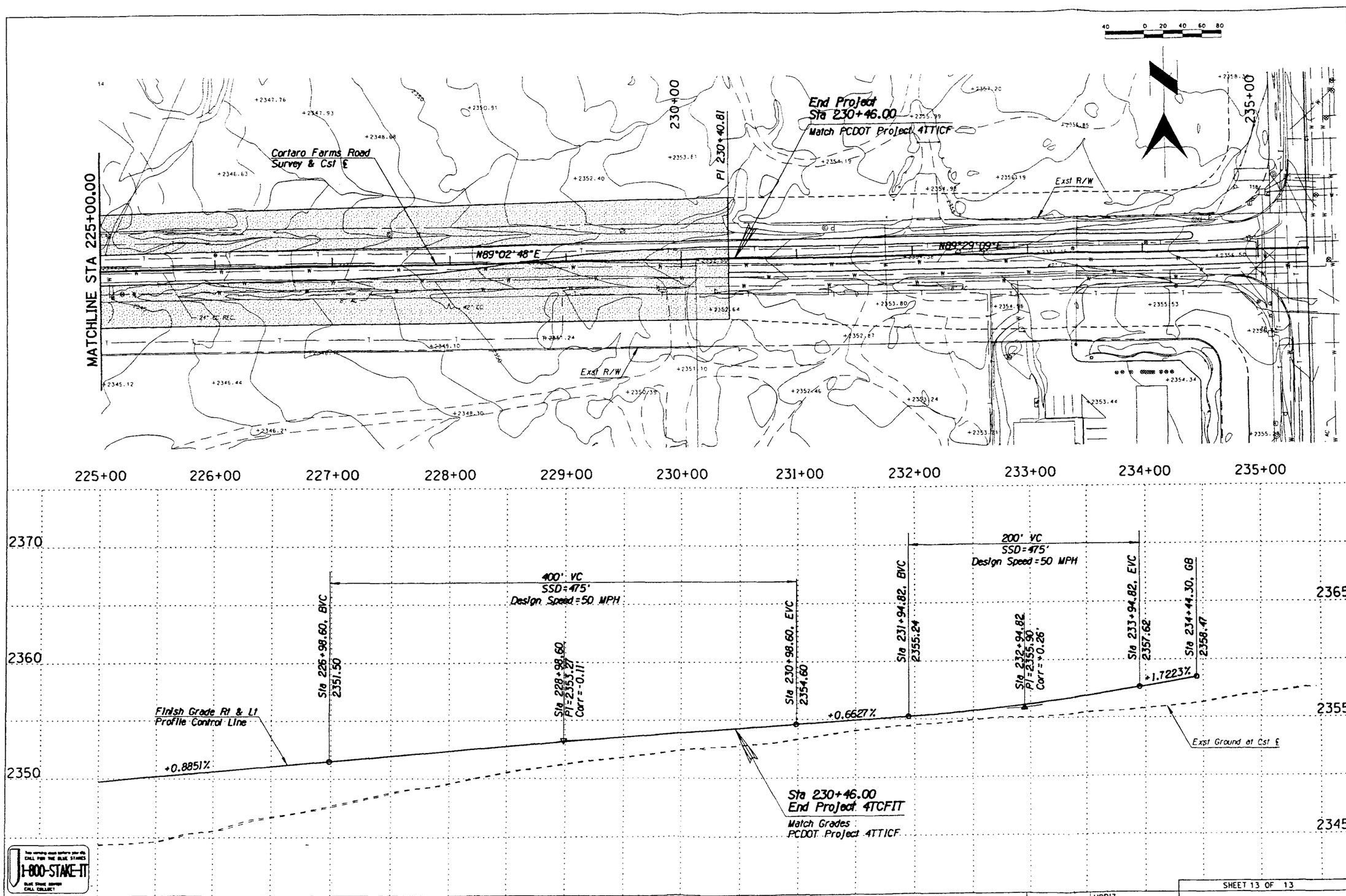

SCALES HORIZ. VERT.

SHEET 13 OF 13

SHEET OF

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT

BENJAMIN H. GOFF, P.E., DEPUTY DIRECTOR

ROADWAY IMPROVEMENT PLANS FOR CORTARO FARMS ROAD

PLAN AND PROFILE STA 225+00.00 - END

NO.	REVISION DESCRIPTION	DIV.- SECT. ENGR.	DATE

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DRAWN	RDM	04-01
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SCHEMATIC NOT FOR CONSTRUCTION

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EXHIBIT 9

Preliminary Noise Measurement Locations

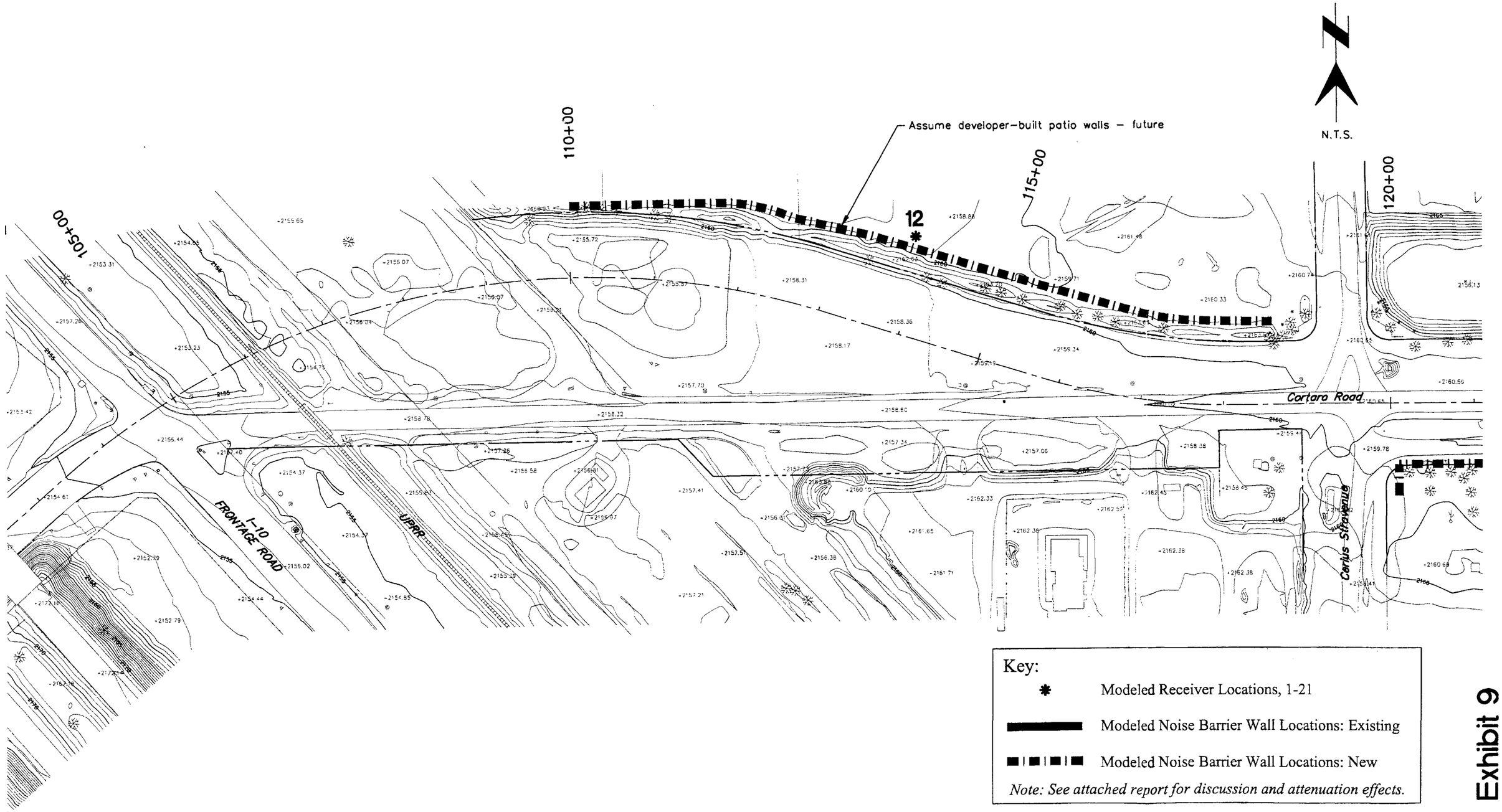
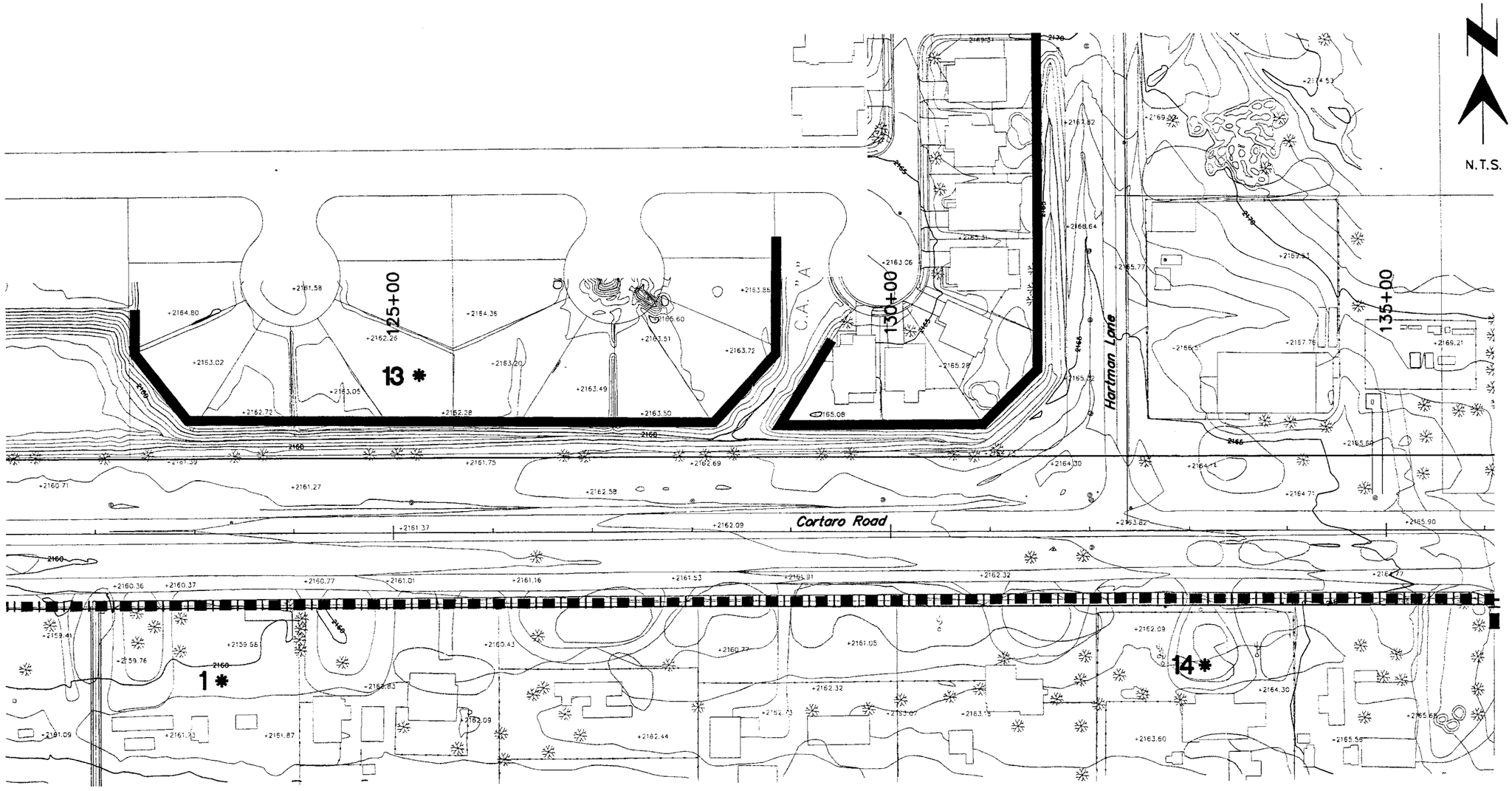


Exhibit 9

Map of Noise Modeling Receivers and Barriers

Cortaro Farms Road Traffic Noise Study, ***RECON*** Consultants



Key:

✱ Modeled Receiver Locations, 1-21

Modeled Noise Barrier Wall Locations: Existing

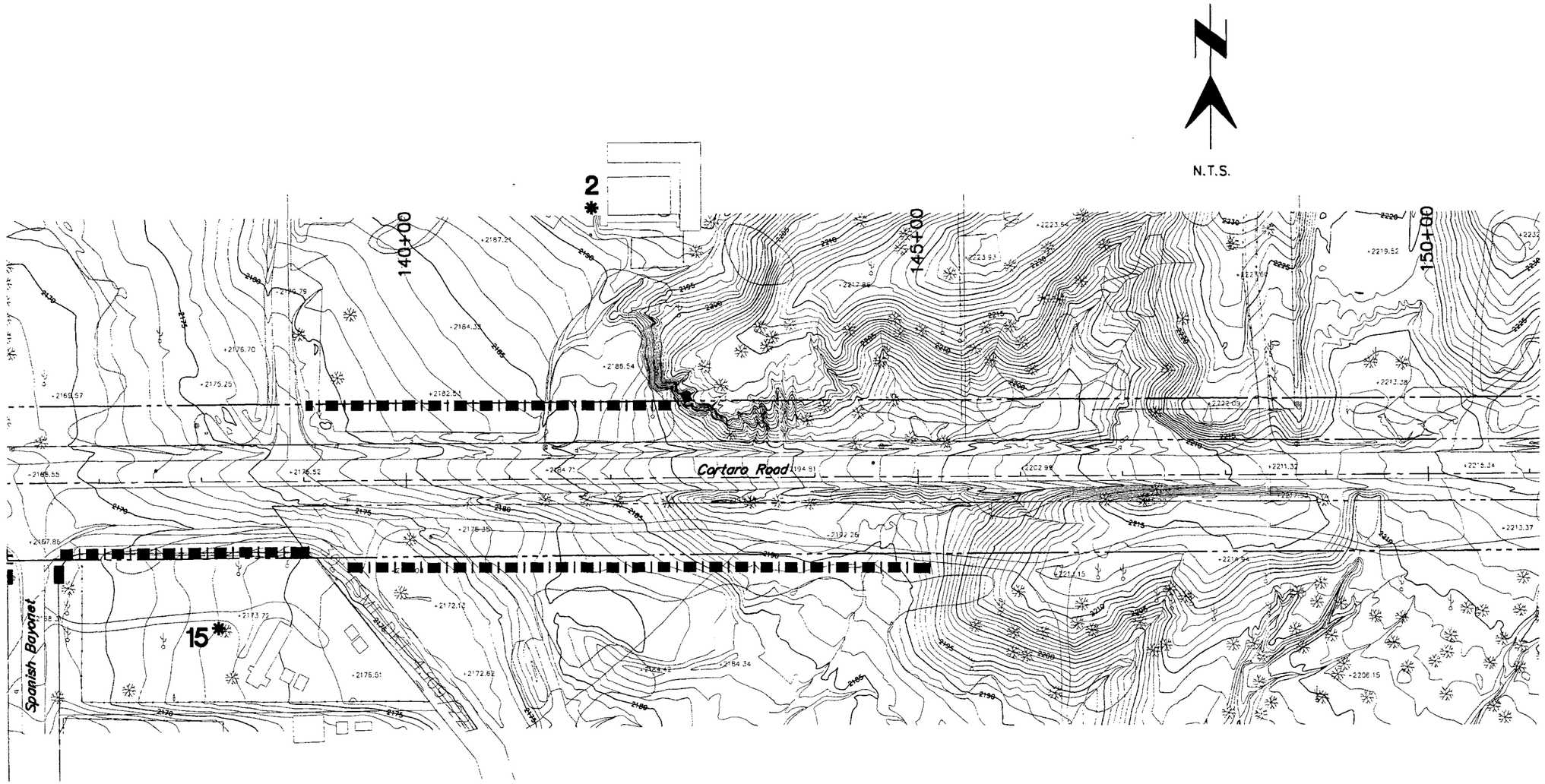
Modeled Noise Barrier Wall Locations: New

Note: See attached report for discussion and attenuation effects.

Exhibit 9

Map of Noise Modeling Receivers and Barriers

Cortaro Farms Road Traffic Noise Study, ***RECON*** Consultants



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Cortaro Farms Road Traffic Noise Study, ***RECON*** Consultants

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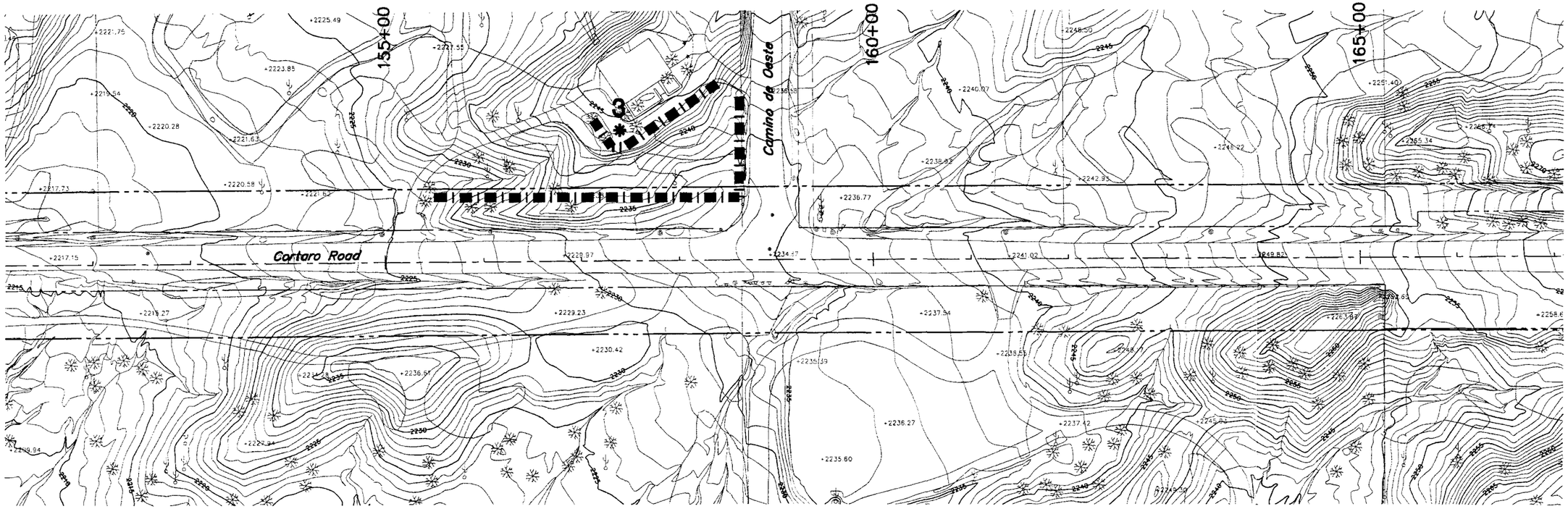

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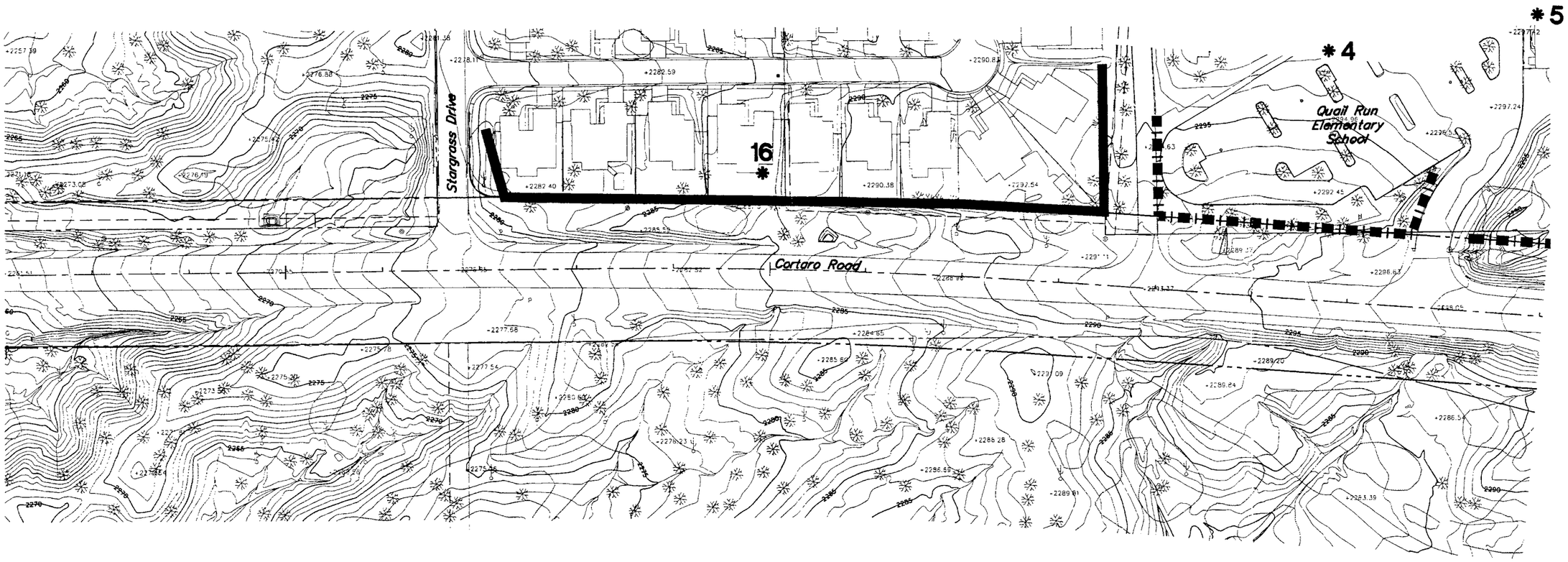

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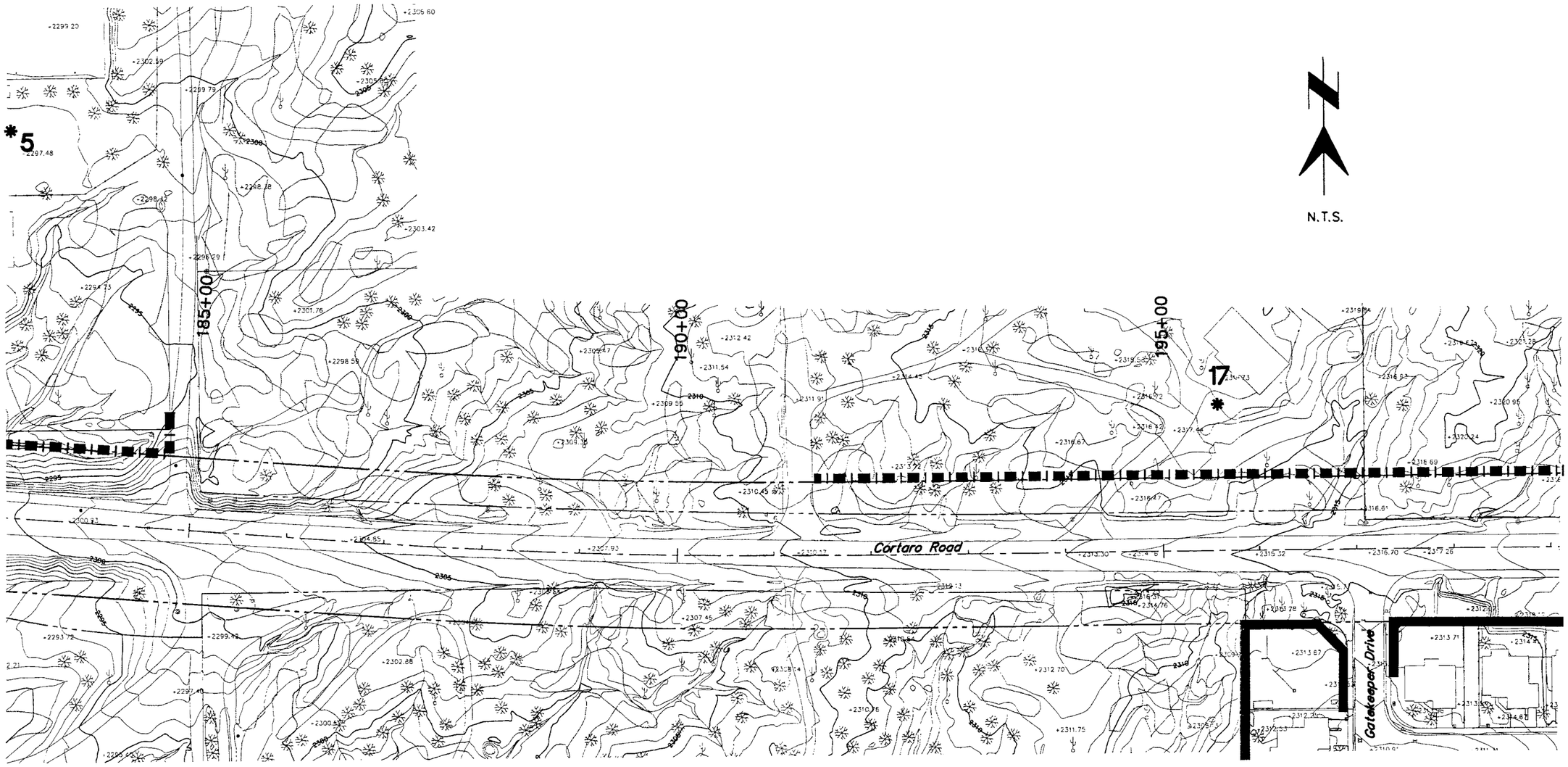
Cortaro Farms Road Traffic Noise Study, ***RECON*** Consultants



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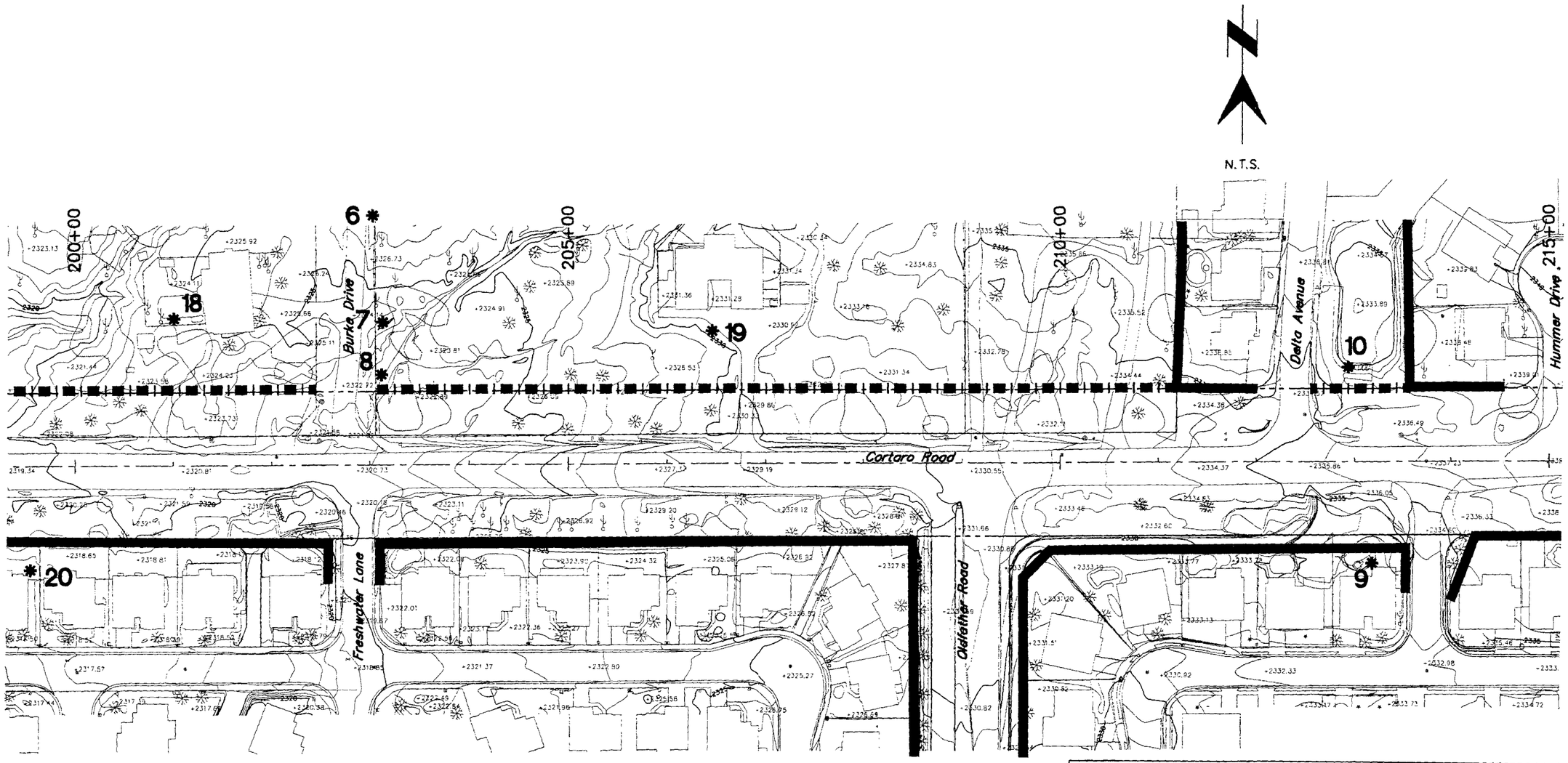
Cortaro Farms Road Traffic Noise Study, ***RECON*** Consultants



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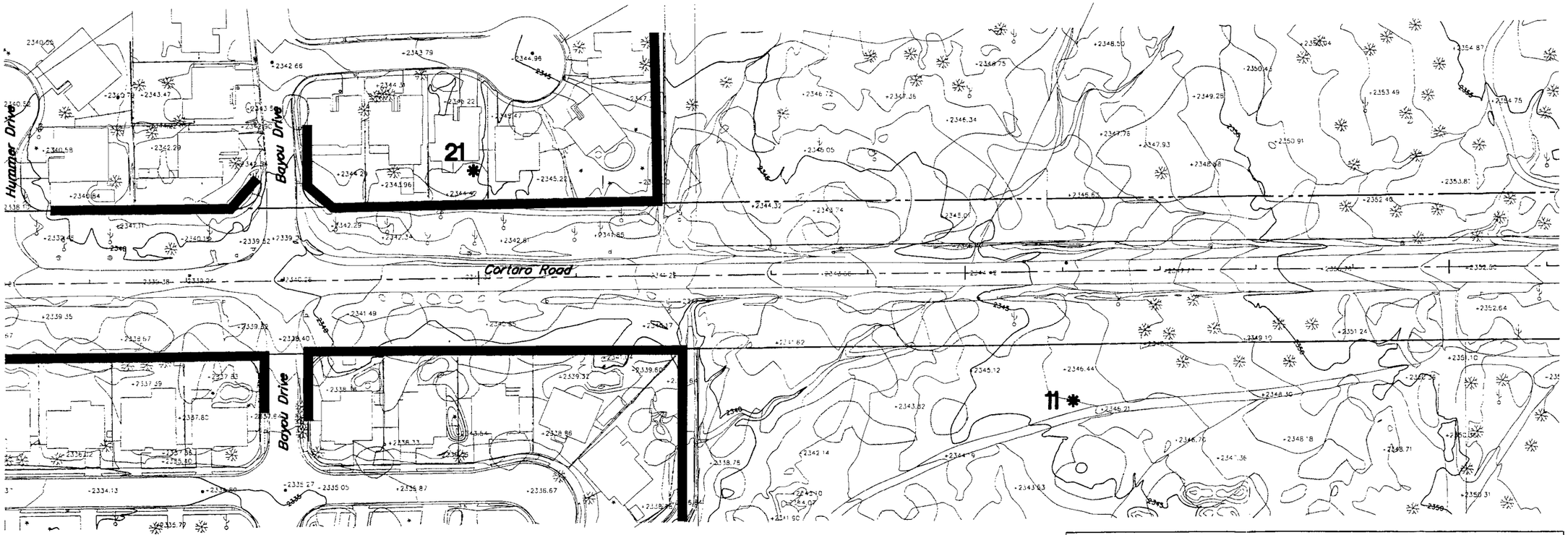

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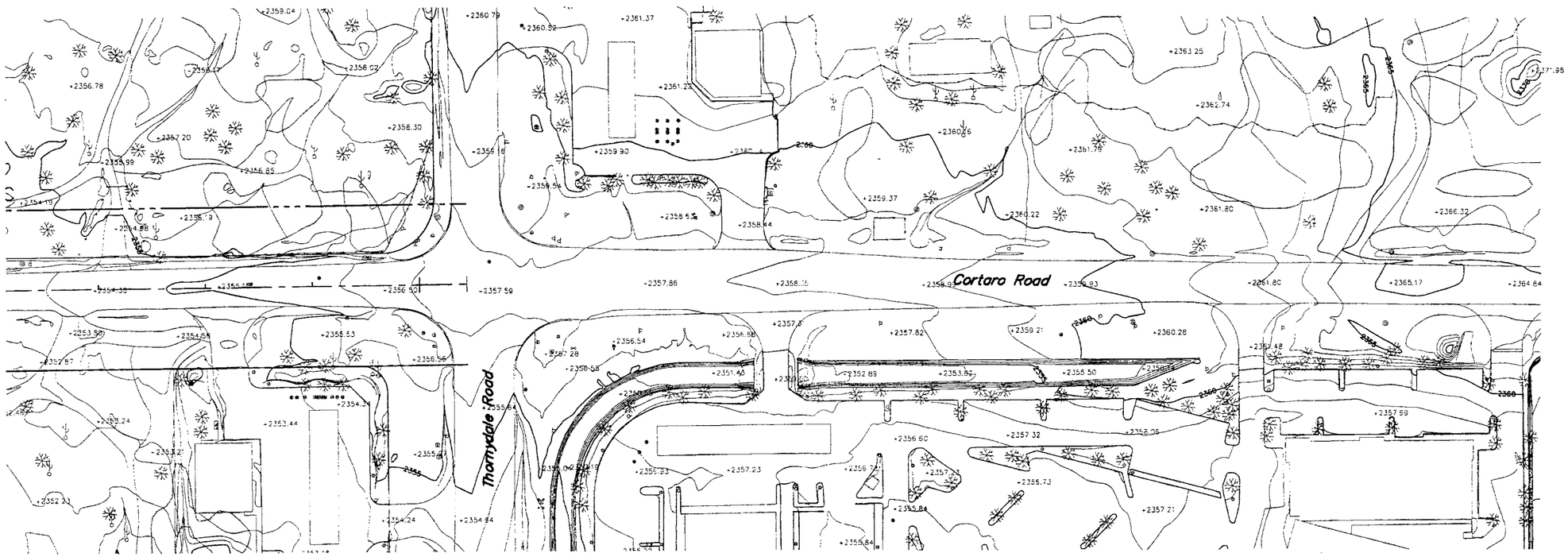

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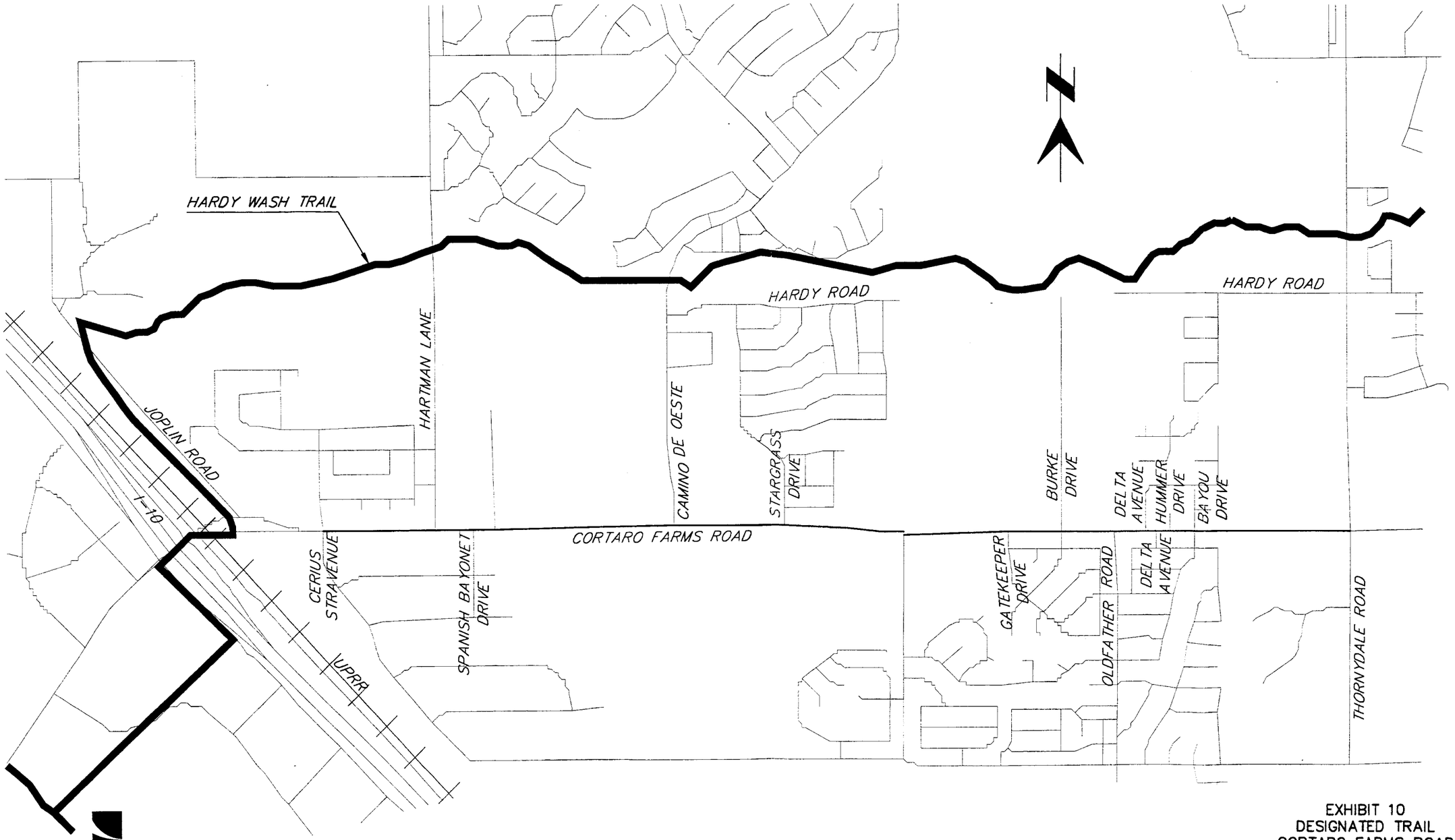
Exhibit 9

Map of Noise Modeling Receivers and Barriers

Cortaro Farms Road Traffic Noise Study, ***RECON*** Consultants

EXHIBIT 10

Existing Trail, Bike & Bus Routes



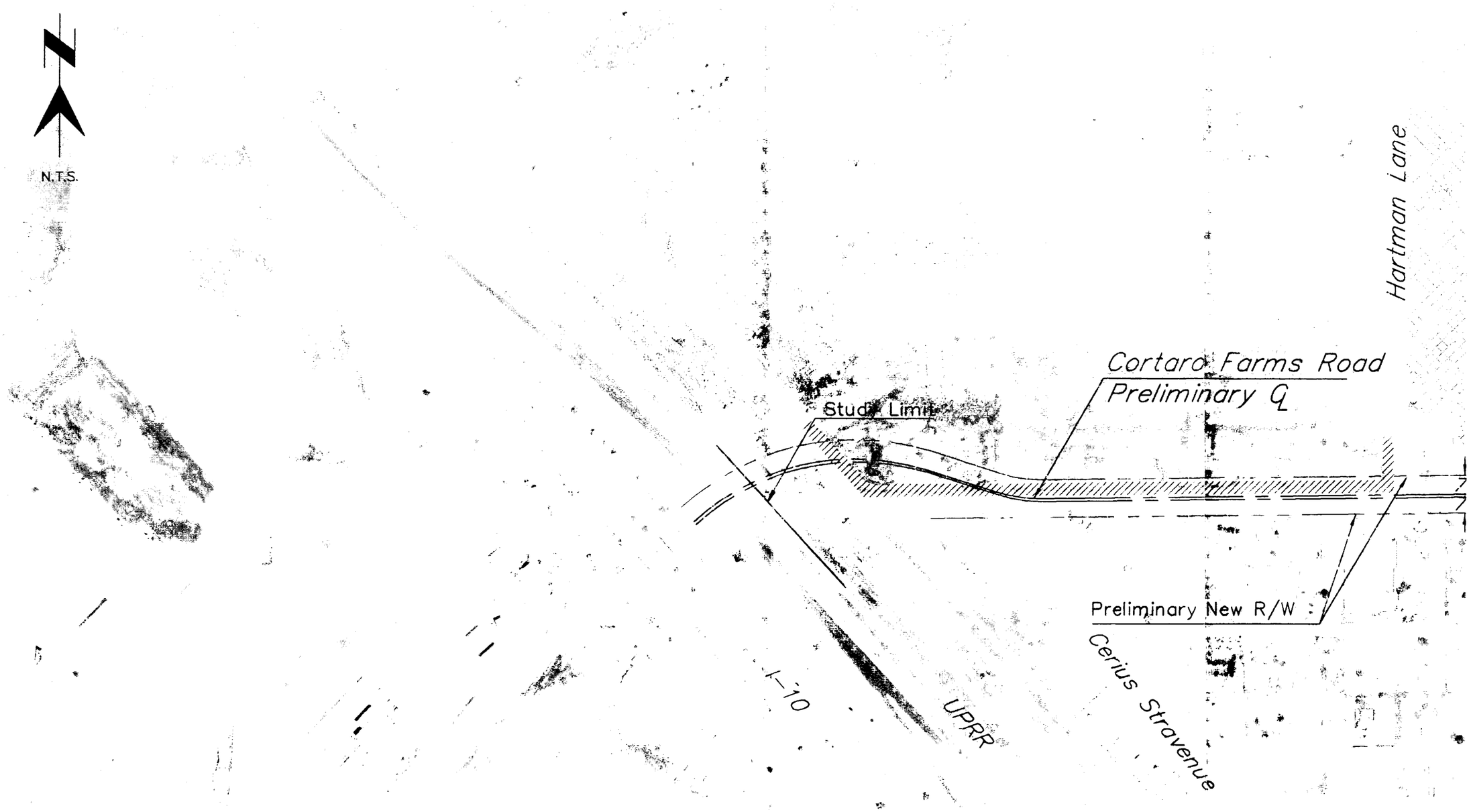
MMLA
McGovern MacWhite Lodge & Associates, Inc.

