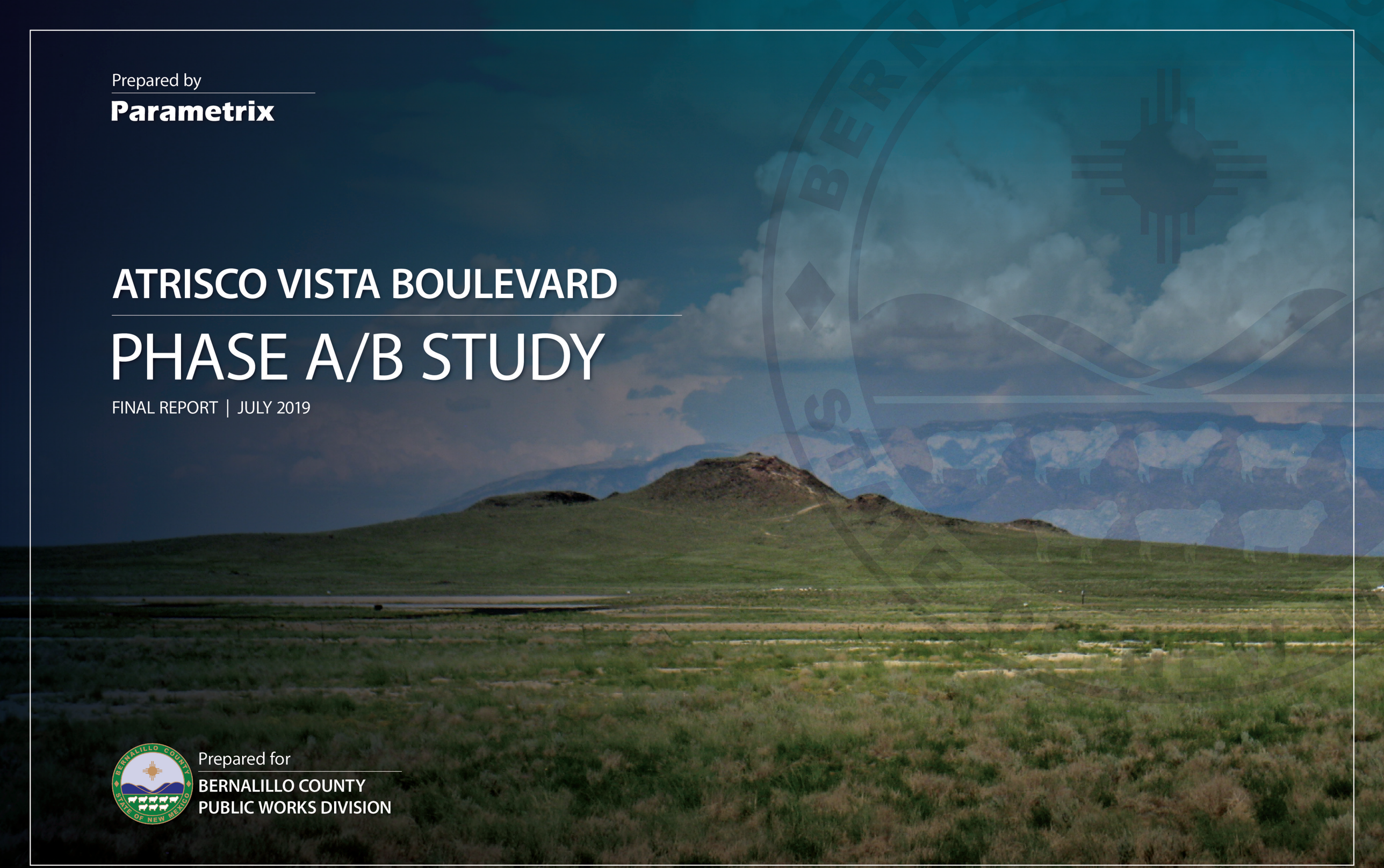
Prepared by

Parametrix

ATRISCO VISTA BOULEVARD

PHASE A/B STUDY

FINAL REPORT | JULY 2019



Prepared for

BERNALILLO COUNTY
PUBLIC WORKS DIVISION

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ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ABCWUA	Albuquerque Bernalillo County Water Utility Authority
AMAFCA	Albuquerque Metropolitan Arroyo Flood Control Authority
AMREP	American Realty and Petroleum Corporation
CAWMP	Calabacillas Watershed Park Management Plan
cfs	cubic feet per second
CM	Construction Management
FHWA	Federal Highway Administration
I-40	Interstate 40
LRRS	Long Range Roadway System
MRCOG	Mid-Region Council of Governments
MRMPO	Mid-region Metropolitan Planning Organization
MTP	Metropolitan Transportation Plan
NEPA	National Environmental Policy Act
NMDOT	New Mexico Department of Transportation
RACP	Roadway Access Control Policies
SAMM	State Access Management Manual
SAMS	Southwest Aeronautic Math and Sciences Academy
SSCAFCA	Southern Sandoval County Arroyo Flood Control Authority
TAC	Technical Advisory Committee
V/C	volume-to-capacity



Petroglyph National Monument is located east of the project area.

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1.0 INTRODUCTION

Atrisco Vista Boulevard is a **critical link in the transportation system** for the northwest subarea of metropolitan Albuquerque.

Atrisco Vista Boulevard currently provides:

- Direct access to several large manufacturing and warehouse facilities just north of I-40, a regional general aviation airport, several large tracts of lands master planned for development, and several recreational destinations.
- Access to several large neighborhoods in northwest Albuquerque off of Paseo del Norte.

1.1 Project Setting and Description

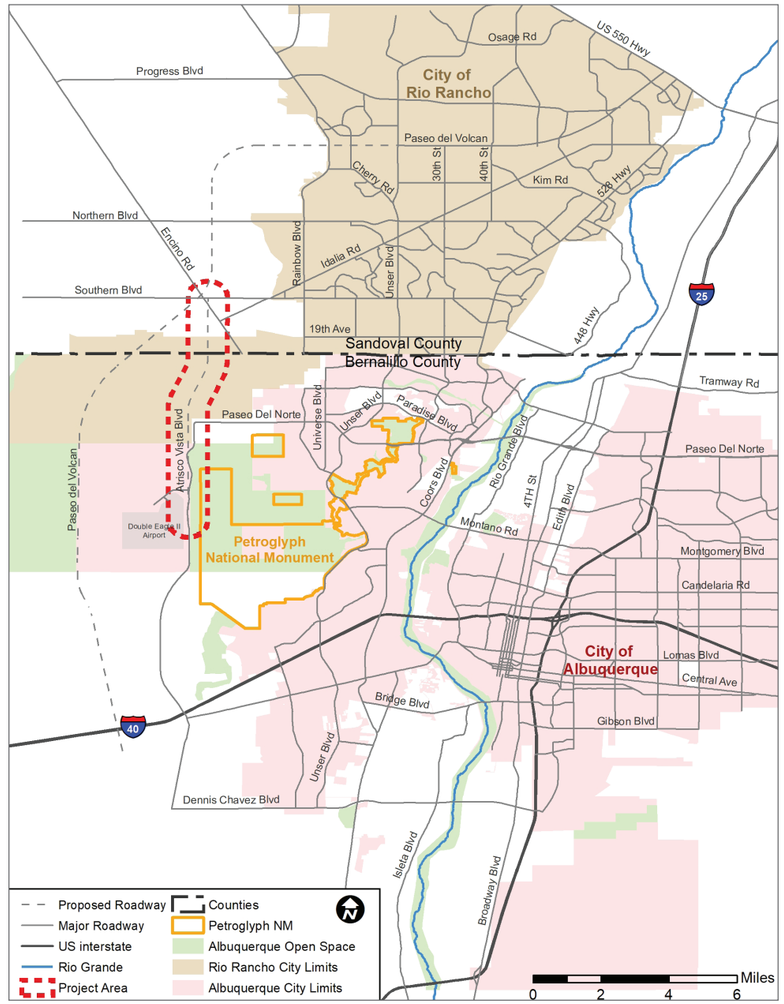
Atrisco Vista Boulevard is a principal arterial located in the northwest quadrant of the Albuquerque urban area. The roadway currently exists as a two-lane facility that extends from Central Avenue north to Paseo del Norte — a distance of approximately 9 miles. With an interchange at Interstate 40 (I-40), Atrisco Vista Boulevard provides direct access to several large manufacturing and warehouse facilities just north of I-40, a regional general aviation airport, several large tracts of lands master planned for development, and several recreational destinations. This roadway also provides access to several large neighborhoods in northwest Albuquerque off of Paseo del Norte. For these reasons, Atrisco Vista Boulevard is a critical link in the transportation system for the northwest subarea of metropolitan Albuquerque.

Continued development along the Atrisco Vista Boulevard corridor, northwest Albuquerque, southern Sandoval County, and southwestern Rio Rancho necessitates expansion of the roadway network in this area to maintain efficient mobility and to facilitate orderly growth and development. Recognizing this need, the Bernalillo County Commission directed the Bernalillo County Public Works Division to conduct an engineering and environmental study focused on extending Atrisco Vista Boulevard north from Paseo del Norte to Southern Boulevard in Sandoval County.

The proposed project evaluated by this study includes the existing segment of Atrisco Vista Boulevard from Double Eagle Road north to Paseo del Norte, and the proposed extension of the existing roadway on a new alignment north from Paseo del Norte to Southern Boulevard in Sandoval County (Figure 1-1). The total project area is approximately 5.75 miles in length. The proposed improvements within the project area include:

- Reconstruction and shoulder-widening of Atrisco Vista Boulevard from the Double Eagle II Airport north to Paseo del Norte. Based on the findings of the engineering analysis, changes in the horizontal alignment of Atrisco Vista Boulevard are needed in this segment to bring the roadway up to current design standards.
- The extension of Atrisco Vista Boulevard from Paseo del Norte north to Southern Boulevard. The improvements proposed in this segment include a two-lane roadway with shoulders for shared bicycle use.
- A 10-foot multi-use trail is included in the proposed project for the entire project area from the Double Eagle II Airport to Southern Boulevard. Implementation of the trail segment north of Paseo del Norte would be deferred to a future date when the area develops further and a trail connection with Southern Boulevard is available.

Figure 1-1. *Project Location*



The **proposed improvements** within the project area include:

- Reconstruction and shoulder-widening of Atrisco Vista Boulevard from the Double Eagle II Airport north to Paseo del Norte.
- The extension of Atrisco Vista Boulevard from Paseo del Norte north to Southern Boulevard.
- A 10-foot multi-use trail is included in the proposed project for the entire project area from the Double Eagle II Airport to Southern Boulevard.

Parametrix

Project development consists of several distinct steps including:

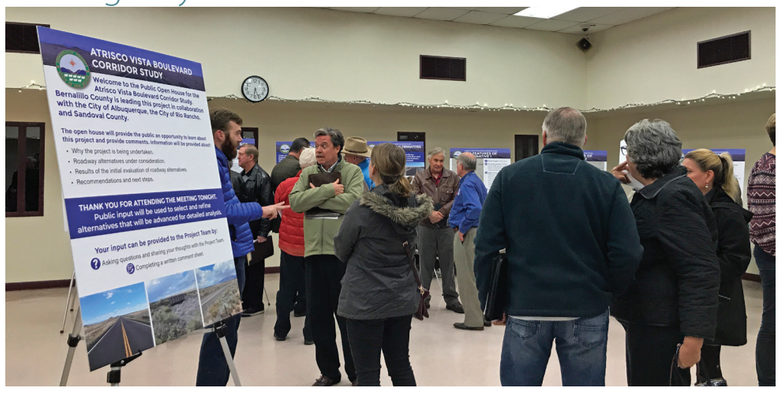
1. DOCUMENT EXISTING CONDITIONS
2. DETERMINE PURPOSE AND NEED
3. IDENTIFY PROJECT ALTERNATIVES
4. PERFORM INITIAL ALTERNATIVE SCREENING
5. PERFORM DETAILED ALTERNATIVE ANALYSIS
6. ENVIRONMENTAL DOCUMENTATION AND PRELIMINARY DESIGN
7. FINAL DESIGN

NOTE: Steps six and seven are future efforts.

Bernalillo County Public Works Division is serving as the lead agency for the study. However, because the project area passes through and/or is near jurisdictions and facilities managed by other entities, the study was conducted in collaboration with several other jurisdictions and agencies. These include the City of Albuquerque, City of Rio Rancho, Sandoval County, and the Mid-Region Council of Governments (MRCOG). In addition, the study is coordinating with several other entities with management responsibility for facilities potentially affected by the proposed project. These entities include the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA), Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA), and Petroglyph National Monument.

This Phase A/B study was prepared following the process set by the New Mexico Department of Transportation (NMDOT) Location Study Procedures. These procedures provide a systematic analysis and decision-making approach and process to follow during early project development. The Location Study Procedures process is consistent with the environmental regulations of the Federal Highway Administration (FHWA) as mandated by the National Environmental Policy Act (NEPA) of 1970, as amended, and the planning and environmental linkages process. Following these procedures helps locally funded projects remain eligible for future federal funding.

1.2 Agency Coordination and Public Involvement



Two public meetings were held to gather public comments.

Involvement of the public, stakeholder agencies, and elected officials is a key part of the Phase A/B study process. The goals of public involvement for this study are to:

- Inform the public, stakeholders, agencies, and elected officials about the project and let them know how they can be involved
- Provide opportunities to engage with the public, stakeholders, agencies, and elected officials throughout the process to identify key issues and community concerns
- Inform the development of a project that meets the needs of the community and stakeholders

This section summarizes the approach to public involvement and the specific methods that were used for engaging the public, agencies, and elected officials.

1.2.1 Public Outreach and Meetings

Public outreach activities conducted during the study included coordination with neighborhood associations, bicycle and environmental advocacy groups, major landowners within the project area, and local and state jurisdictions.

A project briefing was provided to the Westside Coalition of Neighborhoods on May 2, 2018. The feedback from this meeting helped Bernalillo County Public Works Division identify major issues of interest to the communities and major landowners within and adjacent to the project area. This information was used to help project scoping and to identify potential alignment alternatives. A second briefing was provided on July 10, 2019, to the Coalition. The briefing provided project findings and recommendations.

A public meeting was held during the alternatives screening phase to inform the public about the proposed project and solicit feedback. The meeting was held on December 5, 2018, from 6:00 p.m. to 8:00 p.m. at the Paradise Hills Community Center — a community facility to the east of the project area. The meeting was held using an open house format where the public could come at a time of their convenience to view project display boards and talk with project staff. Display boards and project handouts were provided that included key information about the project background, project objectives, roadway alternatives evaluated, initial screening evaluation results, and next steps. Twenty-nine people signed in at the open house.

The open house was advertised by distributing a one-page flyer to residents and businesses in proximity to the project corridor, neighborhood associations, agency representatives and elected officials, special interest groups, and public utilities. Notices were also sent using the social network Nextdoor and a display advertisement published in the Rio Rancho Observer. Local media, including the KRQE television station and Albuquerque Journal also announced the meeting as part of community interest spots.

Seven comment sheets were submitted at the open house. In addition, verbal feedback was obtained through discussions with the public in attendance. The following key themes emerged from both written and verbal feedback:

- **General support** – Of the alignments that were initially considered and screened, there was support for the Alternative 2 alignment, safety improvements to the existing section of Atrisco Vista Boulevard, paved shoulders, and multi-use trail.
- **Funding priorities** – Concern was expressed that implementation of this project would reprioritize funding away from other roadway improvements (e.g. Unser Boulevard and Paseo del Norte) and future roadway projects (Paseo del Volcan).
- **Connection to existing recreational facilities** – Request to connect the proposed Atrisco Vista Boulevard multi-use trail to the City of Albuquerque's Paseo de la Mesa multi-use trail (north of Petroglyph National Park). In addition, the request also suggested an improved parking area at the trailhead.
- **Truck Use** – A question was asked whether Atrisco Vista Boulevard currently allows commercial truck traffic and whether the pavement design can accommodate commercial truck loading.
- **Southern Boulevard** – Request that improvements to Southern Boulevard be evaluated by the study, including desired improvements for bicyclists.

A second public open house was held May 16, 2019, from 6:30 p.m. – 8:00 p.m. at the Star Heights Recreation Center in Rio Rancho. The purpose of the open house was to provide updated project information and to inform the public of project recommendations, including the recommended roadway alignment. Meeting notice and meeting format were as described for the first public open house. Display boards and handouts presented information about the work completed to date, results of the detailed alternative analysis, project recommendations, and next steps. Seventeen people attended the open house. Feedback from meeting participants varied and ranged from general support to concerns that the project had not been adequately evaluated. The following general points were expressed by meeting participants:



Two public meetings were held to gather public comments.

Agency coordination and public involvement is the foundation of the project development process and a critical part of the decision-making process.

- Support for the proposed roadway as an additional connection between Southern Boulevard and I-40
- Concern that roadway connection would support access to fracking activities and an algae/fertilizer plant.
- Interest in advancing Paseo del Volcan instead of Atrisco Vista Boulevard because the commenter believes that Paseo del Volcan would attract more jobs to the westside and better serve Rio Rancho
- Questions whether NEPA compliance has been fulfilled, and questions about whether analysis of green-house gas emissions were performed and whether Section 106 consultation (specifically Traditional Cultural Properties) was provided
- Several attendees asked for information on why the roadway was needed, the analyses conducted to date, what was being recommended, and if a construction date has been decided

Written comments were received from three individuals. These comments included one landowner concerned about the impacts of Paseo del Volcan on their residence, and a second individual who suggested that Atrisco Vista be constructed as a 4-lane facility now, rather than as a 2-lane roadway. The third written comment raised several questions about the lack of analyses for fracking activity, siting of an algae and fertilizer plant, need for an environmental impact statement and a public hearing, and the adequacy of public outreach and public information.

1.2.2 Agency Coordination

The project spans four governmental jurisdictions including lands within the boundaries of Bernalillo County, Sandoval County, City of Albuquerque, and City of Rio Rancho. These jurisdictions, along with the various transportation, land use, flood control, and recreational entities having responsibility within the study area were involved throughout the process. A Technical Advisory Committee (TAC) was formed to engage these and other agencies to provide interagency and interjurisdictional project oversight and technical expertise to help guide the study.

A Technical Advisory Committee, consisting of representatives from the various jurisdictions, transportation, land use, flood control, and recreational entities who have responsibilities within the study area, was formed to engage stakeholders, as well as provide interagency and interjurisdictional project oversight and technical expertise to help guide the study.

The TAC was convened several times throughout the study at important project milestones. In addition, topic-specific meetings with individual agencies were held as needed. The following agencies and departments were invited to participate in the TAC:

- Bernalillo County Public Works Division
- City of Albuquerque Department of Municipal Development
- City of Albuquerque Aviation Department
- City of Albuquerque Planning Department
- City of Albuquerque Parks and Recreation Department/Open Space Division
- Albuquerque Metropolitan Arroyo Flood Control Authority
- Southern Sandoval County Arroyo Flood Control Authority
- City of Rio Rancho Public Works Department
- City of Rio Rancho City Manager
- Sandoval County Public Works Department
- Mid-Region Council of Governments
- NMDOT Local Governments Liaison

Three meetings of the TAC were held over the course of the study.

- The first TAC meeting was held on July 18, 2018. The meeting objective was to kick-off off the study with partner agencies and jurisdictions. The group discussed the study background, objectives, approach, roles and responsibilities, and schedule. The group also reviewed the proposed initial alignment alternatives and evaluation criteria and provided feedback.
- A second meeting of the TAC was held on November 14, 2018. The meeting objective was to review the Existing Conditions Report and the Alternatives Screening Report, which was provided to the group in advance of the meeting. The group concurred with the project team that Alternative 2 should be advanced for detailed analysis. The group also discussed the upcoming public open house meeting and related public outreach activities.
- The third meeting of the TAC occurred on April 10, 2019. The purpose of this meeting was to review the detailed analysis of alternatives advanced from initial screening. The group provided feedback on project recommendations, including roadway design, drainage, access management, right-of-way needs, environmental impacts, estimated costs, and potential project phasing.

1.2.3 Elected Officials and Other Coordination

Notification of project kick-off and request for involvement were sent at the start of the project to elected officials from project area jurisdictions (Bernalillo County, Sandoval County, City of Albuquerque, and City of Rio Rancho) and MRCOG. Briefings to elected officials were provided, as requested, at major milestones.

Presentations were made to the Transportation Coordinating Committee and the Metropolitan Transportation Board of MRCOG in June 2019. The briefings to these groups were as "information items" and not for action. The purpose of the presentations was to inform these groups as the Metropolitan Transportation Plan (MTP) and Transportation Improvement Plan are updated.

1.2.4 Report Format

The information provided in the remaining chapters of this report includes:

- **Chapter 2** summarizes the existing conditions, including engineering, environmental, and community conditions within the project area and area of influence
- **Chapter 3** describes the project purpose and the key factors that comprise the need for improving and extending Atrisco Vista Boulevard
- **Chapter 4** identifies and describes the initial set of alternatives considered to extend Atrisco Vista Boulevard north from Paseo del Norte to Southern Boulevard and summarizes the results of the initial screening process used to evaluate the identified alternatives
- **Chapter 5** provides additional detailed engineering and environmental analysis of the alternative advanced from initial screening
- **Chapter 6** summarizes report conclusions and provides recommendations for implementation and project phasing

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2.0 EXISTING CONDITIONS

This chapter summarizes the existing conditions within the project area, including engineering, environmental, and community conditions. A detailed description of existing conditions can be found in the Atrisco Vista Boulevard Existing Conditions Report, November 2018. This report is on file with the Bernalillo County Public Works Division.

2.1 Roadway Network

Atrisco Vista Boulevard is part of the existing and proposed major street network serving far northwest Albuquerque and western Rio Rancho. The current arterial street network in this geographic area is very limited and characterized by long distances between principal arterials and incomplete connectivity, in both the north-south and east-west directions. Figure 2-1 illustrates the existing street system and proposed improvements within the 2040 planning horizon.

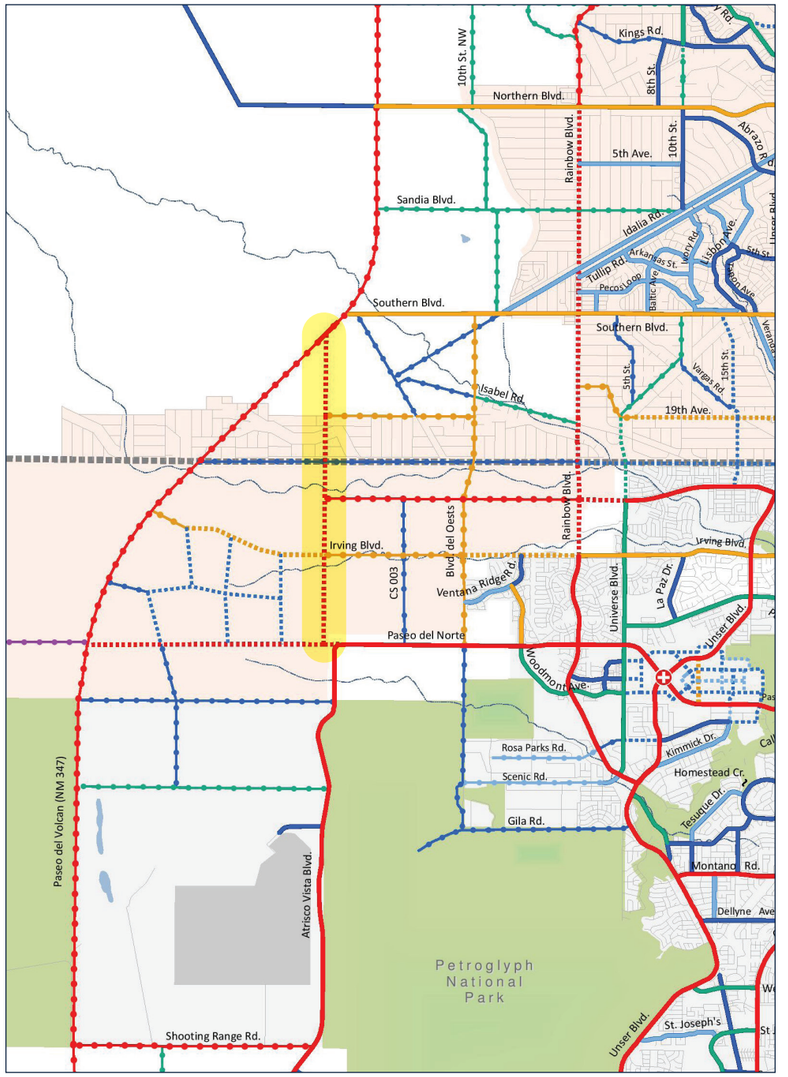
The closest existing major north-south arterial to Atrisco Vista Boulevard is Unser Boulevard to the east. Unser Boulevard is the primary north-south arterial street that spans the entire westside of the Albuquerque / Rio Rancho urban area. The alignment of Unser Boulevard is very curvilinear and varies from about 3 to 5 miles from the proposed alignment of Atrisco Vista Boulevard.

Rainbow Boulevard is an existing and proposed principal arterial that serves northwest Albuquerque and western Rio Rancho. This street is currently discontinuous and consists of a 2.75-mile segment south of Irving Boulevard and a 2.5-mile segment north of Southern Boulevard. The central 2.5-mile segment between Irving Boulevard and Southern Boulevard has not yet been constructed, although it is included as a planned arterial street in the 2040 MTP (Figure 2-1). The distance between the future alignments of Atrisco Vista Boulevard and Rainbow Boulevard is approximately 2.25 miles; a spacing consistent with other arterial streets in Rio Rancho.

In addition to the arterial streets described above, Paseo del Volcan is planned west of Atrisco Vista Boulevard. Paseo del Volcan is a planned principal arterial with right-of-way adequate to accommodate a future freeway facility. While it is not included in the 2040 MTP, it is identified as a "post 2040" roadway and local efforts are underway to advance its implementation. The spacing of Paseo del Volcan from the proposed extension of Atrisco Vista Boulevard varies from about 1.4 to 2.75 miles, although at the north terminus the separation is less than 1/2 mile.

Existing east-west arterial streets within the project area include Paseo del Norte and Southern Boulevard. Paseo del Norte runs from the current northern terminus of Atrisco Vista Boulevard east through the City of Albuquerque. Southern Boulevard is a principal arterial that runs east-west through Rio Rancho and extends into unincorporated Sandoval County.

Figure 2-1. *Existing and Planned Street System within the Project Vicinity*



2040 Long Range Roadway System

- Interchange/Crossing
- Interchange/Crossing, Post 2040
- Freeways
- Regional Principal Arterial
- Community Principal Arterial
- Minor Arterial
- Major Collector
- Minor Collector
- Proposed Regional Principal Arterial
- Proposed Community Principal Arterial
- Proposed Minor Arterial
- Proposed Major Collector
- Proposed Minor Collector
- Proposed Regional Principal Arterial, Post 2040
- Proposed Community Principal Arterial, Post 2040
- Proposed Minor Arterial, Post 2040
- Proposed Major Collector, Post 2040
- Proposed Minor Collector, Post 2040
- Classification TBD, Post 2040



Atrisco Vista Boulevard typical near the airport.

2.2 Existing Roadway Conditions

The roadways of interest for this study include Atrisco Vista Boulevard, both within and adjoining the project area to the south, and the intersecting segments of Paseo del Norte and Southern Boulevard. The key characteristics of the project segment of Atrisco Vista Boulevard and these other roadways are summarized in Table 2-1 below.

Table 2-1. *Summary of Roadway Conditions - Atrisco Vista Blvd. and Adjoining Roadway Segments*

Design Features	Roadway Segments			
	Atrisco Vista Boulevard (Double Eagle Road to Paseo del Norte)	Atrisco Vista Boulevard (I-40 to Double Eagle Road)	Paseo del Norte Boulevard (Atrisco Vista Boulevard to Ventana West Parkway)	Southern Boulevard (20th Street to Rainbow Boulevard)
Length	2.0 miles	6.7 miles	2.0 miles	2.2 miles
Lane Configuration	Two, 11-foot driving lanes with narrow, unpaved shoulders.	Two, 12-foot driving lanes with 6-foot bike lanes/ paved shoulders.	Two, 11-foot driving lanes with narrow paved shoulders, and a 13-foot graded earth shoulder on the south side.	Two, 12- to 14-foot driving lanes with no consistent shoulder.
Posted Speed	40 mph. Advisory speeds of 25 to 35 mph at curves north of Double Eagle Road.	40 mph.	50 mph west of Ventana West Parkway; 35 to 45 mph east of Ventana West Parkway.	35 mph.
Intersections and Access	At Double Eagle Road with stop control on the minor road; access to open space on the east side, 1.4 miles north of Double Eagle Road.	At Tempur-Pedic Parkway and Shooting Range Road, with stop control on the intersecting streets.	At Ventana West Parkway with stop control on the intersecting street; at Rainbow Boulevard with a signal.	At Rainbow Boulevard with stop control on Rainbow Boulevard; 22 residential side streets with stop control on the side streets; 25 individual residences with direct access.
Pedestrian/ Bicycle Accommodations	None.	Bike lanes shared with shoulders.	Multi-use path on the north side east of Ventana West Parkway.	Intermittent facilities. Condition variable.
Right-of-Way/ Easement	156-foot easement from Double Eagle Road north for 1.4 miles; 40 feet from there north to Paseo del Norte Boulevard (mixture of ROW and easements).	156-foot easement.	40-foot easement west of Ventana West Parkway; 156 feet east of Ventana West Parkway.	100 feet.
Pavement Condition	Pavement depth is unknown; recently repaved and appears to be in good condition	Pavement depth is unknown; constructed approximately 5 years ago and appears to be in good condition	Pavement depth is unknown; appears to be in fair condition with some transverse and map cracking.	Pavement depth is unknown; appears to be in poor condition with extensive transverse and longitudinal cracking.

The design speeds of Atrisco Vista Boulevard and Southern Boulevard were assessed. Design speeds were estimated based on the horizontal and vertical alignment of the existing roadways as compared to design standards in the AASHTO Green Book.

- The horizontal alignment on Atrisco Vista Boulevard includes two reverse curves starting north of Double Eagle Road with a design speed of approximately 25 to 40 mph.
- The horizontal alignment of Southern Boulevard includes a reverse curve just west of Hondo Road with a design speed estimated to be 30 to 35 mph.
- The design speed for the vertical alignment of Atrisco Vista Boulevard is consistent with a 50 mph design speed.
- On Southern Boulevard there are various vertical curves with 40 mph design speeds plus a crest curve near 4th Street with a design speed between 35 and 40 mph.

2.3 Existing Traffic Conditions

Traffic volumes on Atrisco Vista Boulevard north of I-40 are generally low and consistent with a two-lane roadway. According to MRCOG traffic count data, the Average Weekday Daily Traffic volume in 2016 ranged from about 1,300 to 2,100 vehicles. This traffic is a mixture of commuter vehicles, recreational traffic, and trucks serving the industrial area. Table 2-2 summarizes the existing traffic volumes on various segments of Atrisco Vista Boulevard and Southern Boulevard.

Table 2-2. *Existing Traffic Volumes for Atrisco Vista Boulevard and Adjoining Roadways*

Roadway and Segment	Average Daily Weekday (2016[1])	PM Peak Hour (2012[2])
Atrisco Vista Boulevard		
I-40 to Arroyo Vista Boulevard	2,100	300
Arroyo Vista Boulevard to Double Eagle Road	1,100	210
Double Eagle Road to Paseo del Norte	1,300	230
Southern Boulevard		
Atrisco Vista Boulevard to Hondo Road	1,080	100
Hondo Road to Rainbow Boulevard	2,860	280

Notes:
[1] 2016 traffic volumes are from MRCOG Traffic Counts Map.
[2] PM Peak hour volumes are from MRCOG Model for the 2012 Base Year.

2.4 Safety



Northbound Atrisco Vista to Paseo del Norte, 90-degree curve.



Traffic volumes on Atrisco Vista Boulevard north of I-40 are generally low and consistent with a two-lane roadway.



The crash records identified a total of 13 crashes within the project area and 135 crashes on roadways within the project influence area. **Excessive speed and horizontal curves were primary contributing factors.**

Existing safety conditions within the project area and project influence area were assessed based on a review of crash records, field observations, and anecdotal information. Crash data were obtained from the NMDOT Traffic Safety Division for the years 2014 through 2016, the most recent 3-year period available. The review of the crash records identified a total of 13 crashes within the project area and 135 crashes on roadways within the project influence area. Crashes by facility include:

- 13 crashes in the project area of Atrisco Vista Boulevard. Based on the information included in the crash reports, excessive speed and horizontal curves were primary contributing factors. The majority of these crashes occurred at the transition curve between Atrisco Vista Boulevard and Paseo del Norte. Several crashes also occurred through the reverse curves between Double Eagle Road and Paseo del Norte.
- 28 crashes on Atrisco Vista Boulevard between I-40 and Double Eagle Road. The majority of these crashes were in proximity to the I-40 interchange and at the Shooting Range Access Road intersection.
- 81 crashes on Paseo del Norte between Atrisco Vista Boulevard and Rainbow Road. The vast majority of crashes occurred at the intersections, involved two or more vehicles, and failure to yield — typical of urban intersections.
- 26 crashes on Southern Boulevard between 20th Street and Rainbow Road. The design and condition of Southern Boulevard is a likely contributing factor to the reported crashes.

2.5 Drainage

Existing watersheds within the project area are within the jurisdictions of the City of Albuquerque, City of Rio Rancho, Bernalillo County, and Sandoval County. The Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) and the Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA) have jurisdiction over portions of the drainageways within Bernalillo County and Sandoval County, respectively. AMAFCA and SSCAFCA work cooperatively with the agencies within their jurisdictions: Bernalillo County, Sandoval County, the City of Albuquerque, and the City of Rio Rancho. These four agencies will be responsible for regulating, approving, and maintaining the drainage infrastructure within the study area.

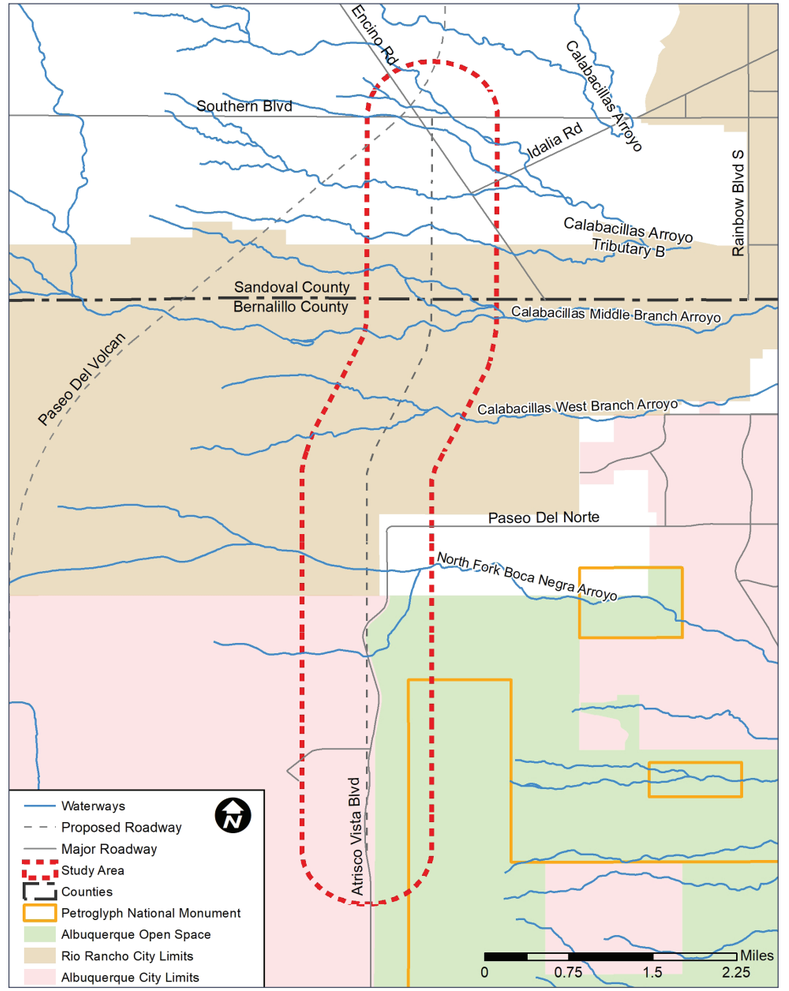
Several major arroyos and a number of minor channels drain from east to west across the corridor (see Figure 2-2). Major arroyos crossing the Atrisco Vista corridor are the North Fork Boca Negra, Calabacillas West Branch, Calabacillas Middle Branch, Calabacillas Middle Branch Tributary, and Calabacillas Tributary B. Major arroyos crossing Southern Boulevard include the Calabacillas Arroyo (main channel). No major arroyos cross Paseo del Norte Boulevard in the study area. Existing small-diameter culverts cross under Atrisco Vista Boulevard from Double Eagle Road north to Paseo del Norte. South of Paseo del Norte, Atrisco Vista Boulevard crosses the North Fork Boca Negra arroyo on a 20' span by 6' rise bridge. Southern Boulevard crosses the Calabacillas Arroyo with five 8' span by 6' rise concrete box culverts.

Federal Emergency Management Administration Flood Insurance Rate Maps show the Atrisco Vista Boulevard corridor crosses multiple mapped flood plains created by existing arroyos. These include a tributary and the main channel of the North Fork Boca Negra Arroyo, the Calabacillas West Branch Arroyo (up to two floodplains), the Calabacillas Middle Branch Arroyo (up to three floodplains), and the Calabacillas Arroyo Tributary B (up to two floodplains).

2.6 Property Ownership and Right-of-Way

The project area for the Atrisco Vista Boulevard project is in a largely undeveloped subarea in northwest Albuquerque and southwest Rio Rancho. Within Bernalillo County, property ownership consists of a mixture of municipal, state, and private owners. Beginning at Double Eagle Road and extending north for approximately 1.4 miles, the City of Albuquerque owns

Figure 2-2. *Project Area Waterways*



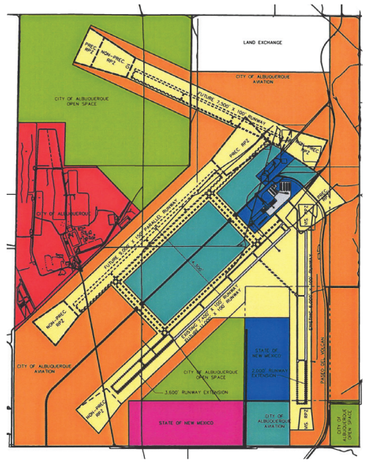
the vast majority of land on both sides of Atrisco Vista Boulevard except for a large parcel (approximately 38.7 acres) immediately west of the roadway and north of the airport that is owned by the New Mexico State Land Office. From this point north to the county line, land ownership is predominantly private entities with many parcels under common ownership by Paradise West, Inc.

Most of the property within Sandoval County is part of Rio Rancho Estates, a subdivision established over 50 years ago, and is predominantly owned by private entities and individuals. Parcel sizes vary from 0.5 to 1.8 acres, with most lots approximately 0.5 acres in size. Based on Sandoval County data, several corporations own many lots with the remainder under individual ownership.

Numerous roadway rights-of-way and easements are present within the proposed project area. The right-of-way for Atrisco Vista Boulevard consists of 156 feet from Double Eagle Road north for approximately 1.4 miles (contiguous with the land owned by the City of Albuquerque). From this point north to Paseo del Norte, Atrisco Vista Boulevard is within a mix of 40-foot right-of-way and easements. The roadway easements are reserved by deed. No



Southwest Aeronautics, Mathematics, and Science Academy.



Double Eagle II Airport Master Plan.

roadway right-of-way is present north of Paseo del Norte to Southern Boulevard. However, various roadway rights-of-way 50 feet in width exist within the Rio Rancho Estates parcels.

2.7 Utilities



Public Service Company of New Mexico Transmission Lines North of the Double Eagle II Airport.

Existing and proposed utilities in the project area were researched with utility owners. The findings are summarized below:

- Public Service Company of New Mexico has electric transmission lines running northwest to southeast that cross Atrisco Vista Boulevard, 1.3 miles north of Double Eagle Road. Electric transmission and distribution lines also run east-west along Southern Boulevard.
- The Albuquerque Bernalillo County Water Utility Authority (ABCWUA) has water and sanitary sewer lines in the southern portion of the corridor. Coordination with ABCWUA indicates that future master plans for development along Paseo del Norte site a future water reservoir, supporting east-west water transmission lines, and a booster station near the intersection of Atrisco Vista Boulevard and Paseo del Norte. A future reservoir is planned approximately 0.5 mile south of the intersection of Atrisco Vista Boulevard and the future extension of Irving Boulevard.
- CenturyLink has fiber optic and copper communication lines along Southern Boulevard at the north end of the corridor.
- South of Paseo del Norte, the New Mexico Gas Company has multiple high-pressure transmission lines and an existing junction facility near the intersection of Encino Road and 18th Street.

2.8 Geotechnical Conditions

A geologic and geotechnical literature search and site reconnaissance were performed and are discussed in a separate preliminary geotechnical report prepared for the corridor. Based on the literature review, site surface and subsurface soils are anticipated to consist predominantly of alluvium, eolian, and colluvium deposits comprised of sands, silts, and clays. These soils may have a tendency for settlement with elevated moisture content and low to moderate bearing capacity. Subsurface bedrock materials likely consist of volcanic igneous formations predominantly comprised of basalt. The surface and subsurface bedrock along the project alignments may have a tendency for compression and/or expansion with elevated moisture content and will likely have moderate to high bearing capacity depending upon the degree of hardness and weathering. Groundwater depth in the project area will likely exceed 300 to 440 feet below the existing ground surface.

2.9 Transportation Plans and Policies

The extension of Atrisco Vista Boulevard and connection to Southern Boulevard is included in the MRCOG 2040 MTP as a "Project of Special Interest". The MTP describes the project as a north-south arterial connection between the existing I-40 interchange at Exit 149 and US 550 via the existing Atrisco Vista Boulevard and the future Paseo del Volcan north of Southern Boulevard. The intent of this corridor is to provide improved north-south access serving the areas both north and south of I-40 and, ultimately, Rio Rancho via a connection with Southern Boulevard and northern Rio Rancho via a future connection to Paseo del Volcan. The 2040 MTP notes an anticipated timeframe for construction of 2026 to 2040, or earlier if warranted. Total cost for right-of-way acquisition and construction was estimated in the 2040 MTP at approximately $24 M (2014 $).

In addition to the 2040 MTP, the Bernalillo County Commission adopted Administrative Resolution 2016-42, which acknowledges the extension of Atrisco Vista Boulevard as a priority project for Bernalillo County and directs the County Public Works Division to begin implementation activities.

2.10 Community, Environmental, and Cultural Conditions

This section describes relevant community and environmental factors and includes discussion of land use, economic conditions, natural resource, and cultural resources conditions.

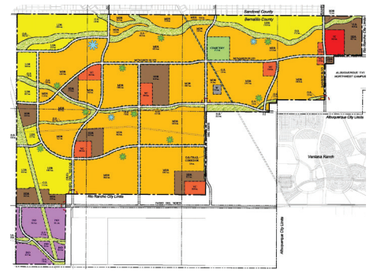
2.10.1 Land Use and Plans

Land use in the project area and area of influence is largely undeveloped parcels interspersed with municipal, state, and federal lands and operations. However, a small pocket of single-family residences exists near the northern terminus of the proposed alignment along Southern Boulevard in unincorporated Sandoval County. The undeveloped lands vary from large master-planned areas under single ownership to small, individually owned parcels. The individual parcels are primarily located in Rio Rancho Estates, Rio Rancho, and Bernalillo County.

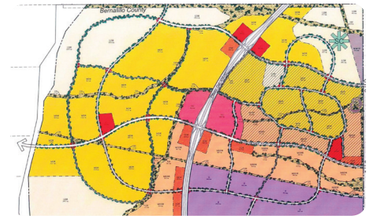
Four master planned areas are within the project area including Paradise West, Rio Rancho Estates, Quail Ranch, and Westland. These planned developments include future residential, commercial, industrial, and recreational/open space land uses. Two of the planned areas, Paradise West and Rio Rancho Estates are directly affected by the proposed alignment (Figure 2-3). The proposed extension of Atrisco Vista Boulevard is assumed as part of the future Paradise West roadway network. The plans for Rio Rancho Estates did not identify future roadways. Quail Ranch and Westland are outside of but contiguous to the project area. Both of these master planned areas would be indirectly impacted and served by enhanced network connectivity in the area.

Parks/open space land is present in the southern portion of the project area and includes Petroglyph National Monument (managed by the National Park Service), City of Albuquerque open space land, and State of New Mexico Public Land. Petroglyph National Monument is east of the existing Atrisco Vista Boulevard at the southern end of the project area. The City of Albuquerque open space is located east of the existing Atrisco Vista Boulevard north of Double Eagle Road and also west of Atrisco Vista Boulevard and the Double Eagle II Airport. State of New Mexico Public Land is present north of the airport and west of the existing Atrisco Vista Boulevard alignment.

The Double Eagle II Airport is a general aviation facility located on the southwestern end of the project area. The Southwest Aeronautic Math and Sciences Academy (SAMS) is adjacent to Atrisco Vista Boulevard in the southeast part of the airport. Shooting Range Park and the City of Albuquerque Fire Training site are located west of the airport.



Paradise West Master Plan.



Quail Ranch Master Plan.



Westland Sector Development Plan (2016); proposed 2019 amendment for 'Upper Petroglyphs Sector Development Plan.'



Several large industries, including Tempur-Pedic manufacturing plant, have located north of the I-40/ Atrisco Vista Boulevard interchange.

South of the project area, Atrisco Vista Boulevard serves several large industrial and commercial uses north of the I-40 interchange, including Tempur-Pedic Manufacturing, Shamrock Foods Distribution Center, and a Federal Express Distribution Center.

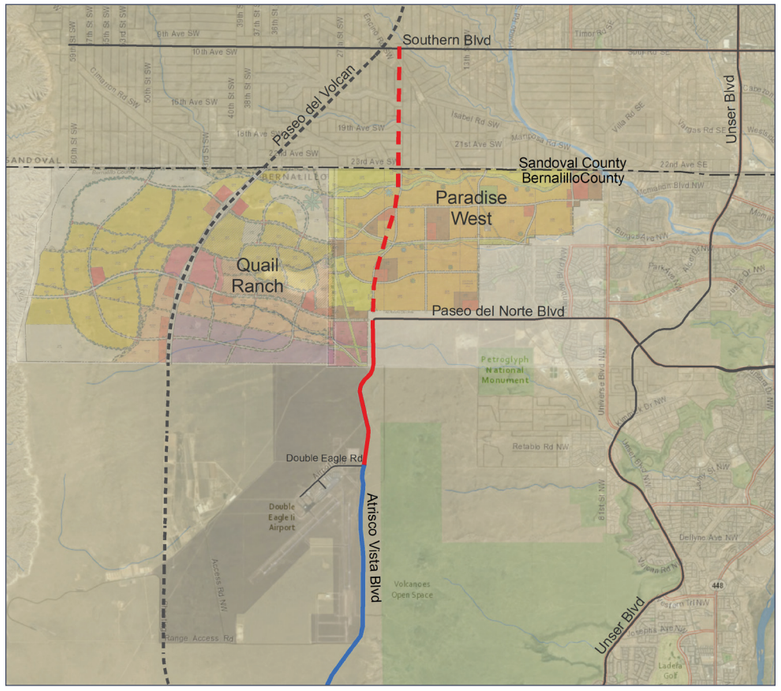
2.10.2 Community

Very little community development exists within the project corridor. Residential uses are limited to the very north end of the project area and in the area approximately 1/2 to 1 mile east along Paseo del Norte where several large residential subdivisions are present. Data from the US Census Bureau's 2012-2016 American Community Survey were reviewed at the tract and block group levels to determine these characteristics. Socioeconomic conditions are similar to the broader geographical area and no major demographic or environmental justice issues were identified.

2.10.3 Economic

The Albuquerque/Rio Rancho metropolitan area is characterized by major employment centers east of the Rio Grande and major population areas west of the Rio Grande. The imbalance of jobs and housing is a major contributor to congestion that affects east-west river crossings. Because of this, regional partners are interested in developing opportunities to attract and locate major employment centers on the west side of the metropolitan area. Several large industries have located within the project area over recent years. These include the Tempur-Pedic manufacturing plant, Shamrock Food Distribution Warehouse, and the recently opened a FedEx shipping center. The employment center currently provides over 500 jobs on the West Side. In addition, several large RV sales facilities are located near the I-40/Atrisco Vista Boulevard interchange. The Double Eagle II Airport and the nearby SAMS, Shooting Range State Park, and Petroglyph National Monument are also located along this corridor.

Figure 2-3. *Paradise West and Quail Ranch Master Planned Areas*



2.10.4 Environmental Resources

The environmental setting of the project area is predominantly high desert mesa/grasslands crossed by several small- to medium-sized arroyos. The topography general slopes west to east and includes gently rolling hills and flat expanses. The steep basalt escarpment along the east side of the project area is a distinct physical barrier between the mesa and the Rio Grande valley.

Natural Resources

Wildlife in the area is predominantly small reptiles, small and mid-sized mammals, and birds common to mesa scrub and grasslands. No federally- or state-listed species are expected to be in the project area due to the lack of suitable habitat. Vegetation is typical of the deep sandy soils and stabilized dunes of the Albuquerque west mesa.

Waterways present within the project area are limited to ephemeral arroyos that cross the project area from west to east. Most of these drainages lack the characteristics to qualify as jurisdictional under Section 404 of the Clean Water Act. Additional discussion on the extent of these water resources are described in Section 2.5.



Typical vegetation in the project area.

Cultural Resources

Situated between a series of ancient volcanoes and the West Mesa escarpment, human activity has occurred within the study area for millennia. Despite this occupational history, however, previously conducted research in and near the study area shows a relatively low density of archaeological sites. A total of eight archaeological sites have been previously documented in the study area, that included cultural material from the Paleoindian, Archaic, Puebloan, and Historic time periods. Two archaeological sites were identified as part of a cultural survey conducted in March 2019.

Visual Resources

Petroglyph National Monument and the volcanoes flanking the east side of the existing Atrisco Vista Boulevard are prominent visual resources in the project area. Roadway improvements could be perceived as having adverse visual impacts to these resources.

Parks and Open Space

Petroglyph National Monument and the City of Albuquerque open space are resources valued by the community. Increased traffic, noise, and visual impacts may have indirect effects to the use of these park resources. Conversely, improved access from Rio Rancho and the addition of a bicycle and pedestrian trail will be a project benefit.



Petroglyph National Monument is located east of the project area.



Southern Boulevard.

2.11 Existing Conditions Summary

Review of existing conditions within the project area identified several items that were considered in the project purpose and need and the development and assessment of project alternatives. These include:

- The subarea between Paseo del Norte and Southern Boulevard and west of Unser Boulevard does not include any continuous north-south roadways or other transportation facilities. Considerable residential development exists west of Unser Boulevard in both Bernalillo County and Sandoval County. Additions to the street network are needed to facilitate orderly growth and to enable and improve accessibility and mobility, and to improve the jobs/housing imbalance for economic development within the area..
- The existing section of Atrisco Vista Boulevard between Double Eagle Road and Paseo del Norte does not meet criteria for a 50-mph design speed. This section lacks adequate shoulders, includes a reverse curve, and has a sharp curve with inadequate signing where the road transitions to Paseo del Norte. Accommodations for bicyclists and pedestrians are lacking.
- The segment of Southern Boulevard from 20th Street east to Rainbow Boulevard is in poor condition, lacks continuous sidewalks, and has a discontinuous trail.
- Crash data for 2014 to 2016, including the number, type, and location of crashes, are consistent with the design problems described above for the existing Atrisco Vista Boulevard roadway.
- Several major east-west drainages and floodplains cross the project area and will need to be considered in the design and evaluation of project alternatives.
- Property ownership within the project area is a mix of public and private lands. The area from Double Eagle Road north for approximately 1.4 miles is owned by the City of Albuquerque and New Mexico State Land Office. Land ownership from this point north to the project terminus is predominantly private. Four large master planned areas are within or adjacent to the project area. Alignment alternatives for Atrisco Vista Boulevard will need to consider the existence of these plans.
- Access to private parcels between Paseo del Norte and the Bernalillo County/Sandoval County line is currently provided by easements surrounding each parcel. Methods to maintain access will need to be investigated.
- Utilities within the project area that could be affected by the extension of Atrisco Vista Boulevard include a high-pressure natural gas transmission line, a large overhead electric transmission line, and several smaller water, sanitary sewer, and communication lines.
- No major issues are anticipated for either natural resources or cultural resources.
- An existing residential community exists in the northern part of the project area. No major demographic or environmental justice issues are anticipated; however, the effect of project alternatives on this community and others will need to be considered as the project advances.

3.0 PURPOSE AND NEED

Project purpose is typically a broad statement of the overall objectives to be achieved by a proposed project.

Project need refers to the specific problems or deficiencies that a proposed project will address.

The **objectives** of the Atrisco Vista Boulevard extension project are to:

- Enhance system connectivity
- Improve access and mobility
- Encourage development

Understanding and documenting the purpose and need of a proposed project is an important step in the study process. This section summarizes the project purpose and the key factors that comprise the need for improving and extending Atrisco Vista Boulevard.

The objectives of the Atrisco Vista Boulevard extension project are to:

- **Enhance system connectivity** of the major street network serving southern Rio Rancho and northwest Albuquerque
- **Improve access and mobility** to developing areas and lands planned for development in northwest Albuquerque and southwest Rio Rancho and facilitate and promote orderly growth
- **Encourage development** of major employment centers on Albuquerque's westside to increase the number of jobs in this area

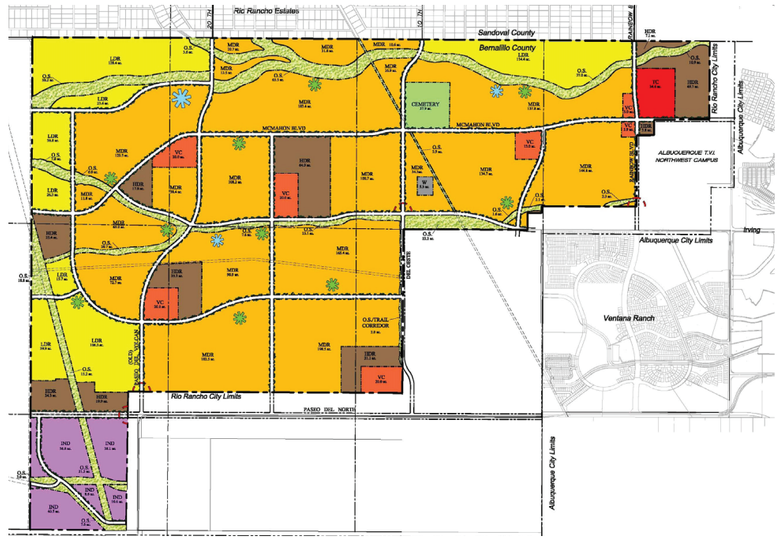
Information that supports these objectives are discussed below.

Enhance system connectivity – As described in Section 2.1, the roadway network serving the far northwest Albuquerque and western Rio Rancho area is very limited and characterized by long distances between principal arterials and incomplete connectivity, in both the north-south and east-west directions. The area bounded by Paseo del Norte on the south, Unser Boulevard on the east, Southern Boulevard on the north, and the future alignment of Paseo del Volcan on the west includes approximately 22 square miles (more than 14,000 acres) of land available for development. While considerable development already exists in this area, and additional areas are planned and approved for development, there are no major continuous streets serving the interior of this area. North-south streets include short segments of Rainbow Boulevard and Universe Boulevard that extend north from Paseo del Norte about 0.5 miles. Further extension of these two streets has been hindered by the difficulty and cost of crossing the Calabacillas Arroyo – a major east-west drainage crossing this area.

Improved access and mobility – Continued development within northwest Albuquerque, southern Sandoval County, and western Rio Rancho will require expansion of the roadway network to enable efficient access. A properly spaced and planned street network will also help facilitate orderly growth and development. The project area spans several existing and planned growth areas:

- Two master planned areas, Paradise West and Quail Ranch, include approximately 10,000 acres of proposed residential, commercial, and industrial land within or near the proposed extension of Atrisco Vista Boulevard. Paradise West specifically envisions the extension of Atrisco Vista Boulevard as part of the future road network and a principal north-south arterial that provides access from Paseo del Norte to Southern Boulevard (Figure 3-1).

Figure 3-1. *Paradise West Master Plan*



- The Rio Rancho Estates lands in the northern reaches of the project area are developing as single-family residential units. Rio Rancho Estates is characterized by antiquated platting which is noted in the Rio Rancho Comprehensive Plan (amended 2015) as one of the City's most significant issues. The plan notes that antiquated platting inhibits the ability to plan for roads and other infrastructure needs and that cooperation is needed with other governmental jurisdictions to address this challenge. In addition, Rio Rancho transportation policy notes a desired transportation system of a clearly defined network of major streets on a regular north-south and east-west grid, using half mile spacing for collectors and one mile spacing for arterials as a desired goal; however, this is a work in progress and has not been completed due to the pattern of antiquated platting.
- Development in Rio Rancho Estates is currently occurring in a random fashion and encompasses a broad area. A review of current and historic aerial photographs of the project area shows approximately 275 houses have been added near the north terminus of the proposed project area, the majority of which have occurred in the last 15 years. This includes the area north and south of Southern Boulevard and east and west of 20th Street. Without proper planning, the ability to implement future major streets will be severely hindered as lands for roadway rights-of-way will be lost to residential development and/or the costs of right-of-way acquisition will escalate due to the need for relocations.

