Design Concept Report

Yavapai County Northern Connector
CIP # 16-19419

LYON PROJECT 875-05
November 2017

Prepared for:

Yavapai County Public Works
1100 Commerce Drive
Prescott, AZ 86305

Prepared by:
Lyon Engineering & Surveying, Inc.
1650 Willow Creek Road
Prescott, AZ 86301
In Association with Biozone and Lee Engineering

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KEVIN D. HORTON, P.E.

EXPIRES 3/31/2018

LYON ENGINEERING
Civil Engineers • Land Surveyors

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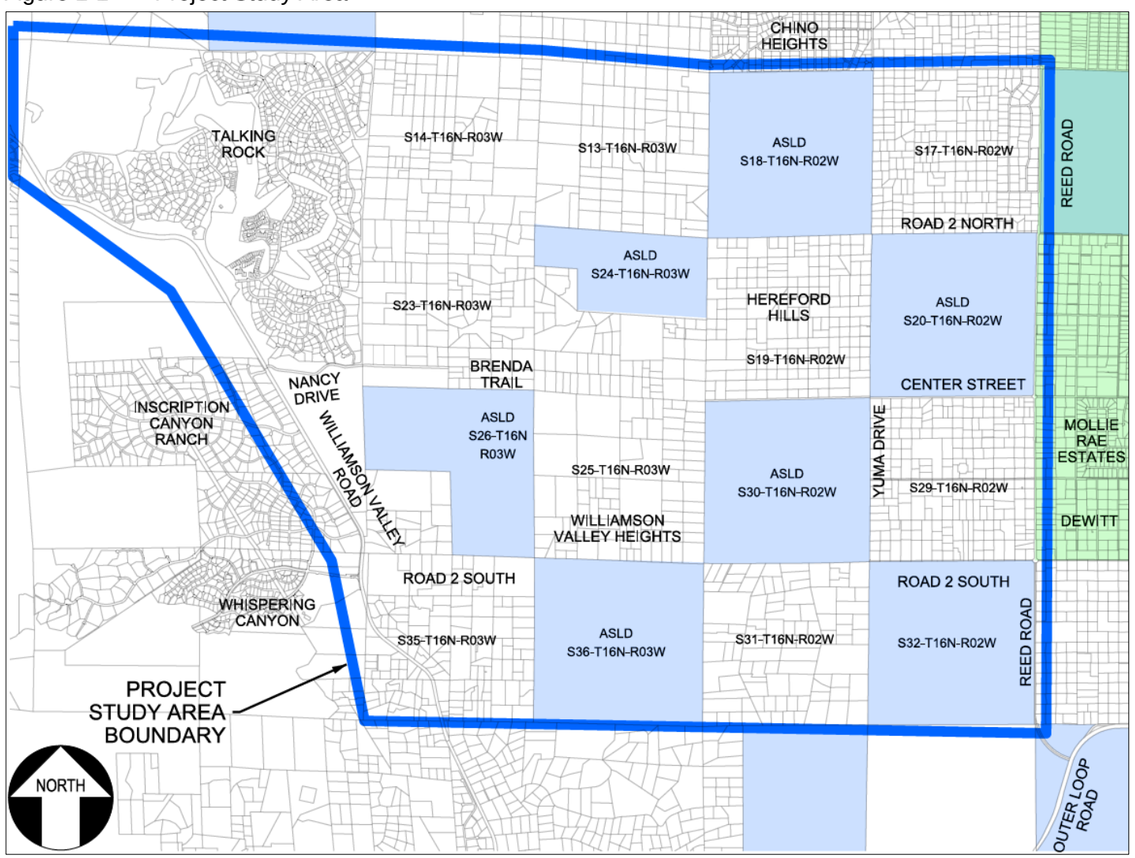
SECTION 1. Executive Summary