EXHIBIT 10
DESIGNATED TRAIL
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 1 of 1

EXHIBIT 11

Existing Vegetation



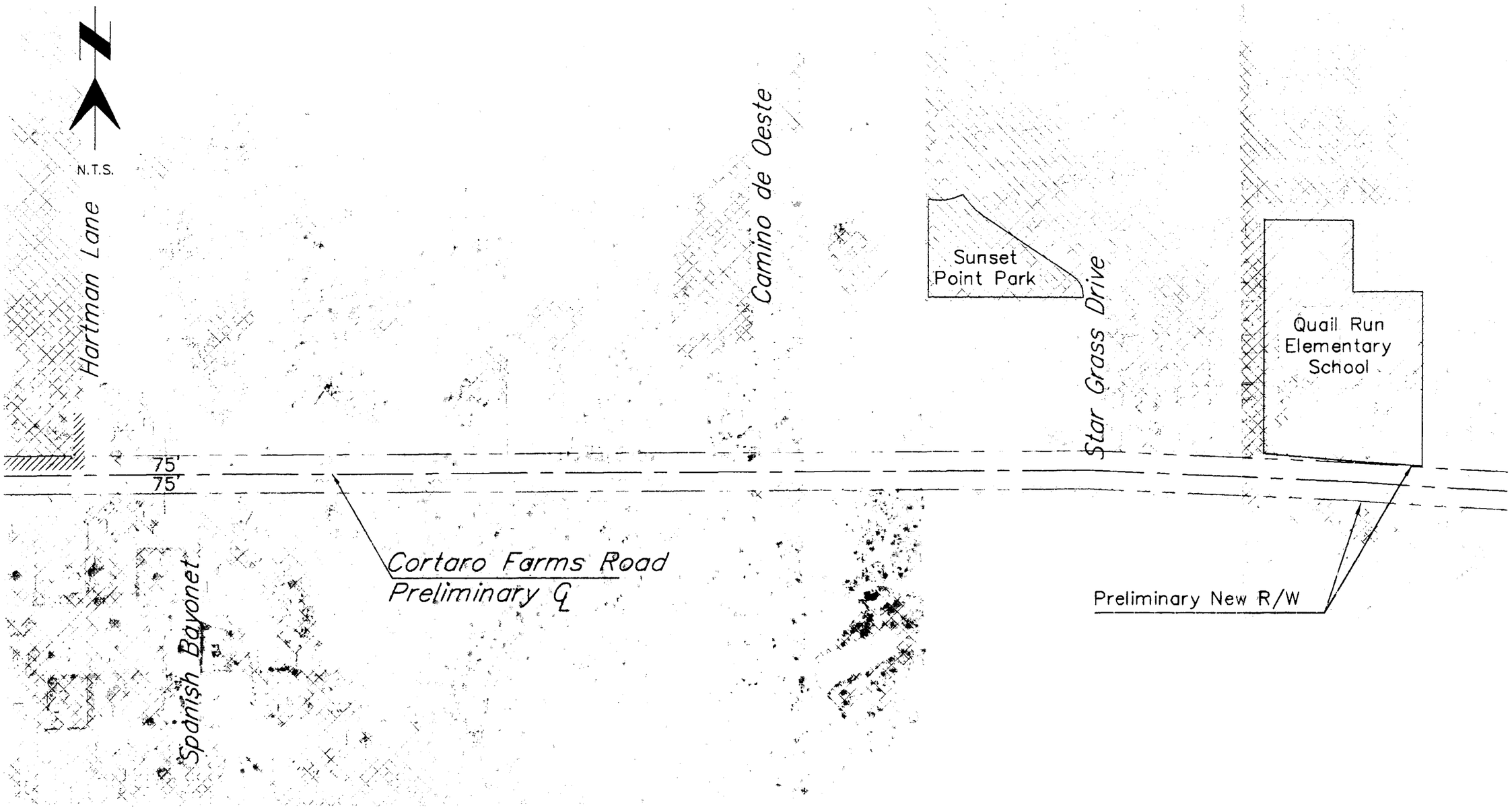
LEGEND

- DISTURBED DESERT SCRUB
- FOOTHILLS PALO VERDE / IRONWOOD MIXED SCRUB
- NON-NATIVE PLANT BUFFER
- NATIVE PLANT BUFFER
- WASH

LANDSCAPE ARCHITECTURE

EXHIBIT 11
EXISTING VEGETATION
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 1 of 3



LEGEND

- DISTURBED DESERT SCRUB
- FOOTHILLS PALO VERDE / IRONWOOD MIXED SCRUB
- NON-NATIVE PLANT BUFFER
- NATIVE PLANT BUFFER
- WASH

LANDSCAPE ARCHITECTURE

EXHIBIT 11
EXISTING VEGETATION
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 2 of 3

LEGEND

- DISTURBED DESERT SCRUB
- FOOTHILLS PALO VERDE / IRONWOOD MIXED SCRUB
- NON-NATIVE PLANT BUFFER
- NATIVE PLANT BUFFER
- WASH

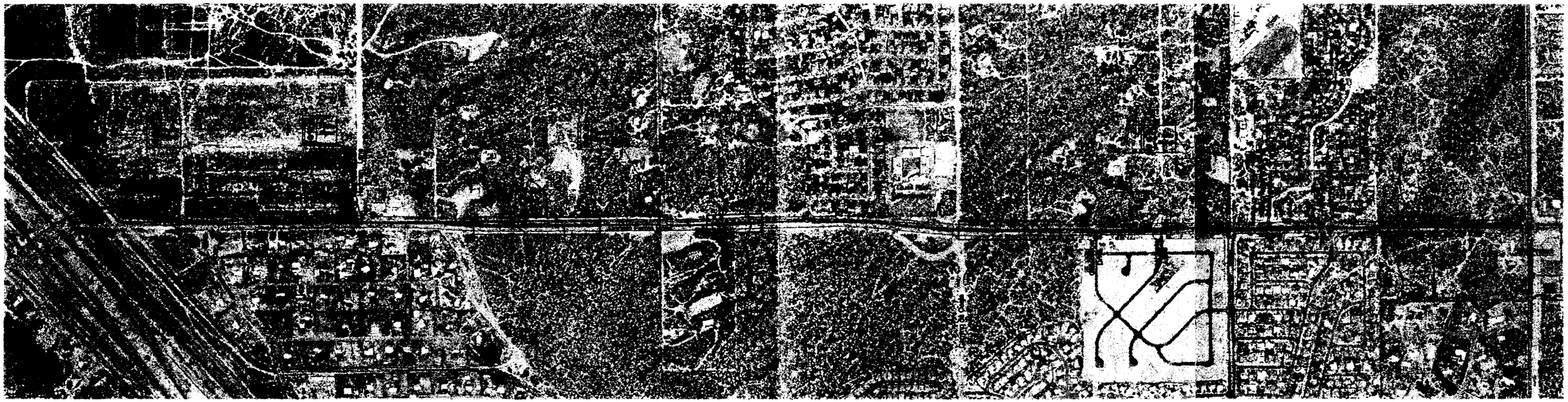
LANDSCAPE ARCHITECTURE

EXHIBIT 11
EXISTING VEGETATION
CORTARO FARMS ROAD
UNION PACIFIC RAILROAD TO THORNYDALE ROAD
PIMA COUNTY W.O.# 4TCFIT

SHEET 3 of 3

EXHIBIT 12

Pygmy Owl Sensitive Habitat



Proposed Pygmy Owl Roadway Crossing Corridor

Owl Habitat

Roadway Pavement

Median

Maximum Grading Limits

Cortaro Farms Road

Cortaro Farms Road Aerial Photograph taken in 1996

EXHIBIT 12

PYGMY OWL SENSITIVE HABITAT

CORTARO FARMS ROAD

UNION PACIFIC RAILROAD TO THORNYDALE ROAD

PIMA COUNTY W.O. #4TCFIT

SHEET 1 OF 1

A Cultural Resources Survey of Cortaro Farms Road Between Interstate 10 and Thornydale Road, Pima County, Arizona

M. L. Brack

Reviewed by:

Patricia Castalia
Desert Archaeology, Inc.
3975 N. Tucson Boulevard
Tucson, AZ 85716

Submitted to:

McGovern, MacVittie, Lodge, and Associates
800 E. Wetmore Road, Suite 110
Tucson, AZ 85719

Project Report No. 00-131
Desert Archaeology, Inc.
(DAI Project No. 00-117)
3975 North Tucson Boulevard, Tucson, Arizona 85716 • 08 March 2001

REPORT ABSTRACT

DATE: 08 March 2001

AGENCY: McGovern, MacVittie, Lodge, and Associates of Tucson, Arizona (MMLA) contracted by Pima County.

PROJECT TITLE: A Cultural Resources Survey of Cortaro Farms Road Between Interstate 10 and Thornydale Road, Pima County, Arizona.

PROJECT DESCRIPTION: An archaeological survey of the right-of-way for proposed improvements to Cortaro Farms Road.

PERMIT NUMBERS: 2001-7bl

LOCATION:

> **County:** Pima
>
> **Description:** The center of Sections 25 and 26 of Township 12S, Range 12E; and Section 30 of Township 12S, Range 13E.

NUMBER OF SURVEYED ACRES: 66

NUMBER OF SITES: 4

LIST OF REGISTER-ELIGIBLE PROPERTIES: AZ AA:12:285 (ASM), AZ AA:12:774 (ASM), AZ AA:12:780 (ASM), and EE:3:53 (ASM).

LIST OF INELIGIBLE SITES: N/A

COMMENTS: New sites were not identified by the survey. Four previously recorded sites are located in the project area. Archaeological data recovery is recommended at the two National Register of Historic Places-eligible sites, AZ AA12:285 (ASM) and AZ AA:12:774 (ASM), prior to construction.

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A CULTURAL RESOURCES SURVEY OF CORTARO FARMS ROAD BETWEEN INTERSTATE 10 AND THORNYDALE ROAD, PIMA COUNTY, ARIZONA

Pima County has proposed widening and realigning of a portion of Cortaro Farms Road between Interstate 10 (I-10) and Thornydale Road. McGovern, MacVittie, Lodge, and Associates (MMLA) of Tucson has been contracted by the County to complete this project. As a segment of a larger environmental assessment, MMLA requested a cultural resources survey of the project area to identify and assesses archaeological sites and/or historical properties that may be affected by construction. Michael Brack of Desert Archaeology, Inc., completed this evaluation on 13 February 2001 with William H. Doelle, Ph.D., acting as Principal Investigator. Fieldwork was completed under State of Arizona Blanket Antiquities Permit No. 2001-7bl. Other project records are curated by the Arizona State Museum in Tucson.

Four previously recorded archaeological sites are located within the scope of the proposed project. These include AZ AA:12:285 (ASM) and AZ AA:12:774 (ASM), which meet eligibility requirements for inclusion in the National Register of Historic Places (NRHP). AZ AA:12:780 (ASM) and EE:3:53 (ASM) have been heavily disturbed and lack sufficient integrity in the project area to qualify for inclusion in the NRHP. New significant cultural resources were not identified during an archaeological survey of the project area, and one isolated occurrence (IO) was recorded. As proposed, the project will adversely affect the integrity of AA:12:285 and AA:12:774. Additional archaeological investigation is recommended at these sites prior to construction to assess and mitigate the effects of the construction project.

PROJECT AREA LOCATION AND DESCRIPTION

The project area is depicted on the Jaynes Quadrangle (USGS 1992) and is located in northeast Pima County along Cortaro Farms Road, east of Interstate 10 (I-10) (see Figure 1). In this vicinity, the Union Pacific Railroad (formerly Southern Pacific) parallels the east side of I-10 and is the western extent of the survey area. The project extends east from the Union Pacific Railroad along Cortaro Farms Road for a distance of about 4 km (2.5 mi) to Thornydale Road. Cortaro Farms Road will maintain its existing alignment over most of the length of the project area. However, west of Cerius Stravenue (the western 400 m [.25 mi] of the project area), Cortaro Farms Road will be moved a maximum of about 46 m (150 ft) north of the existing roadbed. The proposed right-of-way measures 23 m (75 ft) in width on either side of the Cortaro Farms Road centerline. The existing Cortaro Farms right-of-way is owned by Pima County, and roadway improvements will widen the right-of-way to include adjacent property presently under private ownership.

The project area is in the center of Sections 25 and 26 of Township 12S, Range 12E; and Section 30 of Township 12S, Range 13E. Universal Transverse Mercator (UTM) coordinates (1927 North American Datum) for the survey corridor are as follows: 491614E, 3580149N; 492449E, 3580094N; 494056E, 3580049N; and 495600E, 3580038N. The project area encompasses approximately 26.7 ha (66 acres), and about half of this total area is occupied by the existing Cortaro Farms roadbed.

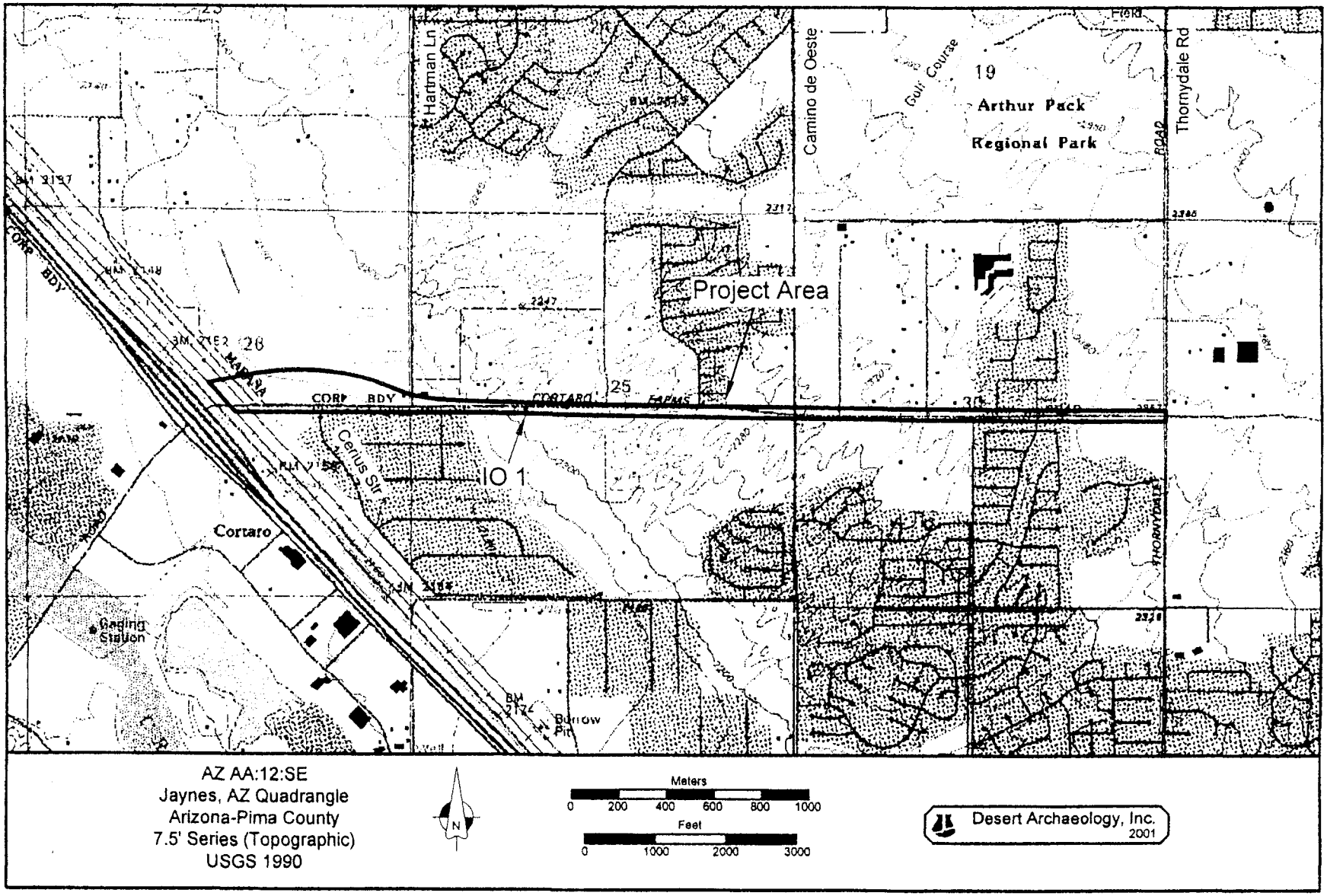

Figure 1. Overview showing project area, physiographic features, and Isolated Occurrence (IO) 1.

Because of increasing population densities, Pima County has proposed the improvement of Cortaro Farms Road to provide better access to I-10. MMLA is designing and implementing the project. Construction will involve the demolition of the existing Cortaro Farms roadbed. A new, widened road base will be constructed and surfaced. In order to widen the existing roadbed, extensive grading and earthwork is anticipated within the proposed right-of-way. Road cuts and fills are expected to be used to develop an adequate road base. Outside curbs, storm drains, and landscaping will also be added along Cortaro Farms. The improved roadbed will follow the existing Cortaro Farms alignment, except at its western end where it will be moved slightly north to intersect I-10. The Cortaro Farms Road right-of-way will double in width to 46 m (150 ft) over the length of the project area. Completion of the project is expected in 2004.

The Area of Potential Effects (36 CFR 800.4) is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if such properties exist" (36 CFR 800.16[d]). For the Cortaro Farms Road project, the Area of Potential Effects is defined roughly by the footprint of the proposed construction corridor. In the eastern portion of the project area, where Cortaro Farms will maintain its existing alignment, the Area of Potential Effects will include about 46 m (150 ft) on either side of the existing centerline. In the west, Cortaro Farms will be moved slightly north. In this vicinity, the Area of Potential Effects extends from 23 m (75 ft) south of the present Cortaro Farms centerline to 23 m (75 ft) north of the proposed centerline.

ENVIRONMENTAL SETTING OF THE PROJECT AREA

The setting of the project area is a dissected bajada which flanks the eastern margin of the Santa Cruz River. The Santa Cruz floodplain intersects the bajada near the western extreme of the project area forming deep, fine-grained alluvial soils. Rising up out of the Santa Cruz bottoms at an elevation of about 652 m (2,140 ft) above mean sea level, the landform rises steadily toward the east to a maximum elevation of 719 m (2,360 ft).

The project area is broken by a series of southwest-trending intermittent drainages that flow into the Santa Cruz. The extreme western portion of the project area is characterized by gently sloping overbank deposits. Moving east, the bajada is moderately dissected by deeply down-cut arroyos. Lower-gradient, more mature fan channels are more typical of the eastern portion of the project corridor. East of the floodplain, sediments in the project area are typical of low- to moderate-energy deposition along the terminal margin of an alluvial fan. They consist of light brown to reddish-brown sandy matrix supporting variable densities of texturally mature gravels and cobbles.

The landscape surrounding the project area supports a lush desert vegetation characteristic of bajada settings in the Sonoran Desert. Natural vegetation is dominated by an overstory of mature yellow paloverde (*Cercidium microphyllum*), mesquite (*Prosopis* sp.), and ironwood (*Olneya tesota*). Scattered creosotebushes (*Larrea tridentata*) are dispersed amongst the mature trees along with scrub acacia (*Acacia* sp.) and desert broom (*Baccharis sarothroides*). Ground cover consists primarily of triangle bursage (*Ambrosia deltoidea*), and cacti are dense and diverse. This setting supports communities of giant saguaro (*Carnegiea gigantea*), prickly pear (*Opuntia phaeacantha*), fish-hook barrel (*Ferocactus wislizenii*), Christmas cacti (*Opuntia leptocaulis*) and a numerous species of cholla, including teddy bear (*Opuntia bigelovii*), chain fruit (*Opuntia fulgida*), staghorn (*Opuntia versicolor*), pencil (*Opuntia arbuscula*), silver (*Opuntia echinocarpa*), and cane (*Opuntia spinosior*).

Cortaro Farms Road has seen rapid commercial and residential development in recent years. The project area is lined with high-density housing additions, churches and schools, various business enterprises, and dispersed single-family home sites. Little of the immediate project area remains unaffected by development. The Pima County right-of-way that parallels the paved road has been heavily impacted by road building and maintenance, utility construction, nearby development, and off-road vehicle traffic. Private lands abut the existing right-of-way along Cortaro Farms. These properties have been affected to various degrees by localized construction and development. Disturbance also has been substantial along the Union Pacific Railroad grade, which includes the construction of the rail bed itself and a low drainage channel east of the railway. Within the project area, disturbance has affected the integrity of most surface and near-surface deposits.

CULTURAL BACKGROUND OF THE PROJECT AREA

The history of the Southwest and the Tucson Basin is marked by a close relationship between people and the natural environment. Environmental conditions have strongly influenced subsistence practices and social organization, and social and cultural changes have, in turn, made it possible to better exploit environmental resources. Through time, specialized adaptations to the arid region distinguished people living in the Southwest from those in other areas. Development of cultural and social conventions also became more regionally specific over time, and by A.D. 650 groups living in the Tucson Basin can be readily differentiated from those living in other areas of the Southwest. Today, the harsh desert climate no longer isolates Tucson and its inhabitants, but life remains closely tied to the unique resources of the Southwest. Table 1 summarizes the chronology of the Tucson Basin.

Paleoindian Period (10,000?-8500 B.C.)

Archaeological investigations suggest that the Tucson Basin was initially occupied some 10,000 years ago, a time much wetter and cooler than today. The Paleoindian period is characterized by small, mobile groups of hunter-gatherers who briefly occupied temporary campsites as they moved across the countryside in search of food and other resources (Cordell 1997:67). The hunting of large mammals, such as mammoth and bison, was a particular focus of the subsistence economy. A Clovis point characteristic of the Paleoindian period (circa 9500 B.C.) was collected from the Valencia site, located along the Santa Cruz River in the southern Tucson Basin (Doelle 1985:181-182). Another Paleoindian point was found in Rattlesnake Pass in the northern Tucson Basin (Huckell 1982). These rare finds suggest that prehistoric use of the Tucson area probably began at this time. Paleoindian use of the Tucson Basin is supported by archaeological investigations in the nearby San Pedro Valley and elsewhere in southern Arizona, where Clovis points in association with extinct mammoth and bison remains have been discovered (Huckell 1992, 1995). However, because Paleoindian sites have yet to be found in the Tucson Basin, the extent and intensity of this occupation are unknown.

Archaic Period (8500-1700 B.C.)

The transition from the Paleoindian period to the Archaic period was accompanied by marked climatic changes. During this time, the environment came to look much like it does today. Archaic period groups pursued a mixed subsistence strategy characterized by intensive wild plant gathering

Table 1. Cultural chronology of the Santa Cruz River Valley.

Periods	Phases	Date Ranges
Historic	American Statehood period	A.D. 1912-present
	American Territorial period	A.D. 1854-1912
	Spanish-Mexican period	A.D. 1697-1854
Protohistoric		A.D. 1450-1697
Hohokam Classic	Tucson	A.D. 1300-1450?
	Tanque Verde	A.D. 1150-1300
Hohokam Sedentary	Late Rincon	A.D. 1100-1150
	Middle Rincon	A.D. 1000-1100
	Early Rincon	A.D. 950-1000
Hohokam Colonial	Rillito	A.D. 850-950
	Cañada del Oro	A.D. 750-850
Hohokam Pioneer	Snaketown	A.D. 700-750
	Sweetwater	A.D. 675-700
	Estrella	A.D. 650-675
Early Ceramic	Tortolita	A.D. 550-650
	Agua Caliente	A.D. 150-550
Early Agricultural	Late Cienega	400 B.C.-A.D. 150
	Early Cienega	800-400 B.C.
	San Pedro	1200-800 B.C.
	Unnamed	1700-1200 B.C.
Archaic	Chiricahua	3000-1700 B.C.
	(Occupation gap?)	6000-3000 B.C.
	Sulphur Springs-Ventana	8500-6000 B.C.
Paleoindian		10,000?-8500 B.C.

and the hunting of small animals. The only Early Archaic period (8500-5000 B.C.) site known from the Tucson Basin region was found in Ruelas Canyon, south of the Tortolita Mountains (Swartz 1998:24). However, Middle Archaic period sites dating between 5000 and 1500 B.C. are known from the bajada zone surrounding Tucson, and, to a lesser extent, from floodplain and mountain areas. Recent investigations conducted at Middle Archaic period sites include excavations along the Santa Cruz River (Gregory 1999), in the northern Tucson Basin (Roth 1989), at the La Paloma development (Dart 1986), and along Ventana Canyon Wash and Sabino Creek (Dart 1984; Douglas and Craig 1986). Archaic period sites in the Santa Cruz floodplain were found to be deeply buried by alluvial sediments, suggesting that more of these sites are present but undiscovered because of the lack of surface evidence.

Early Agricultural Period (1700 B.C.-A.D. 150)

The Early Agricultural period (previously known as the Late Archaic period) was the time when domesticated plant species were first cultivated in the greater Southwest region. The exact timing of the introduction of cultigens from Mexico is not known, but maize was available in some form by approximately 1500-1200 B.C. (Gregory 2000; Wills 1988). By at least 400 B.C., groups were living

in substantial agricultural settlements in the floodplain of the Santa Cruz River. Recent archaeological investigations suggest that canal irrigation also began sometime during this period.

Several Early Agricultural period sites are known from the Tucson Basin and its vicinity (Diehl 1997; Ezzo and Deaver 1998; Freeman 1998; Gregory 2000; Huckell and Huckell 1984; Huckell et al. 1995; Mabry 1998; Roth 1989). While there is variability between these sites, most likely due to the 1,550 years included in the period, all excavated sites to date contain small, round, or oval semisubterranean pithouses, many with large internal storage pits. At some sites, a larger round structure is also present, which is thought to be for communal or ritual purposes. Stylistically distinctive Cienega, Cortaro, and San Pedro type projectile points are common at Early Agricultural sites as are a range of ground stone and flaked stone tools, ornaments, and shell jewelry (Diehl 1997; Mabry 1998). The fact that shell and some of the material used for stone tools and ornaments were not locally available in the Tucson area suggests that trade networks were in operation. Agriculture, particularly the cultivation of corn, was important in the diet and increased in importance through time. However, gathered wild plants, such as tansy mustard and amaranth seeds, mesquite seeds and pods, and agave hearts, were also frequently used resources. Like the preceding Archaic period, the hunting of animals such as deer, cottontail rabbits, and jackrabbits, continued to provide an important source of protein.

Early Ceramic Period (A.D. 150-650)

Although ceramic artifacts, including figurines and crude pottery, were first produced in the Tucson Basin during the Early Agricultural period (Heidke and Ferg 2000; Heidke et al. 1998), the widespread use of ceramic containers marks the transition to the Early Ceramic period (Huckell 1992). Undecorated plain ware pottery was widely used in the Tucson Basin by around A.D. 150, marking the start of the Agua Caliente phase (A.D. 150-550), and red ware pottery was introduced to the ceramic assemblage during the subsequent Tortolita phase (A.D. 550-650). The Tortolita phase also saw the addition of a number of new pottery vessel forms, suggesting that by this time ceramics were being used for a multitude of purposes.

Architectural features became more formalized and substantial during the Early Ceramic period, representing a greater investment of effort in construction and perhaps more permanent settlement. A number of pithouse styles are present, including small, round, and basin-shaped houses, as well as slightly larger subrectangular structures. As during the Early Agricultural period, a class of significantly larger structures may have functioned in a communal or ritual manner. Reliance on agricultural crops continued to increase, and a wide variety of cultigens, including maize, beans, squash, cotton, and agave, were an integral part of the subsistence economy. Populations grew as farmers expanded their crop production to floodplain land near permanently flowing streams and it is assumed that canal irrigation systems also expanded. Evidence from archaeological excavations indicates that trade in shell, turquoise, obsidian, and other materials intensified and that new trade networks were developed.

Hohokam Sequence (A.D. 650-1450)

The Hohokam tradition developed in the deserts of central and southern Arizona sometime around A.D. 650 and is characterized by the introduction of decorated ceramics: red-on-buff wares in the Phoenix Basin and red-on-brown wares in the Tucson Basin (Doyel 1991; Wallace et al. 1995).

Through time, Hohokam artisans embellished this pottery with highly distinctive geometric figures and life forms such as birds, humans, and reptiles. The Hohokam diverged from the preceding periods in a number of other important ways: pithouses were clustered into formalized courtyard groups, which in turn were organized into larger village segments, each with their own roasting area and cemetery; new burial practices appeared (cremation instead of inhumation) in conjunction with special artifacts associated with death rituals; canal irrigation systems were expanded and, particularly in the Phoenix Basin, represented huge investments of organized labor and time; and large communal or ritual features such as ballcourts and platform mounds were constructed at many village sites.

The Hohokam sequence is divided into the pre-Classic (A.D. 650-1150) and Classic (A.D. 1150-1450) periods. At the start of the pre-Classic, small pithouse hamlets and villages were clustered around the Santa Cruz River. However, beginning about A.D. 750, large, nucleated villages were established along the river or its major tributaries, with smaller settlements in outlying areas serving as seasonal camps for functionally specific tasks such as hunting, gathering, or limited agriculture (Doelle and Wallace 1991). At this time, large, basin-shaped features with earthen embankments called ballcourts were built at a number of the riverine villages. Although the exact function of these features is unknown, they probably served as arenas for playing a type of ball game as well as places for holding religious ceremonies and for bringing different groups together for trade and other communal purposes (Wilcox 1991; Wilcox and Sternberg 1983).

Between A.D. 950 and 1150, Hohokam settlement in the Tucson area became even more dispersed, utilizing the extensive bajada zone as well as the valley floor (Doelle and Wallace 1986). An increase in population is apparent, and both functionally specific seasonal sites, as well as more permanent habitations, were now situated away from the river, although the largest sites were still on the terraces just above the Santa Cruz. At this time, there is strong archaeological evidence for increasing specialization in ceramic manufacture, with some village sites producing decorated red-on-brown ceramics for trade throughout the Tucson area (Harry 1995; Heidke 1986, 1996; Huntington 1986).

The Classic period is marked by dramatic changes in settlement patterns and possibly social organization. Aboveground adobe compound architecture appeared for the first time, supplementing, but not replacing, the traditional semisubterranean pithouse architecture (Haury 1928; Wallace 1995). Although corn agriculture was still the primary subsistence focus, extremely large Classic period rock pile field systems associated with the cultivation of agave have been found in both the northern and southern portions of the Tucson Basin (Doelle and Wallace 1991; Fish et al. 1992). Platform mounds were also constructed at a number of Tucson Basin villages sometime around A.D. 1275-1300 (Gabel 1931). These features are found throughout southern and central Arizona and consist of a central structure that was deliberately filled to support an elevated room upon a platform. The function of the elevated room is unclear; some were undoubtedly used for habitation whereas others may have been primarily ceremonial. Building a platform mound took organized and directed labor, and the mounds are believed to be symbols of a socially differentiated society (Doelle et al. 1995; Elson 1998; Fish et al. 1992; Gregory 1987). By the time platform mounds were constructed, most smaller sites had been abandoned, and Tucson Basin settlement was largely concentrated at only a half dozen large, aggregated communities. Recent research has suggested that aggregation and abandonment in the Tucson area may be related to an increase in conflict and possibly warfare (Wallace and Doelle 1998). By A.D. 1450, the Hohokam tradition, as it is presently known, disappeared from the archaeological record.

Protohistoric Period (A.D. 1450-1697)

Little is known of the period from A.D. 1450, when the Hohokam disappeared from view, to A.D. 1697, when Father Kino first traveled to the Tucson Basin (Doelle and Wallace 1990). By that time, the Tohono O'odham people were living in the arid desert regions to the west of the Santa Cruz River, and groups that lived in the San Pedro and Santa Cruz valleys were known as the Sobaipuri (Doelle and Wallace 1990; Masse 1981). Both groups spoke the Piman language and, according to historic accounts and archaeological investigations, lived in oval jacal surface dwellings rather than pithouses. One of the larger Sobaipuri communities was found at Bac, where the Spanish Jesuits and later Franciscans constructed the mission of San Xavier del Bac (Huckell 1992; Ravesloot 1987). Due to the paucity of historic documents and archaeological research, however, little can be said regarding this poorly known period.

Spanish and Mexican Periods (A.D. 1697-1854)

Spanish exploration of southern Arizona began at the end of the seventeenth century A.D. Early Spanish explorers in the Southwest noted the presence of Native Americans living in what is now the Tucson area. These groups comprised the largest concentration of population in southern Arizona (Doelle and Wallace 1990). In 1757, Father Bernard Middendorf arrived in the Tucson area, establishing the first local Spanish presence. Fifteen years later, the construction of the San Agustín Mission near a Native American village at the base of A-Mountain was initiated, and by 1773 a church was completed (Dobyns 1976:33).

In 1775, the site for the Presidio of Tucson was selected on the eastern margin of the Santa Cruz River floodplain. In 1776, Spanish soldiers from the older presidio at Tubac moved north to Tucson, and construction of defensive and residential structures was begun. The Presidio of Tucson was one of several forts built to counter the threat of Apache raiding groups that had entered the region at about the same time as the Spanish (Thiel et al. 1995; Wilcox 1981). Spanish colonists soon arrived to farm the relatively lush banks of the Santa Cruz River, to mine the surrounding hills, and to graze cattle. Many indigenous settlers were attracted to the area by the availability of Spanish products and the relative safety provided by the Presidio. The Spanish and Native American farmers grew corn, wheat, and vegetables, and cultivated fruit orchards, and the San Agustín Mission was known for its impressive gardens (Williams 1986).

In 1821, Mexico gained independence from Spain, and Mexican settlers continued farming, ranching, and mining activities in the Tucson Basin. By 1831, the San Agustín Mission had been abandoned (Elson and Doelle 1987; Hard and Doelle 1978), but settlers continued to seek the protection of the presidio walls.

American Period (1856-Present)

Through the 1848 settlement of the Mexican-American War and the 1853 Gadsden Purchase, Mexico ceded much of the Greater Southwest to the United States, establishing the international boundary at its present location. The U.S. Army established its first outpost in Tucson in 1856 and, in 1873, founded Fort Lowell at the confluence of the Tanque Verde Creek and Pantano Wash, to guard against continued Apache raiding.

Railroads arrived in Tucson and the surrounding areas in the 1880s, opening the floodgates of Anglo-American settlement. With the surrender of Geronimo in 1886, Apache raiding ended and the region's settlement boomed. Local industries associated with mining and manufacturing continued to fuel growth, and the railroad supplied the Santa Cruz River Valley with the commodities it could not produce locally. Meanwhile, homesteaders established numerous cattle ranches in outlying areas, bringing additional residents and income to the area (Mabry et al. 1994). By the turn of the century, municipal improvements to water and sewer service, and the eventual introduction of electricity, made life in southern Arizona more hospitable. New residences and businesses continued to appear within an ever-widening perimeter around Tucson, and city limits stretched to accommodate the growing population. Tourism, the health industry, and activities centered around the University of Arizona and Davis-Monthan Air Force Base have contributed significantly to growth and development in the Tucson Basin in the twentieth century (Sonnichsen 1982).

Historical Development of the Project Area

Because the project area lies outside of metropolitan Tucson, few records trace the historical development of the property. Available references consist of historical U.S. Geological Survey (USGS) maps, Government Land Office (GLO) maps, aerial photographs obtained from the Arizona Historical Society, and GLO records administered by the U.S. Bureau of Land Management.

Completed as part of the Northern Tucson Basin Survey, an overview of historical resources has been compiled for the project area and surrounding property (Stein 1993). Few historical properties were identified, and these consist primarily of isolated homesteads and their associated irrigation canals which date from around the end of the nineteenth century into the 1920s. Stein (1993) found that many historic-period properties identified through archival research have been removed from the archaeological record by modern agriculture and development. Only one site, AZ AA:12:372 (ASM), was identified within 1 mi of the project area during the Northern Tucson Basin Survey. It is the Emmett Mix homestead located north of the present project area. The site consists of a house foundation and various related features which date to around World War I. A second historic-period occupation was recorded at AZ AA:12:736 (ASM) (Wellman 2000). This component includes the homestead of A. T. Clark, a small store, and a power plant for the local irrigation system.

The project area lies in the Cortaro Farms Irrigation Project, which was one of the first large-scale irrigation projects based on groundwater pumping (Mabbutt and Wilson 1980). It has been in operation since about 1916. Associated features include canals and wells. AZ AA:12:780 (ASM) and the historic-period component at AA:12:736 may relate to this endeavor.

Few cultural features are depicted on historical maps of the project area, suggesting the historic occupation was minor in this locale. The earliest representations of the project area comes from GLO maps dating from 1897 to 1915 that were derived from survey data collected in 1895. The railroad is shown running northwest in its present alignment. To the east, the Picacho-Tucson road meanders parallel to the railroad grade. Near the project area, the road runs north from Section 36 and would have crossed Cortaro Farms Road just east of the boundary between Section 25 and 26 (Hartman Lane). North of the project area, the road turns sharply west and runs back toward the railway. A second road is depicted running north through the center of Section 30 and would have also intersected the project area. These two roads were connected by a third segment that deviates from the Picacho-Tucson road south of the project area. It runs east across Section 25 and then turns

northeast. The road would have crossed present-day Cortaro Farms near the boundary between Section 25 and 30 (Camino de Oeste) and continued northeast to connect to the other major roadway.

GLO records indicate that property in and around the project area was homesteaded as early as 1862. Mateo Pacheco applied for a homestead patent in 1862 for lands adjacent to the project area in Sections 25 and 26. The patent was granted in 1908. The Southern Pacific Railroad began acquiring land in Sections 25 and 26 in 1892 as a part of an Indian reservation exchange. Patents on these railroad properties were issued in 1915. In 1916, Anna Lester and Joseph L. Neff applied for homestead patents in Sections 25 and 30, respectively. Neff's patent was granted in 1927, but Lester's was not issued until 1939. Available historical maps do not depict any features associated with these private homestead applications filed with the GLO.

Development of the project area has been quite slow until recently. Aerial photographs and USGS maps from 1968 through 1992 show limited evidence for development along Cortaro Farms Road. Most features depicted on these maps represent dispersed residential structures. Even today, many roads around the project area remain unpaved, as recent residential and commercial enterprises have outpaced the development of public infrastructure.

PREVIOUS RESEARCH IN THE PROJECT AREA

Numerous cultural resources surveys have been completed within and around the project area (Figure 2). The majority of the project area has been evaluated by linear and block surveys. Unsurveyed land in the project area includes only the property 250 m (650 ft) on either side of Hartman Lane, north of Cortaro Farms. Twelve previously recorded archaeological sites are located within 1 mi of the project area (Figure 3). Four of these, AA:12:285, AA:12:774, AA:12:780, and EE:3:53, are located in the Area of Potential Effects of the proposed construction project.

Previous Surveys

Documented as ASM survey number 1981-174, about half of the present project area was surveyed by the Northern Tucson Basin Survey (Fish et al. 1992; Madsen et al. 1993). This project was a major research-oriented reconnaissance survey of the northern Tucson Basin. Significant cultural resources were not identified in the present project area, but the survey recorded AZ AA:12:226, AZ AA:12:232, AZ AA:12:285, AZ AA:12:286, AZ AA:12:287, AZ AA:12:372, and AZ AA:12:396 within 1 mi. Boundaries of AA:12:285 have since been revised. The project area now includes part of this site.

The rights-of-way for the Union Pacific Railroad (formerly the Southern Pacific), I-10, and adjacent utility easements have been surveyed west of the project area. In 1955, the railroad alignment was surveyed for a petroleum pipeline (McConville and Holskamper 1955), and AZ AA:12:51 (ASM) was recorded. This same corridor was evaluated for a buried fiber optic cable by ASM survey number 1986-214 (O'Brien et al. 1987). The survey relocated sites AA:12:51 and AZ AA:12:232 (ASM) and recommended construction clearance without further archaeological work. Bernard-Shaw (1991) completed a cultural resources survey of the I-10 right-of-way in the vicinity of the project area (ASM survey number 1990-173). The survey was completed in preparation for continuing improvements to the interstate corridor, and AZ AA:12:736 (ASM) was recorded.

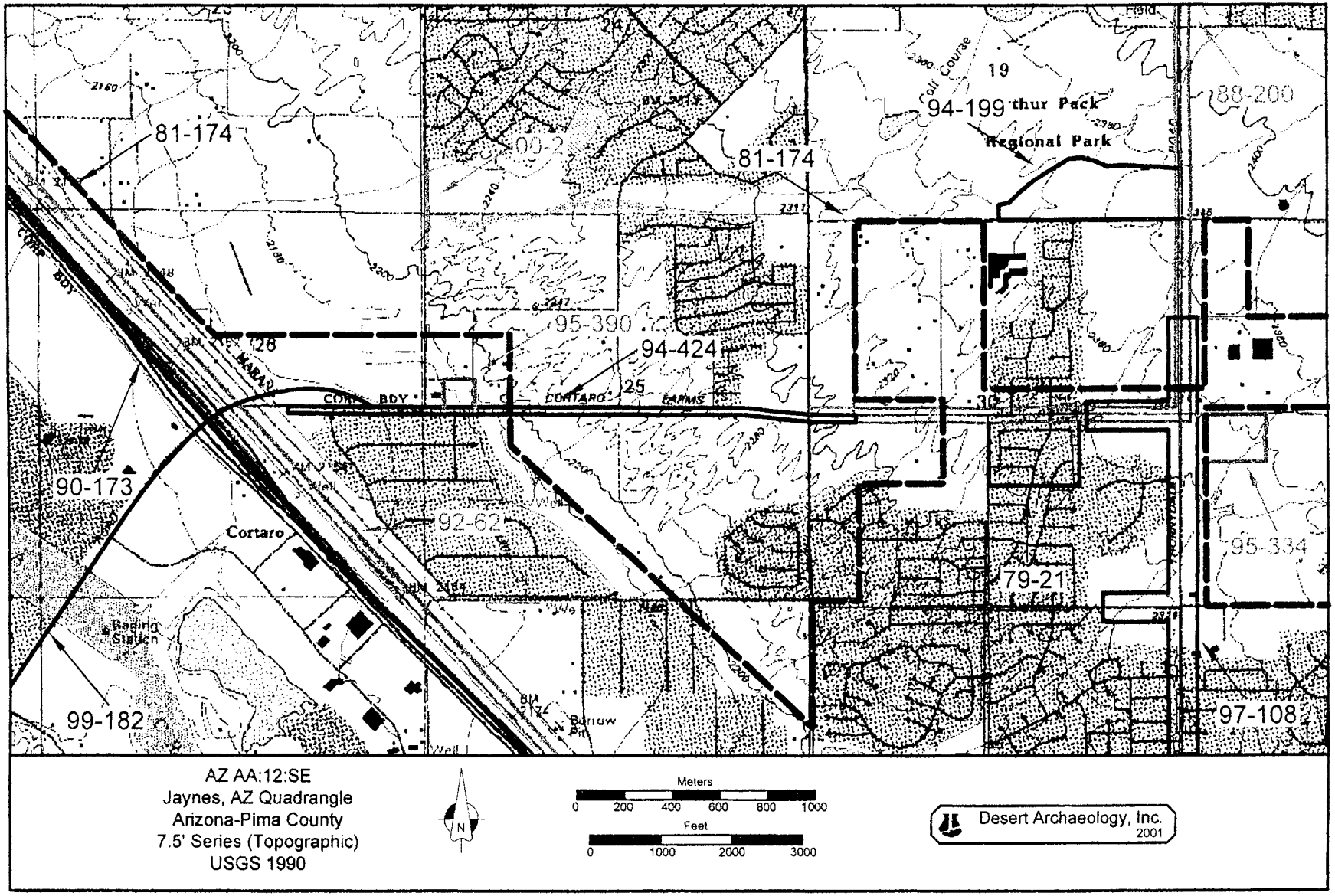

Figure 2. Previous archaeological surveys within 1 mi of the project area.

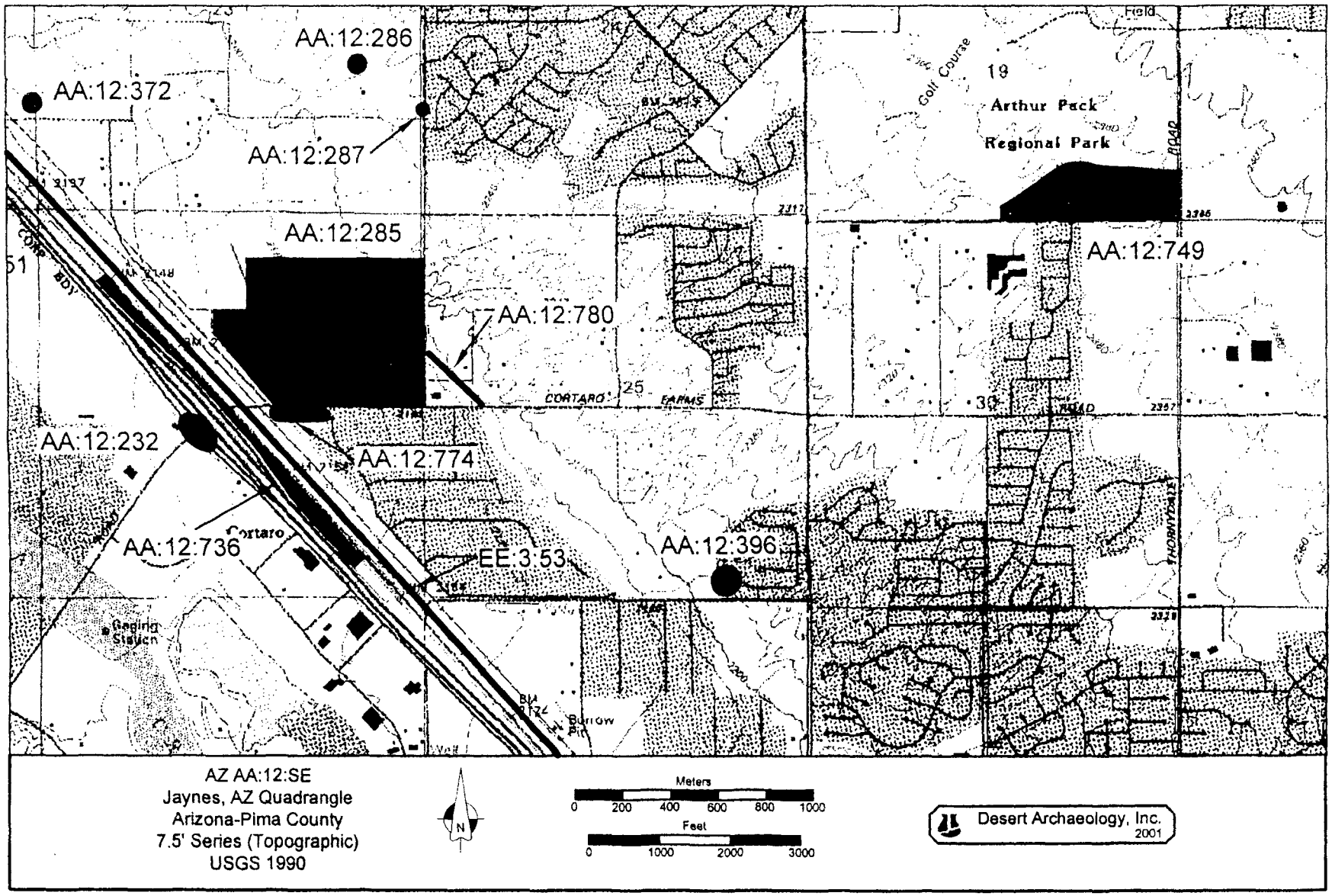

Figure 3. Previously recorded archaeological sites within 1 mi of the project area.

ASM survey number 1992-62 again evaluated the Union Pacific Railroad right-of-way for a buried petroleum pipeline (Adams and Macnider 1992). Archaeological sites were not recorded in the vicinity of the present project area; however, two artifact scatters were noted near Cortaro Farms Road. Artifact Scatter 4 is located south of Cortaro Farms Road and includes flaked stone, plain ware ceramics, and red-on-buff sherds. Artifact Scatter 5 is a concentration of plain ware sherds located north of Cortaro. These artifact scatters were later incorporated with AZ AA:12:736 (ASM) (Terzis et al. 1997; Wellman, ed. 2000). The survey also relocated AZ AA:12:736 (ASM), as previously recorded, and recommended archaeological testing at the site prior to construction. Additionally, monitoring was recommended in the vicinity of Cortaro Farms Road during construction of the pipeline.