Parametrix

Analysis of the number of people living within 30 minutes of the Atrisco Vista employment area south of Double Eagle II Airport found that **the extension of Atrisco Vista Boulevard would provide access to an additional 18,000 people** – nearly double the number of potential employees than without the extension of this roadway.

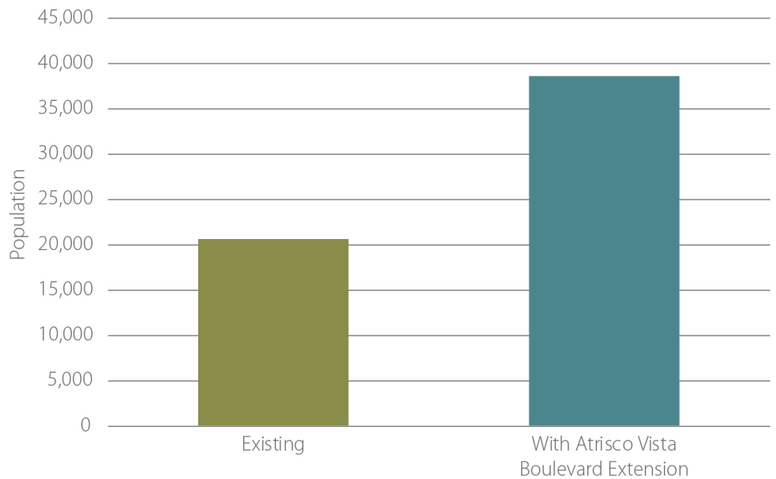


Two factors that support the objectives of the project are **emergency response access and safety**. The extension of Atrisco Vista Boulevard provides an additional route to access Double Eagle II Airport or a major crash on Atrisco Vista Boulevard in the event of a closure on Paseo del Norte.

Support economic development – The *Albuquerque/Bernalillo County Comprehensive Plan* (March 2017) emphasizes the importance of balancing jobs and housing on the west of the Rio Grande. The Comprehensive Plan describes the existing jobs-housing imbalance on the West Side and how this contributes to traffic congestion on the routes leading to and at river crossings as westside residents travel to jobs located in north and east Albuquerque. Creating new job opportunities and providing services west of the Rio Grande was noted as a major priority for the region. Part of meeting this challenge is locating additional employment opportunities on the west side to ensure that housing is located closer to jobs and services.

The *Atrisco Vista Boulevard Roadway Feasibility Study* and *Economic Opportunity Analysis* (Bernalillo County, February 2016) found nearly 1,000 acres of shovel ready land available for industrial/commercial uses along the Atrisco Vista Boulevard corridor north of I-40. Development of industrial and commercial centers such as Double Eagle II Airport, Tempur-Pedic Manufacturing, and Shamrock Foods Distribution Center, near the interchange of Atrisco Vista Boulevard and I-40 has created and provides job opportunities for residents living on the west side. In addition, the Westland Master Plan (amended 2016) proposes approximately 1,100 acres of commercial and industrial land that is projected to create 23,620 jobs along Atrisco Vista Boulevard south of Double Eagle II Airport. However, because the arterial network is limited and discontinuous, access to jobs in this corridor is inefficient. Analysis of the number of people living within 30 minutes of the Atrisco Vista employment area south of Double Eagle II Airport found that the extension of Atrisco Vista Boulevard would provide access to an additional 18,000 people – nearly double the number of potential employees than without the extension of this roadway (Figure 3-2).

Figure 3-2. *Sandoval Co. Population Living within 30 Minutes of Atrisco Vista Employment Area*



Other considerations – In addition to the key factors above, two other factors worth noting are emergency response access and safety. Because Double Eagle II Airport is located at the far west edge of the City, response time for fire and rescue services are affected. The nearest fire stations are located east of the escarpment in Albuquerque (Paradise Hills and Taylor Ranch) and Rio Rancho on Southern Boulevard. The extension of Atrisco Vista Boulevard provides an additional route to access Double Eagle II Airport or a major crash on Atrisco Vista Boulevard in the event of a closure on Paseo del Norte.

As discussed in the Existing Conditions section, the segment of Atrisco Vista Boulevard between Double Eagle Road and Paseo del Norte lacks full-width shoulders. The review of crash reports showed a total of 13 crashes in this segment for the years 2014 through 2016, eight of which were associated with the roadway curves. The proposed project would add shoulders and flatten the curves in this segment to meet criteria for a 45 mph to 50 mph arterial street. It would also reduce the risk for bicyclists using this route who currently share lanes used by motorists.

The proposed project would add shoulders and flatten the curves in this segment to meet criteria for a 45 mph to 50 mph arterial street. **It would also reduce the risk for bicyclists** using this route who currently share lanes used by motorists.



4.0 ALTERNATIVES IDENTIFICATION AND SCREENING

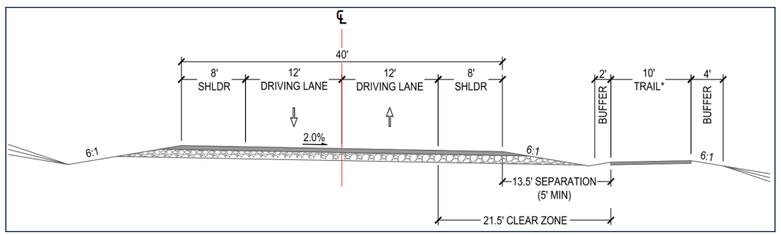
Project alternatives are specific transportation improvement options that could be used to satisfy a project's purpose and need and take into consideration engineering, environmental, and community factors.

As mentioned in Chapter 1, the assessment of the proposed extension and improvements to Atrisco Vista Boulevard was undertaken in two steps: 1) the identification of potential alignment alternatives and subsequent screening of these alternatives based on engineering, environmental, and community criteria; and 2) a more detailed evaluation of alternatives advanced from the screening phase. This chapter describes the initial set of alternatives identified to extend Atrisco Vista Boulevard north from Paseo del Norte to Southern Boulevard and summarizes the results of the initial screening process. A detailed description of the initial screening process can be found in the Alternatives Identification and Initial Screening Report on file on Bernalillo County Public Works Division.

4.1 Alternatives Development

The initial set of alternatives focused on potential alignments to extend Atrisco Vista Boulevard north from Paseo del Norte to Southern Boulevard. Because of the need to widen Atrisco Vista Boulevard and improve the reverse curve north of Double Eagle Road, the alternative alignments include the 2-mile segment of existing roadway between Double Eagle Road and Paseo del Norte, plus the 3.6-mile new alignment section between Paseo del Norte and Southern Boulevard. All of the alignment alternatives assumed a two-lane roadway, a 10-foot multi-purpose pedestrian and bicycle facility, and 180-foot right-of-way width, as shown in Figure 4-1, below.

Figure 4-1. *Proposed Atrisco Vista Typical Section for Initial Screening*



Alignment alternatives were developed by a team of transportation planners and engineers and considered engineering, environmental, and community factors. These include the project purpose and need, terrain, drainages, other existing and planned roads and easements, adopted land use and development plans, parcel size, and community and environmental resources.

Because the roadway is identified as a principal arterial in the Long-Range Roadway System for the 2040 MTP, the design criteria used assumes a 50-mph design speed, 12-foot lane widths, and 8-foot shoulders. A rural typical section is assumed consistent with the segment of Atrisco Vista Boulevard south of the project area. A 186-foot right-of-way width was assumed to accommodate the proposed typical section, and to allow for potential future widening consistent with the road's designation as a principal arterial. Using the factors listed above, three alternatives were developed for initial screening. The general alignment of each alternative is illustrated in Figure 4-2 and described below.

4.1.1 Alternative 1

This alternative begins at Double Eagle Road and follows the existing roadway alignment for approximately one mile. At this point, the alignment veers away from the existing roadway slightly to the northwest where it intercepts an existing major electrical transmission line. It follows the east side of the transmission line for approximately 1.6 miles and then turns north and follows the east edge of the Quail Ranch master-planned area. At the Bernalillo County/Sandoval County boundary, the route turns northeast and then intersects Southern Boulevard at 20th Avenue SW in Sandoval County. The total route length is approximately 6.05 miles. This alignment is illustrated in Figure 4-2.

The alignment of Alternative 1 emphasizes better access to Quail Ranch and takes advantage of the existing transmission line. The terrain for this alignment is generally steeper and more rolling than the other two alternatives.

4.1.2 Alternative 2

Alternative 2 generally follows the alignment of the existing segment of Atrisco Vista Boulevard from Double Eagle Road north to Paseo del Norte. The exception to this is a minor shift to soften the reverse curve located in the first 1.5-mile of the route. At Paseo del Norte, the route follows a northerly bearing for approximately 0.75 miles and then shifts in a northeasterly direction for approximately one-half mile before turning north again. At this point, the route stays on a northerly bearing to its terminus at Southern Boulevard. The total route length is approximately 5.81 miles. See Figure 4-2.

Alternative 2 includes two potential options (Option 2A and 2B) that shift the alignment. Option 2A avoids an arroyo confluence. Option 2B shifts the roadway east of 20th Street north of the future extension of McMahon Boulevard to follow Alternative 3. Similarly, this option takes advantage of the existing parcel configuration and provides additional separation to the two existing residences near 20th Street and Chippewa Road. These options may result in fewer impacts and lower costs. They were not evaluated as part of the screening assessment but are explored in greater detail during the subsequent detailed evaluation.

This alignment is generally consistent with the main north-south roadway through the adopted Paradise West Master Plan. Within Sandoval County, Alternative 2 is parallel to and immediately west of 20th Street to take advantage of the parcel configuration and minimize impacts to parcel access.

SUMMARY OF ALTERNATIVES

Alternative 1 is the western alignment. This alternative emphasizes better access to Quail Ranch and takes advantage of an existing transmission line.

Alternative 2 is the center alignment. This alternative is generally consistent with the Paradise West Master Plan and was designed to minimize impacts to parcel access. This alternative included two Options, 2A and 2B, where the alignment would cross large drainages.

Alternative 3 is the eastern alignment. This alignment follows a proposed major collector in the Long Range Roadway System Plan for the Albuquerque Urban area and the Paradise West Master Plan.

4.1.3 Alternative 3

This alternative follows the same alignment as Alternatives 1 and 2 through the first reverse curve north of Double Eagle Road. At this point, the route turns northeasterly and intersects Paseo del Norte approximately 0.65 miles east of Atrisco Vista Boulevard. After crossing Paseo del Norte, the alignment follows a northerly bearing for approximately 2 miles before turning slightly to the northwest where it crosses the Bernalillo County/Sandoval County line. After crossing the county line, the alignment follows a northerly bearing to its terminus at Southern Boulevard. Route length is approximately 6.16 miles. This alignment is illustrated in Figure 4-2.

Within Bernalillo County, this alignment follows the planned street CS 003 — a proposed major collector in the Long Range Roadway System (LRRS) Plan for the Albuquerque Urban area. In Sandoval County, it is west of and parallel to 19th Avenue SW to take advantage of the parcel configuration and minimize impacts to parcel access.

4.2 Initial Screening

The three alternatives described above were evaluated using a qualitative and quantitative screening process. This section summarizes the screening criteria used and results of the screening evaluation.

The no-action alternative, i.e., the "do nothing" option is always viable and will be considered in the final decision for the proposed project. However, because the objective of the screening evaluation is to compare build alternatives and select the alternative(s) advanced for further detailed evaluation, it is not included in the discussion of initial evaluation findings.

The initial screening was based on both qualitative and quantitative methodologies and criteria. Screening criteria used fell into general categories of: 1) consistency with project purpose and need; 2) engineering factors; and 3) community and environmental factors. The identification and selection of criteria used for the initial screening of alternatives considered factors identified through review of existing conditions and input from the TAC.

A full description of the initial screening evaluation, including methodology used, can be found in the Alternatives Identification and Initial Screening Report, December 2018, available from the Bernalillo County Public Works Division.

The purpose of the **initial screening evaluation** was to identify key differences between alternatives and select the alternative(s) that best meet the project objective and eliminate those that are not reasonable or practicable, or have substantial lower performance than the others.

4.2.1 Screening Criteria

Consistency with Project Need

This criterion considers how well each alternative meets the project objectives and purpose, i.e., system connectivity, improved access, support economic development, and other considerations, as described in Chapter 3 above.

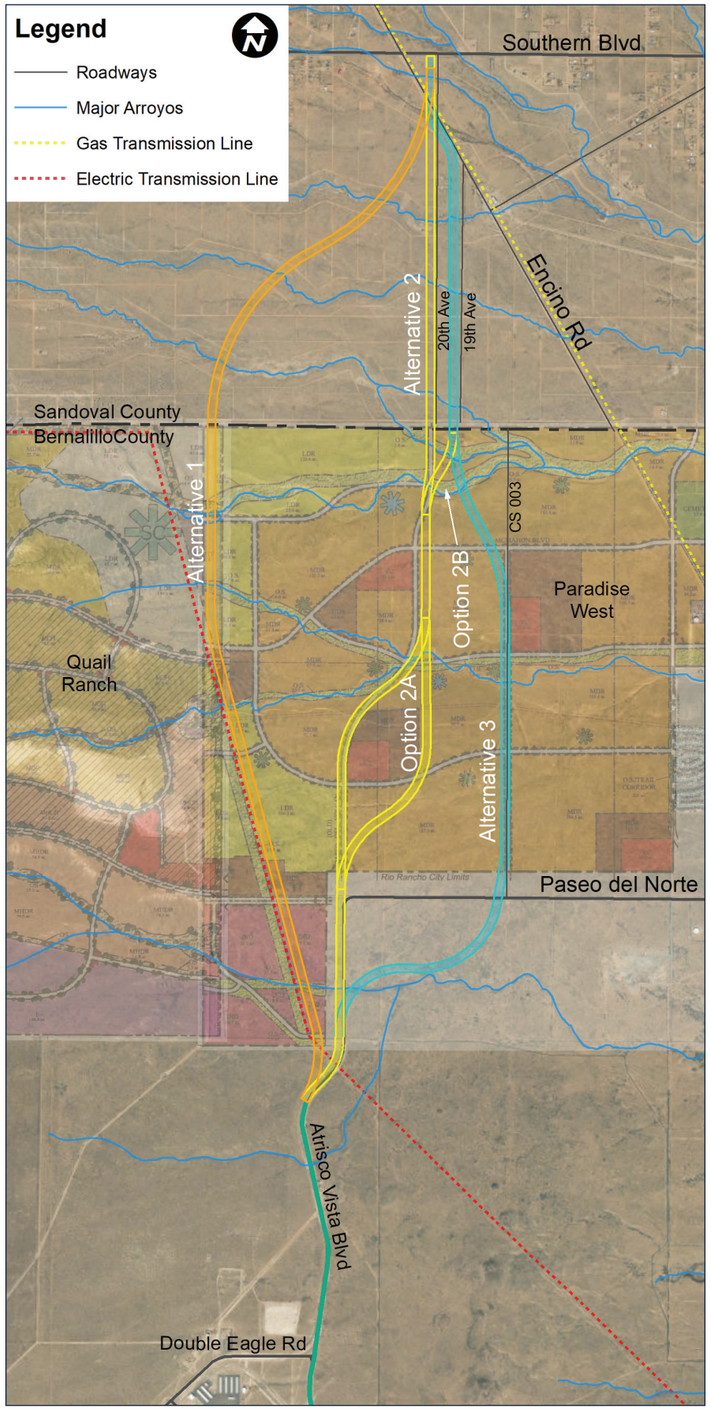
In general, all alternatives would meet the project needs. The extension of Atrisco Vista Boulevard would:

- Provide a north-south principal arterial from Paseo del Norte to Southern Boulevard that would serve as an additional continuous north-south connection west of Unser Boulevard and serve the existing and planned development in this area
- Improve access to currently undeveloped master planned areas within and adjacent to the project area and assist in promoting orderly and planned growth in western Rio Rancho/Sandoval County
- Support economic development by providing efficient access from employment opportunities along the Atrisco Vista Boulevard corridor south of Double Eagle II Airport to residential areas in western Rio Rancho/Sandoval County

CONSISTENCY WITH PROJECT NEED

Summary of findings: No major differences were identified between alternatives for this criterion.

Figure 4-2. *Initial Project Alternatives*



ROADWAY LENGTH

Summary of findings: Alternative 2 has the shortest overall length of the three alternatives considered. However, the difference in length is generally minor and, by itself, would not substantially affect project cost or travel time.

TRAFFIC

Summary of findings: The V/C analysis indicates that a two-lane roadway will be able to accommodate the projected future volumes and Atrisco Vista Boulevard will remain well within capacity if constructed as a two-lane roadway. In addition, improvements to Atrisco Vista Boulevard would affect Southern Boulevard, therefore improvements to Southern Boulevard should be considered to mitigate the impacts of adding traffic on this route. No major differences were identified between alternatives for this criterion.

- Improve safety by adding shoulders and flattening curves on Atrisco Vista Boulevard from Double Eagle Road to Paseo del Norte

Summary of findings: No major differences were identified between alternatives for this criterion.

Roadway Length

Alignment length indicates the directness of the connection between the beginning and end points of the corridor. In addition, route length is correlated to the construction cost of the roadway, i.e. a longer roadway will require more work and materials to build. Length also has a direct effect on the travel time for vehicles along the route, which is important for network efficiency.

Alternative 1 has a length of 6.05 miles, Alternative 2 has a length of 5.81 miles, and Alternative 3 has a length of 6.16 miles. The maximum difference between alignments is 0.35 miles, or about 6 percent of the corridor length.

Summary of findings: Alternative 2 has the shortest overall length of the three alternatives considered. However, the difference in length is generally minor and, by itself, would not substantially affect project cost or travel time.

Traffic

Table 4-1 summarizes the existing and projected traffic volumes, PM peak hour, and the volume-to-capacity (V/C) estimates for the 2040 PM peak hour on segments of Atrisco Vista Boulevard and Southern Boulevard. As shown in this table, significant growth is anticipated on all segments of Atrisco Vista Boulevard and Southern Boulevard; however, the projected volumes remain well within the capacity of a two-lane road.

Table 4-1. *Existing and Projected Traffic Volumes for Atrisco Vista Blvd. and Adjoining Segments*

Roadway and Segment	Average Daily		PM Peak Hour		
	2016	2040	2012	2040	V/C
Atrisco Vista Boulevard					
I-40 to Arroyo Vista Boulevard	2,100	4,700	300	950	0.34
Arroyo Vista Boulevard to Double Eagle Road	1,100	7,800	210	1,570	0.59
Double Eagle Road to Paseo del Norte	1,300	8,100	230	1,600	0.61
Paseo del Norte to Southern Boulevard	N/A	3,500	N/A	730	0.52
Southern Boulevard					
Atrisco Vista Boulevard to Hondo Road	1,080	3,280	100	703	0.55
Hondo Road to Rainbow Boulevard	2,860	4,160	280	782	0.50

Notes:
2016 traffic volumes are from MRCOG Traffic Counts Map.
PM Peak hour volumes are from MRCOG Model for the 2012 Base Year.
2040 traffic volumes for Southern Boulevard and Paseo del Norte assume Atrisco Vista is in place.

Traffic is projected to increase on Southern Boulevard with the connection of Atrisco Vista Boulevard. As shown in the table, the change in daily traffic volume between 2016 and 2040 is approximately 2,200 vehicles, a portion of which is a direct result of the new roadway. However, some of the increase is due to growth in the area along Southern Boulevard west of the Calabacillas Arroyo and will occur whether or not Atrisco Vista Boulevard is extended.

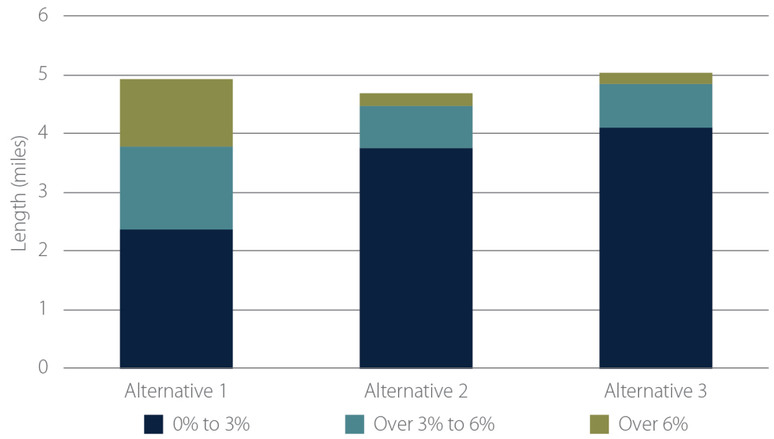
Summary of findings: The V/C analysis indicates that a two-lane roadway will be able to accommodate the projected future volumes and Atrisco Vista Boulevard will remain well within capacity if constructed as a two-lane roadway. In addition, improvements to Atrisco Vista Boulevard would affect Southern Boulevard, therefore improvements to Southern Boulevard should be considered to mitigate the impacts of adding traffic on this route. No major differences were identified between alternatives for this criterion.

Grades

Differences in terrain along each alignment is an important factor that will influence roadway design and cost. The existing terrain varies from level to rolling, depending on the alignment and the location. Areas where existing grades are steeper or flatter than the design criteria require would require more earthwork to build. This generally would result in higher construction costs, longer earth tie slopes, and a larger roadway footprint, with more right-of-way acquisition and associated impacts.

The grade analysis results are shown in Figure 4-3 in terms of the percentage of alignment length within selected slope ranges: zero to three percent grades are the range where most vehicles can operate freely; three to six percent grades represent the range that causes some vehicles, primarily trucks, to slow appreciably when traveling uphill; and over six percent is at or above the maximum design grade for an arterial roadway.

Figure 4-3. *Length Versus Slope Along Alternatives*



Summary of findings: Grade is of most concern with Alternative 1 as it traverses the hilliest terrain and 50 percent of its length has existing grades steeper than 3 percent. This indicates the need for more extensive earthwork, more difficult construction, and higher costs. Alternatives 2 and 3 have sections that are steeper than 3 percent, but these comprise less than 20 percent of the overall alignments.

Right-of-way Acquisition

All of the alternatives under consideration would require acquisition of public and private property for the proposed roadway right-of-way. The total acreage required for acquisition directly influences overall project costs (described below). In addition, the number of parcels required can influence overall project complexity with respect to the number of transactions needed and the time needed for acquisition.

During the initial screening, roadway right-of-way needs assumed a 180-foot width along each alternative to accommodate the roadway, roadside drainage, and the multi-use trail. Non-right-of-way acreage includes parcels that would be acquired due to lack of access as a result of the new roadway or parcels that after right-of-way acquisition are less than 1 acre and therefore inadequate to meet local building requirements. Table 4-2 summarizes the number of parcels, right-of-way acreage, and total acreage required for each alternative.

GRADES

Summary of findings: Grade is of most concern with Alternative 1 as it traverses the hilliest terrain and 50 percent of its length has existing grades steeper than 3 percent. This indicates the need for more extensive earthwork, more difficult construction, and higher costs. Alternatives 2 and 3 have sections that are steeper than 3 percent, but these comprise less than 20 percent of the overall alignments.

RIGHT-OF-WAY ACQUISITION

Summary of findings: Alternative 1 requires acquisition of the greatest number of parcels and total acreage and is substantially higher than the other alternatives. Alternative 2 requires the least number of parcels and total acreage to be acquired. Alternative 3 falls in the middle of the range for right-of-way needs.

DRAINAGE

Summary of findings:
As the drainage basin areas increase from west to east across the study area, the peak flows will increase. Therefore, the drainage costs increase for Alternatives 1, 2, and 3 respectively. The costs were adjusted relative to Alternative 2 in proportion to the total contributing watershed area.

Alternative 2 crosses the Calabacillas West Branch Arroyo near the confluence of two tributaries. The confluence of the natural arroyos would be expected to be unstable, with increased sediment deposition and potential meandering. This meandering could encroach into the proposed alignment and could cause design and maintenance issues. To minimize these issues, Option 2A was located to cross the arroyo further downstream of the confluence.

Table 4-2. *Summary of Right-of-way Acquisition*

	Parcels Acquired	Right-of-Way (acres)	Total Acres (ROW and NRW)
Alternative 1	144	107	156
Alternative 2	101	101	125
Alternative 3	112	108	137

Note: ROW = right-of-way; NRW = non-right-of-way.

Summary of findings: Alternative 1 requires acquisition of the greatest number of parcels and total acreage and is substantially higher than the other alternatives. Alternative 2 requires the least number of parcels and total acreage to be acquired. Alternative 3 falls in the middle of the range for right-of-way needs.

Drainage



Atrisco Vista Boulevard Crossing at the North Fork Boca Negra Arroyo.

The terrain along the study corridor generally slopes east toward the Rio Grande. As described in Section 2.5, several major arroyos and a number of minor channels drain from west to east across the corridor (Figure 2-2). Major arroyos include the North Fork Boca Negra, the Calabacillas West Branch, the Calabacillas Middle Branch, Calabacillas Middle Branch Tributary, and Calabacillas Tributary B.

Summary of findings: The proposed alignment Alternatives are located in different areas of the watershed. As the drainage basin areas increase from west to east across the study area, the peak flows will increase. Therefore, the drainage costs increase for Alternatives 1, 2, and 3 respectively. The costs were adjusted relative to Alternative 2 in proportion to the total contributing watershed area.

Alternative 2 crosses the Calabacillas West Branch Arroyo near the confluence of two tributaries. The confluence of the natural arroyos would be expected to be unstable, with increased sediment deposition and potential meandering. This meandering could encroach into the proposed alignment and could cause design and maintenance issues. To minimize these issues, Option 2A was located to cross the arroyo further downstream of the confluence. Other alignment options could be considered to accomplish the same goal.

Utilities

Utilities are in place along and crossing portions of the corridor. These include underground small diameter water and sanitary sewer lines, communication lines, and natural gas transmission lines. There are overhead electric transmission and distribution lines crossing the corridor. All the alignment alternatives will cross over the gas transmission lines and under the electric transmission lines.

Alternative 1 parallels the high-voltage electric transmission lines for approximately 1.8 miles. Alternative 3 parallels major gas transmission lines along Encino Road for 0.25 mile.

Summary of findings: While utility conflicts are possible with any of the alternatives, they would be similar in nature. Therefore, utility issues do not differentiate the alignment alternatives.

Geotechnical Aspects

Site surface and subsurface soils are anticipated to consist predominantly of alluvium, eolian, and colluvium deposits comprised of sands, silts, and clays. Subsurface bedrock materials likely consist of volcanic igneous formations predominantly comprised of basalt.

Summary of findings: The soils appear relatively consistent throughout the corridor in terms of their suitability for roadway construction. Therefore, geotechnical conditions are not expected to be a differentiator between the alternatives.

Estimated Cost

Major costs include right-of-way acquisition, planning and design, and roadway construction. Roadway construction costs were limited to major categories, such as earthwork, surfacing, drainage, utilities, etc. In general, the construction costs are approximately proportional to the roadway length. However, other aspects influence cost, such as earthwork and drainage. The estimated costs for each alternative are summarized in Table 4-3. Because of the limited design detail at the initial screening phase of the process, the estimates were very preliminary and were intended to provide a basis of comparison for alternatives.

Table 4-3. *Comparison of Construction Costs for Alternatives*

	Alternative 1	Alternative 2	Alternative 3
Roadway	$10,954,660	$9,394,705	$9,961,909
Drainage	$2,075,000	$2,465,000	$2,682,000
Right-of-Way	$1,020,162	$815,470	$898,608
Subtotal	**$14,049,822**	**$12,675,175**	**$13,542,517**
Engineering and CM (15%)	$2,107,473	$1,901,276	$2,031,378
Contingency (30%)	$4,214,947	$3,802,553	$4,062,755
Subtotal	$20,372,242	$18,379,004	$19,636,650
NMGRT (8%)	$1,629,779	$1,470,320	$1,570,932
Total	**$22,002,021**	**$19,849,324**	**$21,207,582**

Note: CM = Construction Management; NMGRT = New Mexico Gross Receipts Tax.

Right-of-way costs were estimated using the Bernalillo County and Sandoval County assessed values per acre and then multiplying the values by three. This results in a per acre cost of $7,080 for Bernalillo County and $6,012 for Sandoval County. With the 30% contingency, the cost is about $7,800 in Sandoval County and $9,200 in Bernalillo County.

Factors affecting the costs of each alternative include:

- Alternative 1 traverses rolling terrain, as discussed above. Because the longitudinal grades are steeper in areas than the maximum allowable grade, substantial earthwork is needed to achieve suitable grades. This work would increase the construction cost relative to the other alternatives. On the other hand, Alternative 1 is further west than the other alternatives. The further west, the smaller the drainage basin and flows. Therefore, the cost of drainage structures would be lower for Alternative 1 than for the other alternatives.

UTILITIES

Summary of findings:
While utility conflicts are possible with any of the alternatives, they would be similar in nature. Therefore, utility issues do not differentiate the alignment alternatives.

GEOTECHNICAL ASPECTS

Summary of findings:
The soils appear relatively consistent throughout the corridor in terms of their suitability for roadway construction. Therefore, geotechnical conditions are not expected to be a differentiator between the alternatives.

ESTIMATED COST

Summary of findings:

Alternative 1 » **$22,002,021**

Alternative 2 » **$19,849,324**

Alternative 3 » **$21,027,582**

CONSISTENCY WITH PLANS

Summary of findings: All alternatives are generally consistent with transportation and land use plans; however, Alternative 2 is the most consistent with the future transportation network envisioned with the Paradise West Master Plan.

- Alternative 2 would have the shortest length of the alternatives and would be expected to have a lower roadway construction cost. This alternative follows relatively level terrain, so earthwork costs would be relatively low. Drainage costs would be close to the average for the alternatives.
- Alternative 3 is the longest alternative. Although it follows relatively flat terrain, it would have a higher roadway construction cost. Also, it is the furthest east and downstream of the alternatives, so drainage costs would be higher. Because of the relatively larger parcel sizes in this part of the project area, the number of non-right-of-way parcels is reduced. Therefore, the right-of-way costs are less than Alternative 1.

Summary of findings: Alternative 2 would be the least expensive to construct at an estimated cost of $19,849,324. Alternative 1 would be the most expensive to construct, with an estimated cost of $22,002,021. Alternative 3 would fall in the middle of the range at approximately $21,027,582 to construct.

Consistency with Plans

The project alternatives' consistency with local and regional planning efforts was evaluated to ensure that the proposed project is compatible with the future transportation network and adequately serves proposed future land uses. This criterion considered the consistency of each alternative with the 2040 MTP, Paradise West Master Plan (June 2004), Quail Ranch Phase One "Specific Area Plan" (April 2005), and the Rio Rancho Estates Area Plan (updated 2014).

As noted in Section 2.9, the extension of Atrisco Vista Boulevard from Paseo del Norte to Southern Boulevard is included in the 2040 MTP. While the alignment for the future Atrisco Vista Boulevard extension included in the 2040 MTP is not specific other than its connection to Southern Boulevard, all alternatives are consistent with the corridor intent as described in this Plan.

There are two large master planned areas in the project area, Paradise West and Quail Ranch. The Paradise West master planned area is currently undeveloped and directly within the project area. Although all three alternatives would provide access to Paradise West, Alternative 2 is most consistent with the primary north-south roadway alignment depicted in the adopted plan and is the most consistent with the overall transportation network envisioned by the Paradise West Master Plan (Figure 3-1).

Quail Ranch is west of the project area and is also currently undeveloped. The proposed extension of Atrisco Vista Boulevard would benefit Quail Ranch by providing additional access. All three alternatives provide options for roadway extensions westward to serve this master plan area.

Existing residential development along and south of Southern Boulevard in the northern portion of the project area is located within the southern end of the Rio Rancho Estates area. Southern Boulevard serves as a major access point into the southern portion of Rio Rancho Estates within the project area. All three alternatives would be consistent with the Rio Rancho Estates Area Plan, benefit the roadway network in this area and help promote orderly growth.

Summary of findings: All alternatives are generally consistent with transportation and land use plans; however, Alternative 2 is the most consistent with the future transportation network envisioned with the Paradise West Master Plan.

Network Spacing

The roadway network serving far northwest Albuquerque and western Rio Rancho is characterized by long distances between principal arterials and incomplete connectivity. In Rio Rancho, the arterial street spacing is generally planned at intervals of about 2 miles. In the existing transportation network, the closest existing major north-south arterial to Atrisco Vista Boulevard is Unser Boulevard to the east. The network spacing for each alternative ranges from approximately 3.5 miles for Alternative 3 to over 5 miles for Alternative 1.

In the planned future transportation network, the closest existing major north-south arterial to Atrisco Vista Boulevard would be Rainbow Boulevard to the east and Paseo del Volcan to the west. Under all alternatives, the planned arterial street spacing in the area that would be served by the proposed extension of Atrisco Vista Boulevard would still be greater than 2 miles.

Summary of findings: Despite the large network spacing between north-south arterials in this area, all alternatives would enhance network connectivity by providing an additional north-south arterial connection. Alternative 2 would provide more equidistant spacing between the future north-south arterials of Rainbow Boulevard and Paseo del Volcan.

Community Aspects

Very little community development exists within the project corridor. Residential development is limited to the very north end of the project area along Southern Boulevard where over 275 homes currently exist within a radius of about ½ mile from the proposed intersection of Southern Boulevard and Atrisco Vista Boulevard. Residential neighborhoods are also present in Rio Rancho and Albuquerque approximately ½ mile to 1 mile east of the project area.

Community considerations include possible impacts, both adverse and beneficial, to communities within the project influence area. Adverse impacts include direct impacts such as property acquisition and property access changes as well as indirect impacts from increased traffic and noise. Benefits include increased access for the residential neighborhoods near the corridor to destinations throughout the western Albuquerque/ Rio Rancho metropolitan area, including employment centers along Atrisco Vista Boulevard near the I-40 interchange, Double Eagle II Airport, and recreational amenities at Petroglyph National Monument.

Summary of findings: Adverse and beneficial impacts to communities within and in proximity to the project area are the same for all three alternatives. No residential displacements have been identified for any of the alternatives. The project would result in higher traffic noise levels for the residents along Southern Boulevard and two residential dwellings on 19th Street south of Southern Boulevard and immediately east of the proposed alignments of Alternatives 2 and 3.

Natural Environment

Each alternative was evaluated for potential to impact the natural environment, specifically natural and cultural resources. Impacts to these resources were considered as they could require additional compliance with federal permitting, mitigation, or regulations which could impact alternative selection and implementation. Impacts were assessed by considering locations of notable resources and their intersection with the proposed alternatives.

No federal- or state-listed animal or plant species (threatened, endangered, or species of concern) are expected to be in the project area due to the lack of suitable habitat. All alternatives would be expected to have similar impacts on vegetation and habitat as a result of roadway construction. However, the loss of habitat would be minor given the large expanse of habitat within the project area.

NETWORK SPACING

Summary of findings: Despite the large network spacing between north-south arterials in this area, all alternatives would enhance network connectivity by providing an additional north-south arterial connection. Alternative 2 would provide more equidistant spacing between the future north-south arterials of Rainbow Boulevard and Paseo del Volcan.

COMMUNITY ASPECTS

Summary of findings: Adverse and beneficial impacts to communities within and in proximity to the project area are the same for all three alternatives. No residential displacements have been identified for any of the alternatives. The project would result in higher traffic noise levels for the residents along Southern Boulevard and two residential dwellings on 19th Street south of Southern Boulevard and immediately east of the proposed alignments of Alternatives 2 and 3.

NATURAL ENVIRONMENT

Summary of findings: Impacts to aspects of the environment, specifically natural and cultural resources, would generally be the same for all alternatives. Impacts to natural and cultural resources are anticipated to be minor with all alternatives.

Review of records found a total of eight archaeological sites previously documented in the study area. Alternative 1 intersects with the greatest number of previously recorded sites. However, this alignment also has been the subject of more previous archaeological surveys than the other two alignments. Alternative 3 intersects with the fewest number of previously recorded sites but has also experienced the least amount of previous investigation. In general, it appears that there will be no substantial difference in the number of archaeological sites that could potentially be impacted under each alternative.

All of the alignments cross several arroyos (Figure 2-2). Because these drainages increase in size from west to east, the impacts also increase as the alternatives progress from west to east. These drainages are tributaries to the Rio Grande. As such, they could qualify as jurisdictional waterways of the US Army Corps of Engineers and require a 404 permit prior to construction. Field review of these drainages indicates that most of the arroyos are small and lack the defining characteristics of a jurisdictional waterway. Several of the larger arroyos are very likely to qualify. Even though the amount of disturbed area will be different between alternatives, there is not an appreciable difference and, as such, this is not a major factor in alternative selection.

Summary of findings: Impacts to aspects of the environment, specifically natural and cultural resources, would generally be the same for all alternatives.

4.3 Summary of Screening Analysis and Recommendations

Three distinct alignment alternatives to extend Atrisco Vista Boulevard and connect it to Southern Boulevard were identified and developed at a conceptual level of detail. The alternatives were evaluated using a screening process that included major engineering, planning, environmental, and community factors. The objective of the screening assessment was to identify notable differences between alternatives that affect their viability and practicality. A summary of the screening assessment is provided in an evaluation matrix, as shown in Table 4-4.

The screening assessment identified several notable differences between alternatives, primarily for the criteria related to engineering, cost, and consistency with local plans and policies. The assessment did not determine substantial differences for factors specific to potential utility conflicts, geotechnical considerations, and impacts to community, cultural, and natural resources. The criteria with notable differences between alternatives are as follows:

- **Alternative Length** – The difference in route length between alternatives is about 6%. The longest is Alternative 3 at about 6.2 miles. The shortest is Alternative 2 with an approximate length of 5.8 miles. Alternative 1 is approximately 6.0 miles long. While the difference in length is not significant, together with grades, it will affect construction cost.
- **Alternative Grades** – The terrain within the project area varies from rolling hills to relatively flat lands. Grade is of most concern with Alternative 1 as it traverses the most hilly terrain and 50 percent of its length has existing grades steeper than 3 percent. This indicates the need for more extensive earthwork, more difficult construction, and higher costs. Alternatives 2 and 3 have sections that are steeper than 3 percent, but these comprise less than 20 percent of the overall alignments. When overall route length is considered, Alternative 2 compares most favorably with regard to roadway grade.
- **Right-of-Way** – Alternative 1 would require the greatest number of parcels and total acreage. At an estimated 156 acres, this alternative requires almost 25% more property than the other alternatives. Alternative 2, including both options 2A and 2B, requires the least number of parcels and total acreage to be acquired. Alternative 3 falls in the middle of the range for right-of-way needs.
- **Drainage** – Drainage basin areas increase from west to east across the study area. Consequently, the size and costs of drainage structures increase from Alternative 1 to Alternative 3. Drainage needs and costs are lowest with Alternative 1 and greatest with Alternative 3.
- **Cost** – Construction costs were estimated including roadway and trail construction, drainage, right-of-way, contingency, and taxes. Alternative 2 is the least expensive to construct at an estimated cost of $19,849,324. Alternative 1 would be the most expensive to construct, with an estimated cost of $22,002,021. Alternative 3 would fall in the middle of the range at approximately $21,207,582 to construct.
- **Consistency with Plans** – All of the project alternatives are generally consistent with transportation and land use plans. However, Alternative 2 is the most consistent with the future transportation network envisioned with the Paradise West Master Plan.

The findings of the screening analysis were presented to and discussed with the TAC at a meeting on November 14, 2018. Based on the analysis and discussion, the TAC recommended that Alternative 2 proceed to Phase B for detailed analysis. In addition, the TAC recommended that additional analysis be focused on two options for the existing reverse curve north of Double Eagle Road with one that follows the existing alignment and one that is offset to flatten the horizontal curves in this segment. The TAC also recommended that the alignment be better defined and refined where it crosses the Calabacillas West Branch Arroyo (Option 2A area in Figure 4-2).

The findings of the screening analysis were presented at a public meeting on December 5, 2018. Comments received at this meeting generally supported Alternative 2 alignment (see discussion in Section 1.2).

Based on the findings of the initial screening, TAC recommendation, and public input, Alternative 2 was advanced for more detailed evaluation.

Based on the findings of the initial screening, TAC recommendation, and public input, **Alternative 2** was advanced for more detailed evaluation.

Table 4-4. *Summary Matrix of Key Metrics for the Screening Analysis*

Screening Criteria	Alternative 1	Alternative 2	Alternative 3
Consistency with Project Need	Alternative meets project objectives by enhancing system connectivity, improving access, and supporting economic development.	Alternative meets project objectives by enhancing system connectivity, improving access, and supporting economic development.	Alternative meets project objectives by enhancing system connectivity, improving access, and supporting economic development.
Length	6.05 miles	5.81 miles	6.16 miles
Traffic	Projected traffic volumes indicate that Atrisco Vista Boulevard will remain well below capacity if constructed as a two-lane roadway and that improvements to Southern Boulevard should be considered as a result of adding traffic to this route.	Projected traffic volumes indicate that Atrisco Vista Boulevard will remain well below capacity if constructed as a two-lane roadway and that improvements to Southern Boulevard should be considered as a result of adding traffic to this route.	Projected traffic volumes indicate that Atrisco Vista Boulevard will remain well below capacity if constructed as a two-lane roadway and that improvements to Southern Boulevard should be considered as a result of adding traffic to this route.
Right-of-way Acquisition	• 144 parcels • 107 acres of right-of-way • 156 total acres (right-of-way and non-right-of-way)	• 101 parcels • 100 acres of right-of-way • 125 total acres (right-of-way and non-right-of-way)	• 112 parcels • 108 acres of right-of-way • 137 total acres (right-of-way and non-right-of-way)
Estimated Cost	High cost alternative due to longer route length and increased construction costs. Lowest drainage cost, but highest earthwork cost. Highest ROW cost.	Shortest route length, lowest roadway construction cost, and moderate drainage costs. Lowest ROW cost.	Longest alternative with high roadway construction and drainage cost. Moderate ROW cost.
Network Spacing	Alternatives would enhance network connectivity by providing an additional north-south arterial connection.	Alternative would enhance network connectivity by providing an additional north-south arterial connection. Alternative 2 would provide more equidistant spacing between the future north-south arterials of Rainbow Boulevard and Paseo del Volcan.	Alternatives would enhance network connectivity by providing an additional north-south arterial connection.
Grades	Rolling terrain with existing grades steeper than 3% over half of the length.	Relatively flat terrain. Existing grades are flatter than 3% for 80% of the length.	Relatively flat terrain. Existing grades are flatter than 3% for 80% of the length.
Drainage	Crosses 5 major arroyos. Flows will be at the low end of the range within the study area.	Crosses 5 major arroyos. Flows will be in the middle of the range within the study area. Option 2A provides separation from arroyo confluence.	Crosses 5 major arroyos. Flows will be at the high end of the range within the study area.
Utilities	Utility conflicts are possible with any of the alternatives and would be similar in nature. Therefore, utility issues do not differentiate the alignment alternatives.	Utility conflicts are possible with any of the alternatives and would be similar in nature. Therefore, utility issues do not differentiate the alignment alternatives.	Utility conflicts are possible with any of the alternatives and would be similar in nature. Therefore, utility issues do not differentiate the alignment alternatives.
Geotechnical Aspects	The soils appear relatively consistent throughout the corridor in terms of their suitability for roadway construction.	The soils appear relatively consistent throughout the corridor in terms of their suitability for roadway construction.	The soils appear relatively consistent throughout the corridor in terms of their suitability for roadway construction.
Consistency with Plans	Consistent with 2040 MTP, Quail Ranch Phase One "Specific Area Plan", and Rio Rancho Estates Area Plan. Would be less consistent with Paradise West Master Plan than Alternative 2.	Consistent with 2040 MTP, Quail Ranch Phase One "Specific Area Plan", and Rio Rancho Estates Area Plan. Would be most consistent with Paradise West Master Plan than the other project alternatives.	Consistent with 2040 MTP, Quail Ranch Phase One "Specific Area Plan", and Rio Rancho Estates Area Plan. Would be less consistent with Paradise West Master Plan than Alternative 2.
Community Aspects	Adverse and beneficial impacts to communities would be similar under all alternatives.	Adverse and beneficial impacts to communities would be similar under all alternatives.	Adverse and beneficial impacts to communities would be similar under all alternatives.
Environmental Aspects	All alternatives would be expected to have similar impacts on natural resources. No major impacts identified for water ways, communities, habitat, special status plant and animal species, or neighborhoods. Traffic noise for residents living along Southern Boulevard is expected as a consequence of all alternatives.	All alternatives would be expected to have similar impacts on natural resources. No major impacts identified for water ways, communities, habitat, special status plant and animal species, or neighborhoods. Traffic noise for residents living along Southern Boulevard is expected as a consequence of all alternatives.	All alternatives would be expected to have similar impacts on natural resources. No major impacts identified for water ways, communities, habitat, special status plant and animal species, or neighborhoods. Traffic noise for residents living along Southern Boulevard is expected as a consequence of all alternatives.

Note: ROW= right-of-way

Legend

- Better performance relative to other alternatives
- Lower performance relative to other alternatives
- No appreciable difference identified

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5.0 DETAILED ALTERNATIVES ANALYSIS

In the initial screening phase of the corridor study process (discussed in Chapter 4), project alternatives are developed at a conceptual engineering level. The level of engineering detail for the screening phase is typically limited to the proposed typical section, horizontal and vertical alignment of the roadway centerline, and anticipated right-of-way width. In the detailed analysis phase, alternatives are developed in greater engineering detail. This typically includes refinements to the proposed typical section and refinements to the horizontal and vertical alignment using specific design criteria. The engineering details developed for Alternative 2 included the following:

- Development of, and refinements to, the roadway and trail typical sections
- Refinements to the roadway/trail horizontal and vertical alignment
- Development of roadway/trail plan and profile drawings and cross sections
- Preliminary drainage analysis and design
- Preliminary right-of-way analysis and maps
- Assessment of access needs and development of an access management plan

The initial engineering plans were used to estimate probable costs for implementation and to evaluate impacts of the project. This chapter discusses and summarizes the design approach and assumptions and presents the findings of the detailed evaluation of Alternative 2.

5.1 Design Assumptions and Criteria

At the onset of the detailed analysis phase, several objectives and assumptions were established to guide the roadway design. These objectives and assumptions included:

1. Develop the design of the initial roadway to enable future widening that accommodates traffic growth as additional development occurs in the project area. The 2040 Long Range Roadway System (LRRS) for the Mid-Region Metropolitan Planning Organization (MRMPO) identifies Atrisco Vista Boulevard as a Regional Principal Arterial. As stated in the LRRS, "Trips on regional principal arterials are primarily for traveling longer distances across the region…These roadways should have high levels of access". The proposed project is to establish a two-lane roadway. While a two-lane facility is adequate to serve the projected traffic through the year 2040, it is intended to be an initial facility to establish connectivity with other existing principal arterials and to facilitate access and connectivity between Rio Rancho and Albuquerque. However, given the amount of land available for development and growth trends in the metropolitan area, it is highly likely that Atrisco Vista Boulevard will ultimately be developed as a 4 or 6-lane facility. For this reason, the roadway alignment and right-of-way needs were planned to enable future widening.
2. A second objective of the design was to minimize impacts to privately-owned properties. This included maintaining existing access to the extent practical and minimizing the amount of private property needed for right-of-way. This issue was of greatest concern in Rio Rancho Estates. Parcels in this subdivision are generally small (less than one acre) and are accessed via old platting that established an extensive and closely spaced street network. The initial alignment of Alternative 2 generally followed 20th Street within Sandoval County. 20th Street is an existing but unimproved platted street within Rio Rancho Estates. As currently configured, access is provided to every parcel along the road. Following 20th Street would have resulted in the need to acquire parcels on both sides of this roadway. By offsetting the proposed roadway alignment to one side of 20th Street, property acquisition would be limited to only one side of the street. Parcels are much larger (5 acres or more) in the portion of the project within Bernalillo County and south of Rio Rancho Estates. In this area, the alignment was set to following the existing edge of parcels to the extent practical. This approach generally minimized the amount of property needed to implement the proposed roadway while leaving adequate size of impacted parcels suitable for development.

In addition to the general approach, specific design criteria and design assumptions were established for the roadway and trail. As a starting point, the design criteria used are from the American Association of State Highway and Transportation Officials (AASHTO) *A Policy on Geometric Design of Highways and Streets* (Green Book). Because the project encompasses lands under the jurisdiction of the City of Rio Rancho and City of Albuquerque, design criteria specific to the local practices of these jurisdictions were also used. Table 5-1 and Table 5-2 summarize the primary design criteria and additional design assumptions used to develop the proposed project.

Table 5-1. *Design Criteria Used to Develop Preliminary Design Plans*

Roadway Classification and Setting	Principal Arterial (from MRCOG Functional Classification Map)
Design / Posted Speed	50 mph / 45 mph
Lane Width	12' (11' lanes assumed for the ultimate condition with 6 lanes)
Shoulder Width	8'
Trail Width	10'
emax (super-elevation)	4% (from 2018 AASHTO Table 3-8)
Maximum Grade	4% (6% assumed within the City of Albuquerque; AASHTO Table 7-2)
Minimum Grade	0.3%
Minimum K Values for Crest Curves	84 Stopping Sight Distance / 229 Passing Sight Distance
Minimum K Values for Sag Curves	96

At the onset of the detailed analysis phase, several **objectives and assumptions** were established to guide the roadway design. These objectives and assumptions included:

- Develop the design of the initial roadway to enable future widening that accommodates traffic growth as additional development occurs in the project area.
- A second objective of the design was to minimize impacts to privately-owned properties. This included maintaining existing access to the extent practical and minimizing the amount of private property needed for right-of-way.

Figure 5-2. *Alternative 2 Alignment*

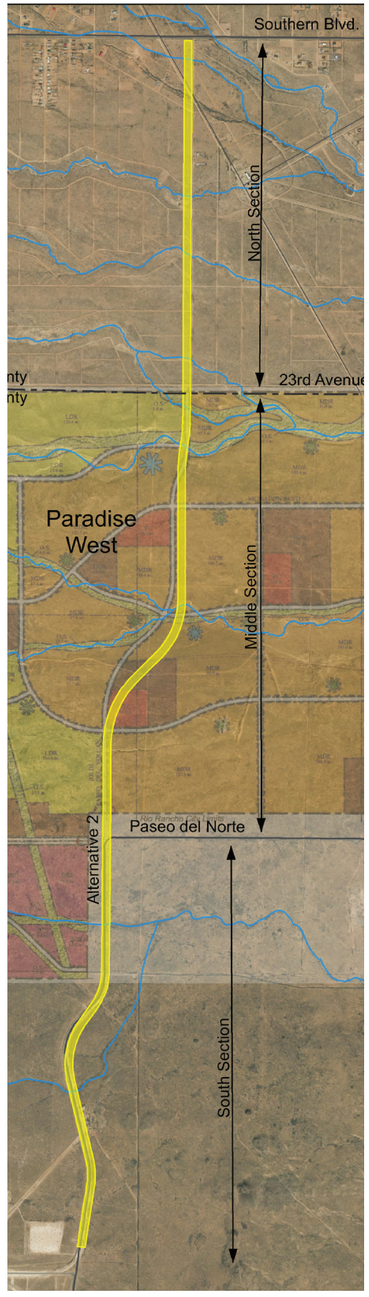


Table 5-2. *Additional Design Assumptions and Details*

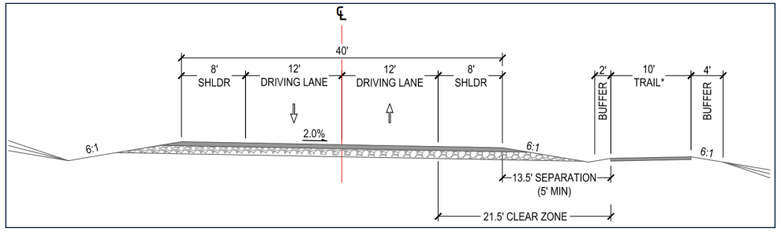
Surfacing Taper Slopes	6:1
Cut/Fill Slope Design	0′ to 5′ depth – 6:1; 5′ to 10′ depth – 4:1; > 10′ depth – 3:1
Roadside Drainage	1′ deep roadside ditches
Minimum Culvert Size and Cover over Drainage Structures	30″ with 1′ cover
Proposed Right-of-Way Width	186′

5.2 Roadway and Trail Typical Section

The typical section of Alternative 2 assumes a two-lane roadway with shoulders, and a 10-foot multi-purpose pedestrian and bicycle facility as shown in Figure 5-1. A rural typical section was used to be consistent with the character of the area and the existing design of Atrisco Vista Boulevard south of Double Eagle II Airport. This section uses pavement surfacing tapers with roadside ditches rather than curb and gutter.

The trail is proposed to parallel the east side of the roadway at the edge of right-of-way to provide access to existing trails in the Petroglyph National Monument and for convenient access to existing and proposed developments. The separation from the trail to the driving lane was based on providing the minimum clear zone per AASHTO's Roadside Design Guide. The clear zone is defined as "the unobstructed, traversable area provided beyond the edge of the through traveled way for the recovery of errant vehicles" and includes shoulders and auxiliary lanes.

Figure 5-1. *Roadway and Typical Section*



The typical section assumes a right-of-way width of 186 feet. While this width is greater than typically used for principal arterial roadways, the additional width is to facilitate future widening and to provide a buffer between the roadway and future development in the area.

As noted in Section 5.1, the design assumed that the ultimate configuration of Atrisco Vista Boulevard would be wider than the initial 2-lane section. The engineering analysis assumed Atrisco Vista Boulevard would be a 6-lane roadway south of Paseo del Norte and a 4-lane facility north of Paseo del Norte. These assumed typical sections (see Appendix B-1) were used to set the alignment of the initial two-lane roadway so that future widening could be accomplished without the need to reconstruct the initial roadway.

5.3 Roadway Design Refinements and Engineering Factors

5.3.1 Refinements to the Alignment

Based on the design approach and criteria, the next step in developing the design concept was to refine the alignment of Alternative 2 (see Figure 5-2). Based on jurisdiction, property ownership, and general terrain, Alternative 2 can be described in three sections: south, middle and north. The south section, from Double Eagle Road to Paseo del Norte, is within the jurisdiction of the City of Albuquerque and Bernalillo County and includes the existing reverse curves south of Paseo del Norte. The middle section is within the jurisdiction of Bernalillo County and the City of Rio Rancho and includes the Paradise West Master Planned area. This section is bounded by Paseo del Norte on the south and 23rd Avenue (county line) to the north. The north section extends from 23rd Avenue to Southern Boulevard and is entirely in Sandoval County and Rio Rancho Estates. Refinements were made to the alignment are described below by section.

South Section

The existing alignment of Atrisco Vista Boulevard from Double Eagle Road to Paseo del Norte includes a reverse curve that does not meet criteria for 50 mph. Two options to improve the safety and drivability of this segment were identified and evaluated (Figure 5-3). The first option, referenced as Option 2C, would shift Atrisco Vista Boulevard to the east of the existing roadway and transition to match the existing road just north of Double Eagle Road. In the area of the reverse curves, Option 2C contains curves that are substantially flatter than the existing curves and provides a slight change of bearing of the connecting tangent to decrease the amount of curve deflection. The south curve radius is increased to 1,720 feet, from an existing radius of approximately 1,200 feet. The north curve radius is increased to 1,550 feet, from an existing radius of approximately 850 feet. Flattening these curves would increase the design speed and make the alignment consistent with the rest of the roadway. One advantage of this option is that the offset roadway could be constructed while traffic is maintained on the existing road. However, Option 2C would require acquisition of several acres from City of Albuquerque Open Space lands (see Section 5.8.4).

The second option in this segment, Option 2D, maintains the existing centerline alignment of Atrisco Vista Boulevard but reconstructs the horizontal curves by increasing the super-elevation rates to an amount appropriate for a 50-mph design speed (Figure 5-3). In addition to the super-elevation changes, the roadway would be widened to provide 8-foot shoulders and the multi-purpose trail would be constructed along the east edge of the roadway. Even though the existing alignment is maintained, the majority of the roadway would require reconstruction to accommodate the super-elevation transitions and horizontal curves. This option would generally fit within the existing roadway easement, but a small amount of right-of-way would be required from the west side to accommodate slopes.