Lyon Engineering (LE), in cooperation with Yavapai County (YC), has completed a design report, alternative alignment analysis, hydrologic/hydraulic analysis, preliminary design plans, and a cost estimate for an all-weather future connector roadway between Williamson Valley Road and Reed Road at the western limits of Chino Valley, AZ. Due to continued growth in northern Williamson Valley, the need for an additional east-west connector roadway north of existing Outer Loop Road was originally identified by the Central Yavapai Metropolitan Planning Organization (CYMPO) in 2006. Subsequent evaluation by CYMPO, YC staff, and YC leadership led to the development of this study, entitled the ***Design Concept Report, Yavapai County Northern Connector (Project)***. The *Project* study area boundary is shown in Figure 1-1. The preliminary design *Project* planset includes drainage conveyance and roadway infrastructure to accommodate two paved travel lanes along the preferred east-west corridor as identified during the alternative route evaluation process.

Figure 1-1 Project Study Area



The *Project* is within the jurisdiction of both YC and the Arizona State Land Department (ASLD) and includes approximately five (5) miles of roadway corridor analysis and design. The *Project* is bound by existing Williamson Valley Road (WVR) on the west and Reed Road at the Chino Valley Town limits on the east. The YC and LE *Project* numbers are listed below:

- **Yavapai County Project Number – CIP # 16-19419**
- **Lyon Engineering Project Number – 875-05**

The purpose of this study is to have a plan in place for future growth, transportation needs, emergency response, and access to commercial services surrounding the *Project* area. The Doce Fire in June 2013, subsequent evacuations, and required emergency personnel response resulted in significant traffic congestion along the WVR corridor due to limited access routes to the area. The Doce Fire made it apparent that a secondary east-west corridor would significantly benefit emergency access and response time to the WVR corridor in the event WVR or Outer Loop became impassible. In addition to a roadway conceptual alignment alternative (CAA) analysis, this report contains analysis and information that can be utilized in the future to approximate *Project* constraints, cost, and required action items necessary for successful final design efforts and right-of-way (ROW) acquisition. All design documentation, analysis, reports, and plans are also included in this report and Appendix. The *Project* consists of several major components as listed below:

- Conceptual Alignment Analysis (CAA), public outreach, ASLD review, and preferred alignment selection
- Existing condition analysis including:
  - Property boundary field survey
  - Biological and cultural evaluation
  - Potential Waters of the United States (WoUS) evaluation
  - Detailed aerial imagery and topography
  - Surface drainage analysis
- Traffic impact and safety analysis
- Roadway and drainage design parameters and analysis
- Preliminary (15%) design planset and cost estimate

The original scope of work was described in the ***Design Concept Report Scope of Work for the Northern Connector Williamson Valley Road to Reed Road in Chino Valley*** published by YC in April 2016. After LE was selected for the *Project* in July 2016, LE and YC staff further refined the *Project* scope to be included in the final design contract approved by the YC Board of Supervisors on September 7, 2016. YC previously developed, analyzed, and evaluated five potential corridors within the *Project* area in a report entitled the ***Preliminary Corridor Evaluation/Location Report Williamson Valley to Chino Valley Town Limits, Northern Connector Study*** (PCER study). In 2013, the YC Board of Supervisors (BOS) approved the PCER study and the recommended alignment beginning at the Inscription Canyon Drive/WVR intersection and ending at the Center Street/Reed Road intersection at the western limits of Chino Valley (Alignment 2B). Included in this report is additional evaluation of the five (5) PCER alignments and two (2) new alignment options as shown in Figure 1-2.