Cortaro Farms Road and the project area has been the subject of five other investigations. ASM survey number 1979-21 was a small block survey located between Camino de Oeste and Thornydale Road south of Cortaro Farms. Other than locational data, ASM does not hold any additional information on this survey, but significant cultural resources were not identified. ASM survey number 1988-200 was a compliance survey for a buried water main (Heuett 1988). About 3 mi of road right-of-way in the present project area was evaluated. Cortaro Farms Road was surveyed between Camino de Oeste and Thornydale Road. Significant cultural resources were not recorded during the survey. The south side of Cortaro Farms Road from I-10 to east of Camino de Oeste was the focus for ASM survey number 1994-424. The survey related to a proposed wastewater pumping station and pipeline (Myers and Slaughter 1994). The survey identified four isolated artifacts and AZ AA:12:774 (ASM) near the intersection of Cortaro Farms and I-10. Avoidance of the site was recommended. An alternate location for the wastewater pumping station surveyed by Myers and Slaughter (1994) was evaluated by ASM survey number 1995-390 (Noll and Myers 1995). This small block survey is located northeast of the intersection of Hartman Lane and Camino de Oeste. The survey recorded a historic canal, AA:12:780 (ASM). The project determined the research potential of the site was exhausted and recommended that construction proceed at the proposed locality. ASM survey number 99-182 included a portion of the present project area (Archer and Wellman 1999). This survey evaluated the proposed realignment of Cortaro Farms Road west to I-10 and continued along Cortaro Road. Cultural resources were not reported.

Four additional surveys have been completed within 1 mi of the project area. ASM survey number 1994-199 evaluated a small parcel associated with developments at Arthur Pack Park (Slawson 1994a). The project identified AZ AA:12:749 (ASM), which is located north of the present project area. Associated with a proposed development, ASM survey number 1995-334 evaluated a small block east of the present project area (Swartz 1995). Significant cultural resources were not identified. ASM survey number 1997-108 was completed prior to the improvement and widening of Thornydale Road and its intersections (Elson 1997). The project evaluated Thornydale Road and a portion of Cortaro Farms Road. Cultural resources were not identified in the vicinity of the present project area. A segment of Hartman Lane, north of the present project area, was investigated by ASM survey number 2000-2 (Jones 2000). The survey was associated with proposed roadway improvements, and significant cultural resources were not identified.

Previously Recorded Sites

AZ AA:12:51 (ASM)

Initially recorded in 1955 (McConville and Holskamper), this site is a large prehistoric habitation site located north of the present project area along I-10. The Northern Tucson Basin Survey (Fish et al. 1992; Madsen et al. 1993) recorded an artifact scatter east of I-10 as AA:12:226, but this designation has since been subsumed by AA:12:51. Surface artifacts include Sweetwater Red-on-gray, Cañada del Oro Red-on-brown, Rillito Red-on-brown, and Santa Cruz Red-on-buff sherds. Desert Archaeology, Inc., completed a testing program at the site that revealed subsurface cultural features consisting of hearths, occupation surfaces, pits, and charcoal lenses (Bernard-Shaw et al. 1988). Some of these features are thought to date to the Archaic period. Much of this site has been impacted by modern development.

AZ AA:12:232 (ASM)

Located along Cortaro Farms Road west of I-10, this site was recorded by the Northern Tucson Basin survey (Fish et al. 1992; Madsen et al. 1993) as a scatter of flaked stone and plain ware pottery. Surface artifacts suggest a Hohokam occupation, but a subsurface testing program completed at the site revealed buried Archaic deposits (Slawson et al. 1986). Features included hearths and extramural pits. The periphery of the site was again tested by Desert Archaeology, Inc., with inconclusive results as to the nature and extent of cultural deposits (Bernard-Shaw et al. 1988).

AZ AA:12:285 (ASM)

Named for Shamrock Dairy, which once occupied the property, AA:12:285 is more popularly referred to as the Dairy site. It is an extensive habitation site located north of Cortaro Farms Road and west of Hartman Lane. Although known locally prior to recording, the site was first documented by the Northern Tucson Basin Survey in 1982 (Fish et al. 1992; Madsen et al. 1993). It has since been the subject of additional investigations.

Site records curated by ASM show the Dairy site as being located well north of the present project area. However, subsequent research has demonstrated that the site is more substantial, extending at least as far south as Cortaro Farms Road (Altschul and Huber 1995). The east-west extent of the site along its southern margin remains unclear, but likely extends from the Union Pacific Railroad grade to Hartman Lane.

The Dairy site contains copious evidence for stratified preceramic and ceramic occupations. It is arguably one of the most significant sites in the Tucson Basin and is pivotal to a developing framework of regional prehistory. Buried preceramic remains are dispersed across the horizontal extent of the site (Altschul and Huber 1995) but, as of yet, cannot be reliably assigned to either the Late Archaic or Early Agricultural period. These types of sites, in a subsurface context, are infrequent in the Tucson Basin and have only recently been a focus of investigation. Early Ceramic deposits are known at the site in addition to Hohokam Pioneer period materials (Altschul and Huber 1995). Pioneer sites are exceedingly rare in the Tucson Basin, and the dynamics of these occupations are essentially unknown. Compared to their frequency in the Tucson Basin as a whole, Hohokam Colonial, Sedentary, and early Classic phase deposits are not well represented at the Dairy site (Altschul and Huber 1995). Conversely, the following Tucson phase is rare throughout

the basin, but the Dairy site contains an extensive village component belonging to this phase. Additionally, historic-period canals have also been identified at the site (Altschul and Huber 1995).

Following its initial recording, the history of research at the Dairy site is convoluted. ASM recorded an artificial cutbank at the north end of the site which exposed deep, stratified cultural deposits (Fish et al. 1992). The site's significance was immediately obvious, and data derived from the ASM work became incorporated into a study of alluvial fan geomorphology and its relationship to prehistoric agriculture (Field 1985). During the early 1990s, the dairy ceased operation and its facilities were demolished. In 1994, the development of a residential housing community was proposed for the Shamrock Dairy property. Later that year, Cultural and Environmental Systems, Inc. (CES), completed a limited testing program on the property. Aztlan Archaeology later produced a publication documenting this research (Slawson 1994b). The quality of the testing program and its documentation have been questioned extensively by independent analysts (Altschul and Huber 1995; Dart 1994; Deaver and Altschul 1996).

Following the determination that the CES testing program was insufficient (Dart 1994), Statistical Research, Inc. (SRI), was contracted to conduct testing at the site (Altschul and Huber 1995), and later, a data recovery program (Deaver 1996). SRI's investigations have contributed significantly toward understanding the occupational sequence at the site, however, the work has not been thoroughly published. Importantly, testing by SRI essentially doubled the known extent of the Dairy site and documented intact buried cultural deposits at a depth of nearly 2 m below the present ground surface.

Tierra Archaeological and Environmental Consultants (Tierra) later monitored construction activities at the Dairy site, but to date these results have not been published. Tierra's findings concur closely with SRI's preliminary publications derived from testing and data recovery (Lee Fratt, personal communication 2001).

Despite the number of field projects completed at the Dairy site, little of the data are presently accessible. Given the expanse of the site and the regional significance of the occupations preserved there, archaeological testing and data recovery efforts have been inadequate. Modern development north of Cortaro Farms Road continues to adversely affect the integrity of this site, and some components have likely been destroyed. Based on the findings of prior investigations, the Dairy site is known to extend north from Cortaro Road between the Union Pacific Railroad track and Cerius Stravenue (Lee Fratt, personal communication 2001). However, the southern extent of the site between Cerius Stravenue and Hartman Lane has not been thoroughly tested. Subsurface testing has securely identified deeply buried cultural deposits immediately north of the proposed Cortaro Farms Road right-of-way.

AZ AA:12:286 (ASM)

This is a small multicomponent site containing remains of a historic-period structure dating to around 1940 and prehistoric agricultural features. The site is located north of the present project area and was initially recorded by the Northern Tucson Basin Survey (Fish et al. 1992; Madsen et al. 1993).

AZ AA:12:287 (ASM)

AZ AA:12:287 (ASM) was recorded during the Northern Tucson Basin Survey (Fish et al. 1992; Madsen et al. 1993) and consisted only of an isolated rock-filled hearth. The feature was excavated to recover macrobotanical samples and was found to contain maize. The site is located north of the present project area.

AZ AA:12:372 (ASM)

This site was recorded by the Northern Tucson Basin Survey (Fish et al. 1992; Madsen et al. 1993) and contains a historic-period structure and associated features which postdate World War I. The site has been identified as the Emmett Mix land purchase (Stein 1993). The site is located north of the present project area.

AZ AA:12:396 (ASM)

The Northern Tucson Basin Survey (Fish et al. 1992; Madsen et al. 1993) recorded this site south of Cortaro Farms Road. The site consists of a low-density scatter of undiagnostic Hohokam pottery.

AZ AA:12:736 (ASM)

This site was initially identified during a survey of the I-10 corridor as a scatter of undiagnostic pottery and flaked stone (Bernard-Shaw 1991). The site was recorded as being south of the Cortaro Farms interchange on the east side of I-10. Subsequent investigations have extended site boundaries to about 800 m north and south of Cortaro between I-10 and the eastern frontage road (Terzis et al. 1997; Wellman, ed. 2000). The site boundary to the east is arbitrary, based on the extent of I-10 right-of-way.

SWCA Environmental Consultants (SWCA) implemented testing and data recovery programs at AA:12:736. The site was found to contain extensive, deeply buried Late Archaic-Early Agricultural deposits overlain by shallow pre-Classic and Classic period Hohokam occupations. A historic-period component overlies the prehistoric materials and includes the remains of a homestead, a small store, a power station, irrigation-related features, and roads. The spatial relationship between this site and the adjacent sites, AA:12:232 and AA:12:774, was not addressed during investigations at AA:12:736.

Road and railroad building and natural erosion have clearly affected the surface integrity of the site. Despite this, testing and data recovery have clearly demonstrated that intact cultural stratigraphy underlies the surficial disturbance. As presently recorded, AA:12:736 lies west of the Cortaro Farms Road project area, but given the arbitrary nature of the eastern boundary, it likely extends beyond the I-10 and Union Pacific rights-of-way into the current study area.

AZ AA:12:749 (ASM)

This site is the remains of a historic structure and its associated trash scatters which date between 1930 and 1940 (Slawson 1994a). The site was recorded during ASM survey number 1994-199 and is located north of the present project area.

AZ AA:12:774 (ASM)

AA:12:774 is located immediately adjacent to Cortaro Farms Road near the I-10 interchange. The site was identified during ASM survey number 1994-424 (Myers and Slaughter 1994). The site includes dense flaked stone, pottery, and ground stone. A shell bracelet fragment was also observed during recording. Boundaries of the site are arbitrary, and the full extent of the site remains undetermined. It is likely to be considerably larger than presently recorded. This artifact scatter can likely be tied to AA:12:736, or even AA:12:285. This site falls within the scope of the present project area and has been disturbed by modern development in the locality.

Tierra was contracted to implement a testing program for a proposed construction project at the southwest corner of Cortaro Farms Road and Cerius Stravenue. Cultural deposits were discovered and the boundaries of AA:12:774 were expanded to include this manifestation. Tierra's testing program identified deeply buried cultural features, which were interpreted to be Late Archaic in age (Lee Fratt, personal communication 2001). Features included pits, an inhumation, and a canal. This investigation has yet to be published.

AZ AA:12:780 (ASM)

This is a historic canal segment identified during ASM survey number 1995-390 (Noll and Myers 1995). The canal runs between Hartman Lane and Cortaro Farms Road and was identified as the Cañada Canal, which was constructed in 1919. The feature consisted of a 20-ft-wide canal paralleled by low earthen berms. The site has since been destroyed by construction in the locality. It is recorded as being immediately adjacent to the present project area.

AZ EE:3:53 (ASM)

Within Arizona, tracks and associated features of the Southern Pacific Railroad have been recorded as EE:3:53 (Woodall 1996). Segments of this transcontinental railroad were first constructed as early as 1880, while tracks in the project area were laid after 1892. The integrity of the railway has been compromised over much of it length. Such is the case within the Cortaro Farms Road project area, where the railroad grade and its surroundings have been modified so substantially that it no longer maintains its original integrity.

SURVEY METHODS

Following archival research, the project area was surveyed by Michael Brack on 12 February 2001. The project area includes a 23 m (75 ft) right-of-way on either side of the existing Cortaro Farms Road centerline between the Union Pacific Railroad and Thornydale Road. This proposed right-of-way was evaluated with a single pedestrian transect on either side of Cortaro Farms. The western 400 m (.25 mi) of the proposed alignment is located north of the existing Cortaro Farms roadbed. In this vicinity, property located from 23 m (75 ft) south of Cortaro Farms to 23 m (75 ft) north of the proposed centerline was surveyed with a series of east-west transects spaced at no more than 15 m. The project area encompasses about 26.7 ha (66 acres). The existing Cortaro Farms roadbed occupies approximately half this area.

Ground surface visibility is variable across the extent of the project area. East of Hartman Lane, a low density of native ground cover provided visibility ranging from good to excellent. West of

Hartman, modern disturbance has provided localized settings for weedy annuals and grasses. Low areas along the Union Pacific Railroad right-of-way hold water during wet periods and contain dense, low vegetation that precluded adequate surface visibility. South of Cortaro Farms Road, two of these shallow depressions were holding water at the time of survey. AA:12:774 is located in this area.

Modern disturbance is extensive in the project area. It ranges from minor off-road vehicle traffic to substantial mechanical earthwork. Disturbance has had its greatest effect in the western portion of the project area where cuts and fills and general construction activities have either obscured or obliterated the modern ground surface. Because previously recorded archaeological sites occupy these areas, this disturbance had a negligible affect on the results of the survey.

SURVEY RESULTS

Fieldwork identified a single isolated occurrence (IO 1) and no new archaeological sites or historical properties in the project area. Of the four previously recorded sites within the scope of the project area, AA:12:285, AA:12:780, and EE:3:53 were positively relocated. Three historic-period roads were identified through archival research, but evidence for these roadways is no longer preserved in the project area.

IO 1 is a modern roadside memorial marker (see Figure 1 for location). It consists of a white wooden cross set upright into a ring of rounded river cobbles. A wooden plaque adorns the cross, which memorializes Johnny R. Munoz. The shrine is actively maintained, and recent offerings include a pottery cherub and flowers. Dates listed on the marker indicate it was constructed following December 2000. It is located south of Cortaro Farms Road, east of Hartman Lane. UTM coordinates (NAD 1927) for the IO are 492906E, 3580063N. The caretaker of the memorial has been identified as Ms. Sylvia Cupis of 7301 South Camino Vahcom, Tucson, Arizona, 85746.

Four previously recorded archaeological sites are located in the project area: AA:12:285, AA:12:774, AA:12:780, and EE:3:53. AA:12:285 was relocated during the present survey. The site is exposed on the north side of Cortaro Farms Road between Cerius Stravenue and Joplin Lane at the western end of the project area. The site may extend west of Joplin to the Union Pacific right-of-way, but dense vegetation in this area precluded adequate evaluation. Similarly, disturbance and development obscure the ground surface east of Cerius Stravenue to Hartman Lane, making assessment difficult. In the project area, the site is manifested as a light scatter of plain ware ceramics and flaked stone debitage. Surface and near surface disturbance to this locality has been extreme, and observed artifacts are in displaced context. The south side of Cortaro Farms was intensively surveyed, but evidence for the site was not noted. Disturbance south of Cortaro Farms is even more extreme than the north side. Much of the existing ground surface south of the roadbed is either redeposited fill or has been the result of deep mechanical grading. Previous investigations by Statistical Research and Tierra Archaeological and Environmental Consultants indicate that deeply buried cultural deposits are located immediately north of the proposed Cortaro Farms right-of-way at Cerius Stravenue (Altschul and Huber 1995; Deaver 1996; Lee Fratt, personal communication 2001).

The survey also relocated AA:12:780, a historic-period canal, near Cortaro Farms and Hartman roads. Modern development of the property, combined with disturbances to the road rights-of-way, appears to have destroyed all surface expressions of the site within the immediate project area and

to the north. The canal is visible, however, south of Cortaro Farms Road. Beyond the proposed right-of-way, it continues southeast for an unknown distance.

The Southern Pacific Railroad has been recorded as EE:3:53. The railway crosses the western extreme of the project area. In the project area, the tracks and grade appear to be of modern construction. There is no evidence remaining of the historic Southern Pacific Railroad other than the general alignment of the extant Union Pacific tracks.

AA:12:774 was not relocated. It is recorded as a scatter of ceramics and flaked stone located south of Cortaro Farms and east of the Union Pacific right-of-way to Cerius Stravenue. The property has been developed for commercial purposes, and the original ground surface appears to have been modified by grading and the deposition of fill. Around the perimeter of this commercial development, dense vegetation, and standing water affect ground surface visibility. Substantial mechanical disturbance is obvious, and there is only limited surface visibility in the vicinity of the site. Development, earthwork, and road building has likely led to the partial destruction of the site. Testing near its intersection with Cerius Stravenue has identified buried cultural deposits associated with AA:12:774 in the Cortaro Farms right-of-way.

SIGNIFICANCE ASSESSMENT

National Register of Historic Places

The National Register of Historic Places is the nation's inventory of historic sites. It was established after the passage of the National Historic Preservation Act of 1966 to promote preservation and study of historic resources. Most projects involving federal agencies, federal land, or federal funds require evaluation and mitigation of their impacts on properties eligible for the National Register. In addition, many state and local laws, ordinances, and regulations require similar evaluations.

In order for a property to be listed in the National Register, it must meet integrity requirements and at least one of four significance criteria. These criteria are summarized in Table 2. An important aspect of significance is a property's historic context (cultural affiliation and dates of use). If a historic context cannot be established, or if the property cannot be shown to be significant within its historic context, then it does not meet eligibility requirements for the National Register. Furthermore, except in special circumstances, properties must be at least 50 years old to be considered for inclusion in the National Register.

Assessment of AZ AA:12:285 (ASM)

The Dairy site is an extensive habitation locale that manifests evidence for a nearly continuous occupation from Late Archaic or Early Agricultural times through the Hohokam Classic period. The site is deeply stratified and contains intact structural, extramural, and mortuary features. AA:12:285 contains Late Archaic and/or Early Agricultural, Pioneer period, and Tucson phase components, which are rare throughout the Tucson Basin. The site has the potential to address critical issues of chronology, the development of agriculture and sedentism, and sociocultural affiliations. Despite extensive disturbance to surface and near-surface deposits at the site, previous testing and data recovery projects (Altschul and Huber 1995; Deaver 1996) have evidenced intact, stratified deposits

Table 2. National Register eligibility criteria (Code of Federal Regulations, Title 36, Part 60).

The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:	
A.	That are associated with events that have made a significant contribution to the broad pattern of our history; or
B.	That are associated with the lives of persons significant in our past; or
C.	That embody the distinctive characteristics of a type, period, or method of construction or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
D.	That have yielded, or may be likely to yield, information important in prehistory or history.

and features. AA:12:285 meets eligibility requirements for inclusion in the National Register of Historic Places under Criterion D.

Assessment of AZ AA:12:774 (ASM)

This site was recorded as a surface scatter of prehistoric artifacts. Subsequent archaeological testing has documented occupations during Late Archaic or Early Agricultural times into the Early Ceramic or Hohokam periods (Lee Fratt, personal communication 2001). Little information is available as to the extent, nature, and preservation of these archaeological deposits. However, buried cultural stratigraphy is preserved at this site. Given their close spatial relationship, cultural remains at AA:12:774 may address similar issues as the Dairy site. This site meets eligibility requirements for inclusion in the National Register of Historic Places under Criterion D.

Assessment of AZ AA:12:780 (ASM)

This site was the remains of a historic-period canal. It has since been affected by the industrial development of the property. The integrity of the site in this locale has been destroyed, and no evidence for the site is preserved in the current project area. Furthermore, it has been previously determined that the data potential of this site has been exhausted (Noll and Myers 1995). The integrity of the site has been compromised in and near the Cortaro Farms project area, and this segment does not contribute to the eligibility of the site as a whole. However, AA:12:780 may maintain sufficient integrity to meet eligibility requirements for inclusion in the National Register of Historic Places along other segments of the canal, south of the current project area under Criterion D.

Assessment of EE:3:53 (ASM)

The historic-period railroad grade of the Southern Pacific Railroad has been recorded as EE:3:53. The integrity of the Southern Pacific Railroad has been compromised in the project area. Evidence of the historic line is not preserved in the project area, and this segment of the site does not contribute to the eligibility of the site as a whole. However, portions of the historic-period Southern Pacific alignment, outside of the project area, may maintain sufficient integrity for inclusion in the National Register of Historic Places under Criteria A and/or D.

Assessment of Isolated Occurrences

IO 1 is a modern roadside memorial shrine that was constructed after December 2000. The marker does not meet minimum age guidelines of the National Register; therefore, a historic context cannot be demonstrated. IO 1 does not meet eligibility requirements for inclusion in the National Register of Historic Places under any criterion. The memorial cannot be considered a significant cultural resource, but it is nonetheless a noteworthy modern feature that carries cultural value.

ASSESSMENT OF PROJECT EFFECT

Pima County has proposed upgrading the infrastructure of Cortaro Farms Road between the Union Pacific Railroad near I-10 and Thornydale Road. The project will involve the demolition of Cortaro Farms Road and the reconstruction of a wider roadbed. Additionally, Cortaro Farms will be realigned slightly at the western end. Cortaro Farms Road will be resurfaced with the addition of gutters, drainage features, and landscaping. Extensive earthwork is anticipated.

As proposed, the widening and refurbishment of Cortaro Farms Road will result in direct, adverse effects to National Register-eligible sites AA:12:285 and AA:12:774. Any disturbance to these sites has the potential to destroy intact subsurface cultural deposits and features, but until construction plans are finalized, details of the project's effects cannot be adequately projected. Archaeological testing and data recovery programs have been completed adjacent to the proposed Cortaro Farms right-of-way and have demonstrated the existence of buried cultural stratigraphy. However, these limited investigations focused only on a small segment of the sites' overall manifestations.

AA:12:780 and EE:3:53 will also be affected by the improvement of Cortaro Farms Road. Although other segments of these sites may maintain adequate integrity for inclusion in the National Register of Historic Places, portions within the Cortaro Farms Road project area do not meet eligibility requirements. Because their integrity was compromised previously, the project will not result in an adverse effect to these sites.

Unless steps are taken to avoid impacting the feature, the proposed project will destroy the memorial marker recorded as IO 1.

RECOMMENDATIONS

The proposed demolition and reconstruction of Cortaro Farms Road will adversely affect the integrity of sites AA:12:285 and AA:12:774. Avoidance of these two sites is not a feasible option because of existing development and infrastructure and the density of the National Register-eligible sites that abut the western margin of the project area.

The boundaries of AA:12:285 and AA:12:774 are essentially arbitrary, based on the spatial limits of the projects themselves, rather than the distribution of cultural artifacts and features. Modern disturbance obscures the ground surface at these sites in the present project area. This limits the applicability of surface evaluations. Previous archaeological research in the western portion of the project area has clearly demonstrated the ubiquity of intact, subsurface cultural stratigraphy underlying a modest surface manifestation (Altschul and Huber 1995; Bernard-Shaw 1991; Bernard-Shaw et al. 1988; Deaver 1996; Slawson et al. 1986; Terzis et al. 1997; Wellman, ed. 2000). Therefore,

AA:12:285 and AA:12:774 must be considered as expressions of a larger cultural phenomena which is closely tied to the ecotone of the terminal bajada and the floodplain of the Santa Cruz River.

Desert Archaeology, Inc., recommends that the project area west of Hartman Lane to the Union Pacific Railroad be subject to additional archaeological investigation prior to any ground-disturbing activities. In the western portion of the project area, where the proposed alignment deviates from the existing roadbed, lands between the southern Cortaro Farms right-of-way and the northern limit of the proposed alignment should be included within the scope of this additional archaeological work. Desert Archaeology, Inc., recommends that appropriate archaeological data recovery and monitoring plans be developed, approved, and implemented to mitigate impacts of the proposed construction.

Additionally, destruction of the modern memorial marker recorded as IO 1 can be avoided by the proposed construction project. The feature will not be affected if it is moved about 25 m (82 ft) south of its present location. It is recommended that Pima County and/or MMLA contact the caretaker of the memorial to discuss appropriate preservation alternatives.

AA:12:780 and EE:3:53 are also located within the Area of Potential Effects of the project. These sites have been destroyed in the project area by prior construction and do not maintain sufficient integrity to qualify for inclusion in the National Register of Historic Places. Therefore, no additional archaeological work is recommended at these sites prior to construction in the project area. The proposed right-of-way may be developed without regard to AA:12:780 and EE:3:53.

Significant archaeological sites were not identified east of Hartman Lane during this or other previous surveys. Therefore, it is recommended that the project proceed in this area without further archaeological investigations. However, if cultural materials are encountered unexpectedly during construction, work should be temporarily halted until the nature and significance of these remains can be assessed by a professional archaeologist.

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BIOLOGICAL EVALUATION

PIMA COUNTY DEPARTMENT OF TRANSPORTATION AND FLOOD CONTROL DISTRICT BOND PROJECT

CORTARO FARMS ROAD, UPRR TO THORNYDALE ROAD (W.O. # 4TCFIT)

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February 23, 2001

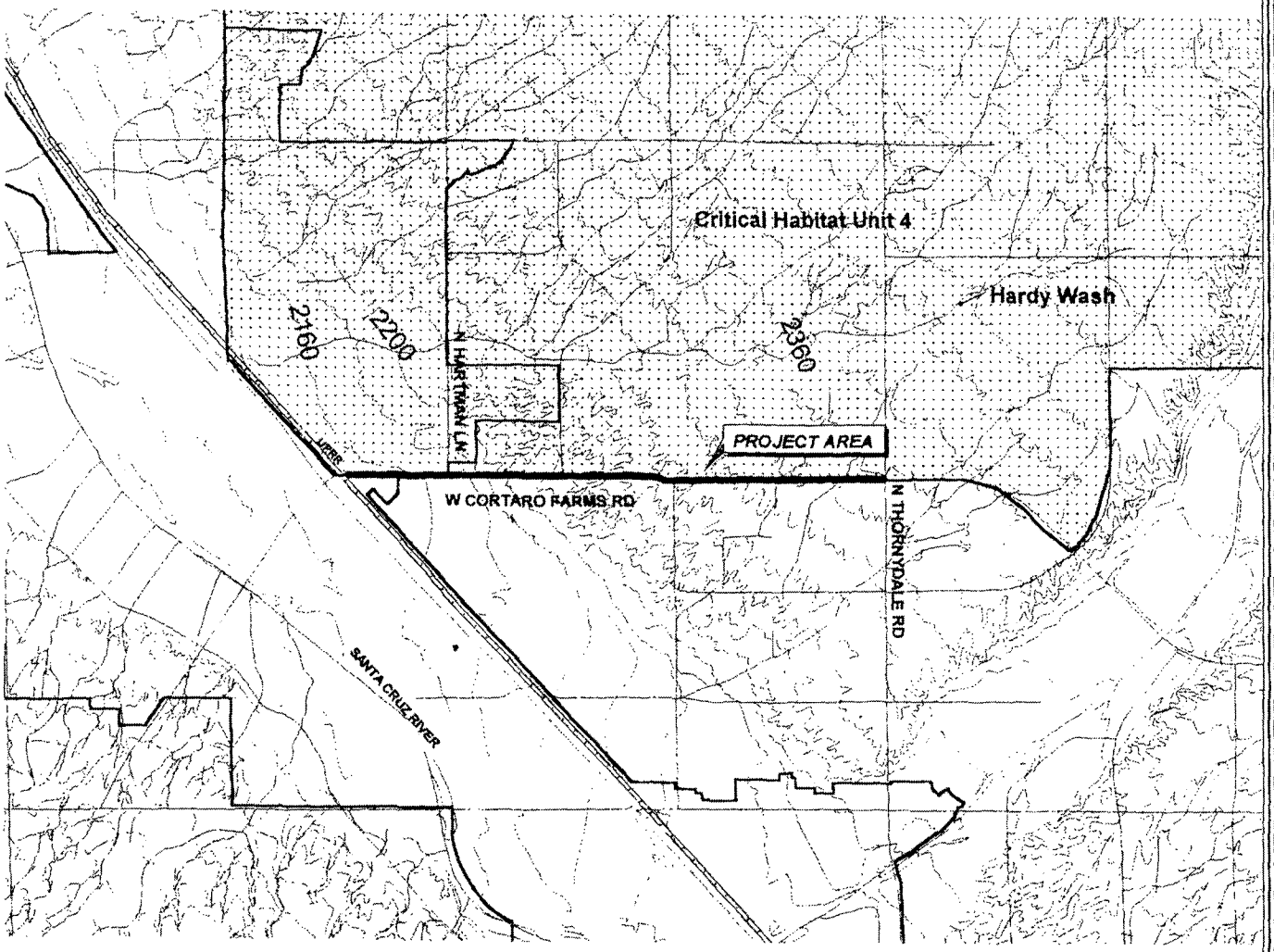
1. Project Location

We conducted a biological evaluation of a proposed road widening project for a Pima County Department of Transportation District Bond Project in northwest Tucson and Marana, Arizona, to determine the presence or absence of special status species. The road widening project is located along 2.2 miles of Cortaro Farms Road from the Union Pacific Rail Road (UPRR) to 1000 feet west of Thornydale Road (Figure 1). The western 0.5 mile section of the route is located within Marana town limits and the remaining 1.7 miles of the road are located within unincorporated Pima County. Specifically, the site was located within Sections 25 and 26 of Township 12 South, Range 12 East and Section 30 of Township 12 South, Range 13 East (G&SRM). The northern ROW of Cortaro Farms Road is the southern recorded boundary of federally designated critical habitat (Unit 4) for the cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*), a federally listed endangered species. Unit 4, encompasses lands with the highest known population of pygmy-owls in northwest Tucson. The USFWS delineated the areas of concern; ¼ mile west of Thornydale Road and from the Camino de Oeste alignment of west to Spanish Bayonet. The delineation incorporates all areas that support undisturbed, native vegetation on both sides of Cortaro Farms Road, washes, and areas with large stands of trees.

Based on communications with Arizona Game and Fish Department (AGFD) and the U.S. Fish and Wildlife Service (USFWS) we have been advised to treat both the northern and southern ROW as though both are in critical habitat. AGFD confirmed a pygmy-owl territory in February 2001 south and west of the Thornydale/Cortaro Farms roads intersection.

Figure 1: Project Location Map

Pima County Department of Transportation and Flood Control District
Proposed Road Widening Project
Cortaro Farms Road: UPRR to Thornydale Road



0.5 0 0.5 1 Miles

N
W E
S

Project Area
Topography
Railroads
Wash Network *
Street Network
Town of Marana Boundary
Pygmy-Owl Habitat - Unit 4

* Some washes not shown.

HARRIS ENVIRONMENTAL GROUP INC

2. Project Description

The Bond Project consists of widening 2.2 miles of Cortaro Farms Road from a 2-lane to a 4-lane road with raised medians, multi-use lanes, curbs, drainage and landscaping. The minimum right-of-way (ROW) will be 150 feet wide, 75 feet from the center line of the existing road. Of the 4 travel lanes, 2 will be 14-foot and 2 will be 12-foot wide with 2 10-foot wide multi-use lanes. The multi-use lanes will include gutter and curb. The shoulder and median will be landscaped using native desert plantings to mimic the surrounding undisturbed vegetation. Drainages will be sufficient to convey the 100-year storm rates for all washes crossed.

The project will encompass approximately 40 acres of ROW (2.2 miles X 150 feet). Of this, approximately 76% (30.59 of 40 acres) will incorporate either currently or previously disturbed ROW. This includes shoulders, easements, and newly landscaped buffer areas for adjacent developments. The remaining 9.41 acres will encompass undisturbed, native vegetation.

3. Project Area

We conducted our initial site assessment on 13 November 2000 and surveys for the pygmy-owl on January 2, 3, 22, 24, 25, and 26, and on February 15, 16, and 19, 2001. Topography at the site was varied and sloped to the west. Topography was relatively flat with an elevation of approximately 2160 feet (above mean sea level) near the UPRR and gradually rose to 2180 feet east of Hartman Lane. This area of gently sloping topography was originally associated with the Santa Cruz River floodplain. The Santa Cruz River is located approximately ½-mile west of the UPRR/Cortaro Farms Road intersection. Although flood control measures minimize the possibility of the river overflowing its banks, the project area is considered a

FEMA floodplain. East of Hartman Lane the topography changes and the elevation climbs to 2360 feet near Thornydale Road. No surface water was present during our field visits.

Surrounding land use included commercial business (CB-1), suburban ranch (SR), high density housing (CR-4 and CR-5) and suburban housing (SH). Quail Run Elementary School was located north of Cortaro Farms Road, 1 mile west of Thornydale Road. Commercial businesses included a gas station (under construction) and a Wendy's fast food restaurant.

Several minor washes crossed Cortaro Farms Road in a northeast-to-southwest orientation. A channeled wash crossed the project area east of Hartman Lane where the elevation began to climb. The wash supported vegetation typically found in an area that has been previously disturbed. Larger washes crossed Cortaro Farms Road near Camino de Oeste, Quail Run Elementary School, and Thornydale Road. These washes are tributaries to the larger Hardy Wash, located approximately 1/2 mile north of the project area. Hardy Wash, through a complex system of washes, provides connectivity between the Santa Cruz River and the Tortolita Mountains north of Oro Valley.

The project area supported vegetation within the Arizona Uplands Subdivision of the Sonoran Desert (Brown 1994). Within the project area, vegetation was divided into 2 categories based on value to wildlife species; undisturbed and disturbed.

The undisturbed portions of the ROW supported vegetation typical of the Arizona Uplands. Plants included canopy species such as paloverde *(Cercidium microphyllum* and *C. floridum)*, ironwood *(Olneya tesota)*, and mesquite *(Prosopis velutina)* trees; shrubs species such as desert hackberry *(Celtis pallida)* and creosote bush *(Larrea tridentata)*; and ground cover species such as desert senna *(Cassia covesii)* and brittle bush *(Encelia farinosa)*. Several species

of cacti were identified in the project area including cholla and prickly pear *(Opuntia* spp.*)*, barrel *(Ferocactus wislizenii)*, and saguaro *(Carnegiea gigantea)*.

Vegetation within the disturbed portions of the ROW was less diverse. The canopy layer was lacking and shrub species included desert broom *(Baccharis sarothroides)* and creosote bush. Ground cover species, when present, were dominated by weeds including Russian thistle *(Salsola tragus)* and pigweed *(Amaranthus* spp.*)*. Large areas within the disturbed portions of the ROW consisted of bare ground. Although vegetation within newly landscaped areas adjacent to developments contained native plants, these areas generally failed to mimic the surrounding vegetation. Bare ground was prevalent and trees were immature and heavily manicured. Additional plant species identified are presented in Appendix A.

Wildlife species seek areas of native vegetation that are diverse in plant species and structure. Structural diversity includes layers of vegetation such as a canopy (tall trees or cacti), a midstory (small trees, shrubs, and cacti), and understory or groundcover (sub-shrubs, cacti and grasses). These layers of vegetation combine to create foraging, nesting, and escape habitats for wildlife species. Vegetation within the undisturbed portions of the ROW supported a high degree of structural diversity. The disturbed and newly landscaped areas lacked structural diversity typically preferred by some wildlife species.

Wildlife species observed on the site were limited to birds, an unidentified lizard species, coyote *(Canis latrans)*, and javelina *(Tayassu tajacu)*. Some of the bird species observed on the site included pyrrhuloxia *(Cardinalis sinuatus)* and common raven *(Corvus corax)*. For non-sensitive species we did not conduct any quantitative wildlife surveys. Instead, we noted the species which were present or for which we observed distinct signs (scat, tracks, bones, skin) (Appendix A).

4. Species Identification

Special status species are plant and wildlife species that are of concern because their populations are either in jeopardy of extinction or are declining in size. We contacted state and federal natural resource agencies, USFWS and AGFD, requesting information on possible special status species (sensitive, threatened, and endangered species) that may exist on or near the site.

In a letter dated 2 October 2000, David L. Harlow, Field Supervisor, USFWS, listed 17 federal threatened and endangered species and 5 federal candidate species that occur in Pima County. Secondly, in a letter dated 1 May 2000 (and updated on 11 December 2000), AGFD listed 9 special status species that are known to occur in the vicinity of the project or may be expected to occur on the site if suitable habitat exists. The information listed in the letter was based on the Department's Heritage Data Management System. In addition, the AGFD letter stated the project site was located within critical habitat of 1 endangered species. We surveyed the 2.2-mile Pima County Bond road improvement project for these 9 special status species:

Common Name	Scientific Name	Status
cactus ferruginous pygmy-owl	*Glaucidium brasilianum cactorum*	LE, WC
California leaf-nosed bat	*Macrotus californicus*	SC, S^2, WC
cave myotis	*Myotis velifer*	SC, S^2
fulvous whistling-duck	*Dendrocygna bicolor*	SC, S^2
Pima Indian mallow	*Abutilon parishii*	SC, S^1, SR
Sonoran desert tortoise	*Gopherus agassizii* (Sonoran population)	SC, WC
sparseleaf hermannia	*Hermannia pauciflora*	S^1
Tucson Mountain spiderling	*Boerhavia megaptera*	S^1
Tumamoc globeberry	*Tumamoca macdougalii*	SR, S^1, S^2

Status Definitions

LE: Listed Endangered. Species identified by the USFWS under the Endangered Species Act as being in imminent jeopardy of extinction.

WC: Wildlife of Special Concern in Arizona. Species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the AGFD's listing of

Wildlife of Special Concern in Arizona (WSCA, in prep.). Species included in WSCA are currently the same as those in **Threatened Native Wildlife in Arizona** (1988).

SC: **Species of Concern.** The terms "Species of Concern" or "Species at Risk" should be considered as terms-of-art that describe the entire realm of taxa whose conservation status may be of concern to the USFWS, but neither term has official status (currently all former C2 species).

S^1: **Sensitive.** Species classified as "**sensitive**" by the Regional Forester when occurring on lands managed by the U.S.D.A. Forest Service.

S^2: **Sensitive.** Those taxa occurring on Bureau of Land Management (BLM) Field Office Lands in Arizona which are considered "**sensitive**" by the Arizona State Office of the BLM.

SR: **Salvage Restricted.** Those Arizona native plants not included in the Highly Safeguarded Category, but that have a high potential for theft or vandalism, as described by the Arizona Native Plant Law (1993).

Of these species, the cactus ferruginous pygmy-owl is listed as endangered under the Endangered Species Act (ESA) of 1973. The results of our survey showed that there was habitat for 3 special status species: the cactus ferruginous pygmy-owl, the Sonoran Desert tortoise, and the desert night blooming cereus *(Penicereus greggii* var. *greggii)*. We met with representatives of the USFWS and AGFD on 4 January 2001 to discuss the project and its potential impact to the cactus ferruginous pygmy-owl and its critical habitat.

Although the night blooming cereus, which is protected by the Arizona Native Plant Law (and is classified as salvage restricted), did not appear in the agency correspondence, 1 specimen was identified within the Cortaro Farms Road ROW. Species included in the USFWS list but excluded from further evaluation are addressed in Appendix D.

We surveyed the length of the ROW for plant species and habitat for the vertebrate special status species on 13 November 2000 and conducted surveys for the endangered cactus ferruginous pygmy-owl in spring 2001. Pygmy-owl surveys were conducted on January 2, 3, 22, 24, 25, and 26, and on February 15, 16, and 19, 2001. While the results of our 2001 survey effort were negative (no pygmy-owls were detected), AGFD located a pygmy-owl in February 2001 near the intersection of Cortaro Farms and Thornydale roads.

SURVEY METHODOLOGY AND RESULTS

We surveyed the property for special status species and their habitat. The results are described below by species, with those having federal protection listed first.

1. Federal Sensitive Species

These are federally protected species under the Endangered Species Act of 1973. Endangered species status implies that the species are in imminent jeopardy of extinction.

A. Cactus ferruginous pygmy-owl (LE, WC):

General: The Arizona population of the pygmy-owl was federally listed by the USFWS as endangered in March 1997 (USFWS 1997) and critical habitat was designated in July 1999 (USFWS 1999). In southern Arizona 731,712 acres of riverine, riparian, and upland habitat were designated as critical habitat, with 260,883 of those acres in Pima County. Under the designation of critical habitat, protected blocks of land, or units, were created. The units represent areas in need of protection because of the current presence of pygmy-owls, or future potential use by pygmy-owls to use the lands for breeding or dispersal.

The northern ROW of Cortaro Farms Road is the southern recorded boundary of Unit 4, which encompasses lands with the highest known population of pygmy-owls in northwest Tucson. Based on communications with AGFD and USFWS at our 4 January 2001 meeting, we were advised to treat both the northern and southern ROW the same, as though both are in critical habitat. Prior to 2001 AGFD had identified pygmy-owls north and south of the roadway widening project. In February 2001, AGFD confirmed an occupied territory south and west of the Thornydale/Cortaro Farms roads intersection.

Distribution: Pygmy-owls have been documented in several habitat types in the northern portion of its range in Arizona and adjacent Mexico. In Arizona, these include streamside Sonoran riparian deciduous forest and woodland associations, and Sonoran Desertscrub representative of

the Arizona Upland subdivision. Pygmy-owls also inhabit Sinaloan Deciduous Forest and Thornscrub in Mexico (not discussed here). The streamside associations include such species as cottonwood *(Populus fremontii)*, ash *(Fraxinus pennsylvannica* var. *velutina)*, net-leaf hackberry *(Celtis reticulata)*, willows *(Salix* spp.*)*, velvet mesquite, and others. The Sonoran Desertscrub associations are composed of relatively dense saguaro cactus stands associated with short trees such as paloverde, mesquite, and ironwood, and an open understory of triangle-leaf bursage, creosote bush, and various other cacti and shrubs. Throughout its range, the pygmy-owl occurs at low elevations, generally below 4,000 feet.

Pygmy-owls found in Sonoran Desertscrub habitats are typically found associated with structurally diverse stands of desert riparian scrub with saguaros along washes. Such habitat is often referred to as xeroriparian vegetation (Johnson and Haight 1985). These washes have no permanent water flow; instead, flow is intermittent and based on seasonal rainfall as well as strength and duration of individual storms. Desert riparian scrub vegetation is easily recognizable by the presence of a linear assemblage of trees and shrubs that grow along the wash. These plants are denser and taller than the sparse desertscrub vegetation that typically exists in the adjacent uplands. Just prior to listing the species as endangered, all of the known pygmy-owls were documented in such Sonoran Desertscrub habitat (Lesh and Corman 1995, Abbate and Ditty 1996).

At the northern periphery of the subspecies' range in southern Arizona, pygmy-owl distribution and preferred habitat is not well understood. However, it is believed that the pygmy-owl requires the cover of denser wooded areas with understory thickets, like riparian areas, for nesting, foraging, and predator avoidance. Riparian areas also are known for its high density and diversity of animal species that constitute the pygmy-owl's prey base.

A significant decline in the Arizona population has occurred over the past several decades (USFWS 1997, Richardson et al. 2000). Loss or modification of habitat from woodcutting, agriculture, groundwater pumping, and related human activities is believed to be the reasons for the population decline.

Natural History: Very little is known about the life history of pygmy-owls in Arizona (Cartron et al. 2000). Little or no literature currently exists concerning life history variables such as longevity, age distribution, age to maturity, and recruitment. Studies currently being undertaken will examine these variables.

The diet of pygmy-owls is not well understood, but the owl is believed to be a prey generalist (Cartron et al. 2000). Observations, stomach content analysis, and records of Texas pygmy-owls suggests that the pygmy-owls have a diverse diet that includes mammals, birds, reptiles, and insects (Proudfoot and Beasom 1997).

The pygmy-owl nests in cavities of larger trees (typically defined as a tree with a trunk at least 6 inches in diameter, measured at breast height) or large columnar cactus. Cavities may be naturally formed (e.g. knotholes) or excavated by woodpeckers. Pygmy-owls do not construct their own nest holes. All currently known pygmy-owl nest sites in Arizona are in woodpecker-excavated holes in saguaros. Historically, the species also has been documented nesting in cottonwood *(Populus fremontii)*, paloverde, and mesquite trees in Arizona.

Nesting activity for this owl species in Arizona begins in late winter to early spring (Lesh and Corman 1995, Abbate et al. 1996). Little is known about its courtship flight behavior. Egg laying begins by late April with 3 to 4 eggs typically laid. It is uncertain if only 1 brood is hatched per year. Nestlings have been observed through the end of July. During nesting, the male brings food to the female and young (Glinski 1998).

The majority of pygmy-owl sightings in Arizona identified between 1993 and 2000 were in, or peripheral to, dense desertscrub thickets bordering dry desert washes. Dominant plants in these washes include paloverde, ironwood *(Olneya tesota)*, mesquite, acacia *(Acacia* spp.*)*, canyon ragweed *(Ambrosia ambrosioides)*, various shrubs, as well as saguaro and/or organpipe cactus *(Stenocereus thurberi)*.

Current Site Conditions: Vegetation along most of the project area supported potential habitat for the cactus ferruginous pygmy-owl. Specifically, there were trees and saguaro cacti large enough to support cavities. Also, areas within and between the washes supported dense and structurally diverse native vegetation required by the pygmy-owl for nesting, foraging and escape cover. A section (approximately 1,700 feet) of predominately disturbed vegetation and a highly developed area (commercial and high density residential) at the west end of the project area did not support habitat components for the owl. In total, we estimated 9.41 acres of potential pygmy-owl habitat along the ROW.