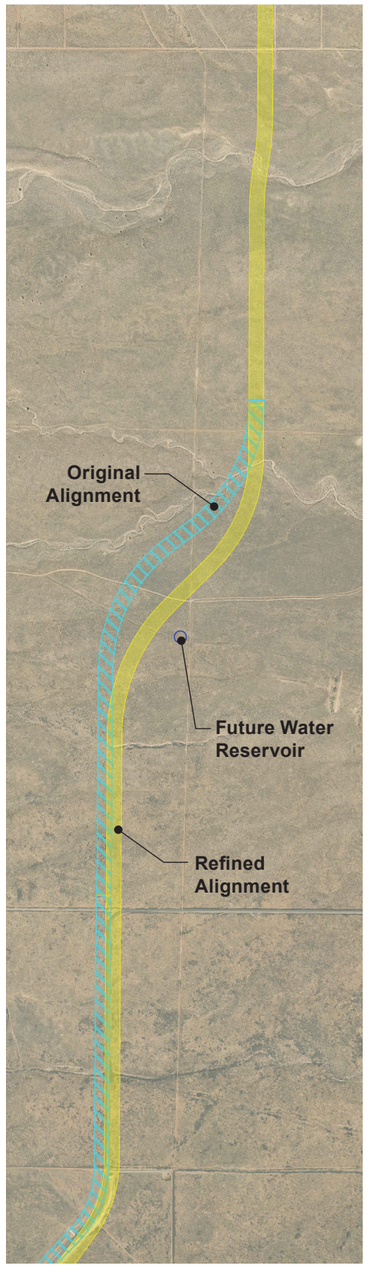
As described above, Option 2C would substantially flatten the reverse curves compared to Option 2D which maintains the existing roadway alignment. The curve radii proposed with Option 2C enable super-elevations rates of 3.4% and 3.6% to be used. With Option 2D, the reverse curves would need to be reconstructed with 4% and 3.8% super-elevation rates. Lower super-elevation rates correspond to increased driver comfort and are also preferable for constructability aspects such as matching the grade of adjacent property.

A factor considered in the comparison of Options 2C and 2D is maintenance of traffic during construction. Because Option 2C is offset from the existing alignment, it could be constructed off-line, allowing traffic to be maintained on the existing road. This would likely shorten construction duration and reduce cost for traffic control management and devices. The widening and reconstruction involved with Option 2D will likely require temporary pavement if two lanes are to remain open during construction. Given the low volume of traffic on Atrisco Vista Boulevard it may be possible to use one-lane/two-way traffic (flagger or pilot car) operations during construction. However, this introduces delays to the traveling public and may require separate traffic control during non-working hours.

Figure 5-3. *Realignment Options to Correct Reverse Curves in South Section*



Figure 5-4. *Realignment of Reverse Curves in Middle Section*



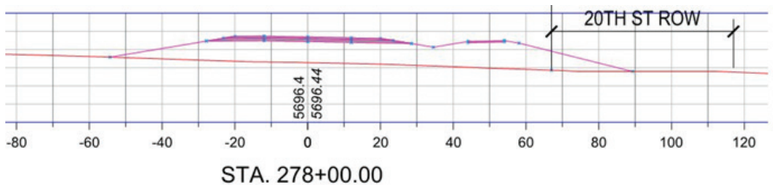
Middle Section

The alignment of Alternative 2 in the middle segment was originally developed to follow the alignment of Atrisco Vista Boulevard assumed in the Paradise West Master Plan. As shown in the master plan, the alignment crosses the Calabacillas West Branch Arroyo at the confluence of two tributaries. A planned municipal reservoir is also in this area to the east of the roadway alignment. Refinements were made in this section to cross the arroyos at a more efficient location to use a single drainage structure, rather than the two required in the master plan, while avoiding the planned reservoir. This was accomplished by shifting the alignment centerline slightly to the east and moving the reverse curve to the south. The original alignment and the changes made are shown in Figure 5-4.

North Section

Refinements were made to the alignment of Alternative 2 in the north section as a result of the higher level of engineering performed during the detailed alternatives analysis. As discussed in Section 5.3.5 Design Features, several factors affected the design and resultant roadway model: the sloping terrain, and the raised profile grade for drainage, passing sight distance and the multi-use trail. With the previously assumed centerline alignment, these factors resulted in fill slopes significantly extending into the 20th Street easement in several locations (see example shown in Figure 5-5). In order to preserve the 20th Street easement so that access to the parcels on the east side of this street can be maintained, the alignment of Alternative 2 was shifted further to the west. This provides greater separation to allow more room for fill slopes on the east side of the trail.

Figure 5-5. *Example of Roadway Fill Impacts on 20th Street*



Note: This occurred at multiple locations before the alignment was refined.

5.3.2 Initial Design

Using the design criteria and assumptions shown in Tables 5-1 and 5-2, and the general considerations described above, the roadway design was developed in greater detail by modeling the proposed roadway in AutoCAD Civil 3D. The roadway model serves to approximate the resultant roadbed and slope limits (roadway footprint) by incorporating the existing terrain, design assumptions, and anticipated drainage needs into a 3D representation. This information was then used to determine the specific parcels needed for right-of-way and also provides the quantities of major construction materials needed to estimate costs and assess impacts. The initial plan and profile design developed for the proposed project is included in Appendix B-1.

The major factors included in the roadway model are discussed below, and include:

- **Survey and Mapping** – Modeling was based on MRCOG 2018 orthophotography developed using MRCOG 2010 LIDAR data. Parcel ownership and boundary lines were obtained from GIS data maintained by Bernalillo County and Sandoval County. Control survey was obtained by field surveys to verify block corners in Rio Rancho Estates and tract concerns of Double Eagle II Airport properties.
- **Existing Terrain** – The existing terrain slopes west to east along the project length. In modeling the roadway, it was assumed that the proposed two-lane road would be widened to four or six lanes at some point in the future. Thus, the elevation of the 2-lane roadway was set to enable future widening to the west without the need for extensive excavation and/or use of retaining walls. This approach resulted in the need for considerable fill to construct the initial two-lane facility and trail with east side slopes tying farther away than if the ground were level. This assumption can be revisited during final design if the proposed project is advanced for construction. A stepped ultimate typical section may be feasible, where the southbound lanes are higher than the northbound lanes. This approach would match the existing terrain better and reduce the need for fill slopes and reduce the project footprint, while considering intersection grades and access needs.
- **Profile Grade for Drainage** – The drainage analysis for the project area (see Section 5.4) identified crossing structure locations and sizes to pass flows at existing drainageways. In order to provide sufficient cover over culverts and vertical clearance for maintenance, the Atrisco Vista Boulevard profile grade was raised over existing ground at drainage structure locations. The cover over drainage structures was also set so that adequate cover could be achieved if the roadway is widened to the west in the future. This would result in a roadway profile higher than the adjacent terrain and that would require longer fill slopes along the east side of the facility.
- **Profile Grade for Passing Sight Distance** – On a two-lane roadway, drivers may look for opportunities to pass slower vehicles. The AASHTO Green Book contains guidelines for establishing the vertical geometry of the roadway so drivers have adequate sight distance to pass safely. While not an issue if Atrisco Vista Boulevard is reconstructed as a four or six lane roadway in the future, providing adequate passing sight distance is recommended with a two-lane section. Thus, the profile grade was designed to provide adequate passing sight distance as much as possible. As a result, limited opportunities were available to "roll" the profile grade, with alternating high- and low-profile elevation points, to match the existing terrain and reduce the amount of earthwork. As currently designed, there are two locations where passing sight distance cannot be provided. The first is in the south section in the area of the existing reverse curves where Option 2C flattens the south curve into City of Albuquerque Open Space lands. The second is in the middle section just north of Paseo del Norte and is also on a horizontal curve. During final design there will be an opportunity to evaluate whether it would be preferable to establish no passing zones at these locations or revise the alignment to provide passing sight distance; however, the latter option would occur at the expense of potentially significant earthwork.
- **Multi-Use Trail** – The trail was situated within the proposed right-of-way such that it would be outside of the roadway clear zone and approximately level with the two-lane road. This approach created large fills on the east side of the facility due to the slope of the existing terrain. During final design there will be an opportunity to investigate an independent profile grade for the trail in order to reduce the amount of fill.
- **Pavement Design** – For cost estimating and roadway design modeling purposes, a pavement section of 6 inches of hot mix asphalt over 12 inches of base course was assumed. This is generally consistent with the design of Atrisco Vista Boulevard and Paseo del Norte in the project vicinity. As the project advances into final design, a pavement design will be developed consistent with the traffic volume and functional class of vehicles anticipated to use the roadway.

  The pavement design will need to consider truck use on Atrisco Vista Boulevard. Both Paseo del Norte and Unser Boulevard have truck restrictions in certain sections; however, no restrictions are in currently in effect for either Atrisco Vista or Southern Boulevards. Truck use of Atrisco Vista Boulevard is consistent with its functional classification and existing and planned industrial developments south of the airport.

As the project is advanced to preliminary design, other measures to reduce the project footprint and minimize right-of-way may be investigated. However, even with refinements to the design, due to parcel sizes and configuration, reducing the right-of-way width is not expected to affect the number of parcels impacted.



Arroyo in project area.

The items discussed above were used to establish the construction and right-of-way footprint of the proposed roadway, and to estimate specific right-of-way limits, costs, and project impacts. As the project is advanced to preliminary design, other measures to reduce the project footprint and minimize right-of-way may be investigated, such as roadside barriers to permit steeper fill slopes, and the use of an urban section with curb and gutter and possibly a storm drain system. However, even with refinements to the design, due to parcel sizes and configuration, reducing the right-of-way width is not expected to affect the number of parcels impacted.

5.4 Preliminary Drainage Analysis and Design

Drainage recommendations were developed that identify preliminary improvements consistent with the goals of minimizing flooding, conveying stormwater runoff safely, and maintaining the drainage facilities. The proposed drainage facilities affect the proposed roadway vertical alignment, cost, right-of-way footprint, and other factors as described below. Improvements to Southern Boulevard from 20th Street to Rainbow Boulevard are also being considered (see discussion in Section 5.9.2), which would affect the Southern Boulevard crossing of the Calabacillas Arroyo. Additional detailed analysis can be found in the Preliminary Drainage Report, on file at Bernalillo County Public Works Division. Existing drainage conditions are summarized in Section 2.5 and detailed in the Existing Conditions Report. A copy of the Preliminary Drainage Report is located in Appendix D.

The proposed roadway will increase the imperviousness of the existing watershed, reduce infiltration, and increase runoff flow rates and volumes from the right-of-way. The roadway will also act as a divide within the watershed and will require drainage flows to be channeled north or south along the roadway to the nearest crossing structure. This will be accomplished using parallel drainage ditches constructed adjacent to Atrisco Vista Boulevard within the right-of-way. Channel lining and/or check structures may be required depending on the flows, the roadway slopes, and the soils.

The roadway should be designed to maintain existing drainage patterns to the extent practicable. In general, flow changes due to the proposed roadway improvements will be minor relative to the size of the overall watershed. Also, drainage ditches and structures will be designed to help minimize erosion and sedimentation.

Preliminary drainage structure recommendations were developed in consideration of hydrologic criteria and peak drainage flows. Hydrologic criteria for off-site flows were previously defined by various drainage master plans prepared by AMAFCA and SSCAFCA. Hydraulic criteria for rural highway design from local agencies are limited, so the NMDOT Drainage Design Manual (July 2018) was the proposed source of design criteria to address bridges, crossing culverts, and roadside ditches. Peak drainage flows for the 100-year storm were taken from the appropriate drainage management plans for the area, as available. In general, the developed condition flows were used for preliminary structure sizing.

5.4.1 Atrisco Vista Boulevard Crossing Structures

Crossing structures were sized preliminarily using the 100-year developed peak flows. Pipe culverts were assumed for the smaller basins. Box culverts were sized for the larger basins. A bridge is proposed at the Calabacillas Middle Branch Arroyo due to the high flows at that location. The existing drainageways typically are shallow and relatively flat in cross section where they intersect with Atrisco Vista Boulevard and do not have well defined channels. Culverts will be used in these areas and should be designed to avoid causing additional ponding on private property upstream of the roadway. Draft preliminary crossing structure locations and recommendations are shown in Figure 5-6 and Table 5-3. Several of the critical crossing structures for Atrisco Vista Boulevard and Southern Boulevard are discussed below, along with considerations that influence the proposed project alignment.

- **Structure 10, North Fork Boca Negra Arroyo** – The North Fork Boca Negra Arroyo crosses Atrisco Vista Boulevard 0.4 mile south of Paseo del Norte through an existing 20' span bridge. According to the Boca Negra DMP, the existing culvert has adequate capacity; however, widening Atrisco Vista Boulevard on its existing alignment will require widening or replacement of the existing bridge.
- **Structure 14, Calabacillas West Branch Arroyo** – The Calabacillas West Branch Arroyo crosses the proposed alignment of Atrisco Vista Boulevard 1.1 miles north of Paseo del Norte. As discussed in Section 5.3.3, the proposed alignment was shifted to the south and east to avoid locating the structure at the confluence of two branches of the arroyo.
- **Structure 16, Calabacillas Middle Branch Arroyo** – This tributary of the Calabacillas Middle Branch Arroyo crosses Atrisco Vista Boulevard 1.8 miles north of Paseo del Norte. Anticipated flows at this location are too large to accommodate economically with a box culvert, so a bridge crossing is assumed at this location.
- **Structure 20** – Structure 20 is part of the Tributary B watershed of the Calabacillas Arroyo. There is a major natural gas facility 1,300 feet downstream to the east, which appears to be at risk of flooding. The proposed roadway crossing will be designed to maintain historic flow conditions at this location.
- **Structures 21A and 21B** – Structures 21A and B are in the Tributary B watershed of the Calabacillas Arroyo. The existing drainage channels are shallow and poorly defined. The new culvert pipes should be designed to maintain historic flow patterns and avoid directing flows toward the existing buildings. In addition, detention ponding should be considered on the west side of Atrisco Vista Boulevard within the right-of-way at this location to help attenuate peak flows and reduce velocities downstream.

In addition to the above structures for Atrisco Vista Boulevard, drainage improvements were also evaluated for the Calabacillas Arroyo crossing of Southern Boulevard (see discussion in Section 5.9.2). The existing structure at the Calabacillas Arroyo includes five 8-foot span by 6-foot rise concrete box culverts. The culverts are undersized, and they have flooded and overtopped the roadway in the past during major storms. If the proposed roadway improvements require significant modifications to the existing box culverts, they should be replaced with a bridge with adequate capacity. The bridge opening should approximate the existing channel width to avoid creating a flow restriction.

5.4.2 Stormwater Quality

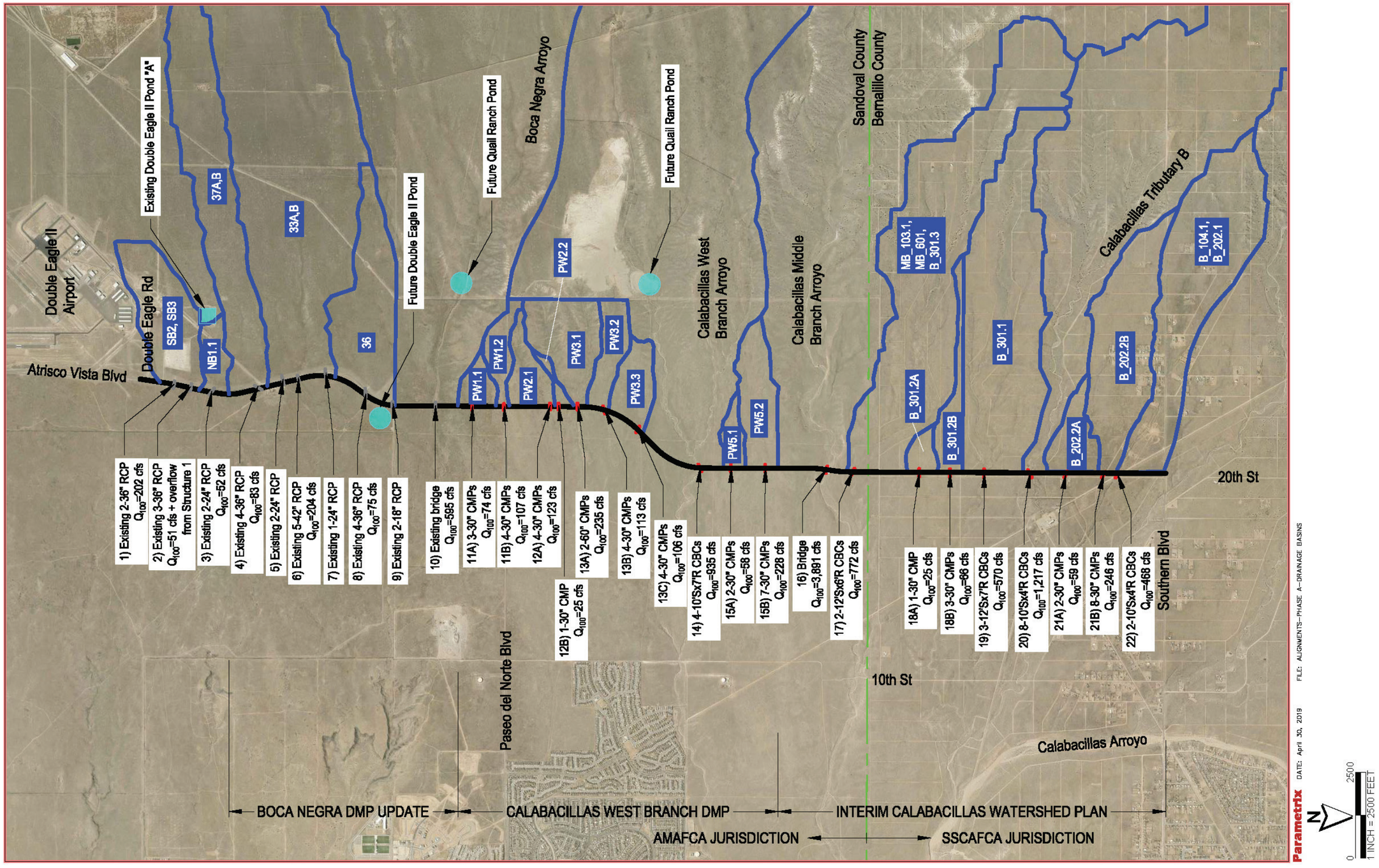
Atrisco Vista Boulevard is within the EPA Middle Rio Grande Watershed Municipal Separate Storm Sewer System (MS4) Permit area. This permit is intended to help protect water resources and is a cooperative effort between the agencies in the watershed responsible for storm water management. In general, the MS4 Permit requires on-site retention of runoff from small, relatively frequent storm events. In statistical terms, this is the 90th percentile rainfall event (for new development), which produces approximately 0.6 inches of precipitation in the study area. Note this is the requirement for the permanent facility. Other EPA requirements are in place to help protect water quality during construction, which will be addressed during design and construction.

Several options could be considered to retain the roadway runoff. One option is to retain runoff in roadway ditches. Check dams could be placed in these ditches to retain runoff while maintaining the ditch capacity for larger storms. Another option would be to grade small ponds within the new right-of-way areas. Drainage details for the project will be developed in subsequent design phases.



Existing drainage facility.

Figure 5-6. *Proposed Drainage Structures*





Existing drainage facility.

Table 5-3. *Proposed Drainage Structures*

Structure #	Station	Drainage Management	Existing Q100 cfs	Developed Q100 cfs	Existing Structure	Preliminary Recommendation	Comments
1	10+00	DEIIADR	54	202	2-36" RCP	Extend or replace in-kind	Assume 7% bulking, grade to allow overflow to Structure 2
2	15+00	DEIIADR	47	51	3-36" RCP	Extend or replace in-kind	Assume 7% bulking
3	21+00	DEIIADR	42	52	2-24" RCP	Extend or replace in-kind	Assume 7% bulking, add detention pond "A" outflow of 23/33 cfs (AP2NB), without routing
4	35+50	BNDMPU	54	83	4-36" RCP	Extend or replace in-kind	Use 7% bulking
5	42+75	BNDMPU			2-24" RCP	Extend or replace in-kind	Use 7% bulking. Drains to Structure #6, which has capacity for the entire basin, so a sub-basin was not delineated
6	47+00	BNDMPU	126	204	5-42" RCP	Extend or replace in-kind	Use 7% bulking
7	55+00	BNDMPU			1-24" RCP	Extend or replace in-kind	Use 7% bulking. Drains to Structure #6, which has capacity for the entire basin, so a sub-basin was not delineated
8	68+25	BNDMPU	66	75	4-36" RCP	Extend or replace in-kind	Use 7% bulking
9	76+75	BNDMPU			2-18" RCP	Extend or replace in-kind	Use 7% bulking. Structure #8 has capacity for the entire basin, so a sub-basin was not delineated
10	89+50	BNDMPU	595	327	Slab bridge, 20' span	Widen	N. Fork Boca Negra Arroyo
11A	100+00	CWBDMP		74		3 - 30" CMPs	
11B	109+75	CWBDMP		107		4 - 30" CMPs	
12A	102+75	CWBDMP		123		4 - 30" CMPs	
12B	125+25	CWBDMP		25		1 - 30" CMP	
13A	130+75	CWBDMP		235		2 - 60" CMPs	
13B	138+75	CWBDMP		113		4 - 30" CMPs	
13C	150+00	CWBDMP		106		4 - 30" CMPs	Need an inlet berm at NW corner
14	172+25	CWBDMP		935		4 - 10' x 7' CBCs	Calabacillas West Branch Arroyo, assume 4.0' HW to top of bank at west property line
15A	181+00	CWBDMP		58		2 - 30" CMPs	
15B	191+00	CWBDMP		228		7 - 30" CMPs	
16	209+00	CAWMP	2645	3891		Bridge	Calabacillas Middle Branch Arroyo
17	216+50	CAWMP	437	772		2 - 12' x 6' CBC's	Assume 5.0' HW to west property line
18A	236+00	CAWMP	14	25		1 - 30" CMP	
18B	245+00	CAWMP	37	66		3 - 30" CMPs	
19	255+00	CAWMP	318	570		3 - 12' x 7' CBC	Design for developed flow in existing channel, assume 3.0' bank-full depth
20	268+25	CAWMP	830	1217		8 - 10' x 4' CBC	Calabacillas Tributary B, design for developed flow in existing channel, assume 3.0' bank-full depth
21A	278+75	CAWMP	36	59		2 - 30" CMPs	
21B	290+00	CAWMP	150	246		8 - 30" CMPs	
22	294+00	CAWMP	278	468		2 - 10' x 4' CBCs	Assume 4.0' HW, need inlet berm at SW corner

Notes:
1. DMP flows were prorated based on fraction of total basin area(s) as needed.
2. Bulking factors were assumed if they were not already included in DMP flows.

Abbreviations

BNDMPU = Drainage Management Plan Update for Boca Negra Arroyo, Draft (August 2018)

CAWMP = INTERIM Calabacillas Watershed Park Management Plan (February 2015)

CWBDMP = Calabacillas West Branch Arroyo Drainage and Storm Water Quality Management Plan, Final (August 2018)

DEIIADR = Double Eagle II Airport Drainage Report (March 1988)

CBC = concrete box culvert

CMP = corrugated metal pipe

HW = headwater

RCP = reinforced concrete pipe

5.5 Right-of-way

The right-of-way needed for the Alternative 2 is summarized in Table 5-4 below. As shown in this table, the base alignment would require the acquisition of approximately 121 acres. The base alignment assumes Option 2C is used between Double Eagle Road and Paseo del Norte (see discussion in Section 5.3.2). The amount of right-of-way needed would be slightly less if Option 2D is used — a total of 119 acres as compared to 121 acres.

Table 5-4. *Summary of Right-of-Way Needs*

Corridor Segment	Acres	Parcels	Ownership	Notes
Double Eagle Road to Paradise West Boundary	6.8	2	1 (CoA)	186' wide ROW - includes reverse curve realignment
Paradise West Boundary to County line (includes Paseo del Norte)	46.2	41	19 Various	186' wide ROW
Non Right-of-Way Total	2.7	NA	NA	Remainders of parcels less than 1 acre
Bernalillo County Total	**56**	**43**		
Rio Rancho Estates - County line to Southern Boulevard	44.0	84	67 Various	186' wide ROW - includes access point ROWs
Non Right-of-Way Total	21.3	NA	NA	Remainders of parcels less than 1 acre
Sandoval County Total	**65**	**84**		
Project Total	**121.0**	**127**		

Notes: CoA = City of Albuquerque; ROW = right-of-way

Key aspects of the right-of-way needs include:

- All of the property identified for right-of-way is currently undeveloped. No homes, businesses, or other buildings are affected.
- A total of 127 distinct parcels are affected with 87 different owners. Of this total 43 parcels with 20 owners are within Bernalillo County and 84 parcels with 67 owners are within Sandoval County.
- Of the total 121 acres, 97 acres are needed for roadway right-of-way and 24 acres are identified as non-right-of-way (NRW) parcels. NRWs are parcel remnants that are not needed for the roadway but are unusable due to their size or lack of access. Most of the NRWs are within the Rio Rancho Estates subdivision of Sandoval County.
- The parcels impacted by the alignment of Alternative 2C are owned by the City of Albuquerque and are within public open space. The conversion of this property for use as public right-of-way will not diminish the use of the open space (see further discussion in Section 5.9.4).

Initial right-of-way maps and current ownership is included in Appendix B-2.

The right-of-way needs of the project are based on the assumed typical section of the roadway and trail and the design features described in Section 5.3. As the project is advanced to preliminary design, other measures to reduce the project footprint and minimize right-of-way may be investigated. This could include design items such as roadside barriers to permit steeper fill slopes, and the use of an urban section with curb and gutter and possibly a storm drain system. However, even with refinements to the design that narrow the construction footprint, due to the parcel sizes and configuration in Rio Rancho Estates, reducing the right-of-way width would not significantly reduce the number of parcels impacted.



The base alignment would require the acquisition of approximately 121 acres. **All of the property identified for right-of-way acquisition is currently undeveloped.**

County	No. of Parcels	No. of Owners
Bernalillo	43	20
Sandoval	84	67
Total	**127**	**87**

5.6 Cost

The cost estimate for Alternative 2 prepared as part of the alternatives screening and shown in Chapter 4 was updated based on the refinements to the design and the materials quantities derived from the AutoCAD Civil3D roadway model. The following assumptions were used:

- **Pavement section** – 6 inches of hot mix asphalt over 12 inches of base course. This is generally consistent with designs for Atrisco Vista Boulevard and Paseo del Norte in the project vicinity.
- **Drainage** – Proposed drainage crossing structures were sized to limit headwater depths in order to limit backwater and flooding of the adjacent properties upstream to the west. They were also sized to allow vertical clearance for standard maintenance equipment where practical.
- **Fill** – The quantity of fill reflects a two-lane roadway set at the ultimate profile grade and a trail that is level with the roadway. The earthwork needed for the ultimate roadway widening would be constructed in the future and was not included in the quantity.
- **Trail** – Though planned for the entirety of Atrisco Vista Boulevard from the airport to Southern Boulevard, the governing jurisdictions who oversaw the preparation of this corridor study requested that the trail only be constructed from Double Eagle Road to Paseo del Norte in the project timeframe. This is reflected in the cost estimates and roadway plans.

The cost estimate was further updated using NMDOT 2018 Average Unit Bid (AUB) prices, from the 2017 AUBs available for the initial screening. A significant increase in the cost of some materials was observed in the 2018 AUBs over those in 2017. Consequently, the estimated cost to implement the proposed improvements increased from the previous estimates. The higher costs are attributed to three primary factors:

- The greater design detail now available was based on the additional engineering analysis, which allowed for refinement of quantity estimates.
- Unit costs appear to have increased substantially over the last year, most notably in culvert, concrete, excavation and borrow prices.
- Consistent with local drainage policies, the drainage analysis assumed full build-out/development of the surrounding area, but it also assumed undeveloped conditions at the drainage crossings. This combination of assumptions produced conservatively sized structures.
- The roadway design includes substantial drainage improvements and earth fill as a consequence of the more detailed drainage and roadway design.

Detailed cost estimates for the implementation of the proposed project are provided in Appendix B and include contingency, design, construction management, right-of-way acquisition, and NM gross receipts tax (the average of the jurisdictions' tax rates). A summary of the estimated costs is provided in Table 5-5, below.

Table 5-5. *Estimate of Probable Cost*

Major Cost Components	Alternative with Option 2C	Alternative with Option 2D
Roadway	$13,786,482	$13,036,782
Drainage & Structures	$5,315,720	$5,315,720
Roadway & Drainage Subtotal	$19,102,202	$18,352,502
Contingency (20%)	$3,820,440	$3,670,500
Subtotal	**$22,922,642**	**$22,023,002**
Engineering (8%)	$1,833,811	$1,761,840
Construction Management (11%)	$2,521,491	$2,422,530
Construction Subtotal	**$27,277,944**	**$26,207,373**
Right-of-Way	$1,391,500	$1,368,500
Project Total	**$28,669,444**	**$27,575,873**
NM Goss Receipts Tax	$2,033,810	$1,956,232
Project Total with Tax	**$30,703,255**	**$29,532,105**

5.7 Access Management

As a regional principal arterial, the proposed roadway is intended to serve longer trips and as such, will have limited access. The following access management policies and guidelines were used to develop the recommended access policy for Atrisco Vista Boulevard:

- City of Rio Rancho Development Process Manual, which follows the NMDOT State Access Management Manual (SAMM). For an urban principal arterial with a posted speed of 50 mph or less, signalized intersections are permitted every half mile and unsignalized intersections are permitted every quarter mile.
- MRMPO's *Roadway Access Control Policies (RACP) for the Albuquerque Metropolitan Planning Area* (Adopted June 2019). This policy defines the locations of full intersections and limits "T intersections and right-in/right-out driveways at approximately one-quarter mile intervals."

In addition to the above policies, the intersections along Atrisco Vista Boulevard identified in the Paradise West Master Plan were also considered. The intersections in that plan are generally consistent with the MRMPO RACP except for the location of Irving Boulevard. As discussed in Section 5.3.3, the alignment of Atrisco Vista Boulevard was revised in the vicinity of Irving Boulevard. The alignment change required a northward shift in the intersection with Irving Boulevard. The resulting location is less than the desired ½ mile spacing, but at 2,000 feet is adequate to achieve reasonable traffic operations.

Based on the above policies and adjustment to Irving Boulevard, full intersection access on Atrisco Vista Boulevard within the project limits is limited to the following cross streets and locations:

- **Paseo del Norte** – This intersection will stay in its current location but will be reconfigured to improve safety. Providing full access at this cross street will result in access constraints for the parcels immediately surrounding the intersection. A separate assessment of access needs along Paseo del Norte is underway and will be documented in a separate report.
- **Ventana Ridge Road, Irving Boulevard, and McMahon Boulevard** – None of these roads currently extend into the project corridor; however, they are all identified in the 2040 Long Range Roadway System (LRRS) as future extensions of existing roadways.
- **23rd Avenue, 19th Avenue, Cherokee Road, and Dakota Road in Rio Rancho Estates** – The spacing between 23rd Avenue and 19th Avenue, and between Dakota Road and Southern Boulevard is approximately 1,900 feet — less than the desired ½ mile spacing. However, intersections at these locations is needed to provide reasonable access to all of the properties in this area. Existing platting and the presence of several arroyos limits the efficiency of access in this segment of Atrisco Vista Boulevard. If parcels are consolidated and re-platted by new subdivisions, opportunities to eliminate one of these intersections may be available.
- **Southern Avenue** – The intersection of Atrisco Vista Boulevard at Southern Boulevard is the northern terminus of the proposed roadway. Thus, this intersection will be a T configuration.
- In addition to the above locations where full intersections are proposed, right-in/right-out access will be allowed at approximate ¼ mile intervals.

It is anticipated that most, if not all of the above locations can be initially operated as stop-controlled intersections and will not require traffic signals. Signal warrants will be conducted during final design and after implementation to determine the need for and location of traffic signals.

For the Rio Rancho Estates area in the north section, future platted roads would be realigned to conform to the proposed access management plan and to limit the number of access points onto Atrisco Vista Boulevard. Conceptual access changes, proposed intersections, and access locations are shown in the Plan and Profile sheets in Appendix B-1, and in Figure 5-7 below.

Within Rio Rancho Estates, 20th Street is currently platted within a 50-foot easement that extends from Southern Boulevard all the way to the southern boundary of the subdivision. Since Atrisco Vista Boulevard is immediately west of 20th Street, changes to 20th Street are needed at proposed intersections to provide the minimum spacing between intersections. The conceptual access plan shows a schematic of how 20th Street could connect to 19th Street and Atrisco Vista Boulevard through re-aligned "jug handles" that would meet the minimum intersection spacing requirements per the SAMM. It is recommended that 20th Street be terminated before intersecting Southern Boulevard.

5.8 Project Impacts

The initial design plans for Atrisco Vista Boulevard were used to assess project impacts. This assessment included impacts to traffic and the subarea street system, adopted plans and policies, environmental resources, neighborhoods and communities, and recreational properties. The project effects on each of these items are discussed below.

5.8.1 Traffic and Impacts to Other Arterial Streets

As discussed in Section 4.2, projected traffic volumes for the proposed roadway remain relatively low and within a maximum projected daily traffic volume of 8,100 south of the airport and less than 4,000 north of Paseo del Norte. These volumes are well within the capacity of a two-lane limited access roadway.

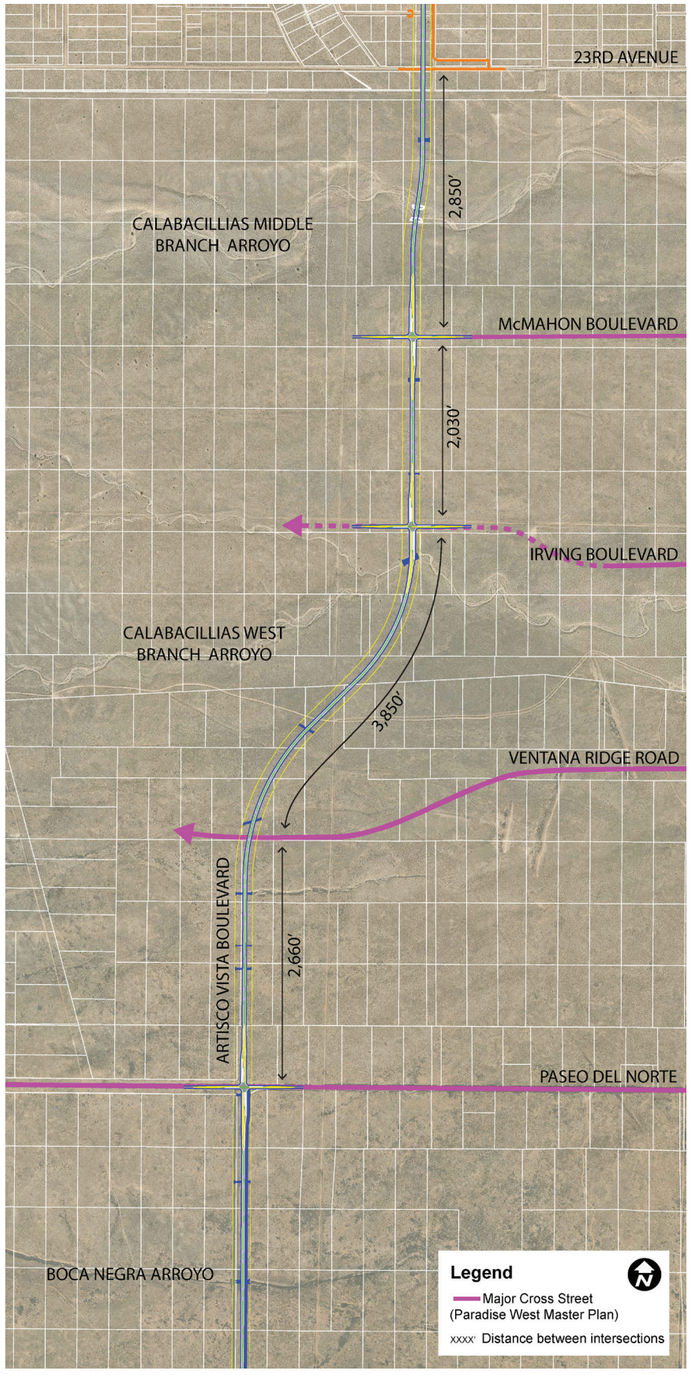
However, the extension of Atrisco Vista Boulevard north to Southern Boulevard will likely alter traffic circulation in the area bounded by Southern Boulevard, Unser Boulevard, Paseo del Norte, and the proposed extension of Atrisco Vista Boulevard. Once the roadway extension and connection to Southern Boulevard are implemented, traffic traveling between Rio Rancho and I-40 via Atrisco Vista Boulevard will change, with some of these streets having an increase in traffic and others having a slight decrease. A slight decrease in traffic volume will likely occur on Unser Boulevard between Southern Boulevard and Paseo del Norte, and on Paseo del Norte west of Unser Boulevard. Traffic using the new segment of Atrisco Vista Boulevard will result in an increase in traffic traveling on Southern Boulevard between Atrisco Vista Boulevard and Rainbow Road.



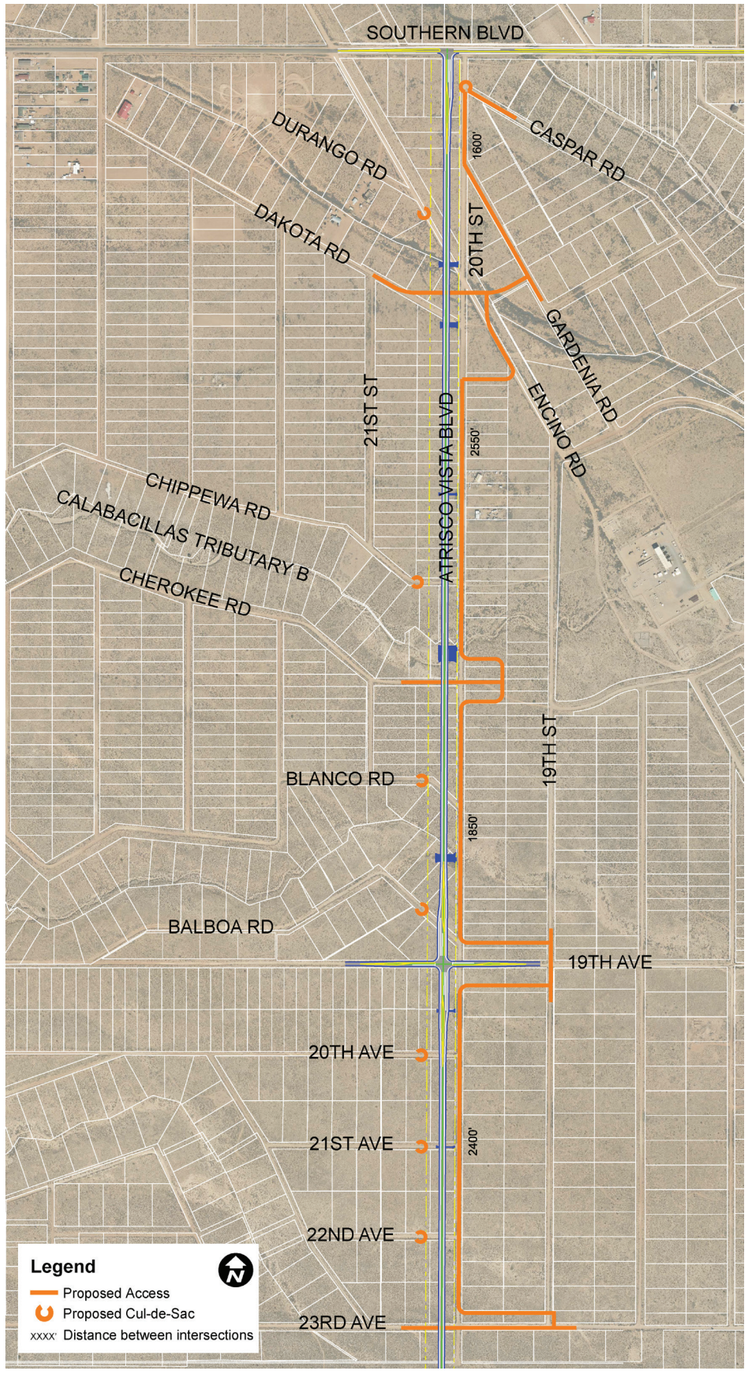
Side street intersection with Southern Boulevard.

Atrisco Vista Boulevard is identified as a limited access arterial street in the regional roadway system. Full intersections will be allowed at approximate ½ mile spacing with right-in/right-out intersections allowed at approximate ¼ mile intervals. The project segment within Bernalillo County includes intersections with three existing streets that will be extended from the east.

Figure 5-7. *Proposed Access Management – Paseo del Norte to 23rd Avenue*



23rd Avenue to Southern Boulevard



Access within Rio Rancho Estates will include full intersections with four future streets. This area will require cul-de-sacs at several local streets and rerouting of traffic on these streets to other, nearby streets with access to Atrisco Vista. 20th Street will serve as a local "frontage road" along the east side of Atrisco Vista to collect side street traffic and direct it to points where access to Atrisco Vista can be safely accommodated.

There are currently 57 intersections with Southern Boulevard between 20th Street and Rainbow Boulevard including 28 driveways to single family residences and 29 side streets. Consequently, left turns are common and can present a potential safety concern as left-turning vehicles conflict with through traffic. To mitigate this, Southern Boulevard would consist of a 14-foot center turn lane and two 12-foot driving lanes.

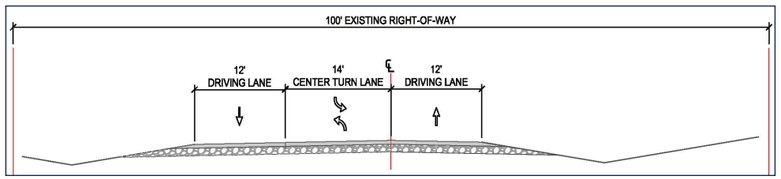
The change in traffic is projected to be minor — estimates prepared by the MRCOG indicate daily traffic flows on Southern Boulevard west of the Calabacillas Arroyo will increase from approximately 1,080 vehicles today to 3,280 in the next 20 years. East of the Calabacillas Arroyo to Rainbow Boulevard, daily traffic is projected to increase from 2,860 today to 4,160 by the year 2040. While some of this traffic is due to area growth and will occur whether or not Atrisco Vista is extended, a portion of the increase is a direct result of the proposed extension of Atrisco Vista Boulevard.

Southern Boulevard west of Rainbow Boulevard is currently in very poor condition. The typical section consists of two travel lanes. A paved trail exists from Rainbow Boulevard west for approximately one-half mile; however, this trail is also in very poor condition. The crossing at the Calabacillas Arroyo is also in poor condition and is inadequate to pass 100-year flows. Moreover, the existing roadway has numerous driveways and intersections with side streets. There are currently 57 intersections with Southern Boulevard between 20th Street and Rainbow Boulevard including 28 driveways to single family residences and 29 side streets. Consequently, left turns are common and can present a potential safety concern as left-turning vehicles conflict with through traffic.

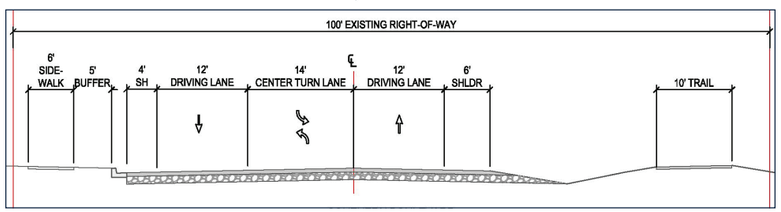
Because of the roadway condition and potential safety concerns, improvements to the segment of Southern Boulevard between 20th Street and Rainbow Boulevard were evaluated as part of the Atrisco Vista Boulevard study. The improvements considered are not intended to meet all the existing and long-term needs of this facility. Rather, they are intended as improvements needed to preserve safety and improve the existing roadway condition. This would include reconstructing Southern Boulevard from its intersection with Atrisco Vista Boulevard east to provide a three-lane roadway and connecting to the existing three-lane roadway section at Atlantic Road immediately west of Rainbow Boulevard. Widening the current two-lane road was not considered due to the condition of the existing pavement. Additionally, it is recommended that the existing undersized concrete box culverts over the Calabacillas Arroyo be replaced with a new bridge as described in Section 5.4.1 above.

Two typical sections were identified for Southern Boulevard. West of the Calabacillas Arroyo, Southern Boulevard would consist of a 14-foot center turn lane and two 12-foot driving lanes as shown in Figure 5-8. Surfacing tapers would be constructed in keeping with the existing rural character of the roadway west of the Arroyo.

Figure 5-8. *Proposed Typical Section – Southern Boulevard, West of Calabacillas Arroyo*



Southern Boulevard, East of Calabacillas Arroyo



East of the Calabacillas Arroyo, the roadway section would be the same but with a 4-foot shoulder and curb and gutter on the north side and a six-foot shoulder on the south side, shown in Figure 5-8. Since this portion of Southern Boulevard currently has curb, gutter, and storm drain on the north side, and none of these features on the south side, it is proposed to maintain the same drainage pattern. Considering future constructability, the curb and gutter and associated storm drain features could be built for the three-lane road, allowing for future widening to four-lanes without reconstructing these elements. On the south side, the edge of the six-foot shoulder could coincide with the center of a future lane, with the intent to prevent pavement joints from being located in the wheel path. The three-lane section would continue east of Rainbow Boulevard and match the existing three-lane section at Atlantic Road.

Improvements to pedestrian and bicycle facilities along Southern Boulevard would consist of extending the sidewalk on the north side and the multi-use trail on the south between Atlantic Road west to the new bridge over the Calabacillas Arroyo.

5.8.2 Traffic Noise

Because of the limited development and generally low traffic volumes within the project area, ambient noise levels are generally low. The sources of noise include light aircraft operations from Double Eagle II Airport, traffic on Southern Boulevard, and equipment noise from the natural gas transmission facility located on Encino Road about a ½ mile south of Southern Boulevard and ¼ mile east of 20th Street.

Implementation of the proposed project will result in an increase in traffic noise along the corridor, the most notable of which would be at the residential areas near 20th Street and Southern Boulevard, and along Southern Boulevard. While traffic noise will increase throughout the corridor, no noise sensitive land uses are currently present, except for the Albuquerque Open Space and Petroglyph National Monument properties east of Atrisco Vista Boulevard and south of Paseo del Norte. Because the open space and national monument activity areas (e.g., trails and trailheads) are located about 1,000 to 3,500 feet from the roadway, any change in traffic from the existing condition will be negligible.

The assessment of traffic noise from the proposed project was determined from measurements obtained using a sound level meter, and model predicted traffic noise levels estimated using the FHWA Traffic Noise Model (TNM). All of the modeled traffic noise levels were estimated based on the existing geometric relationship between the roadway and noise receiver and assumed future year traffic volumes prepared by MRCOG. Measurement sites focused on three locations where the change in traffic noise would be expected to increase the most as a result of the proposed project. These included two residences and a vacant parcel on 20th Street immediately east of the proposed alignment of Atrisco Vista Boulevard. In addition, the TNM modeled was used to estimate traffic noise levels at six residences along Southern Boulevard between 20th Street and Rainbow Boulevard. These six residences are representative of the overall corridor. The findings of the assessments are shown in Table 5-6.



The assessment of traffic noise from the proposed project was determined from measurements obtained using a sound level meter.

Table 5-6. *Existing and Projected Traffic Noise*

Receiver Location	Modeled Sound Level	Measured Noise Levels
Vacant parcel #1 (20th Street)	53.2	N.A.
Residence #1 (20th Street)	51.6 dB(A)	44.0 dB(A)
Residence #2 (20th Street)	51.7 dB(A)	54.6 dB(A)
Residence #3 (Southern Blvd. w/of Calabacillas Arroyo)	57.4 dB(A)	N.A.
Residence #4 (Southern Blvd. w/of Calabacillas Arroyo)	54.0 dB(A)	N.A.
Residence #5 (Southern Blvd. w/of Calabacillas Arroyo)	59.1 dB(A)	N.A.
Residence #6 (Southern Blvd. e/of Calabacillas Arroyo)	65.4 dB(A)	N.A.
Residence #7 (Southern Blvd. e/of Calabacillas Arroyo)	57.9 dB(A)	N.A.
Residence #8 (Southern Blvd. e/of Calabacillas Arroyo)	57.8 dB(A)	N.A.

All levels are Leq A-weighted decibels.

According to FHWA Noise Abatement guidelines, traffic noise mitigation for residential land uses is not considered until the hourly-average peak hour traffic noise approaches 67 dB(A). As shown in Table 5-6, all locations evaluated are well below the mitigation threshold, with the exception of Residence #6. This residence is located less than 50 feet from the edge of Southern Boulevard, whereas all of the other locations evaluated are generally 100 feet or further from the roadway edge.

One seeming discrepancy in the analysis is at Residence #2. For this location, the field measured noise level without the roadway in place is higher than the model estimated condition with the roadway in place. This is attributed to the presence of audible noise observed during the field measurements coming from equipment at the natural gas transmission facility located to the east of this residence.

5.8.3 Neighborhoods and Communities

The proposed project passes through an area that is mostly undeveloped. Residential development is limited to the area surrounding the northern terminus at Southern Boulevard. Project impacts to neighborhoods and communities are anticipated to include:

- Impacts resulting from changes in traffic circulation (see discussion under Section 5.8.1, above). The connection of Atrisco Vista Boulevard to Southern Boulevard will result in an increase in traffic on Southern Boulevard. While the resulting traffic volume is less than 5,000 vehicles per day (including existing traffic and added traffic resulting from the new street connection), the potential for conflicts between through traffic and cars entering side streets and driveways will be greater that the existing condition. Improvements to Southern Boulevard to improve safety have been identified and proposed as part of the project (see discussion in Section 5.8.1).
- Access to some individual lots along the proposed roadway will change. Alternative access to maintain reasonable access has been identified as part of the proposed project (see Section 5.7). This proposed access management plan will result in out-of-direction travel for some properties. However, access to all lots will be improved by having a new roadway connection to Southern Boulevard and Paseo del Norte. No residential displacements have been identified.
- With one exception, the scattered residential areas along Southern Boulevard east and west of the proposed northern terminus of Atrisco Vista Boulevard are generally 1,000 feet or further away. Thus, nuisance impacts such as noise are likely to be inconsequential. The exception is two houses located south of Southern Boulevard along the east side of 20th Avenue SW. These homes will be located about 100 feet of the proposed roadway edge. Based on analysis of traffic noise at these two residences, noise levels will remain well below the threshold when mitigation of noise is required.
- At the subarea level, the improved access provided by the proposed roadway will benefit the residents of Rio Rancho destined to I-40 or job sites at the airport and industries located on Atrisco Vista Boulevard. It will also benefit the users of Double Eagle II Airport who come from Rio Rancho and northwest Albuquerque.
- The improvements to the segment of Atrisco Vista Boulevard between Double Eagle II Airport and Paseo del Norte, and the extension of the roadway north to Southern Boulevard will improve emergency response for fire, medical, and police personnel to this airport. Access for emergency response teams currently rely on access from the south via the existing segment of Atrisco Vista or via Paseo del Norte to the east. The additional access from Southern Boulevard will improve response for major events at the airport and/or when crashes or other conditions limit access from the existing roadways.

5.8.4 Parks and Recreation Resources



Signage directing visitors to Paseo de la Mesa Recreation Trail.

Overall, the proposed project will improve access to the open space lands and associated national monument sites east of Atrisco Vista Boulevard. Access will be enhanced by the improved roadway section, the multi-purpose trail, and the better street connectivity with Rio Rancho. However, the project will have isolated adverse impacts. Both Option 2C and 2D of Alternative 2 would acquire lands currently designated as open space. Option 2C would acquire approximately 6.8 acres and Option 2D would acquire about 4.8 acres of open space lands. The acquisition of this property will not negatively impact any existing use or the function of the larger open space area. Because the overall open space lands in this area are several thousand acres in size, the amount needed to improve Atrisco Vista Boulevard is negligible.

Depending on funding sources used to implement the proposed project, additional analysis and documentation following the federal Section 4(f) process may be required as part of the environmental process in a subsequent phase of the project. Given the small size of land needed for acquisition and the absence of impacts that affect the function and use of the property, it is anticipated that the impacts would qualify under the *de minimis* rules.

The proposed project will require reconstruction of the gravel access road that intersects Atrisco Vista Boulevard approximately ½ mile south of Paseo del Norte. This road is used to access a small parking area and paved trail located about 600 feet east of Atrisco Vista Boulevard. The improved typical section of Atrisco Vista Boulevard and changes to the reverse curves just south of the intersection provide an opportunity to improve visibility of turning traffic and motorist safety. The City of Albuquerque Open Space Division has asked if improvements to the access road to the parking area can be made to offset the loss of land from their property. This will be evaluated in greater detail and considered in the environmental documentation and preliminary design phase.

Overall, the proposed project will **improve access to the open space lands and associated national monument sites east of Atrisco Vista Boulevard**. Access will be enhanced by the improved roadway section, the multi-purpose trail, and the better street connectivity with Rio Rancho.

Petroglyph National Monument and the volcano features flanking the east side of the existing Atrisco Vista Boulevard are prominent visual resources in the project area. Roadway improvements could be perceived as having adverse visual impacts to these resources. Because of the relatively flat terrain within this portion of the monument, the roadway will not be visible except from the elevated areas at the volcanic features. The roadway extension is over one and one-half miles from these features; therefore, visibility of the roadway from the volcano area is not expected to be a major visual impact.

5.8.5 Plans and Policies

The proposed project is consistent with local adopted transportation, land use, and economic plans and policies. The extension of Atrisco Vista Boulevard and connection to Southern Boulevard is included in the MRCOG 2040 MTP as a Project of Special Interest. In addition, this project is supported by Bernalillo County through an Administrative Resolution 2016-42, which acknowledges the extension of Atrisco Vista Boulevard as a priority project for Bernalillo County and directs the County Public Works Division to begin implementation activities. The access management plan of the proposed project, as discussed in Section 5.7, is consistent with the Roadway Access Control Policy for the Albuquerque Metropolitan Planning Area. This policy was amended and adopted in June 2019.

The proposed project is also generally consistent with the transportation element of the Paradise West Master Plan. While the realignment of the roadway extension through this master plan area will necessitate revision to the alignment shown in the adopted plan, it does not change the general land use assumptions of the plan.

Extending Atrisco Boulevard into Rio Rancho is consistent with the economic objectives of the region in that it will improve access to the growing employment center from I-40 north to the Double Eagle II Airport. It will also provide employers with increased access to the labor force in northwest Albuquerque and Rio Rancho. With extensive shovel-ready industrial land available and freeway access to I-40, Atrisco Vista Boulevard has the potential to support significant industrial development and increase employment and economic activity in the western metropolitan area.



5.8.6 Cultural Resources

A cultural resource survey was conducted for Alternative 2 in March 2019. The survey identified two archaeological sites, both located at the north end of the project area. The first site is a small, prehistoric lithic scatter. No diagnostic artifacts were identified; however, due to the lack of ceramics and previous research conducted across Albuquerque's West Mesa, the site is likely Archaic in age. Although no features were identified, the site is in a depositional environment of windblown sand and has high potential for subsurface deposits.

The second site is a small prehistoric flaked-stone artifact scatter with a pot drop. The southern boundary of the site terminates at a wide, shallow swale/wash, and the site's position on a ridge adjacent to the wash makes it an ideal location for a temporary encampment. As noted for the first site, additional artifacts and other cultural deposits may be present and are likely buried under wind-blown silt.

Both Alternative 2 options (Option 2C and 2D) for addressing the curve north of Double Eagle Road were surveyed and no archaeological sites were found in either option alignment.

Additional evaluation of both sites will be required to determine their eligibility for listing on the National Register of Historic Places (NRHP) and to assess the project's impact to the sites. During the NEPA phase of project development the results of the survey will be documented and concurrence on the sites' NRHP eligibility and project effects will be obtained from the NM State Historic Preservation Officer.

5.8.7 Natural Resources

Field visits were conducted in April to review waterways and flora and fauna within the project area. No federal- or state-listed animal and plant species or critical habitat were observed during the field visits. Five ephemeral waterways were observed to have characteristics that may qualify them as jurisdictional by the United States Army Corps of Engineers (USACE). As such, roadway construction will likely require permitting under Section 404 of the Federal Clean Water Act. Given their size, and the anticipated amount of construction in these drainages, it is likely they can be covered by Nationwide Permit #14 (linear transportation projects) and an individual permit would not be required. No wetlands were observed during the field review. The need for a permit and coordination with the USACE will be determined as part of the environmental documentation phase after additional engineering detail is available.



6.0 SUMMARY AND RECOMMENDATIONS

6.1 Project Overview and Summary

Based on the analyses completed for the Atrisco Vista Boulevard Corridor Study, and input received from the partner jurisdictions and public, Alternative 2 with Option 2C is recommended for implementation. This alternative and option achieves the desired safety improvements to the existing segment of roadway south of Paseo del Norte, achieves an efficient connection to Southern Boulevard, and enables future widening without losing the initial investment to construct the 2-lane facility.

Analysis of Alternative 2 did not identify any substantive impacts to the cultural and natural environment, or the existing recreational open space and national monument uses in the southeast area of the corridor. Potential adverse impacts were identified for the communities along Southern Boulevard as a result of increased traffic. While the increase in traffic and resulting total volume on Southern Boulevard will remain relatively low at approximately 4,100 vehicles per day, the increased through traffic will still result in higher potential for conflicts between through and turning vehicles. Improvements to Southern Boulevard have been identified to mitigate this impact.