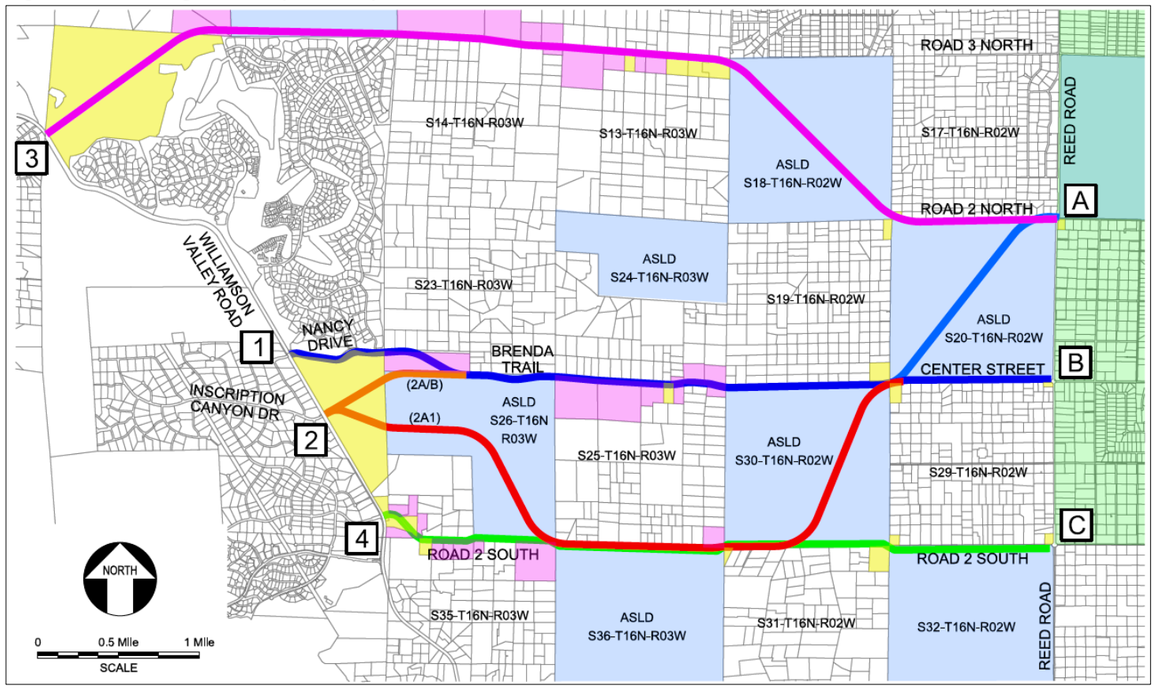
A goal of the CAA analysis was to evaluate the seven (7) corridor alignment options considering YC/LE identified evaluation criteria including; property impact, total right-of-way needed, route length, proximity to CV business center, utility conflicts, floodplain impact, drainage structure requirements, and total anticipated *Project* cost. Public information, input, participation, and responses were considered a significant component of the evaluation process, and all public input and responses were reviewed prior to the completion of the route evaluation process. The seven (7) route alignment options (in order of ranking) are summarized below:

Table 1-1 Alternative Alignment Evaluation Summary

Rank	Alignment Name & Description	Length (mi)	Properties Affected	Total Cost*
1	1B – Nancy Drive to Center Street	4.8	14 private, 3 state land	$12.9M
2	2B – Inscription Canyon to Center Street	4.6	13 private, 3 state land	$13.4M
3	4C – Road 2 South	4.2	18 private, 3 state land	$12.5M
4	2A – Inscription Canyon to Road 2 North	5.1	13 private, 3 state land	$15.2M
5	1A – Nancy Drive to Road 2 North	5.3	14 private, 3 state land	$15.6M
6	2A1 – Inscription Canyon to Road 2 North (south)	6.0	7 private, 4 state land	$16.6M
7	3A – Talking Rock to Road 2 North	6.9	18 private, 3 state land	$34.6M

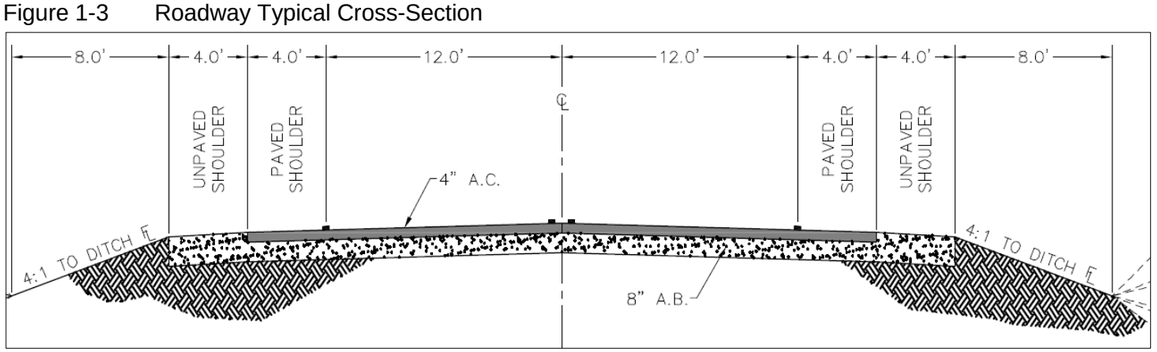
*Costs based on preliminary evaluations during the CAA process and not the 15% construction drawings