Pygmy-owls have been documented in the vicinity of the project area since 1995 and in 2001 a single male territory was confirmed 1/3 mile south of the Cortaro Farms/Thornydale roads intersection (persn. comm., S. Richardson, Region 5 Urban Wildlife Specialists, 21 February 2001). In previous years a pair was identified north of Cortaro Farms Road, near Old Father Road, but in the fall of 1999 the male owl died. Although the female did not respond to 2000 survey attempts, she may continue to hold the territory. Another breeding pair of owls was documented in the vicinity of Hardy Wash and Camino de Oeste from 1995–1997. The pair fledged young that dispersed to the Hartman/Overton area. In 1999 dispersing juvenile owls were documented crossing Cortaro Farms Road west of Thornydale Road.

Although none of the territories are centered at the project area, several of the territories overlap the area. Exact size of pygmy-owl territories is still unknown, however AGFD has estimated the territory radius at 600 meters (approximately 1/3 mile) from the nest location.

Surveys: In 2001 we surveyed the length of the ROW for pygmy-owls 3 times during the spring field season following the survey protocol (USFWS 2000). We surveyed the site in the late afternoon/early evening (1 hours before sunset, ending no later then 1 hour after sunset) on 2 and 3 January and in the early morning (1 hour before sunrise, ending no later then 2 hours after sunrise) on 2, 3, 22, 24, 25, 26 January, and 15, 16, and 19 February 2001. At least 1 of the surveys was conducted during the required time period of February 15–April 15, when the owl is most active. The surveys did not occur during adverse weather conditions such as rain or high winds.

The 2001 survey followed the USFWS survey protocol and used the broadcast call methodology (USFWS 2000). Each call-point was located at an interval of 150 meters. At each call-point, a 2-minute listening period was conducted prior to broadcasting taped calls. Following the initial listening period, calls were broadcast for 30-seconds followed by a 90-second listening and observation period at each of the 4 cardinal directions and a 5th random direction (approximately 10 minutes). After completing the 10-minute survey/listening sequence, an additional 3-minute observation/listening period was conducted. We used a Johnny Stewart Caller set at medium volume to broadcast a taped cactus ferruginous pygmy-owl call. The caller speaker was placed between waist and chest height during each call broadcast.

We broadcast 34 call points (17 on each side of the road) along Cortaro Farms Road from the UPRR to Thornydale Road during the first 2 surveys and 27 call points during the 3rd survey (195 call points total) of the spring 2001 field season. The shortened call route during the 3rd

survey was in response to AGFD's confirmation of an occupied territory south of Cortaro Farms Road. We were requested by Pima Count Department of Transportation and Flood Control District (and in response to a request from AGFD) to stop conducting call points along Cortaro Farms Road from Thornydale to Old Father Road. Conducting surveys within close proximity of a known territory would constitute harassment of the pygmy-owl under the ESA.

Noise from vehicular traffic was loud during our field visits and noise from Cortaro Farms Road could have made detection of a pygmy-owl difficult. Call points were placed within the proposed ROW, but as far from the roadway as possible. Because of the traffic volume on the road we tried to schedule most of the survey sessions during the early morning hours, when traffic was less intense.

We received no confirmed response to our taped call during the survey period, nor did we observe any birds. Furthermore, we did not observe any significant mobbing behavior characteristic of the gnatcatcher *(Polioptila* spp.*)* or verdin *(Auriparus flaviceps)* in response to the calls. As these owls are predators of small birds and other animals, gnatcatchers and verdins familiar with an owl typically "mob", or show signs of activity when owl calls are broadcast.

Three years (2001, 2002, 2003) of surveys will be conducted for this project. A 3rd survey year will be conducted to ensure 2 years of consecutive surveys prior to actual construction.

Concerns: Maintaining connectivity across Cortaro Farms Road after it is widened to 4 lanes is a concern of the AGFD and USFWS (4 January 2001 meeting). The flight pattern of the pygmy-owl is short and from tree to tree (Abbate et al. 2000). Areas of dense, structurally diverse vegetation facilitate this type of dispersal while wide roadways (i.e. a 4-lane road) may impede flight. Pygmy-owls have been documented flying around large obstacles (developments) rather than flying over them (Abbate et al. 2000). Design features suggested by AGFD and USFWS to

minimize the impact of the 4-lane road include a median landscaped with large native trees and shrubs to mimic the surrounding vegetation. Additionally, AGFD and USFWS suggested supplementing some of the larger wash crossings with additional native vegetation.

Project Effects: The proposed Cortaro Farms Road widening project contained potential foraging and breeding habitat for the cactus ferruginous pygmy-owl. AGFD located a pygmy-owl neat the intersection of Cortaro Farms and Thornydale roads in 2001 and the area has a documented history of pygmy-owl occupation. The project may affect and is likely to adversely affect both the pygmy-owl and its habitat.

B. Cave myotis (SC):

Description: The cave myotis is one of the larger species of *Myotis* bats. It is a dull brown bat with large feet and a conspicuous bare patch on the back (Hoffmeister 1986). The cave myotis typically inhabits creosote scrub, brittlebush, cactus scrub, and riparian habitats. Roosting sites consist of mines, caves, tunnels, bridges and abandoned buildings. Even though these bats are found in xeric areas, they are never more than a few miles from a water source, such as water tanks, canals, or creeks. This species forages over water for insects. It is known to occur in southwestern Arizona and adjacent California.

Project Effects: The proposed Cortaro Farms Road widening project contained no potential foraging habitat for the cave myotis. No water tanks, canals, or creeks existed along the proposed improvement route. In addition, no potential roosting habitat (caves and abandoned mine tunnels) exist within the project site. Therefore, the proposed road widening project will not have an adverse affect on the habitat of the cave myotis and no surveys were conducted.

C. Fulvous whistling-duck (SC):

Description: This species of whistling duck looks more like a goose than a duck with its long

neck and legs (Bellrose 1980). The head has a flattened crown and the tail is short. The whistling duck requires large ponds or coastal areas and migrates to Mexico for the winter.

Project Effects: The project area along Cortaro Farms Road did not contain any standing water. No habitat for this species of duck was identified. No surveys for the fulvous whistling-duck were conducted. Because no habitat is present along the project area, the proposed road widening project will not have an adverse affect on this species.

2. USDA Forest Service Sensitive Species

These are plants and animals that are classified as sensitive by the Regional Forester when occurring on lands managed by the USDA Forest Service. The project site does not occur on lands managed by the USDA Forest Service.

A. Sparseleaf hermannia (S):

Description: The hermannia has small flowers with yellow petals and oblong leaves (Kearney and Peebles 1960). The hermannia is best identified during the spring months.

This herbaceous plant species is known from the Santa Catalina and Tucson Mountains and is found from 2,400–3,800 feet above mean sea level. It is typically found on dry, rocky slopes, hillsides, alluvial fans and canyon bottoms of desertscrub and riparian plant communities (AGFD 2000).

Project Effects: No sparseleaf hermannia were identified during our field survey. As no individual specimens were located along the proposed road widening project, construction activities will not likely impact this species.

B. Tucson Mountain spiderling (S):

Description: This species of plant is known from the Tucson Mountains and southern Arizona. This plant is an herbaceous, annual, or perennial with branched stems, small pink flowers, and

winged seeds. This species of spiderling prefers full sunlight, but has been noted in open chaparral. Flowers bloom in late summer and autumn. This plant occurs in Pima County from Tucson westward at elevations of 2,500–4,500 feet above mean sea level.

Project Effects: No Tucson Mountain spiderlings were identified during the survey. As no individual specimens were located along the proposed road widening project, construction activities will not likely impact any spiderling.

3. State Sensitive Species

These are species whose occurrence in Arizona is or may be in jeopardy or with known or perceived threats or population declines:

A. California leaf-nosed bat (WC, SC):

Description: The California leaf-nosed bat is 1 of 3 members of the American leaf-nosed bats (Family Phyllostomidae) in Arizona (Hoffmeister 1986). It is a fairly large bat with big ears and the nose leaf is erect and shaped like an arrowhead. In Arizona, the leaf-nosed bat frequents lowland desert habitats. Caves are favored roosting sites of this bat but it also occupies abandoned mine tunnels and suitable buildings. It is a year-round resident in southern Arizona. The species' diet consists primarily of insects, but also can include fruits, such as those of cacti.

Project Effects: The proposed Cortaro Farms Road widening project does not contain any roosting sites (caves and abandoned mine tunnels). However, the site did contain potential foraging habitat for the California leaf-nosed bat and potential roosting habitat may exist in the nearby Tortolita or Tucson mountains. Because of the size of the project and the availability of foraging habitat elsewhere, the proposed road widening project is not likely to have an adverse affect on the bat or its habitat.

B. Sonoran desert tortoise (WC, SC):

***Description*:** A high-domed shell characterizes the desert tortoise, usually with prominent growth lines on the shields of both carapace and plastron. The carapace is horn-colored or brown, often with yellowish centers in the laminae. The plastron is yellow shaded with brown along the edges of the laminae. The head is relatively small and rounded in front with the alveolar ridges of the upper jaws forming a sharp angle with each other. The desert tortoise has elephantine hind legs and flattened front limbs covered with large scales. Both legs and neck are retractable with limbs completely closing the anterior and posterior shell openings when withdrawn. The male tortoise has a longer tail and a more concave plastron than the female (Murray and Dickinson 1996).

Natural History: The Sonoran desert tortoise population is found south of the Colorado River in Arizona into Sonora, Mexico. It differs from the desert tortoise in other areas by preferring rocky slopes and boulders over open flat basins (Murray and Dickinson 1996). Desert tortoise occur primarily on rocky slopes and bajadas in the Arizona Upland and Lower Colorado River Valley subdivisions of the Sonoran Desert (Brown et al. 1979). They most often occur in paloverde-mixed cacti associations. In the Arizona Upland subdivision, boulders, outcrops, and natural cavities are important substrate components of the habitat as shelter sites. Burrows are usually located near rock-outcrops (especially within the deep soils at the base of rocks), and in caliche caves and incised, cut banks along washes (Murray and Dickinson 1996).

Desert tortoise primarily consume plant species, although they also eat arthropods, and feces of vertebrates including that of other tortoises. Studies have shown that desert tortoise prefer native plant species to exotic species. Diets often include fresh summer and winter buds, annuals, leaf-litter, perennial plants, grasses, and cacti leaves and fruit (Murray and Dickinson 1996).

Females begin laying eggs, which are fertilized by sperm from the previous summers' mating, just before or during the onset of the summer rains, typically in late June or early July (Klug and Averill-Murrey 1999). Female tortoise dig deep crescent-shaped nests in which 1 to 15 eggs are laid. After the young emerge from their shells, the 2-inch hatchlings dig out of the nest burrows to the surface (Hanson and Hanson 1997).

Status: There are 2 distinct desert tortoise populations, the Mojave Desert and the Sonoran Desert populations. The Mojave Desert tortoise population was listed in 1990 by the USFWS as threatened. Critical habitat for the Mojave Desert tortoise population was designated in 1994, and includes portions of Arizona (USFWS 1994). The Sonoran Desert tortoise population was not included in the federal ruling by the USFWS and is listed as a species of special concern in Arizona.

Status of non-urban Sonoran Desert populations of desert tortoise is not well known, but there is currently no evidence of range-wide declines. However, urban Sonoran Desert populations in the Tucson and Phoenix areas have declined over the past several years. Major, range-wide threats to this species are habitat fragmentation, habitat loss and degradation from urban and agricultural development as well as roads, wildfires associated with the invasion by non-native annual grasses, illegal collection, and genetic contamination of wild populations by escaped or released captives (AGFD 1996). Most of the research and management efforts have been directed towards the Mojave population. However, AGFD and USFWS recognize the need to continue to monitor the status of the Sonoran Desert population and take action if necessary to provide additional conservation (Averill-Murray 2000).

Project Effects: The proposed Cortaro Farms Road widening project contained potential habitat for the Sonoran desert tortoise. The vegetation within the site consisted of the paloverde-mixed

cacti association preferred by desert tortoise. The site also contained rock outcrops, boulders and natural cavities that could be used as shelter sites. During our site visit we looked for signs of desert tortoise, such as scat or active burrows. No scat or other visible evidence of Sonoran desert tortoise was evident. We recommend that pre-construction tortoise surveys be conducted to reduce impacts to desert tortoise and their habitat within the project area.

C. Tumamoc globeberry (SR, S):

Description: Formerly a federally listed endangered species under the Endangered Species Act, the Tumamoc globeberry was removed from the list on 18 June 1993. The Tumamoc globeberry is a perennial vine found in the shade of shrubs and trees in southern Arizona and Sonora, Mexico. The species is dormant during winter and early spring. Above ground growth generally occurs after summer rains with fruits appearing in August and September. Surveys are conducted between August 15 and November 15. Distribution in Arizona is restricted to Pima and Pinal counties below 3,000 ft. (Reichenbacher 1990). The species is known from several localities in the greater Tucson area.

Project Effects: No Tumamoc globeberries were identified during our surveys of the site. As no individual specimens were located along the proposed road improvement project, construction activities will not likely impact any globeberries. In the event that individuals are impacted it will not likely result in a trend toward federally listing the species or loss of viability.

D. Desert night blooming cereus (SR):

This species of cactus was not included in AGFD's list of sensitive species known to occur in the area, however, 1 specimen was found on the property. Its location was recorded for relocation (see Appendix D).

Description: The desert night blooming cereus is an inconspicuous cactus that resembles sticks

or bare branches (Benson 1969). The cereus blooms from late May to June, with flowers lasting a few days. Roots of the cereus are large, turnip shaped tubers. The tubers are disproportionately large compared to the above ground stems, weighing up to 43 pounds.

Project Effects: The specimen identified during our survey of the site should be transplanted outside of the construction zone. An Arizona Native Plant tag and a permit is required from the Arizona Department of Agriculture (ADA) (Arizona Native Plant Law 1993) for removal or transportation of the specimen outside of the ROW. Transplantation is relatively easy and successful when handled properly. The stems can be fragile and easily broken if not supported during the transplantation process, and care should be taken in removing the large root ball (the tuber).

CONSERVATION MEASURES

The project site contains potential habitat for 3 special status species: cactus ferruginous pygmy-owl, a federally protected species, and the Sonoran desert tortoise, a state sensitive species. In addition, we located a night blooming cereus, a native plant projected by the state. In an effort to conserve these species, we recommend the following conservation measures.

1. Cactus Ferruginous Pygmy-owl: The goals of the conservation measures are to minimize the amount of vegetation removed from the project site and not to create a dispersal barrier by building a 4-lane road that is too wide for a pygmy-owl to cross. At the time of construction a current (that spring season) survey should be conducted to verify if any owls are in the ROW or immediately adjacent to it. USFWS and AGFD should be notified prior to conducting surveys to determine if there are any known birds in the vicinity of the project area. Strategies to meet the conservation goal include:

a. Utilizing already cleared area for road placement.

b. Maintaining tall vegetation (defined as trees greater than 20 feet in height) on either side of the ROW.

c. Placing utilities in shoulder and under sidewalk, so that less vegetation is cleared.

d. Narrowing road in areas where there is existing undisturbed vegetation.

e. Planting vegetation as close to shoulder as feasible.

f. Utilizing a wider medium and narrower lanes, if feasible.

g. Re-creating surrounding plant community in median. Utilize tall native trees with mature canopies and understory plants to create plantings with structural diversity (groundcover, shrubs, tall trees).

h. Placing noise-walls/retaining walls in areas adjacent to existing residential and school use. Do not design noise-walls/retaining walls in areas where there is undisturbed vegetation.

i. Utilizing lighting at signaled intersections only.

j. There should be no noise disturbance from heavy equipment (e.g., grading, paving, cutting, filling, hauling, heavy earthwork, clearing, grubbing, work in culverts/storm drains) during the breading season (February 1-July 31).

k. At the time of construction, if pygmy-owls are located to the south of the ROW or immediately adjacent to it (as defined by AGFD and/or USFWS), the construction time-frame will be re-examined so that dispersal to the north will not be jeopardized.

l. The contractor should not undertake any activity which results in traffic congestion or delays 1 hour before, during, or 1 hour after sunrise and sunset to reduce noise.

m. Destroyed potential habitat will be mitigated at 4:1 (for every 1 acre lost, 4 acres of suitable habitat will be purchased). The potential habitat is 9.41 acres, consequently the mitigation amount would be 37.64, if all of this potential habitat is destroyed.

2. Sonoran Desert Tortoise: The Arizona Game and Fish Department has published guidelines for handling tortoises encountered on development projects (AGFD 1996). These guidelines should be made available to all construction managers and foremen associated with the project (Appendix E). In summary, the guidelines restrict the distance and temperature that a desert

tortoise can be moved from its burrow. If possible a substitute burrow (determined by a qualified biologist) should be located prior to moving a tortoise, especially if the ambient air temperature is above 105 degrees Fahrenheit. A tortoise only should be moved during extreme temperatures if the specimen is in imminent danger. Avoidance is preferred. For long term development projects (such as this one) AGFD should be notified for guidance and assistance in placing salvaged tortoise in a AGFD regulated adoption program.

3. Desert Night Blooming Cereus: Prior to construction and during native plant salvage efforts, the night blooming cereus should be transplanted to a location outside of roadway construction activities. The specimen should be transplanted by a qualified expert, knowledgeable on the transplanting techniques for this species.

CONCLUSION

We conducted a biological evaluation of special status species for Pima County Transportation and Flood Control District's proposed widening of Cortaro Farms Road from the UPRR to Thornydale Road. The project area is located within federally designated critical habitat (unit 4) for the cactus ferruginous pygmy-owl, an endangered species.

We evaluated the property on 13 November 2000, 2, 3, 22, 24, 25, 26 January, and 15, 16, and 19 February 2001 for the presence/absence of 9 special status species based on correspondence with the USFWS (letter dated 2 October 2000) and the AGFD (letter dated 2 May 2000 and updated on 11 December 2000). The site supported potential habitat for 2 species listed in the agency correspondence: cactus ferruginous pygmy-owl and Sonoran desert tortoise. Additionally, desert night blooming cereus was identified within the project area. The Arizona Native Plant Law categorizes the cereus as Salvage Restricted and a permit must be obtained

from the Arizona Department of Agriculture prior to removing or transporting the specimen from the site. Sonoran desert tortoise surveys are recommended prior to construction activities.

Cactus ferruginous pygmy-owls territories have been documented north and south of the Cortaro Farms Road since 1995 with a single male territory identified in both 2000 and 2001. Several of the territories are within 1/3 mile of the project area, thus the pygmy-owl territories have a potential to overlap with the project boundaries. Our 2001 survey did not identify any pygmy-owls, however, AGFD located a pygmy-owl near the Cortaro Farms and Thornydale road intersection in February 2001. Additional surveys are planned for 2002 and 2003 and the year of road construction if later than 2003. Arizona Game and Fish Department and the USFWS (in a meeting of 4 January 2001) have expressed concerns over maintaining connectivity of the wash systems and existing open space after completion of the road widening project. Connectivity is necessary to allow dispersal and movement of cactus ferruginous pygmy-owls from and within areas supporting suitable habitat. Recommended conservation measures include maximizing the existing native vegetation adjacent to the roadway project and within landscaped areas including medians, minimizing the amount of noise disturbance during peak breeding and dispersal periods, and purchasing supplemental lands that support suitable habitat for the owl at a ratio of 4 undisturbed acres per every disturbed acre of habitat.

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APPENDIX A.

Plants identified along the Pima County Department of Transportation and Flood Control District proposed road widening project, Cortaro Farms Road, UPRR to Thornydale Road, during the site visits (13 November 2000, 2, 3, 22, 24, 25, 26 January and 15, 16, and 19 February 2001).

Scientific Name	Occurrence	Common Name
Acacia greggii	common	cat-claw acacia
Amaranthus sp.	common	pigweed
Ambrosia deltoidea	common	triangle-leaf bursage
Aristida spp.	uncommon	three-awn grasses
Atriplex sp.	uncommon	saltbush
Baccharis sarothroides	common	desert broom
Baileya multiradiata	common	desert marigold
Carnegiea gigantea	common	saguaro
Cassia covesii	abundant	desert senna
Celtis pallida	common	desert hackberry
Cercidium floridum	common	blue paloverde
Cercidium microphyllum	common	foothill paloverde
Cucurbita spp.	uncommon	gourd
Echinocereus engelmannii	common	Engelmann hedgehog cactus
Encelia farinosa	abundant	brittlebush
Ferocactus wislizenii	common	fish-hook barrel cactus
Hymenoclea salsola	common	burro bush
Isocoma tenuisecta	common	burroweed
Janusia gracilis	uncommon	janusia
Krameria parvifolia	common	ratany
Larrea tridentata	common	creosote bush
Mammillaria microcarpa	abundant	pincushion cactus
Olneya tesota	common	ironwood
Opuntia fulgida	common	chain fruit cholla
Opuntia leptocaulis	common	desert Christmas cholla
Oputia spp.	common	prickly pear
Penicereus greggii var. *greggii*	rare	desert night blooming cereus
Prosopis velutina	common	mesquite
Prosopis velutina	common	mesquite
Salsola iberica	common	Russian thistle
Ziziphus obtusifolia	common	greythorn

APPENDIX A (CONTINUED).
Vertebrates found or expected along the Pima County Department of Transportation and Flood Control District proposed road widening project, Cortaro Farms Road, UPRR to Thornydale Road, during the site visits (13 November 20002, 3, 22, 24, 25, 26 January and 15, 16, and 19 February 2001).

Scientific Name	**Common Name**
Reptiles:	
Callisaurus draconoides	zebra-tail lizard
Cnemidophorus spp.	whiptail lizard
Crotalus atrox	western diamondback rattlesnake
Birds:	
Accipiter cooperii	Cooper's hawk
Amphispiza bilineata	black-throated sparrow
Auriparus flaviceps	verdin
Buteo jamaicensis	red-tailed hawk
Campylorhynchus brunneicapillus	cactus wren
Cardinalis sinuatus	pyrrhuloxia
Carpodacus mexicanus	house finch
Cathartes aura	turkey vulture
Chordeiles acutipennis	lesser nighthawk
Colaptes auratus	gilded flicker
Corvus corax	common raven
Falco sparverius	American kestrel
Geococcyx californianus	greater roadrunner
Lophortyx gambelii	Gambel's quail
Melanerpes uropygialis	gila woodpecker
Micrathene whitneyi	elf owl
Myiarchus cinerascens	ash-throated flycatcher
Polioptila melanura	black-tailed gnatcatcher
Sturnus vulgaris	European starling
Toxostoma curvirostra	curve-billed thrasher
Zenaida macroura	mourning dove
Mammals:	
Canis latrans	coyote
Dicotyles	javelina
Felis rufus	bobcat
Neotoma albigula	white-throated woodrat
Odocoileus hemionus	mule deer
Perognathus spp.	pocket mouse
Spermophilus tereticaudus	round-tailed ground squirrel
Sylvilagus audubonii	desert cottontail

APPENDIX B.

1. U. S. Fish and Wildlife Service, dated 2 October 2000
2. Arizona Game and Fish Department, dated 1 May 2000
3. Arizona Game and Fish Department, dated 11 December 2000

United States Department of the Interior

U.S. Fish and Wildlife Service
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Telephone: (602) 640-2720 FAX: (602) 640-2730

In Reply Refer To:
AESO/SE
2-21-00-I-213

October 2, 2000

Ms. Susy Morales
Harris Environmental Group Inc.
1749 East 10th Street
Tucson, Arizona 85719

RE: BE for Road Widening Project at Cortaro Farms and Thornydale Roads for Pima County Department of Transportation (T12S, R12E, S25 & 26; and T12S, R13E, S30)

Dear Ms. Morales:

This letter responds to your September 28, 2000, request for an inventory of threatened or endangered species, or those that are proposed to be listed as such under the Endangered Species Act of 1973, as amended (Act), which may potentially occur in your project area (Pima County) The enclosed list may include candidate species as well. We hope the enclosed county list of species will be helpful. In future communications regarding this project, please refer to consultation number 2-21-00-I-213.

The enclosed list of the endangered, threatened, proposed, and candidate species includes all those potentially occurring anywhere in the county, or counties, where your project occurs. Please note that your project area may not necessarily include all or any of these species. The information provided includes general descriptions, habitat requirements, and other information for each species on the list. Also on the enclosed list is the Code of Federal Regulations (CFR) citation for each list and is available at most public libraries. This information should assist you in determining which species may or may not occur within your project area. Site-specific surveys could also be helpful and may be needed to verify the presence or absence of a species or its habitat as required for the evaluation of proposed project-related impacts.

Endangered and threatened species are protected by Federal law and must be considered prior to project development. If the action agency determines that listed species or critical habitat may be adversely affected by a federally funded, permitted or authorized activity, the action agency must request formal consultation with the Service. If the action agency determines that the planned action may jeopardize a proposed species or destroy or adversely modify proposed critical habitat, the action agency must enter into a section 7 conference with the Service. Candidate species are those which are being considered for addition to the list of threatened or endangered species. Candidate species are those for which there is sufficient information to support a

proposal for listing. Although candidate species have no legal protection under the Act, we recommend that they be considered in the planning process in the event that they become listed or proposed for listing prior to project completion.

If any proposed action occurs in or near areas with trees and shrubs growing along watercourses, known as riparian habitat, the Service recommends the protection of these areas. Riparian areas are critical to biological community diversity and provide linear corridors important to migratory species. In addition, if the project will result in the deposition of dredged or fill materials into waterways or excavation in waterways, we recommend you contact the Army Corps of Engineers which regulates these activities under Section 404 of the Clean Water Act.

Additional information regarding critical habitat designation for the cactus ferruginous pygmy-owl is also enclosed.

The State of Arizona protects some plant and animal species not protected by Federal law. We recommend you contact the Arizona Game and Fish Department and the Arizona Department of Agriculture for State-listed or sensitive species in your project area.

The Service appreciates your efforts to identify and avoid impacts to listed and sensitive species in your project area. If we may be of further assistance, please feel free to contact Tom Gatz.

Sincerely,

Jacqueline Harson

for David L. Harlow
Field Supervisor

Enclosures

cc: John Kennedy, Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: PIMA

08/03/2000

1)LISTED TOTAL= 17

NAME: HUACHUCA WATER UMBEL *LILAEOPSIS SCHAFFNERIANA ssp RECURVA*

STATUS: ENDANGERED CRITICAL HAB Yes RECOVERY PLAN: No CFR: 62 FR 665, 01-06-97

DESCRIPTION: *HERBACEOUS, SEMI-AQUATIC PERENNIAL IN THE PARSLEY FAMILY (UMBELLIFERAE) WITH SLENDER ERECT, HOLLOW, LEAVES THAT GROW FROM THE NODES OF CREEPING RHIZOMES. FLOWER: 3 TO 10 FLOWERED UMBELS ARISE FROM ROOT NODES.*

ELEVATION RANGE: 3500-6500 FT.

COUNTIES: PIMA, SANTA CRUZ, COCHISE

HABITAT: CIENEGAS, PERENNIAL LOW GRADIENT STREAMS, WETLANDS

AND IN ADJACENT SONORA, MEXICO, WEST OF THE CONTINENTAL DIVIDE. POPULATIONS ALSO ON FORT HUACHUCA MILITARY RESERVATION. CRITICAL HABITAT IN COCHISE AND SANTA CRUZ COUNTIES (63 FR 37441)

NAME: KEARNEY'S BLUE STAR *AMSONIA KEARNEYANA*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 54 FR 2131, 01-19-1989

DESCRIPTION: *A HERBACEOUS PERENNIAL IN THE DOGBANE FAMILY (APOCYNACEAE). THICKENED WOODY ROOT AND MANY PUBESCENT (HAIRY) STEMS THAT RARELY BRANCH. FLOWERS:WHITE TERMINAL INFLORESCENCE IN APRIL & MAY.*

ELEVATION RANGE: 3600-3800 FT.

COUNTIES: PIMA

HABITAT: WEST-FACING DRAINAGES IN THE BABOQUIVARI MOUNTAINS.

PLANTS GROW IN STABLE, PARTIALLY SHADED, COARSE ALLUVIUM ALONG A DRY WASH IN THE BABOQUIVARI MOUNTAINS. RANGE IS EXTREMELY LIMITED. PROTECTED BY ARIZONA NATIVE PLANT LAW.

NAME: NICHOL'S TURK'S HEAD CACTUS *ECHINOCACTUS HORIZONTHALONIUS VAR NICHOLII*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: No CFR: 44 FR 61927, 10-26-1979

DESCRIPTION: *BLUE-GREEN TO YELLOWISH-GREEN, COLUMNAR, 18 INCHES TALL, 8 INCHES IN DIAMETER. SPINE CLUSTERS HAVE 5 RADIAL & 3 CENTRAL SPINES; ONE DOWNWARD SHORT; 2 SPINES UPWARD AND RED OR BASALLY GRAY. FLOWER:PINK FRUIT:WOOLLY WHITE*

ELEVATION RANGE: 2400-4100 FT.

COUNTIES: PINAL, PIMA

HABITAT: SONORAN DESERTSCRUB

FOUND IN UNSHADED MICROSITES IN SONORAN DESERTSCRUB ON DISSECTED ALLUVIAL FANS AT THE FOOT OF LIMESTONE MOUNTAINS AND ON INCLINED TERRACES AND SADDLES ON LIMESTONE MOUNTAINSIDES.

NAME: PIMA PINEAPPLE CACTUS *CORYPHANTHA SCHEERI ROBUSTISPINA*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: No CFR: 57 FR 14374, 04-20-1992

DESCRIPTION: HEMISHPERICAL STEMS 4-7 INCHES TALL 3-4 INCHES DIAMETER. CENTRAL SPINE 1 INCH LONG STRAW COLORED HOOKED SURROUNDED BY 6-15 RADIAL SPINES. FLOWER: YELLOW SALMON OR RARELY WHITE NARROW FLORAL TUBE.

ELEVATION RANGE: 2300-5000 FT.

COUNTIES: PIMA, SANTA CRUZ

HABITAT: SONORAN DESERTSCRUB OR SEMI-DESERT GRASSLAND COMMUNITIES

OCCURS IN ALLUVIAL VALLEYS OR ON HILLSIDES IN ROCKY TO SANDY OR SILTY SOILS. THIS SPECIE CAN BE CONFUSED WITH JUVENILLE BARREL CACTUS (FEROCACTUS). HOWEVER, THE SPINES OF THE LATER ARE FLATTENED, IN CONTRAST WITH THE ROUND CROSS-SECTION OF THE CORYPHANTHA SPINES. ALSO THE AREOLES (SPINE CLUSTERS) OF CORYPHANTHA ARE ON TUBERCULES (BUMPS), WHILE THE AREOLES OF FEROCACTUS ARE ON RIDGES (RIBS). 80-90% OF INDIVIDUALS ON STATE AND PRIVATE LAND.

NAME: LESSER LONG-NOSED BAT *LEPTONYCTERIS CURASOAE YERBABUENAE*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 53 FR 38456, 09-30-88

DESCRIPTION: ELONGATED MUZZLE, SMALL LEAF NOSE, AND LONG TONGUE. YELLOWISH BROWN OR GRAY ABOVE AND CINNAMON BROWN BELOW. TAIL MINUTE AND APPEARS TO BE LACKING. EASILY DISTURBED.

ELEVATION RANGE: <6000 FT.

COUNTIES: COCHISE, PIMA, SANTA CRUZ, GRAHAM, PINAL, MARICOPA

HABITAT: DESERT SCRUB HABITAT WITH AGAVE AND COLUNMNAR CACTI PRESENT AS FOOD PLANTS

DAY ROOSTS IN CAVES AND ABANDONED TUNNELS. FORAGES AT NIGHT ON NECTAR, POLLEN, AND FRUIT OF PANICULATE AGAVES AND COLUMNAR CACTI. THIS SPECIES IS MIGRATORY AND IS PRESENT IN ARIZONA, USUALLY FROM APRIL TO SEPTMBER AND SOUTH OF THE BORDER THE REMAINDER OF THE YEAR.

NAME: MEXICAN GRAY WOLF *CANIS LUPUS BAILEYI*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 32 FR 4001, 03-11-67; 43 FR 1912, 03-09-78

DESCRIPTION: LARGE DOG-LIKE CARNIVORE WITH VARYING COLOR, BUT USUALLY A SHADE OF GRAY. DISTINCT WHITE LIP LINE AROUND MOUTH. WEIGH 60-90 POUNDS.

ELEVATION RANGE: 4,000-12,00FT.

COUNTIES: APACHE, COCHISE, GREENLEE, PIMA, SANTA CRUZ

HABITAT: CHAPPARAL, WOODLAND, AND FORESTED AREAS. MAY CROSS DESERT AREAS.

HISTORIC RANGE IS CONSIDERED TO BE LARGER THAN THE COUNTIES LISTED ABOVE. UNCONFIRMED REPORTS OF INDIVIDUALS IN THE SOUTHERN PART OF THE STATE (COCHISE, PIMA, SANTA CRUZ) CONTINUE TO BE RECEIVED. INDIVIDUALS MAY STILL PERSIST IN MEXICO. EXPERIMENTAL NONESSENTIAL POPULATION INTRODUCED IN THE BLUE PRIMITIVE AREA OF GREENLEE AND APACHE COUNTIES

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: **PIMA**

08/03/2000

NAME: OCELOT *LEOPARDUS (=FELIS) PARDALIS*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 47 FR 31670; 07-21-82

DESCRIPTION: MEDIUM-SIZED SPOTTED CAT WHOSE TAIL IS ABOUT 1/2 THE LENGTH OF HEAD AND BODY. YELLOWISH WITH BLACK STREAKS AND STRIPES RUNNING FROM FRONT TO BACK. TAIL IS SPOTTED AND FACE IS LESS HEAVILY STREAKED THAN THE BACK AND SIDES.

ELEVATION RANGE: <8000 FT.

COUNTIES: SANTA CRUZ, PIMA, COCHISE

HABITAT: HUMID TROPICAL & SUB-TROPICAL FORESTS, SAVANNAHS, AND SEMI-ARID THORNSCRUB.

MAY PERSIST IN PARTLY-CLEARED FORESTS, SECOND-GROWTH WOODLAND, AND ABANDONED CULTIVATION REVERTED TO BRUSH. UNIVERSAL COMPONENT IS PRESENCE OF DENSE COVER. UNCONFIRMED REPORTS OF INDIVIDUALS IN THE SOUTHERN PART OF THE STATE CONTINUE TO BE RECEIVED.

NAME: SONORAN PRONGHORN *ANTILOCAPRA AMERICANA SONORIENSIS*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 32 FR 4001, 03-11-67

DESCRIPTION: BUFF ON BACK AND WHITE BELOW, HOOFED WITH SLIGHTLY CURVED BLACK HORNS HAVING A SINGLE PRONG. SMALLEST AND PALEST OF THE PRONGHORN SUBSPECIES.

ELEVATION RANGE: 2000-4000 FT.

COUNTIES: PIMA, YUMA, MARICOPA

HABITAT: BROAD, INTERMOUNTAIN ALLUVIAL VALLEYS WITH CREOSOTE-BURSAGE & PALO VERDE-MIXED CACTI ASSOCIATIONS

TYPICALLY, BAJADAS ARE USED AS FAWNING AREAS AND SANDY DUNE AREAS PROVIDE FOOD SEASONALLY. HISTORIC RANGE WAS PROBABLY LARGER THAN EXISTS TODAY. THIS SUBSPECIES ALSO OCCURS IN MEXICO.

NAME: DESERT PUPFISH *CYPRINODON MACULARIUS*

STATUS: ENDANGERED CRITICAL HAB Yes RECOVERY PLAN: Yes CFR: 51 FR 10842, 03-31-1986

DESCRIPTION: SMALL (2 INCHES) SMOOTHLY ROUNDED BODY SHAPE WITH NARROW VERTICAL BARS ON THE SIDES. BREEDING MALES BLUE ON HEAD AND SIDES WITH YELLOW ON TAIL. FEMALES & JUVENILES TAN TO OLIVE COLORED BACK AND SILVERY SIDES.

ELEVATION RANGE: <5000 FT.

COUNTIES: LA PAZ, PIMA, GRAHAM, MARICOPA, PINAL, YAVAPAI, SANTA CRUZ

HABITAT: SHALLOW SPRINGS, SMALL STREAMS, AND MARSHES. TOLERATES SALINE & WARM WATER

CRITICAL HABITAT INCLUDES QUITOBAQUITO SPRING, PIMA COUNTY, PORTIONS OF SAN FELIPE CREEK, CARRIZO WASH, AND FISH CREEK WASH, IMPERIAL COUNTY, CALIFORNIA. TWO SUBSPECIES ARE RECOGNIZED: DESERT PUPFISH (C. m. macularis) AND QUITOBAQUITO PUPFISH (C. m. eremus).

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: PIMA

08/03/2000

NAME: GILA TOPMINNOW *POECILIOPSIS OCCIDENTALIS OCCIDENTALIS*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 32 FR 4001, 03-11-1967

DESCRIPTION: SMALL (2 INCHES), GUPPY-LIKE, LIVE BEARING, LACKS DARK SPOTS ON ITS FINS. BREEDING MALES ARE JET BLACK WITH YELLOW FINS.

ELEVATION RANGE: <4500 FT.

COUNTIES: GILA, PINAL, GRAHAM, YAVAPAI, SANTA CRUZ, PIMA, MARICOPA, LA PAZ

HABITAT: SMALL STREAMS, SPRINGS, AND CIENEGAS VEGETATED SHALLOWS

SPECIES HISTORICALLY OCCURRED IN BACKWATERS OF LARGE RIVERS BUT IS CURRENTLY ISOLATED TO SMALL STREAMS AND SPRINGS

NAME: LOACH MINNOW *TIAROGA COBITIS*

STATUS: THREATENED CRITICAL HAB Yes RECOVERY PLAN: Yes CFR: 51 FR 39468, 10-28-1986; 59 FR 10898, 03-08-1994;

DESCRIPTION: SMALL (<3 INCHES LONG) SLENDER, ELONGATED FISH, OLIVE COLORED WITH DIRTY WHITE SPOTS AT THE BASE OF THE DORSAL AND CAUDAL FINS. BREEDING MALES VIVID RED ON MOUTH AND BASE OF FINS

ELEVATION RANGE: <8000 FT.

COUNTIES: PINAL, GRAHAM, GREENLEE, GILA, APACHE, NAVAJO, *YAVAPAI, *COCHISE, *PIMA

HABITAT: BENTHIC SPECIES OF SMALL TO LARGE PERENNIAL STREAMS WITH SWIFT SHALLOW WATER OVER COBBLE& GRAVEL. RECURRENT FLOODING AND NATURAL HYDROGRAPH IMPORTANT.

PRESENTLY FOUND IN ARAVAIPA CREEK, BLUE RIVER, CAMPBELL BLUE CREEK, SAN FRANCISCO RIVER, DRY BLUE CREEK, TULAROSA RIVER, EAST-WEST-AND MIDDLE FORKS OF THE GILA RIVER, EAGLE CREEK, EAST FORK, BLACK RIVER, AND THE MAINSTEM UPPER GILA RIVER. CRTITICAL HABITAT WAS REMOVED IN MARCH 1998; BUT RE-PROPOSED DEC 1999 AND FINALIZED APRIL 2000. SPECIES ALSO FOUND IN CATRON, GRANT, AND HIDALGO COUNTIES IN NEW MEXICO. *COUNTIES WITH CRITICAL HABITAT PRESENTLY CONTAIN NO KNOWN EXISTING POPULATIONS OF LOACH MINNOW.

NAME: SPIKEDACE *MEDA FULGIDA*

STATUS: THREATENED CRITICAL HAB Yes RECOVERY PLAN: Yes CFR: 51 FR 23769,07-01-1986; 59 FR 10906, 03-08-1994;

DESCRIPTION: SMALL (<3 INCHES) SLIM WITH SLIVERY SIDES & 'SPINE" ON DORSAL FIN. BREDING MALES BRASSY GOLDEN COLOR

ELEVATION RANGE: <6000 FT.

COUNTIES: GRAHAM, PINAL, GREENLEE, YAVAPAI, APACHE*, COCHISE*, GILA*, NAVAJO*, PIMA*

HABITAT: MODERATE TO LARGE PERENNIAL STREAMS WITH GRAVEL COBBLE SUBSTRATES AND MODERATE TO SWIFT VELOCITIES OVER SAND AND GRAVEL SUBSTRATES. RECURRENT FLOODING AND NATURAL

PRESENTLY FOUND IN ARAVAIPA CREEK, EAGLE CREEK, VERDE RIVER, EAST-WEST- MAIN AND MIDDLE FORKS OF THE GILA RIVER IN NEW MEXICO, AND GILA RIVER FROM SAN PEDRO RIVER TO ASHURST HAYDEN DAM. CRITICAL HABITAT WAS REMOVED IN MARCH 1998, BUT RE-PROPOSED DEC 1999 AND FINALIZED IN APRIL 2000. SPECIES ALSO FOUND IN CATRON, GRANT, AND HIDALGO COUNTIES IN NEW MEXICO. *COUNTIES WITH CRITICAL HABITAT PRESENTLY CONTAIN NO KNOWN EXISTING POPULATIONS OF SPIKEDACE.

LISTED, PROPOSED, AND CANDIDATE SPECIES FOR THE FOLLOWING COUNTY: PIMA

08/03/2000

NAME: BALD EAGLE *HALIAEETUS LEUCOCEPHALUS*

STATUS: THREATENED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 60 FR 35999, 07-12-95

DESCRIPTION: LARGE, ADULTS HAVE WHITE HEAD AND TAIL. HEIGHT 28 - 38"; WINGSPAN 66 - 96". 1-4 YRS DARK WITH VARYING DEGREES OF MOTTLED BROWN PLUMAGE. FEET BARE OF FEATHERS.

ELEVATION RANGE: VARIES FT.

COUNTIES: YUMA, LA PAZ, MOHAVE, YAVAPAI, MARICOPA, PINAL, COCONINO, NAVAJO, APACHE, SANTA CRUZ, PIMA, GILA, GRAHAM, COCHISE

HABITAT: LARGE TREES OR CLIFFS NEAR WATER (RESERVOIRS, RIVERS AND STREAMS) WITH ABUNDANT PREY

SOME BIRDS ARE NESTING RESIDENTS WHILE A LARGER NUMBER WINTERS ALONG RIVERS AND RESERVOIRS. AN ESTIMATED 200 TO 300 BIRDS WINTER IN ARIZONA. ONCE ENDANGERED (32 FR 4001, 03-11-1967; 43 FR 6233, 02-14-78) BECAUSE OF REPRODUCTIVE FAILURES FROM PESTICIDE POISONING AND LOSS OF HABITAT, THIS SPECIES WAS DOWN LISTED TO THREATENED ON AUGUST 11, 1995. ILLEGAL SHOOTING, DISTURBANCE, LOSS OF HABITAT CONTINUES TO BE A PROBLEM. SPECIES HAS BEEN PROPOSED FOR DELISTING (64 FR 36454) BUT STILL RECEIVES FULL PROTECTION UNDER ESA.

NAME: CACTUS FERRUGINOUS PYGMY-OWL *GLAUCIDIUM BRASILIANUM CACTORUM*

STATUS: ENDANGERED CRITICAL HAB Yes RECOVERY PLAN: No CFR: 62 FR 10730, 3-10-97

DESCRIPTION: SMALL (APPROX. 7"), DIURNAL OWL REDDISH BROWN OVERALL WITH CREAM-COLORED BELLY STREAKED WITH REDDISH BROWN. SOME INDIVIDUALS ARE GRAYISH BROWN

ELEVATION RANGE: <4000 FT.

COUNTIES: MARICOPA, YUMA, SANTA CRUZ, GRAHAM, GREENLEE, PIMA, PINAL, GILA, COCHISE

HABITAT: MATURE COTTONWOOD/WILLOW, MESQUITE BOSQUES, AND SONORAN DESERTSCRUB

RANGE LIMIT IN ARIZONA IS FROM NEW RIVER (NORTH) TO GILA BOX (EAST) TO CABEZA PRIETA MOUNTAINS (WEST). ONLY A FEW DOCUMENTED SITES WHERE THIS SPECIES PERSISTS ARE KNOWN, ADDITIONAL SURVEYS ARE NEEDED. CRITICAL HABITAT IN PIMA, COCHISE, PINAL, AND MARICOPA COUNTIES (64 FR 37419).

NAME: MASKED BOBWHITE *COLINUS VIRGINIANUS RIDGEWAYI*

STATUS: ENDANGERED CRITICAL HAB No RECOVERY PLAN: Yes CFR: 35 FR 4001, 03-11-1967; 35 FR 8495, 06-02-70

DESCRIPTION: MALES BRICK-RED BREAST AND BLACK HEAD AND THROAT. FEMALES ARE GENERALLY NONDESCRIPT BUT RESEMBLE OTHER RACES SUCH AS THE TEXAS BOBWHITE.

ELEVATION RANGE: 1000-4000 FT.

COUNTIES: PIMA

HABITAT: DESERT GRASSLANDS WITH DIVERSITY OF DENSE NATIVE GRASSES, FORBS AND BRUSH

SPECIES IS CLOSELY ASSOCIATED WITH ACACIA ANGUSTISSIMA. FORMERLY OCCURRED IN ALTAR AND SANTA CRUZ VALLEYS, AS WELL AS SONORA, MEXICO. PRESENTLY ONLY KNOWN FROM REINTRODUCED POPULATION ON BUENOS AIRES.

NAME: MEXICAN SPOTTED OWL *STRIX OCCIDENTALIS LUCIDA*

STATUS: THREATENED CRITICAL HAB Yes RECOVERY PLAN: Yes CFR: 56 FR 14678, 04-11-91

DESCRIPTION: MEDIUM SIZED WITH DARK EYES AND NO EAR TUFTS. BROWNISH AND HEAVILY SPOTTED WITH WHITE OR BEIGE.