A summary of the proposed project is as follows:

- **Proposed Improvements** – The recommended alternative assumes a 2-lane roadway with 12-foot travel lanes and 8-foot shoulders. A 10-foot multi-purpose trail is included along the east side of the roadway. The project will realign and reconstruct the existing segment of Atrisco Vista from Double Eagle Road north to Paseo del Norte to reduce the reverse curves in this section to improve driver comfort and safety. A new roadway will be constructed north of Paseo del Norte to Southern Boulevard.
- **Right-of-Way** – The proposed project will acquire approximately 121 acres of private and public property. Of this amount, 97 acres are needed for roadway right-of-way. The remaining 24 acres are non-right-of-way parcels that are unusable due to their size or lack of access or parcel size. Approximately 7 acres of lands are publicly owned and are part of Open Space managed by the City of Albuquerque.
- **Cost** – The estimate of probable cost to implement the proposed project is approximately $28.7 million, not including NM gross receipts tax. This includes approximately $23M for construction and 20% contingency, engineering and construction management costs of about $4.3M, and $1.4M for right-of-way.
- **Other Improvements and Costs** – In addition to the costs of Atrisco Vista Boulevard, $14.6M is estimated for improvements to Southern Boulevard. This amount is estimated for the reconstruction of Southern Boulevard as a 3-lane roadway between 20th Street to Rainbow Boulevard. Improvements to this roadway are proposed because of the poor condition of the existing road and to improve safety by providing a center left-turn lane.
- **Access Management** – The proposed roadway will be implemented as a limited access principal arterial. Full intersection access will be limited to east-west streets including Paseo del Norte, Ventana Ridge Road, Irving Boulevard, McMahon Boulevard, 23rd Avenue, 19th Avenue, Cherokee Road, and Dakota Road. Limited access (right-in/right-out intersections) will be permitted at approximate ¼ intervals.

6.2 Implementation Approach

The corridor study has established the purpose and need for the proposed project, identified and evaluated various project alternatives, identified the preferred alternative, and developed initial engineering plans used to estimate costs, right-of-way needs, and assess project impacts. Assuming federal funding is used to implement the project, the next steps for implementation are:

1. Preparation of preliminary design (30%) plans and an environmental document. Based on the initial analysis of environmental and community impacts, public comments received, and type of project being considered, it is anticipated that the environmental class of action can be met with either a categorical exclusion or an environmental assessment/FONSI. The environmental class of action will be determined in consultation with the NMDOT and FHWA.
2. Preparation of Plans, Specifications, and Estimates
3. Preparation of Right-of-Way Maps
4. Final design plan and construction bid documents.
5. Right-of-way acquisition
6. Construction

6.3 Potential Project Phasing

Depending on funding availability, the proposed project can be implemented in several phases. These phases included:

6.3.1 Early Implementation Phases

If full funding cannot be secured, several early phases of the project could be implemented. Each of the potential phases have independent utility and can therefore, be implemented individually or by combining two or more project phases, depending on funding. Potential phasing of the project could include:

- **Improvements to the Intersection of Paseo del Norte and Atrisco Vista Boulevard** – this intersection is associated with the greatest number of crashes occurring within the study area. Due to its remote location, absence of street lighting, and current geometry, crashes in this area typically involve motorists driving through the intersection and off the road. Minor and low-cost improvements could be made to improve signage, lighting, and geometry to reduce crashes at this intersection. The cost for this phase could range from less than $100K to several hundred thousand dollars depending on the extent of improvements implemented.
- **Reconstruction of Atrisco Vista Boulevard between Double Eagle Road and Paseo del Norte** – This project phase would realign and reconstruct Atrisco Vista between the airport and Paseo del Norte, including the intersection at Paseo del Norte. Reconstruction of this segment would enhance safety as a result of the improvements through the reverse curves and shoulder widening. Some right-of-way acquisition would be needed from the City of Albuquerque and private properties between the City lands and Paseo del Norte. The cost of the segment is estimated at $8.7M.
- **Right-of-Way Acquisition/Preservation** – Currently, no buildings or other improvements exist within the proposed right-of-way. However, numerous homes are present in the portion of the alignment in Rio Rancho Estates, including two residences immediately adjacent to the alignment about ¼ mile south of Southern Boulevard. Because electric utilities are already available in this area, the likelihood of additional home construction is increased. If funds to implement the full project cannot be acquired in the near future, the acquisition of property needed for right-of-way within Rio Rancho Estates is recommended. Early acquisition will protect the corridor from development and facilitate orderly development. Moreover, it will prevent the need for relocations which are significantly more costly than acquiring undeveloped land. The cost to acquire the parcels in Rio Rancho Estates is estimated at approximately $750K. Preliminary design and environmental documentation would be required before right-of-way acquisition can proceed, which would add to the cost.

6.3.2 Future Implementation Phases

Once full funding is obtained, the two remaining phases of implementation could include:

- **Construction of Atrisco Vista Boulevard between Paseo del Norte to Southern Boulevard** – This phase is estimated to cost approximately $18.6M.
- **Reconstruction of Southern Boulevard from 20th Street to Atlantic Road** – Because additional traffic will use Southern Boulevard after the extension of Atrisco Vista is complete, this phase is recommended to be concurrent with the construction of Atrisco Vista south of Southern Boulevard. The cost for this element is estimated at $14.7M not including NMGRT.

6.3.3 Implementation Cost by Jurisdiction

The existing and proposed alignment and extension of Atrisco Vista Boulevard is within four governmental jurisdictions including the City of Albuquerque, City of Rio Rancho, Bernalillo County, and Sandoval County. The implementation of the proposed project will require a cooperative effort, one key aspect of which is funding. Table 6-1 summarizes the estimated cost for by jurisdiction. The costs shown include design, right-of-way, construction, contingency, and construction management. New Mexico gross receipts tax are not included. This information is not intended to indicate responsibility for funding or implementation; rather it is to intended to illustrate the approximate costs of the project within each jurisdiction for consideration when funds are programmed within the region.

Table 6-1. *Cost Estimate Summary by Jurisdiction*

	Total Estimated Cost*	CITY OF ALBUQUERQUE "Double Eagle Road to Open Space Property Line"	BERNALILLO COUNTY Open Space Property Line to One Parcel North Of Paseo Del Norte	CITY OF RIO RANCHO One Parcel North of Paseo Del Norte to 19th Avenue	SANDOVAL COUNTY "19th Avenue to Southern Blvd"
ATRISCO VISTA BLVD - ALTERNATIVE 2 WITH OPTION 2C: OFFSET ROADWAY					
Roadway	$13,786,482	$3,424,094	$1,757,101	$5,902,056	$2,703,232
Drainage	$5,315,720	$466,900	$543,400	$2,569,200	$1,736,220
Contingency	$3,820,440	$947,469	$485,196	$1,635,148	$752,627
Engineering and Construction Management	$4,355,302	$1,080,115	$553,123	$1,864,069	$857,994
Right-Of-Way	$1,345,000	$68,000	$147,000	$665,000	$465,000
Constructional Total*	**$28,622,944**	**$5,986,578**	**$3,485,820**	**$12,635,474**	**$6,515,073**

	Total Estimated Cost*		CITY OF RIO RANCHO West Edge of Calabacillas Arroyo to Atlantic Rd	SANDOVAL COUNTY Atrisco Vista Blvd to West Edge of Calabacillas Arroyo
ATRISCO VISTA BLVD - ALTERNATIVE 2 WITH OPTION 2C: OFFSET ROADWAY				
Roadway	$6,977,932		$2,668,033	$4,309,899
Drainage	$2,499,400		$1,548,529	$950,871
Contingency	$2,843,199		$1,086,102	$1,757,097
Engineering and Construction Management	$2,340,901		$894,224	$1,446,677
Constructional Total*	**$14,661,432**		**$6,196,888**	**$8,464,543**

** Does not **include** NMGRT.*

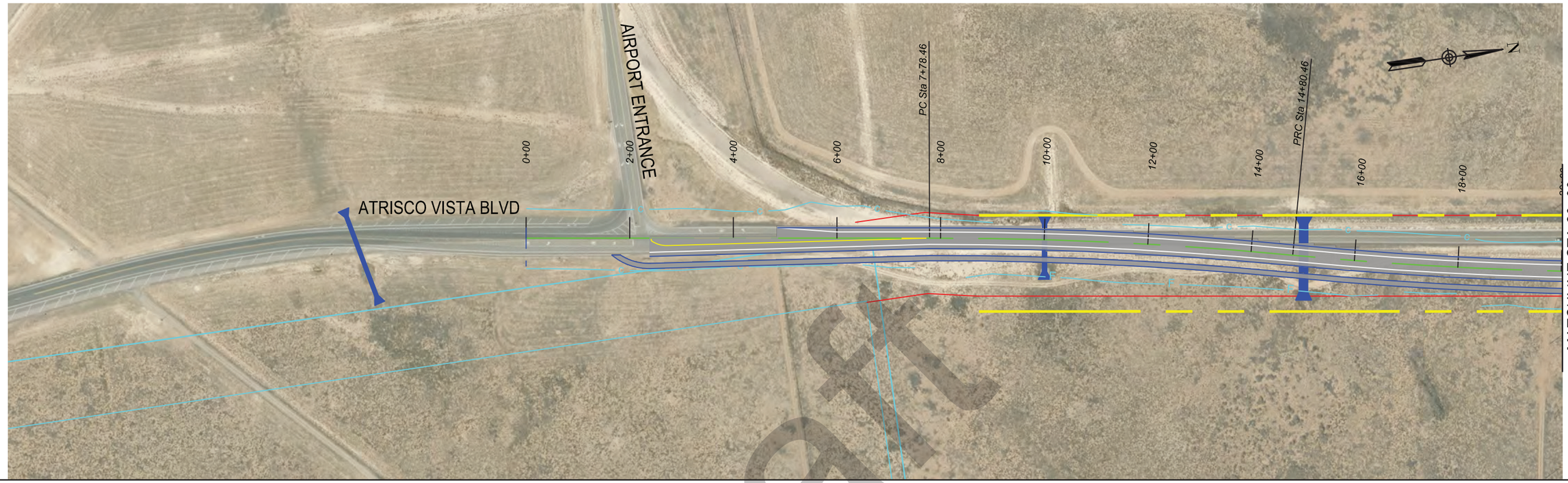
Cost Assumptions

1. Pavement section: 6" HMA over 12" base course.
2. Drainage assumes fully developed future condition.
3. Fill assumes a profile grade that accommodates a wider roadway in the future, and a trail that is level with the roadway.
4. Trail only from Double Eagle Road to Paseo del Norte.
5. Right-of-way cost estimated at $10,000 per acre.

APPENDIX A

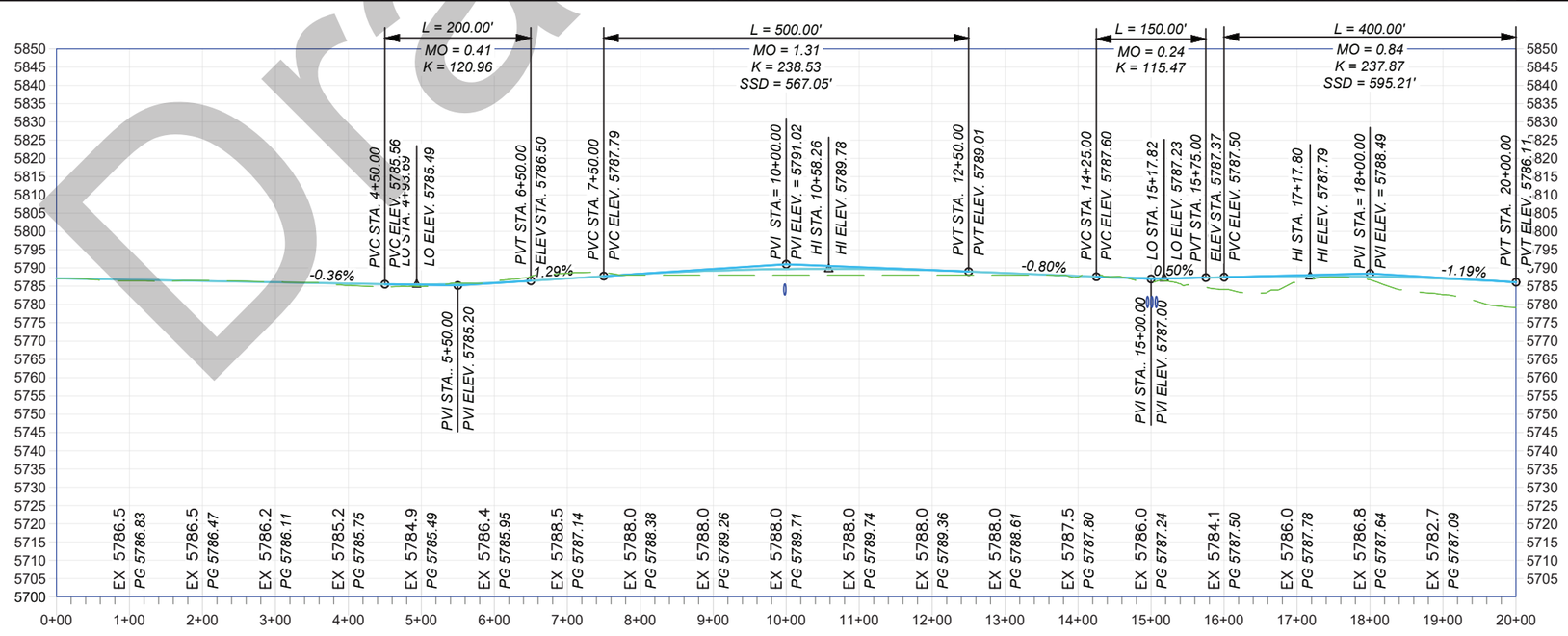
PLAN AND PROFILE SHEETS

ATRISCO VISTA BOULEVARD PHASE A/B STUDY



LEGEND

- EXISTING PARCEL LINE
- EXISTING EASEMENT LINE
- PROPOSED R/W LINE
- C — CUT SLOPE LIMIT
- F — FILL SLOPE LIMIT
- DRAINAGE STRUCTURE
- SUGGESTED ACCESS



SCALE:
1" = 200' HORIZ
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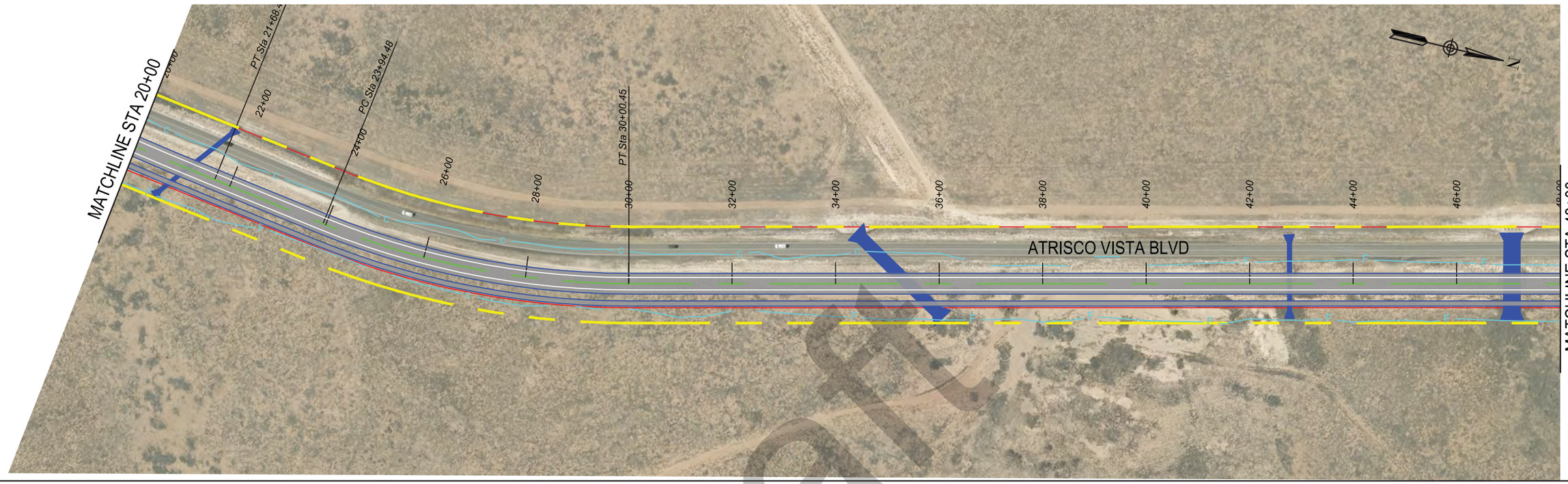
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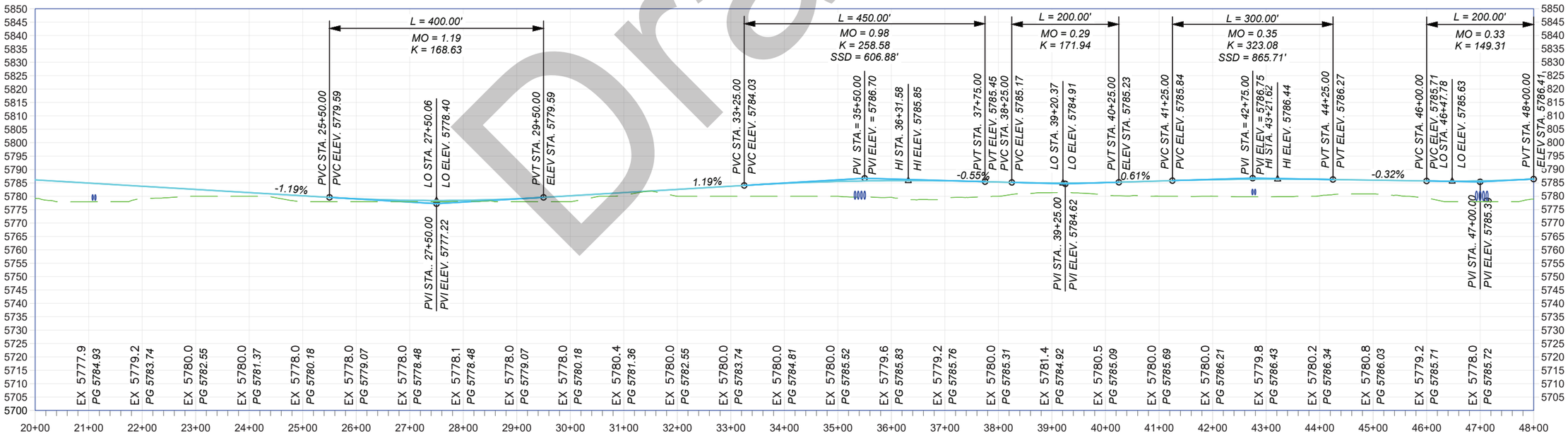
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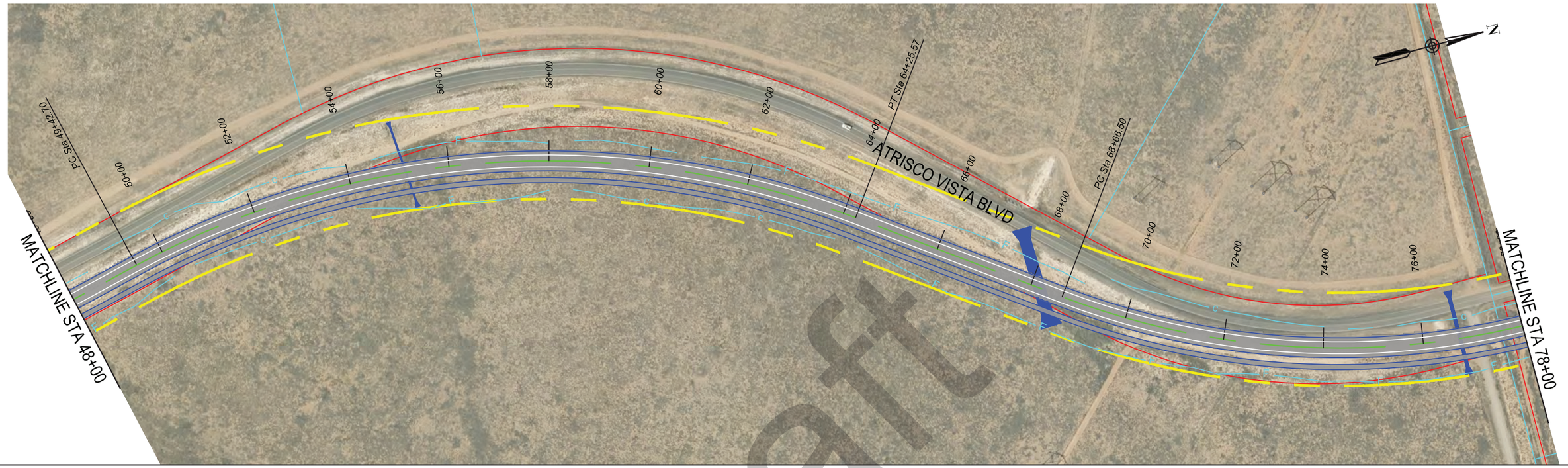
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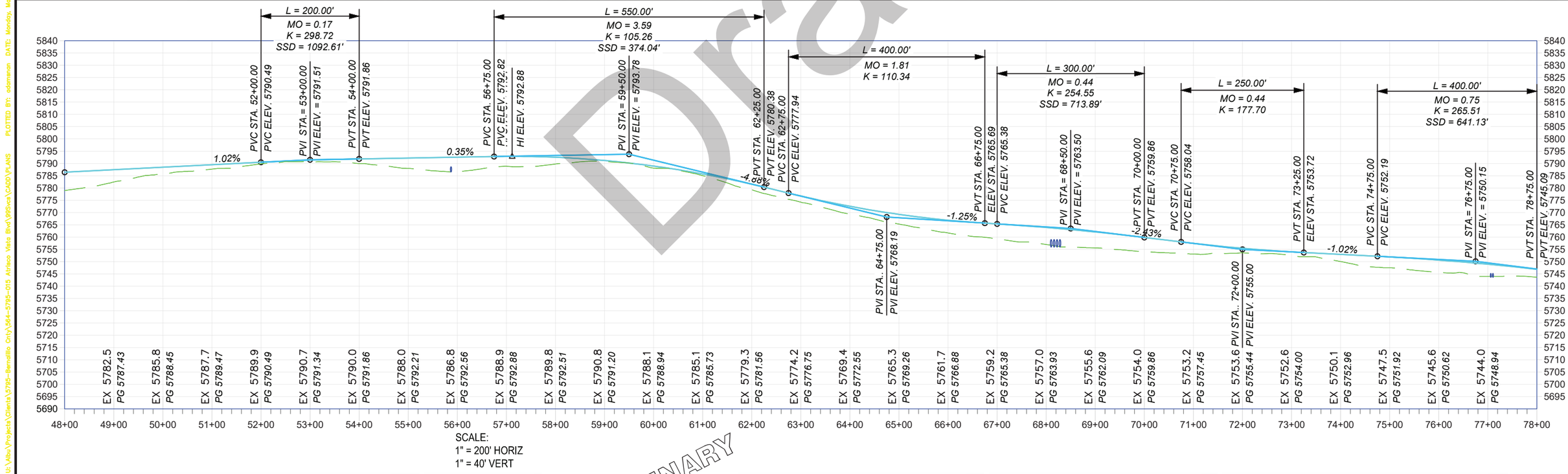
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ATRISCO VISTA BOULEVARD
PHASE A/B STUDY

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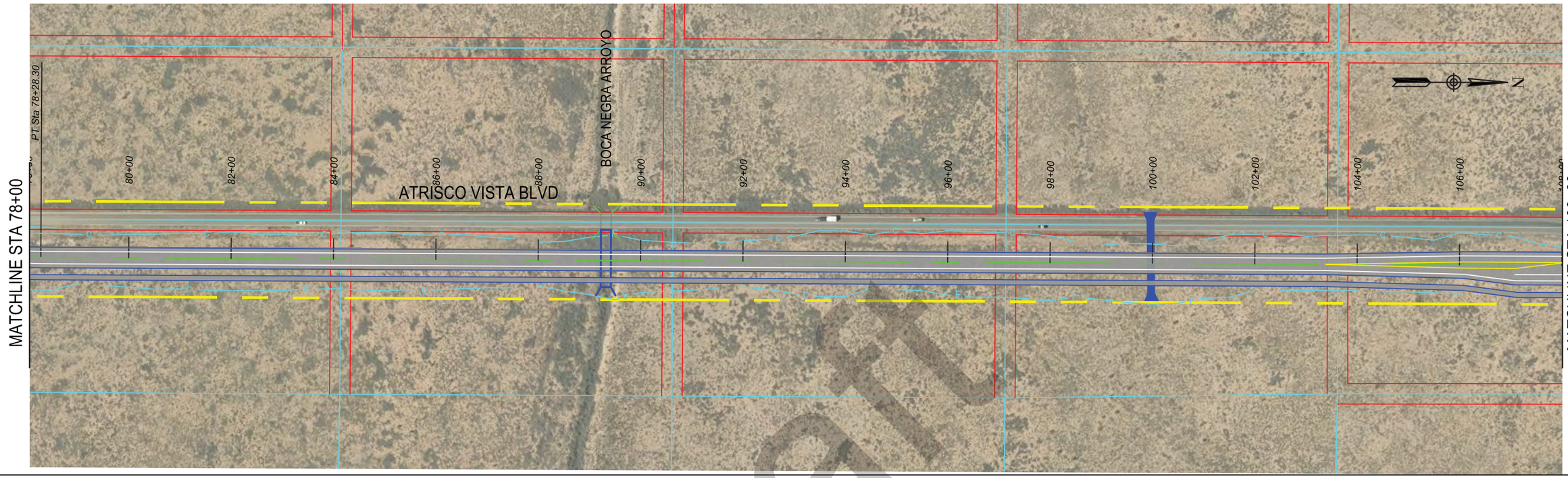
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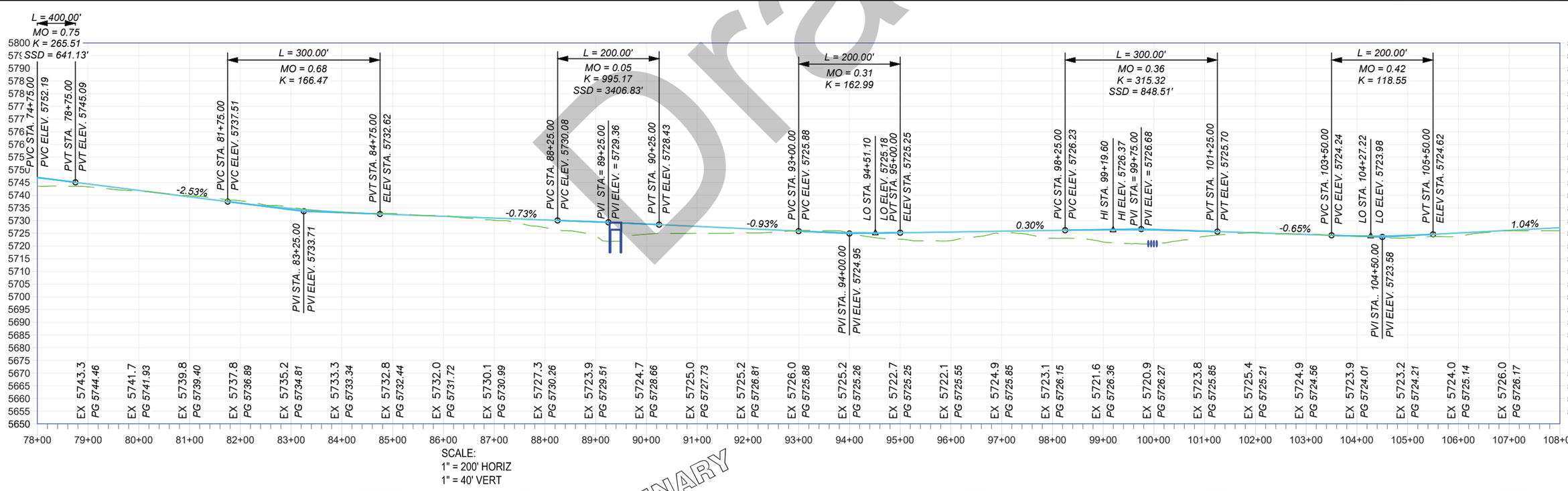
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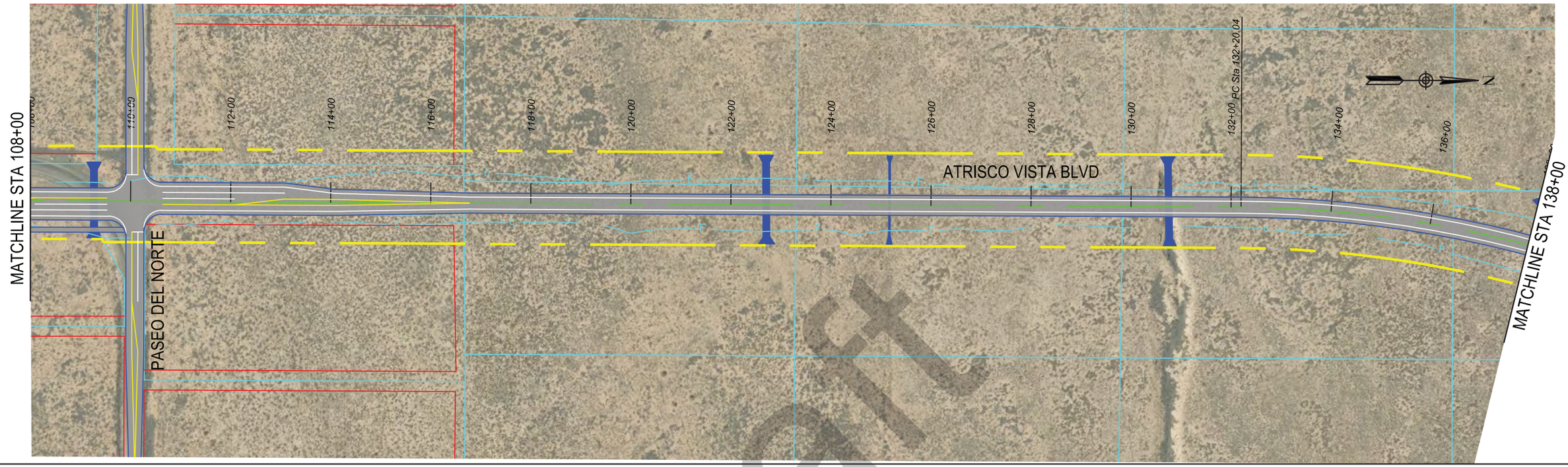
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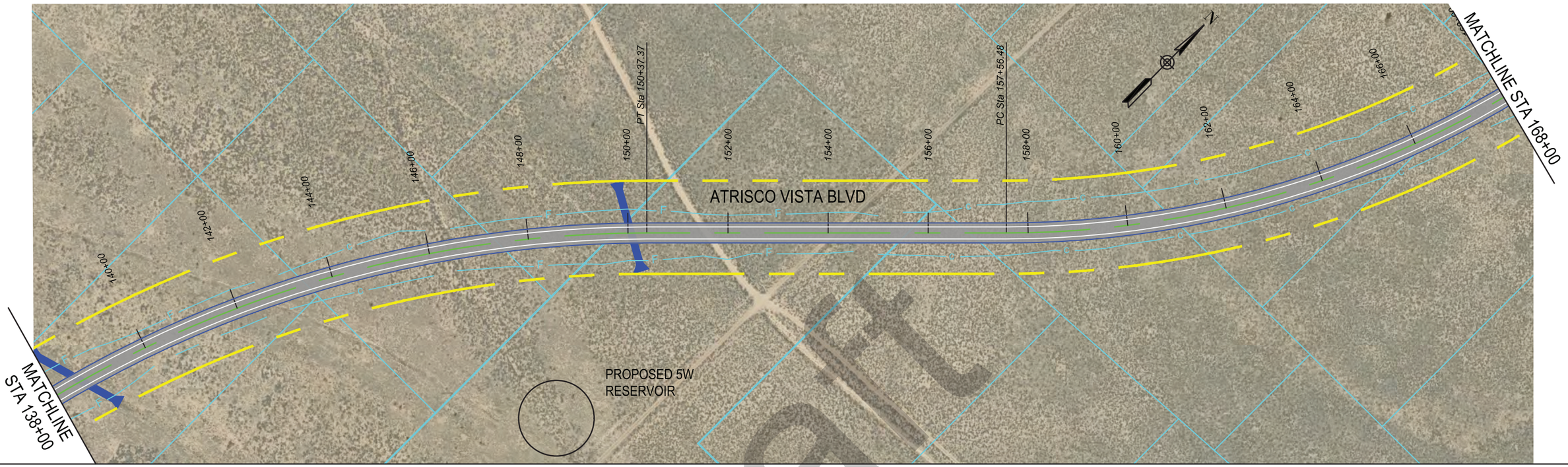
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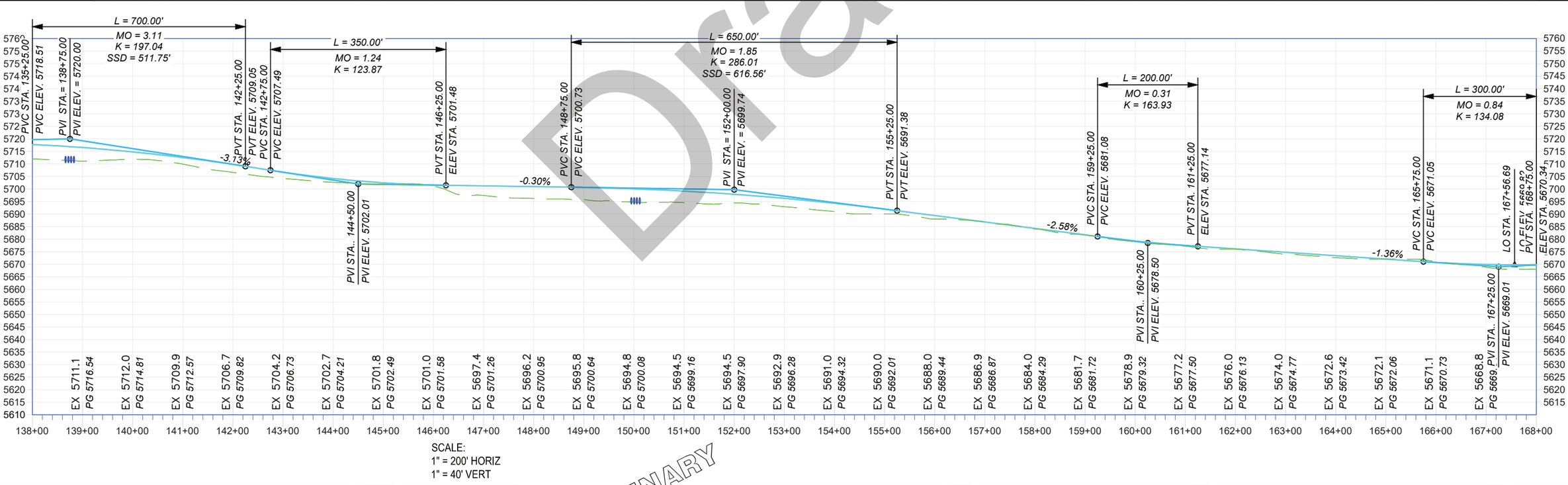
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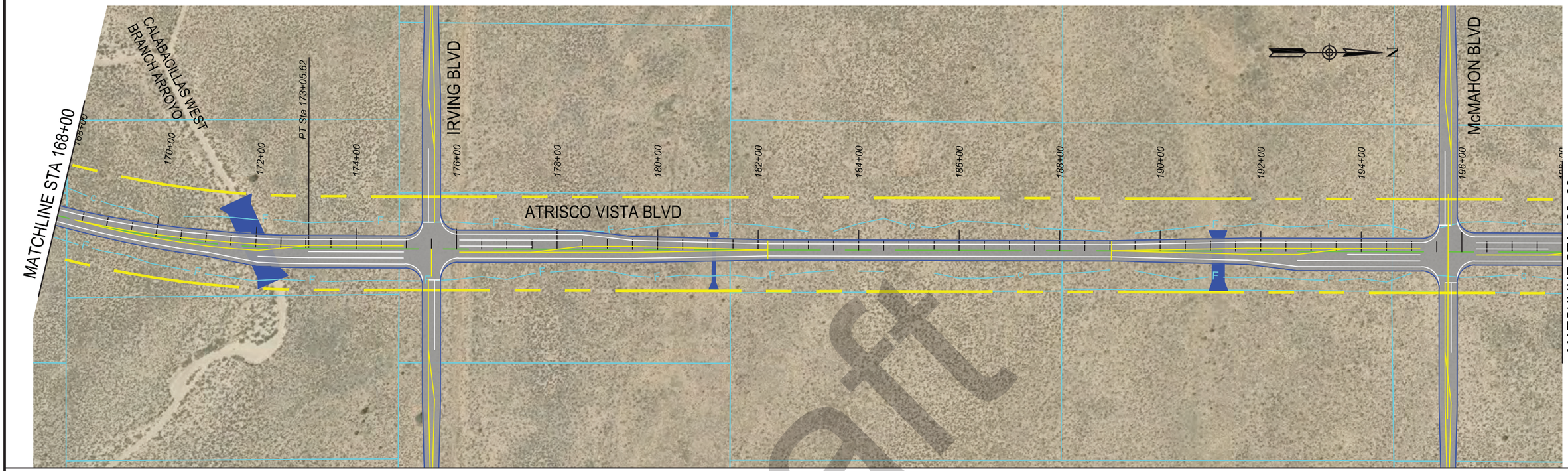
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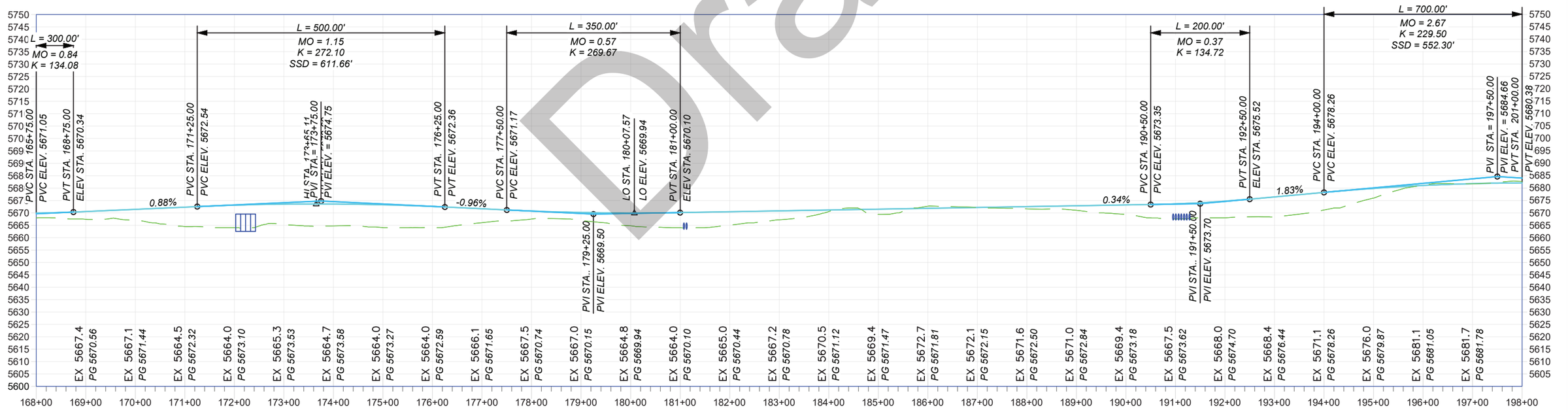
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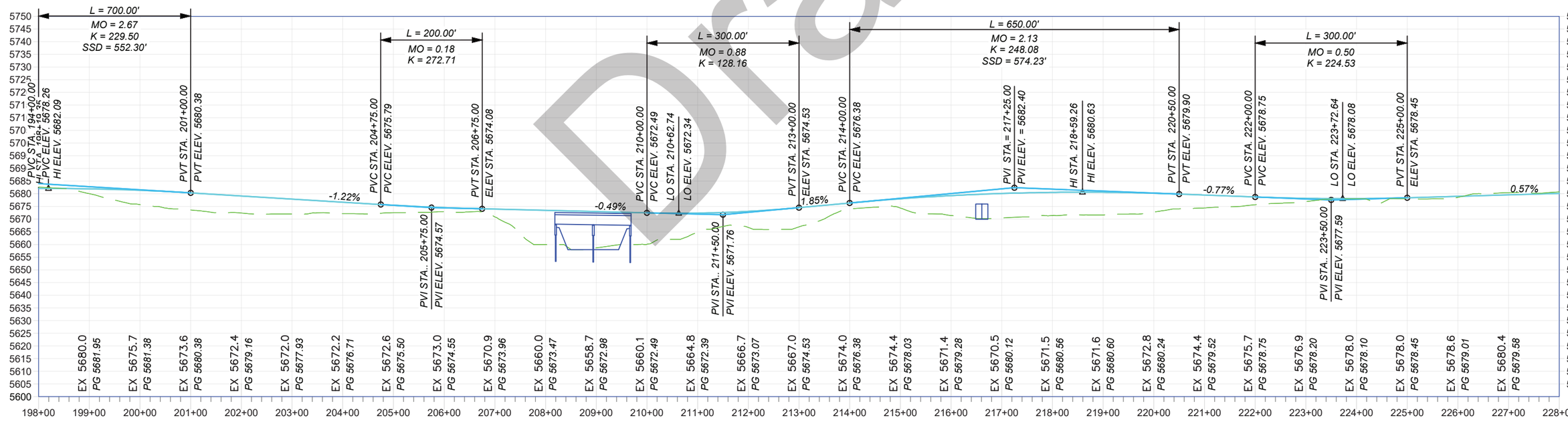
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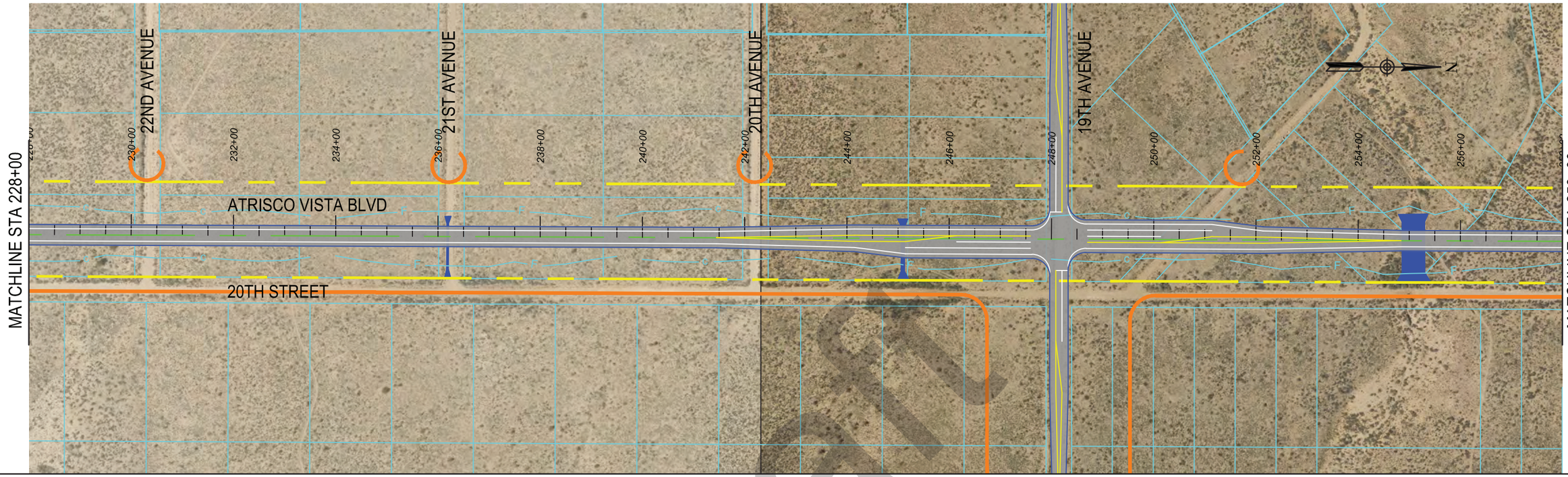
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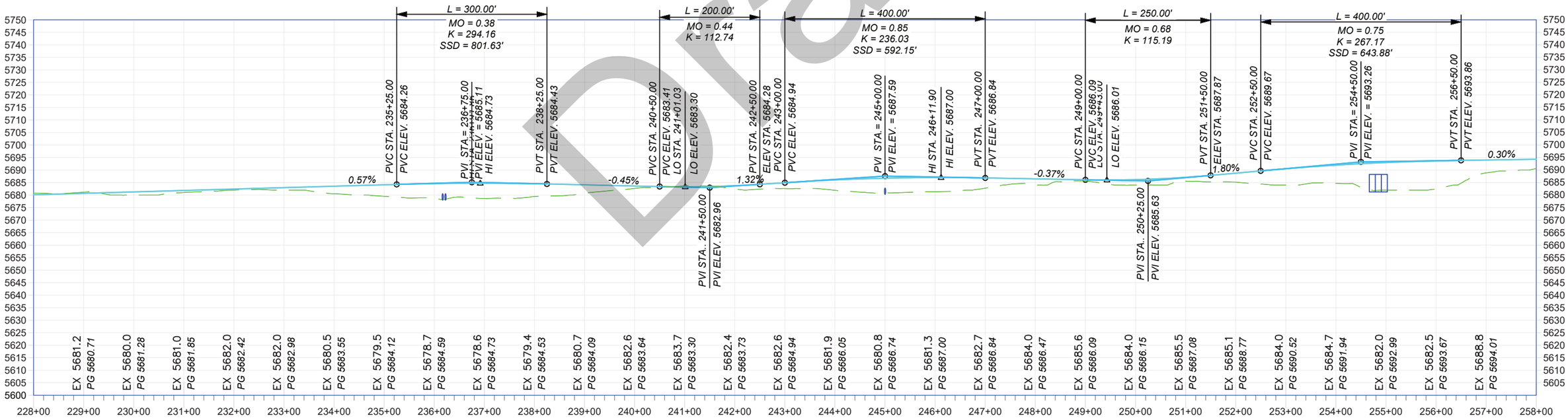
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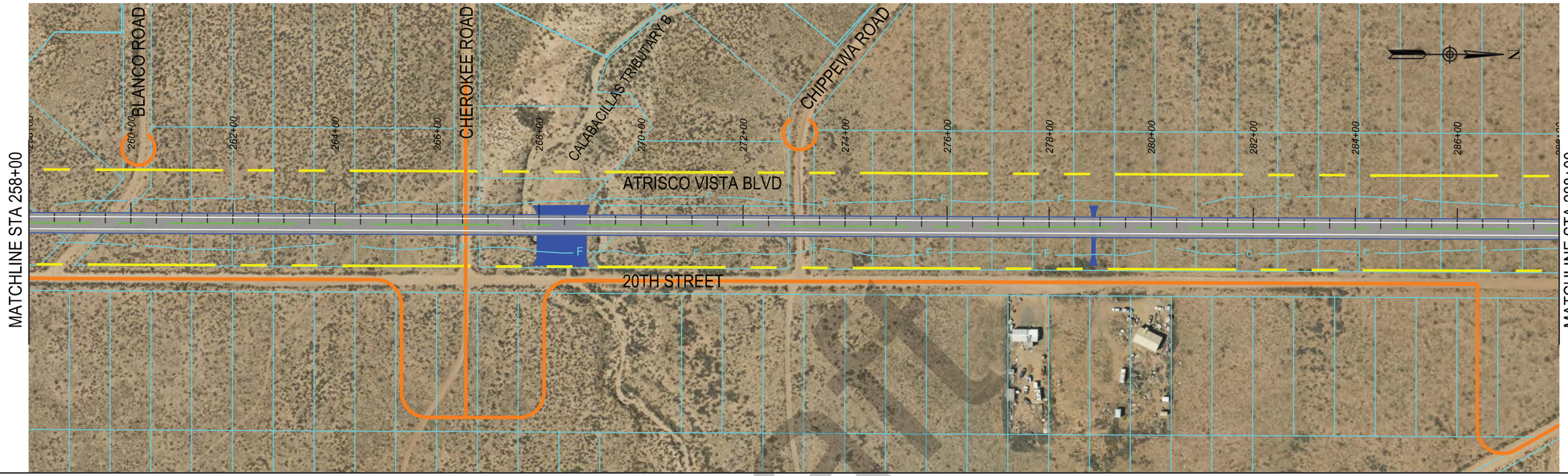
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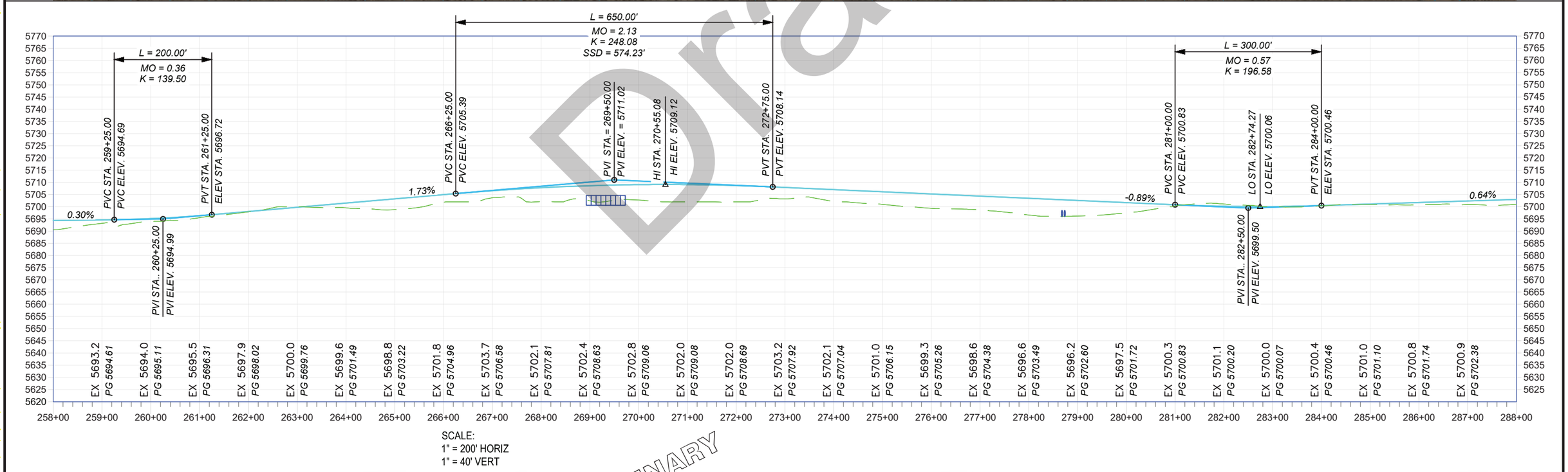
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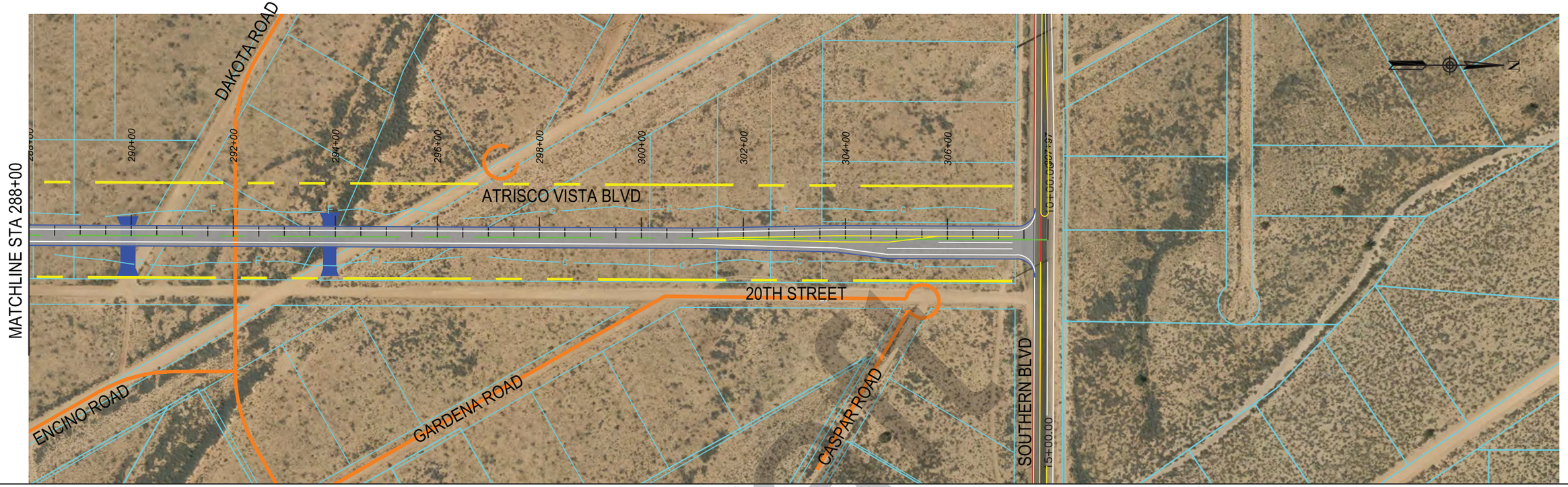
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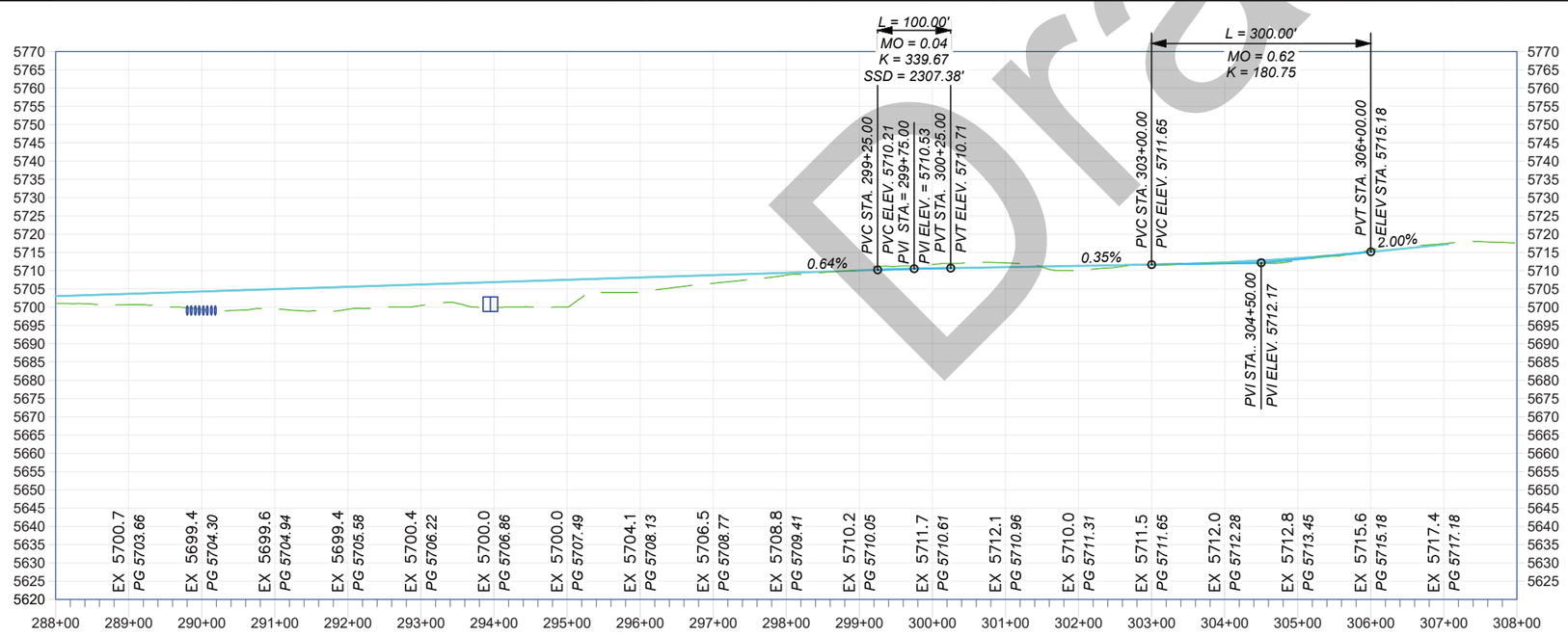
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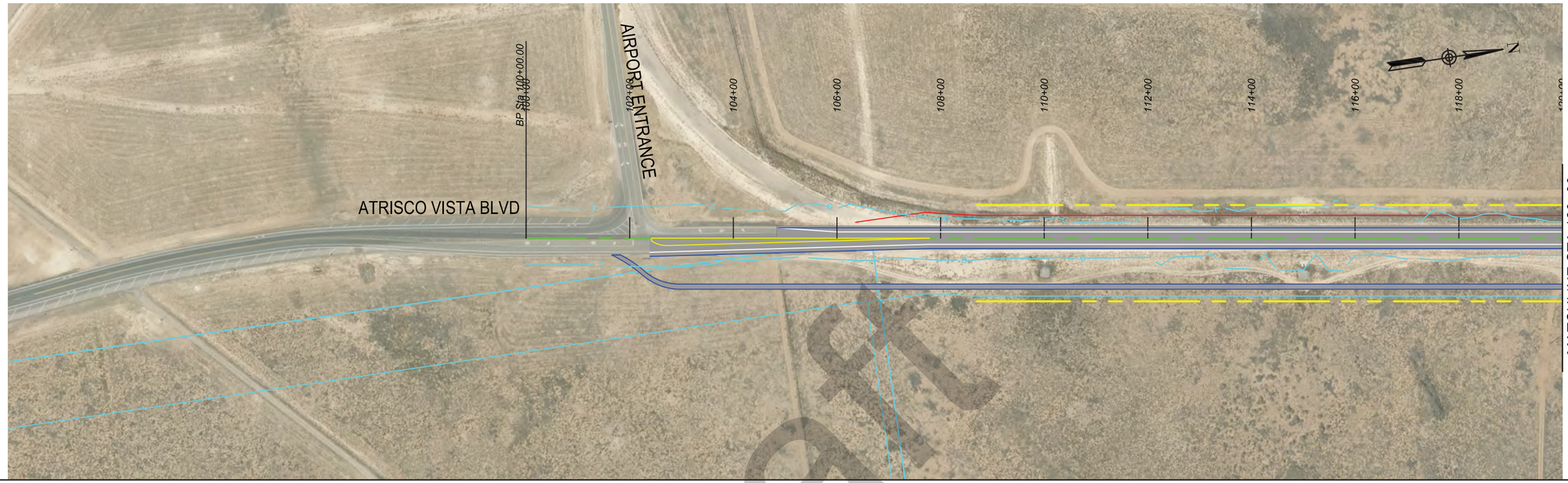
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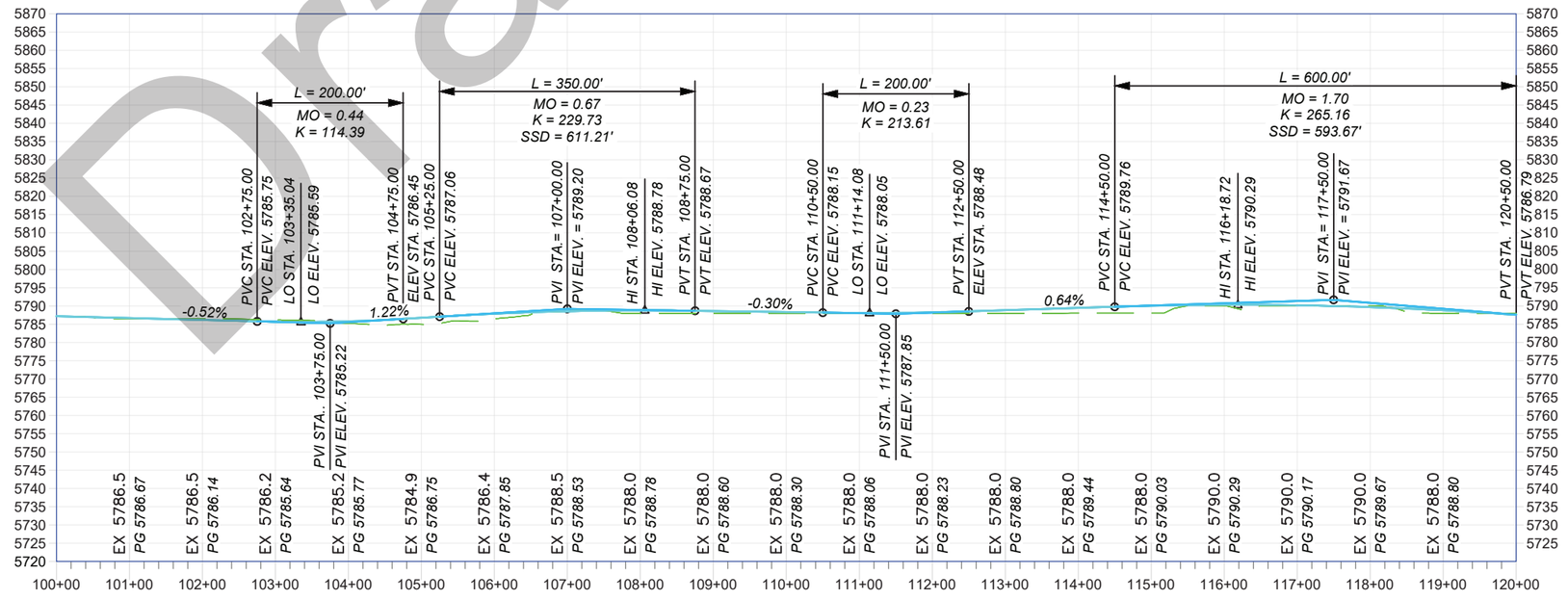
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LEGEND