Figure 1-2 Alignment Option Map



There are no existing all-weather roadway corridors north of Outer Loop Road that connect west Chino Valley to WVR; however, there are two existing unmaintained primitive private dirt roadway routes that provide limited connectivity. The existing northern alignment connects existing Nancy Drive and Center Street via private roadways (near Alignment 1B) and the existing southern connection follows the Road 2 South alignment (near Alignment 4C). However, due to the primitive roadway condition, inadequate drainage conveyance infrastructure, required low travel speeds, and the need for 4-wheel drive in adverse weather conditions (rain/snow), neither can be considered an existing viable connector roadway for commuters and emergency response vehicles. The PCER report roadway cross-section shown in Figure 1-3 was utilized as the proposed roadway for the *Project.* The 15% plans propose a three-lane cross-section to accommodate left turn lanes at anticipated key intersection locations. Although a typical 2-lane roadway section is anticipated to suffice into the distant future, the ROW limits were evaluated for an ultimate 4-lane roadway section with an additional center turn lane at the same key intersection locations to ensure no additional ROW acquisition will be required.

Figure 1-3 Roadway Typical Cross-Section



The preferred Alignment Corridor (1B) has 2.7 miles of existing YC ROW that can be utilized (to the best extent practical) to accommodate the proposed roadway section. This report also identifies the anticipated ROW that will need to be acquired from private property and the Arizona State Land Department (ASLD) prior to construction. All of the properties in the *Project* area are on private wells, septic systems, and propane, so no significant impacts to public water mains, sewage collection system, or gas distribution systems are anticipated to complete the *Project*. Overhead electric and communication system lines are expected to be the primary focus for utility conflicts that will need to be identified and relocated during subsequent design and planning stages. Below is a list of the major stakeholders and service providers and their involvement in the *Project* implementation process.

Table 1-2 Identified Project Area Stakeholders

Stakeholder	Project Impact
Yavapai County	Existing Roadway and Drainage Infrastructure Impacted
YC Residents	Private Property Impact → Right-of-Way Acquisition and Impacts
Utility Companies & Service Providers	Dry Utility Coordination, Relocations Required, and Serviceability
Town of Chino Valley	Connectivity to Existing Roadways and Services
Arizona State Land Department	Route and Right-of-Way Approval Required

The *Project* design team consisted of LE and sub-consultants for specialized project tasks. Design team parties and duties are listed below:

- **Lyon Engineering** – Principal engineer and *Project* management
  - Field survey, data collection, potential WoUS evaluation
  - Roadway and drainage preliminary infrastructure design
  - Design report and CAA analysis
  - Stakeholder notifications and coordination
- **BetaPr** – Public relations
- **Biozone** – Biological and cultural analysis and reports
- **Cooper Aerial Mapping** – Aerial photography and imagery
- **Lee Engineering** – Traffic/safety analysis and report

At the completion of the *Project*, LE and the design team have prepared analysis and preliminary design documentation to be used as a roadmap for future final design efforts for YC staff and design professionals. The proposed route was chosen in accordance with evaluation criteria that demonstrates efficiency, comparatively low cost, and minimized negative impact to adjacent property owners. A thorough safety evaluation of the proposed roadway configuration and geometry was completed to ensure compliance with current design and safety standards. As demonstrated in the analysis, the corridor will improve regional connectivity, emergency response times, and access to amenities in Chino Valley. Since future funding to implement the *Project* is not secured, and the time frame for final design and construction was unknown at the time this report was prepared, it is imperative that future YC staff and design professionals take into consideration the significant lead time necessary for final design and post-design critical path items. Listed below are the critical path action items that YC and LE have identified as requirements for successful *Project* implementation (prior to the installation of the proposed roadway and drainage improvements).