ELEVATION RANGE: 4100-9000 FT.

COUNTIES: MOHAVE, COCONINO, NAVAJO, APACHE, YAVAPAI, GRAHAM, GREENLEE, COCHISE, SANTA CRUZ, PIMA, PINAL, GILA, MARICOPA

HABITAT: NESTS IN CANYONS AND DENSE FORESTS WITH MULTI-LAYERED FOLIAGE STRUCTURE

GENERALLY NESTS IN OLDER FORESTS OF MIXED CONIFER OR PONDERSA PINE/GAMBEL OAK TYPE, IN CANYONS, AND USE VARIETY OF HABITATS FOR FORAGING. SITES WITH COOL MICROCLIMATES APPEAR TO BE OF IMPORTANCE OR ARE PREFERED. CRITICAL HABITAT WAS REMOVED IN 1998 BUT RE-PROPOSED IN JULY2000 FOR APACHE, COCHISE, COCONINO, GILA, GRAHAM, GREENLEE, MARICOPA, MOHAVE, NAVAJO, PIMA, PINAL, SANTA CRUZ, AND YAVAPAI COUNTIES.

NAME: SOUTHWESTERN WILLOW FLYCATCHER *EMPIDONAX TRAILLII EXTIMUS*

STATUS: ENDANGERED CRITICAL HAB Yes RECOVERY PLAN: No CFR: 60 FR 10694, 02-27-95

DESCRIPTION: SMALL PASSERINE (ABOUT 6") GRAYISH-GREEN BACK AND WINGS, WHITISH THROAT, LIGHT OLIVE-GRAY BREAST AND PALE YELLOWISH BELLY. TWO WINGBARS VISIBLE. EYE-RING FAINT OR ABSENT.

ELEVATION RANGE: <8500 FT.

COUNTIES: YAVAPAI, GILA, MARICOPA, MOHAVE, COCONINO, NAVAJO, APACHE, PINAL, LA PAZ, GREENLEE, GRAHAM, YUMA, PIMA, COCHISE, SANTA CRUZ

HABITAT: COTTONWOOD/WILLOW & TAMARISK VEGETATION COMMUNITIES ALONG RIVERS & STREAMS

MIGRATORY RIPARIAN OBLIGATE SPECIES THAT OCCUPIES BREEDING HABITAT FROM LATE APRIL TO SEPTEMBER. DISTRIBUTION WITHIN ITS RANGE IS RESTRICTED TO RIPARIAN CORRIDORS. DIFFICULT TO DISTINGUISH FROM OTHER MEMBERS OF THE EMPIDONAX COMPLEX BY SIGHT ALONE. TRAINING SEMINAR REQUIRED FOR THOSE CONDUCTING FLYCATCHER SURVEYS. CRITICAL HABITAT ON PORTIONS OF THE 100-YEAR FLOODPLAIN ON SAN PEDRO AND VERDE RIVERS; WET BEAVER AND WEST CLEAR CREEKS, INCLUDING TAVASCI MARSH AND ISTER FLAT; THE COLORADO RIVER, THE LITTLE COLORADO RIVER, AND THE WEST, EAST, AND SOUTH FORKS OF THE LITTLE COLORADO RIVER, REFERENCE 60 CFR:62 FR 39129, 7/22/97.

2) PROPOSED TOTAL= 2

NAME: MOUNTAIN PLOVER *CHARADRIUS MONTANUS*

STATUS: PROPOSED THREATENED CRITICAL HAB No RECOVERY PLAN: No CFR: 64 FR 7587; 02-16-1999

DESCRIPTION: IN BREEDING SEASON WITH WHITE FOREHEAD AND LINE OVER THE EYE; CONTRASTING WITH DARK CROWN; NONDESCRIPT IN WINTER. VOICE IS LOW, VARIABLE WHISTLE.

ELEVATION RANGE: VARIABLE FT.

COUNTIES: YUMA, PIMA, COCHISE, PINAL, APACHE

HABITAT: OPEN ARID PLAINS, SHORT-GRASS PRAIRIES, AND CULTIVATED FORMS.

SPECIES PRIMARILY FOUND IN ROCKY MOUNTAIN STATES FROM CANADA TO MEXICO. AZ PRIMARILY PROVIDES WITNERING HABITAT. BREEDING HAS BEEN DOCUMENTED, BUT IS RARE, AND IS LIKELY RESTRICTED TO TRIBAL AND STATE LANDS IN APACHE COUNTY.

NAME: CHIRICAHUA LEOPARD FROG *RANA CHIRICAHUENSIS*

STATUS: PROPOSED CRITICAL HAB No RECOVERY PLAN: No CFR: 65 FR 37343, 6-14-2000

DESCRIPTION: CREAM COLORED TUBERCULES (spots) ON A DARK BACKGROUND ON THE REAR OF THE THIGH, DORSOLATERAL FOLDS THAT ARE INTERRUPTED AND DEFLECTED MEDIALLY, AND A CALL GIVEN OUT OF WATER DISTINGUISH THIS SPOTTED FROG FROM OTHER LEOPRD

ELEVATION RANGE: 3300-8900 FT.

COUNTIES: SANTA CRUZ, APACHE, GILA, PIMA, COCHISE, GREENLEE, GRAHAM, YAVAPAI, COCONINO

HABITAT: STREAMS, RIVERS, BACKWATERS, PONDS, AND STOCK TANKS THAT ARE FREE FROM INTRODUCED FISH AND BULLFROGS

REQUIRE PERMANENT OR NEARLY PERMANENT WATER SOURCES. POPULATIONS NORTH OF THE GILA RIVER MAY BE CLOSELY-RELATED, BUT DISTINCT, UNDESCRIBED SPECIES.

3) CANDIDATE TOTAL= 3

NAME: ACUNA CACTUS *ECHINOMASTUS ERECTOCENTRUS ACUNENSIS*

STATUS: CANDIDATE CRITICAL HAB No RECOVERY PLAN: No CFR:

DESCRIPTION: <12 INCHES HIGH SPINE CLUSTERS BORNE ON TUBERCLES, EACH WITH A GROOVE ON THE UPPER SURFACE. 2-3 CENTRAL SPINES AND 12 RADIAL SPINES. FLOWERS PINK TO PURPLE

ELEVATION RANGE: 1300-2000 FT.

COUNTIES: PINAL, PIMA

HABITAT: WELL DRAINED KNOLLS AND GRAVEL RIDGES IN SONORAN DESERT SCRUB

IMMATURE PLANTS DISTINCTLY DIFFERENT FROM MATURE PLANTS. THEY ARE DISC-SHAPED OR SPHERICAL AND HAVE NO CENTRAL SPINES UNTIL THEY ARE ABOUT 1.5 INCHES . RADIAL SPINES ARE DIRTY WHITE WITH MAROON TIPS.

NAME: GILA CHUB *GILA INTERMEDIA*

STATUS: CANDIDATE CRITICAL HAB No RECOVERY PLAN: No CFR:

DESCRIPTION: DEEP COMPRESSED BODY, FLAT HEAD. DARK OLIVE-GRAY COLOR ABOVE, SILVER SIDES. ENDEMIC TO GILA RIVER BASIN.

ELEVATION RANGE: 2000 - 3500 FT.

COUNTIES: SANTA CRUZ, GILA, GREENLEE, PIMA, COCHISE, GRAHAM, YAVAPAI

HABITAT: POOLS, SPRINGS, CIENEGAS, AND STREAMS

MULTIPLE PRIVATE LANDOWERS, INCLUDING THE NATURE CONSERVANCY, THE AUDUBON SOCIETY, AND OTHERS. ALSO FT. HUACHUCA. SPECIES ALSO FOUND IN SONORA, MEXICO.

NAME: SONOYTA MUD TURTLE *KINOSTERNON SONORIENSE LONGIFEMORALE*

STATUS: CANDIDATE CRITICAL HAB No RECOVERY PLAN: No CFR:

DESCRIPTION: PRIMARILY A POND TURTLE, PREFERS MUD OR SANDY BOTTOMS. BODY 3 1/2 TO 6 1/2. HEAD AND NECK MOTTLED WITH CONTRASTING LIGHT AND DARK MARKINGS. FOUND IN QUITOBAQUITO SPRINGS.

ELEVATION RANGE: 1,100 FEET FT.

COUNTIES: PIMA

HABITAT: PONDS AND STREAMS.

SPECIES ALSO FOUND IN RIO SONOYTA, SONORA, MEXICO.

CONSERVATION AGREEMENT TOTAL= 2

NAME: GOODDINGS ONION *ALLIUM GOODDINGII*

STATUS: CONSERVATION AGREEMENT CRITICAL HAB No RECOVERY PLAN: No CFR:

DESCRIPTION: HERBACEOUS PERRNIAL PLANT; BROAD, FLAT, RATHER BLUNT LEAVES; FLOWERING STALK 14-17 INCHES TALL, FLATTENED, AND NARROWLY WINGED TOWARD APEX; FRUIT IS BROADER THAN LONG; SEEDS ARE SHORT AND THICK

ELEVATION RANGE: > 7,500 FT FT.

COUNTIES: APACHE, GREENLEE, PIMA

HABITAT: FORESTED DRAINAGE BOTTOMS AND ON MOIST NORTH FACING SLOPES OF MIXED CONIFER AND SPRUCE FIR FORESTS

CONSERVATION AGREEMENT BETWEEN THE SERVICE AND THE FOREST SERVICE SIGNED IN FEBURARY 1998. IN NEW MEXICO ON THE LINCOLN AND GILA NATIONAL FORESTS

NAME: SAN XAVIER TALUSSNAIL *SONORELLA EREMITA*

STATUS: CONSERVATION AGREEMENT CRITICAL HAB No RECOVERY PLAN: No CFR:

DESCRIPTION: LAND SNAIL, LESS THAN ONE INCH IN DIAMETER (ABOUT 19 MM), 4.5 WHORLS, ROUND SHELL, WHITE TO PINKISH TINT

ELEVATION RANGE: 3,850-3,920 FT.

COUNTIES: PIMA

HABITAT: DEEP, LIMESTONE ROCKSLIDE WITH OUTCROPS OF LIMESTONE AND DECOMPOSED GRANITE

CONSERVATION AGREEMENT SIGNED BY THE SERVICE, ARIZONA GAME AND FISH DEPARTMENT, EL PASO NATURAL GAS COMPANY, AND ARIZONA ELECTRIC POWER COOPERATIVE, INC. IN SEPTEMBER 1998

RECOMMENDED GUIDANCE FOR PRIVATE LANDOWNERS CONCERNING THE CACTUS FERRUGINOUS PYGMY-OWL

March 2000

The following recommendations[1] are offered by the U.S. Fish and Wildlife Service (FWS) to assist private landowners in minimizing their risk of inadvertently "taking[2]" the endangered cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*) (pygmy-owl) and violating Section 9 of the Endangered Species Act (ESA).

On August 13, 1998, the FWS published a notice of availability and the opening of a 30-day public comment period for a proposed survey protocol and the accompanying " Private Landowner Take Guidance for the Pygmy-owl[3]." This comment period was extended on September 15, 1998[4] and again on November 20, 1998[5], closing on March 14, 1999 to allow interested parties additional time to provide input. During this seven month period, we received many comments from Federal and State agencies, local jurisdictions, independent consultants, and private individuals on both the proposed protocol and take guidance. We reviewed these comments and revised the proposed landowner take guidance and the accompanying survey protocol, incorporating changes we believed were appropriate. We also received technical input from the Arizona Game and Fish Department (AGFD) in developing these recommendations. We thank all of those who commented for their assistance in helping us develop the following landowner guidance recommendations.

These recommendations apply only to those areas that support suitable pygmy-owl habitat in south-central Arizona. Suitable habitat is defined as areas below 4,000 feet in elevation characterized by one or more of the following vegetation communities:

1. **riparian vegetation** (such as cottonwoods, willows, mesquites, ash, or other trees growing along watercourses);

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[1]U.S. Fish and Wildlife Service. 2000. Recommended guidance for private landowners concerning the cactus ferruginous pygmy-owl

[2]defined under Section 9 of the Endangered Species Act as harming, harassing, injuring, or killing a listed species

[3]published in the *Federal Register* (63 FR 43362)

[4]published in the *Federal Register*(63 FR 49539)

[5]published in the *Federal Register* (63 FR 64449)

2. **Sonoran desertscrub**, particularly areas containing saguaro cactus or other columnar cactus [8 feet or taller], or with ironwood, mesquites, palo verde or other trees in association with at least some shrubs (acacia, prickly pear, desert hackberry, greythorn, etc.), and ground cover (triangle leaf bursage, burro weed, grasses, etc.); or

3. **semidesert grassland** with drainages containing mesquite, hackberry, cottonwood, willow, ash, etc.

Any of these three areas with or without saguaros, but which contain the appropriate trees and lower-level cover, are considered suitable if there are individual trees with a trunk diameter of 6 inches or greater measured at 4.5 feet above the ground. Urban areas (see map for excluded areas within the Tucson and Phoenix metropolitan areas) and areas currently devoid of saguaros, other columnar cactus, or trees (such as agricultural fields) are excluded. Furthermore, this guidance only applies to actions on private lands that do not involve Federal funds, actions or permits. Federal agencies have additional responsibilities under the ESA (Section 7) and this may require the private landowner seeking Federal funds or permits for an action on private lands to take additional steps to address possible effects to the pygmy-owl.

We have identified three zones (delineated on attached maps) based on the degree of potential risk for a private or Federal entity to "take" a pygmy-owl. All three zones contain suitable pygmy-owl habitat, and are delineated according to our knowledge of their locations. Zones 1 and 2 include areas that are within the current range of the pygmy-owl and Zone 3 is within the historic range of the species. Clearing or disturbance of vegetation affecting suitable pygmy-owl habitat in Zone 1 would generally have a high risk of taking a pygmy-owl, activities in Zone 2 would be at moderate risk, and activities in Zone 3 would be a lower risk. Maps showing these zones are available from your local planning and zoning department, FWS[6], or AGFD[7]

The following recommendations apply to all areas that meet the suitable habitat criteria regardless of whether the activity is occurring within, or outside of, the designated Critical Habitat boundary[8] for the pygmy-owl.

To reflect the most current distribution of the species, the zone boundaries may change over time as new pygmy-owl location information is gathered. Zone boundaries will be adjusted no more than once during the calendar year to add newly documented locations or delete areas no longer suitable as habitat for pygmy-owls. If modification is necessary, the boundaries will be adjusted prior to the beginning of the January through June survey season.

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[6]Arizona Ecological Services Office (Phoenix - 602/640-2720 or Tucson - 520/670-4860)

[7]AGFD, Region 5 - Tucson - 520/628-5376

[8]as published in the *Federal Register* on July 12, 1999 (64 FR 37419)

We recommend conducting surveys when private actions without a Federal nexus[9] removes pygmy-owl habitat in Zones 1 and 2. In Zone 3, no surveys are recommended for strictly private actions. Unlike private landowners, Federal agencies have additional responsibilities under the ESA (Section 7) and we recommend they contact the FWS before undertaking any actions or issuing permits that might affect the pygmy-owl or its habitat in any zone, regardless of whether or not an owl is currently located in the area.

The current pygmy-owl survey protocol[10] will remain in effect until a revised survey protocol[11] is made available by a notice in the *Federal Register*. Surveys conducted prior to the effective date of the revised protocol according to either the Corman (1993 and 1995) protocol or the proposed protocol as published in the August 13, 1998 *Federal Register* (63 FR 43362) may be counted as year one of the two-year survey recommendation, if surveys were conducted in consecutive breeding seasons.

ZONE 1 AREAS WITHIN THE CURRENT RANGE OF THE PYGMY-OWL WITH A HIGH POTENTIAL FOR OCCUPANCY

Currently, this zone is located within portions of Pima and southern Pinal Counties in southern Arizona, and encompasses all recent[12] pygmy-owl locations (see current maps available from FWS, AGFD, or local planning and zoning departments).

We recommend that all private landowners in this zone that are planning to remove any of the vegetation components of suitable habitat, choose one of the following three options to minimize the risk of taking a pygmy-owl and violating Section 9 of the ESA:

1. Coordinate with the FWS to develop your property in a manner that avoids any negative effects to the pygmy-owl[13]; or

2. Proceed as if pygmy-owls are present and develop a Habitat Conservation Plan (HCP) so your activity can proceed, with any modifications necessary to minimize and mitigate effects or taking of an owl. The FWS is responsible for approving these plans and

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[9]any action or project occurring on Federal lands or other lands that involves Federal funds, actions, or authorizations.

[10]Corman 1993 and revised in 1995

[11]Cactus ferruginous pygmy-owl survey protocol (AGFD and FWS 2000)

[12]since January 1, 1993

[13]such as development that avoids adverse impacts to suitable habitat and occurs outside of the breeding season

issuing an incidental take permit[14] for proposed activities. Please contact the FWS for assistance if you are considering developing an HCP; or

3. Survey your property to determine if an owl is present (see guidance below):

   If you choose to survey your property, we recommend three surveys be conducted each year, for two consecutive years before any vegetation suitable for pygmy-owls is disturbed (see revised survey protocol for proper timing and spacing).

   Upon the adoption of a revised survey protocol, we recommend that all surveys be conducted between January 1 and June 30 in accordance with the timing and spacing guidelines described in the revised protocol and by a person with the necessary experience and surveyor permits from the FWS. Contact the FWS for a list of persons with these credentials. Survey results from the two consecutive year effort will be valid from the last survey of the second year of surveys through December 31 of that calendar year. This will provide a six to ten month window for vegetation clearing activities. If vegetation clearing is not completed in that time frame and suitable habitat is still present on January 1, we recommend that three additional surveys be completed during the following survey season (January through June) before further land clearing of suitable habitat occurs.

   Annual surveys (three survey visits conducted during the breeding season) using the revised survey protocol would be recommended for each additional year beyond the initial two-year recommended protocol until land clearing is completed. If a pygmy-owl is located, contact the FWS immediately for guidance.

ZONE 2 AREAS WITHIN THE CURRENT RANGE OF THE PYGMY-OWL WITH A MODERATE POTENTIAL FOR OCCUPANCY

This zone includes the currently known range of the pygmy-owl within Pima and southern Pinal counties, excluding those areas designated as Zone 1 (see current maps available from FWS, AGFD, or local planning and zoning departments). We expect to have pygmy-owls from Zone 1 dispersing into suitable habitat in Zone 2 and a greater likelihood of documenting new pygmy-owl locations in Zone 2 than in Zone 3. We recommend that all private landowners in this zone that are planning to remove any of the vegetation components of suitable habitat choose one of the following three options to reduce the risk of taking a pygmy-owl and violating Section 9 of the ESA:

1. Coordinate with the FWS to develop your property in a manner that avoids any negative

[14] an exemption under Section 10(a)(1)(B) of the ESA to take a listed species that is incidental to the action, is legal, and does not result jeopardize the continued existence of the listed species

effects to the pygmy-owl; or

2. Survey your property to determine if an owl is present (see guidance below), or

3. Proceed as if pygmy-owls are present and develop a HCP so your activity can proceed, with any modifications necessary to minimize and mitigate effects or taking of an owl. The FWS is responsible for approving these plans and issuing an incidental take permit for proposed activities. Please contact the FWS for assistance if you are considering developing an HCP.

If you choose to survey your property for pygmy-owls, we recommend one of the two following survey options based upon the type of development proposed. If a pygmy-owl is located, contact the FWS immediately for guidance.

a) A single-family residence:

We recommend landowners building a single-family residence[15] conduct surveys within a one-calendar year period. This recommendation is based on the low likelihood of take of a pygmy-owl in this zone from a small-scale action such as construction of a single-family residence. We recommend a one calendar year survey protocol consisting of three to five surveys, prior to land clearing activities. Three surveys are recommended between January 1 and June 30 and, if land clearing is not completed between the time the third spring survey is completed and September 14, two additional surveys are recommended between September 15 and October 31 (see revised survey protocol for specified timing and spacing). Spring surveys are conducted when breeding birds are thought to be most responsive, and the fall surveys could determine if dispersing birds have moved into the area. Limited AGFD data indicate that dispersing birds tend to establish new territories in the fall and remain there through the winter and into the following breeding season.

If land clearing is not completed between completion of the second fall survey and December 31, we recommend the one-year survey protocol be reinitiated if suitable habitat for pygmy-owls is still present and is proposed for removal or disturbance.

b) All other developments such as multiple (two or more) residential developments, commercial developments, public works, etc.:

We recommend that the two-year survey protocol identified for Zone 1 be

[15] a single-family residence can include a guesthouse

completed for activities that remove or disturb suitable habitat. Survey results will be valid from the last survey during the second year of surveys until December 31 of that same calendar year. After January 1, we recommend additional surveys if suitable habitat for pygmy-owls is still present and is proposed for removal or disturbance.

ZONE 3 AREAS WITHIN THE HISTORIC RANGE OF THE PYGMY-OWL WITH A LOW POTENTIAL OF OCCUPANCY

This zone includes portions of Santa Cruz, Gila, Graham, Maricopa, Cochise, and Pinal counties in Arizona (see current maps available from FWS, AGFD, or local planning and zoning departments). This area is based on the historical distribution of this species and the presence of suitable habitat. We are not recommending pygmy-owl surveys for private actions on private land that have no Federal nexus in Zone 3. This recommendation is based on the low likelihood of take of a pygmy-owl in this zone. We recommend that governmental agencies[16] take the lead in conducting surveys within suitable habitat in this zone to help determine if pygmy-owls are present.

For any land-clearing activities in Zone 3 affecting suitable pygmy-owl habitat, and involving private landowner actions that have a Federal nexus, consultation under Section 7 of the ESA may be required and the FWS may recommend that surveys be conducted.

If other activities[17] with a Federal nexus are proposed in Zones 1, 2, or 3 that could affect the pygmy-owl but do not involve the clearing of land, please contact the FWS for specific survey protocol guidance.

NOTE: The FWS believes that following the above survey recommendations will greatly reduce the likelihood that your activity would result in take of the endangered cactus ferruginous pygmy-owl. However, no survey protocol is 100 percent effective and some risk remains that a pygmy-owl will be missed or will show up after surveys are completed. If a pygmy-owl is detected on your property at any time, even if you have conducted the surveys as recommended and the results were negative, you will need to contact the FWS immediately for assistance in helping you to comply with the ESA.

---

[16]Federal, State, county, or local municipalities and jurisdictions

[17]such as livestock grazing, blasting, recreation, ORV use, low-level flight, loud noises, etc.

THE STATE OF ARIZONA

GAME & FISH DEPARTMENT

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May 1, 2000

Ms. Susy Morales
Harris Environmental Group, Inc.
1749 East 10TH Street
Tucson, Arizona 85719

Re: Special Status Species; Biological Assessment of Pima County Department of Transportation Widening of Cortaro Farms Road

Dear Ms. Wolff:

The Arizona Game and Fish Department (Department) has received your letter, dated March 23, 2000, regarding special status species for the above-referenced project area. The Department's Heritage Data Management System (HDMS) has been accessed and current records indicate that the special status species listed in Attachment A have been documented as occurring in the project vicinity. In addition, the project appears to occur in the vicinity of designated Critical Habitat for the cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*) (64 FR 37419, July 12, 1999). We recommend contacting the U.S. Fish and Wildlife Service, at the address listed below, for additional information regarding the Endangered Species Act and how it applies to Critical Habitat for the pygmy-owl.

Arizona Ecological Services State Office
U.S. Fish and Wildlife Service
2321 West Royal Palm Road, Suite 103
Phoenix, Arizona 85021-4951
Phone: (602) 640-2720

At this time, the Department's comments are limited to the special status species information provided above. This correspondence does not represent the Department's evaluation of impacts to wildlife or wildlife habitat associated with activities occurring in the subject area. If you have any questions regarding the HDMS information provided in this letter, please contact me at (602) 789-3605.

Sincerely,

Bob Broscheid
Project Evaluation Program Coordinator

attachment

cc: Sherry Barrett, Arizona Ecological Services Field Office, USFWS
Joan Scott, Habitat Program Manager, Region V, Tucson

AGFD# 3-24-00(06)

ATTACHMENT A

Arizona Game and Fish Department

Heritage Data Management System Query

Special Status Species

in the Vicinity of T12S, R12E, SEC 25 & 26

T12S, R13E, SEC 30

JMMON NAME	SCIENTIFIC NAME	ESA	WSCA	USFS	NPL
CTUS FERRUGINOUS PYGMY-OWL	GLAUCIDIUM BRASILIANUM CACTORUM	LE	WC		
LIFORNIA LEAF-NOSED BAT	MACROTUS CALIFORNICUS	SC	WC		
VE MYOTIS	MYOTIS VELIFER	SC			
VOUS WHISTLING-DUCK	DENDROCYGNA BICOLOR	SC			
A INDIAN MALLOW	ABUTILON PARISHII	SC		S	SR
NORAN DESERT TORTOISE	GOPHERUS AGASSIZII (SONORAN POPULATION)	SC	WC		
RSELEAF HERMANNIA	HERMANNIA PAUCIFLORA			S	
CSON MOUNTAIN SPIDERLING	BOERHAVIA MEGAPTERA			S	
AMOC GLOBEBERRY	TUMAMOCA MACDOUGALII			S	SR

CRITICAL HABITAT: VICINITY OF CACTUS FERRUGINOUS PYGMY-OWL

STATUS DEFINITIONS

LE - **Listed Endangered.** Species identified by the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA) as being in imminent jeopardy of extinction.

LT - **Listed Threatened.** Species identified by USFWS under ESA as being in imminent jeopardy of becoming Endangered.

PT - **Proposed Threatened.** Species being reviewed by USFWS for listing as Threatened under ESA.

C - **Candidate.** Species for which USFWS has sufficient information on biological vulnerability and threats to support proposals to list as Endangered or Threatened under ESA. However, proposed rules have not yet been issued because such actions are precluded at present by other listing activity.

SC - **Species of Concern.** The terms "Species of Concern" or "Species at Risk" should be considered as terms-of-art that describe the entire realm of taxa whose conservation status may be of concern to the USFWS, but neither term has official status (currently all former C2 species).

WC - **Wildlife of Special Concern in Arizona.** Species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the Department's listing of **Wildlife of Special Concern in Arizona** (WSCA, in prep.). Species included in WSCA are currently the same as those in **Threatened Native Wildlife in Arizona** (1988).

S - **Sensitive.** Species classified as "**sensitive**" by the Regional Forester when occurring on lands managed by the U.S.D.A. Forest Service.

HS - **Highly Safeguarded.** Those Arizona native plants whose prospects for survival in this state are in jeopardy or are in danger of extinction, or are likely to become so in the foreseeable future, as described by the Arizona Native Plant Law (1993).

SR - **Salvage Restricted.** Those Arizona native plants not included in the Highly Safeguarded Category, but that have a high potential for theft or vandalism, as described by the Arizona Native Plant Law (1993).

THE STATE OF ARIZONA
GAME AND FISH DEPARTMENT
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Project Evaluation Program, Habitat Branch
Heritage Data Management System (HDMS) Information

Project Description: Harris Environmental; Cortaro Farms Road
Township 12 South, Range 12 East, Sections 25,26
Township 12 South, Range 13 East, Section 30

12/11/00

The Department's HDMS has been accessed and current records indicate that the special status species listed below have been documented in the project vicinity (within 5 miles). Status definitions are included as an attachment to this form letter.

COMMON NAME	SCIENTIFIC NAME	ESA	USFS	BLM	WSCA	NPL
CACTUS FERRUGINOUS PYGMY-OWL	GLAUCIDIUM BRASILIANUM CACTORUM	LE			WC	
CALIFORNIA LEAF-NOSED BAT	MACROTUS CALIFORNICUS	SC		S	WC	
CAVE MYOTIS	MYOTIS VELIFER	SC		S		
FULVOUS WHISTLING-DUCK	DENDROCYGNA BICOLOR	SC		S		
PIMA INDIAN MALLOW	ABUTILON PARISHII	SC	S			SR
SONORAN DESERT TORTOISE	GOPHERUS AGASSIZII (SONORAN POPULATION)	SC			WC	
SPARSELEAF HERMANNIA	HERMANNIA PAUCIFLORA		S			
TUCSON MOUNTAIN SPIDERLING	BOERHAVIA MEGAPTERA		S			
TUMAMOC GLOBEBERRY	TUMAMOCA MACDOUGALII		S	S		SR

CRITICAL HABITAT: Cactus ferruginous pygmy-owl (appears to occur within)
CACTUS FERRUGINOUS PYGMY-OWL ZONE: Zone 1

At this time, the Department's comments are limited to the special status species information provided above. This correspondence does not represent the Department's evaluation of impacts to wildlife or wildlife habitat associated with activities occurring in the subject area. If you have any questions regarding this special status species information, please contact Aimee MacIlroy, Project Evaluation Program Specialist at (602) 789-3593.

cc: Joan Scott, Habitat Program Manager, Region V
David Harlow, Field Supervisor, AZ Ecological Services, USFWS

AGFD #10-2-00(07)

Attachments

APPENDIX C

Federally Listed, Proposed, and Candidate Species under jurisdiction of the U.S. Fish and Wildlife Service in Pima County, Arizona as of 3 August 2000, excluded from further consideration.				
COMMON NAME	**SCIENTIFIC NAME**	**STATUS**	**HABITAT**	**EXCLUSION JUSTIFICATION**
Plants				
Huachuca water umbel	*Lilaeopsis schaffneriana* ssp. *recurva*	Endangered	An emergent aquatic plant that requires marshy wetlands.	No habitat present
Kearney's blue star	*Amsonia kearneyana*	Endangered	Known only from the Baboquivari Mountains.	Outside of known range.
Nichol's Turk's head cactus	*Echinocactus horizonthalonius* var. *nicholii*	Endangered	Dependent on limestone substrates in desert hills.	No habitat present
Goodings onion	*Allium gooddingii*	Conservation Agreement	Occurs in forested drainage bottoms and on moist north facing slopes of mixed conifer and spruce forests	No habitat present
Pima pineapple cactus	*Coryphantha scheeri robustispina*	Endangered	Occurs in alluvial valleys or hillsides within desertscrub or semi-desert grassland.	No habitat present
Acuna cactus	*Echinomastus erectocentrus acunensis*	Candidate	Prefers well-drained knolls and gravely ridges in Sonoran Desertscrub.	No habitat present
Animals				
San Xavier talussnail	*Sonorella eremita*	Conservatio n Agreement	Requires deep, limestone rockslide areas with outcrops of limestone and decomposed granite	No habitat present
Gila topminnow	*Poeciliopsis o. occidentalis*	Endangered	Requires small streams, springs or cienegas	No water/habitat present
Loach minnow	*Tiaroga cobitis*	Threatened	Requires perennial streams with swift water over cobble or gravel	No habitat present
Desert pupfish	*Cyprinodon macularius*	Endangered	Requires shallow springs, small streams or marshes	No water/habitat present

APPENDIX C (CONTINUED)

Federally Listed, Proposed, and Candidate Species under jurisdiction of the U.S. Fish and Wildlife Service in Pima County, Arizona as of 3 August 2000, excluded from further consideration.				
COMMON NAME	**SCIENTIFIC NAME**	**STATUS**	**HABITAT**	**EXCLUSION JUSTIFICATION**
Spikedace	*Meda fulgida*	Threatened	Requires perennial streams with swift velocities over sand and gravel	No habitat present
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Sonoran deciduous forest, woodland, and scrub habitats near perennial water	No habitat present
Lesser long-nosed bat	*Leptonycteris curasoae yerbabuenae*	Endangered	Requires specific roost sites (caves & abandoned mines) and dense stands of saguaro or agave for forage.	No roost sites/habitat present
Mexican gray wolf	*Canis lupus baileyi*	Endangered	Prefers chaparral, woodland, or forested habitats.	No habitat present
Ocelot	*Felis pardalis*	Endangered	Prefers humid tropical & sub-tropical habitats; typically found at higher elevations.	No habitat present
Sonoran pronghorn	*Antilocapra americana sonoriensis*	Endangered	Grassy desertscrub in northwestern Sonora and adjacent Arizona borderlands, mainly Yuma Co.	No habitat present
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Requires large trees or cliffs near water.	No habitat present
Mexican spotted owl	*Strix occidentalis lucida*	Threatened	Montane forests and woodlands and canyon bottoms generally above 6,000-ft. elevation.	No habitat present
Gila chub	*Gila intermedia*	Candidate	Requires small streams, pools, springs or cienegas.	No water/habitat present
Masked bobwhite	*Colinus virginianus ridgewayi*	Endangered	Only known Arizona population has been re-introduced on Buenos Aires Natl. Wildl. Refuge	Outside of known range.

APPENDIX C (CONCLUDED)

Federally Listed, Proposed, and Candidate Species under jurisdiction of the U.S. Fish and Wildlife Service in Pima County, Arizona as of 3 August 2000, excluded from further consideration.

COMMON NAME	SCIENTIFIC NAME	STATUS	HABITAT	EXCLUSION JUSTIFICATION
Chiricahua leopard frog	*Rana chiricahuensis*	Candidate	Requires permanent or nearly permanent water sources.	No water/habitat present
Sonoyta mud turtle	*Kinosternon sonoriense longifemorale*	Candidate	Requires ponds and streams.	No water/habitat present
Mountain plover	*Charadrius montanus*	Candidate	Wading bird and grassland nesting species; known from near Springerville, Apache County.	No habitat present

Status Definitions:

Endangered: Imminent jeopardy of extinction.
Threatened: Imminent jeopardy of becoming endangered.
Proposed Endangered: Proposed Rule has been published in Federal Register to list as Endangered.
Proposed Threatened: Proposed Rule has been published in Federal Register to list as Threatened.
Candidate: Species for which USFWS has sufficient information on biological vulnerability and Threats to support proposals to list as Threatened or Endangered.

APPENDIX D.

Location (UTM coordinates) of desert night blooming cereus, a Salvage Restricted plant under the Arizona Native Plant Law (1993). Specimen was identified along the Pima County Department of Transportation and Flood Control District proposed road widening project, Cortaro Farms Road, UPRR to Thornydale Road, during the site visit (13 November 2000).

UTM COORDINATES: Zone 12 South, E: 0494254 N: 3580221

APPENDIX E.
Guideline for handling desert tortoises during construction projects.

GUIDELINES FOR HANDLING DESERT TORTOISES

DURING CONSTRUCTION PROJECTS

July 1994
(Revised July 1999)

prepared by:

The Desert Tortoise Council
P.O. Box 3141
Wrightwood, California 92397
Contact: Edward L. LaRue, Jr.
(PH/FAX) (760) 249-4948

prepared for:

U.S. Fish and Wildlife Service
U.S. Bureau of Land Management
California Department of Fish and Game
Nevada Department of Wildlife
Arizona Game and Fish Department
Utah Division of Wildlife Resources

Warning: These Guidelines do not authorize individuals to handle tortoises. Such authorization should come from Federal and State wildlife resource agencies, including, at least, those listed above.

Cite as: Desert Tortoise Council. 1994 (Revised 1999). *Guidelines for Handling Desert Tortoises During Construction Projects.* Edward L. LaRue, Jr., editor. Wrightwood, California.

GUIDELINES FOR HANDLING DESERT TORTOISES DURING CONSTRUCTION PROJECTS

Developed by the Desert Tortoise Council

Handling of desert tortoises and other forms of "take" (includes to harass, harm, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct) are prohibited by section 9 of the Endangered Species Act of 1973, as amended. Desert tortoise handling can only be authorized through an incidental take statement in a biological opinion, an incidental take permit (section 10(a)(1)(B) permit), or a scientific collecting permit (section 10(a)(1)(A) permit). The regulatory document(s) or permit(s) authorizing handling are the ultimate guides to how desert tortoises should be handled. We expect that these documents will often authorize handling in accordance with the following handling guidelines.

The following Guidelines have been reviewed and are based on information provided to the Desert Tortoise Council (DTC) by the U.S. Fish and Wildlife Service (Reno and Las Vegas, NV; Ventura and Carlsbad, CA; Phoenix, AZ; Salt Lake City, UT), California Department of Fish and Game (Chino and Long Beach, CA), Utah Division of Wildlife Resources (Cedar City, UT), Nevada Department of Wildlife (Las Vegas, NV), Arizona Game and Fish Department (Phoenix, AZ), U.S. Bureau of Land Management (Saint George, UT; Riverside, CA; Phoenix, AZ), several private consultants, and other individuals. Individuals contacted to develop and/or review these Guidelines are listed in Attachment 1.

The Guidelines are intended for use during construction projects monitored by authorized biologists (tortoise monitors) who are working on behalf of a project proponent in the absence of special regulatory requirements, such as a 10(a)(1)(A) scientific collecting permit. The Guidelines will be helpful to tortoise monitors performing clearance surveys and construction monitoring where tortoises need to be moved out of harm's way. They are intended to be used in coordination with U.S. Fish and Wildlife Service (USFWS) Biological Opinions issued to federal action agencies (e.g., U.S. Bureau of Land Management (BLM), U.S. Army Corps of Engineers, etc.), and state agency documents for state-authorized actions. Although useful information is provided, the Guidelines are **not** intended to replace scientific research project methodologies for handling and processing tortoises.

These Guidelines do not authorize tortoise handling. Depending on the project, responsible federal and state agencies review a person's résumé and authorize him/her to handle tortoises. These Guidelines are provided for tortoise monitors already authorized, or who hope to be authorized, by federal and state agencies. The DTC assumes that such monitors are qualified to handle and process tortoises. These Guidelines include methods and alternatives that are effectively used by professional tortoise researchers to safely handle tortoises in the field. The DTC believes that tortoise handling should be an evolving process, continually updated to include the latest, most effective and efficient methods for safe handling. A wealth of information is already available, and these Guidelines provide that information to construction monitors.

A sequential checklist for use in the field is included (section F.). When necessary, the checklist should be cross-referenced with the Guidelines for more detailed information. The inexperienced monitor should use the checklist as a reminder of steps to be taken when handling and processing tortoises, and should be completely familiar with the Guidelines before handling tortoises. The experienced monitor may also gain useful information from these Guidelines.

You are encouraged to submit comments on these Guidelines to the USFWS and the DTC. In subsequent years, the DTC will work with the USFWS, using your input, to ensure that the Guidelines are revised to incorporate new information and techniques.

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GUIDELINES FOR HANDLING DESERT TORTOISES

A. PRELIMINARY STEPS

A.1. Federal and state authorizations

Once you are selected by a project proponent to monitor construction, your résumé is typically submitted to the nearest field office of the USFWS at least 15 days prior to construction. You may also need to submit your résumé to the federal action agency (i.e., the federal agency with whom the USFWS has consulted under Section 7 of the Act) and state wildlife agencies. Within the State of Utah, any individual (including any qualified biologist) must obtain a section 10(a)(1)(A) permit from the USFWS to be authorized to handle desert tortoises. Within the States of Arizona, California, Nevada, and Utah, individuals must obtain the appropriate permits from the respective State wildlife agency to be authorized to handle tortoises. If your résumé has not been previously accepted by the responsible agency(s), you should not assume that you are approved until you have written or verbal confirmation from them. After you are authorized, you must read and comply with any federal and state regulatory documents for the project.

A.2. Specific requirements for monitors

The USFWS requires that you observe field demonstrations for egg handling or artificial burrow construction before performing either of these activities. Since 1993, the DTC has arranged for USFWS-authorized biologists to demonstrate these procedures at its annual workshop. Those observing the demonstrations were given certificates. Such demonstrations may be available at future DTC workshops, depending on demand.

The USFWS distinguishes between desert tortoise biologists and environmental monitors as follows: Biologists should (a) possess a bachelor's or graduate degree in biology, ecology, wildlife biology, herpetology, or related fields; (b) demonstrate a minimum of 60 days prior field experience using accepted resource agency techniques to survey for desert tortoises; and (c) have the ability to recognize and to accurately identify and record all types of desert tortoise sign. Generally, only qualified biologists, and not environmental monitors, may handle tortoises. Environmental monitors may handle tortoises in emergency situations, but only if they have explicit authorization to do so by the appropriate office of the USFWS.

A.3. Sequential numbering scheme

Prior to beginning the project, you should contact the USFWS and/or other regulatory agency to determine if tortoises are to be marked for your project. In California, the BLM and United States Geological Survey - Biological Resources Division (USGS - BRD) assign tortoise numbers that are used by scientists to mark tortoises on study plots located throughout the Mojave and Colorado Deserts. If your project is near one of these plots, it is important that you contact the appropriate offices of the BLM and USGS - BRD before marking tortoises to ensure that your numbers will not be confused with those used by the federal agencies.

A.4. Examples of numbering schemes

If tortoises are to be marked, they should be identified by project initials and numbers. Examples include: (a) initials of the project followed by a sequential number; (e.g., "MB1" for the first tortoise marked on the Morongo Basin Pipeline project, "MB2" for the second, etc.); (b) initials of the monitoring organization followed by a sequential number; (e.g., "DTC1" for the first tortoise marked by the Desert Tortoise Council on a project, "DTC2" for the second, etc.).

A.5. Getting organized

The materials that you are likely to need for handling tortoises are listed in Attachment 2. Many researchers organize their materials so that they have a "tortoise handling kit for the field," "tortoise handling kit for the truck," "burrow excavation kit," "tortoise marking kit," etc. In any case, it is important that you have all the materials that you need to safely and quickly handle tortoises. It is equally important that you be organized and ready to handle tortoises expeditiously when they are found.

B. IN THE FIELD

While monitoring construction, you will observe tortoises either aboveground or in burrows. When aboveground, tortoises should only be moved if in harm's way. If not, do not handle them, but monitor them to ensure that they are not adversely affected by construction. Depending on the circumstances, tortoises that are beneath machinery, in trenches or pipes, under pallets, or anywhere within the right-of-way may be in danger and need to be moved. If they must be moved, use the appropriate recommendations in these Guidelines to ensure safe handling.

You will also find tortoises in burrows in areas where they will be harmed if not moved. The following sections advise you on how to handle such tortoises.

B.1. Prior to excavating burrows

B.1.a. Determining if burrows should be excavated - *According to most agency* documents, tortoise burrows are excavated only if they occur within a construction right-of-way, in an area to be cleared of vegetation, or in areas that will not be cleared, but will be negatively impacted by heavy equipment, such as staging areas and turnarounds. The agency document typically requires that such areas be flagged and that construction activities be confined to those areas.

If a tortoise burrow is inside the designated construction area and will be damaged or destroyed, excavate it. Spider webs, litter, and other debris may accumulate in burrow openings overnight, and openings may collapse during winter rains. Do not assume that a burrow is inactive if it looks unused or collapsed. Tortoises may use canid or mustelid digs, and may be found in burrows of other animals, particularly kit foxes. Burrowing owls may use tortoise burrows, but do not assume that burrows occupied by owls are not also occupied by tortoises. Juvenile tortoise burrows may resemble rodent burrows, or juveniles may be inside such burrows. Therefore, excavate all burrows that will be lost to construction. If a burrow opening is outside the construction area, but a tortoise at the end of the burrow may be within the area, excavate it. Remember that a burrow may extend 30 feet beyond the opening.

B.1.b. Describing burrows When possible, we recommend that you take measurements of the burrow before excavating it. The information should be recorded in your field notebook, and, if a tortoise is present, would be transferred to the data sheet (section E.). Measure the width and height just inside the opening of the burrow, the length (in many cases you cannot measure the length until you are finished excavating the burrow), determine burrow orientation using a compass, and record its condition using the categories given below. We recommend that you use permanent black ink and high rag content, acid-free paper for recording data. The following categories may be used to describe the conditions of burrows (U.S. Fish and Wildlife Service 1992):

Class:
1. currently active, with tortoise or recent tortoise sign
2. good condition, definitely tortoise; no evidence of recent use
3. deteriorated condition; definitely tortoise (please describe)
4. good condition; possibly tortoise (please describe)
5. deteriorated condition; possibly tortoise (please describe)

B.1.c. Other considerations - Depending on the time of year and other conditions (*B.5.c.ii.*) you may need to construct a burrow **before** you remove a tortoise from its natural burrow. Recommended techniques for burrow construction are discussed in section *B.5.f.*

B.2. Mapping burrows

If a burrow is to be excavated, there are several important reasons for mapping it: (a) resource agencies can determine how many tortoises were encountered on the project compared with the number of burrows excavated; (b) the information will be available for future projects in the same area; (c) burrow locations may be important for organizing monitors and determining tortoise "hot spots" versus areas where few, if any, tortoises are found; and (d) the number and location of burrows found during initial tortoise surveys can be compared with the number and location of burrows found during monitoring; (i.e., the data may provide information to determine appropriate take limits based on the findings of initial surveys). Typically, the USFWS requires that the number of tortoises observed during construction be reported. Mapping the information will show the location of the tortoises. Some monitoring supervisors require that all tortoise sign be mapped. If an artificial burrow is used, we recommend that it be accurately mapped. If the burrow is blocked (section *B.5.f.i.*), it is essential that you map it and mark it in the field so you can find and unblock it later.

B.3. Map types

When you map burrows, we recommend that they be numbered and shown on maps of appropriate scale. If monitoring a linear right-of-way, it often helps to number burrows sequentially within a given section of the alignment (e.g., "B-23-2," for burrow #23 on reach 2). Mapping is important if many monitors are locating, numbering, and mapping burrows simultaneously. United States Geological Survey (USGS) 7.5' topographical maps (scale 1" = 2,000'), or enlargements of them, are useful. Project maps at a scale of 1" = 100' or 1" = 200' are particularly useful when burrows are common and better resolution is necessary. The assigned numbers may be cross-referenced with data sheets, field notes, and photographs.