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- EXISTING EASEMENT LINE
- PROPOSED R/W LINE
- SLOPE LIMIT



SCALE:
1" = 200' HORIZ
1" = 40' VERT

PRELIMINARY

	REVISIONS	DATE	BY	DESIGNED NLA
				DRAWN NLA
				CHECKED
				APPROVED

ONE INCH AT FULL SCALE, IF NOT, SCALE ACCORDINGLY

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JOB No. 564-5795-015
DATE March 2019

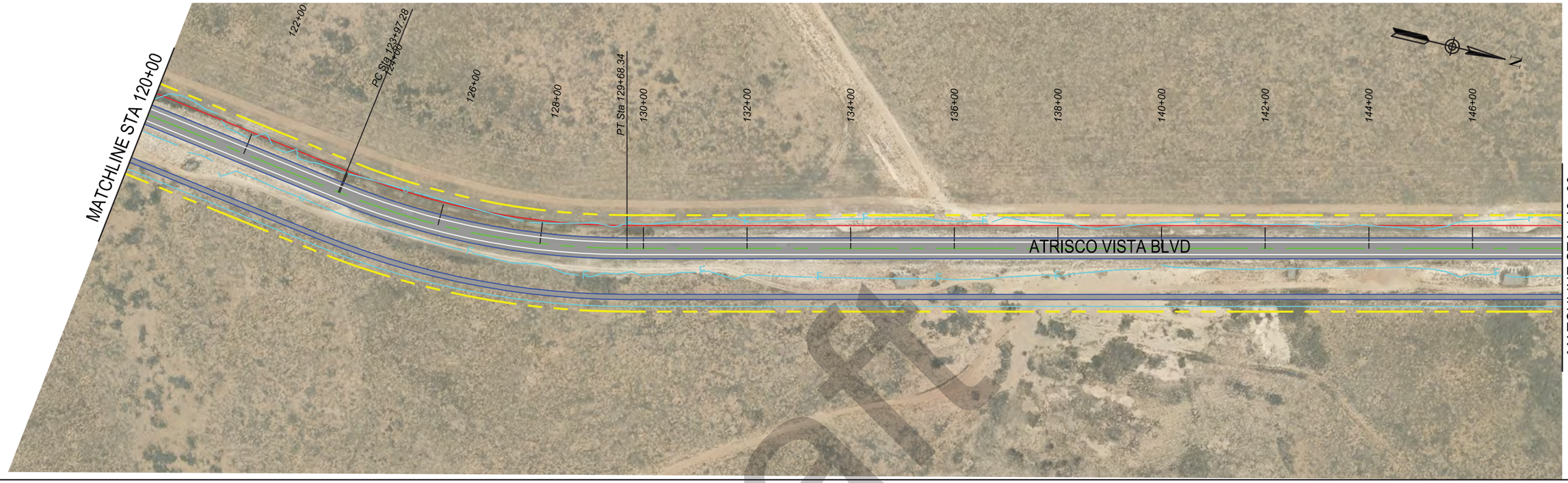
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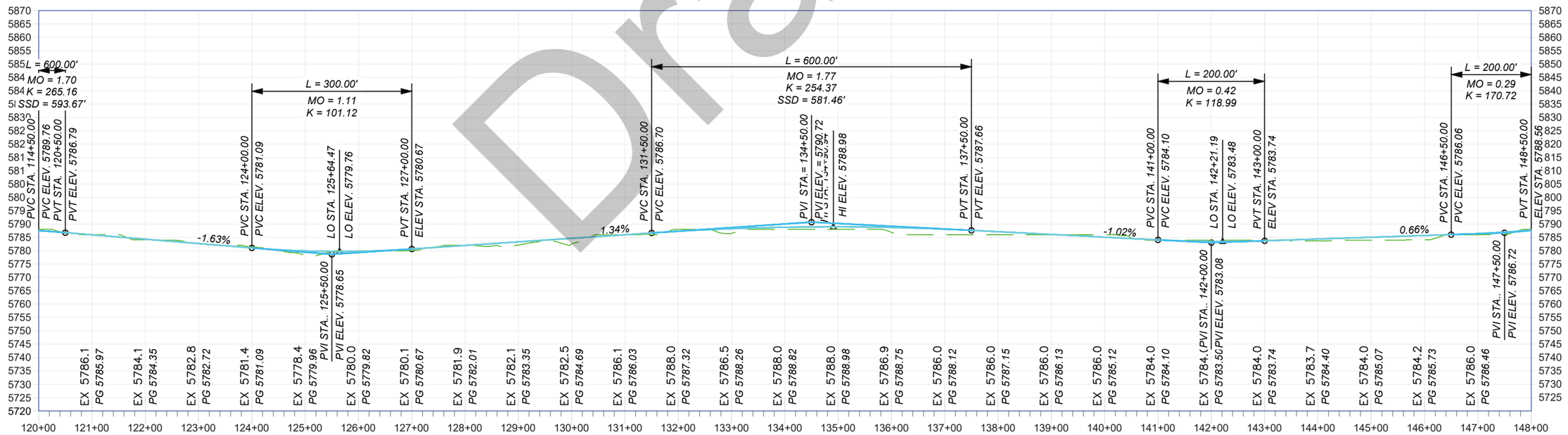
PROJECT NAME
ATRISCO VISTA BOULEVARD
PHASE A/B STUDY

OPTION 2D PLAN & PROFILE DOUBLE EAGLE ROAD TO PASEO DEL NORTE

DRAWING NO.
1 OF 3
C2-1

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LAYOUT: 1





SCALE:
1" = 200' HORIZ
1" = 40' VERT

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	REVISIONS	DATE	BY

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FILE NAME AVP2D3
JOB No. 564-5795-015
DATE March 2019

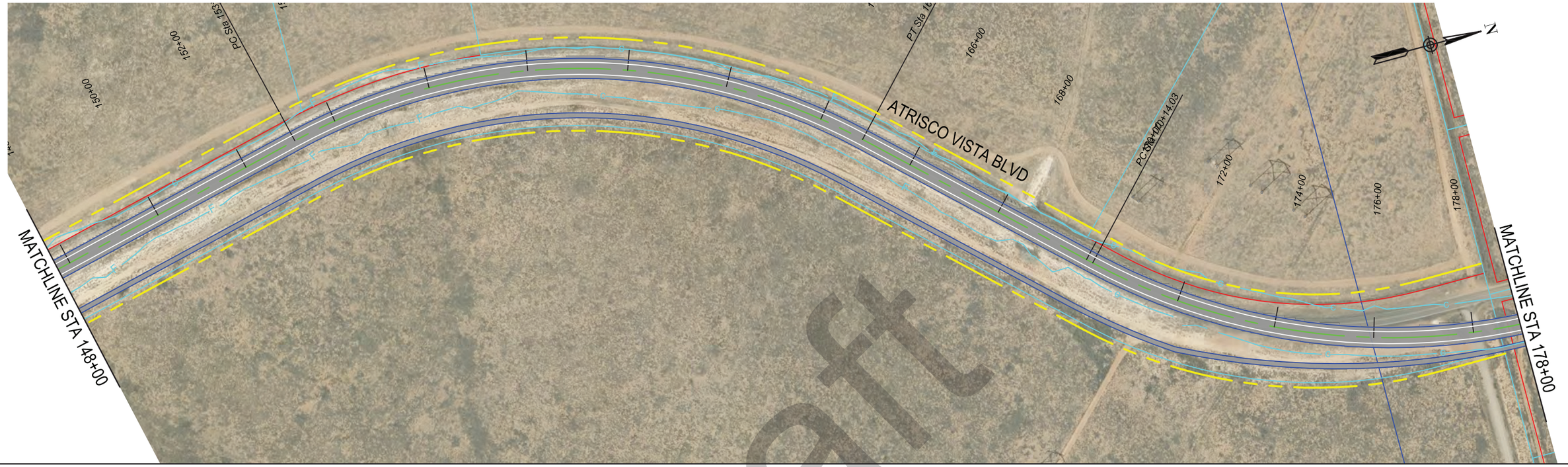
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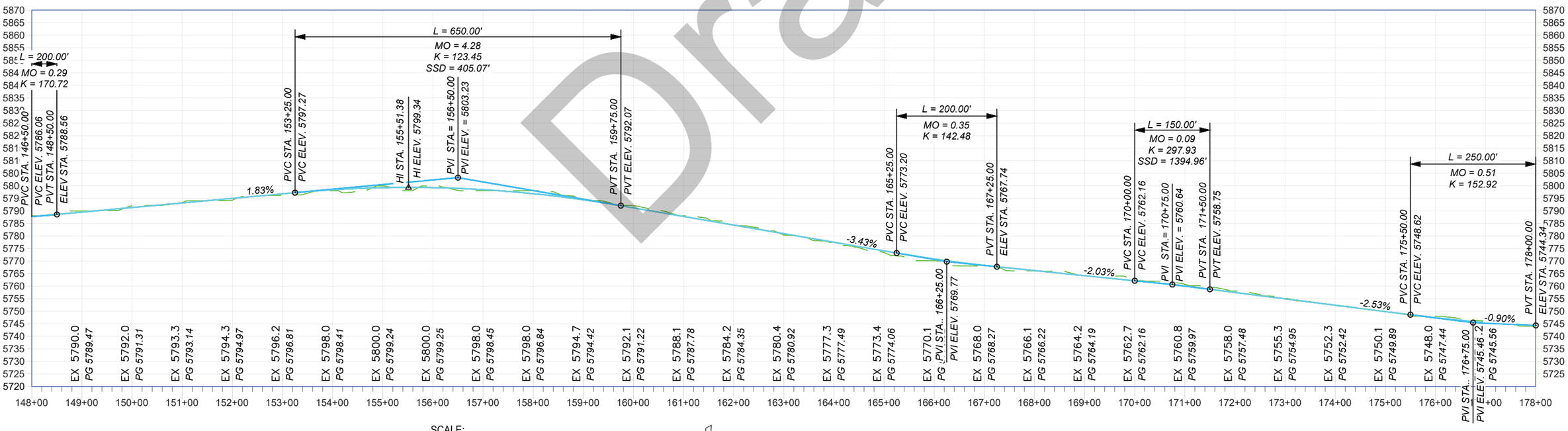
PROJECT NAME
ATRISCO VISTA BOULEVARD
PHASE A/B STUDY

OPTION 2D PLAN & PROFILE DOUBLE EAGLE ROAD TO PASEO DEL NORTE

DRAWING NO. 2 OF 3
C2-2

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SCALE:
1" = 200' HORIZ
1" = 40' VERT

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FILE NAME: AVP2D3
JOB No.: 564-5795-015
DATE: March 2019

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ATRISCO VISTA BOULEVARD
PHASE A/B STUDY

OPTION 2D PLAN & PROFILE DOUBLE EAGLE ROAD TO PASEO DEL NORTE

DRAWING NO.
3 OF 3
C2-3

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APPENDIX B

CROSS SECTIONS

ATRISCO VISTA BOULEVARD PHASE A/B STUDY

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XS01

DRAWING NO. 1 OF 12

CROSS SECTIONS

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DRAWING NO. 2 OF 12

CROSS SECTIONS

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BY	DATE	REASONS

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CROSS SECTIONS

PROJECT NAME

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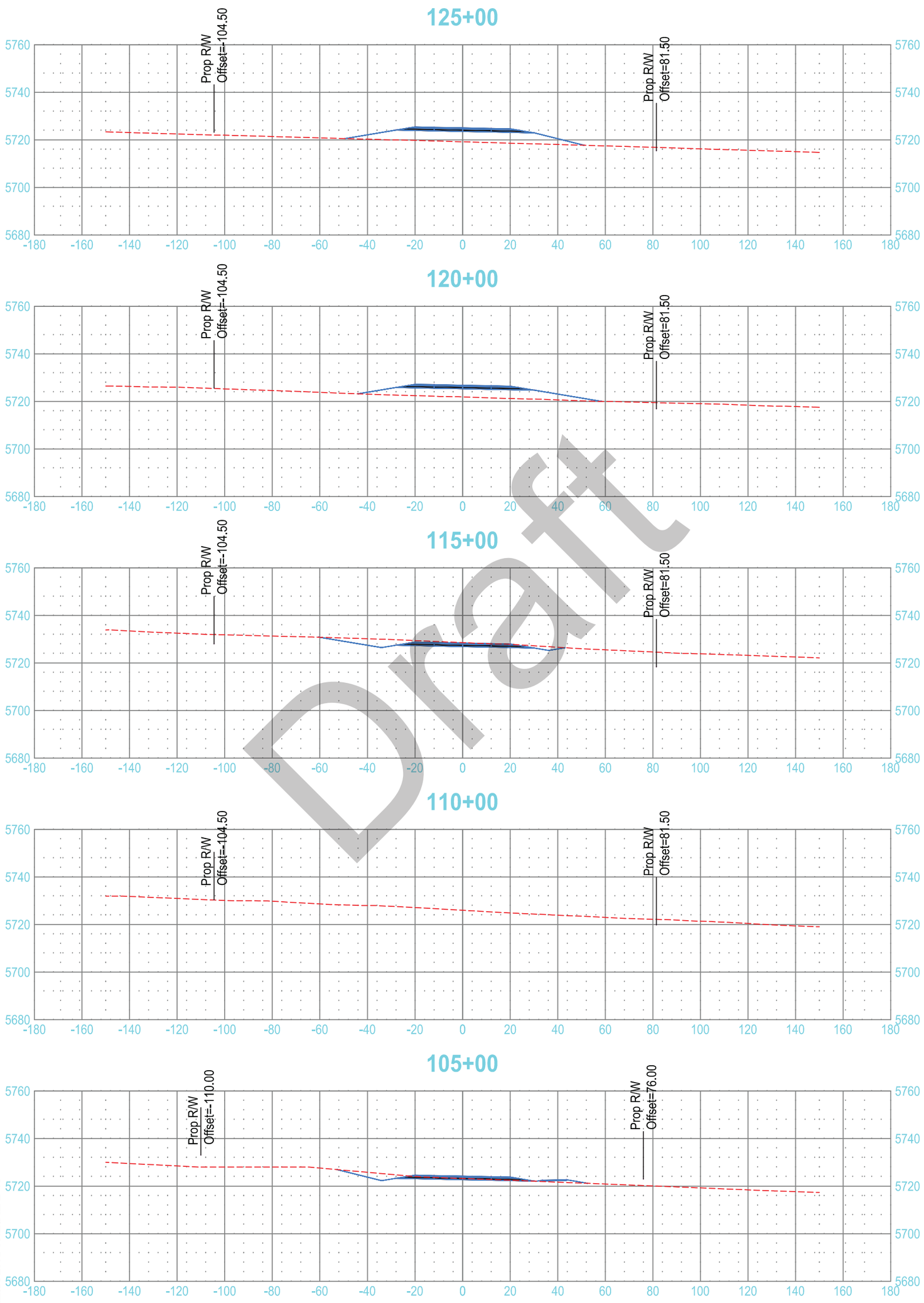
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DRAWING NO. 5 OF 12

CROSS SECTIONS

PROJECT NAME

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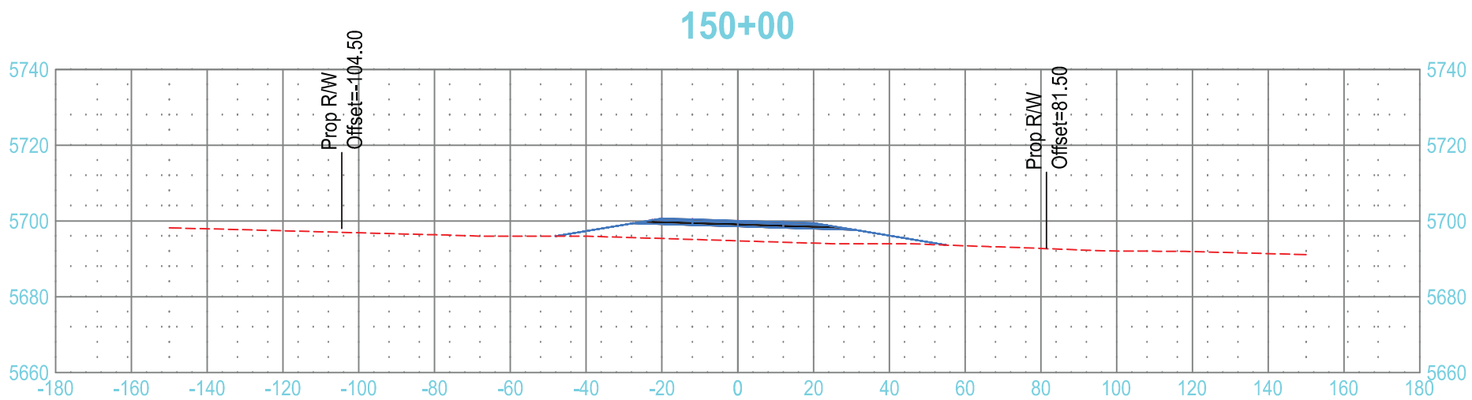
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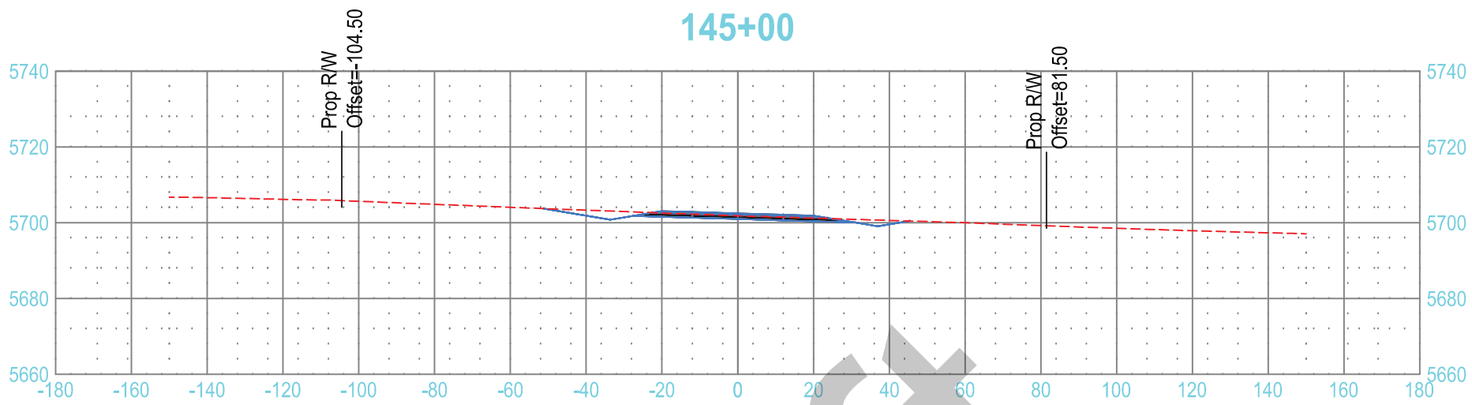
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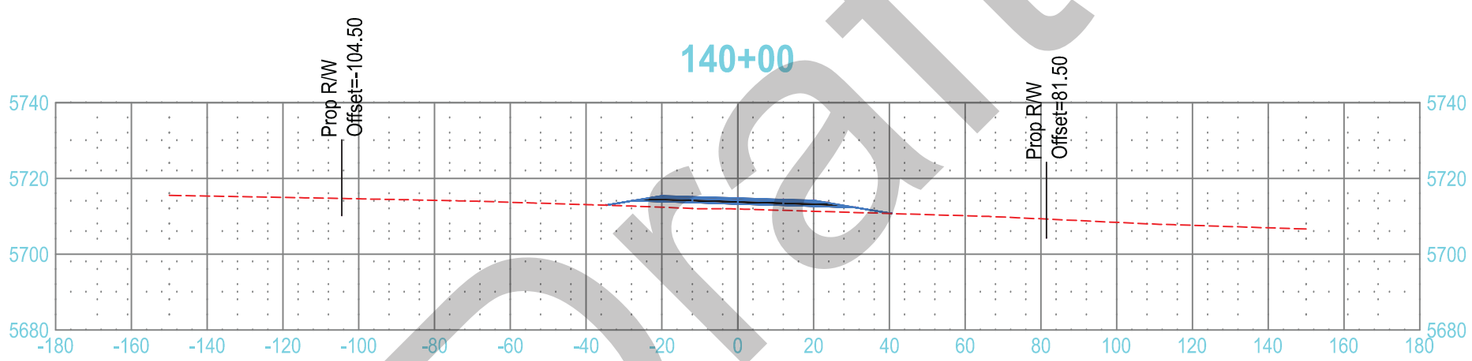
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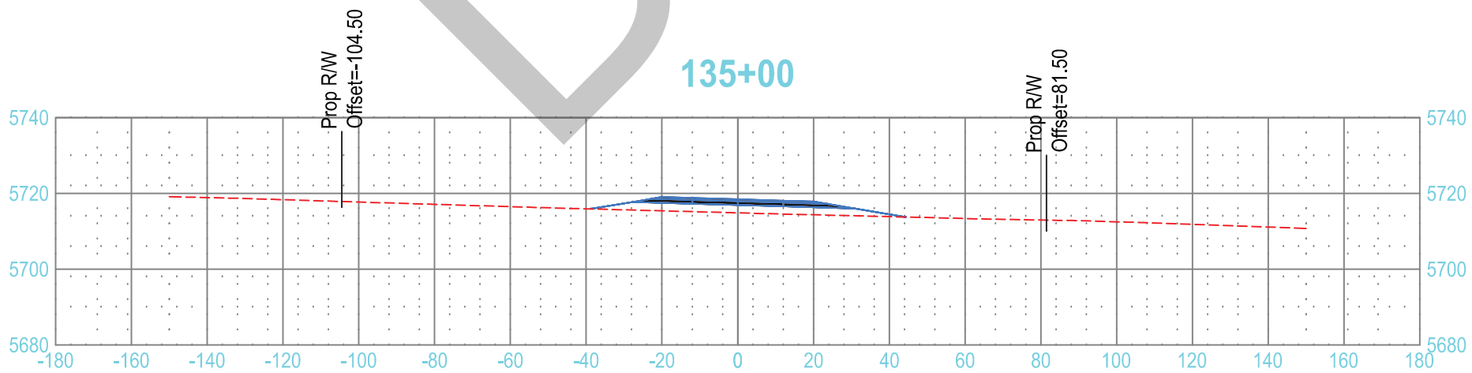
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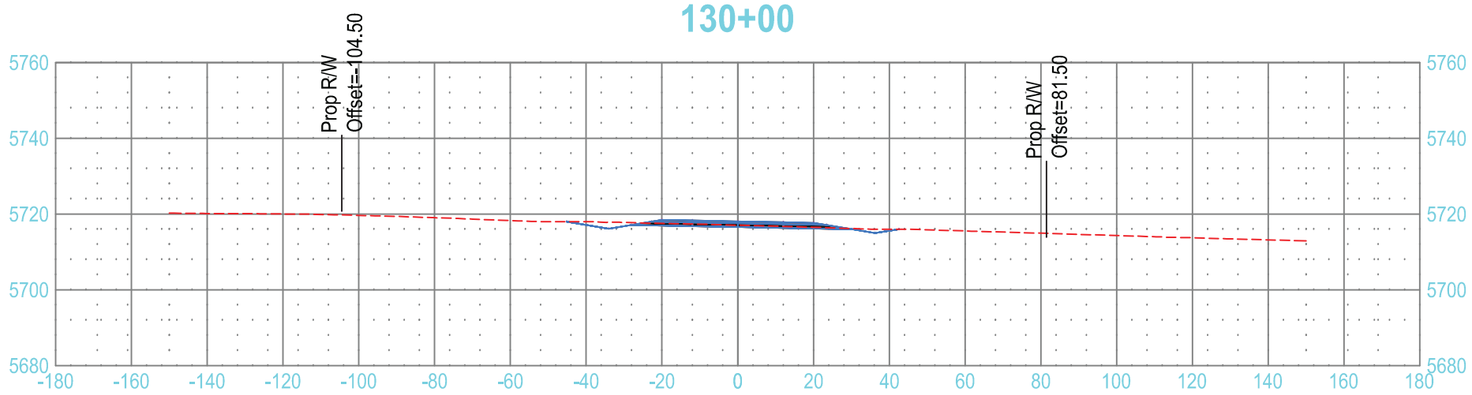
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CROSS SECTIONS

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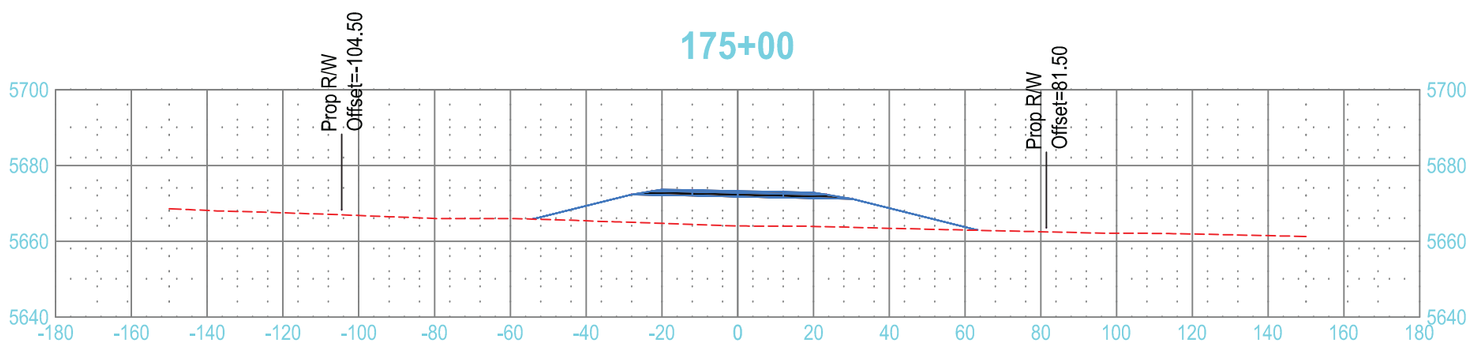
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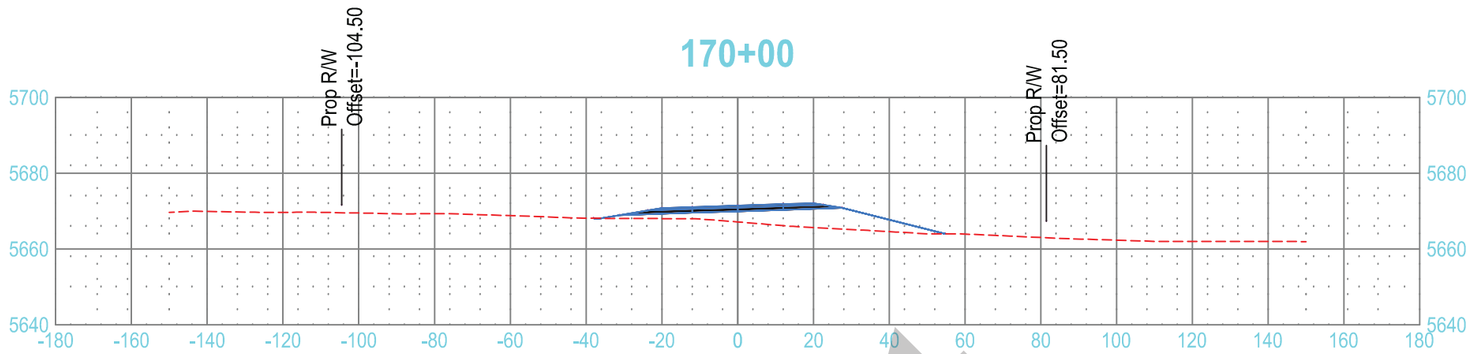
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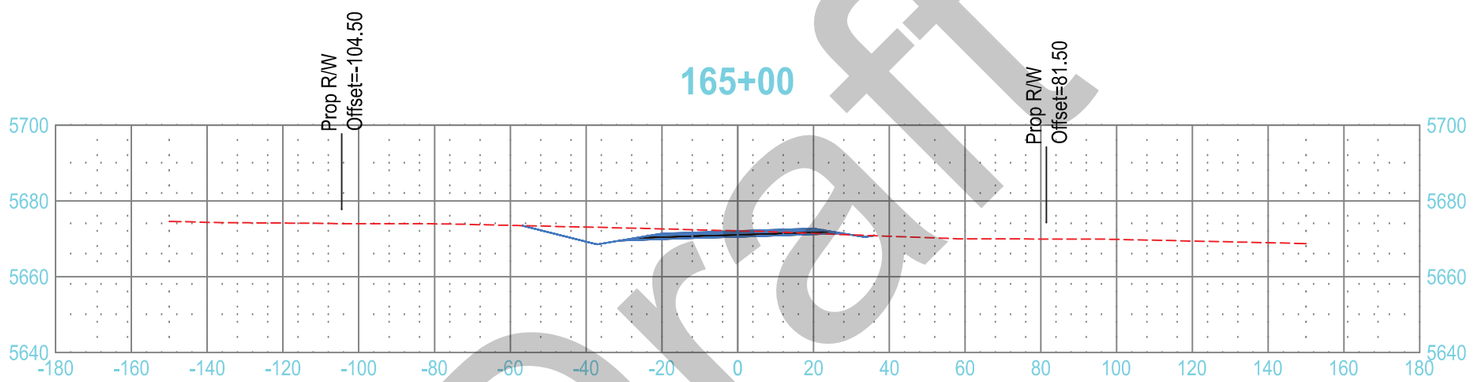
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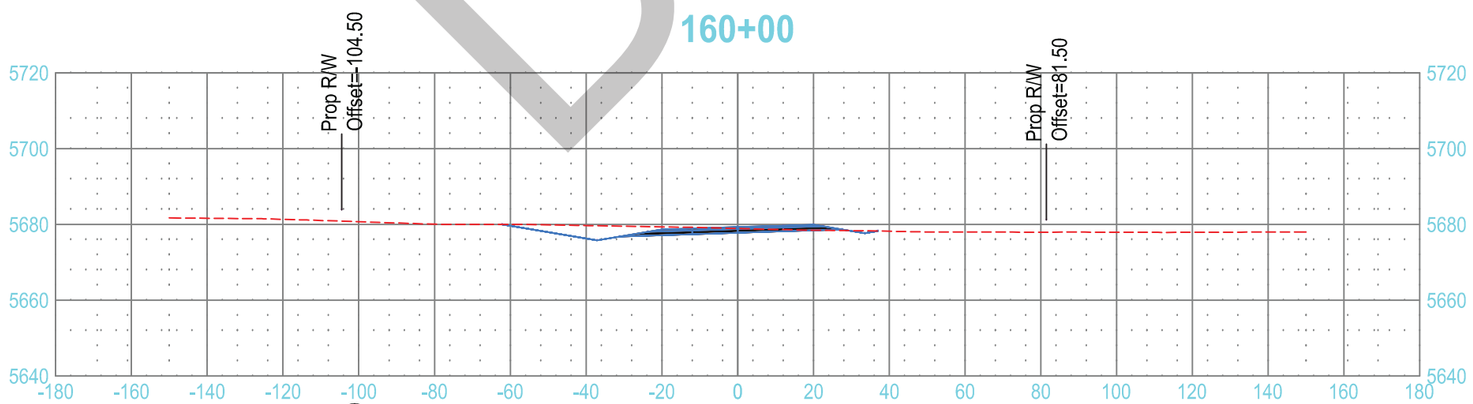
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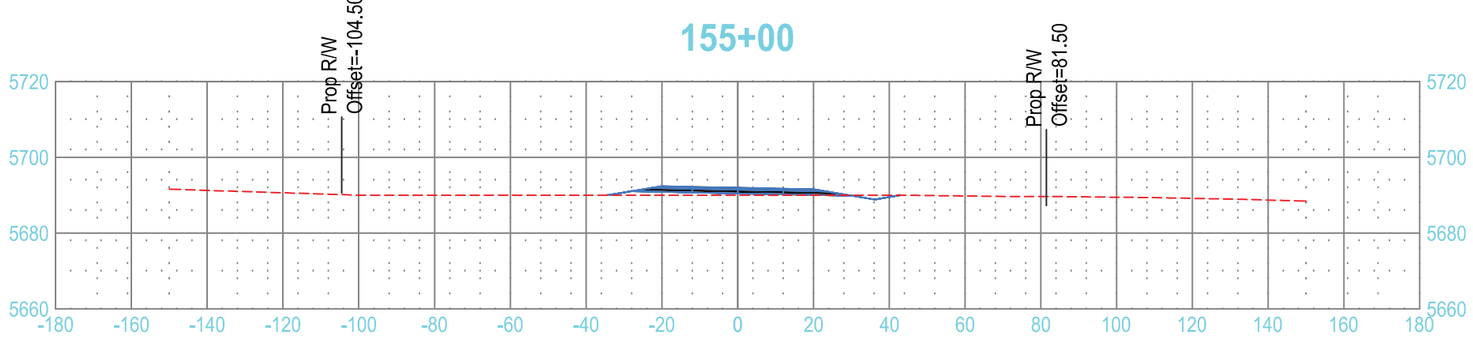
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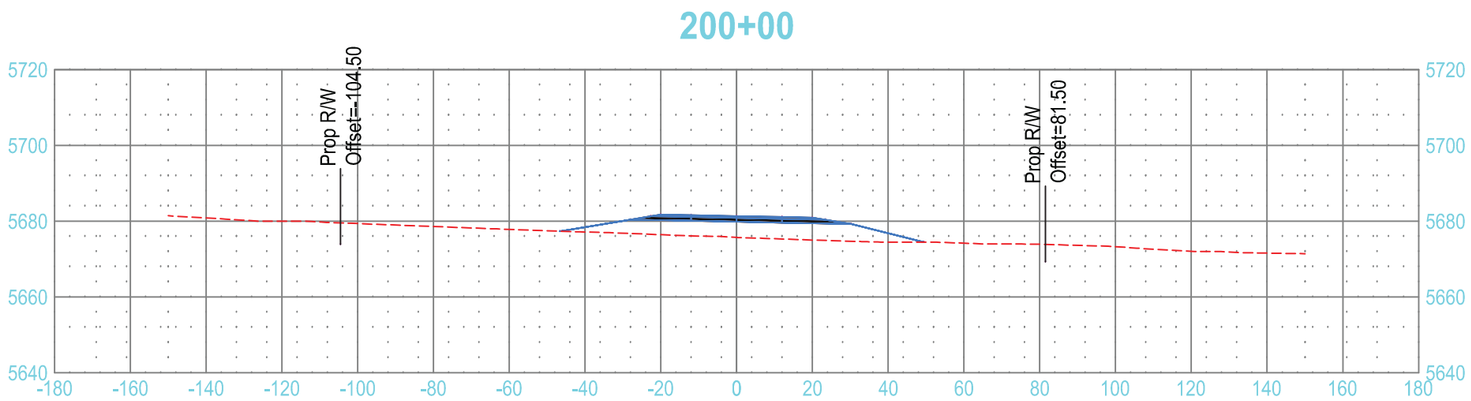
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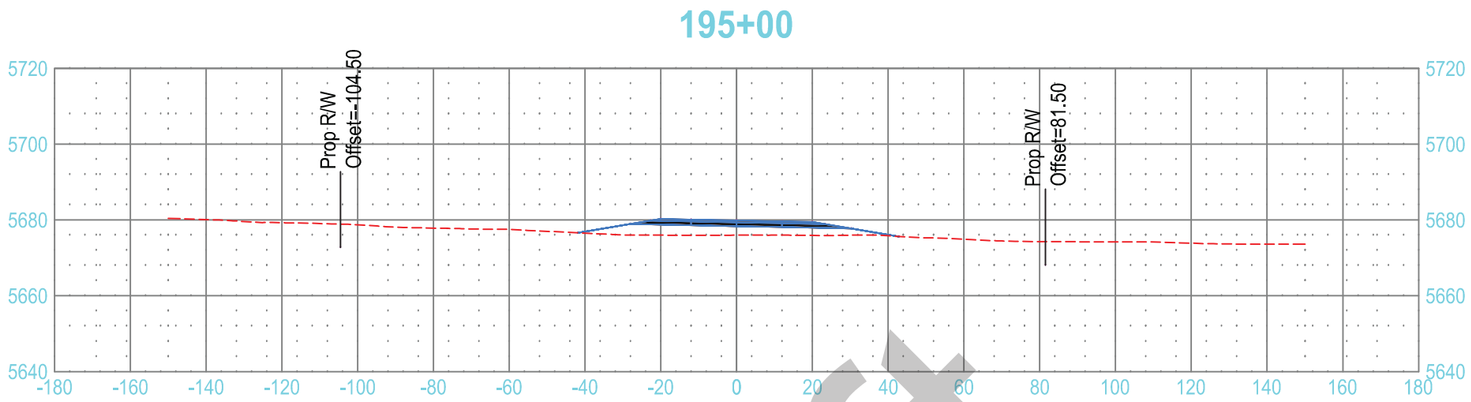
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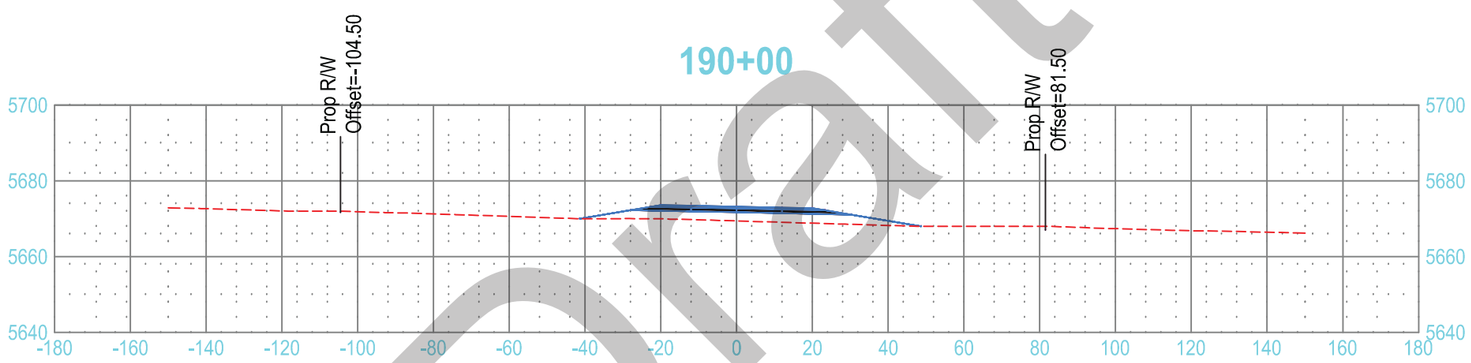
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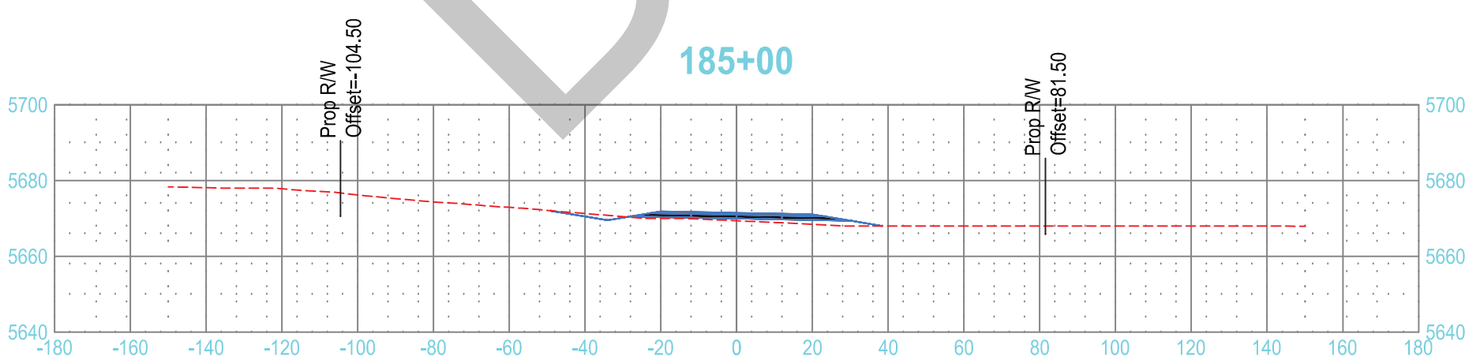
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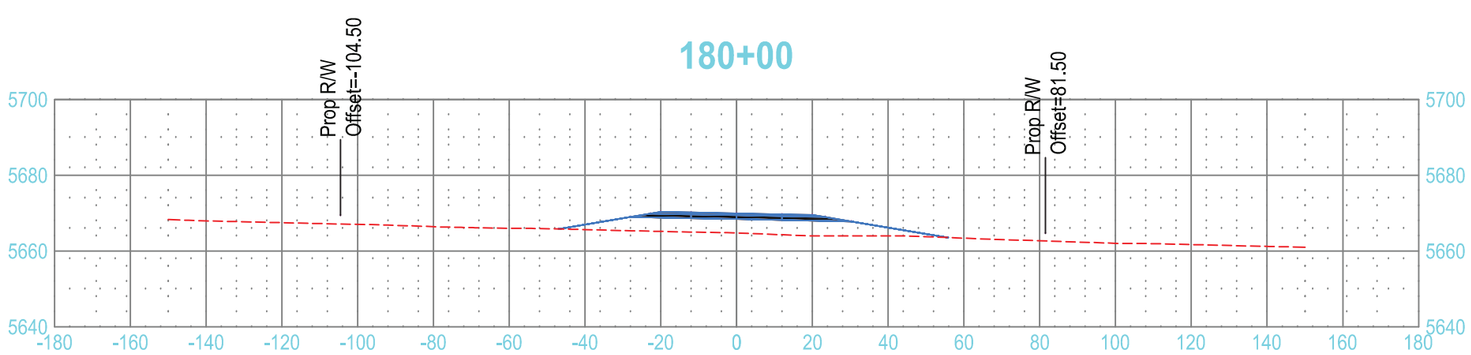
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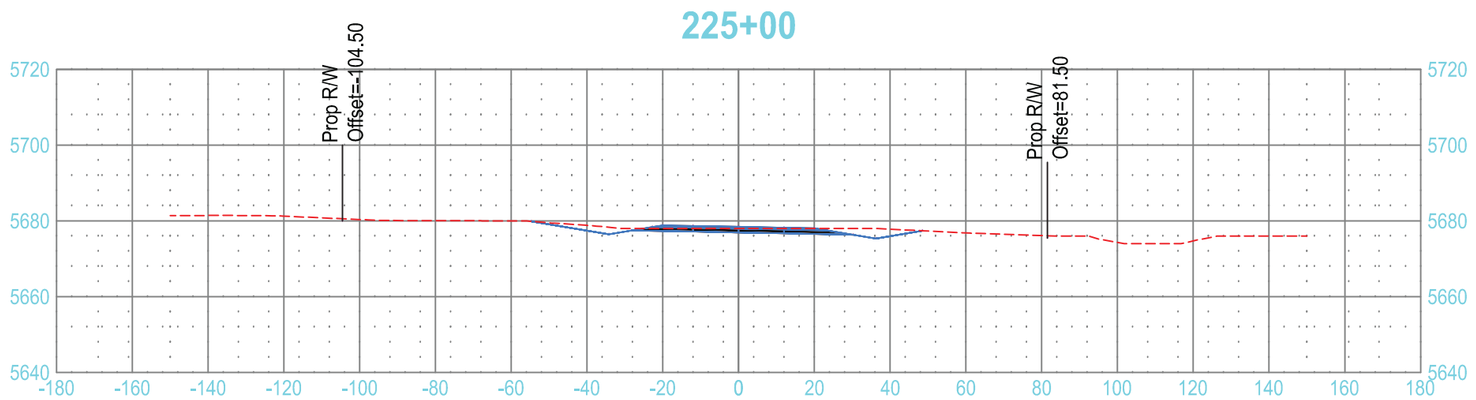
PROJECT NAME
ATRISCO VISTA BOULEVARD
PHASE A/B STUDY

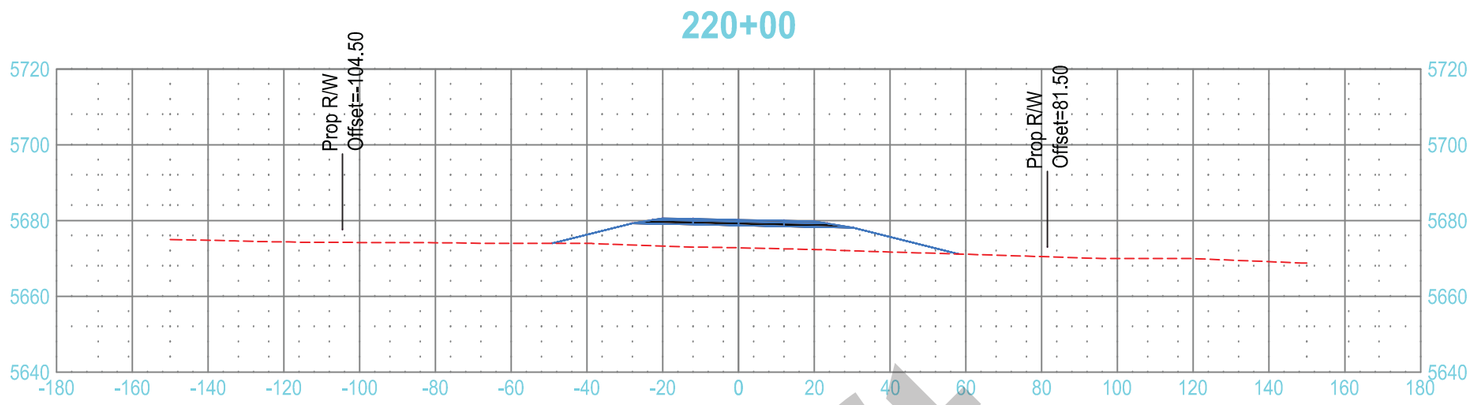
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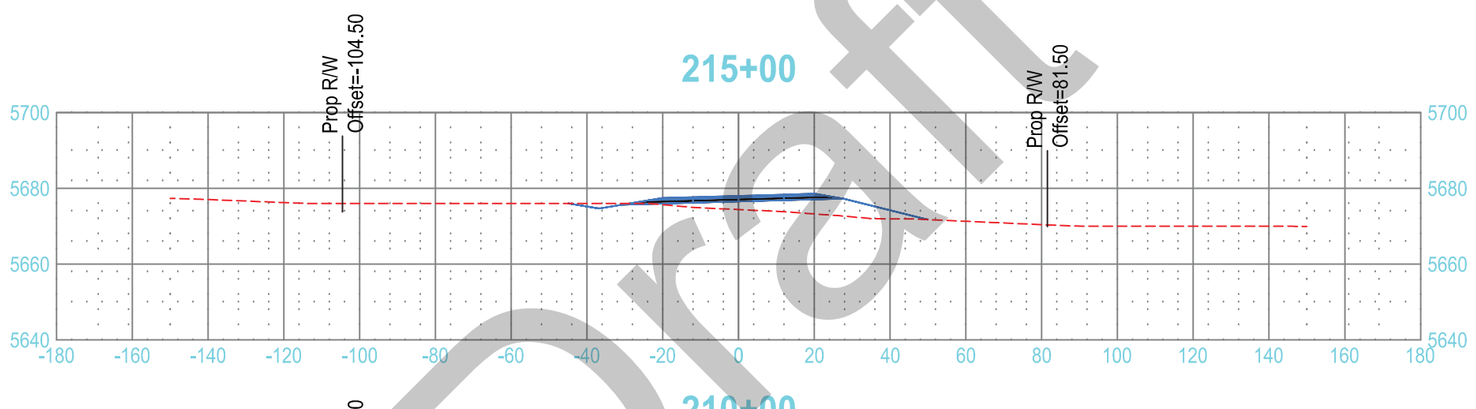
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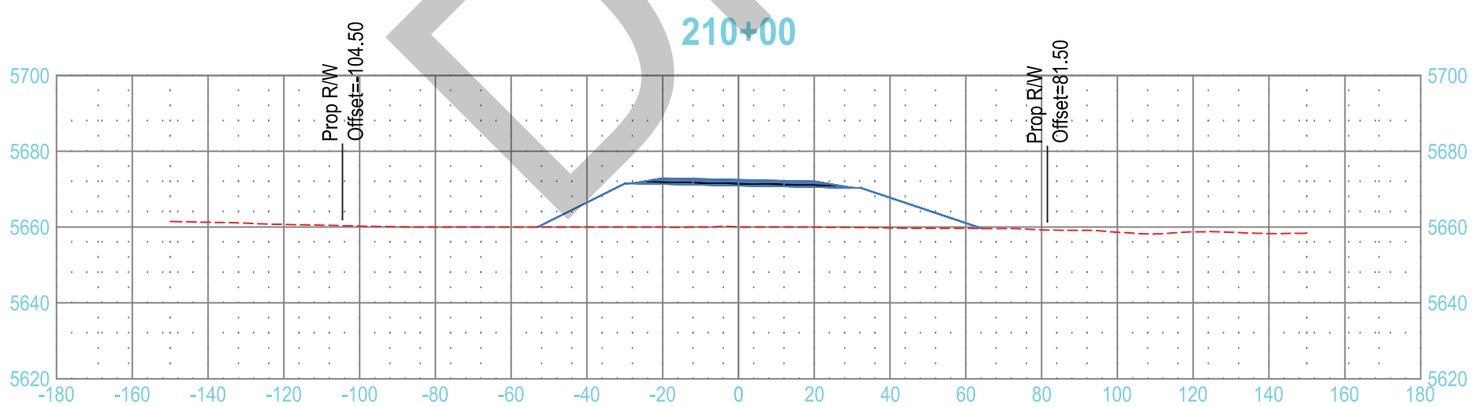
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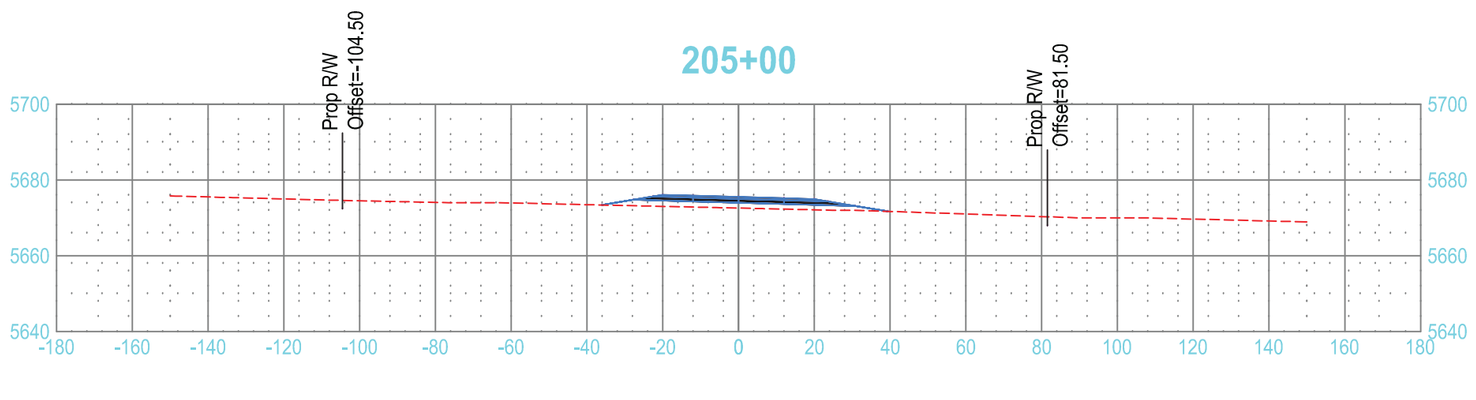
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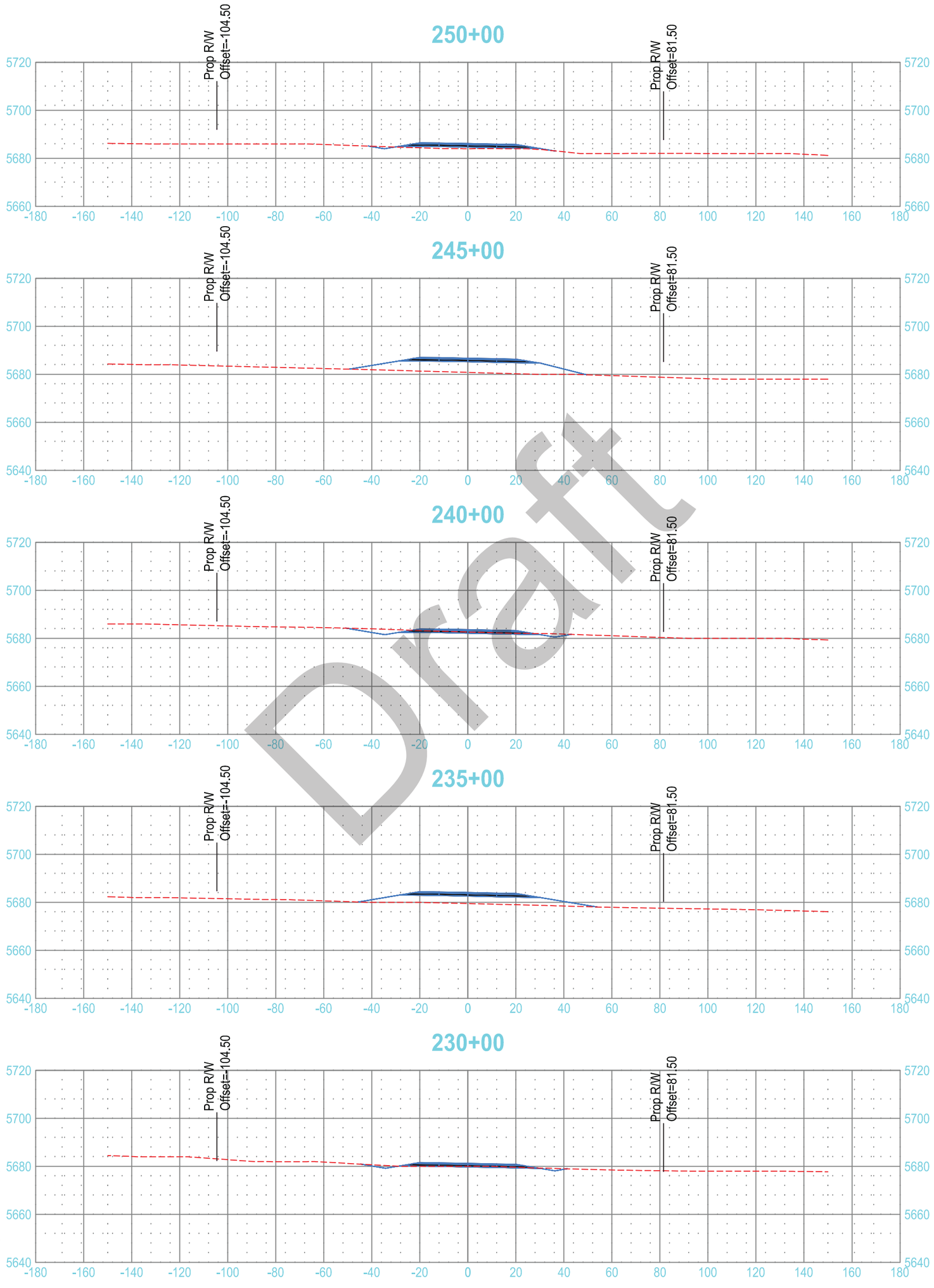
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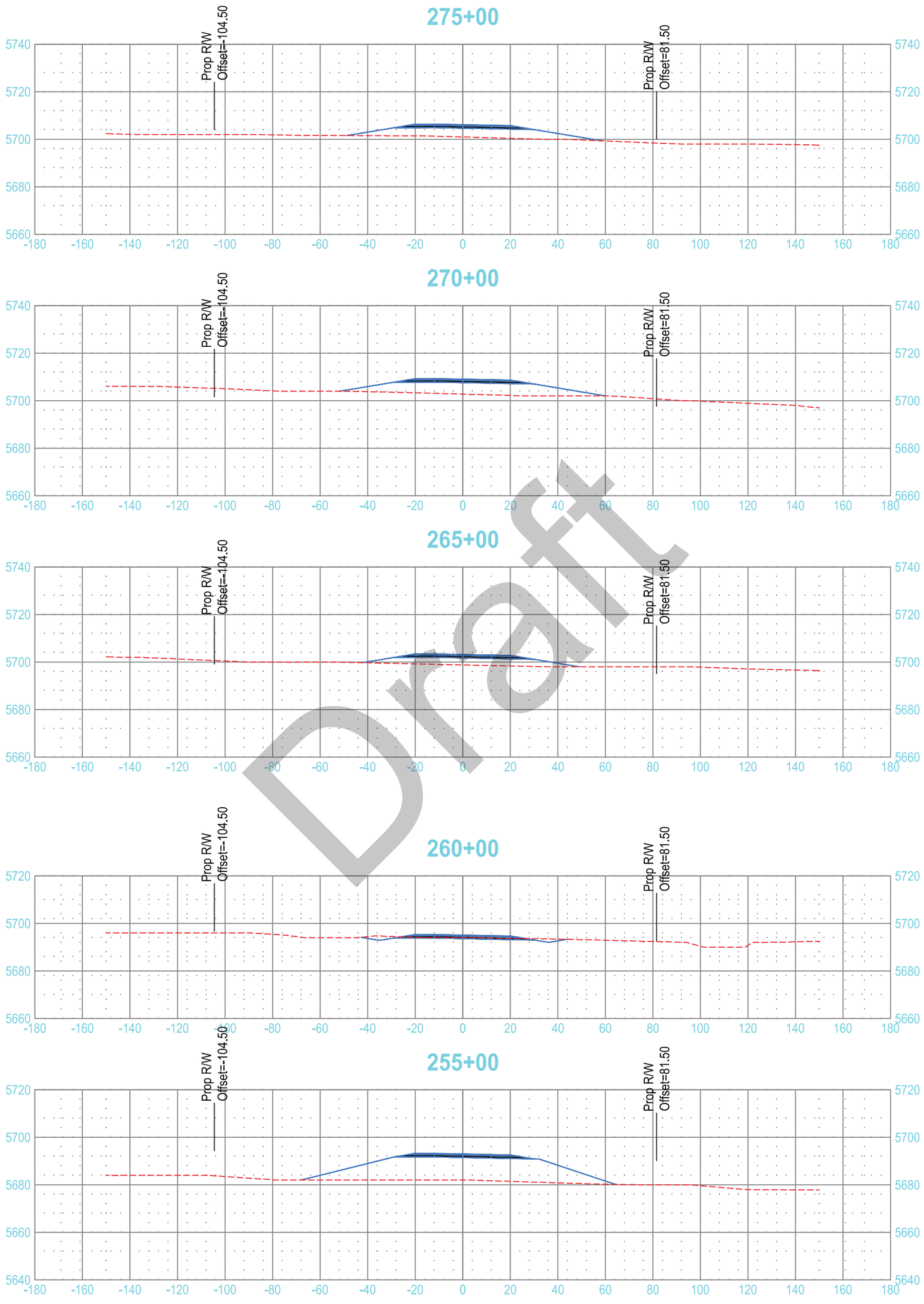
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XS11	11 12