1) Analysis of future design standards, constraints, and requirements vs. those utilized in this study
2) Private property and Arizona State Land right-of-way review and acquisition process
3) Utility conflict verification/identification and relocations
4) EPA Clean Water Act compliance and comparison of future rules/regulations vs. those in effect during this study
5) Evaluation of future vs. 2017 effective FEMA regulatory documents and potential impact on the *Project*
6) Preparation of final design plans, specifications, and special provisions

SECTION 2. Introduction

2.1 Foreword

Williamson Valley is a rural region in Yavapai County encompassing a large area north of Prescott that has experienced one of the highest growth rates in unincorporated Yavapai County over the last 20 years. Although not officially geographically bound, rural Williamson Valley is located both east and west of Williamson Valley Road (WVR) approximately from Pioneer Parkway at the south, nearly 20 miles north to Camp Wood Road (Forest Service Road 21) at the north. Although a significant amount of development in the Williamson Valley corridor has been in the form of parcel splits per the underlying RCU-2A (2-acre) zoning designation, several large residential subdivisions have also recently become established, creating population clusters throughout the area. American Ranch, Mint Creek Ranch, Williamson Valley Ranch, Whispering Canyon, Inscription Canyon, Talking Rock, Valley View Estates, Long Meadow Ranch, Crossroads Ranch, Rancho Diamante, and Las Vegas Ranch are all significant subdivisions in northern Williamson Valley that have been constructed within the last 20 years. Parcel splits and development in the area bound by WVR at the west and State Route 89 (SR89) in Chino Valley (CV) at the east has also resulted in a significant increase in population and traffic in the area. The only east-west paved roadway that connects WVR to SR89 and Chino Valley is Outer Loop Road.

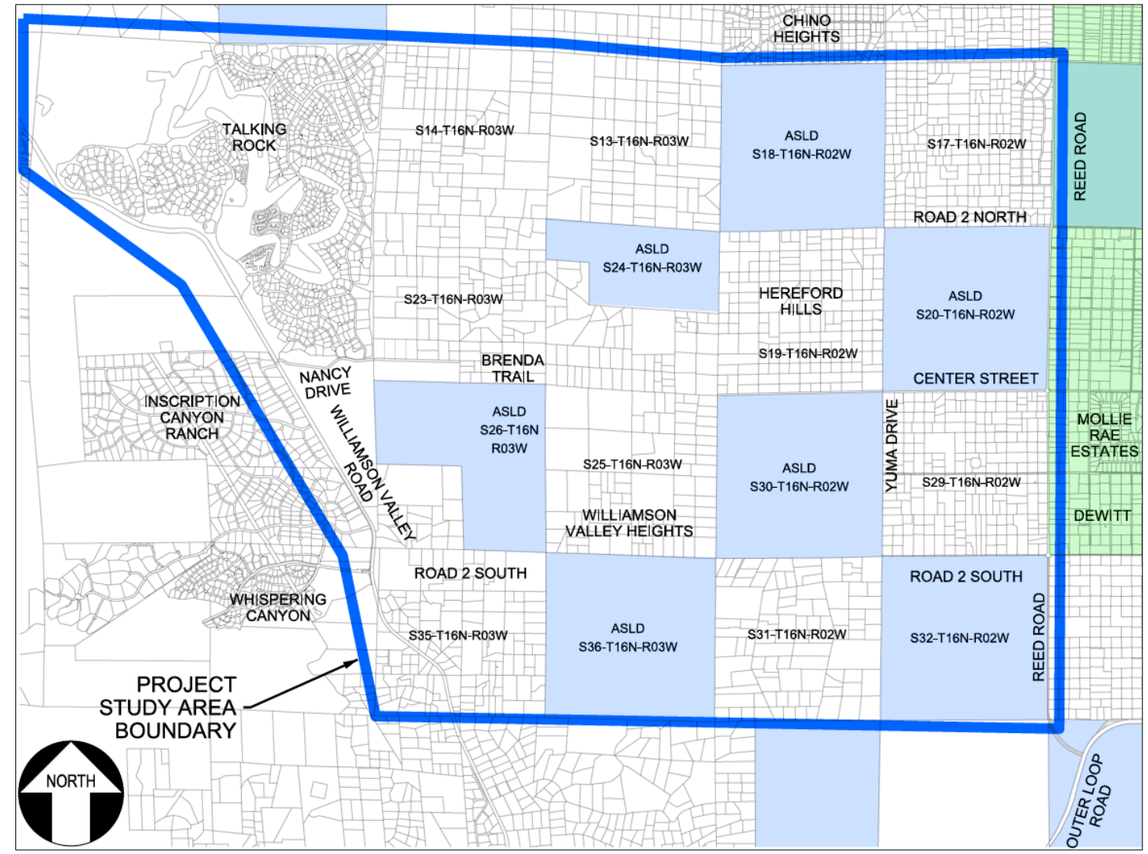
Williamson Valley residents have access to the Town of Chino Valley business center, which is approximately nine (9) miles from the WVR/Outer Loop Road intersection, or to the City of Prescott business center, which is approximately 14 miles south of the Outer Loop Road intersection. The significant residential development and growth in the Williamson Valley corridor in recent years has led to increased traffic volumes, and continued growth will result in Outer Loop Road experiencing even higher levels of traffic in the future. Due to continued growth in northern Williamson Valley, the need for an additional east-west connector roadway north of existing Outer Loop Road was originally identified by the Central Yavapai Metropolitan Planning Organization (CYMPO) in 2006. Subsequent evaluation by CYMPO, Yavapai County (YC) staff, and YC leadership led to the development of this study, entitled the ***Design Concept Report, Yavapai County Northern Connector*** *(Project)*. The *Project* study area boundary is shown in Figure 2-1.