B.4. Excavating burrows

B.4.a. Looking for eggs - Feel for tortoise eggs by gently probing the soil in front of the burrow opening (i.e., the mound) and along the floor as you excavate the burrow. Eggs have been found up to six feet in front of burrow openings and up to six feet within the entrance of a burrow; they may occur in the mound at the burrow opening. To avoid crushing eggs, do not scrape the shovel across the bottom of the burrow, but continue to probe the area with your fingers as you proceed. Removal of the top ten inches of soil (or until a hard layer of soil is encountered) will typically ensure that you find any tortoise eggs. Be particularly careful between late April and mid-October when eggs are most likely present. If found, follow the USFWS's egg handling protocol (Attachment 3). Although not included in the protocol, we strongly recommend that you wear disposable latex gloves when handling eggs.

B.4.b. Excavating burrows - We recommend that monitors wear leather or cloth gloves during burrow excavation to avoid being bitten or stung by venomous animals. Blunt-nosed shovels or garden trowels are useful. If available, two monitors, each with a shovel, may excavate a burrow. One person may place his/her shovel in the burrow entrance and the other person, using a similar shovel or spade, would slice away the ceiling. Excavate the burrow slowly and carefully and stop often to see if a tortoise is within reach. It may take several minutes or several hours to excavate a tortoise burrow, depending on its length and other characteristics.

If you are the only monitor present, we recommend the following. Depending on the size and depth of the burrow, carefully slide an appropriate-sized plank six inches to two feet into the opening. You could use a 1" x 2" plank for smaller burrows and a 2" x 4" plank for larger burrows. Gradually collapse the burrow onto the plank, and remove the soil from the burrow tunnel as you go. Do not collapse the burrow ahead of the plank. You should feel the shovel contact the plank with each stroke. In this way, you will avoid striking a tortoise with the shovel. Alternatively, you may use a second shovel instead of the plank, which will facilitate removing soil from the burrow as you collapse it.

B.4.c. Finding and removing all tortoises - Regardless of the excavation method, you should always excavate the burrow to its absolute end(s), then excavate an additional foot-or-so of harder soil beyond the suspected end to ensure that a tortoise is not behind a dirt "plug" or mound. Search all side tunnels within the burrow for tortoises, especially in kit fox dens. If a tortoise is found, do not assume that it is alone. After removing the first tortoise encountered, you should return to the burrow and continue to excavate it looking for additional tortoises. After excavating the burrow, leave it collapsed so that no tortoise may reuse it easily.

B.5. Finding tortoises in burrows

B.5.a. Taking temperature readings - When a tortoise is encountered during burrow excavation, we recommend that you stop digging and check and record the air temperature [thermometer shaded at 1.5 m (4.9 ft) above the ground] and ground temperature [thermometer shaded at 1.0 cm (0.4 in) above the ground].

B.5.b. *Deciding if tortoises should be processed* - Data collected in a consistent manner during construction projects will be useful to resource agencies developing mitigation measures for future projects. However, the health of a tortoise is your number one priority. Only process a tortoise (i.e., weigh, measure, sex, and photograph it; section B.7.) if the situation allows you to do so without harming it or neglecting additional tortoises that may enter the construction site. If you are unable to do more than move a tortoise out of harm's way and monitor it to ensure its safety, you have done your job. Skip section B.7. if the situation is not right for processing a tortoise. The following sections discuss situations where you should or should not process tortoises.

B.5.c. Specific considerations before processing tortoises

B.5.c.i. Tortoise temperature preferences - The preferred daytime body temperature of desert tortoises is 69 °F to 101 °F (McGinnis and Voigt 1971). The critical maximum body temperature is between 103 °F and 112 °F (Brattstrom 1965, Naegle 1976). Berry and Turner (1984) found that juvenile tortoises preferred air temperatures of 63 °F to 66 °F during March, and 77 °F to 83 °F during June. Consequently, more juvenile tortoises were located in the morning (76.1%) than in the afternoon (23.9%). USFWS (1991) requires that measures be taken to ensure a tortoise does not overheat if it is processed when air temperature exceeds 90 °F at 1.5 m above the ground or if ground temperature exceeds 95 °F. Unless detailed processing (i.e., weighing, measuring, and photographing tortoises) is specifically required by federal or state agencies, we recommend that tortoises **not** be completely processed when air temperature exceeds 90 °F or ground temperature exceeds 95 °F. Under such conditions, the tortoise should be only inspected (section *B.7.d., B.7.e.,B.7.f.*), marked (section *B.7.g.*), and released (section *B.8.*).

B.5.c.ii. Other considerations - Based on the time of year and other conditions, we make the following recommendations to help you decide if tortoises should be processed. In this section, we assume that (1) you are authorized to handle tortoises during the authorized construction project, and (2) the tortoise must be moved out of harm's way regardless of extreme weather conditions or other potentially threatening situations.

B.5.c.ii.(a). During hot temperatures - When air temperature is greater than 90 °F or if the ground temperature is greater than 95 °F at the time you find a tortoise in a burrow that must be excavated, we recommend that you only inspect, mark, and release the tortoise (section *B.5.c.i*); construction of an artificial burrow may be necessary (*B.5.f.*). If possible, only excavate burrows and remove tortoises when temperatures do not exceed these limits. If a tortoise is found aboveground when these upper temperatures are exceeded, and the tortoise must be moved from harm's way, place it in the shade of a shrub, ideally in the vicinity of a nearby burrow of similar size (*B.8.a.*).

B.5.c.ii.(b). During cold temperatures - When tortoises are likely inactive (section *B.5.e.*), prior to removing them from their burrows, construct an artificial burrow and place the tortoise inside after it has been processed. The USFWS requires that you receive written permission from the private land owner if a tortoise is to be placed on private property.

B.5.c.ii.(c). At or near sunset - If a tortoise with a midline carapace length (MCL) (section *B.7.h.*) less than or equal to 180 mm is rescued from the construction site at or near sunset, we recommend that it be held overnight in a clean, unused cardboard box and released the next morning near the capture site. A larger tortoise (i.e., MCL greater than 180 mm), which may be less prone to predation than a juvenile tortoise, does not need to be held overnight, but should be released under a shrub (section B.8. for more information on releasing tortoises). We recommend that the tortoise be monitored until it resumes normal behavior, "settles in" for the night, or until you are no longer able to watch it due to darkness. In such a situation, we recommend that you be at the release site at or before sunrise the next morning to look for and continue to monitor the tortoise.

B.5.c.ii.(d). If tortoises are seriously ill - If a tortoise has prevalent signs of Upper Respiratory Tract Disease (section *B.7.d.iv.*) or hyperthermia (section *B.6.a.i.*), or otherwise appears to be seriously ill, we recommend that you construct a burrow, place the tortoise inside, block its entrance (section *B.5.f.i.*), and call the USFWS or the action agency to inform them of the situation. If you are unable to reach the appropriate agency for further instruction, check the tortoise on the next day(s), continue to record observations on its health, and contact the agency as soon as possible.

B.5.c.ii.(e). Other situations - There will be times when you will be required to exercise judgment on the appropriate disposition of a tortoise. For example, if you are the only monitor on a pipeline project in an area of high tortoise density, you would not likely process tortoises because other tortoises may wander, unseen, into harm's way while you were doing so. You may put an "excavated" tortoise in an artificial, plugged burrow until pipe installation has moved out of the area. Use your common sense, and always keep the welfare of the tortoise in mind.

B.5.d. Transporting tortoises

B.5.d.i. Use a box - There are a few situations where a tortoise may be taken from the field, held overnight, and then released the next morning. We recommend that during transport each tortoise remain in a clean, unused cardboard box that is covered or closed. Newspaper placed in the bottom will absorb any urine that is voided. The box should be ventilated in such a way that a tortoise's leg or head will not get stuck. Never put more than one tortoise in a box. Do not allow tortoises to roam freely in the vehicle, nor should they be transported in shopping bags or other containers less sturdy than a new cardboard box. Mark the box or discard it immediately after use to be sure that it is not used for another tortoise.

B.5.d.ii. Precautions - Never place tortoises over the catalytic converter or other area that becomes hot with vehicle operation. Truck beds or floorboards should be padded and travel should be at speeds that minimize vibrations or shifting of the box. A tortoise should never be left unattended in a vehicle. During summer months, desert tortoises may be transported in an air conditioned vehicle as long as they are in a covered cardboard box and the vehicle interior temperature is maintained between approximately 75 °F and 80 °F. If a tortoise is taken during the winter inactivity period, it should be maintained at approximately 55 °F, which will be less stressful to it than much warmer temperatures, and may allow it to remain in a physiological state of hibernation.

B.5.e. Preliminary steps to handling tortoises - When a tortoise is encountered, stop digging. If it is during the tortoise inactivity period (i.e., typically during July and August, and between November and February, when tortoises are less likely found aboveground; in Arizona the inactivity period may begin in late May or June), we recommend that you or another monitor construct an artificial burrow into which the tortoise will be placed after processing. If it is during the activity period (i.e., when tortoises are typically found aboveground between March and June and again between September and October), we recommend that you place the tortoise in the shade of a shrub, or depending on conditions (section *B.5.c.ii*), in an artificial burrow.

In previous federal Biological Opinions, the USFWS has recommended that a tortoise removed from its burrow be placed in a similar-sized burrow found in the area. We do not recommend this for the following two reasons: (a) there is the possibility of exposing a clinically healthy tortoise to URTD or another pathogen in the similar-sized burrow; and, (b) burrows are often too deep to tell if a resident tortoise is already in the burrow, and placing the "excavated" tortoise into an occupied burrow would result in stressing both tortoises. Therefore, if conditions are appropriate (section *5.c.ii.*), we recommend that the tortoise be placed *beside* a burrow of similar size or be placed in an artificial burrow as described below.

B.5.f. Constructing burrows - A reasonable amount of time to create an artificial burrow is from 30 minutes to several hours depending on the substrate. A suitable burrow may be created in several minutes using a gas-powered auger.

B.5.f.i. The "traditional method" - An artificial burrow is intended to provide immediate shelter and protection to a tortoise that was hibernating or aestivating when you removed it from its natural burrow. The following are guidelines to assist artificial burrow construction (after Tortoise Group 1994). The USFWS requires that you observe a field demonstration before constructing a burrow.

Dig a burrow that is (a) roughly the same orientation and size as the burrow from which the tortoise was taken, (b) six feet long, and (c) slanted downward about 15 to 20° below the horizontal line of the ground. Next, slide the plywood top onto the shelf. Avoid knocking dirt into the tortoise crawl space by inserting the plywood onto the three-sided shelf from the front end of the burrow. Do not drop the plywood onto the burrow from above. Once you are sure the plywood fits snugly, remove the plywood, smooth out the bottom of the burrow, and be sure that it will accommodate the tortoise. Loosen the soil along the floor of the crawl space to a depth of six inches to allow a tortoise to dig its way out should the plywood sag and possibly trap or pin it in the burrow. Replace the plywood and shovel dirt on top. Mound the dirt so that rain water will not puddle on top of the finished burrow.

We recommend that you cover the opening of the artificial burrow with rocks or wood for two or three days to ensure that the tortoise remains within the burrow and out of harm's way, or that it resumes hibernation or aestivation. This is particularly important if most of a tortoise's burrows have been lost to construction and it would be unable to find an existing burrow in a reasonable amount of time. After several days, when construction activities have left the area (i.e., as on a pipeline or transmission line), or when you are reasonably sure that the tortoise is safely hibernating or aestivating, **it is absolutely essential that you remove the rocks from the opening of the blocked burrow.**

B.5.f.ii. Another method - EnviroPlus (Goodlett 1992) has found that a safe burrow can be created quickly using a gas-powered auger. They have observed wild tortoises voluntarily enter these burrows shortly after they are made. Different-sized augers are available to create burrows for juvenile or large adult tortoises. With an extension, the burrow can be dug to a depth of about five feet. Using an auger, you can make a burrow that meets the criteria suggested above for a traditional burrow.

B.5.f.iii. Mapping and finding blocked burrows - If you block a tortoise inside a burrow, you must find that burrow in a few days to unblock it. Accurately map the burrow so that you can find it again. Additionally, we recommend that you mark the area. For example, Tierra Madre Consultants (LaRue 1993) marks burrows with lath or ribbon placed a standard distance and direction from each burrow. A cryptic message is written on the lath to show burrow location: "B23-2100FTS," to indicate that "Burrow #23 on Reach 2 is 100 feet south of the lath." The area must be discreetly marked to avoid attracting people or ravens to the burrow.

B.6. Handling tortoises

B.6.a. Precautions while handling tortoises

B.6.a.i. Avoiding hyperthermia - Do not expose a tortoise to direct sunlight. Keep it in the shade of your body, a shrub, a truck, etc. Remember that ground temperatures are much hotter than air temperatures. You should not place a tortoise on the hot ground, but may remove the top several inches of hot sand to expose a cooler layer below. Indications of hyperthermia may include aggressive struggling by the tortoise, a tortoise hot to the touch, frothing at the mouth (i.e., excessive salivation), or voiding of the bladder. The critical maximum body temperature for desert tortoises is between 103 °F and 112 °F (Brattstrom 1965, Naegle 1976).

If an animal begins frothing at the mouth (i.e., salivating excessively) it is probably nearing a lethal body temperature and immediate action is required: (a) if already constructed, place the tortoise in the artificial burrow, or create a pallet burrow in the shade of a bush and place the tortoise inside; (b) pour water on the ground beneath a shrub and place the tortoise in the shade on the water; (c) pour tepid (approximately 68-95 °F) water over the shell and/or wipe the skin and shell with a wet cloth; and, (d) if an air conditioned vehicle is available, place the tortoise into a box and take it into the cool vehicle (section *B.5.d.ii.*). Heat-stressed tortoises should not be released until they resume normal behavior. They should be monitored after release.

B.6.a.ii. Avoiding transmission of Upper Respiratory Tract Disease - At all times, you should handle a tortoise as if it has URTD, and in such a way that you will not transmit the disease from one tortoise to another. Much of the following information was developed by Dr. Kristin Berry (Berry 1993, 1988).

B.6.a.ii.(a). Treating clothing - Do not allow a tortoise to contact your clothing. If it does, change your clothes before handling another tortoise. Contaminated clothes should be washed before you wear them again while handling tortoises. It is advisable to have a change of clothes on-hand. Change your clothes, including your shoes, before leaving the site for another geographical region; (e.g., another valley or mountain range would be considered a separate region). Dipping the bottoms of your shoes into a sterilizing solution [section *B.6.a.ii.(d).*] or wiping them with a rag dipped in the solution may be sufficient for the shoes to be worn at another location. When visiting multiple sites on a single trip, always visit sites with known occurrence of URTD last. This will minimize the probability of spreading disease.

B.6.a.ii.(b). Treating vehicles - The USFWS recommends that you wash vehicle undercarriages and tires prior to traveling from a site where URTD is known or expected to occur to a site where URTD has not been reported. With appropriate planning, you should be able to accomplish this task.

B.6.a.ii.(c). Treating processing implements - The tips of calipers, which contact tortoises during shell measurements (section *B.7.h.*), may be covered with material to avoid direct contact with a tortoise and therefore contamination of the calipers. However, as with all other implements not directly contacting a tortoise, handling a tortoise, then handling the calipers results in contamination, and we believe that the instrument should be sterilized even if the tips are "protected." Alice Karl, who has handled tortoises for many years, only touches a tortoise with one hand, leaving the other one free and uncontaminated to handle the implements and record the data (personal communication, 6 August 1993). In such a case, the covered caliper tips are sufficiently protected. A metal or plastic rule may be used to measure the plastron (section *B.7.h*), but do not use wooden rules, which are too porous and cannot be properly sterilized. Although using a file to notch tortoises is not used for construction monitoring, if a researcher uses this technique (only with prior approval from the USFWS), the file should also be sterilized before use on another tortoise.

B.6.a.ii.(d). Sterilizing solutions - The USFWS requires that you sterilize all materials that contact a tortoise in one of the following solutions: (a) 95% isopropyl alcohol, (b) 95% ethyl alcohol, or (c) 25% solution of chlorine bleach and water. However, given that the organism is now known to be a mycoplasma, Berry (personal communication, 1 March 1994), citing discussions with Dr. Elliot Jacobson, indicated that of these three solutions, only bleach would be effective against the organism. All implements should be soaked in the solution for at least 20 minutes prior to using them on a different tortoise.

B.7. Processing tortoises

Processing a tortoise (i.e., weighing, measuring, sexing, and photographing it) should only be done by experienced monitors. If you have never handled or processed a tortoise, we recommend that you obtain experience before doing so in the field. Careful practice on pet tortoises, or observing more experienced biologists handling tortoises in the field, are recommended. Experts say that with practice you should be able to process a tortoise in 15 - 20 minutes. We do not recommend that you process a tortoise if the temperature is too hot, or if there is a chance that a second tortoise may be endangered while you are processing the first one. If processing a tortoise will endanger it or other tortoises, or if you have little or no experience in processing tortoises, skip this section and continue with section B.8.

B.7.a. Maintaining sterile conditions - Before touching a tortoise, the USFWS requires that you put on clean latex disposable gloves, and that you have them on during the entire process. Even if you do not process the tortoise, but only move it out of harm's way, you should wear gloves. We recommend that if a glove is torn while handling the tortoise, which is likely when its toenails scrape the glove, you should put a new glove on over the torn one. Once used, disposable materials such as latex gloves, t-shirt bags, or surveyor's tape (section *B.7.b.*) must be disposed of promptly. We recommend that each monitor have a garbage bag on hand, and that disposable materials be placed in the bag immediately after use. For non-disposable materials, the USFWS requires that each item be sterilized before it is used on a separate tortoise [section *B.6.a.ii.(c).*]. Additional recommendations and USFWS requirements are given in subsections of section *B.6.a.ii.*

B.7.b. Weighing tortoises - If the situation allows, you may weigh a tortoise. Experts recommend weighing a tortoise immediately after it is removed from the burrow. This way you have a true weight should the tortoise void its bladder, and can weigh it afterwards to determine how much fluid has been lost. One reason for weighing a tortoise is to determine if it is underweight, which may be one sign that it has URTD or another disease.

B.7.b.i. Using spring scales - If you are using a spring scale, a plastic grocery bag, cotton string, or surveyor's tape may be used to suspend the tortoise from the scale. If you use string or surveyor's tape as a sling, be sure that the material is strong enough to support the tortoise. The tape may be doubled for use with very heavy tortoises. Smaller tortoises may be placed inside a grocery bag or ziplock bag and weighed. Larger tortoises can be weighed by making a sling with one loop of the bag placed posterior to its forelimbs and the other loop placed anterior to its hindlimbs. Never suspend a tortoise far from the ground; suspend the tortoise over sand rather than large rocks; keep weighing time to a minimum; and take every precaution to prevent the tortoise from falling.

The following scale sizes are recommended: (a) 0 to 100 g scale with a 1.0 g precision for small tortoises, (b) 1 kg scale with a 10 g precision for moderate-sized tortoises, and (c) 5 kg scale with a 50 g precision for large tortoises. *Pesola* brand spring scales have been recommended. It is best to use the smallest scale that will accommodate the weight of a tortoise. Occasionally a tortoise will weigh more than 5 kg; mark that information on the data sheet. Keep scales clean. When weighing a tortoise, hold the ring at the top of the scale to ensure that the scale is suspended vertically and the correct weight is being taken. Record the information on the data sheet. Note: Some researchers use electronic *Mettler* scales or *Chantillon* balances for more accurate weights.

B.7.c. Immobilizing tortoises

B.7.c.i. Using coffee cans - A desert tortoise may be placed on the top of a coffee can or other large can to facilitate observations and measurements as described in the following sections. The can should be large enough to support the tortoise and small enough to prevent any waving appendages from touching the can. (Note that coffee cans come in several sizes and can be "nested" in one another for ease of transport and for handling different-sized tortoises). Freedom to move its appendages may encourage a tortoise to extend its head, which allows you to observe the eyes, nares, chin glands, and beak where most signs of URTD are observed. The can must be sterilized before using it with another tortoise, or you may place waterproof plastic, such as a baggy, on top of the can, the tortoise on top of the plastic, and discard the plastic afterwards.

B.7.c.ii. Using towels - A tortoise may be held on a clean cloth between your knees as you kneel. Use your body to shade the tortoise during processing. You may scrape away the hot, upper surface of the soil down to a cooler level onto which you can place the towel and the tortoise. While holding the tortoise firmly between your knees, carefully press down on its back to immobilize it. The cloth prevents direct tortoise contact with your clothing, but may not prevent urine or nasal exudate from soaking through the towel and contaminating your clothes. If this happens, you should change your clothes before processing another tortoise. In either case, the cloth must be soaked in a disinfecting solution and laundered before it can be used on another tortoise. Disposable baby changing sheets have been suggested in place of cloth towels.

B.7.d. Observing tortoises - If the situation allows, we recommend that you observe a tortoise and record ectoparasites, shell lesions, signs of osteoporosis or osteomalacia, injuries, and evidence of URTD. Much of this information is taken from Berry (1993, 1988).

B.7.d.i. Ectoparasites - Potentially encountered parasites of tortoises include adobe tick (*Ornithodorus turicata*), mites (*Trombicula sp.*), and bot fly larvae (Family: Cuterebridae). In some areas, ticks are the most common parasite observed on wild tortoises. They generally adhere to the growth areas between scutes, particularly on rear marginal scutes. If present, mites will be found on the skin. Bot fly larvae would appear as a large swelling or bulge (1.0 - 1.5 cm long) on the neck, leg, or tail. There will be a small hole through which you may observe the larva. Experts recommend that you do not try to remove parasites. Such unnecessary handling would likely injure and/or stress the tortoise. We recommend that the numbers and locations of each parasite be recorded on the data sheet.

B.7.d.ii. Shell lesions - There are many types of lesions, ranging from injuries caused by predators to diseases of scute and bone The field worker should look for and record any observations on scute and bone irregularities, discoloration, apparent damage (healed or healing), open wounds, holes, pits, etc. Since we do not know much about shell diseases in the desert tortoise at this time, photographs and written descriptions will be very useful. See section **B.7.h.** for taking photographs of plastrons.

B.7.d.iii. Osteoporosis and Osteomalacia - These diseases can manifest themselves to the observer by depressed scutes and/or thinning scutes with exposed bone beneath. Some scute depression and thinning is part of the normal aging process of the shell, or may result from nutritional deficiencies or pathologies. It is recommended that the field worker photograph such conditions and record the information on the data sheet.

B.7.d.iv. Upper Respiratory Tract Disease - Tortoises may have this disease and not show any obvious sign of it. Therefore, **treat every tortoise as if it has URTD to avoid spreading the disease to healthy tortoises.** Observe all tortoises for the following signs of URTD: (a) wheezy, rattling breath; (b) clear to green mucous coming from the nostrils or dirt caked around the nostrils; (c) dirt caked on forelimbs due to mucous being rubbed there; (d) puffy eyes or eyes sunken and dull; (e) swollen, oozing chin glands; (f) lethargic, with legs or head listlessly distended from shell; etc. Very low body weight, lack of skin luster, or a dry mummified appearance may be evidence of URTD or another disease (Kristin Berry, personal communication, 2 February 1994). We recommend that these signs or abnormal behavior be recorded on the data sheet. Photo-documentation of signs of URTD is strongly recommended.

B.7.e. Recording distinctive features - If the situation allows, we recommend that you record on the data sheet diagram any marks or anomalies (e.g., unique morphological features, damaged limbs, damaged shell, manmade marks on the shell, etc.): Captive tortoises may be marked with paint, have initials carved in their carapaces, have holes drilled in their marginal scutes, or have raised centers on their carapace scutes due to abnormally high growth rates. Some anomalies may include irregular gulars, extra vertebral scutes (normal is five), paired or malformed costal scutes (normal is four on each side), extra marginal scutes (normal is 11 on each side), or missing scutes. There may be too many or too few toes, or malformed toe nails. We recommend that you describe a tortoise in enough detail that another monitor would recognize it from your description. This information may be important to distinguish "problem" tortoises that persistently enter construction sites.

B.7.f. Sexing tortoises - If the situation allows, we recommend determining the sex of a tortoise if its midline carapace length (MCL) is greater than or equal to 180 mm (section *B.7.h.*); the sex of smaller tortoises is not easily, if at all, determinable. If the MCL is less than 180 mm, mark "sex unknown" on the data sheet. Generally, the following male characteristics may help differentiate them from females: (a) concave plastron; (b) longer, more curved gulars; (c) larger size; (d) longer, broader, more conical tail; (e) shorter, thicker toenails; and (f) larger, well-developed chin glands. For less experienced monitors, pay particular attention to the gular projection and the shape of the plastron, which are the two best characters for differentiating the sexes. For very large tortoises, you can feel the concave (male) or flattened (female) plastron or see it by holding the tortoise at eye level without turning the tortoise over on its back. When in doubt, record all other information and mark "sex unknown" on the data sheet.

B.7.g. Marking tortoises - If the situation allows and if you are required to mark a tortoise by painting an identification number on a scute, we recommend the following. Use a clean, sterile toothbrush to remove dirt from the left fourth costal scute, where the tortoise will be marked. If this scute is damaged, use the right fourth costal scute. The number is likely to last longer if placed on a rough, off-centered surface where shell-wear is less common, which is one reason only the fourth costal scutes are used for marking. Next, place a small dot (i.e., no larger than 1/4 inch diameter) of "white-out" or acrylic paint on the scute. Once the spot is dry, write the pre-arranged number on the spot using a waterproof, permanent black ink pen. Some biologists recommend using a capillary type technical pen with a point diameter of about 0.25 mm.

Allow the number to dry before applying epoxy. Devcon brand, five-minute epoxy has been recommended by some field-workers. It is advisable to mix the epoxy on a file card or piece of paper, then transfer the mixed epoxy to the number on the shell with something such as a toothpick, wooden coffee stirrer, or tongue depressor. Wait several seconds until the epoxy starts to thicken but is still liquid enough to spread over the numbered spot with ease. Cover the paint spot overlapping its edges just enough to seal the paint. **Never allow the epoxy to spill over onto the growth area, which occurs at the border between two scutes.** Anticipate this when applying the paint so there will be space for the epoxy to overlap the paint without entering the seams. It may be helpful to cover the margins of the scute with 1/2" wide masking tape before applying the epoxy, to ensure that the epoxy does not touch the growth area, especially on smaller tortoises. Record the assigned number on the data sheet.

B.7.h. Measuring tortoises - If the situation allows, while the epoxy is drying (be careful to avoid smearing the epoxy), we recommend that you measure the tortoise and record the following information on the data sheet: (a) carapace length at the midline (MCL), (b) plastron length from the gular notch to the anal notch (PLN), (c) width at the junction of the seventh and eighth marginal scutes (Width M7/M8), and (d) maximum height from the intersection of the abdominal and femoral scutes (i.e., at the junction of the two largest scutes on the plastron and the two immediately posterior) to the corresponding position on the carapace (Max height). The USFWS requires that all measurements be in millimeters. Use calipers for the most accurate measurements, or a plastic/metal rule as an alternative.

While taking measurements, tortoises are to be handled carefully. Do not turn the tortoise over to measure its plastron. This measurement can be made with the tortoise in an upright position. Mishandling may result in pulmonary edema, psychogenic shock, or intestinal torsion. If eggs inside a female are broken while you are handling her, she may die from egg yolk peritonitis.

B.7.i. Photographing tortoises - If the agency requires that you photograph processed tortoises, we recommend that you take the following color, slide photographs: (a) dorsal view of the carapace, (b) ventral view of the plastron, (c) the numbered scute, and (d) frontal view of the tortoise's face and forelegs. If the tortoise is too large for you to hold while taking a photograph of the plastron from the underside, do not take this photo. If present, have another monitor hold the tortoise while you take the plastral photograph. It is important that each object fill 80 - 90% of the frame and that the object be clearly focused. Kodachrome film has been suggested because the slides last longer with less discoloration than Ektachrome, for example. We recommend that the following information appear in the photograph: date, biologist's name, project name, and tortoise number. Two types of labels have been recommended:

(a) hold a small card adjacent to the tortoise so that the above information is clearly visible on the photograph without blocking the part of the tortoise being photographed; or,

(b) attach a 1/2" x 1/2", adhesive "Avery label" to the tortoise to allow for closer, more detailed photographs of the subject.

It is suggested that you keep a log of the photographs in your field notes (e.g., "Roll 1, Slide 23, carapace of Tortoise 4.") If you are inexperienced with photography, we recommend that you not photograph tortoises. If you are only somewhat experienced, we recommend that you shoot several test rolls of film prior to photographing tortoises in the field. Use only camera settings that produce the clearest slides. If available, we recommend that a second monitor take the photograph while you, the processor, hold the tortoise. We recommend that processed slides be labeled with the following information: date, biologist's name, project name, tortoise number, township, range, section, county, and state.

B.8. Releasing tortoises

B.8.a. Translocating tortoises - Once a tortoise has been processed, or moved out of harm's way, do not move the tortoise more than 1,000 feet from the collection site unless otherwise directed by the USFWS. You should carefully consider the situation before you release tortoises (section *B.5.c.ii.*). The minimum distance from the edge of the construction zone that a tortoise can be translocated will be determined by its age and sex (different home range sizes), the presence or absence of tortoise-proof fencing around the perimeter of the construction zone, and the duration of the construction activity The USFWS has required that tortoises removed from construction sites be placed in the shade of a shrub, in a natural unoccupied burrow, or in an artificial burrow (section *B.5.*). We do not recommend that tortoises found aboveground be placed inside an artificial burrow, but rather released as described elsewhere (section *B.8.b.*). Further, the DTC recommends that tortoises not be put into existing burrows for reasons given in section *B.5.e.* A tortoise should not be placed on private land without the written permission of the landowner.

B.8.b. Releasing tortoises

B.8.b.i. Temperature considerations - The USFWS requires that tortoises be released at a temperature that is suitable for activity, with reasonable expectation that the temperature will remain within the tortoise's thermal preference long enough for it to adjust to its surroundings. McGinnis and Voigt (1971) found the preferred daytime body temperature of tortoises to be 80.6 °F to 100.4 °F during July, and somewhat lower during May (section *B.5.c.*). Some situations and recommended procedures are given in section *B.5.c.ii.*

B.8.b.ii. Discouraging urination - Many experts state that tortoises are most likely to urinate while being carried, and that the longer you handle them, the more likely they are to urinate. A tortoise may be more prone to void its bladder during drought conditions, which is also when water availability is at its lowest. You may discourage bladder voiding by pressing the tortoise's tail against its vent while you are carrying it. Also, press the tail against its vent if it starts to urinate. If it does, record on the data sheet the quantity, color, and viscosity of the urine. If the tortoise has already been weighed, weigh it again to estimate the amount of lost fluid.

B.8.b.iii. Monitoring released tortoises - Upon releasing a tortoise, the USFWS requires: (a) that each tortoise be accompanied by an authorized monitor, (b) that each tortoise be monitored at the release site until it is exhibiting normal behavior, and (c) that there be no mass releases of animals.

C. FOLLOW-UP SUGGESTIONS

C.1. Caring for field supplies

Some of the materials you may use are very sensitive to desert conditions. Spring scales will register incorrect weights if they become clogged or rusty; surveyor's tape may become brittle and not support the weight of a tortoise; masking tape will dry up and be useless. It is best if you have well-maintained materials for handling tortoises. Non-disposable materials should be cleaned and sterilized between uses on different tortoises, and may need to be cleaned before using them at the beginning of a project if they have not been used in a long time. Care for field materials is equivalent to the care you can offer a desert tortoise.

C.2. Information sharing

The USFWS typically requires a follow-up report to construction projects authorized by their Biological Opinions. We recommend that each project be considered an opportunity to provide information to the resource agencies on the best ways to accomplish tortoise monitoring. We feel that a consistent approach to handling and processing tortoises and recording the data will ultimately benefit the conservation effort for the species. The DTC is very appreciative of the many individuals, representing many organizations, who have already shared information to develop these Guidelines. Their names are listed in Attachment 1, and they are to be commended for their invaluable input.

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TORTOISE MEASUREMENTS AND OBSERVATIONS

Tortoise #:_____ Numbered Scute:_____ Tortoise Weight (g):_____ Sex:_____

Measurements (mm): MCL:_____ PLN:_____ Width M7/M8:_____ Max Height:_____

Photos Taken: Carapace:_____ Plastron:_____ Frontal:_____ Numbered Scute:_____

Comments:_____

_____

Tortoise Health Profile (indicate the best description with an "x" in the appropriate space).

Nasal Description
- _____ Nostrils dry
- _____ Nostrils damp
- _____ Nostrils wet
- _____ Nasal exudate present
- _____ Bubbles from nostrils

Breathing
- _____ Clear
- _____ Wheezing
- _____ Rasping
- _____ Bubbly
- _____ Normal

URTD Determination
- _____ Sufficient sign present
- _____ Insufficient sign present
- _____
- _____
- _____

Describe:_____

_____

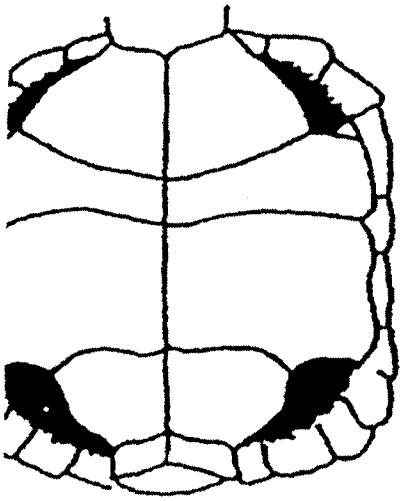
Posture and Behavior
- _____ Alert, responsive
- _____ Lethargic
- _____ Appendages limp
- _____ Head hanging

Shell Disease*
- _____ Lesions present
- _____ Sunken scutes
- _____ Thinning scutes
- _____ None observed

Trauma*
- _____ Head
- _____ Forelimbs
- _____ Hindlimbs
- _____ Shell, gular horn

Describe:_____

_____



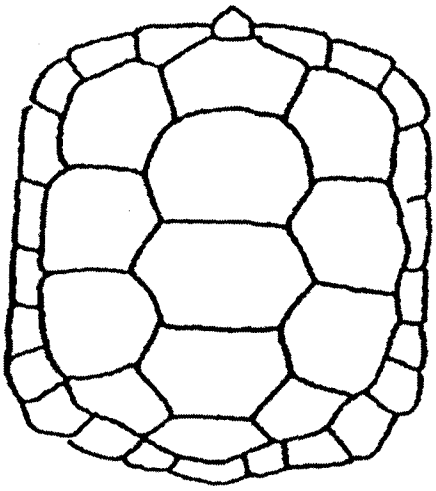


Diagram Legend

- Shell Necrosis
- Trauma
- Bone Wear
- Scute Wear
- Ticks, Mites, etc.

* Sketch all features mentioned above, including the epoxied number, gular horn, anomalies, and other identifying features.

DATA SHEET FOR HANDLING DESERT TORTOISES

Complete both sides of this data sheet when either a tortoise is moved out of harm's way, or a burrow is excavated and a tortoise found.

Project Identification

Date:_____ Project Name:_____ Monitor's Name(s)_____

Location: State:_____ County:_____

USGS quadrangle:_____ T:_____ R:_____ 1/4 of_____ 1/4_____

Comments:_____

Project Description

Slope:_____ Aspect:_____ Elevation:_____

Topography	Soil Type	Vegetation	Location found
_____ Flat	_____ Sandy loam	_____ Creosote bush	_____ Burrow
_____ Small hills	_____ Blow sand	_____ Saltbush scrub	_____ Pallet burrow
_____ Large hills	_____ Gravel	_____ Blackbrush	_____ Other
_____ Small wash	_____ Cobble	_____ Desert wash	_____ Under shrub
_____ Large wash	_____ Caliche	_____ Joshua tree	_____ In open
_____ Bajada	_____ Rocky	_____ Thorn scrub	_____ Caliche cave
_____ Dune	_____ Pavement	_____ Grassland	_____ Rock shelter

Describe:_____

_____

_____

_____

Tortoise Burrow Data

Time of excavation: Start:_____ End:_____ Burrow #:_____

Temperature during excavation (1.5m/1.0cm): Start:_____ End:_____

Burrow: Width:_____ Height:_____ Length:_____

Orientation:_____ Condition:_____

Burrowdescription/contents:_____

_____

_____

_____

F. CHECKLIST FOR HANDLING DESERT TORTOISES

The following sequence is recommended for handling and processing tortoises. If this differs from an established sequence that you, as an experienced monitor, have developed, the DTC does not require that you abandon your approach, but that you consider the information. For the inexperienced monitor, we **do** recommend that you follow this sequence. Each step is cross-referenced with sections in the Guidelines. See the Table of Contents for page numbers. The bold word, "**data**," follows a given instruction where we recommend information be recorded on your data sheet, maps, or personal journal.

Before going to the field, be authorized (A.1.) and trained (A.2.), determine if tortoises are to be marked (A.3.), if so, develop a numbering scheme (A.4.), and have your materials organized (A.5.).

Upon finding a burrow, determine if it will be excavated (B.1.a.). If so, describe it beforehand (B.1.b. **data**) and decide if an artificial burrow is needed (B.1.c.). Map (B.2. **data**) and number (B.3. **data**) excavated and artificial burrows.

Before excavating a burrow, check for eggs (B.4.a.) and, if found, follow USFWS protocol for handling them (Attachment 3). Then, excavate the burrow (B.4.b.) and be absolutely sure that it is empty or that you have removed all tortoises (B.4.c.).

When you find a tortoise in a burrow, take the temperature (B.5.a. **data**) and decide if the tortoise should be processed (B.5.b. and B.5.c.).

Before you handle a tortoise, determine if it will be processed and how it will be disposed during hot temperatures [B.5.c.ii.(a).], during cold temperatures [B.5.c.ii.(b).], at or near sunset [B.5.c.ii.(c).], if the tortoise is seriously ill [B.5.c.ii.(d).], or during other situations [5.c.ii.(e).]. If the tortoise must be transported in a vehicle, use a new cardboard box (B.5.d.i.) and take precautions (B.5.d.ii.).

If an artificial burrow needs to be constructed (B.5.e.), use either the traditional method (B.5.f.i.) or another acceptable method (B.5.f.ii.). Take every precaution to ensure that the tortoise, if blocked in its burrow, is unblocked after several days (B.5.f.iii.).

When removing a tortoise from its burrow, avoid hyperthermia (B.6.a.i.), and take precautions to prevent the transmission of URTD (B.6.a.ii.) with proper treatment of clothing [B.6.a.ii.(a).], vehicles [B.6.a.ii.(b).], and processing implements [B.6.a.ii.(c).], using appropriate sterilizing materials [B.6.a.ii.(d).].

If the tortoise is to be processed, put on disposable gloves and maintain sterile conditions (B.7.a.), weigh the tortoise (B.7.b.i. **data**), immobilize it using a can (B.7.c.i.) or a towel (B.7.c.ii.), observe it for ectoparasites (B.7.d.i. **data**), shell lesions (B.7.d.ii. **data**), osteoporosis and osteomalacia (B.7.d.iii. **data**), and URTD (B.7.d.iv. **data**). Record distinctive features (B.7.e. **data**), sex the tortoise (B.7.f. **data**), mark it (B.7.g. **data**), measure it (B.7.f. **data**), and photograph it (B.7.i. **data**).

After the tortoise has been processed, release it into the adjacent area or place it in the artificial burrow (B.8.a.). Be careful of temperature extremes (B.8.b.i.), discourage tortoise urination (B.8.b.ii.), and monitor the tortoise (B.8.b.iii.).

After you leave the field, maintain your field materials in good working order (C.1.), and share your experiences with the USFWS (C.2.).

ATTACHMENT 1: PERSONS CONTACTED

Edward L. LaRue, Jr. assembled the information and drafted the Guidelines in 1994, and, with input from USFWS field offices in California, Arizona, Nevada, and Utah, revised them in April 1996 and again in July 1999. The following individuals were contacted to develop and/or review preliminary drafts. Not all of them responded to the initial or subsequent requests for information. For those who did, thank you very much for your invaluable assistance. When known, contributors' July 1999 affiliations are given rather than their 1994 affiliations. Tierra Madre Consultants, Inc. is given special thanks for its commitment to this project, and for much of the funding to complete it.

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ATTACHMENT 2: HANDLING SUPPLIES

Burrow excavation and construction
Thermometer (to measure air and ground temperatures)
Watch or clock (to record start and finish processing times)
Measuring tape (for burrow dimensions)
Compass (for burrow orientation)
Hand held mirror (for viewing inside burrow)
Leather or cloth gloves (to avoid animal stings and/or bites)
Blunt-nosed shovel(s) (for excavating burrow)
Garden trowel (for excavating burrow)
1" x 2" plank (to insert in small burrows)
2" x 4" plank (to insert in larger burrows)
4' x 8' x 1/4" thick plywood (for artificial burrow construction)
Hand saw (to cut plywood into appropriate size and shape)
Surveyor's tape (for marking a burrow or making a weighing harness/sling)

Tortoise handling and marking
Disposable latex gloves (for handling tortoise)
Different sizes of coffee cans/sterilized towel (for immobilizing tortoise)
Toothbrush, sterilized (for cleaning dirt from scute to be numbered)
Acrylic paint or typewriter correction fluid (for making dot to number tortoise)
Waterproof, capillary pen (for numbering the tortoise and keeping notes)
1/2" masking tape (to cover growth areas prior to applying epoxy)
Epoxy, toothpicks, wooden coffee stirrer, tongue depressors (to cover the number on the scute and to apply the epoxy)
Plastic, ziplock bags (for holding used latex gloves and weighing juvenile tortoises)
Hand lens (for observing parasites)
95% ethyl or isopropyl alcohol, or 25% chlorine solution (for sterilizing equipment)
Rubber/plastic container and lid (for soaking instruments)
New, disposable cardboard boxes (for holding and/or transporting tortoises)
Garbage bags (for disposing of used gloves, t-shirt bags, etc.)

Tortoise measurements and photography
Grocery, t-shirt bags, surveyor's tape, cotton string (to weigh the tortoise)
Calipers (for measuring carapace length, width, and height)
Metal or plastic rule (to measure plastron length)
100 g, 1.0 kg, and 5.0 kg tubular spring scale (to weigh small and large tortoises)
3" x 5" file cards (for mixing epoxy and identifying photographic slides)
Avery labels or other stickers (to attach to tortoise to identify photograph)
35 mm camera (for taking photographs)
Slide film (for taking photographs)

Egg handling
Felt-tipped pen (for marking eggs)
Bucket (for transporting eggs)

Miscellaneous
Agency document(s) regulating the specific project (e.g., USFWS Biological Opinion, State Memorandum of Understanding, BLM Stipulations, etc.)
Handling Guidelines and checklist
Agency approved, sequential numbering scheme for marking tortoises
Project maps for mapping tortoise burrows
Clipboard
Data sheets
Pads or blanket for truck bed to cushion transported tortoise and reduce heat
Phone number and contact person of local USFWS field office, State fish and game departments, BLM field office, etc.
Phone number of nearest qualified veterinarian to treat injured tortoise
Extra change of clothing, including extra shoes

(Much of this list is taken from McCullough et al. 1993)

ATTACHMENT 3: EGG HANDLING PROTOCOL

This Egg Handling Protocol is taken verbatim from U.S. Fish and Wildlife Service File No. 1-5-93-TA-390. Wording concerning placing eggs on private lands was added to be consistent with USFWS recommendations for the Tortoise Handling Guidelines.

Tortoise eggs shall be moved to artificial nests either in the wild or at an approved facility. Biologists must receive special training in the procedures outlined below, but such training can be obtained after a nest is actually found. If this is done, the nest shall be carefully covered with soil so as not to move the eggs and protected until on-site training is provided. The responsible federal agency shall ensure that this training is made available.

Any nest that is found shall be carefully excavated by hand at a time of day when the air temperature six inches above the ground is approximately equal to the soil temperature at egg level. Immediately upon finding a nest, large tool use shall be discontinued and the nest excavated by the biologist using his or her hands. [DTC recommends that the monitor put on disposable latex gloves before marking and handling eggs]. Before disturbance of nest contents, each egg shall be gently marked with a small dot on the top using a felt-tipped pen to establish the egg's orientation in the nest. In handling nest contents, eggs must be maintained in this orientation at all times. Because egg shells become extremely fragile in the last few weeks before hatching, special care shall be taken with eggs found from August to mid-October. Because these eggs are very fragile, some may break during handling. This will be lethal to egg contents. Such an accident can be expected to occur until techniques are developed to avoid this type of incident. Broken eggs shall be buried nearby and left in the field, or the contents preserved and provided to qualified researchers.

The biologist shall measure and record the depth of the nest below the soil surface, the location of the nest in relation to any adjacent shrub (i.e, whether on the north, south, east, or west side of the shrub) the species of shrub and its approximate foliage volume, and the soil type. Place approximately 1 inch of soil from the nest area in a bucket and carefully transfer the eggs to the bucket, maintaining egg orientation. Cover the eggs with soil that is free of cobbles and pebbles, to a depth equivalent to that of the original nest.

If good tortoise habitat is available in the general area, the eggs shall be relocated between 150 to 1,000 feet from outer boundary of the project site, unless directed differently by USFWS. [Eggs should only be placed on lands administered by a federal agency, or on private lands when a written authorization to bury the eggs there has been obtained]. Prepare a nest with the same depth, orientation, location in relation to a specific shrub species, and in the same soil type as the original nest. Carefully transfer the eggs, maintaining their original orientation, to the new nest. The eggs shall be replaced so that they touch one another. Gently cover with soil from which cobbles and pebbles have been removed so that all the air spaces around the eggs are filled. Relocated nests in the wild shall be monitored by a qualified biologist. The monitoring program shall be developed in consultation with the Fish and Wildlife Service.