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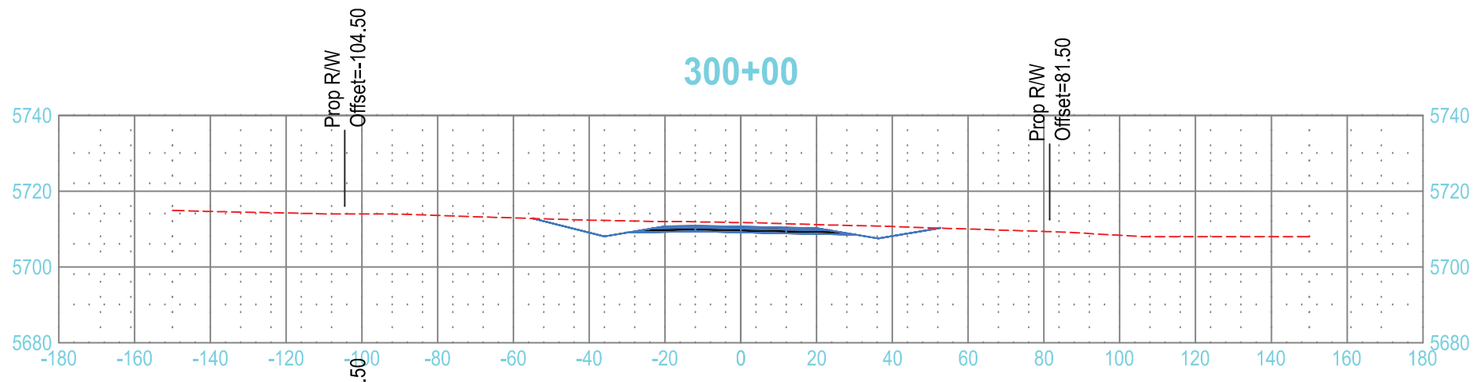
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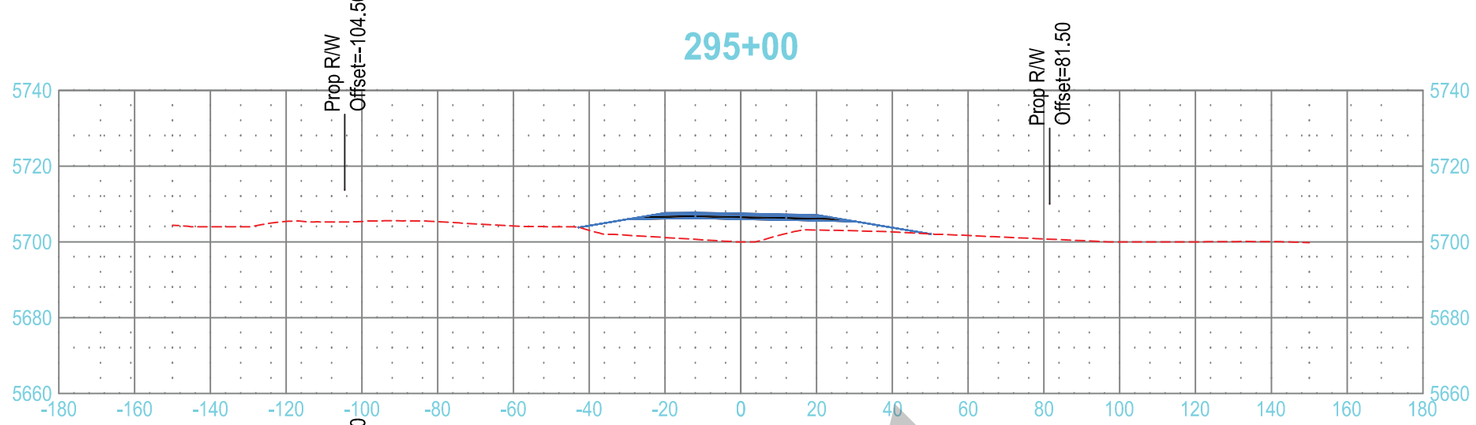
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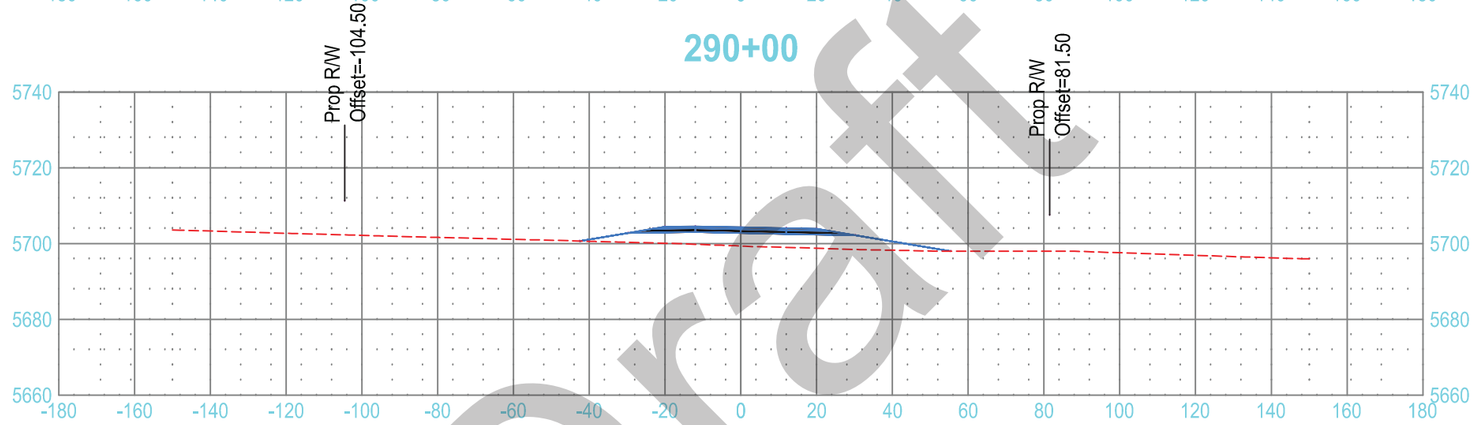
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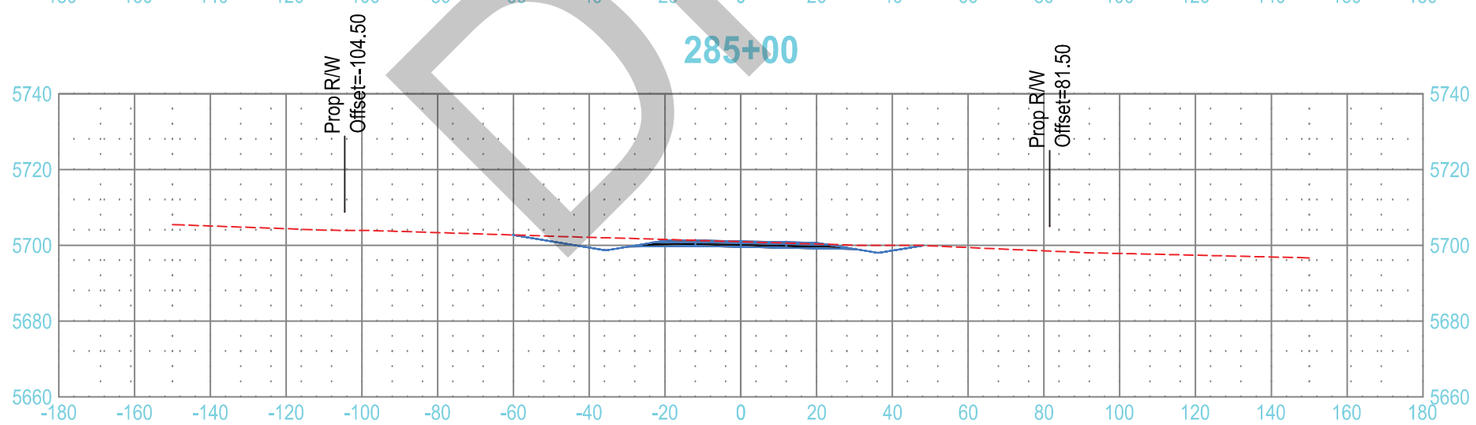
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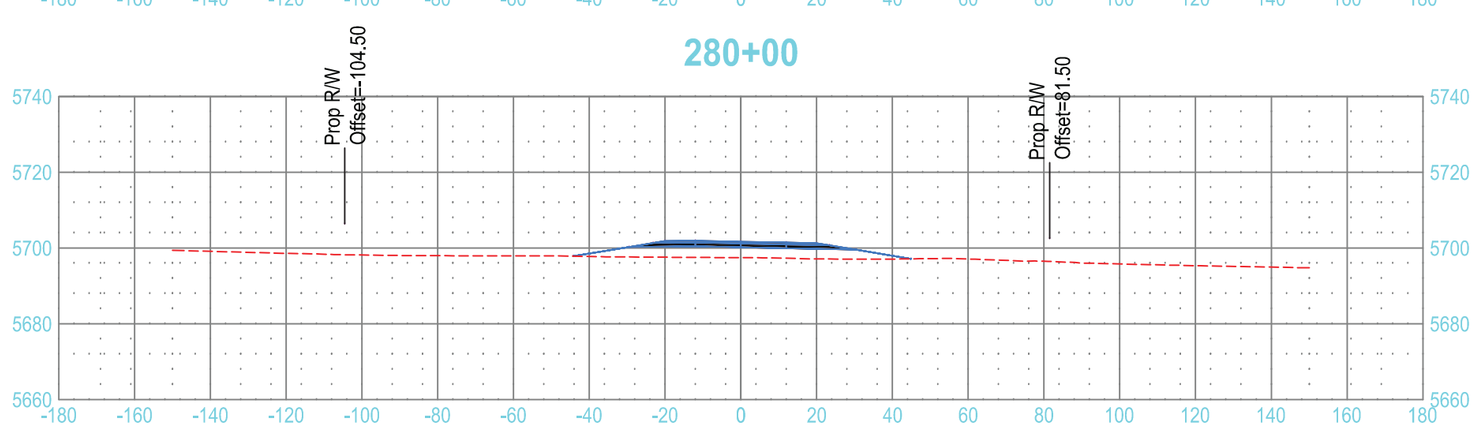
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PROJECT NAME

ATRISCO VISTA BOULEVARD

PHASE A/B STUDY

Parametrix
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DATE	DESIGNED	CHECKED
MARCH 2019	NLA	
JOB No. 564-5795-015	DRAWN NLA	APPROVED

ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY

REVISIONS	DATE	BY

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APPENDIX C

COST ESTIMATES

ATRISCO VISTA BOULEVARD PHASE A/B STUDY



Phase B Cost Estimates

Atrisco Vista Boulevard - 20-Year Design 2-Lane Road					
Alternative 2 with Option 2C: Offset Roadway				Length of Project (Ft)	30600
New 2-lane road with 8' shoulders and 10' trail				(Mi)	5.80
Item	Description	Unit	Quantity	Unit Cost	Estimated Cost
ROADWAY					
201000	CLEARING AND GRUBBING	LS	1	0.5%	$93,900
203000	UNCLASSIFIED EXCAVATION	CU YD	59,250	$8.00	$474,000
203100	BORROW	CU YD	151,100	$12.00	$1,813,200
601000	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$5,000	$5,000
601110	REMOVAL OF SURFACING	SQ YD	29,400	$6.00	$176,400
603050	CLEAN WATER ACT COMPLIANCE WORK PLAN	ALOW	1	$10,000	$10,000
603261	MULCH SOCKS	LF	30,600	$2.00	$61,200
606001	SINGLE FACE W-BEAM GUARDRAIL	LF	2400	$40.00	$96,000
606011	SINGLE FACE THRIE-BEAM GUARDRAIL	LF	600	$40.00	$24,000
606052	END TREATMENT TL-2 END TERMINAL	EACH	12	$3,200.00	$38,400
606053	END TREATMENT W-BEAM END ANCHOR	EACH	12	$1,300.00	$15,600
607004	BARBED WIRE FENCE 4'	LF	61,200	$6.50	$397,800
618000	TRAFFIC CONTROL MANAGEMENT	LS	1	0.5%	$93,900
621000	MOBILIZATION	LS	1	10.0%	$1,878,000
702810	TRAFFIC CONTROL DEVICES FOR CONSTRUCTION	LS	1	0.5%	$93,900
801000	CONSTRUCTION STAKING BY THE CONTRACTOR	LS	1	2.0%	$375,600
802000	POST CONSTRUCTION PLANS	LS	1	$50,000	$50,000
901000	CONTRACTOR PROCESS QUALITY CONTROL	LS	1	$180,000	$180,000
2-LANE	ATRISCO VISTA BLVD 2-LANE ROADWAY SECTION	MI	5.80	$1,294,400	$7,501,636
TRAIL	10' ASPHALT TRAIL	MI	2.05	$125,200	$256,091
LIGHTING	INTERSECTION LIGHTING	LS		$250,000	$0
SIGNING	PERMANENT SIGNING	MI	5.80	$10,000	$57,955
UTILITIES	UTILITY RELOCATIONS	LS	1	0.5%	$93,900
				ROADWAY SUBTOTAL	**$13,786,482**
DRAINAGE & STRUCTURES					
511030	STRUCTURAL CONCRETE, CLASS AA	CU YD	2000	$910.00	$1,820,000
540060	REINFORCING BARS GRADE 60	LBS	475,300	$1.40	$665,420
570018	18" CULVERT PIPE	LF	230	$70.00	$16,100
570019	18" CULVERT PIPE END SECTION	EACH	2	$500.00	$1,000
570024	24" CULVERT PIPE	LF	575	$100.00	$57,500
570025	24" CULVERT PIPE END SECTION	EACH	5	$600.00	$3,000
570030	30" CULVERT PIPE	LF	4680	$115.00	$538,200
570031	30" CULVERT PIPE END SECTION	EACH	84	$900.00	$75,600
570036	36" CULVERT PIPE	LF	1380	$175.00	$241,500
570037	36" CULVERT PIPE END SECTION	EACH	12	$1,100.00	$13,200
570042	42" CULVERT PIPE	LF	575	$190.00	$109,250
570043	42" CULVERT PIPE END SECTION	EACH	5	$2,500.00	$12,500
570060	60" CULVERT PIPE	LF	230	$275.00	$63,250
570061	60" CULVERT PIPE END SECTION	EACH	4	$3,900.00	$15,600
602000	RIPRAP CLASS A	CU YD	350	$216.00	$75,600
BRIDGE	NEW BRIDGE	SQ FT	10,720	$150.00	$1,608,000
				DRAINAGE & STRUCTURES SUBTOTAL	**$5,315,720**
				ROADWAY & DRAINAGE SUBTOTAL	$19,102,202
				CONTINGENCY (20%)	$3,820,440
				SUBTOTAL	$22,922,642
ENGINEERING					
	ENGINEERING (DESIGN)			8%	$1,833,811
	CONSTRUCTION MANAGEMENT			11%	$2,521,491
				CONSTRUCTION SUBTOTAL	$27,277,944
RIGHT-OF-WAY					
	UNDEVELOPED	AC	121	$10,000	$1,210,000
	DEVELOPED	AC			$0
	ROW ACQUISTION (MAPS, APPRAISALS, ETC)	LUMP		15%	$181,500
				RIGHT-OF-WAY SUBTOTAL	$1,391,500
				PROJECT TOTAL	**$28,669,444**
				NMGRT (7.094% AVERAGE)	$2,033,810
				PROJECT TOTAL WITH NMGRT	$30,703,255

Draft

Phase B Cost Estimates

Atrisco Vista Boulevard - 20-Year Design 2-Lane Roac					
Alternative 2 with Option 2D: Existing Atrisco Vista Alignment				Length of Project (Ft)	30600
New 2-lane road with 8' shoulders and 10' trail				(Mi)	5.80
Item	Description	Unit	Quantity	Unit Cost	Estimated Cost
ROADWAY					
201000	CLEARING AND GRUBBING	LS	1	0.5%	$90,300
203000	UNCLASSIFIED EXCAVATION	CU YD	69,900	$8.00	$559,200
203100	BORROW	CU YD	90,100	$12.00	$1,081,200
601000	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$5,000	$5,000
601110	REMOVAL OF SURFACING	SQ YD	29,400	$6.00	$176,400
603050	CLEAN WATER ACT COMPLIANCE WORK PLAN	ALOW	1	$10,000	$10,000
603261	MULCH SOCKS	LF	30,600	$2.00	$61,200
606001	SINGLE FACE W-BEAM GUARDRAIL	LF	2400	$40.00	$96,000
606011	SINGLE FACE THRIE-BEAM GUARDRAIL	LF	600	$40.00	$24,000
606052	END TREATMENT TL-2 END TERMINAL	EACH	12	$3,200.00	$38,400
606053	END TREATMENT W-BEAM END ANCHOR	EACH	12	$1,300.00	$15,600
607004	BARBED WIRE FENCE 4'	LF	61,200	$6.50	$397,800
618000	TRAFFIC CONTROL MANAGEMENT	LS	1	0.5%	$90,300
621000	MOBILIZATION	LS	1	10.0%	$1,804,200
702810	TRAFFIC CONTROL DEVICES FOR CONSTRUCTION	LS	1	0.5%	$90,300
801000	CONSTRUCTION STAKING BY THE CONTRACTOR	LS	1	2.0%	$360,900
802000	POST CONSTRUCTION PLANS	LS	1	$50,000	$50,000
901000	CONTRACTOR PROCESS QUALITY CONTROL	LS	1	$180,000	$180,000
2-LANE	ATRISCO VISTA BLVD 2-LANE ROADWAY SECTION	MI	5.80	$1,294,400	$7,501,636
TRAIL	10' ASPHALT TRAIL	MI	2.05	$125,200	$256,091
LIGHTING	INTERSECTION LIGHTING	LS		$250,000	$0
SIGNING	PERMANENT SIGNING	MI	5.80	$10,000	$57,955
UTILITIES	UTILITY RELOCATIONS	LS	1	0.5%	$90,300
				ROADWAY SUBTOTAL	**$13,036,782**
DRAINAGE & STRUCTURES					
511030	STRUCTURAL CONCRETE, CLASS AA	CU YD	2000	$910.00	$1,820,000
540060	REINFORCING BARS GRADE 60	LBS	475,300	$1.40	$665,420
570018	18" CULVERT PIPE	LF	230	$70.00	$16,100
570019	18" CULVERT PIPE END SECTION	EACH	2	$500.00	$1,000
570024	24" CULVERT PIPE	LF	575	$100.00	$57,500
570025	24" CULVERT PIPE END SECTION	EACH	5	$600.00	$3,000
570030	30" CULVERT PIPE	LF	4680	$115.00	$538,200
570031	30" CULVERT PIPE END SECTION	EACH	84	$900.00	$75,600
570036	36" CULVERT PIPE	LF	1380	$175.00	$241,500
570037	36" CULVERT PIPE END SECTION	EACH	12	$1,100.00	$13,200
570042	42" CULVERT PIPE	LF	575	$190.00	$109,250
570043	42" CULVERT PIPE END SECTION	EACH	5	$2,500.00	$12,500
570060	60" CULVERT PIPE	LF	230	$275.00	$63,250
570061	60" CULVERT PIPE END SECTION	EACH	4	$3,900.00	$15,600
602000	RIPRAP CLASS A	CU YD	350	$216.00	$75,600
BRIDGE	NEW BRIDGE	SQ FT	10,720	$150.00	$1,608,000
				DRAINAGE & STRUCTURES SUBTOTAL	**$5,315,720**
				ROADWAY & DRAINAGE SUBTOTAL	$18,352,502
				CONTINGENCY (20%)	$3,670,500
				SUBTOTAL	$22,023,002
ENGINEERING					
	ENGINEERING (DESIGN)			8%	$1,761,840
	CONSTRUCTION MANAGEMENT			11%	$2,422,530
				CONSTRUCTION SUBTOTAL	$26,207,373
RIGHT-OF-WAY					
	UNDEVELOPED	AC	119	$10,000	$1,190,000
	DEVELOPED	AC			$0
	ROW ACQUISTION (MAPS, APPRAISALS, ETC)	LUMP		15%	$178,500
				RIGHT-OF-WAY SUBTOTAL	$1,368,500
				PROJECT TOTAL	**$27,575,873**
				NMGRT (7.094% AVERAGE)	$1,956,232
				PROJECT TOTAL WITH NMGRT	$29,532,105

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Phase B Cost Estimates

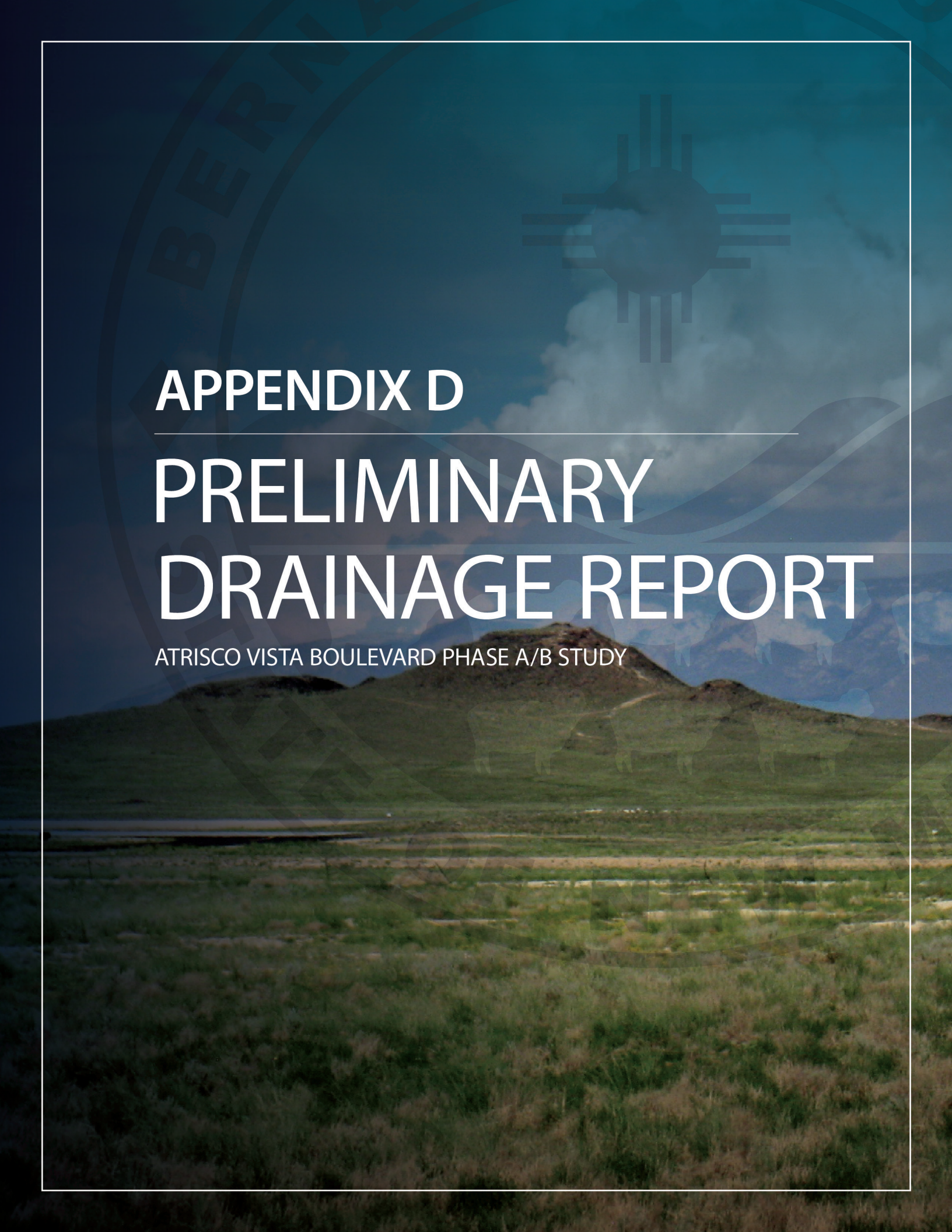
Southern Boulevard					
20th Street to Atlantic Road				Length of Project (Ft)	13600
Reconstruct to 3-lane arterial with new bridge at Calabacillas				(Mi)	2.58
Item	Description	Unit	Quantity	Unit Cost	Estimated Cost
ROADWAY					
201000	CLEARING AND GRUBBING	LS	1	1.0%	$61,300
203000	UNCLASSIFIED EXCAVATION	CU YD	47000	$8.00	$376,000
203100	BORROW	CU YD	13000	$12.00	$156,000
601000	REMOVAL OF STRUCTURES AND OBSTRUCTIONS	LS	1	$355,000	$355,000
601110	REMOVAL OF SURFACING	SQ YD	42400	$6.00	$254,400
603050	CLEAN WATER ACT COMPLIANCE WORK PLAN	ALOW	1	$75,000	$75,000
606001	SINGLE FACE W-BEAM GUARDRAIL	LF	400	$40	$16,000
606011	SINGLE FACE THRIE-BEAM GUARDRAIL	LF	200	$40	$8,000
606052	END TREATMENT TL-2 END TERMINAL	EACH	2	$3,200	$6,400
606053	END TREATMENT W-BEAM END ANCHOR	EACH	2	$1,300	$2,600
608106	DRIVE PAD 6"	SQ YD	700	$65	$45,500
617000	VIBRATION MONITORING	LS	1	$60,000	$60,000
617003	VIDEO TAPING	LS	1	$40,000	$40,000
618000	TRAFFIC CONTROL MANAGEMENT	LS	1	5.0%	$306,100
621000	MOBILIZATION	LS	1	10.0%	$612,100
662400	MANHOLE ADJUSTMENT	EACH	13	$950	$12,350
702810	TRAFFIC CONTROL DEVICES FOR CONSTRUCTION	LS	1	5.0%	$306,100
801000	CONSTRUCTION STAKING BY THE CONTRACTOR	LS	1	3.0%	$183,700
802000	POST CONSTRUCTION PLANS	LS	1	$50,000	$50,000
901000	CONTRACTOR PROCESS QUALITY CONTROL	LS	1	$67,100	$67,100
SOUTHERN WEST	SOUTHERN BLVD ROADWAY SECTION WEST OF CALABACILLAS	MI	1.6	$1,029,300	$1,646,880
SOUTHERN EAST	SOUTHERN BLVD ROADWAY SECTION EAST OF CALABACILLAS	MI	1	$1,406,400	$1,406,400
TRAIL	10' ASPHALT TRAIL	MI	0.3	$125,200.00	$35,568
LIGHTING	INTERSECTION LIGHTING	LS		$250,000	$0
SIGNING	PERMANENT SIGNING	MI	2.58	$10,000	$25,758
LANDSCAPING	LANDSCAPING & FINISH ITEMS	MI	2.58	$100,000	$257,576
UTILITIES	UTILITY RELOCATIONS	LS	1	10.0%	$612,100
				ROADWAY SUBTOTAL	**$6,977,932**
DRAINAGE & STRUCTURES					
570048	48" CULVERT PIPE	LF	100	$200.00	$20,000
570049	48" CULVERT PIPE END SECTION	EACH	2	$2,200.00	$4,400
BRIDGE	NEW BRIDGE	SQ FT	6500	$150.00	$975,000
STORM DRAIN	STORM DRAIN SYSTEM	LS	1	$1,500,000	$1,500,000
				DRAINAGE & STRUCTURES SUBTOTAL	**$2,499,400**
				ROADWAY & DRAINAGE SUBTOTAL	$9,477,332
				CONTINGENCY (30%)	$2,843,199
				SUBTOTAL	$12,320,531
ENGINEERING					
	ENGINEERING (DESIGN)			8%	$985,642
	CONSTRUCTION MANAGEMENT			11%	$1,355,258
				CONSTRUCTION SUBTOTAL	$14,661,432
RIGHT-OF-WAY					
	UNDEVELOPED	AC			
	DEVELOPED	AC			$0
	ROW ACQUISTION (MAPS, APPRAISALS, ETC)	LUMP		15%	$0
				RIGHT-OF-WAY SUBTOTAL	$0
				PROJECT TOTAL	**$14,661,432**
				NMGRT (7.031% AVERAGE)	$1,030,845
				PROJECT TOTAL WITH NMGRT	$15,692,277

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APPENDIX D

PRELIMINARY DRAINAGE REPORT

ATRISCO VISTA BOULEVARD PHASE A/B STUDY



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Atrisco Vista Boulevard
Draft Preliminary Drainage Report

Prepared for

Bernalillo County Public Works Division



Prepared by

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July 2019 |

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Appendix D1 – FIRM Maps

Appendix D2 – DMP Developed Condition Flows

Appendix D3 – Culvert Capacity Calculations

Appendix D4 – Calabacillas Middle Branch channel calculations

1. INTRODUCTION

Atrisco Vista Boulevard is a principal arterial located in the northwest quadrant of the Albuquerque urban area. It provides direct access to several regional facilities including an employment center just north of I-40, a regional general aviation airport, several large tracts of lands master planned for development, and several recreational destinations.

Parametrix is working with Bernalillo County to identify and evaluate route alignment alternatives to connect Atrisco Vista Boulevard with Southern Boulevard and improve the existing roadway from Double Eagle Road to Paseo del Norte Boulevard. Based on the evaluation, Alternative 2 is being advanced as the recommended alternative for implementation. Alternative 2 generally follows the existing Atrisco Vista alignment from Double Eagle Road north to Paseo del Norte Boulevard. North of Paseo del Norte, the alignment jogs east to parallel 20th Street in Rio Rancho. The total route length is approximately 5.8 miles. The Project Location Map is shown in **Figure 2-1**.

The purpose of this Draft Preliminary Drainage Report is to recommend preliminary improvements consistent with the goals of minimizing flooding, conveying stormwater runoff safely, and maintaining the proposed facilities. The Report summarizes previous drainage master plans for the area. Based on those plans, the Report provides draft preliminary recommendations for drainage improvements. Improvements to Southern Boulevard from 20th Street to Rainbow Boulevard are also being considered, which would affect the Southern Boulevard crossing of the Calabacillas Arroyo. Further detailed analysis will be required prior to finalizing the Drainage Report and design for the project.

2. EXISTING CONDITIONS

2.1 Jurisdiction

Existing watersheds within the project area are within the jurisdictions of the City of Albuquerque, City of Rio Rancho, Bernalillo County, and Sandoval County. The Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA) and the Southern Sandoval County Arroyo Flood Control Authority (SSCAFCA) have jurisdiction over portions of the drainageways within Bernalillo County and Sandoval County, respectively. AMAFCA and SSCAFCA will work cooperatively with the agencies within their jurisdictions: Bernalillo County, Sandoval County, the City of Albuquerque, and the City of Rio Rancho. These four agencies will be responsible for regulating, approving, and maintaining the drainage infrastructure within the study area.

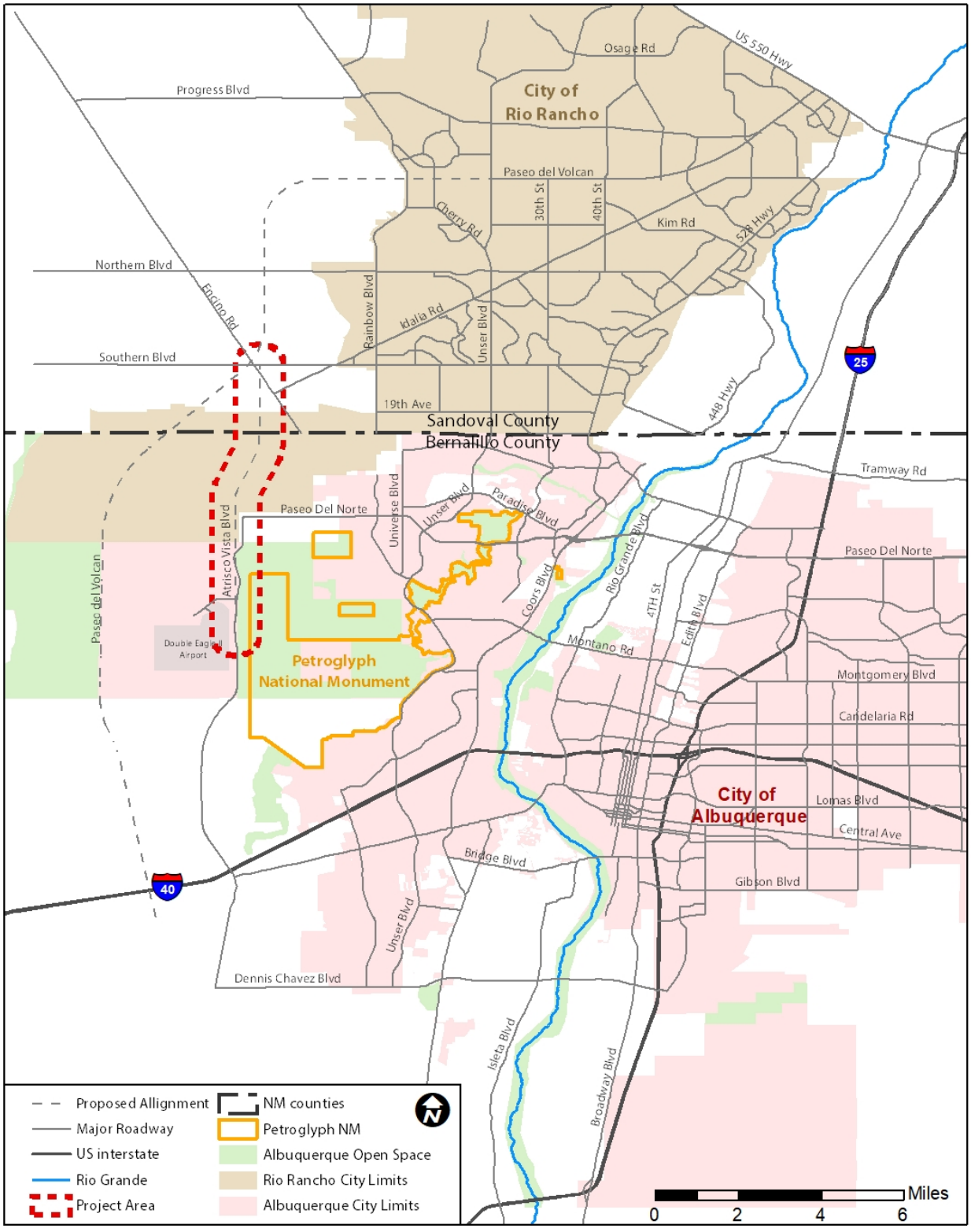


Figure 2-1. Project Location

2.2 Existing Drainage Plans and Reports

Existing drainage plans and reports reviewed for the project are listed below:

- Double Eagle II Airport Drainage Report (March 1988) – This report summarizes the hydrologic and hydraulic studies and drainage recommendations for the Double Eagle II Airport.
- Paradise West Master Plan (June 2004) – This plan describes the development scenario and proposed peak flow rates for the Middle and West Branches of the Calabacillas Arroyo through the subdivision. It also discusses treatment of arroyos under developed conditions.
- Drainage Management Plan Update for Boca Negra Arroyo, Draft (August 2018) – This plan (referred to in this report as the Boca Negra DMP) analyzes the Boca Negra Arroyo, which crosses Atrisco Vista Boulevard south of Paseo del Norte. The report analyzes developed conditions and proposed detention basins, including the Double Eagle II pond, located directly east of Atrisco Vista Boulevard. Prior to construction plan review, hydrologic analysis should be developed specific to the drainage infrastructure to be constructed in Atrisco Vista, in accordance with the City Development Process Manual.
- Calabacillas West Branch Arroyo Drainage and Storm Water Quality Management Plan, Final (August 2018) – This plan (referred to in this report as the Calabacillas West Branch DMP) analyzes developed condition scenarios for the Calabacillas West Branch Arroyo. It identifies two scenarios that maintain flows at or below the capacity of the existing crossing and grade control structures along the Arroyo. One scenario, DCIM #3, proposes construction of the Quail Ranch Pond west of the Atrisco Vista corridor and the Paradise West Pond east of the corridor. Another scenario, DCIM #4, proposes many smaller ponds throughout the watershed. Based on discussions with AMAFCA, this scenario is unlikely, and DCIM #3 should be used. Note the future boundary between the Calabacillas West Branch and Middle Branch watersheds will be McMahon Boulevard, which is not yet reflected in the DMP.
- INTERIM Calabacillas Watershed Park Management Plan (CAWMP) (February 2015) – This plan was prepared for SSCAFCA in February 2015 and is meant to be an interim document for the upper portion of the Calabacillas Watershed located in Sandoval County and does not include final analysis results for the West Branch and Middle Branch tributaries. After AMAFCA finishes the drainage management plan for the West Branch Arroyo, the results from that study will be incorporated into this overall watershed model and the CAWMP will be republished. Note the future boundary between the Calabacillas West Branch and Middle Branch watersheds will be McMahon Boulevard, which is not yet reflected in the DMP.

Pertinent excerpts from these reports are included in **Appendix D2**.

2.3 Watershed Characteristics

The western boundary of the watershed follows the Rio Puerco escarpment west of the study area. The terrain slopes east toward the Rio Grande at slopes between 1 and 3 percent. Grades steepen and become hilly west of the proposed corridor, with slopes approaching 10 percent.

Soils in the study area consist of alluvium, eolian, and colluvium deposits comprised of sand, silt, clay, and gravel. These soils generally have moderate to high infiltration rates. Areas of loamy soil and shallow bedrock exist in the southeastern corner of the study area.

The watershed is generally undeveloped, except for the Double Eagle II Airport, scattered residences in Sandoval County, and an industrial gas facility near Southern Boulevard. Vegetation consists of a mix of shrubs and native grasses.

Several major arroyos and a number of minor channels drain from east to west across the corridor (see **Figure 3-1**). Major arroyos crossing the Atrisco Vista corridor are the North Fork Boca Negra, Calabacillas West Branch, Calabacillas Middle Branch, Calabacillas Middle Branch Tributary, and Calabacillas Tributary B. The Calabacillas Arroyo (main channel) crosses Southern Boulevard east of the study area. No major arroyos cross Paseo del Norte Boulevard in the study area.

2.4 FIRM Maps

The site is located on FIRM Maps 35001C0085H and 35043C2100D. The maps show the Atrisco Vista Boulevard corridor crosses multiple mapped flood plains created by existing arroyos. These include a tributary and the main channel of the North Fork Boca Negra Arroyo, the Calabacillas West Branch Arroyo (up to two floodplains), the Calabacillas Middle Branch Arroyo (up to three floodplains), and the Calabacillas Arroyo Tributary B (up to two floodplains). The floodplains are in Zone A, flood elevations not determined. The area outside the floodplains is shown as Zone X, "other areas," which are outside the 500-year floodplain, and presumably are outside the 100-year floodplain. See **Appendix D1**.

2.5 Existing Structures

Existing small-diameter culverts cross under Atrisco Vista Boulevard from Double Eagle Road north to Paseo del Norte Boulevard. Culverts range in size from 18" to 42" diameter, with concrete blankets or end sections.

The North Fork Boca Negra arroyo crosses under Atrisco Vista through an approximately 20' span by 6' rise structure. No as-built information is available. The structure is referred to as a concrete box culvert in the Boca Negra DMP; however, the invert appears to be lined with loose boulders, and no concrete bottom is visible, so it is referred to as a bridge for the purposes of this report.



Atrisco Vista Boulevard Crossing at the North Fork Boca Negra Arroyo

The Calabacillas Arroyo crosses Southern Boulevard through five 8' span by 6' rise concrete box culverts.

3. PROPOSED CONDITIONS

3.1 Roadway Improvements

The proposed roadway typical section has a 2-lane roadway, 10-foot multi-purpose pedestrian and bicycle facility, and 186-foot right-of-way width (**Figure 3-1**). The right-of-way width is proposed to accommodate additional lanes in the future, if needed.

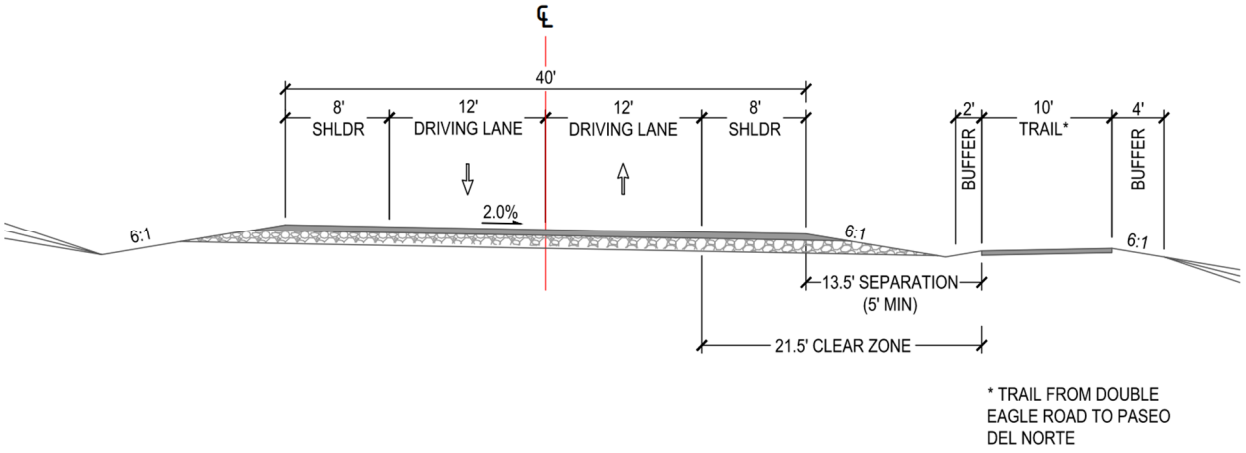


Figure 3-1. Proposed Atrisco Vista Typical Section

3.2 Drainage Criteria

Hydrologic criteria for off-site flows were previously defined by the appropriate drainage master plans. Hydraulic criteria for rural highway design from local agencies are limited, so the NMDOT Drainage Design Manual (July 2018) design criteria were adapted for this report. The criteria address bridges, crossing culverts, and roadside ditches. In the event of discrepancies between NMDOT and local agency criteria, the local criteria will govern.

The following criteria were used:

- Design storm: 100-year
- Bridges
    - Design flow passes below the low chord
    - Maintain 2' minimum freeboard for the 50-year storm*
    - Maintain existing flow depth at the upstream property line
    - Provide 7' minimum vertical clearance for maintenance
- Culverts
    - Limit headwater spread to half of a driving lane
    - Headwater to depth ratio (HW/D) < 1.5 for new culverts
    - Maintain existing flow depth at the upstream property line
    - For box culverts, provide 6' to 7' minimum vertical clearance for maintenance where practical
- Roadside Ditches: Limit spread to half of driving lane

*This criterion was not checked for the purposes of this report, but it was included for future reference consistent with NMDOT and FHWA guidelines.

3.3 Peak Flows

Peak drainage flows for the 100-year storm were calculated using the appropriate drainage management plans for the area (see **Appendix D2**). Note that the hydrologic methods used for these

plans are different, and the CAWMP is an interim document. In addition, the City of Albuquerque has commented that additional analysis will be required at the time of final design. Where necessary, the master plan drainage basins were adjusted and/or subdivided based on 2' contour data from the Middle Rio Grande Council of Governments (2010). With the modified boundaries, the master plan basin flows were prorated based on the new sub-basin areas to calculate preliminary design flows.

The future boundary between the Calabacillas West Branch and Middle Branch watersheds is planned to be McMahon Boulevard, which is close to the natural ridgeline. The future alignment of McMahon Boulevard was not defined for this report, so the existing terrain and master plan boundaries were used. The basin limits and peak flows should be adjusted when the McMahon alignment is determined.

In general, the developed condition flows will be used for preliminary structure sizing, except as noted. Developed condition flows assume one existing City of Albuquerque detention pond and two AMAFCA regional detention facilities west of Atrisco Vista: the Double Eagle II Airport Detention Pond "A," and the Quail Ranch Ponds on the Boca Negra and Calabacillas West Branch Arroyos. These ponds should reduce the flows that reach the proposed roadway in the future. Also, a second Double Eagle II Pond is proposed to be on the east side of Atrisco Vista Boulevard northeast of the airport.

North of the Bernalillo/Sandoval County line, the CAWMP assumes developed conditions with existing drainage facilities in place, which is referred to as DEVEX conditions. There may be opportunities to reduce these flows as drainage ponds are planned in coordination with development.

3.4 Crossing Structures

Crossing structures were sized preliminarily using the 100-year peak flows. Pipe culverts were assumed for the smaller basins. To limit the amount of fill needed to build the roadway, a 30" pipe diameter was assumed as the typical size. Box culverts were sized for the larger basins. A bridge is recommended at the Calabacillas Middle Branch Arroyo due to the high flows at that location.

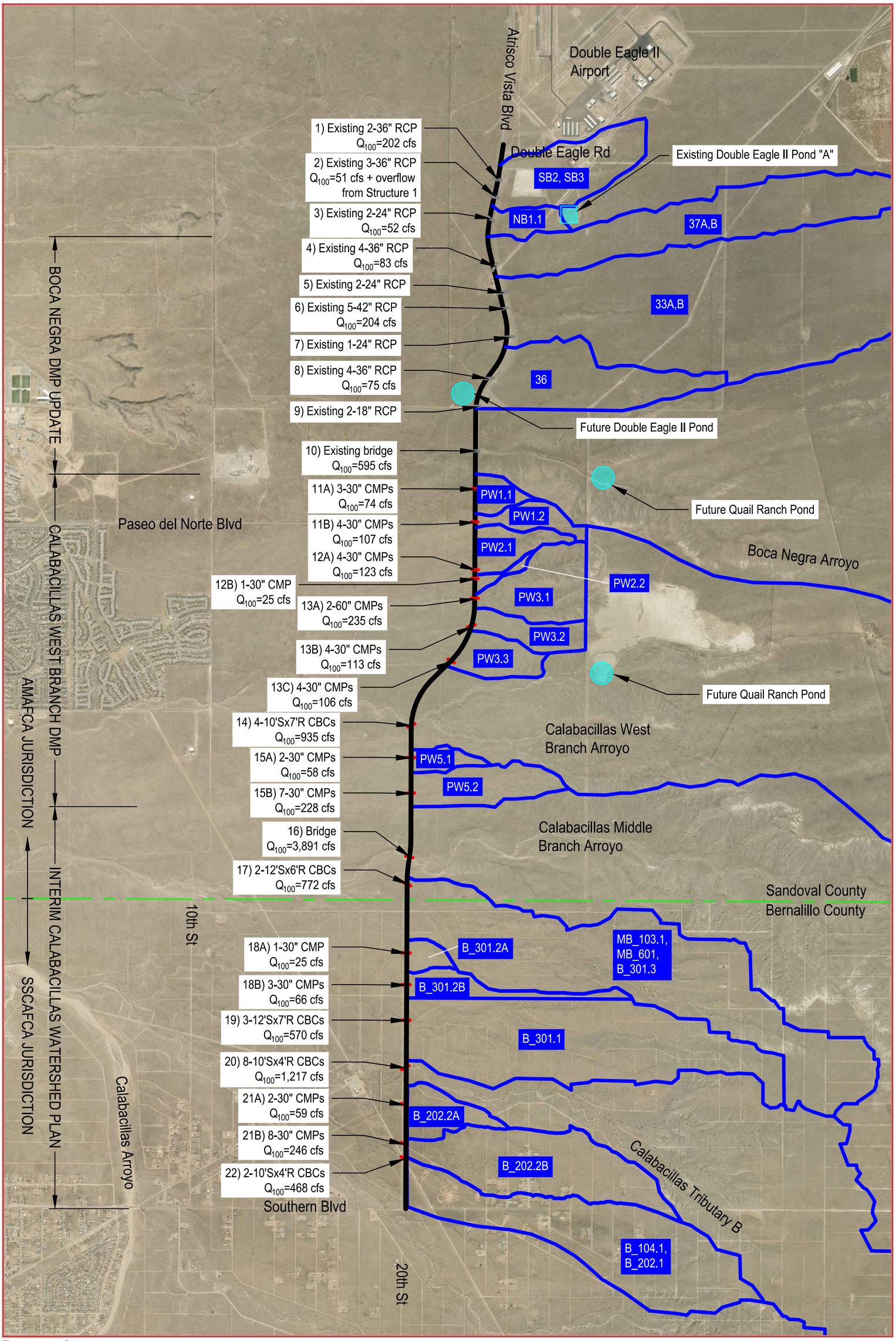
The existing drainageways typically are shallow and relatively flat in cross section where they intersect with Atrisco Vista Boulevard. Most do not have well defined channels. Culverts tend to cause flow constriction and backwater upstream of the crossing. To avoid causing ponding on private property upstream of the roadway, culvert headwaters were limited to the estimated natural channel depth, or to the approximate depth available from the culvert invert to the upstream property line.

Draft preliminary crossing structure recommendations are shown in **Figure 3-2** and **Table 1**. Some of the important crossing structures for Atrisco Vista Boulevard and Southern Boulevard are discussed below.

3.4.1 Atrisco Vista Boulevard

Structures 1 and 2

Structures 1 and 2 are existing multi-barrel reinforced concrete pipe (RCP) culverts under Atrisco Vista Boulevard. The existing and ultimate 100-year flows from basin SB3 to Structure 1 are 50 cfs and 189 cfs, respectively. In the ultimate developed condition, Structure 1 with its two 36" diameter pipes would not have capacity for the ultimate peak flow. When the airport develops to its ultimate configuration, the excess runoff could be diverted to the north to Structure 2 to take full advantage of those culverts' capacity. The existing culverts are proposed to be extended.



Parametrix DATE: April 30, 2019 FILE: ALIGNMENTS-PHASE A-DRAINAGE BASINS

N

0 2500

1 INCH = 2500 FEET

FIGURE 3-2
ATRISCO VISTA PROPOSED DRAINAGE STRUCTURES
Bernalillo County

Table 1. Atrisco Vista Drainage Structures

J Buckman

1/24/2019

Structure #	Station	Drainage Mgmt. Plan	Contributing Basin(s)	Sub-basin I.D.	Analysis Point / Junction I.D.	Existing Q100 cfs	Developed Q100 cfs	Existing Structure	Preliminary Recommendation	Comments
1	10+00	DEIIADR	SB3			54	202	2-36" RCP	Extend or replace in-kind	Assume 7% bulking, grade to allow overflow to Structure 2
2	15+00	DEIIADR	SB2			47	51	3-36" RCP	Extend or replace in-kind	Assume 7% bulking
3	21+00	DEIIADR	NB1	NB1.1		42	52	2-24" RCP	Extend or replace in-kind	Assume 7% bulking, add detention pond "A" outflow of 23/33 cfs (AP2NB), without routing
4	35+50	BNDMPU			J37	54	83	4-36" RCP	Extend or replace in-kind	Use 7% bulking
5	42+75	BNDMPU			J33AB			2-24" RCP	Extend or replace in-kind	Use 7% bulking. Drains to Structure #6, which has capacity for the entire basin, so a sub-basin was not delineated
6	47+00	BNDMPU			J33AB	126	204	5-42" RCP	Extend or replace in-kind	Use 7% bulking
7	55+00	BNDMPU			J33AB			1-24" RCP	Extend or replace in-kind	Use 7% bulking. Drains to Structure #6, which has capacity for the entire basin, so a sub-basin was not delineated
8	68+25	BNDMPU			J36	66	75	4-36" RCP	Extend or replace in-kind	Use 7% bulking
9	76+75	BNDMPU			J36			2-18" RCP	Extend or replace in-kind	Use 7% bulking. Structure #8 has capacity for the entire basin, so a sub-basin was not delineated
10	89+50	BNDMPU			AP5	595	327	Slab bridge, 20' span	Widen	N. Fork Boca Negra Arroyo
11A	100+00	CWBDMP	PW1	PW1.1			74		3 - 30" CMPs	
11B	109+75	CWBDMP	PW1	PW1.2			107		4 - 30" CMPs	
12A	102+75	CWBDMP	PW2	PW2.1			123		4 - 30" CMPs	
12B	125+25	CWBDMP	PW2	PW2.2			25		1 - 30" CMP	
13A	130+75	CWBDMP	PW3	PW3.1			235		2 - 60" CMPs	
13B	138+75	CWBDMP	PW3	PW3.2			113		4 - 30" CMPs	
13C	150+00	CWBDMP	PW3	PW3.3			106		4 - 30" CMPs	Need an inlet berm at NW corner
14	172+25	CWBDMP			AP4		935		4 - 10' x 7' CBCs	Calabacillas West Branch Arroyo, assume 4.0' HW to top of bank at west property line
15A	181+00	CWBDMP	PW5	PW5.1			58		2 - 30" CMPs	
15B	191+00	CWBDMP	PW5	PW5.2			228		7 - 30" CMPs	
16	209+00	CAWMP			MB_102_J	2645	3891		Bridge	Calabacillas Middle Branch Arroyo

Structure #	Station	Drainage Mgmt. Plan	Contributing Basin(s)	Sub-basin I.D.	Analysis Point / Junction I.D.	Existing Q100 cfs	Developed Q100 cfs	Existing Structure	Preliminary Recommendation	Comments
17	216+50	CAWMP	B_301 MB_103 MB_601	B301.3 MB_103.1 MB_601		437	772		2 - 12' x 6' CBC's	Assume 5.0' HW to west property line
18A	236+00	CAWMP	B_301	B_301.2A		14	25		1 - 30" CMP	
18B	245+00	CAWMP	B_301	B_301.2B		37	66		3 - 30" CMPs	
19	255+00	CAWMP	B_301	B_301.1		318	570		3 - 12' x 7' CBC	Design for developed flow in existing channel, assume 3.0' bank-full depth
20	268+25	CAWMP			AP23	830	1217		8 - 10' x 4' CBC	Calabacillas Tributary B, design for developed flow in existing channel, assume 3.0' bank-full depth
21A	278+75	CAWMP	B_202	B_202.2A		36	59		2 - 30" CMPs	
21B	290+00	CAWMP	B_202	B_202.2B		150	246		8 - 30" CMPs	
22	294+00	CAWMP	B_104 B_202	B_104.1 B_202.1		278	468		2 - 10' x 4' CBCs	Assume 4.0' HW, need inlet berm at SW corner

Notes:

1 DMP flows were prorated based on fraction of total basin area(s) as needed

2 Bulking factors were assumed if they were not already included in DMP flows

Abbreviations:

BNDMPU = Drainage Management Plan Update for Boca Negra Arroyo, Draft (August 2018)

CAWMP = INTERIM Calabacillas Watershed Park Management Plan (February 2015)

CWBDMP = Calabacillas West Branch Arroyo Drainage and Storm Water Quality Management Plan, Final (August 2018)

DEIIADR = Double Eagle II Airport Drainage Report (March 1988)

CBC = concrete box culvert

CMP = corrugated metal pipe

HW = headwater

RCP = reinforced concrete pipe

Structure 10, North Fork Boca Negra Arroyo

The North Fork Boca Negra Arroyo crosses Atrisco Vista Boulevard 0.4 mile south of Paseo del Norte through an existing 20' span bridge. According to the Boca Negra DMP, the existing bridge has adequate capacity for the existing 100-year flow of 576 cfs. A future Quail Ranch Pond is planned west of Atrisco Vista Boulevard, which would reduce the developed flow to 327 cfs. To widen Atrisco Vista Boulevard, the existing bridge should also be widened or replaced to convey the existing peak flow if the Quail Ranch Pond is not in place.

Structure 14, Calabacillas West Branch Arroyo

The Calabacillas West Branch Arroyo crosses Atrisco Vista Boulevard 1.1 miles north of Paseo del Norte Boulevard. The proposed alignment was shifted to the east here to avoid the upstream confluence of two branches of the arroyo. The Calabacillas West Branch DMP indicates the developed condition flows would be 935 cfs under if and when a Quail Ranch Pond is built west of Atrisco Vista Boulevard. Four 10' span by 7' rise box culverts would pass the developed flows. The 7' rise is proposed for maintenance purposes, to allow typical equipment access to clean the boxes.

Structure 16, Calabacillas Middle Branch Arroyo

This tributary of the Calabacillas Middle Branch Arroyo crosses Atrisco Vista Boulevard 1.8 miles north of Paseo del Norte Boulevard. The interim CAWMP shows a 100-year DEVEX flow of 3,891 cfs near the proposed Atrisco Vista Boulevard. This is too large to accommodate economically with a box culvert, so a bridge crossing is proposed. A simplified model of the existing channel was created using the Bentley FlowMaster V8i computer program, and the estimated existing flow depth was 3.1' (see **Appendix D4**). A trapezoidal bridge opening with 2:1 side slopes was assumed, with a 100' bottom width. This bridge would have 2 spans and a total length of approximately 150'. The roadway profile was adjusted to provide approximately 7' of vertical clearance for maintenance. This clearance should exceed the 2' minimum freeboard required for the 50-year storm.

Structure 17

Structure 17 will carry a 100-year DEVEX flow of 772 cfs from a tributary to the Calabacillas Middle Branch Arroyo. The structure is about 400' north of the Middle Branch main channel. Though diverting the flow south into the main channel along Atrisco Vista Boulevard was considered, a crossing structure is recommended to maintain historic flow patterns at this location. The proposed structure is a box culvert with two 12' wide by 6' high barrels. The 6' height is recommended to allow adequate clearance for maintenance.

Structure 19

Structure 19 will carry a 100-year DEVEX flow of 570 cfs from part of the Calabacillas Arroyo Tributary B watershed. The proposed structure is a box culvert with three 12' wide by 7' high barrels. The 7' height is recommended to provide clearance for maintenance.

Structure 20

Structure 20 is part of the Tributary B watershed of the Calabacillas Arroyo. It will have a 100-year DEVEX flow of 1,217 cfs. There is a major natural gas facility 1,300' downstream to the east. The gas facility may be at risk of flooding, as noted in the interim CAWMP (page 47). The proposed roadway crossing will be designed to maintain historic flow conditions, and the facility owner should consider making the necessary improvements to prevent flooding. Regional detention ponding upstream of the crossing also may be considered to attenuate flow rates, as discussed in Section 3.5 below.

Structures 21A and 21B

Structures 21A and B are in the Tributary B watershed of the Calabacillas Arroyo. The existing drainage channels are shallow and poorly defined. Because of this, it is difficult to estimate the flows that will reach the crossing structures. There are two existing residences along the east side of 20th Street near Structure 21A, and the existing shallow channel appears to run between the buildings. Based on the available topographic mapping, approximately 246 cfs will reach crossing Structure 21B, and 59 cfs will reach Structure 21A. These flows could vary, depending on the accuracy of the mapping, geomorphic changes over time, and upstream development. We have preliminarily sized Structure 21A as two 30" diameter culverts, and 21B as eight 30" diameter culverts. The pipes should be designed to maintain historic flow patterns and avoid directing flows toward the existing buildings. In addition, detention ponding should be considered on the west side of Atrisco Vista Boulevard here to help attenuate flows and reduce velocities downstream.

Structure 22

Structure 22 will carry a 100-year DEVEX flow of 468 cfs from part of the Calabacillas Arroyo Tributary B watershed. The proposed structure is a box culvert with two 10' wide by 4' high barrels. Although a taller box would be preferred from a maintenance standpoint, the roadway is already elevated in this area. A berm is recommended at the south side of the culvert inlet to provide headwater and prevent flow from bypassing the structure. The existing channel crosses an easement east of Encino Road with major natural gas transmission lines. The culvert should be designed with downstream erosion protection and/or energy dissipation to help minimize erosion near the gas lines.

3.4.2 Southern Boulevard

Southern Boulevard crosses the Calabacillas Arroyo on five 8' span by 6' rise concrete box culverts. The interim CAWMP described past flooding issues at the crossing and analyzed peak flow rates. The 100-year existing peak flow is 8,100 cfs, but the estimated capacity of the structure is only 2,000 cfs. With the proposed Calabacillas Dam in place, the 100-year developed peak flow would be 4,894 cfs. If the proposed roadway improvements require significant modifications to the existing box culverts, they should be replaced with a bridge with adequate capacity for a flow of 4,900 cfs (check flood). The bridge opening should approximate the existing channel width to avoid creating a flow restriction.

The existing storm drain system was not investigated for this report, but it is expected to remain in place.

3.5 Ponding Considerations

Although the existing terrain is relatively flat, there may be an opportunity to provide detention ponding on the west side of Atrisco Vista Boulevard. This is being considered in SSCAFCA's jurisdictional area in Sandoval County. AMAFCA already has plans for regional ponds and dams in Bernalillo County, outside of the Atrisco Vista corridor. North of the Sandoval County line, the proposed roadway will be elevated from about 3' to 7' above the existing ground, so the new embankment could act as a berm or a dam in some areas. **Figure 3-3** shows the approximate flooding limits if the water surface rises to the edge of the proposed roadway. This represents a scenario where the road acts as a dam, without implementing the proposed culverts. Note the crossing structures proposed in Section 3.4 were sized to limit backwater, so damming flows is not being recommended for this report. Further analysis would be

required to determine if it would be feasible to effectively pond runoff to reduce peak flows using the roadway embankment.

SSCAFCA detention ponds could be designed and constructed in conjunction with the Atrisco Vista roadway project. Because these ponds would address regional drainage needs, their implementation should be led by SSCAFCA in coordination with Bernalillo County. Note the regional detention ponds would be in addition to small ponds required for water quality, as discussed in Section 3.7, below.

3.6 Roadway Drainage

The proposed roadway will increase the imperviousness of the watershed, reduce infiltration, and increase runoff flow rates and volumes from the right-of-way. The roadway will also act as a divide within the watershed, and drainage flows will be channeled north or south along the roadway to the nearest crossing structure. Parallel drainage ditches will be constructed adjacent to Atrisco Vista Boulevard within the new right-of-way. Channel lining and/or check structures may be required depending on the flows, the roadway slopes, and the soils.

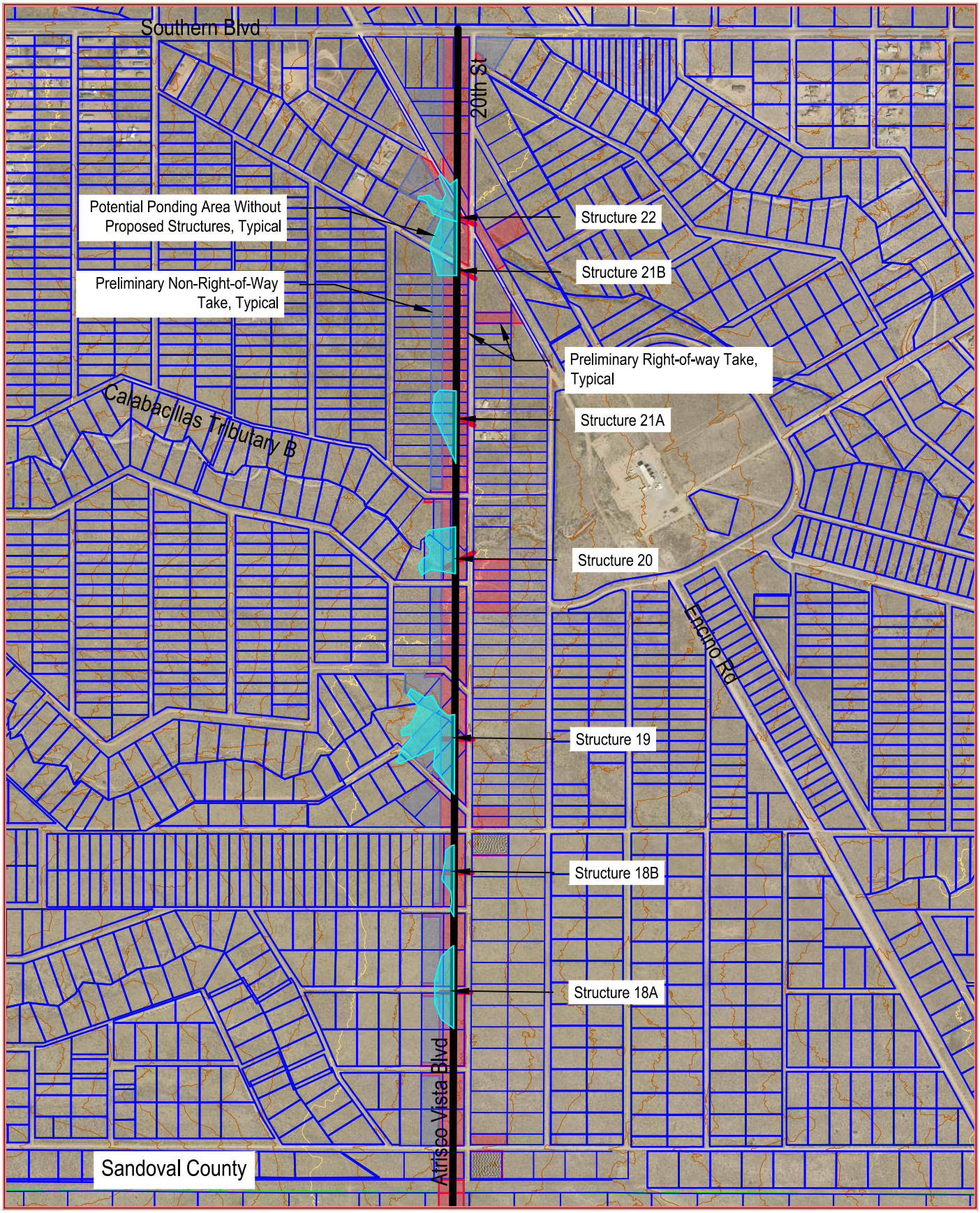
The roadway should be designed to maintain existing drainage patterns to the extent practicable. In general, flow changes due to the proposed roadway improvements will be minor relative to the size of the overall watershed. Also, drainage ditches and structures should be designed to help minimize erosion and sedimentation.

A detention pond is recommended near Structure 21A to attenuate peak flows from the proposed roadway. This should help minimize drainage impacts to the two residences east of 20th Street on either side of the crossing culverts.

3.7 Stormwater Quality

Atrisco Vista Boulevard is within the EPA Middle Rio Grande Watershed Municipal Separate Storm Sewer System (MS4) Permit area. This permit is intended to help protect water resources, and it is a cooperative effort between the agencies in the watershed responsible for storm water management. In general, the MS4 Permit requires on-site retention of the runoff from a small, relatively frequent storm. In statistical terms, this is the 90th percentile rainfall event (for new development), which produces approximately 0.6” of precipitation in the study area. Note this is the requirement for the permanent facility. Other EPA requirements are in place to help protect water quality during construction, which will be addressed during design and construction.

Several options could be considered to retain the runoff from the water quality storm. One option is to retain runoff in the roadway ditches. Check dams could be placed in these ditches to retain runoff while maintaining the ditch capacity for larger storms. Another option would be to grade small ponds within the new right-of-way areas. Drainage details for the project will be discussed and developed as design proceeds.



Parametrix DATE: July 24, 2019 FILE: ALIGNMENTS–PHASE A–DRAINAGE BASINS

0 N 1000

1 INCH = 1000 FT

FIGURE 3-3
PONDING OPPORTUNITIES

4. SUMMARY

Improvements to Atrisco Vista Boulevard are proposed to extend from Double Eagle Road in Albuquerque to Southern Boulevard in Rio Rancho. It is a principal arterial roadway with a length of 5.8 miles. As part of the corridor study process, Alternative 2 has been recommended for further analysis.

This draft Preliminary Drainage Report recommends preliminary improvements consistent with the goals of minimizing flooding, conveying stormwater runoff safely, and maintaining the proposed facilities. The Boca Negra DMP Update, Calabacillas West Branch DMP, and the interim CAWMP were the primary sources for drainage information and flow rates used for this report. Draft preliminary recommendations for drainage improvements have been provided. Proposed crossing structures include culvert pipes, box culverts, and a bridge at the Calabacillas West Branch Arroyo. Assuming Southern Boulevard is improved and widened concurrent with Atrisco Vista construction, the existing box culverts at the Calabacillas Arroyo should be replaced with a bridge. In conjunction with the roadway project, SSCAFCA may consider opportunities to build regional detention ponds along the west side of Atrisco Vista in Sandoval County, using the roadway embankment as a berm. Further detailed analysis will be required prior to finalizing the Drainage Report and design for the project. Recommendations should be finalized during the preliminary design phase.

Appendix D1

FIRM Maps

NOTES TO USERS

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

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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

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

The **projection** used in the preparation of this New Mexico State Plane, Central zone. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

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

NGS Information Services
NOAA, NINGS 12
National Geodetic Survey SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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

Base map information shown on this FIRM was derived from U.S. Geological Survey Digital Orthophoto Quadrangles at a scale of 1:12,000 from photography dated 1996 or later, and from Bohannan Huston Inc. at a scale of 1:12,000 from photography dated 2003 or later.

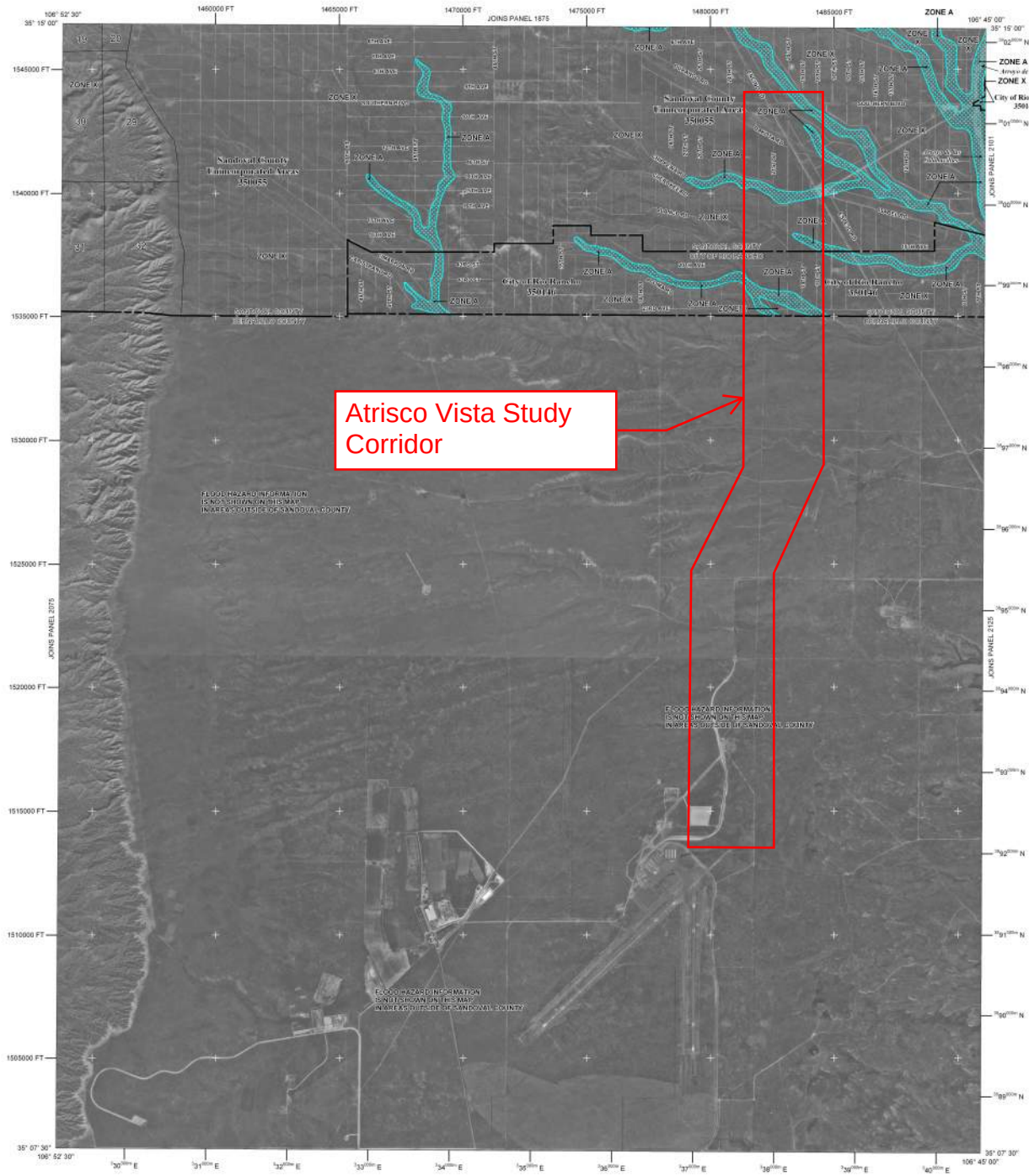
This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

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

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.



LEGEND

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

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

- ZONE A — No Base Flood Elevations determined.
- ZONE AE — Base Flood Elevations determined.
- ZONE AH — Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- ZONE AO — Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- ZONE AR — Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- ZONE A99 — Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
- ZONE V — Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- ZONE VE — Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.
- ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- A — A — Cross section line
- 23 — 23 — Transect line
- 87°07'45", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
- 4276000m N — 1000-meter Universal Transverse Mercator grid values, zone 13
- 6000000 FT — 5000-foot grid ticks: New Mexico State Plane coordinate system, Central zone (FIPSZONE 3002), Transverse Mercator projection
- DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
July 16, 1996

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
March 18, 2008 - to update map format.

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

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-888-CALL-FLOOD (1-888-225-5663).

MAP SCALE 1" = 2000'

1000 0 2000 4000 FEET

300 0 600 1200 METERS

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 2100D

FIRM
FLOOD INSURANCE RATE MAP

SANDOVAL COUNTY, NEW MEXICO AND INCORPORATED AREAS

PANEL 2100 OF 2225
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
RIO RANCHO, CITY OF	350146	2100	D
SANDOVAL COUNTY, UNINCORPORATED AREAS	350055	2100	D

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
35043C2100D

MAP REVISED
MARCH 18, 2008

Federal Emergency Management Agency

NOTES TO USERS

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NGS Information Services
NOAA, N/NGS12
National Geodetic Survey, SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

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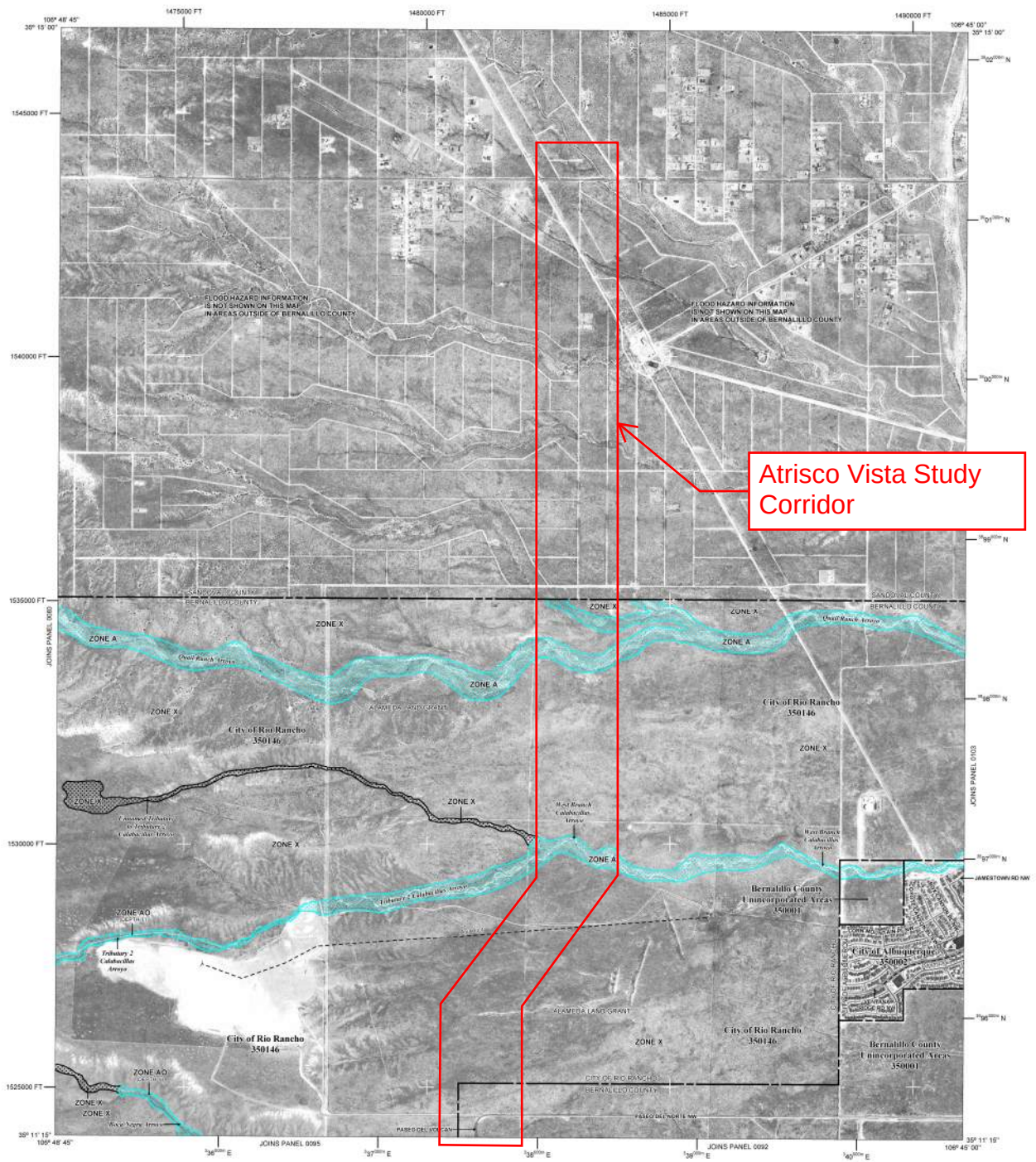
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LEGEND

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

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ZONE A — No Base Flood Elevations determined.
ZONE AE — Base Flood Elevations determined.
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ZONE VE — Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X — Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% annual chance floodplain boundary
0.2% annual chance floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513 — Base Flood Elevation line and value; elevation in feet*
(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*
*Referenced to the North American Vertical Datum of 1988
A — A — Cross section line
23 — 23 — Transect line
97° 07' 30", 32° 22' 30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
1000-meter Universal Transverse Mercator grid values, zone 13
5000-foot grid ticks: New Mexico State Plane coordinate system, Central zone (FIPSZONE 3002), Transverse Mercator
Bench mark (see explanation in Notes to Users section of this FIRM panel)
River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index.

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP PANEL
SEPTEMBER 20, 1996

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
April 2, 2002
November 19, 2003
September 29, 2006
August 16, 2012 - to update corporate limits, to change Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to add roads and road names, to incorporate previously issued Letters of Map Change.

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MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
300 0 300 600 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0085H

FIRM
FLOOD INSURANCE RATE MAP
BERNALILLO COUNTY, NEW MEXICO
AND INCORPORATED AREAS
PANEL 85 OF 825
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ALBUQUERQUE, CITY OF	350002	0085	H
BERNALILLO COUNTY UNINCORPORATED AREAS	350001	0085	H
RIO RANCHO, CITY OF	350146	0085	H

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
35001C0085H

MAP REVISED
AUGUST 16, 2012

Federal Emergency Management Agency

NOTES TO USERS

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

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction, and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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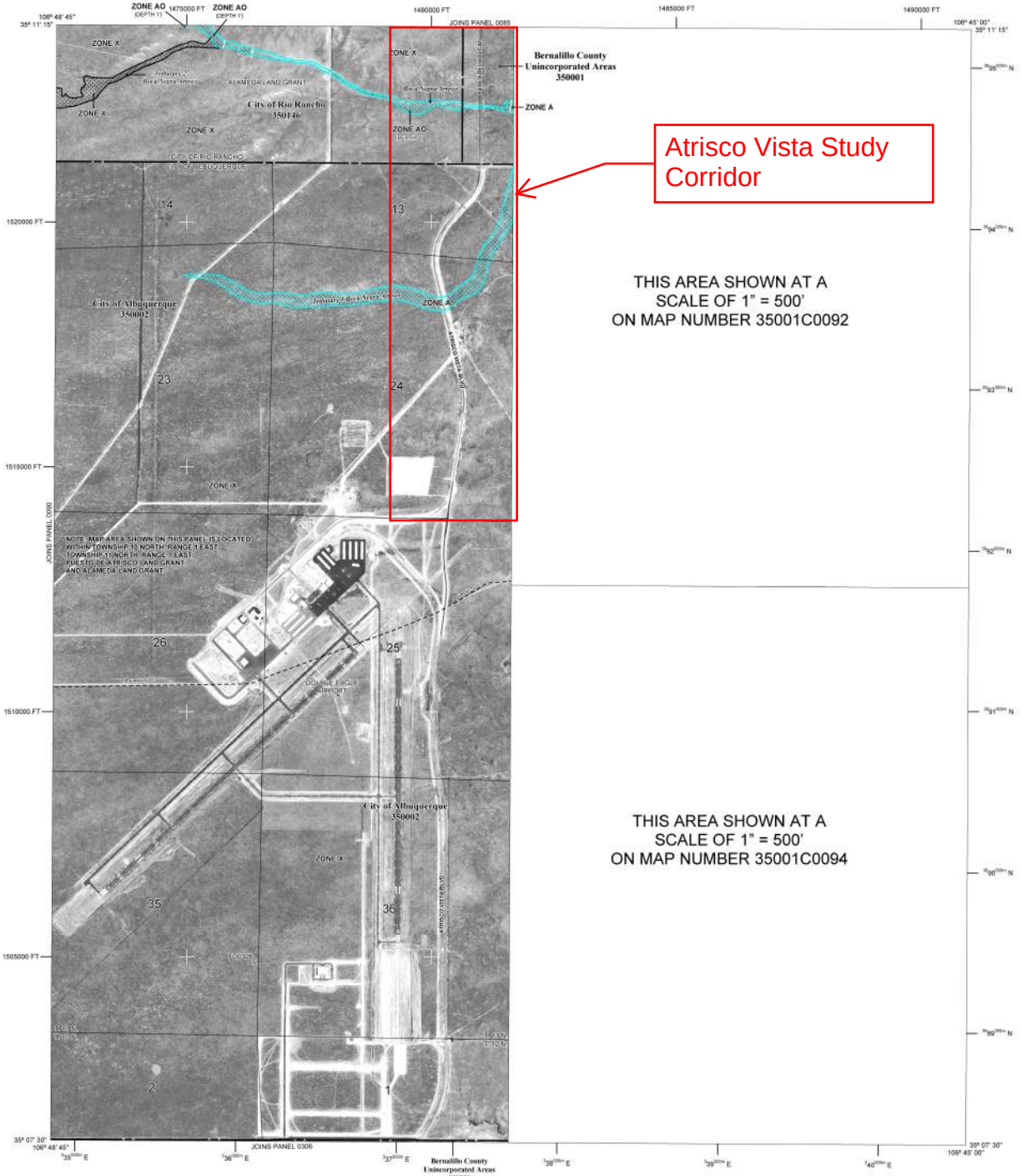
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DX5510 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5 — River Mile

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NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0095H

FIRM
FLOOD INSURANCE RATE MAP
BERNALILLO COUNTY, NEW MEXICO
AND INCORPORATED AREAS
PANEL 95 OF 825
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

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MAP NUMBER
35001C0095H

MAP REVISED
AUGUST 16, 2012

Federal Emergency Management Agency

Appendix D2

DMP Developed Condition Flows

Atrisco Vista Peak Flow Calculations and Structure Recommendations

J Buckman

1/24/2019

Structure #	Station	Drainage Mgmt. Plan	Contributing Basin(s)	Sub-basin I.D.	Analysis Point / Junction			Overall Contributing Basin				Sub-basin					Added Flow		Bulking Factor %[2]	Existing Q100 cfs	Developed Q100 cfs	Existing Structure	Preliminary Recommendation	Comments
					I.D.	Existing Q100, cfs	Developed Q100, cfs	I.D.	Area sq. mi.	Existing Q100, cfs	Developed Q100, cfs	I.D.	Area sq. mi.	Fraction of Basin Area	Existing Q100, cfs[1]	Developed Q100, cfs[1]	Existing cfs	Developed cfs						
1	10+00	DEIIADR	SB3					SB3	0.160						50	189			7%	54	202	2-36" RCP	Extend or replace in-kind	Assume 7% bulking, grade to allow overflow to Structure 2
2	15+00	DEIIADR	SB2					SB2	0.072						44	48			7%	47	51	3-36" RCP	Extend or replace in-kind	Assume 7% bulking
3	21+00	DEIIADR	NB1	NB1.1				NB1	0.304	93	93	NB1.1	0.057	0.19	17	17	23	33	7%	42	52	2-24" RCP	Extend or replace in-kind	Assume 7% bulking, add detention pond "A" outflow of 23/33 cfs (AP2NB), without routing
4	35+50	BNDMPU			J37	50	78	37A,B											7%	54	83	4-36" RCP	Extend or replace in-kind	Use 7% bulking
5	42+75	BNDMPU			J33AB																	2-24" RCP	Extend or replace in-kind	Use 7% bulking. Drains to Structure #6, which has capacity for the entire basin, so a sub-basin was not delineated
6	47+00	BNDMPU			J33AB	118	191	33A,B											7%	126	204	5-42" RCP	Extend or replace in-kind	Use 7% bulking
7	55+00	BNDMPU			J33AB																	1-24" RCP	Extend or replace in-kind	Use 7% bulking. Drains to Structure #6, which has capacity for the entire basin, so a sub-basin was not delineated
8	68+25	BNDMPU			J36	62	70	36											7%	66	75	4-36" RCP	Extend or replace in-kind	Use 7% bulking
9	76+75	BNDMPU			J36																	2-18" RCP	Extend or replace in-kind	Use 7% bulking. Structure #8 has capacity for the entire basin, so a sub-basin was not delineated
10	89+50	BNDMPU			AP5	595	327								595	327				595	327	Slab bridge, 20' span	Widen	N. Fork Boca Negra Arroyo
11A	100+00	CWBDMP	PW1	PW1.1				PW1	0.107	N/A	181	PW1.1	0.044	0.41		74					74		3 - 30" CMPs	
11B	109+75	CWBDMP	PW1	PW1.2				PW1	0.107	N/A	181	PW1.2	0.063	0.59		107					107		4 - 30" CMPs	
12A	102+75	CWBDMP	PW2	PW2.1				PW2	0.1	N/A	156	PW2.1	0.079	0.79		123					123		4 - 30" CMPs	
12B	125+25	CWBDMP	PW2	PW2.2				PW2	0.1	N/A	156	PW2.2	0.016	0.16		25					25		1 - 30" CMP	
13A	130+75	CWBDMP	PW3	PW3.1				PW3	0.346	N/A	454	PW3.1	0.179	0.52		235					235		2 - 60" CMPs	
13B	138+75	CWBDMP	PW3	PW3.2				PW3	0.346	N/A	454	PW3.2	0.086	0.25		113					113		4 - 30" CMPs	
13C	150+00	CWBDMP	PW3	PW3.3				PW3	0.346	N/A	454	PW3.3	0.081	0.23		106					106		4 - 30" CMPs	Need an inlet berm at NW corner
14	172+25	CWBDMP			AP4		935														935		4 - 10' x 7' CBCs	Calabacillas West Branch Arroyo, assume 4.0' HW to top of bank at west property line
15A	181+00	CWBDMP	PW5	PW5.1				PW5	0.181	N/A	286	PW5.1	0.037	0.20		58					58		2 - 30" CMPs	
15B	191+00	CWBDMP	PW5	PW5.2				PW5	0.181	N/A	286	PW5.2	0.144	0.80		228					228		7 - 30" CMPs	
16	209+00	CAWMP			MB_102_J	2645	3891													2645	3891	Bridge	Calabacillas Middle Branch Arroyo	
17	216+50	CAWMP	B_301 MB_103 MB_601	B301.3 MB_103.1 MB_601				B_301 MB_103 MB_601	1.355 0.664 0.8	583 416 322	1046 1058 513	B301.3 MB_103.1 MB_601	0.106 0.111 0.8	0.08 0.17 1.00	46 70 322	82 177 513				437	772	2 - 12' x 6' CBC's	Assume 5.0' HW to west property line	
18A	236+00	CAWMP	B_301	B_301.2A				B_301	1.355	583	1046	B_301.2A	0.033	0.02	14	25				14	25	1 - 30" CMP		
18B	245+00	CAWMP	B_301	B_301.2B				B_301	1.355	583	1046	B_301.2B	0.086	0.06	37	66				37	66	3 - 30" CMPs		
19	255+00	CAWMP	B_301	B_301.1				B_301	1.355	583	1046	B_301.1	0.739	0.55	318	570				318	570	3 - 12' x 7' CBC	Design for developed flow in existing channel, assume 3.0' bank-full depth	
20	268+25	CAWMP			AP23	830	1217													830	1217	8 - 10' x 4' CBC	Calabacillas Tributary B, design for developed flow in existing channel, assume 3.0' bank-full depth	
21A	278+75	CAWMP	B_202	B_202.2A				B_202	1.607	629	1029	B_202.2A	0.092	0.06	36	59				36	59	2 - 30" CMPs		
21B	290+00	CAWMP	B_202	B_202.2B				B_202	1.607	629	1029	B_202.2B	0.384	0.24	150	246				150	246	8 - 30" CMPs		
22	294+00	CAWMP	B_104 B_202	B_104.1 B_202.1				B_104 B_202	1.32 1.607	652 629	1102 1029	B_104.1 B_202.1	0.47 0.118	0.36 0.07	232 46	392 76				278	468	2 - 10' x 4' CBCs	Assume 4.0' HW, need inlet berm at SW corner	

Notes:

1 DMP flows were prorated based on fraction of total basin area(s) as needed

2 Bulking factors were assumed if they were not already included in DMP flows

Abbreviations:

BNDMPU = Drainage Management Plan Update for Boca Negra Arroyo, Draft (August 2018)

CAWMP = INTERIM Calabacillas Watershed Park Management Plan (February 2015)

CWBDMP = Calabacillas West Branch Arroyo Drainage and Storm Water Quality Management Plan, Final (August 2018)

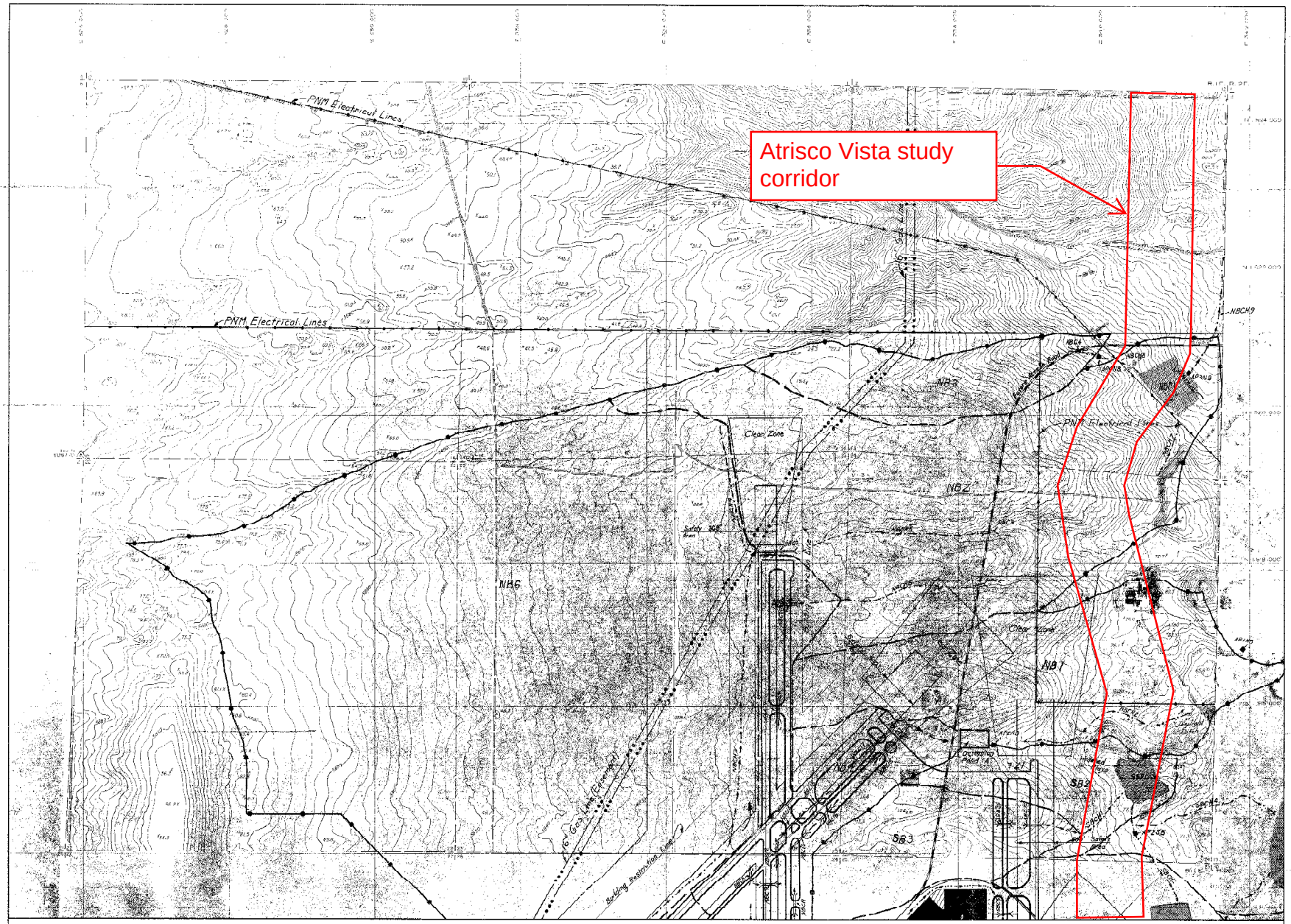
DEIIADR = Double Eagle II Airport Drainage Report (March 1988)

CBC = concrete box culvert

CMP = corrugated metal pipe

HW = headwater

RCP = reinforced concrete pipe


Atrisco Vista study corridor
PNM Electrical Lines
PNM Electrical Lines
PNM Electrical Lines
Clear Zone
Clear Zone
NB2
NB6
NB1
SB3
SB3
NBCH9
Building Restriction Line
PLATE INDEX
LEGEND
MAIN BASIN BOUNDARY
SUB BASIN BOUNDARY
EXISTING CHANNELS
PROPOSED CHANNELS
CULVERTS
30" GAS LINE
PNM ELECTRICAL LINES
EXISTING FACILITIES
PROPOSED DETENTION PONDS
PROPERTY LINE
FLOW DIRECTION
SCALE: 1"=500' (1:6000)
CONTOUR INTERVAL: 2'
VERTICAL DATUM: NATIONAL GEODETIC DATUM 1929
N
PLATE 1
DOUBLE EAGLE II AIRPORT
DRAINAGE MANAGEMENT PLAN
DECEMBER 1987

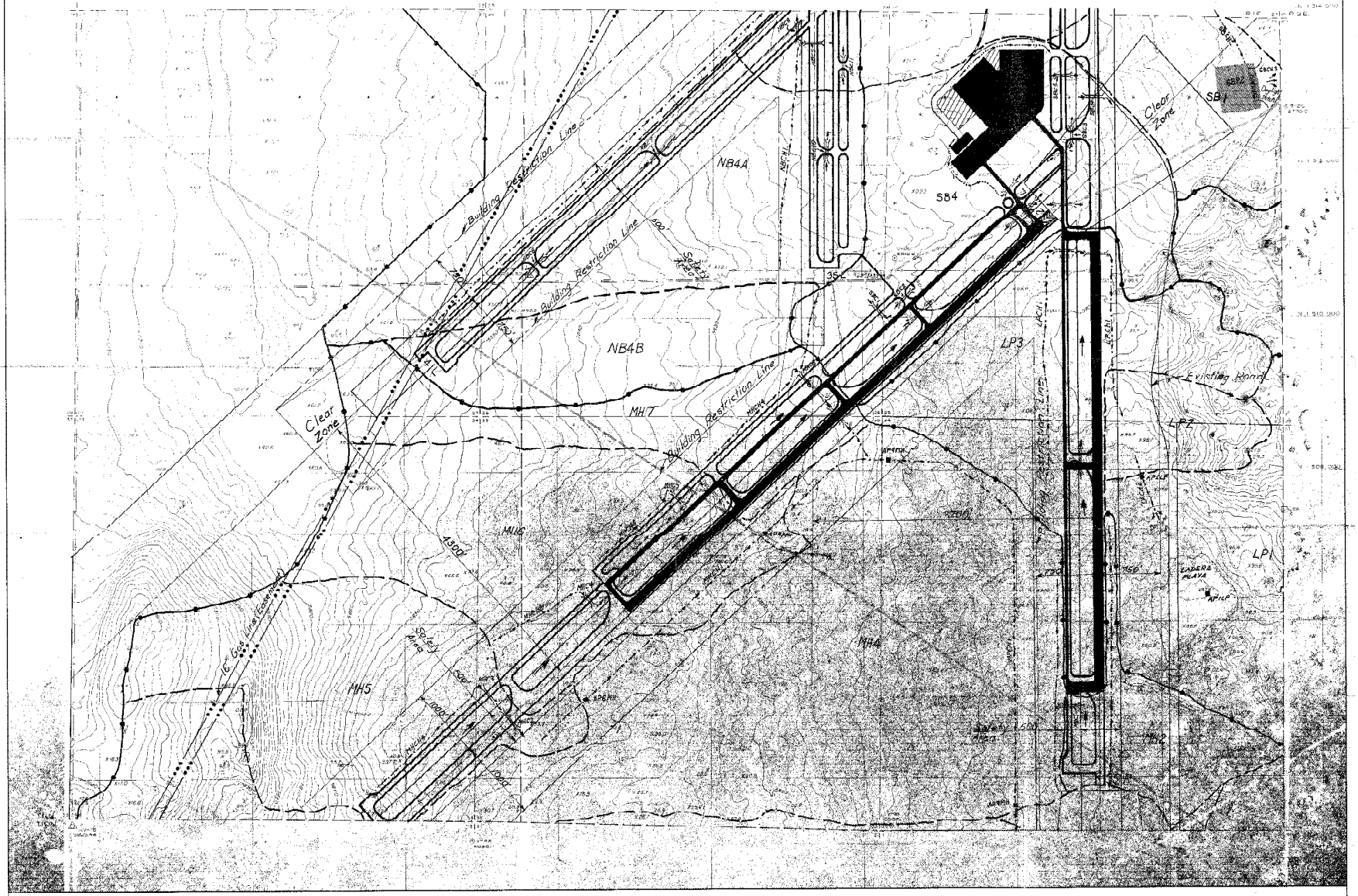
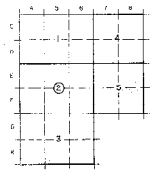


PLATE INDEX



LEGEND

- MAIN BASIN BOUNDARY
- SUB BASIN BOUNDARY
- EXISTING CHANNELS
- PROPOSED CHANNELS
- CULVERTS
- 16" GAS LINE
- PWA ELECTRICAL LINES
- EXISTING FACILITIES
- PROPOSED DETENTION PONDS
- PROPERTY LINE
- FLOW DIRECTION

SCALE: 1"=200' (1:2400)
CONTOUR INTERVAL: 2'
VERTICAL DATUM: NATIONAL GEODETIC DATUM 1929

PLATE 2

DOUBLE EAGLE II AIRPORT

DRAINAGE MANAGEMENT PLAN

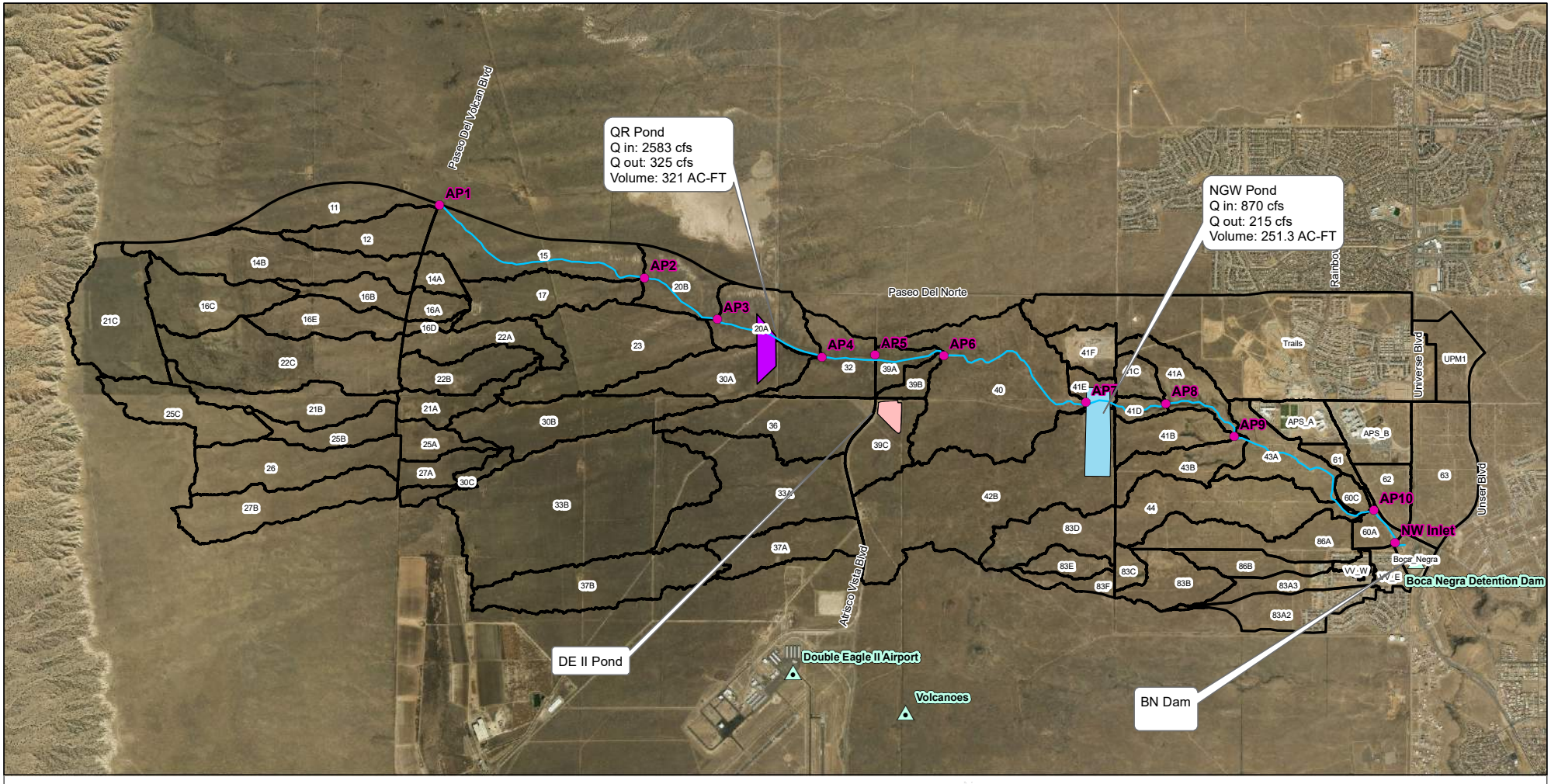
DECEMBER 1987

TABLE 2

HYDROLOGIC ANALYSIS RESULTS

Basin/ Analysis Pt.	Area (Acres)	Undeveloped/Existing		Flow (CFS) Interim	Ultimate	Flow (CFS) Allowed to Leave By Far NW Plan
Ladera Playa:		CFS	CFS/Acre			
LP1	414.0	450		450	450	
LP2	52.9	56		56	56	
LP3	175.6	84		92	92	
AP1LP	642.5	461	0.72	462	462	
AP2LP		73		80	80	
Mirehaven:						
MH1	73.1	76		76	76	
MH2	73.7	41		41	45	
MH3	644.9	193		193	193	
MH4	651.9	174		174	564	
MH5	242.6	104		104	340	
MH6	321.3	107		118	415	
MH7	155.8	49		54	176	
MH8					101	
AP3MH		261		268	937	
AP1MH	2163.3	419	0.19	427	1025	711
South Boca Negra:						
SB1	76.8	67		79	79	
SB2	61.4	58		64	64	
SB3	102.5	50		189	189	
SB4	321.5	130		455	455	
SB5	217.6	268		268	268	
AP1SB	398.3	134	0.34	428	428	110
AP2SB		72		213	213	
AP4SB	381.5	285	0.75	328	328	134
North Boca Negra:						
NB1	194.4	93		93	93	
NB2	349.6	145		393	393	
NB3	87.9	53		156	156	
NB4	88.6	33		40	67	
NB4A	236.0	107		107	180	
NB4B	128.0	60		60	*	
NB5	50.5	15		26	26	
NB6	1190.4	281		281	297	
AP1NB	647.0	96	0.15	96	97	110
AP2NB		23		26	33	
AP3NB	1678.4	216	0.13	640	1100	271
AP4NB		53		156	156	

*Basin NB4B routed as MH8 in ultimate development only



Legend

- AnalysisPoints
- Boca Negra Arroyo
- Locations
- QR_Pond
- DE II Pond
- NGW Pond
- Developed Basins

0 3,000 6,000 Feet

1 in = 3,000 ft

Boca Negra DMP Update

Figure 17
Developed Conditions Model #7

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Author: eburn

Table 3.13: DCM #7
Hydrologic Analysis Results at Analysis Points

Developed Conditions Model #7 (DCM7)							
Event (year)	Bulking Factor	Peak Discharge (cfs) Bulked	Runoff Volume (ac-ft)	Event (year)	Bulking Factor	Peak Discharge (cfs) Bulked	Runoff Volume (ac-ft)
AP1				**AP7**			
2-yr	1.04	117	12	2-yr	1.06	199	193
10-yr	1.05	200	20	10-yr	1.07	298	332
100-yr	1.06	345	32	100-yr	1.09	635	599
AP2				**AP8**			
2-yr	1.05	517	68	2-yr	1.03	71	103
10-yr	1.06	903	107	10-yr	1.03	89	182
100-yr	1.07	1554	175	100-yr	1.03	108	334
AP3				**AP9**			
2-yr	1.10	774	136	2-yr	1.01	143	207
10-yr	1.12	1360	218	10-yr	1.02	178	366
100-yr	1.11	2358	357	100-yr	1.02	217	674
AP4				**AP10**			
2-yr	1.04	175	161	2-yr	1.02	148	221
10-yr	1.04	235	268	10-yr	1.02	209	393
100-yr	1.05	323	459	100-yr	1.04	560	729
AP5				**NW_Inlet**			
2-yr	1.05	177	168	2-yr	1.02	148	222
10-yr	1.06	239	278	10-yr	1.02	211	395
100-yr	1.06	327	476	100-yr	1.04	564	732
AP6				**Boca Negra Inflow**			
2-yr	1.04	194	186	2-yr	1.02	368	345
10-yr	1.05	264	314	10-yr	1.02	778	555
100-yr	1.06	369	559	100-yr	1.04	1,735	956