If a suitable site for a nest is not available in the wild, the eggs shall be prepared for incubation in a suitable holding facility. Place a small amount of soil in a bucket and transfer the eggs to the bucket using the technique specified above, making sure that the eggs are touching one another. Carefully fill the bucket to the depth of the original nest, but leave the top of the soil layer three inches below the rim of the bucket so that future hatchlings cannot escape Bury the bucket in soil in a safe location at an approved holding facility.

The biologist shall record in detail all the procedures used in moving eggs. Personnel caring for incubating eggs at a facility shall maintain a record of where the eggs were found, method of incubation, length of time and conditions under which the eggs were incubated, observations of eggs during the incubation period, information about hatchling health and behavior, and disposition of the hatchlings.

Cortaro Farms Road
Traffic Noise Analysis

Union Pacific Railroad to Thornydale Road
4TCFIT
Pima County, Arizona

Prepared for

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RECON Job #: 8180N

Draft: February 26, 2001

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FIGURE 1. Project Location 2

APPENDICES

A: Noise Measurement and Receiver Locations

B: Stamina & Optima Files

I. Introduction

RECON Consultants was contracted by MMLA, Inc., on behalf of Pima County Department of Transportation and Flood Control District (PCDOT) to conduct an analysis of the traffic noise environment adjacent to Cortaro Farms Road between the Union Pacific Railroad tracks and Thornydale Road, Pima County, Arizona (Figure 1). A Transportation Action Plan (TAP) has been prepared for the road project by MMLA and was approved by the Board of Supervisors November 2000. MMLA is now preparing the Environmental Assessment and Mitigation Report, of which the findings of this study will be a part. To initiate the EAMR process MMLA prepared "pre-design" roadway plans for the project. Roadway plans that are approximately 15% complete were provided to RECON to serve as the basis for this study.

Cortaro Farms Road is primarily a two-lane, paved roadway with unpaved shoulders in this area, although there are sections of continuous two-way left-turn lanes. It is a County-designated Scenic Route. Adjacent land uses are predominantly residential (single-family homes) with some commercial development at the far east and west ends. Most of the residences are in developer-built subdivisions, with 5'-6' high masonry walls along their lot lines that abut the roadway. The remainder of the residences are either on larger lots along the north side of the roadway towards the east end, or are mobile homes along the south side of the roadway towards the west end. These residences do not have patio walls adjacent to the roadway.

Quail Run Elementary School is located on the north side of the roadway between Camino de Oeste and Oldfather Road. The "Desert Son" church is also located on the north side of the roadway, west of Camino de Oeste. Many of the parcels along the roadway exist as vacant, undeveloped land, zoned as SR- but the development trend in the area reflects CR-4 & 5 subdivisions which allow 6-7 residences per acre (or more, with a Small Lot Option). Clearly there is the potential and expectation of this becoming an even more densely populated corridor.

Current traffic volumes exceed the capacity of the roadway and result in moderate to heavy congestion at times, particularly at the west end near I-10. According to PAG studies, future traffic volumes are predicted to more than double by year 2020- proportional to population increases in the area as follows:

Roadway Segment:	1999 ADT	2020 ADT
I-10 to Camino de Oeste	16,311	45,807
Camino de Oeste to Thornydale	15,071	37,828

The proposed project will widen the roadway to four lanes and will include a landscaped median, multi-use/bike lanes on both sides and public art enhancements. The posted speed limit will remain at 45-mph, with a design speed of 50-mph. The right-of-way will be 150-foot full width, minimum.

In accordance with *Pima County's Ordinance Specifying Conditions for Improvement of Public Roads* (Pima County, 1992), noise mitigation is recommended for roadway projects in

Figure 1. Project Location

accordance with Federal Highway Administration (FHWA) noise abatement criteria. The ordinance states that traffic noise shall be abated pursuant to FHWA "Procedures for Abatement of Highway Traffic Noise and Construction Noise" (FHWA, 1982). The FHWA noise standards set forth a noise abatement sound level of 67 dBA L_{eq}[1] (exterior) for potentially sensitive receptors such as residences, recreation areas, motels, schools, churches, hospitals and similar activity categories (See Table 1.). Where future noise levels are predicted to approach or exceed 67 dBA at such locations, or when the predicted traffic noise levels substantially exceed the existing noise levels (i.e., by 10dBA or more), it is the policy of the Pima County Department of Transportation (PCDOT) to consider noise attenuation measures to mitigate those impacts, giving weight to the benefits and cost of abatement, and to the overall social, economic and environmental effects.

Table 1.

FHWA Noise Abatement Criteria[2]

Activity Category	dBA L_{eq}	Description of Activity Category:
A	57 (exterior)	Lands on which serenity and quiet are of extra-ordinary significance and serve an important public need, and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	**67 (exterior)**	**Picnic areas, recreation areas, playgrounds, active sports areas, parks, residences, motels, schools, churches, libraries, and hospitals.**
C	72 (exterior)	Developed lands, properties, or activities not included in Activity Categories A or B above.
D	N.A.	Undeveloped lands.

The potentially sensitive receiver locations that were identified in the study area adjacent to Cortaro Farms Road include existing residences, Quail Run Elementary School and the church. The existing noise environment was measured at twelve locations using a sound level meter. Future noise levels for the design year 2020 were predicted for the locations using the STAMINA 2.0/OPTIMA version of the FHWA Traffic Noise Prediction Model.

1 L_{eq} represents the average noise level during a given period.

2 Source: Federal Highway Administration, 1982

II. Methods of Analysis

A. Existing Noise Levels: Field Measured & Modeled

The existing noise environment of the project area was measured by RECON during January 2001 at twelve locations, using a calibrated Larson-Davis 720 sound meter. Traffic counts and mixes were recorded at the same time the noise level measurements were taken. The field-measured sound level data downloaded from the meter and converted to a spreadsheet to calculate the average noise levels for each location. The average noise levels were then adjusted to reflect the current peak-hour traffic volumes that were provided by DMJM, Project Traffic Engineers (see Table 2.). Traffic data, the existing roadway alignment, and the noise measurement locations were entered into the Federal Highway Department's STAMINA 2.0/OPTIMA traffic noise computer model. The model was adjusted to accurately reflect the adjusted measured levels. Additional receiver locations were added to represent the range of conditions at adjacent residential properties. The approximate heights and locations of existing walls that currently attenuate noise at sensitive receiver locations were added to the model.

B. Future Noise Levels: Modeled

Future noise levels were predicted using the STAMINA 2.0/OPTIMA model. DMJM provided projected future (design year 2020) peak-hour traffic volumes. The traffic data and the "pre-design" roadway alignment (as reflected by the +-15% complete roadway drawings provided by MMLA) were input into the computer model. The noise measurement locations and receiver locations modeled for existing conditions were included along with the approximate heights and locations of existing walls.

III. Results

(The current and future traffic noise levels predicted by the model are shown in Table 3.)

A. Summary: Existing Noise Environment

The existing peak-hour noise levels at the receiver locations range from 56 to 66 dBA. Noise level differences can be attributed to differences in proximity and relationship to the roadway, to the presence or lack of noise-attenuating elements and to the varying traffic volumes attributed to the four roadway segments. Noise levels at the entry courtyards to the church and to the school are 60 and 57 dBA, respectively. Noise levels in yards with masonry walls range from 56 to 63 dBA. These current noise levels are below the federal levels for noise attenuation.

Table 2.
Traffic Data

PEAK-HOUR TRAFFIC VOLUMES[3]

	Number of Vehicles per hour (two-way traffic)	
Roadway Segments:	*Current (Year 2000)*	*Future (Design Year 2020)*
I-10 to Hartman Lane	1865	3422
Hartman Lane to Camino De Oeste	1602	3100
Camino De Oeste to Old Father Road	1621	2948
Oldfather Road to Thornydale Road	1470	3199

FUTURE TRAFFIC MIX
(Source: conservative estimates by DMJM)

Automobiles:	92%
Medium-Heavy Trucks:	4%
Heavy Trucks:	4%

FUTURE TRAFFIC SPEED:

Future through-traffic roadway design speed assumed for this study is 50 miles per hour.

[3] (Source: Traffic analysis for this project conducted by DMJM, Tucson.)

B. Summary: Future Noise Environment

Future peak-hour traffic noise levels predicted for the modeled receiver locations range from 65 to 74 dBA. Future increases are due to increased traffic volumes; an increase in the percentage of medium and heavy trucks, increased speeds, and in some cases a raised vertical alignment. As mentioned above, the differences in noise levels at the various receiver locations reflect differences in distance from the roadway, vertical relationship of the receiver to the roadway, the presence or lack of noise-attenuating elements, and varying traffic volumes attributed to the four roadway segments. The highest noise levels predicted are 73-74 dBA, at receivers R8 and R10, locations that are at or near the right-of-way line. These particular locations are not considered sensitive receivers.

The two receivers representing the school have future noise levels of 65 dBA. All of the receivers representing the church and residential locations have future noise levels predicted to be 65 dBA and greater. Noise levels in yards with masonry walls range from 65 to 69 dBA.

C. Impacts and Mitigation

In accordance with FHWA noise standards, traffic noise impacts occur when traffic noise levels approach or exceed the noise abatement criteria (Table 1.), or when the predicted peak-hour traffic noise levels substantially exceed (i.e., by 10-12 dBA or more) the existing noise levels. The noise standards give primary consideration to exterior use areas when determining and abating traffic noise impacts and state that abatement measures should be considered for exterior locations where frequent human use occurs and a lowered noise level would be of benefit.

In the case of sensitive receivers in the vicinity of Cortaro Farms Road, the 67 dBA criteria level *is* approached or exceeded by future conditions at sensitive receiver locations. Therefore, noise mitigation barriers were evaluated.

Noise barrier walls were modeled at locations shown on maps in Appendix A. Initially, wall heights of six feet were modeled at certain locations along the right-of-way where no walls currently exist. Seven and eight foot height walls were modeled at locations where the existing walls or the new six-foot height walls did not lower noise levels to 67 dBA or under. Where existing walls currently exist, this would require replacing walls unless the wall heights could be raised.

At location R3, a residence exists at a level significantly higher than the roadway. At this location a wall at a lower elevation has limited effectiveness. A wall at a higher elevation and nearer to the residence would be much more effective at reducing noise levels. A wall at the higher elevation was modeled for the purposes of comparison and was found to reduce noise levels to 61 dBA.

Table 3.

Existing and Future Traffic Noise Levels[4]

Receiver/ Measurement Numbers[5]	Land Use	Distance From Future Centerline	Exist. Wall Y/N	Current Peak-Hour Noise Levels	Future 2020 Peak-Hour Noise Levels[6] Unmitigated	Future 2020 Peak-Hour Noise Levels Mitigated with New Walls[7]			
						6' ht. Wall	7' ht. Wall	8' ht. Wall	Other
R1/M1	Residence	150' S	N	66	70	67	66	66	n./a.
R2/M2	Church	270' N	N	60	68	65	n./a.	n./a.	n./a.
R3/M3	Residence	140' N	N	63	71	68	67	n./a.	61
R4/M4	School	260' N	N	57	65	63	n./a.	n./a.	n./a.
R5/M5	School	330' N	N	57	65	64	n./a.	n./a.	n./a.
R6/M6	Burke Road	275' N	N	58	67	n./a.	n./a.	n./a.	n./a.
R7/M7	Burke Road	150' N	N	61	70	n./a.	n./a.	n./a.	n./a.
R8/M8	Burke Road	75' N	N	65	74	n./a.	n./a.	n./a.	n./a.
R9/M9	Residence	110' S	Y	58	66	n./a.	n./a.	n./a.	n./a.
R10/M10	Basin	100' N	N	65	73	70	n./a.	n./a.	n./a.
R11/M11	Vacant	150' S	N	61	71	n./a.	n./a.	n./a.	n./a.
R12/M12	Vacant	100' N	N	61	66	65	n./a.	n./a.	n./a.
R13	Residence	150' N	Y	63	67	n./a.	66	n./a.	n./a.
R14	Residence	150' S	N	65	71	68	67	66	n./a.
R15	Residence	150' S	N	64	71	67	67	67	n./a.
R16	Residence	100' N	Y	58	66	n./a.	n./a.	n./a.	n./a.
R17	Residence	150' N	N	60	69	65	n./a.	n./a.	n./a.
R18	Residence	150' N	N	60	69	65	n./a.	n./a.	n./a.
R19	Residence	150' N	N	60	69	67	66	n./a.	n./a.
R20	Residence	110' S	Y	56	65	n./a.	n./a.	n./a.	n./a.
R21	Residence	150' N	Y	60	69	n./a.	68	67	n./a.

4 Noise levels, predicted by the Stamina/Optima Traffic Noise Model, are shown in decibels, dBA L_{eq}, peak hour. Peak-hour L_{eq} is the standard used by the federal government in assessing potential traffic noise impacts.

5 Locations 1-12 were field measured; locations 1-21 were modeled.

6 With existing walls where they occur, but with no new walls added.

7 See Appendix A. for locations of new noise barrier walls to mitigate traffic noise to these levels.

At location R12 a six foot high noise barrier wall was modeled on the assumption that the new residences soon to be built in that area will have developer-built patio walls for all back yards facing Cortaro Farms Road.

Although walls over eight feet high may be effective in further reducing noise levels at certain sensitive receivers, the associated costs can be prohibitively high and the additional reduction in noise levels is usually relatively low.

IV. Summary & Conclusions

The existing peak-hour noise levels predicted for the modeled receiver locations range from 56 to 66 dBA. Noise level differences can be attributed to differences in proximity and relationship to the roadway, to the presence or lack of noise-attenuating elements and to the varying traffic volumes attributed to the four roadway segments. Noise levels at the entry courtyards to the church and to the school are 60 and 57 dBA, respectively. Noise levels in yards with masonry walls range from 56 to 63 dBA. These current noise levels are below the federal levels for noise attenuation.

Future peak-hour traffic noise levels predicted for the modeled receiver locations range from 65 to 74 dBA. Future increases are due to increased traffic volumes, an increase in the percentage of medium and heavy trucks, increased speeds, and in some cases a raised vertical alignment. The highest noise levels predicted are 73-74 dBA, at receivers R8 and R10, locations that are at or near the right-of-way line. The two receivers representing the school have future noise levels of approximately 65 dBA. All of the receivers representing the church and residential locations have future noise levels predicted to be 65 dBA and greater. Noise levels in yards with existing masonry walls range from 65 to 69 dBA.

New noise barrier walls of six, seven and eight feet heights were modeled at locations along the future right-of-way line. Based on the information available for this study, a combination of these wall heights would reduce noise levels to 67 dBA or less at all sensitive receiver locations. At locations where existing walls of lower heights currently exist, this would probably require replacing existing walls with new ones of greater heights. At a certain residential locations, noise levels may not be effectively attenuated below the 67 dBA level without noise walls exceeding eight feet in height. This and the replacing of walls should be carefully considered and balanced with the degree of attenuation achieved by such efforts.

At this time, the roadway plans are very preliminary and have not been finalized. The analysis performed for this study is based on plans that are estimated to be approximately 15% complete. RECON recommends that a review and re-modeling of the roadway reconfiguration and effected residences be performed once the roadway design and vertical and horizontal alignments have been reviewed and finalized. At that time, we can review the locations of any retaining walls that may be required, final slope configuration, and any changes in the horizontal and vertical alignment- all factors that effect noise levels. The final roadway data will enable a more accurate

prediction of future noise levels, assessment of impacts to adjacent residences, and identification of noise walls and heights that may be warranted.

The placement and design of noise barrier walls should be considered during the roadway design process in order to coordinate with the roadway grading, drainage and hydrology, driveway access, safe sight visibility and the future landscape treatment. Wall alignment may need to respond to the need of preserving specimen trees or cacti in-place. Landscaping, and the integration of art and design elements (e.g., varied materials, forms, line, colors, and textures) will serve to reduce the visual impact of noise walls. Ideas for the aesthetic appearance of walls should be incorporated into their design. Vegetation provides a negligible amount of noise reduction; however, it does provide a visual screen, which is usually considered to be a significant positive benefit to residents along roadways.

Importantly, the design and location of noise barrier walls should take into consideration the movement of sensitive wildlife species, particularly the cactus ferruginous pygmy owl. Research to date indicates wide roadways and barrier walls could negatively affect their flight pattern. A task force has been appointed by Pima County to develop a workable roadway cross-section in response to this concern.

V. References

Arizona Department of Transportation

1988 Noise Abatement Policy for State-Funded Projects. May.

MMLA Engineering Company

2000 Transportation Action Plan for Cortaro Farms Road: Union Pacific Railroad to Thornydale Road. December. Prepared for Pima County Department of Transportation & Flood Control District.

2000 Preliminary horizontal and vertical alignment plans and cross-section drawings for Cortaro Farms Road, December 14 and 28.

Pima County Board of Supervisors

1992 Pima County's Ordinance Specifying Conditions for Improvement of Public Roads, Section 7(1)(c), Noise Abatement. October.

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1973 Fundamentals and Abatement of Highway Traffic Noise. June.

1978 Highway Traffic Noise Prediction Model. December.

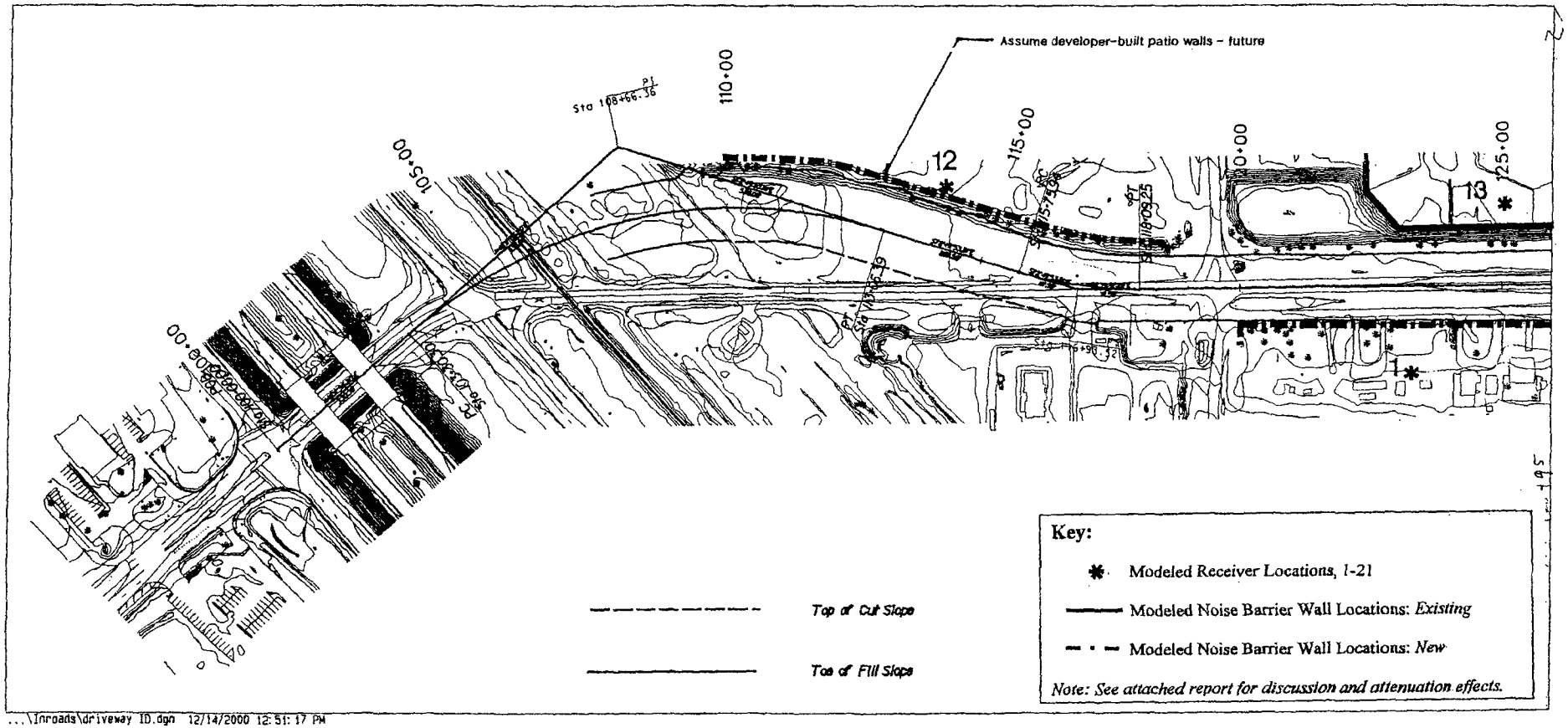
1982 Federal-Aid Highway Program Manual, Section 3, Procedures for Abatement of Highway Traffic Noise and Construction Noise. August.

1982 STAMINA 2.0 Users' Manual. April.

Appendix A.

Map of Noise Modeling Receivers and Barriers

Cortaro Farms Road 1" = 200'



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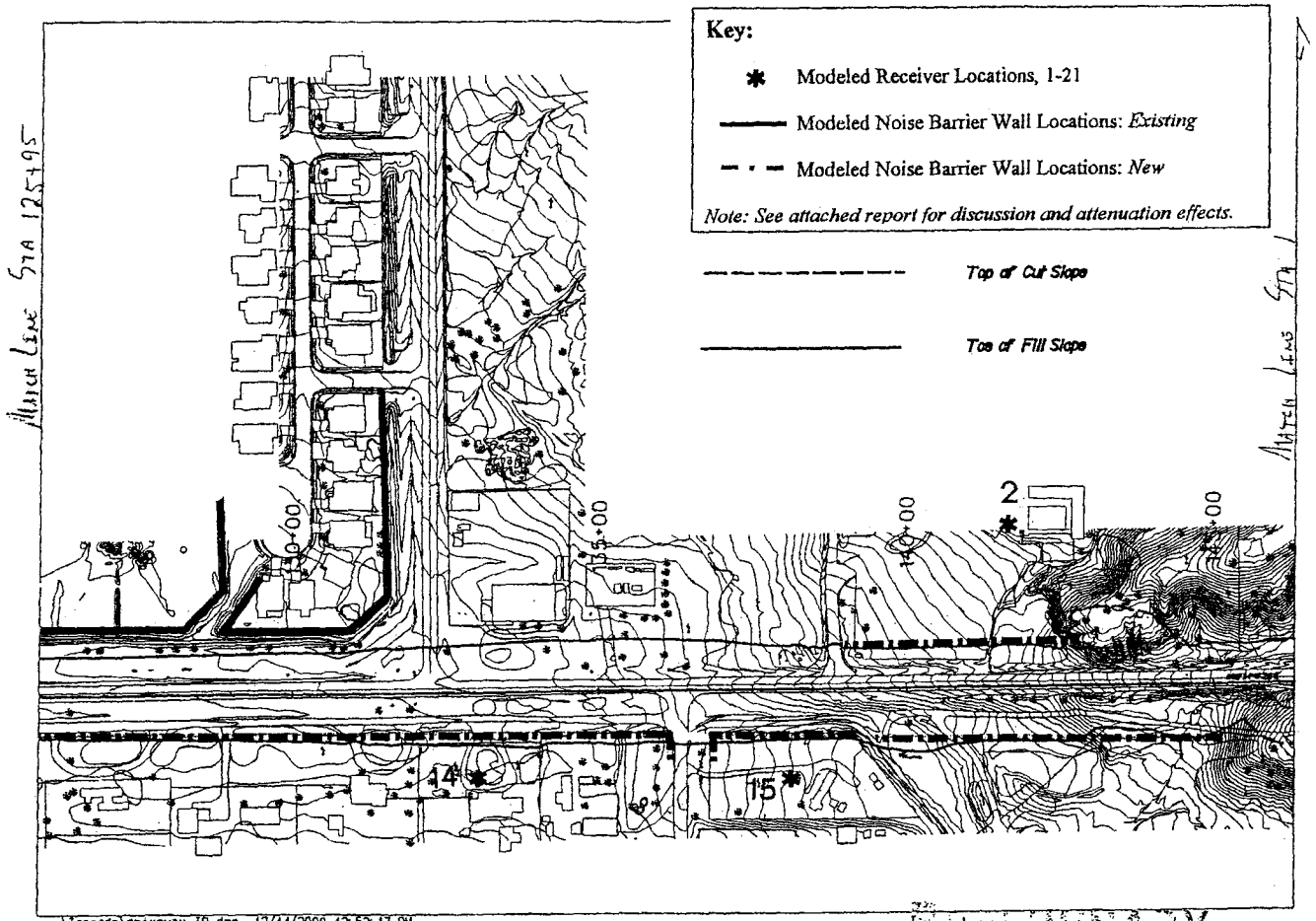
Map of Noise Modeling Receivers and Barriers
Cortaro Farms Road Traffic Noise Study, *RECON* Consultants

Cortaro Farms Rd 1" = 200'



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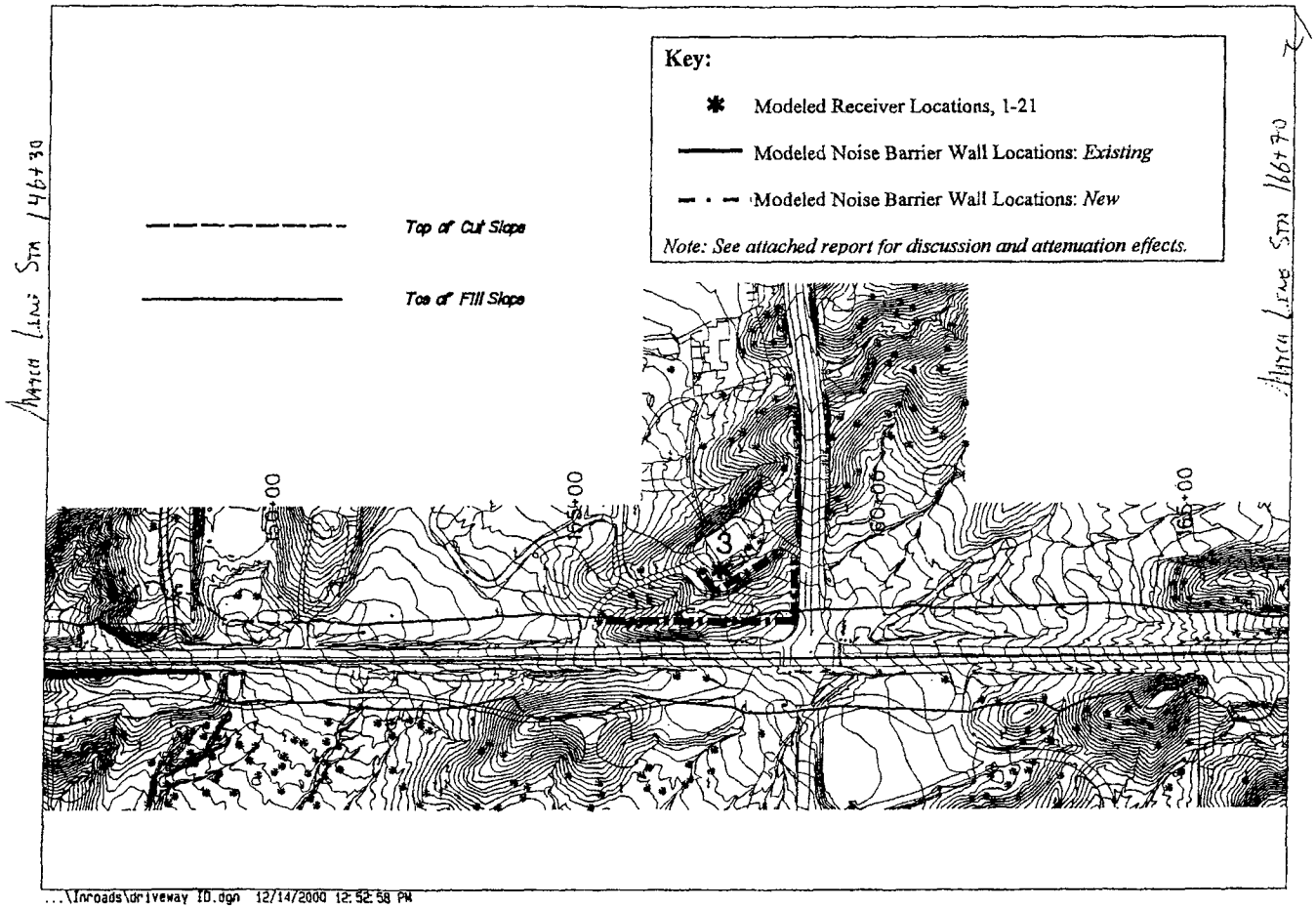
Map of Noise Modeling Receivers and Barriers
Cortaro Farms Road Traffic Noise Study, *RECON* Consultants

Cortaro Farms Road 1" = 20'



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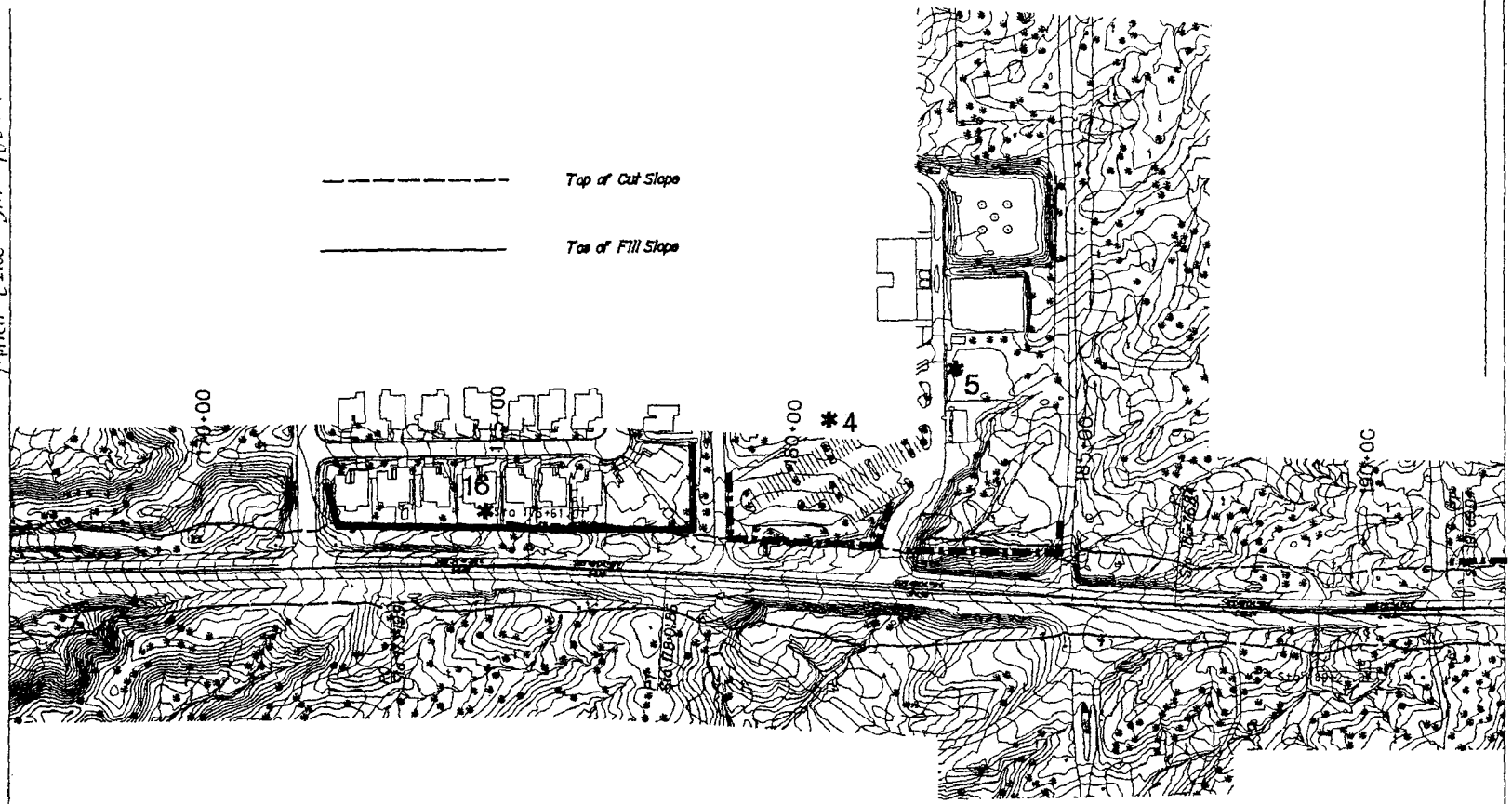
Map of Noise Modeling Receivers and Barriers
Cortaro Farms Road Traffic Noise Study, *RECON* Consultants

March Line Sta 166+70



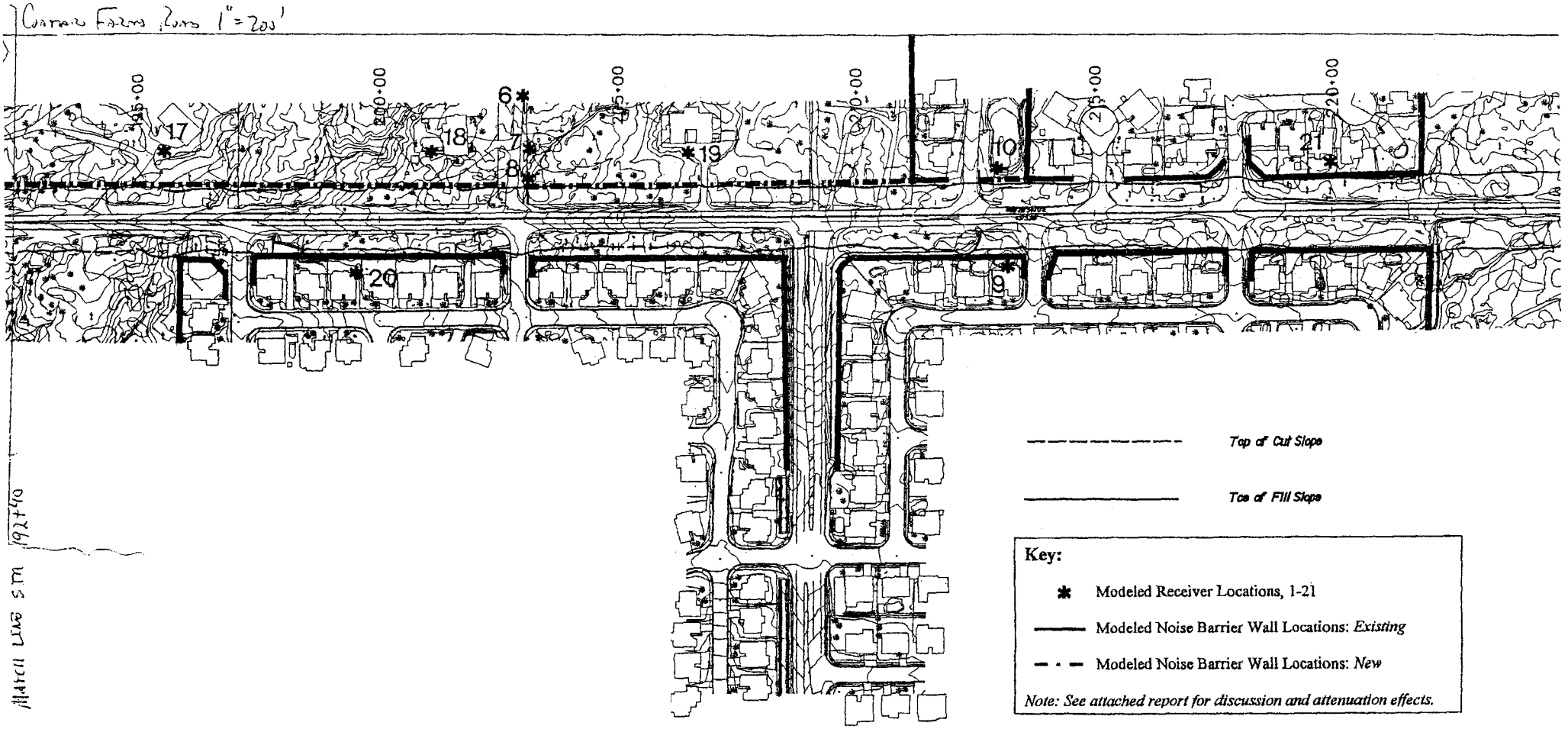
Key:

- ✱ Modeled Receiver Locations, 1-21
- ——— Modeled Noise Barrier Wall Locations: *Existing*
- — · — Modeled Noise Barrier Wall Locations: *New*

Note: See attached report for discussion and attenuation effects.

PRELIMINARY
NOT FOR CONSTRUCTIC

Map of Noise Modeling Receivers and Barriers
Cortaro Farms Road Traffic Noise Study, *RECON* Consultants
Page 4 of 6



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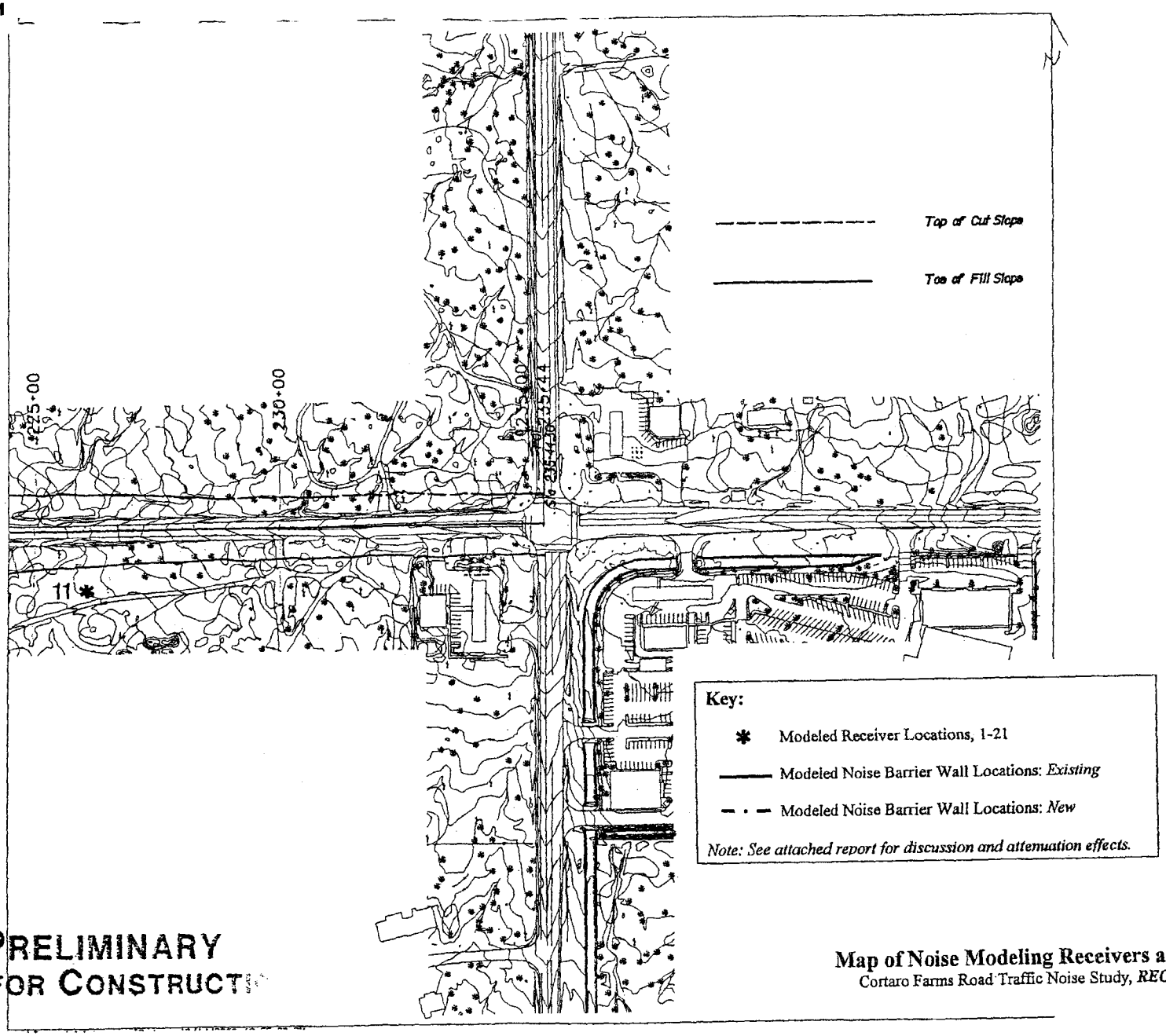
Map of Noise Modeling Receivers and Barriers
Cortaro Farms Road Traffic Noise Study, *RECON* Consultants



PRELIMINARY
NOT FOR CONSTRUCTION

Map of Noise Modeling Receivers and Barriers
Cortaro Farms Road Traffic Noise Study, *RECON* Consultants

Appendix B.

STAMINA File

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*************************
OPTIMA-VU1
*************************
BARRIER OPTIMIZATION PROGRAM USING
PARTIAL SOUND ENERGIES COMPUTED BY THE
STAMINA 2.0 PROGRAM
MODIFIED FROM THE FHWA VAX VERSON -- MARCH 1983

MODIFIED TO:
  1.  PLACE BARRIER COST DATA IN A DATA FILE CALLED
      OPTCOST.DTA TO ALLOW USER TO USE COSTS OTHER THAN
      THE FHWA NATIONAL AVERAGES.
*************************
MODIFIED FOR IBM-COMPATIBLE PC WITH MATH COPROCESSOR
IN JUNE 1991 BY
VANDERBILT ENGINEERING CENTER FOR TRANSPORTATION
OPERATIONS AND RESEARCH (VECTOR)
BOX 96-B, VANDERBILT UNIVERSITY, NASHVILLE, TENNESSEE 37235
(615) 322-3683
************************
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PROBLEM TITLE
****

Future Cortaro Roadway Optima Results

(cortful1bOpt.doc)

EFFECTIVENESS/COST RATIO AND BARRIER HEIGHT MATRICES
****

BARRIER SECTION NO	IDENT	EFFECTIVENESS/COST RATIO								CORRESPONDING BARRIER HEIGHTS(IN FT)						
HEIGHT INDEX		1	2	3	4	5	6	7	8	1	2	3	4	5	6	7
1	a	*	0.	0.	0.	0.	0.	0.	0.	0.	3.	4.	5.	6.	7.	8.
2	b	*	30.	30.	29.	28.	27.	25.	25.	0.	3.	4.	5.	6.	7.	8.
3	c	*	16.	16.	17.	16.	16.	16.	16.	0.	3.	4.	5.	6.	7.	8.
4	d	*	14.	13.	12.	11.	11.	12.	12.	0.	3.	4.	5.	6.	7.	8.
5	a	*	17.	15.	13.	12.	13.	13.	14.	0.	3.	4.	5.	6.	7.	8.
6	b	*	30.	30.	28.	25.	24.	24.	24.	0.	3.	4.	5.	6.	7.	8.
7	c	*	15.	13.	11.	9.	7.	6.	6.	0.	3.	4.	5.	6.	7.	8.
8	d	*	12.	11.	10.	9.	7.	6.	6.	0.	3.	4.	5.	6.	7.	8.
9	e	*	16.	15.	13.	12.	10.	9.	9.	0.	3.	4.	5.	6.	7.	8.
10	f	*	0.	0.	0.	0.	0.	0.	0.	0.	3.	4.	5.	6.	7.	8.
11	a	*	21.	20.	19.	19.	20.	21.	21.	0.	3.	4.	5.	6.	7.	8.
12	a	*	24.	23.	21.	19.	18.	18.	18.	0.	3.	4.	5.	6.	7.	8.
13	b	*	27.	26.	29.	27.	25.	24.	23.	0.	3.	4.	5.	6.	7.	8.
14	d	*	18.	16.	13.	11.	11.	11.	11.	0.	3.	4.	5.	6.	7.	8.