Developed Conditions Clear Water Hydrology - BN_DCM7						
Name	**100-yr Peak Discharge (cfs)**	**100-yr Volume (AC-FT)**	**10-yr Peak Discharge (cfs)**	**10-yr Volume (AC-FT)**	**2-yr Peak Discharge (cfs)**	**2-yr Volume (AC-FT)**
APS_A_I	106.4	6.7	65.2	4.3	38.7	2.8
APS_A_P	44.0	2.9	16.3	1.3	4.1	0.5
APS_A_Pond	7.4	9.7	5.4	5.7	3.8	3.3
APS_B_I	123.6	10.8	75.5	7.0	44.8	4.5
APS_B_P	44.3	4.2	16.0	1.9	3.9	0.7
APS_Pond	4.5	15.0	4.5	8.8	4.5	5.2
AP1	344.8	32.3	200.4	19.5	116.8	12.2
AP10	559.5	729.2	209.2	393.1	147.8	220.5
AP14B	252.7	27.6	151.6	17.0	89.1	10.9
AP16A	318.7	27.7	189.0	17.1	109.2	11.0
AP2	1553.9	175.2	903.4	107.2	517.4	67.8
AP21	223.4	31.8	122.4	18.0	67.0	10.7
AP26	40.3	9.0	9.0	2.9	3.1	0.8
AP3	2357.8	357.3	1359.6	217.8	773.8	135.8
AP4	323.3	458.5	235.5	267.5	174.8	161.4
AP41	107.1	330.1	88.4	180.6	71.2	103.1
AP5	326.7	475.6	238.5	277.6	177.1	167.5
AP6	368.7	558.8	264.4	313.9	194.1	185.9
AP7	635.1	598.8	297.9	331.8	199.1	193.3
AP8	107.8	333.8	88.8	181.9	71.3	103.4
AP9	216.7	673.9	178.3	366.0	143.0	207.4
BN-Spillway	682.4	956.3	527.3	554.5	344.6	345.3
Boca Negra Dam	682.4	956.3	527.3	554.5	344.6	345.3
Boca Negra Inflow	1734.5	956.3	778.2	554.5	368.0	345.3
Boca_Negra	9.1	1.1	1.4	0.3	0.0	0.0
DE II Airport Pond	42.3	78.7	26.1	34.1	17.5	17.4
Diversion-1	107.1	330.1	88.4	180.6	71.2	103.1
JArroyo	107.1	330.1	88.4	180.6	71.2	103.1
JQR	2575.9	458.5	1473.8	267.5	833.1	161.4
JVV_E	88.8	4.3	52.1	2.6	30.9	1.6
JVV_W	30.7	1.9	18.0	1.2	10.6	0.7
J_APS_A	149.5	9.7	80.5	5.7	42.0	3.3
J_APS_A_Pond	7.4	9.7	5.4	5.7	3.8	3.3
J_APS_B	166.8	15.0	90.5	8.8	48.0	5.3
J_UPM1	168.4	13.7	65.3	8.5	36.7	5.4
J_UPM1_Pond	175.5	13.7	102.6	8.5	58.6	5.4
J_63	221.4	21.5	129.1	13.3	74.1	8.4
J_63_UPM1	386.6	35.2	176.8	21.9	107.1	13.7
J11	182.2	17.1	108.6	10.4	63.8	6.7
J11049	253.0	20.1	102.4	9.6	31.1	4.1
J11079	397.6	33.1	159.6	16.1	48.6	7.2
J11082	170.0	10.4	89.1	6.0	45.7	3.5
J11088	285.9	22.8	115.4	10.9	35.2	4.7
J11123	524.3	715.3	192.7	385.4	145.5	216.2
J11128	125.8	20.0	30.8	6.9	2.5	1.6
J11131	0.0	0.0	0.0	0.0	0.0	0.0
J11140	203.5	40.1	50.4	14.8	12.8	4.7
J11171	42.3	78.7	26.1	34.1	17.5	17.4
J11174	252.5	54.6	62.9	21.2	19.9	7.6
J11193	536.4	93.2	272.3	54.6	146.6	32.9
J11206	624.3	113.2	342.7	67.4	186.0	40.9

J12	162.6	15.2	91.8	9.0	53.0	5.6
J14	274.6	33.1	163.6	20.4	95.8	13.1
J14A	90.4	5.5	54.1	3.4	31.8	2.2
J14-16	805.5	83.7	473.2	51.5	272.7	33.0
J15	239.8	34.4	137.2	20.8	78.8	12.9
J16	548.4	50.5	318.4	31.1	181.1	19.9
J16A	113.8	6.9	67.8	4.3	39.6	2.8
J16B	106.2	7.9	63.9	4.9	37.6	3.1
J16C	239.5	19.7	144.4	12.1	84.8	7.8
J16D	42.5	2.5	25.3	1.6	14.7	1.0
J16E	171.1	13.4	101.1	8.1	59.4	5.1
J17	191.0	24.2	110.1	14.8	63.3	9.2
J20A	281.7	17.1	158.8	10.2	93.2	6.3
J20B	224.9	15.8	130.3	9.6	74.8	5.9
J21A	51.3	8.4	26.2	4.6	13.8	2.6
J21B	52.1	8.3	18.5	3.6	7.2	1.4
J21C	174.1	23.2	105.4	14.2	61.5	9.0
J22A	168.3	20.0	101.6	12.8	58.6	8.0
J22B	180.7	20.0	109.1	12.8	62.9	8.0
J22C	285.7	32.6	159.8	18.9	92.4	11.3
J23	321.3	52.6	191.8	33.3	110.4	20.8
J25A	31.0	4.3	12.6	2.0	5.5	0.9
J25B	34.4	4.2	8.2	1.4	0.6	0.3
J25C	26.3	4.7	5.6	1.4	2.6	0.4
J25-27	194.7	37.6	48.3	13.7	9.8	4.2
J26	65.5	10.3	16.0	3.5	1.3	0.8
J27A	26.6	3.8	10.2	1.7	4.3	0.8
J27B	60.3	9.7	14.8	3.3	1.2	0.8
J30A	248.0	29.1	146.1	18.1	86.0	11.6
J30B	55.7	13.9	21.2	6.0	8.9	2.7
J30C	20.1	2.5	7.6	1.1	3.4	0.5
J32	236.0	17.0	129.9	10.0	72.2	6.0
J33A	96.1	19.9	41.9	9.3	22.9	4.8
J33AB	191.4	58.2	78.1	25.1	38.4	13.3
J33B	49.3	16.3	16.9	5.2	10.0	2.7
J36	234.8	71.0	95.6	31.1	48.7	16.4
J37	77.6	21.9	34.5	10.5	17.5	5.7
J37A	52.5	10.3	22.0	4.9	9.7	2.3
J37B	45.3	11.5	22.4	5.6	13.2	3.3
J39	65.1	83.2	27.1	36.2	17.8	18.4
J39A	33.5	2.3	15.4	1.1	9.0	0.6
J39B	30.0	2.1	10.6	0.9	4.4	0.4
J39C	74.8	7.8	22.4	3.1	3.5	1.0
J40	309.2	39.7	114.6	17.7	32.2	7.1
J41	216.7	673.9	178.3	366.0	143.0	207.4
J41A	43.1	4.8	9.5	1.6	0.5	0.3
J41B	44.0	5.3	11.4	1.9	1.1	0.5
J41C	30.0	2.6	8.4	1.0	1.1	0.3
J41D	13.5	1.1	2.6	0.4	0.1	0.1
J41E	50.3	3.3	20.2	1.6	6.4	0.7
J41F Pond	0.0	0.0	0.0	0.0	0.0	0.0
J41-43	253.2	681.8	179.0	369.7	143.4	209.1
J42B	269.8	50.9	110.0	24.1	35.2	10.4
J43A	77.7	9.1	25.7	3.8	6.2	1.4
J43B	89.8	7.9	35.1	3.7	13.0	1.7

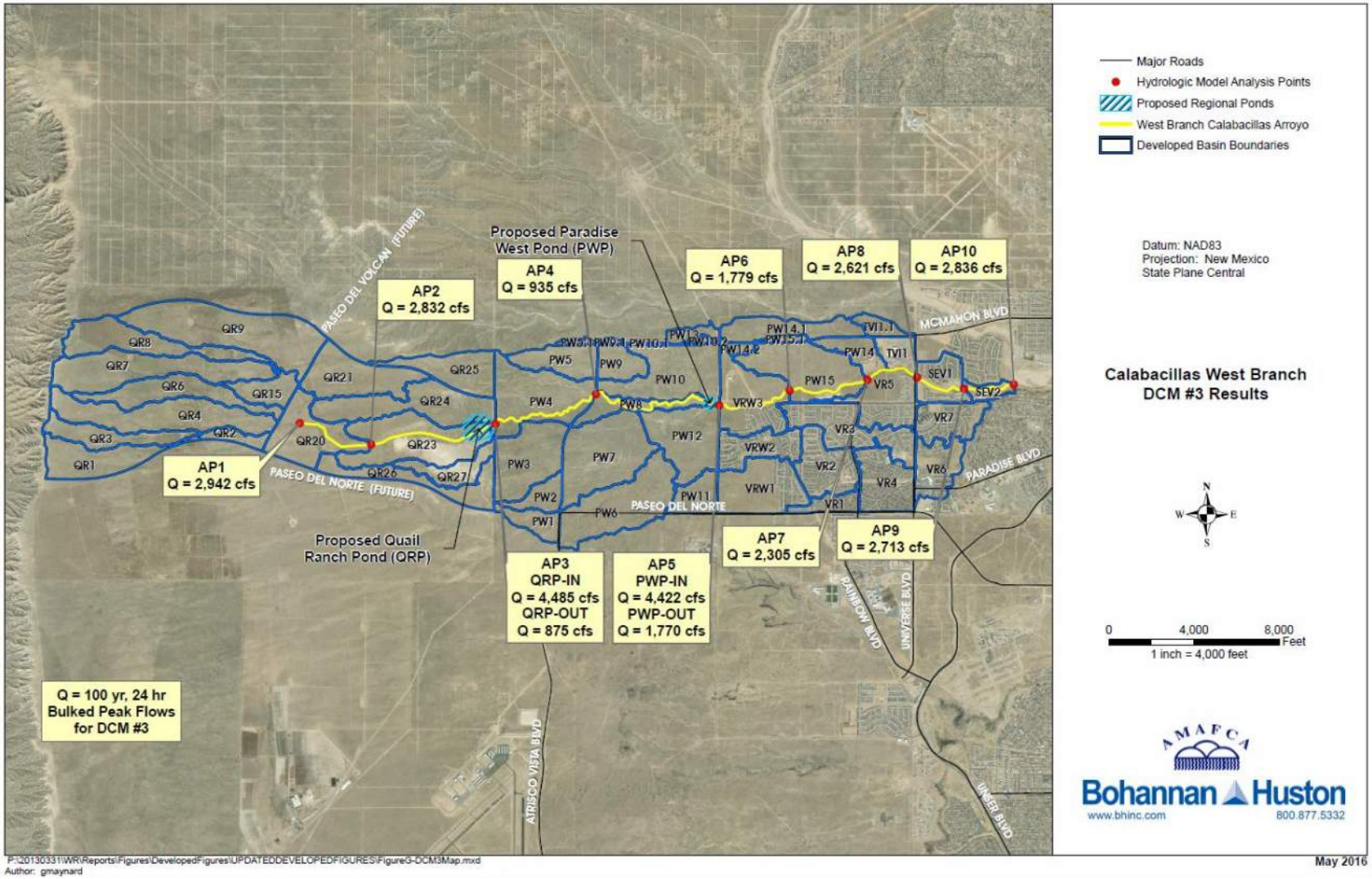
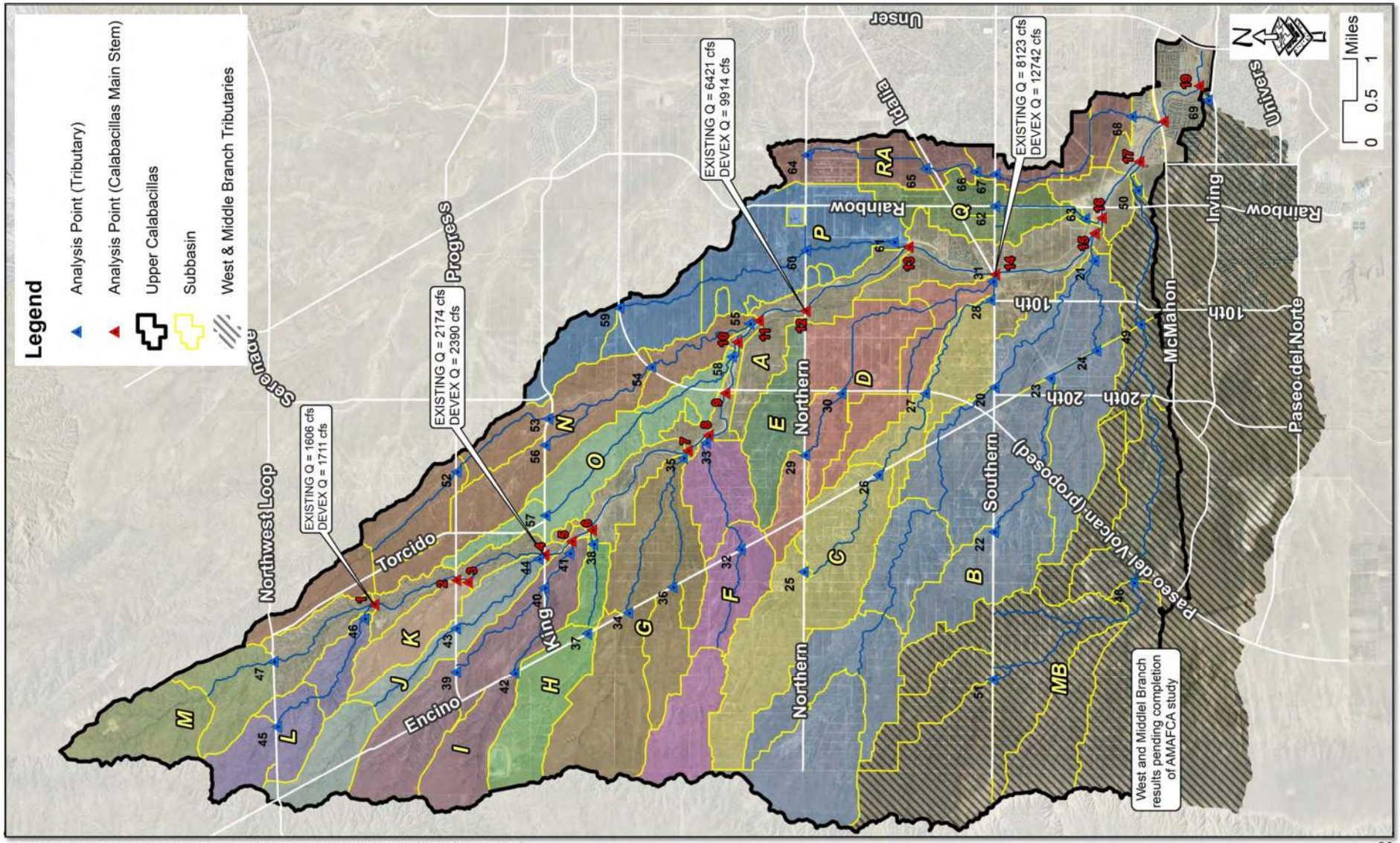


Figure 8 – Calabacillas West Branch DCM #3 Results

DCM#3 RESULTS, 24-hour Event									
Analysis Point (AP)	Hydrologic Element	Drainage Area (mi^2)	Drainage Area (ac)	Peak Discharge (Q_2) (cfs)	Volume (V_2) (ac-ft)	Peak Discharge (Q_{10}) (cfs)	Volume (V_{10}) (ac-ft)	Peak Discharge (Q_{100}) (cfs)	Volume (V_{100}) (ac-ft)
	QR26_P	0.0797	51	0	0	7	1	30	3
	QR26	0.2344	150	90	7	179	14	317	23
	QR25_P	0.1312	84	0	0	1	0	18	2
	QR25_I	0.1024	66	75	5	145	9	240	13
	QR25	0.2336	150	75	5	145	9	251	15
	QR27_I	0.0925	59	53	4	103	8	170	12
	QR27_P	0.0478	31	0	0	4	1	18	2
	QR27	0.1403	90	53	4	106	8	186	14
AP3-QRP	QR3_24	4.952853	3,170	1,228	116	2,395	222	4,288	379
	QPR	4.952853	3,170	301	115	#N/A	#N/A	#N/A	#N/A
	QPR_OUT	4.952853	3,170	301	115	577	221	837	378
	RT.QR24	4.952853	3,170	301	115	577	221	837	378
	PW4_P	0.2187	140	0	0	0	0	10	2
	PW4_I	0.2035	130	136	9	265	17	439	26
	PW4	0.4222	270	136	9	265	17	441	28
AP4	QR3_25_PW4	5.375053	3,440	311	125	594	238	865	406
	RT.PW4	5.375053	3,440	311	125	594	238	865	406
	PW3_P	0.1919	123	0	0	16	2	87	6
	PW3_I	0.1536	98	117	7	227	13	376	20
	PW3	0.3455	221	117	7	237	15	454	26
	PW2_I	0.0511	33	41	2	80	4	132	7
	PW2_P	0.0494	32	0	0	5	1	26	2
	PW2	0.1005	64	41	2	83	5	156	8
	QR26_PW3	0.446	285	158	10	319	19	609	34
	RT.PW3	0.446	285	155	10	311	19	582	34
	PW7_I	0.2944	188	196	14	382	24	633	38
	PW7_P	0.1809	116	0	0	16	2	79	6
	PW7	0.4753	304	196	14	394	26	704	44
	PW6_I	0.2457	157	144	11	280	20	464	32
	PW6_P	0.2093	134	3	1	36	4	122	9
	PW6	0.455	291	145	12	312	24	581	41
	PW1_I	0.0684	44	51	3	100	6	166	9
	PW1_P	0.0352	23	0	0	4	0	17	1
	PW1	0.1036	66	51	3	102	6	181	10
	PW3_PW7	1.4799	947	521	39	1,072	76	1,965	129
	RT.PW7	1.4799	947	519	39	1,067	76	1,952	129
	PW10_I	0.2594	166	179	12	348	21	577	34
	PW10_P	0.1486	95	0	0	5	1	40	3
	PW10	0.408	261	179	12	350	22	608	37
	PW12_I	0.2062	132	134	10	262	17	433	27
	PW12_P	0.1395	89	0	0	15	2	65	5
	PW12	0.3457	221	134	10	272	19	493	32
	PW5_I	0.1171	75	87	5	170	10	281	15
	PW5_P	0.0635	41	0	0	0	0	9	1
	PW5	0.1806	116	87	5	170	10	286	16
	PW5.1_I	0.0097	6	9	1	18	1	29	1
	PW5.1_P	0.0068	4	0	0	0	0	0	0
	PW5.1	0.0165	11	9	1	18	1	29	1
	PW5_5.1	0.1971	126	94	6	184	11	309	17
	RT.PW5	0.1971	126	94	6	183	11	308	18
	PW9_I	0.0738	47	54	3	104	6	173	10

Figure 17: Map showing analysis points along the main stem of the Calabacillas Arroyo (red) and along major tributaries (blue).



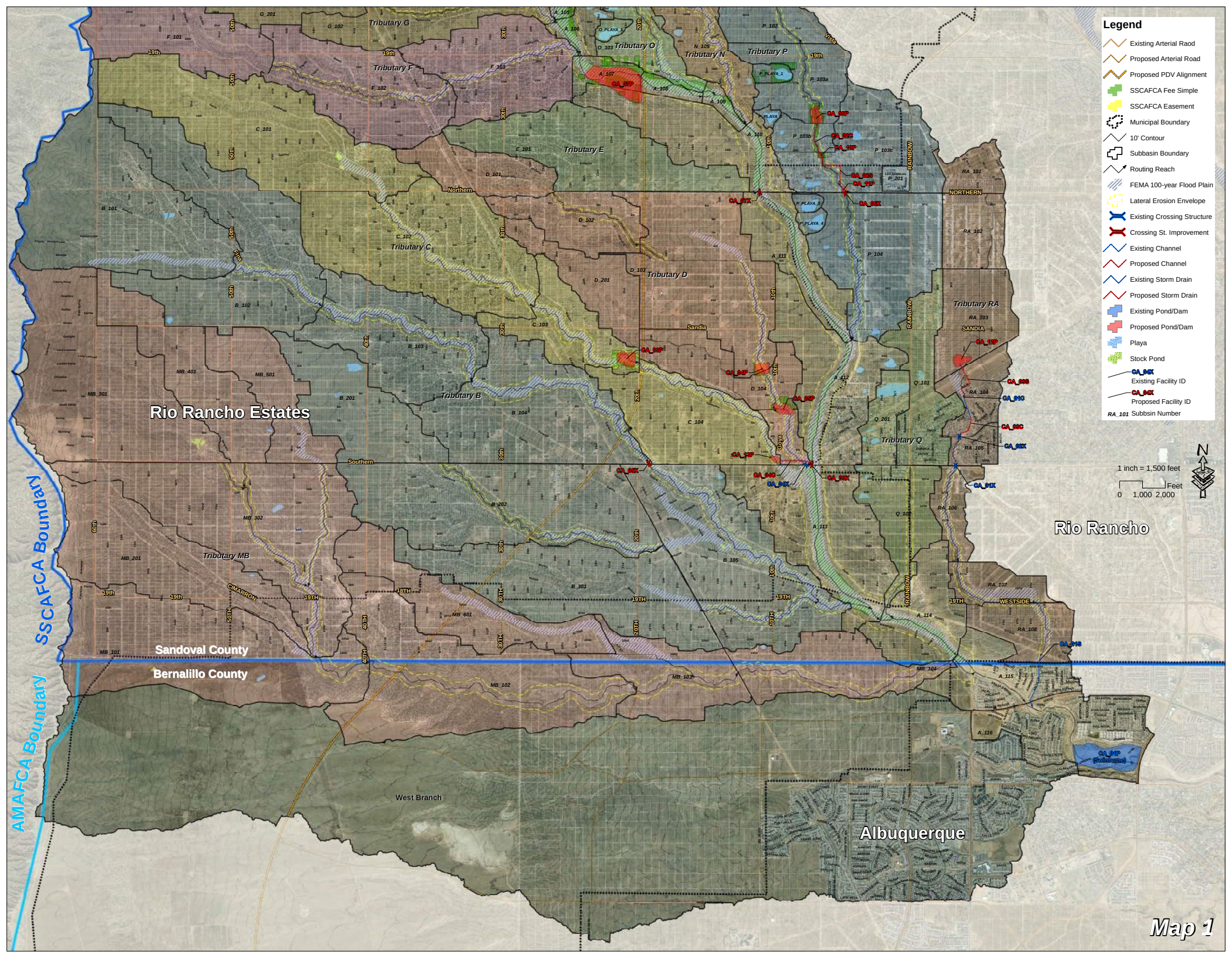

Legend
Existing Arterial Raod
Proposed Arterial Road
Proposed PDV Alignment
SSCAFCA Fee Simple
SSCAFCA Easement
Municipal Boundary
10' Contour
Subbasin Boundary
Routing Reach
FEMA 100-year Flood Plain
Lateral Erosion Envelope
Existing Crossing Structure
Crossing St. Improvement
Existing Channel
Proposed Channel
Existing Storm Drain
Proposed Storm Drain
Existing Pond/Dam
Proposed Pond/Dam
Playa
Stock Pond
CA_04X
Existing Facility ID
CA_04X
Proposed Facility ID
RA_101 Subbsin Number
1 inch = 1,500 feet
0 1,000 2,000 Feet
N
Rio Rancho Estates
Rio Rancho
Albuquerque
Sandoval County
Bernalillo County
SSCAFCA Boundary
AMAFCA Boundary
Tributary G
Tributary F
Tributary O
Tributary N
Tributary P
Tributary E
Tributary C
Tributary D
Tributary B
Tributary MB
Tributary Q
Tributary RA
Northern
Sandia
Southern
West Branch
Map 1

Table 10: EXISTING and DEVEX Flows for selected analysis points; results are based on model runs with depth-area reduction factors based on the size of the area draining to each analysis point.

Analysis Point	Tributary	HEC-HMS Element	Drainage Area (mi^2)	EXISTING 100-year peak flow (cfs)	EXISTING 100-year runoff volume (AC-FT)	DEVEX 100-year peak flow (cfs)	DEVEX 100-year runoff volume (AC-FT)
1	Calabacillas Main Stem (A)	A_101_J	4.2	1606	142	1711	158
2		A_102_J	4.6	1577	153	1687	170
3		A_103_J1	5.3	1694	178	1772	202
4		A_103_J2	7.4	2174	244	2390	279
5		A_104_J1	10.7	2850	349	3988	463
6		A_104_J2	12.4	3237	407	4998	542
7		A_105_J	16.9	4410	525	6727	690
8		A_106_J	19.8	5307	614	7929	794
9		A_107_J	19.9	5279	618	7896	798
10		A_108_J	21.7	5571	670	8562	925
11		A_109_J	26.3	6232	775	9671	1096
12		A_110_J	27.9	6421	826	9914	1170
13		A_111_J	32.1	7113	962	11100	1404
14		A_112_J	40.6	8123	1157	12742	1764
15		A_113_J1	52.3	10158	1468	15566	2241
16		A_113_J2	53.5	10213	1532	15685	2335
17		A_114_J	65.7	*tbd*	*tbd*	*tbd*	*tbd*
18		A_115_J	68.3	*tbd*	*tbd*	*tbd*	*tbd*
19		A_116_J	80.1	*tbd*	*tbd*	*tbd*	*tbd*
20	B	B_104_J	5.5	1823	178	2427	216
21		B_105_J2	10.7	2547	325	3475	462
22		B_201	0.8	391	25	569	30
23		B_202_J	2.4	830	77	1217	100
24		B_301_J	3.7	1117	115	1918	162
25	C	C_101	1.6	663	54	965	61
26		C_102_J	3.1	1048	102	1481	119
27		C_103_J	3.6	1103	118	1636	163
28		C_104_J	4.4	1179	145	1730	226
29	D	D_101	0.4	305	14	487	23
30		D_102_J	0.9	577	30	924	50
31		D_104_J2	3.2	1338	106	2178	181
32	F	F_102_J	1.9	845	66	1187	77
33		F_103_J	2.8	997	94	1360	109
34	G	G_101	1.7	846	59	1245	69
35		G_102_J2	3.8	1586	128	2268	150
36		G_201	0.6	375	22	536	25
37	H	H_101	1.2	732	50	1130	67
38		H_102_J	1.6	868	62	1334	81
39	I	I_101	1.2	657	43	948	50
40		I_102_J1	2.1	1155	77	1955	120
41		I_102_J2	3.4	1565	117	2717	197
42		I_201	0.9	522	33	1041	70
43	J	J_102_J	1.3	650	44	801	54
44		J_103_J	1.8	759	62	893	74
45	L	L_101	0.5	390	18	397	18
46		L_103_J	1.5	812	53	957	66
47	M	M_102_J	2.0	970	71	970	71
48	Middle Branch (MB)	MB_101_J	7.7	*tbd*	*tbd*	*tbd*	*tbd*
49		MB_103_J2	10.9	*tbd*	*tbd*	*tbd*	*tbd*
50		MB_104_J	11.6	*tbd*	*tbd*	*tbd*	*tbd*
51		MB_301	1.7	*tbd*	*tbd*	*tbd*	*tbd*
52	N	N_102_J	1.4	657	50	906	59
53		N_103_J	1.9	730	67	981	78
54		N_104_J2	3.9	1235	132	1829	197
55		N_105_J	4.5	1262	150	1851	219
56		N_201	1.0	479	36	725	43
57	O	O_101	0.3	228	11	312	13
58		O_103_J	1.7	644	56	1584	132
59	P	P_101	0.6	350	19	656	38
60		P_103_J	2.7	1092	104	1699	164
61		P_104_J	3.7	1524	139	2290	233
62	Q	Q_101	0.5	656	39	780	50
63		Q_102_J	1.2	1170	72	1551	104
64	Rainbow Tributary (RA)	RA_101	0.2	210	8	307	14
65		RA_103_J	1.0	723	41	1144	80
66		RA_104_J	1.2	892	61	1400	105
67		RA_105_J	1.3	969	72	1495	116
68		RA_108_J	2.1	1052	98	1753	176
69	West Branch (WB)	WB_SWINBURNE_INFLOW	11.1	*tbd*	*tbd*	*tbd*	*tbd*

- All peak flow rates and runoff volumes in this table are for selected locations in the corresponding HEC-HMS models. For more details, please consult Appendix C.
- The peak flow at a confluence is not necessarily the sum of the peak flows from corresponding tributaries.

DEVEX CONDITIONS RESULTS

Note: Results reported in this table are representative for the area draining to each analysis point (see "Drainage Area" column below). Results were compiled from 14 model runs with varying depth-area reduction factors.

Analysis Point (Hydro ID)	Drainage Area (mi2)	Peak Discharge (cfs)	Time of Peak	Runoff Volume (ac-ft)
B_101_R	1.7	1143	01Jan2000, 01:48	61
B_102	1.5	1043	01Jan2000, 01:42	59
B_102_J	3.2	1998	01Jan2000, 01:48	118
B_102_R	3.2	1962	01Jan2000, 02:03	118
B_103	1.0	770	01Jan2000, 01:39	39
B_103_J	4.2	2256	01Jan2000, 02:03	155
B_103_R	4.2	2211	01Jan2000, 02:18	156
B_104	1.3	1102	01Jan2000, 01:39	64
B_104_J	5.5	2427	01Jan2000, 02:15	216
B_104_R1	5.5	2409	01Jan2000, 02:33	216
B_104_R2	9.3	3299	01Jan2000, 02:39	373
B_105	1.4	1388	01Jan2000, 01:42	99
B_105_J1	9.3	3397	01Jan2000, 02:33	372
B_105_J2	10.7	3475	01Jan2000, 02:03	462
B_201	0.8	569	01Jan2000, 01:39	30
B_201_R	0.8	559	01Jan2000, 02:03	30
B_202	1.6	1029	01Jan2000, 01:45	70
B_202_J	2.4	1217	01Jan2000, 02:00	100
B_202_R	2.4	1202	01Jan2000, 02:06	100
B_301	1.4	1046	01Jan2000, 01:42	66
B_301_J	3.7	1918	01Jan2000, 01:45	162
B_301_R	3.7	1899	01Jan2000, 01:57	162
C_101	1.6	965	01Jan2000, 01:45	61
C_101_R	1.6	949	01Jan2000, 02:03	61
C_102	1.5	1075	01Jan2000, 01:42	60
C_102_J	3.1	1481	01Jan2000, 02:00	119
C_102_R	3.1	1480	01Jan2000, 02:12	119
C_103	0.5	708	01Jan2000, 01:36	45
C_103_J	3.6	1636	01Jan2000, 02:12	163
C_103_R	3.6	1599	01Jan2000, 02:30	163
C_104	0.8	932	01Jan2000, 01:39	64
C_104_J	4.4	1730	01Jan2000, 02:30	226
D_101	0.4	487	01Jan2000, 01:36	23
D_101_R	0.4	472	01Jan2000, 01:45	23
D_102	0.5	583	01Jan2000, 01:36	27
D_102_J	0.9	924	01Jan2000, 01:42	50
D_102_R	0.9	913	01Jan2000, 02:00	50
D_103	1.3	1080	01Jan2000, 01:42	66
D_103_J	2.2	1551	01Jan2000, 01:57	116
D_103_R1	2.2	1536	01Jan2000, 02:00	116
D_103_R2	2.6	1888	01Jan2000, 02:06	135
D_104	0.6	688	01Jan2000, 01:39	47
D_104_J1	2.6	1937	01Jan2000, 02:00	135
D_104_J2	3.2	2178	01Jan2000, 02:06	181
D_201	0.4	460	01Jan2000, 01:36	21
D_201_R	0.4	451	01Jan2000, 02:00	21
E_101	1.0	798	01Jan2000, 01:42	51
F_101	1.0	753	01Jan2000, 01:39	39
F_101_R	1.0	740	01Jan2000, 01:54	39
F_102	1.0	790	01Jan2000, 01:39	38
F_102_J	1.9	1187	01Jan2000, 01:51	77
F_102_R	1.9	1169	01Jan2000, 02:03	77
F_103	0.9	817	01Jan2000, 01:36	34
F_103_J	2.8	1360	01Jan2000, 02:03	109
G_101	1.7	1245	01Jan2000, 01:42	69
G_101_R1	1.7	1230	01Jan2000, 01:54	69
G_101_R2	2.4	1680	01Jan2000, 01:57	95
G_102	1.5	1049	01Jan2000, 01:42	60
G_102_J1	2.4	1709	01Jan2000, 01:54	95
G_102_J2	3.8	2268	01Jan2000, 01:57	150
G_201	0.6	536	01Jan2000, 01:39	25
G_201_R	0.6	522	01Jan2000, 01:48	25
H_101	1.2	1130	01Jan2000, 01:39	67
H_101_R	1.2	1123	01Jan2000, 01:48	67
H_102	0.3	345	01Jan2000, 01:36	14
H_102_J	1.6	1334	01Jan2000, 01:45	81
I_101	1.2	948	01Jan2000, 01:39	50
I_101_R1	1.2	936	01Jan2000, 01:51	50
I_101_R2	2.1	1943	01Jan2000, 01:54	120

DEVEX CONDITIONS RESULTS

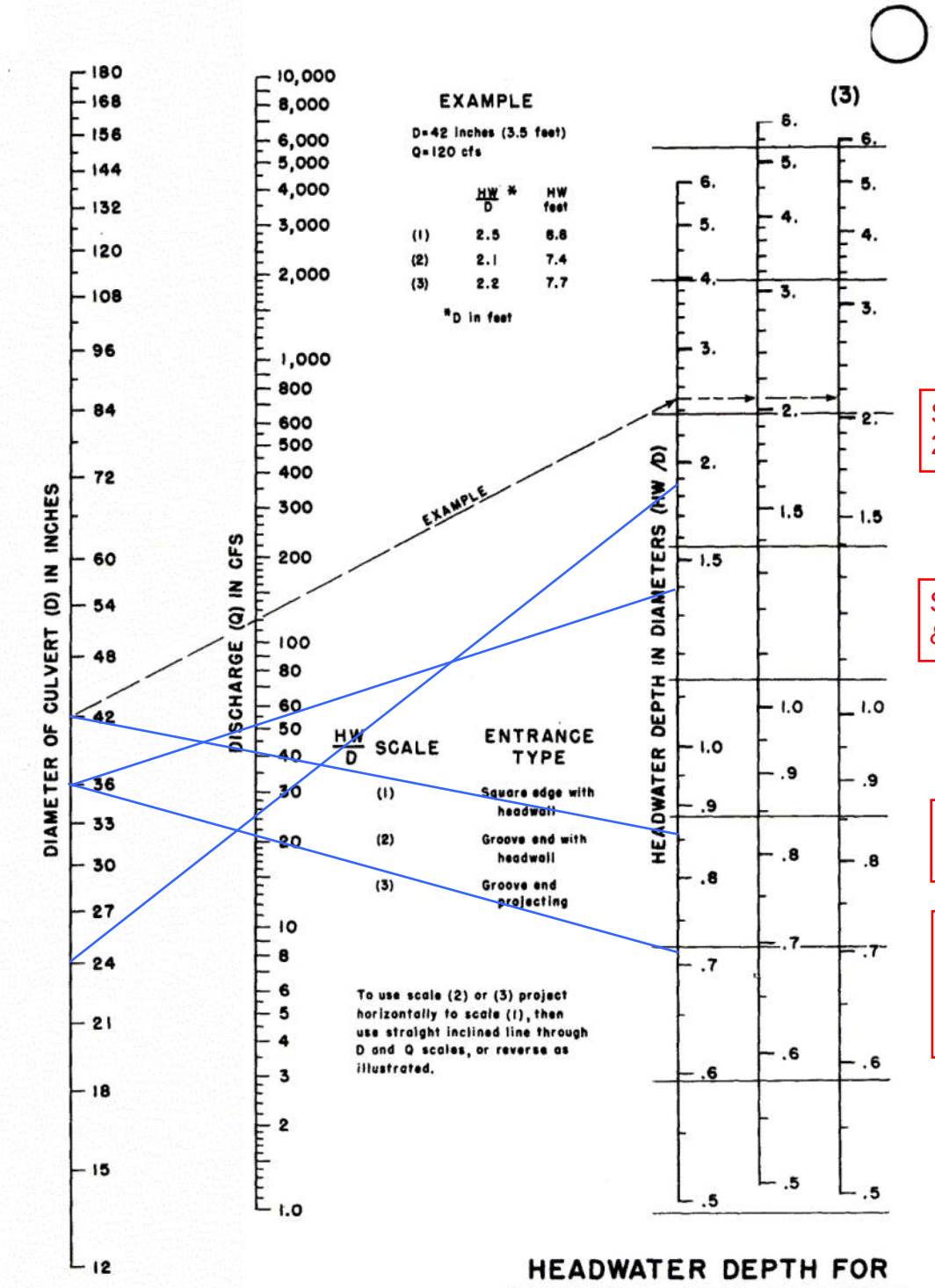
Note: Results reported in this table are representative for the area draining to each analysis point (see "Drainage Area" column below). Results were compiled from 14 model runs with varying depth-area reduction factors.

Analysis Point (Hydro ID)	Drainage Area (mi2)	Peak Discharge (cfs)	Time of Peak	Runoff Volume (ac-ft)
I_102	1.3	1195	01Jan2000, 01:42	80
I_102_J1	2.1	1955	01Jan2000, 01:48	120
I_102_J2	3.4	2717	01Jan2000, 01:51	197
I_201	0.9	1041	01Jan2000, 01:39	70
I_201_R	0.9	1026	01Jan2000, 01:48	70
J_101	0.8	607	01Jan2000, 01:42	34
J_101_R	0.8	598	01Jan2000, 01:57	34
J_102	0.4	446	01Jan2000, 01:36	20
J_102_J	1.3	801	01Jan2000, 01:54	54
J_102_R	1.3	789	01Jan2000, 02:12	54
J_103	0.5	442	01Jan2000, 01:39	20
J_103_J	1.8	893	01Jan2000, 02:09	74
K_101	0.7	651	01Jan2000, 01:39	33
L_101	0.5	397	01Jan2000, 01:39	18
L_101_R	0.5	393	01Jan2000, 01:48	18
L_102	0.5	590	01Jan2000, 01:36	24
L_102_J	1.1	772	01Jan2000, 01:45	42
L_102_R	1.1	757	01Jan2000, 02:00	42
L_103	0.5	587	01Jan2000, 01:36	24
L_103_J	1.5	957	01Jan2000, 01:57	66
M_101	1.2	694	01Jan2000, 01:42	41
M_101_R	1.2	686	01Jan2000, 02:00	41
M_102	0.9	640	01Jan2000, 01:39	30
M_102_J	2.0	970	01Jan2000, 01:57	71
M_102_R	2.0	950	01Jan2000, 02:18	71
MB_101	1.8	1693	01Jan2000, 01:39	108
MB_101_J	7.7	3494	01Jan2000, 02:06	315
MB_101_R	7.7	3389	01Jan2000, 02:30	315
MB_102	1.7	1866	01Jan2000, 01:42	140
MB_102_J	9.4	3891	01Jan2000, 02:09	452
MB_102_R1	9.4	3821	01Jan2000, 02:12	452
MB_102_R2	10.2	3952	01Jan2000, 02:18	476
MB_103	0.7	1058	01Jan2000, 01:33	59
MB_103_J1	10.2	4004	01Jan2000, 02:12	476
MB_103_J2	10.9	4059	01Jan2000, 02:18	533
MB_103_R	10.9	3981	01Jan2000, 02:33	533
MB_104	0.7	876	01Jan2000, 01:36	53
MB_104_J	11.5	4022	01Jan2000, 02:33	581
MB_201	1.1	711	01Jan2000, 01:42	42
MB_301	1.7	1100	01Jan2000, 01:42	59
MB_301_R1	1.7	1092	01Jan2000, 01:45	59
MB_301_R2	2.5	1606	01Jan2000, 01:57	87
MB_301_R3	3.1	2001	01Jan2000, 02:03	109
MB_302	1.7	1144	01Jan2000, 01:42	69
MB_302_J1	2.5	1618	01Jan2000, 01:45	87
MB_302_J2	3.1	2020	01Jan2000, 01:57	109
MB_302_J3	5.9	2894	01Jan2000, 02:03	213
MB_302_R	5.9	2858	01Jan2000, 02:06	213
MB_401	0.8	593	01Jan2000, 01:39	30
MB_401_R	0.8	583	01Jan2000, 01:42	30
MB_501	0.6	449	01Jan2000, 01:39	22
MB_501_R	0.6	443	01Jan2000, 01:54	22
MB_601	0.8	513	01Jan2000, 01:42	32
MB_601_R	0.8	510	01Jan2000, 01:48	32
N_101	0.6	522	01Jan2000, 01:39	24
N_101_R	0.6	512	01Jan2000, 01:54	24
N_102	0.8	727	01Jan2000, 01:39	35
N_102_J	1.4	906	01Jan2000, 01:54	59
N_102_R	1.4	898	01Jan2000, 02:09	59
N_103	0.5	482	01Jan2000, 01:36	19
N_103_J	1.9	981	01Jan2000, 02:09	78
N_103_R1	1.9	954	01Jan2000, 02:15	78
N_103_R2	3.0	1436	01Jan2000, 02:09	119
N_104	1.0	1184	01Jan2000, 01:39	79
N_104_J1	3.0	1467	01Jan2000, 02:00	119
N_104_J2	3.9	1829	01Jan2000, 02:09	197
N_104_R	3.9	1790	01Jan2000, 02:24	196
N_105	0.6	436	01Jan2000, 01:39	24
N_105_J	4.5	1851	01Jan2000, 02:24	219

Appendix D3

Culvert Capacity Calculations

CHART 1B



Structure 3, 2-24"

Structures 1 & 2, 5-36"

Structure 6, 5-42"

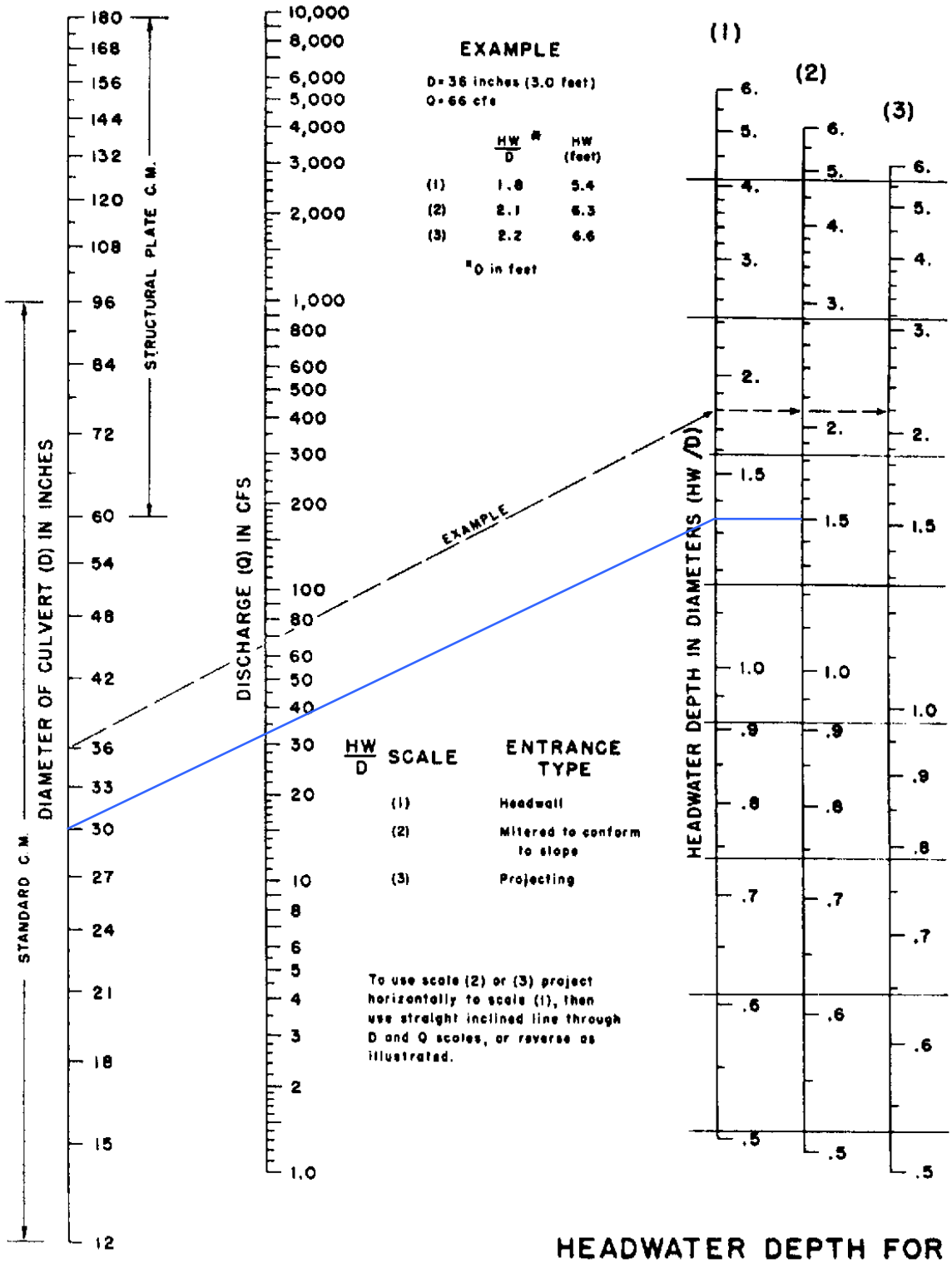
Structure 2, 3-36"
Structure 4, 4-36"

HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 283
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

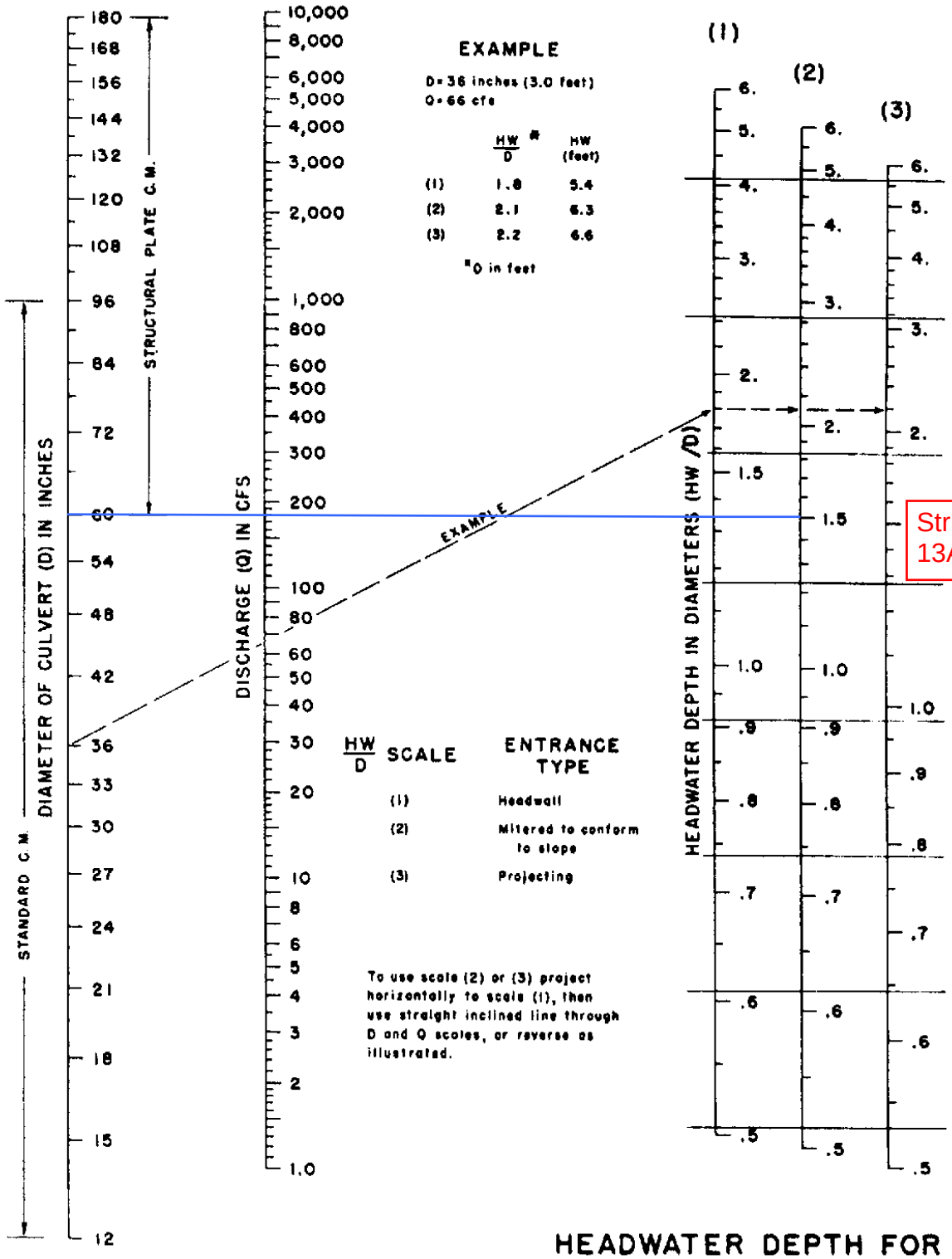
Structures 11A, 11B, 12A, 12B, 13B, 13C, 15A, 15B, 18A, 18B, 21A, & 21B. Typical 30" diameter CMP capacity = 33 cfs



HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

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CHART 2B

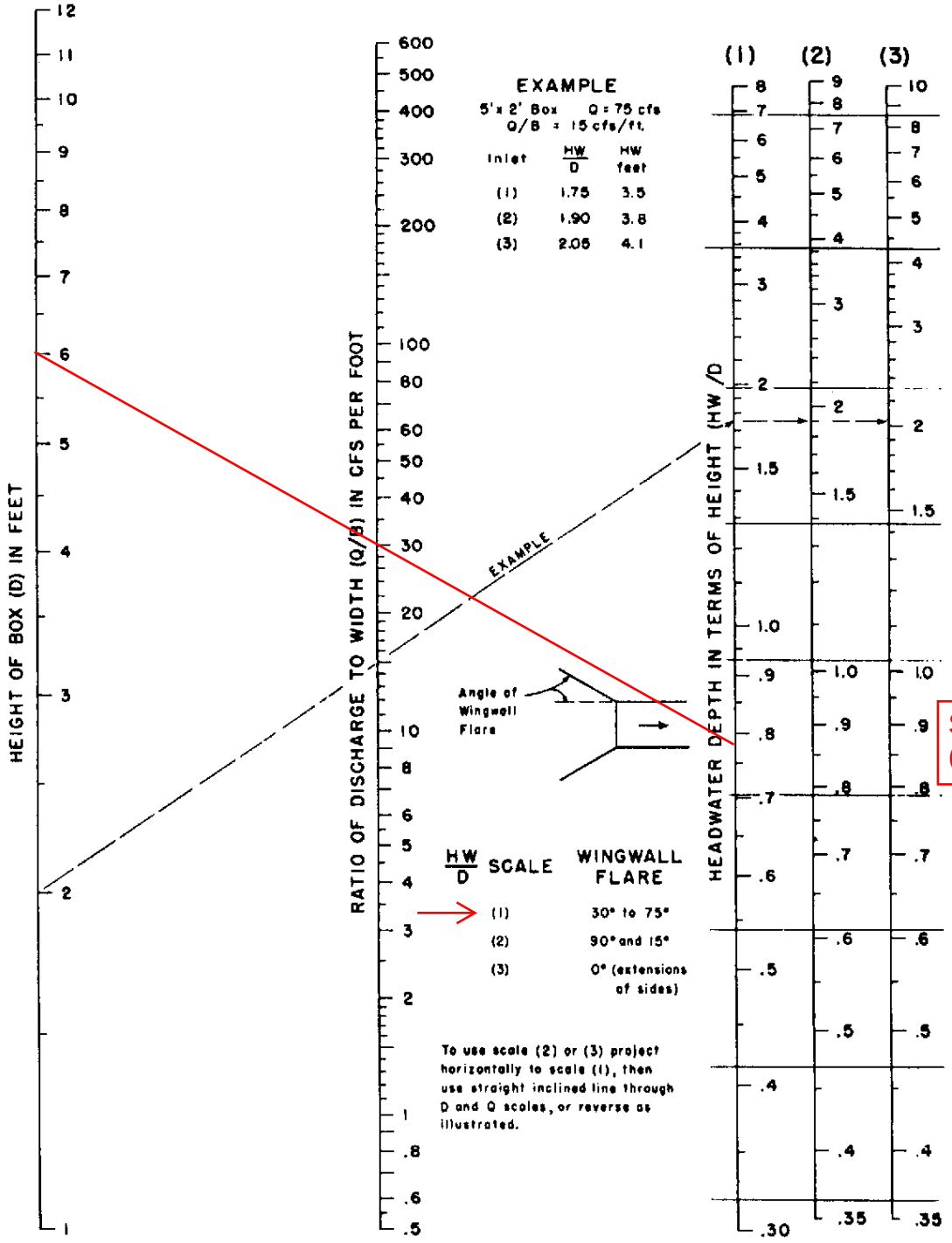


Structure 13A

HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

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CHART 8B

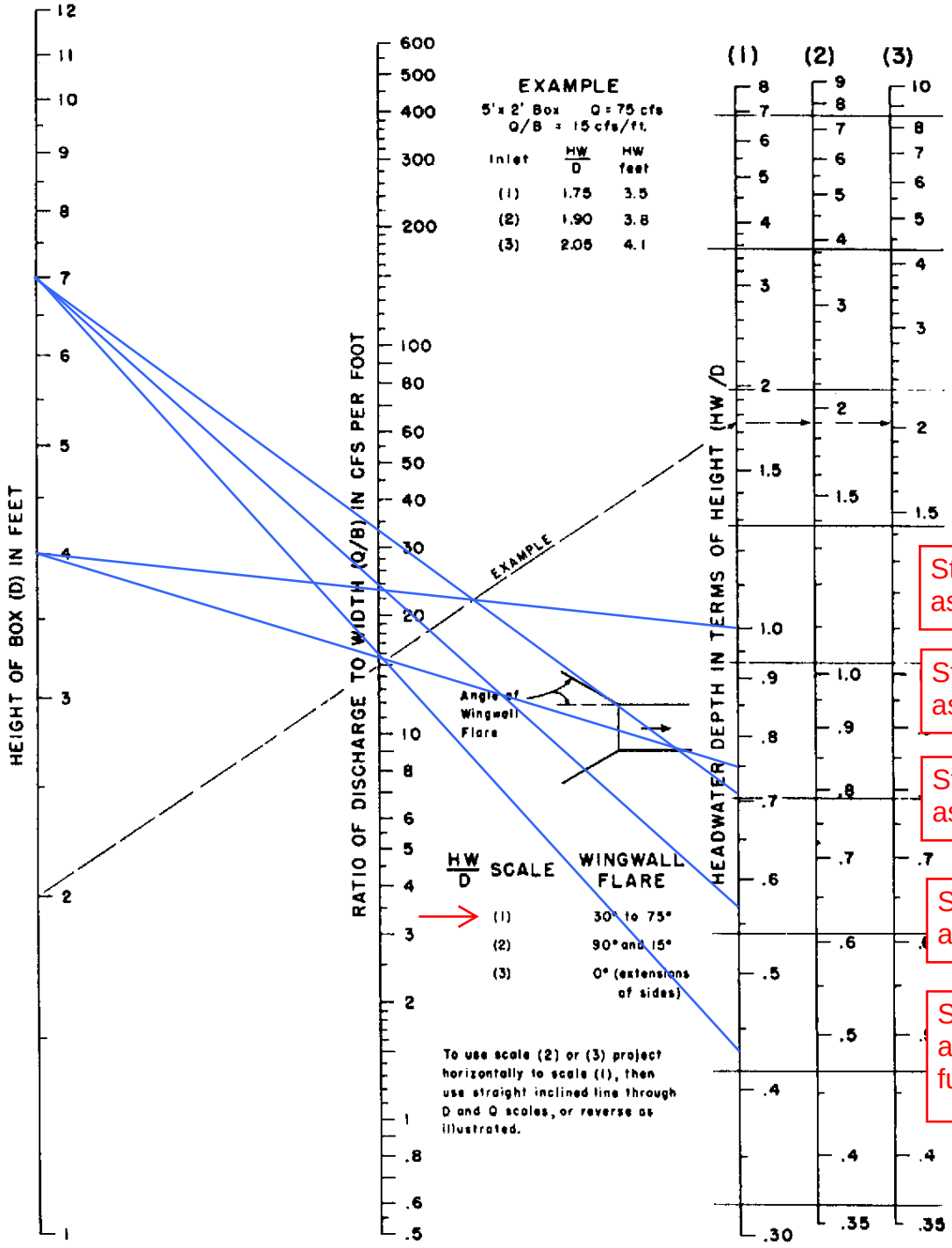


Structure 10 (bridge)

HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

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CHART 8B



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

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Structure 22, assume HW=4.0'

Structure 20, assume HW=3.0'

Structure 17, assume HW=5.0'

Structure 14, assume HW=4.0'

Structure 19, assume 3' bank full depth

Appendix D4

Calabacillas Middle Branch Channel Calculations

Worksheet for Irregular Section - Calabacillas MB existing

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01900	ft/ft
Discharge	3891.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
206+95	71.56
207+77	59.51
208+26	59.51
208+45	57.93
208+84	58.00
209+44	59.51
210+10	59.51
210+25	61.98

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(206+95, 71.56)	(208+26, 59.51)	0.045
(208+26, 59.51)	(209+44, 59.51)	0.030
(209+44, 59.51)	(210+25, 61.98)	0.045

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth		3.06	ft
Elevation Range	57.93 to 71.56 ft		
Flow Area		479.41	ft²

Worksheet for Irregular Section - Calabacillas MB existing

Results

Wetted Perimeter		252.37	ft
Hydraulic Radius		1.90	ft
Top Width		252.05	ft
Normal Depth		3.06	ft
Critical Depth		3.11	ft
Critical Slope		0.01752	ft/ft
Velocity		8.12	ft/s
Velocity Head		1.02	ft
Specific Energy		4.08	ft
Froude Number		1.04	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.06	ft
Critical Depth	3.11	ft
Channel Slope	0.01900	ft/ft
Critical Slope	0.01752	ft/ft

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