15	e	*	21.	20.	17.	15.	14.	14.	14.	0.	3.	4.	5.	6.	7.	8.
9.																
16	f	*	30.	29.	28.	29.	27.	25.	25.	0.	3.	4.	5.	6.	7.	8.
9.																
17	g	*	32.	31.	31.	31.	29.	27.	27.	0.	3.	4.	5.	6.	7.	8.
9.																
18	h	*	25.	24.	22.	23.	23.	20.	20.	0.	3.	4.	5.	6.	7.	8.
9.																
19	i	*	28.	28.	27.	24.	22.	20.	19.	0.	3.	4.	5.	6.	7.	8.
9.																
20	a	*	29.	31.	29.	25.	24.	24.	24.	0.	3.	4.	5.	6.	7.	8.
9.																
21	b	*	31.	30.	26.	22.	21.	23.	24.	0.	3.	4.	5.	6.	7.	8.
9.																
22	c	*	21.	23.	21.	18.	16.	17.	19.	0.	3.	4.	5.	6.	7.	8.
9.																
23	d	*	19.	17.	18.	18.	16.	14.	13.	0.	3.	4.	5.	6.	7.	8.
9.																
24	e	*	16.	16.	17.	14.	12.	10.	9.	0.	3.	4.	5.	6.	7.	8.
9.																
25	f	*	13.	12.	10.	7.	6.	5.	4.	0.	3.	4.	5.	6.	7.	8.
9.																
26	a	*	23.	20.	21.	24.	22.	21.	20.	0.	3.	4.	5.	6.	7.	8.
9.																
27	b	*	22.	21.	19.	17.	17.	17.	17.	0.	3.	4.	5.	6.	7.	8.
9.																
28	c	*	9.	8.	7.	7.	6.	6.	5.	0.	3.	4.	5.	6.	7.	8.
9.																
29	a	*	27.	25.	23.	22.	22.	22.	21.	0.	3.	4.	5.	6.	7.	8.
9.																
30	b	*	32.	32.	32.	30.	28.	28.	27.	0.	3.	4.	5.	6.	7.	8.
9.																
31	c	*	0.	0.	32.	31.	30.	27.	24.	0.	3.	4.	5.	6.	7.	8.
9.																
32	d	*	29.	29.	30.	29.	26.	23.	22.	0.	3.	4.	5.	6.	7.	8.
9.																
33	a	*	15.	17.	17.	17.	17.	17.	17.	0.	3.	4.	5.	6.	7.	8.
9.																
34	b	*	28.	26.	26.	26.	25.	24.	24.	0.	3.	4.	5.	6.	7.	8.
9.																
35	c	*	4.	6.	6.	7.	7.	7.	7.	0.	3.	4.	5.	6.	7.	8.
9.																
36	a	*	19.	17.	16.	15.	15.	15.	15.	0.	3.	4.	5.	6.	7.	8.
9.																
37	b	*	24.	25.	22.	20.	19.	18.	19.	0.	3.	4.	5.	6.	7.	8.
9.																
38	c	*	20.	23.	20.	18.	16.	15.	15.	0.	3.	4.	5.	6.	7.	8.
9.																
39	a	*	22.	23.	22.	22.	20.	18.	18.	0.	3.	4.	5.	6.	7.	8.
9.																
40	b	*	22.	20.	16.	13.	11.	11.	12.	0.	3.	4.	5.	6.	7.	8.
9.																
41	a	*	22.	20.	19.	18.	19.	19.	19.	0.	3.	4.	5.	6.	7.	8.
9.																
42	b	*	28.	28.	26.	25.	24.	24.	24.	0.	3.	4.	5.	6.	7.	8.
9.																
43	c	*	30.	28.	27.	26.	25.	25.	25.	0.	3.	4.	5.	6.	7.	8.
9.																
44	d	*	33.	32.	30.	29.	28.	28.	27.	0.	3.	4.	5.	6.	7.	8.
9.																
45	a	*	31.	31.	29.	28.	27.	26.	26.	0.	3.	4.	5.	6.	7.	8.
9.																

46 a * 26. 25. 23. 21. 21. 21. 21. 0. 3. 4. 5. 6. 7. 8.
9.
47 b * 18. 15. 14. 13. 13. 13. 13. 0. 3. 4. 5. 6. 7. 8.
9.
48 a * 0. 0. 0. 0. 0. 0. 0. 0. 3. 4. 5. 6. 7. 8.
9.
49 b * 0. 0. 0. 0. 0. 0. 0. 0. 3. 4. 5. 6. 7. 8.
9.
50 c * -18. -17. -18. -18. -18. -18. -18. 0. 3. 4. 5. 6. 7. 8.
9.
51 a * 0. 0. 0. 0. 0. 0. 0. 0. 3. 4. 5. 6. 7. 8.
9.
52 b * 0. 0. 0. 0. 0. 0. 0. 0. 3. 4. 5. 6. 7. 8.
9.
53 a * 0. 0. 0. 0. 0. 0. 0. 0. 3. 4. 5. 6. 7. 8.
9.
54 b * -12. -12. -12. -12. -12. -12. -12. 0. 3. 4. 5. 6. 7. 8.
9.
55 a * -9. -8. -8. -8. -8. -8. -8. 0. 3. 4. 5. 6. 7. 8.
9.
56 b * 34. 32. 29. 30. 29. 27. 26. 0. 3. 4. 5. 6. 7. 8.
9.
57 c * 27. 20. 19. 22. 23. 23. 23. 0. 3. 4. 5. 6. 7. 8.
9.
58 a * 21. 16. 16. 17. 19. 19. 19. 0. 3. 4. 5. 6. 7. 8.
9.
59 b * 0. -1. -3. -5. -5. -4. -4. 0. 3. 4. 5. 6. 7. 8.
9.
60 c * 4. 2. 0. -2. -2. -2. -2. 0. 3. 4. 5. 6. 7. 8.
9.
61 d * 13. 12. 9. 7. 5. 4. 4. 0. 3. 4. 5. 6. 7. 8.
9.
62 e * 0. 0. 0. 0. 0. 0. 0. 0. 3. 4. 5. 6. 7. 8.
9.
63 f * 0. 0. 0. 0. 0. 0. 0. 0. 3. 4. 5. 6. 7. 8.
9.
64 g * 0. 16. 15. 14. 13. 11. 10. 0. 3. 4. 5. 6. 7. 8.
9.
65 h * 0. 20. 21. 21. 19. 19. 20. 0. 3. 4. 5. 6. 7. 8.
9.
66 i * 13. 13. 12. 9. 7. 5. 4. 0. 3. 4. 5. 6. 7. 8.
9.
67 a * 12. 9. 8. 8. 9. 10. 11. 0. 3. 4. 5. 6. 7. 8.
9.
68 b * 23. 19. 16. 16. 17. 18. 19. 0. 3. 4. 5. 6. 7. 8.
9.
69 a * 33. 40. 39. 37. 34. 33. 33. 0. 3. 4. 5. 6. 7. 8.
9.
70 a * 0. -2. -2. -2. -1. -1. 0. 0. 3. 4. 5. 6. 7. 8.
9.
71 b * 28. 26. 22. 19. 19. 21. 21. 0. 3. 4. 5. 6. 7. 8.
9.
72 c * 17. 13. 11. 11. 13. 14. 14. 0. 3. 4. 5. 6. 7. 8.
9.
73 d * 14. 11. 8. 6. 7. 8. 9. 0. 3. 4. 5. 6. 7. 8.
9.
74 e * 20. 16. 13. 12. 14. 15. 16. 0. 3. 4. 5. 6. 7. 8.
9.
75 f * 34. 36. 34. 30. 29. 29. 29. 0. 3. 4. 5. 6. 7. 8.
9.
76 g * 16. 13. 10. 7. 7. 9. 10. 0. 3. 4. 5. 6. 7. 8.
9.

5' WALL

CORRESPONDING BARRIER HEIGHTS FOR EACH SECTION
5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.
5.
5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5. 5.
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R E S U L T S
****

REC	REC ID	LEQ	LEQ(Z(0))	IL
1	Achor	67.6	70.7	3.1
2	Church	65.5	67.2	1.8
3	Elliott	68.6	70.9	2.3
4	SchoolEn	63.3	65.5	2.2
5	SchoolYd	63.8	64.9	1.2
6	Burke Rd	64.9	66.7	1.8
7	Burke Rd	68.2	70.2	2.0
8	Burke Rd	73.8	74.0	.2
9	Delta-S	67.5	72.6	5.1
10	Delta-N	71.0	73.0	2.0
11	Vacant-S	71.0	71.2	.2
12	WestEndN	65.6	68.9	3.3
13	118-1850	67.3	71.4	4.1
14	Rockwood	68.7	71.1	2.4
15	Overholt	67.7	71.2	3.5
16	Mendoza	66.6	70.6	4.0
17	McDonald	65.9	68.9	3.0
18	Pandola	65.7	68.9	3.2
19	Lakosky	66.9	69.4	2.6
20	Marshall	63.1	65.3	2.2
21	Keown	69.3	73.0	3.7

6' WALL

CORRESPONDING BARRIER HEIGHTS FOR EACH SECTION
6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6. 6.
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6.

R E S U L T S
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REC	REC ID	LEQ	LEQ(Z(0))	IL
1	Achor	66.7	70.7	4.0
2	Church	65.0	67.2	2.2
3	Elliott	67.9	70.9	3.0
4	SchoolEn	62.9	65.5	2.6
5	SchoolYd	63.5	64.9	1.5
6	Burke Rd	64.3	66.7	2.4
7	Burke Rd	67.9	70.2	2.4
8	Burke Rd	73.8	74.0	.2
9	Delta-S	66.4	72.6	6.3
10	Delta-N	69.9	73.0	3.1

11	Vacant-S	70.9	71.2	.3
12	WestEndN	64.6	68.9	4.2
13	118-1850	66.7	71.4	4.7
14	Rockwood	67.8	71.1	3.3
15	Overholt	67.2	71.2	4.0
16	Mendoza	65.8	70.6	4.8
17	McDonald	65.4	68.9	3.5
18	Pandola	65.3	68.9	3.6
19	Lakosky	66.5	69.4	3.0
20	Marshall	62.6	65.3	2.8
21	Keown	68.4	73.0	4.7

7' WALL

CORRESPONDING BARRIER HEIGHTS FOR EACH SECTION
7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7.
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7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7. 7.
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R E S U L T S
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REC	REC ID	LEQ	LEQ(Z(0))	IL
1	Achor	66.1	70.7	4.6
2	Church	64.6	67.2	2.6
3	Elliott	67.3	70.9	3.6
4	SchoolEn	62.5	65.5	2.9
5	SchoolYd	63.2	64.9	1.7
6	Burke Rd	63.8	66.7	2.8
7	Burke Rd	67.6	70.2	2.6
8	Burke Rd	73.8	74.0	.2
9	Delta-S	64.7	72.6	7.9
10	Delta-N	69.3	73.0	3.6
11	Vacant-S	70.8	71.2	.4
12	WestEndN	63.8	68.9	5.1
13	118-1850	66.2	71.4	5.2
14	Rockwood	67.0	71.1	4.1
15	Overholt	66.9	71.2	4.3
16	Mendoza	64.8	70.6	5.8
17	McDonald	65.0	68.9	3.9
18	Pandola	64.8	68.9	4.1
19	Lakosky	66.1	69.4	3.3
20	Marshall	62.1	65.3	3.2
21	Keown	67.6	73.0	5.4

8' WALL

CORRESPONDING BARRIER HEIGHTS FOR EACH SECTION
8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8. 8.
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8.

R E S U L T S
****

REC	REC ID	LEQ	LEQ(Z(0))	IL
1	Achor	65.6	70.7	5.1
2	Church	64.3	67.2	3.0
3	Elliott	66.9	70.9	4.0
4	SchoolEn	62.2	65.5	3.2
5	SchoolYd	63.1	64.9	1.9
6	Burke Rd	63.5	66.7	3.2
7	Burke Rd	67.4	70.2	2.8
8	Burke Rd	73.8	74.0	.2
9	Delta-S	63.1	72.6	9.5
10	Delta-N	68.9	73.0	4.1
11	Vacant-S	70.7	71.2	.5
12	WestEndN	62.9	68.9	5.9
13	118-1850	65.6	71.4	5.8
14	Rockwood	66.4	71.1	4.7
15	Overholt	66.6	71.2	4.6
16	Mendoza	63.7	70.6	6.9
17	McDonald	64.5	68.9	4.4
18	Pandola	64.3	68.9	4.7
19	Lakosky	65.8	69.4	3.6
20	Marshall	61.8	65.3	3.5
21	Keown	66.9	73.0	6.2

9' WALL

CORRESPONDING BARRIER HEIGHTS FOR EACH SECTION
9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9.
9.
9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9.
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9. 9.

R E S U L T S
****

REC	REC ID	LEQ	LEQ(Z(0))	IL
1	Achor	65.1	70.7	5.6
2	Church	64.0	67.2	3.2
3	Elliott	66.6	70.9	4.4
4	SchoolEn	61.9	65.5	3.5
5	SchoolYd	62.9	64.9	2.0
6	Burke Rd	63.2	66.7	3.5
7	Burke Rd	67.1	70.2	3.1
8	Burke Rd	73.8	74.0	.3
9	Delta-S	61.6	72.6	11.0
10	Delta-N	68.4	73.0	4.6
11	Vacant-S	70.7	71.2	.5
12	WestEndN	62.2	68.9	6.7
13	118-1850	64.9	71.4	6.5
14	Rockwood	65.9	71.1	5.2
15	Overholt	66.2	71.2	5.0
16	Mendoza	62.6	70.6	8.0
17	McDonald	63.9	68.9	5.0
18	Pandola	63.7	68.9	5.2
19	Lakosky	65.4	69.4	4.0
20	Marshall	61.4	65.3	3.9
21	Keown	65.8	73.0	7.3

END OF ALL CASES

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*************************
STAM2VU1
Version 1.20
*************************
STAMINA 2.0/BCR
MODIFIED FROM FHWA VERSION 3 (MARCH 1983)
TRAFFIC NOISE PREDICTION MODEL

MODIFIED TO:
  1.   ALLOW EQUIVALENT SPEEDS BELOW 30 MPH PER NCHRP 311;
  2.   CORRECT MEDIUM TRUCK BARRIER CALCULATION ERROR BY
       USING VEH4, VEH5 AND VEH6 FOR CARS, MT AND HT; AND
  3.   PLACE REFERENCE ENGERGY MEAN EMISSION LEVELS IN A
       DATA FILE CALLED REMEL.DTA TO ALLOW USER TO USE
       LEVELS OTHER THAN THE FHWA NATIONAL AVERAGES.
*************************
MODIFIED FOR IBM-COMPATIBLE PC WITH MATH COPROCESSOR
BY VANDERBILT UNIVERSITY, NASHVILLE, TN 37235
AND BOWLBY & ASSOCIATES, INC.
2014 BROADWAY, SUITE 210
NASHVILLE, TN 37203-2425
TEL 615-327-8130, FAX 615-327-8137

NOTE:
IN STAM2VU1, THE TRAFFIC DATA FROM THE ORIGINAL DATA FILE
HAS BEEN SHIFTED TO CORRECT THE STAMINA 2.0 MEDIUM TRUCK
CALCULATION ERROR. THIS SHIFT IS REFLECTED BELOW IN THE
*.STA OUTPUT FILE. THE ORIGINAL DATA FILE IS UNCHANGED.
 (INPUT UNITS- ENGLISH , OUTPUT UNITS- ENGLISH )
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Future Cortaro Roadway

Run with 6′ ht. Walls
(CortfulBsta.doc)

EMISSION LEVELS: Calveno Levels (trucks>30mph)
PROGRAM INITIALIZATION PARAMETERS

HEIGHT	CODE	DESCRIPTION
.00	1	RECEIVER HEIGHT ADJUSTMENT
1.00	2	A-WEIGHTED SOUND LEVEL ONLY
.00	3	HEIGHT ADJUSTMENT FOR PASSENGER CARS (CARS)
.00	4	HEIGHT ADJUSTMENT FOR HEAVY TRUCKS (HT)
.00	5	HEIGHT ADJUSTMENT FOR MEDIUM TRUCKS (MT)
.000	6	HEIGHT ADJUSTMENT FOR TYPE4 VEHICLES (VEH4)
		CARS--CALVENO
		C0 = 5.20 C1 = 38.80 S0 = .00
2.300	7	HEIGHT ADJUSTMENT FOR TYPE5 VEHICLES (VEH5)
		MT--CALVENO
		C0 = 35.30 C1 = 25.60 S0 = .00
8.000	8	HEIGHT ADJUSTMENT FOR TYPE6 VEHICLES (VEH6)
		HT--CALVEN0
		C0 = 50.40 C1 = 19.20 S0 = .00

ROADWAY 1 Future Cortaro Road- I-10 to Hartman

VEHICLE TYPE	VEHICLES/HOUR	SPEED
CARS	0.	30.0
HT	0.	30.0
MT	0.	30.0
VEH4	3148.	50.0
VEH5	137.	50.0
VEH6	137.	50.0

0

	----------COORDINATES----------			
	X	Y	Z	GRADE
100+00	-1850.0	-300.0	2155.0	0
104+50	-1500.0	.0	2156.5	0
110+00	-980.0	160.0	2157.0	0
115+00	-500.0	60.0	2158.5	0
117+00	-300.0	10.0	2159.5	0
120+00	.0	.0	2161.0	0
125+00	500.0	.0	2163.5	0
130+00	1000.0	.0	2166.5	0
132+00	1200.0	.0	2169.0	0

ROADWAY 2 Future Cortaro Roadway: Hartman to Camino de Oeste

VEHICLE TYPE	VEHICLES/HOUR	SPEED
CARS	0.	30.0
HT	0.	30.0
MT	0.	30.0
VEH4	2852.	50.0
VEH5	124.	50.0
VEH6	124.	50.0

0

	----------COORDINATES----------			
	X	Y	Z	GRADE
132+00	1200.0	.0	2169.0	0
135+00	1500.0	.0	2173.0	0
140+00	2000.0	.0	2184.0	0
145+00	2500.0	.0	2198.5	0
150+00	3000.0	.0	2213.5	0
155+00	3500.0	.0	2228.4	0
159+00	3900.0	.0	2240.0	0

ROADWAY 3 Future Cortaro Roadway: Camino de Oeste to Oldfather

VEHICLE TYPE	VEHICLES/HOUR	SPEED
CARS	0.	30.0
HT	0.	30.0
MT	0.	30.0
VEH4	2712.	50.0
VEH5	118.	50.0
VEH6	118.	50.0

0

	----------COORDINATES----------			
	X	Y	Z	GRADE
159+00	3900.0	.0	2240.0	0
160+00	4000.0	.0	2243.5	0
162+00	4200.0	.0	2249.0	0
165+00	4500.0	.0	2258.0	0
170+00	5000.0	.0	2273.0	0
175+00	5500.0	.0	2285.0	0
180+00	6000.0	-30.0	2294.0	0
185+00	6500.0	-70.0	2301.0	0

190+00	7000.0	-100.0	2307.7	0
195+00	7500.0	-100.0	2314.3	0
200+00	8000.0	-100.0	2320.9	0
205+00	8500.0	-100.0	2327.5	0
209+00	8900.0	-100.0	2334.0	0

ROADWAY 4 Future Cortaro Roadway: Oldfather to Thornydale

VEHICLE TYPE	VEHICLES/HOUR	SPEED
CARS	0.	30.0
HT	0.	30.0
MT	0.	30.0
VEH4	2943.	50.0
VEH5	128.	50.0
VEH6	128.	50.0

0

----------COORDINATES----------

	X	Y	Z	GRADE
209+00	8900.0	-100.0	2334.0	0
210+00	9010.0	-100.0	2334.1	0
215+00	9515.0	-100.0	2340.2	0
220+00	10020.0	-100.0	2345.4	0
224+00	10420.0	-100.0	2350.0	0
225+00	10520.0	-100.0	2349.7	0
226+00	10620.0	-100.0	2351.0	0
227+00	10720.0	-100.0	2352.0	0
228+00	10820.0	-100.0	2352.5	0
229+00	10920.0	-100.0	2353.5	0
230+00	11025.0	-100.0	2353.4	0
235+00	11525.0	-100.0	2358.2	0
235+44	11569.0	-100.0	2357.5	0
240+00	12025.0	-100.0	2359.0	0

1

BARRIER 1 TYPE(A) Berm @ west end: Change to 6' ht. wall

---------COORDINATES----------

	X	Y	Z	Z0	DELZ	P
a	-1000.0	250.0	2167.0	2161.0	1.0	3
b	-750.0	220.0	2167.0	2161.0		
c	-500.0	150.0	2166.0	2160.0		
d	-300.0	90.0	2165.0	2159.0		
e	-90.0	90.0	2165.0	2159.0		

1

BARRIER 2 TYPE(A) Exist. wall, n. side, west of Hartman

---------COORDINATES----------

	X	Y	Z	Z0	DELZ	P
a	240.0	230.0	2166.0	2160.0	1.0	3
b	300.0	100.0	2166.0	2160.0		
c	825.0	100.0	2167.0	2161.0		
d	890.0	100.0	2169.0	2163.0		
e	1100.0	100.0	2169.0	2163.0		
f	1150.0	160.0	2169.0	2163.0		
g	1150.0	490.0	2170.0	2164.0		

1

BARRIER 3 TYPE(A) Existing zero-ht. barrier condition, s. side, east of Cerius Strav: add 6' wall

---------COORDINATES----------

	X	Y	Z	Z0	DELZ	P
a	.0	-100.0	2166.0	2160.0	1.0	3
a	.0	-75.0	2166.0	2160.0		
b	200.0	-75.0	2165.0	2159.0		
d	600.0	-75.0	2166.0	2160.0		
e	900.0	-75.0	2167.0	2161.0		
f	1100.0	-75.0	2167.5	2161.5		
g	1300.0	-75.0	2168.5	2162.5		
h	1400.0	-75.0	2169.0	2163.0		
i	1600.0	-75.0	2173.0	2167.0		
j	1600.0	-100.0	2173.0	2167.0		

1

BARRIER 4 TYPE(A) Existing zero-ht. barrier, s. side, east of Spanish Bayonet: add 6' wall

---------COORDINATES----------

	X	Y	Z	Z0	DELZ	P
a	1650.0	-75.0	2174.5	2168.5	1.0	3
b	1900.0	-75.0	2181.0	2175.0		
c	2100.0	-75.0	2183.0	2177.0		
d	2200.0	-75.0	2186.0	2180.0		
e	2300.0	-75.0	2189.0	2183.0		
f	2400.0	-75.0	2194.0	2188.0		
g	2500.0	-75.0	2197.0	2191.0		

1

BARRIER 5 TYPE(A) Existing zero-ht. barrier, n. side, at Church r.o.w. & ridgeline: add 6' wall,w

---------COORDINATES----------

	X	Y	Z	Z0	DELZ	P
a	1900.0	75.0	2185.0	2179.0	1.0	3
b	2200.0	75.0	2192.0	2186.0		
c	2500.0	200.0	2220.0	2214.0		
d	2700.0	300.0	2225.0	2219.0		

1

BARRIER 6 TYPE(A) Existing zero-ht. barrier @ ROW, NWC CdeOeste (Elliott Res.): Add 6' wall@row

---------COORDINATES----------

	X	Y	Z	Z0	DELZ	P
a	3550.0	75.0	2233.0	2227.0	1.0	3
b	3700.0	75.0	2247.0	2241.0		
c	3800.0	75.0	2242.0	2236.0		
d	3860.0	75.0	2241.5	2235.0		
e	3860.0	125.0	2251.0	2245.0		

1

BARRIER 7 TYPE(A) Existing wall, n. side, west of School

---------COORDINATES----------

	X	Y	Z	Z0	DELZ	P
a	5220.0	140.0	2289.0	2283.0	1.0	3
b	5240.0	75.0	2288.0	2282.0		
c	5850.0	60.0	2300.0	2294.0		
d	5850.0	200.0	2301.0	2295.0		

1

BARRIER 8 TYPE(A) Existing zero-ht. barrier, n. side @ School (west of entry drive): add 6' wall

---------COORDINATES----------

	X	Y	Z	Z0	DELZ	P
a	5900.0	130.0	2301.0	2295.0	1.0	3
b	5900.0	50.0	2300.0	2294.0		
c	6175.0	30.0	2302.0	2296.0		
d	6200.0	100.0	2302.0	2297.0		

1

BARRIER 9 TYPE(A) Existing zero-ht. barrier, n. side @ School (east of entry drive): add 6' wall

---------COORDINATES----------

	X	Y	Z	Z0	DELZ	P
a	6230.0	30.0	2303.0	2297.0	1.0	3
b	6480.0	10.0	2301.0	2295.0		
c	6480.0	60.0	2302.0	2296.0		

1

BARRIER 10 TYPE(A) Existing zero-ht. barrier, n. side @ ROW, west of Burke Road: add 6' wall

---------COORDINATES----------

	X	Y	Z	Z0	DELZ	P
a	7150.0	-30.0	2318.0	2312.0	1.0	3
b	7500.0	-30.0	2323.0	2317.0		
c	7900.0	-30.0	2323.0	2317.0		
d	8100.0	-30.0	2330.0	2324.0		
e	8275.0	-30.0	2329.0	2323.0		

1

BARRIER 11 TYPE(A) Existing zero-ht. barrier, n. side, east of Burke Road: add 6' wall

---------COORDINATES----------

	X	Y	Z	Z0	DELZ	P
a	8325.0	-30.0	2329.0	2323.0	1.0	3
b	8680.0	-30.0	2337.0	2331.0		

1

BARRIER 12 TYPE(A) Existing zero-ht. barrier, n. side, west of Delta: add 6' wall

---------COORDINATES----------

	X	Y	Z	Z0	DELZ	P
a	8710.0	-30.0	2337.0	2331.0	1.0	3
b	8940.0	-30.0	2338.0	2332.0		
c	9125.0	-25.0	2341.0	2335.0		

1

BARRIER 13 TYPE(A) Existing Wall, s. side, west of Gatekeeper

---------COORDINATES----------

	X	Y	Z	Z0	DELZ	P
a	7600.0	-500.0	2318.0	2312.0	1.0	3
b	7600.0	-180.0	2319.0	2313.0		
c	7700.0	-180.0	2319.0	2313.0		
d	7700.0	-280.0	2319.0	2313.0		

1

BARRIER 14 TYPE(A) Existing wall, s. side, east of Gatekeeper

```
          ---------COORDINATES----------
                X          Y          Z          Z0       DELZ          P
 a            7750.0     -180.0     2319.0     2313.0       1.0          3
 b            8275.0     -180.0     2325.0     2319.0
 c            8275.0     -200.0     2325.0     2319.0
1

 BARRIER  15   TYPE(A)     Existing wall, s. side, Freshwater to Oldfather
          ---------COORDINATES----------
                X          Y          Z          Z0       DELZ          P
 a            8320.0     -180.0     2327.0     2321.0       1.0          3
 b            8870.0     -180.0     2336.0     2330.0
 c            8870.0     -600.0     2331.0     2325.0
1

 BARRIER  16   TYPE(A)     Existing wall, s. side, Oldfather to Delta
          ---------COORDINATES----------
                X          Y          Z          Z0       DELZ          P
 a            8975.0     -600.0     2333.0     2327.0       1.0          3
 b            8975.0     -200.0     2338.0     2332.0
 c            9370.0     -200.0     2340.0     2334.0
 d            9370.0     -240.0     2340.0     2334.0
1

 BARRIER  17   TYPE(A)     Existing wall, s. side, east of Delta
          ---------COORDINATES----------
                X          Y          Z          Z0       DELZ          P
 a            9410.0     -240.0     2341.0     2335.0       1.0          3
 b            9410.0     -175.0     2341.0     2335.0
 c            9790.0     -175.0     2343.0     2337.0
 d            9850.0     -175.0     2343.0     2337.0
 e           10230.0     -175.0     2346.0     2340.0
 f           10230.0     -300.0     2346.0     2340.0
 g           10235.0     -300.0     2346.0     2340.0
 h           10500.0     -175.0     2344.0     2338.0
 i           11000.0     -175.0     2351.0     2345.0
 j           11525.0     -175.0     2357.0     2351.0
1

 BARRIER  18   TYPE(A)     Existing wall, n. side, west of Delta
          ---------COORDINATES----------
                X          Y          Z          Z0       DELZ          P
 a            9125.0      500.0     2346.0     2340.0       1.0          3
 b            9125.0      -25.0     2341.0     2335.0
 c            9200.0      -25.0     2342.0     2336.0
1

 BARRIER  19   TYPE(A)     Existing zero-ht. barrier, n.side, east of Delta
by Basin: extend 6' wall

          ---------COORDINATES----------
                X          Y          Z          Z0       DELZ          P
 a            9270.0      -25.0     2341.0     2335.0       1.0          3
 b            9370.0      -25.0     2343.0     2337.0
1
```

BARRIER 20 TYPE(A) Existing Wall, n. side, east of Delta

	---------COORDINATES----------					
	X	Y	Z	Z0	DELZ	P
a	9370.0	150.0	2344.0	2338.0	1.0	3
b	9370.0	-25.0	2343.0	2337.0		
c	9450.0	-25.0	2345.0	2339.0		
d	9575.0	-25.0	2345.0	2339.0		
e	9770.0	-25.0	2346.0	2340.0		
f	9870.0	-25.0	2348.0	2342.0		
g	10200.0	-25.0	2350.0	2344.0		
h	10200.0	150.0	2353.0	2347.0		

1

Measurement Locations

	----------COORDINATES----------		
	X	Y	Z
Achor	310.0	-165.0	2165.0
Church	2170.0	275.0	2196.0
Elliott	3750.0	140.0	2249.0
SchoolEn	6080.0	265.0	2302.0
SchoolYd	6300.0	330.0	2302.0
Burke Rd	8306.0	170.0	2332.0
Burke Rd	8303.0	40.0	2328.0
Burke Rd	8300.0	-25.0	2326.0
Delta-S	9330.0	-210.0	2338.0
Delta-N	9300.0	.0	2343.0
Vacant-S	10630.0	-250.0	2351.0
WestEndN	-570.0	200.0	2162.0
118-1850	500.0	150.0	2166.0
Rockwood	1300.0	-150.0	2167.0
Overholt	1900.0	-150.0	2180.0
Mendoza	5500.0	100.0	2291.0
McDonald	7565.0	50.0	2323.0
Pandola	8100.0	40.0	2326.0
Lakosky	8650.0	50.0	2336.0
Marshall	7959.0	210.0	2323.0
Keown	10000.0	.0	2349.0

1

ALPHA FACTORS - RECEIVER ACROSS,ROADWAY DOWN

1 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	.0									
2 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	.0									
3 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	.0									
4 *	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	.0									

1

SHIELDING FACTORS - RECEIVER ACROSS,ROADWAY DOWN

```
  1 *  .0  .0  .0  .0  .0  .0  .0  .0  .0  .0
       .0  .0  .0  .0  .0  .0  .0  .0  .0  .0
       .0
  2 *  .0  .0  .0  .0  .0  .0  .0  .0  .0  .0
       .0  .0  .0  .0  .0  .0  .0  .0  .0  .0
       .0
  3 *  .0  .0  .0  .0  .0  .0  .0  .0  .0  .0
       .0  .0  .0  .0  .0  .0  .0  .0  .0  .0
       .0
  4 *  .0  .0  .0  .0  .0  .0  .0  .0  .0  .0
       .0  .0  .0  .0  .0  .0  .0  .0  .0  .0
       .0
1

 RECEIVER    LEQ(H)   L10
 Achor        66.7   69.3

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING    1.0 DBA
ROADWAY  SEGMENT
    1        1    2    3    4    5    6    7    8
            48.5 50.6 49.4 48.9 54.7 64.8 58.6 48.6
    2        1    2    3    4    5    6
            47.6 47.4 46.4 45.1 43.1 41.5
    3        1    2    3    4    5    6    7    8    9   10
   11       12
            33.9 36.1 38.0 39.9 38.7 37.6 36.5 35.6 34.6 33.8
            32.9 31.2
    4        1    2    3    4    5    6    7    8    9   10
   11       12   13
            25.5 31.7 31.0 29.3 22.8 22.7 22.6 22.4 22.3 22.4
            28.8 17.8 27.7
1

 RECEIVER    LEQ(H)   L10
 Church       65.2   68.0

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING    1.0 DBA
ROADWAY  SEGMENT
    1        1    2    3    4    5    6    7    8
            38.1 38.7 39.9 38.1 41.6 46.0 52.0 50.4
    2        1    2    3    4    5    6
            54.1 59.9 61.9 51.5 44.6 40.1
    3        1    2    3    4    5    6    7    8    9   10
   11       12
            32.8 35.2 35.9 36.8 35.2 33.7 32.1 30.7 29.4 28.2
            27.0 25.1
    4        1    2    3    4    5    6    7    8    9   10
   11       12   13
            19.4 25.4 24.5 22.7 16.1 16.0 15.8 15.7 15.4 15.5
            21.8 10.8 20.6
1

 RECEIVER    LEQ(H)   L10
 Elliott      67.9   70.5

 ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING    1.0 DBA
ROADWAY  SEGMENT
```

```
    1        1    2    3    4    5    6    7    8
           37.6 37.4 36.9 37.3 39.5 42.5 44.7 41.9
    2        1    2    3    4    5    6
           44.3 48.4 51.2 55.1 59.5 64.3
    3        1    2    3    4    5    6    7    8    9   10
   11       12
           58.7 57.9 52.7 52.1 51.0 48.2 45.9 44.1 42.4 41.0
           39.7 33.1
    4        1    2    3    4    5    6    7    8    9   10
   11       12   13
           26.0 31.6 30.2 28.2 21.7 21.4 21.2 20.9 20.8 20.8
           27.1 15.8 25.6
1

 RECEIVER    LEQ(H)   L10
 SchoolEn     62.9   65.0

 ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING    1.0 DBA
ROADWAY  SEGMENT

    1        1    2    3    4    5    6    7    8
           32.6 31.3 31.0 29.1 31.6 34.2 37.6 35.1
    2        1    2    3    4    5    6
           37.1 39.3 36.3 38.0 44.9 45.6
    3        1    2    3    4    5    6    7    8    9   10
   11       12
           40.3 44.1 42.6 45.6 49.9 56.0 57.9 55.7 52.5 43.8
           41.9 40.2
    4        1    2    3    4    5    6    7    8    9   10
   11       12   13
           33.2 39.2 37.0 34.7 28.0 27.7 27.5 27.2 27.0 27.0
           33.1 21.9 31.6
1

 RECEIVER    LEQ(H)   L10
 SchoolYd     63.5   65.7

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING    1.0 DBA
ROADWAY  SEGMENT
    1        1    2    3    4    5    6    7    8
           32.7 30.2 30.4 27.3 29.8 32.7 33.6 34.6
    2        1    2    3    4    5    6
           36.6 39.8 40.0 36.5 43.2 44.7
    3        1    2    3    4    5    6    7    8    9   10
   11       12
           39.3 43.0 44.8 43.8 47.3 52.2 58.7 58.9 53.4 44.6
           42.9 41.1
    4        1    2    3    4    5    6    7    8    9   10
   11       12   13
           33.8 39.7 37.5 35.2 28.5 28.2 27.9 27.7 27.4 27.4
           33.5 22.2 31.9
1

 RECEIVER    LEQ(H)   L10
 Burke Rd     64.3   67.0

 ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING    1.0 DBA
```

```
ROADWAY  SEGMENT
    1        1    2    3    4    5    6    7    8
            24.3 25.6 25.6 22.2 24.1 26.7 26.9 23.3
    2        1    2    3    4    5    6
            24.9 27.7 28.8 29.9 31.3 31.7
    3        1    2    3    4    5    6    7    8    9   10
   11       12
            26.1 29.6 32.3 36.3 38.5 40.9 47.8 48.7 48.5 54.2
            61.9 56.1
    4        1    2    3    4    5    6    7    8    9   10
   11       12   13
            46.3 50.1 46.2 42.7 35.4 35.0 34.6 34.2 33.8 33.5
            39.4 27.8 37.3
1

 RECEIVER    LEQ(H)   L10
 Burke Rd     67.9   71.0

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING    1.0 DBA
ROADWAY  SEGMENT

    1        1    2    3    4    5    6    7    8
            28.2 25.3 25.3 22.4 24.3 27.0 27.6 24.0
    2        1    2    3    4    5    6
            25.7 28.7 29.8 31.1 32.5 32.7
    3        1    2    3    4    5    6    7    8    9   10
   11       12
            27.1 30.7 33.4 37.1 38.9 45.3 47.9 45.0 49.3 54.4
            66.9 56.9
    4        1    2    3    4    5    6    7    8    9   10
   11       12   13
            46.6 51.5 46.4 42.6 35.4 34.8 34.4 34.0 33.6 33.4
            39.2 27.6 37.0
1

 RECEIVER    LEQ(H)   L10
 Burke Rd     73.8   76.9

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING    1.0 DBA
ROADWAY  SEGMENT

    1        1    2    3    4    5    6    7    8
            26.5 30.1 29.4 28.4 30.5 33.4 34.2 30.8
    2        1    2    3    4    5    6
            32.6 35.6 36.5 37.6 38.6 38.7
    3        1    2    3    4    5    6    7    8    9   10
   11       12
            33.0 36.4 38.9 42.3 43.9 45.8 43.3 44.0 47.6 57.3
            73.3 61.7
    4        1    2    3    4    5    6    7    8    9   10
   11       12   13
            45.9 49.5 45.7 42.0 34.7 34.3 33.8 33.4 33.0 32.8
            38.6 27.0 36.5
1

RECEIVER    LEQ(H)   L10
 Delta-S      66.4   69.1
```

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 1.0 DBA
ROADWAY SEGMENT

```
    1        1    2    3    4    5    6    7    8
            22.7 24.1 24.3 21.0 23.0 25.8 26.4 22.9
    2        1    2    3    4    5    6
            24.6 27.5 28.5 29.6 30.6 30.6
    3        1    2    3    4    5    6    7    8    9   10
   11       12
            24.8 28.2 30.7 34.0 35.3 36.8 38.4 40.2 42.4 45.0
            48.7 52.6
    4        1    2    3    4    5    6    7    8    9   10
   11       12   13
            51.1 64.8 58.0 49.8 41.3 40.4 39.7 39.0 38.4 37.9
            43.3 31.3 40.5
1
```

RECEIVER	LEQ(H)	L10
Delta-N	69.9	72.8

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 1.0 DBA
ROADWAY SEGMENT

```
    1        1    2    3    4    5    6    7    8
            23.3 24.3 24.3 21.6 23.9 26.7 27.4 23.9
    2        1    2    3    4    5    6
            25.7 28.6 29.5 30.4 31.4 31.3
    3        1    2    3    4    5    6    7    8    9   10
   11       12
            25.6 28.9 31.3 34.6 35.9 37.3 38.7 40.6 42.7 45.6
            49.3 53.6
    4        1    2    3    4    5    6    7    8    9   10
   11       12   13
            57.6 68.9 58.1 49.9 41.5 40.7 40.0 39.3 38.7 38.3
            43.6 31.6 40.9
1
```

RECEIVER	LEQ(H)	L10
Vacant-S	70.9	73.5

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 1.0 DBA
ROADWAY SEGMENT

```
    1        1    2    3    4    5    6    7    8
            21.0 22.2 22.3 18.8 20.8 23.4 23.9 20.3
    2        1    2    3    4    5    6
            22.0 24.9 25.7 26.9 27.9 27.9
    3        1    2    3    4    5    6    7    8    9   10
   11       12
            22.1 25.5 27.9 31.3 32.5 33.7 34.9 36.2 37.7 39.4
            41.3 42.6
    4        1    2    3    4    5    6    7    8    9   10
   11       12   13
            38.5 47.5 53.5 62.3 61.6 64.1 64.4 62.2 58.8 55.8
            57.1 41.0 48.9
1
```

```
RECEIVER     LEQ(H)    L10
 WestEndN      64.6    67.1

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING    1.0 DBA
ROADWAY  SEGMENT
    1         1    2    3    4    5    6    7    8
            46.3 52.5 61.4 56.8 54.2 54.0 52.8 46.0
    2         1    2    3    4    5    6
            41.5 42.0 40.2 38.9 37.9 36.0
    3         1    2    3    4    5    6    7    8    9   10
   11        12
            29.3 32.1 33.4 34.9 34.2 33.2 32.2 31.1 30.1 29.1
            28.0 26.0
    4         1    2    3    4    5    6    7    8    9   10
   11        12   13
            20.1 25.9 23.4 22.1 16.0 15.6 15.4 15.2 15.1 15.1
            21.1  9.6 19.4
1

 RECEIVER     LEQ(H)    L10
 118-1850      66.7    69.2

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING    1.0 DBA
ROADWAY  SEGMENT
    1         1    2    3    4    5    6    7    8
            42.4 45.1 47.9 47.2 51.8 63.0 63.0 50.9
    2         1    2    3    4    5    6
            49.2 48.0 45.3 43.5 41.9 39.3
    3         1    2    3    4    5    6    7    8    9   10
   11        12
            32.2 34.9 35.8 36.9 35.5 34.1 32.9 31.8 30.7 29.6
            28.5 26.7
    4         1    2    3    4    5    6    7    8    9   10
   11        12   13
            20.9 27.1 25.3 22.8 16.8 16.7 16.6 16.6 16.5 16.4
            22.2 11.0 20.6
1

 RECEIVER     LEQ(H)    L10
 Rockwood      68.3    71.5

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING    1.0 DBA
ROADWAY  SEGMENT
    1         1    2    3    4    5    6    7    8
            43.9 41.6 43.4 41.3 44.5 50.0 56.4 60.4
    2         1    2    3    4    5    6
            65.7 59.9 50.9 47.0 44.7 43.6
    3         1    2    3    4    5    6    7    8    9   10
   11        12
            38.2 40.7 41.6 42.6 41.2 39.9 38.7 37.6 36.5 35.5
            34.6 32.8
    4         1    2    3    4    5    6    7    8    9   10
   11        12   13
            27.1 33.3 32.5 30.7 24.3 24.1 24.0 23.8 23.7 23.7
            30.2 19.1 29.1
```

1

RECEIVER	LEQ(H)	L10
Overholt	68.8	71.9

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 1.0 DBA

ROADWAY	SEGMENT									
1	1	2	3	4	5	6	7	8		
	41.8	40.1	41.5	38.9	41.7	46.4	50.2	49.1		
2	1	2	3	4	5	6				
	55.6	66.5	62.7	53.1	51.3	48.4				
3	1	2	3	4	5	6	7	8	9	10
11	12									
	40.7	43.1	43.8	44.6	42.9	41.4	40.1	38.9	37.8	36.7
	35.7	33.9								
4	1	2	3	4	5	6	7	8	9	10
11	12	13								
	28.1	34.3	33.4	31.7	25.2	25.0	24.9	24.7	24.6	24.6
	31.1	20.0	29.9							

1

RECEIVER	LEQ(H)	L10
Mendoza	65.8	68.8

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 1.0 DBA

ROADWAY	SEGMENT									
1	1	2	3	4	5	6	7	8		
	29.1	30.7	31.1	27.9	30.1	33.2	34.2	30.9		
2	1	2	3	4	5	6				
	32.8	36.1	37.6	39.4	41.4	42.5				
3	1	2	3	4	5	6	7	8	9	10
11	12									
	37.6	41.6	45.2	51.8	62.1	62.0	51.9	47.1	43.8	41.4
	39.4	36.8								
4	1	2	3	4	5	6	7	8	9	10
11	12	13								
	30.8	36.5	35.1	33.0	26.3	26.1	25.8	25.6	25.4	25.4
	31.5	20.3	30.0							

1

RECEIVER	LEQ(H)	L10
McDonald	65.4	68.0

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 1.0 DBA

ROADWAY	SEGMENT									
1	1	2	3	4	5	6	7	8		
	25.9	26.9	27.1	24.0	26.0	28.8	29.4	25.9		
2	1	2	3	4	5	6				
	27.6	30.6	31.8	33.1	34.5	34.8				
3	1	2	3	4	5	6	7	8	9	10
11	12									
	29.3	33.1	35.7	39.6	41.8	47.5	52.3	54.9	59.2	62.2
	53.7	47.3								
4	1	2	3	4	5	6	7	8	9	10
11	12	13								
	44.7	45.3	43.4	39.6	32.6	32.2	31.8	31.5	31.2	31.0
	37.0	25.6	35.2							

1

RECEIVER	LEQ(H)	L10
Pandola	65.3	68.0

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 1.0 DBA

ROADWAY	SEGMENT									
1	1	2	3	4	5	6	7	8		
	28.3	25.7	25.8	22.8	24.7	27.6	28.2	24.5		
2	1	2	3	4	5	6				
	26.2	29.2	30.4	31.6	33.0	33.3				
3	1	2	3	4	5	6	7	8	9	10
11	12									
	27.7	31.3	34.0	37.8	39.6	46.0	49.0	47.1	51.2	59.1
	62.4	55.2								
4	1	2	3	4	5	6	7	8	9	10
11	12	13								
	44.5	49.4	45.1	41.7	34.4	34.0	33.7	33.3	32.8	32.7
	38.5	27.0	36.4							

1

RECEIVER	LEQ(H)	L10
Lakosky	66.5	69.4

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 1.0 DBA

ROADWAY	SEGMENT									
1	1	2	3	4	5	6	7	8		
	27.5	25.0	25.0	21.9	23.9	26.5	26.9	23.4		
2	1	2	3	4	5	6				
	25.0	27.9	29.0	30.4	31.7	31.9				
3	1	2	3	4	5	6	7	8	9	10
11	12									
	26.3	29.8	32.5	36.2	37.8	43.9	46.0	43.5	46.5	52.2
	58.4	64.4								
4	1	2	3	4	5	6	7	8	9	10
11	12	13								
	53.0	54.8	49.0	44.7	37.2	36.7	36.2	35.7	35.2	35.1
	40.7	29.0	38.4							

1

RECEIVER	LEQ(H)	L10
Marshall	62.6	64.8

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 1.0 DBA

ROADWAY	SEGMENT									
1	1	2	3	4	5	6	7	8		
	24.4	25.7	25.7	22.3	24.3	26.8	27.2	23.6		
2	1	2	3	4	5	6				
	25.1	28.0	29.1	30.4	31.8	32.0				
3	1	2	3	4	5	6	7	8	9	10
11	12									
	26.6	30.2	33.0	37.0	39.2	42.1	49.0	52.0	50.6	58.1
	57.1	50.7								
4	1	2	3	4	5	6	7	8	9	10
11	12	13								
	44.7	46.9	43.9	40.8	33.7	33.3	32.9	32.6	32.1	32.0
	37.9	26.4	35.9							

1

RECEIVER	LEQ(H)	L10
Keown	68.4	71.2

ROADWAY SEGMENT SOUND LEVEL CONTRIBUTIONS EXCEEDING 1.0 DBA

ROADWAY	SEGMENT									
1	1	2	3	4	5	6	7	8		
	22.1	23.0	22.9	20.2	22.3	25.0	25.6	22.1		
2	1	2	3	4	5	6				
	23.8	26.7	27.6	28.5	29.5	29.5				
3	1	2	3	4	5	6	7	8	9	10
11	12									
	23.7	27.1	29.4	32.7	33.9	35.2	36.4	38.0	39.8	41.8
	44.4	46.3								
4	1	2	3	4	5	6	7	8	9	10
11	12	13								
	42.9	53.2	65.5	64.1	49.7	48.0	46.6	45.3	44.2	43.4
	47.9	35.3	44.2							

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