Lyon Engineering (LE), in cooperation with YC, has completed a design report, alternative alignment analysis, hydrologic/hydraulic analysis, preliminary design plans, and a cost estimate for an all-weather future connector roadway between Williamson Valley Road and Reed Road at the western limits of CV as identified in the 2006 CYMPO study. The preliminary design *Project* planset includes drainage conveyance and roadway infrastructure to accommodate two paved travel lanes along the preferred east-west corridor as identified during the alternative route evaluation.

The *Project* is within the jurisdiction of both YC and the Arizona State Land Department (ASLD) and includes approximately five (5) miles of roadway corridor analysis and design. The *Project* is bound by existing Williamson Valley Road (WVR) on the west and Reed Road at the CV Town limits on the east. The YC and LE Project numbers are listed below:

- **Yavapai County Project Number – CIP # 16-19419**
- **Lyon Engineering Project Number – 875-05**

Figure 2-1 Project Study Area



2.2 Purpose

The purpose of this study is to have a plan in place for future growth, transportation needs, emergency response, and access to commercial services surrounding the *Project* area. The Doce Fire in June 2013, subsequent evacuations, and required emergency personnel response resulted in significant traffic congestion along the WVR corridor due to limited access routes to the area. The Doce Fire made it apparent that a secondary east-west corridor would significantly benefit emergency access and response time to the WVR corridor in the event WVR or Outer Loop became impassible. In addition to a roadway conceptual alignment alternative (CAA) analysis, this report contains analysis and information that can be utilized in the future to approximate *Project* constraints, cost, and required action items necessary for successful final design efforts and right-of-way (ROW) acquisition. All design documentation, analysis, reports, and plans are also included in this report and Appendix. The *Project* consists of several major components as listed below:

- Conceptual Alignment Analysis (CAA), public outreach, ASLD review, and preferred alignment selection
- Existing condition analysis including:
  - Property boundary field survey
  - Biological and cultural evaluation

- Potential Waters of the United States (WoUS) evaluation
- Detailed aerial imagery and topography
- Surface drainage analysis

- Traffic impact and safety analysis
- Roadway and drainage design parameters and analysis
- Preliminary (15%) design planset and cost estimate

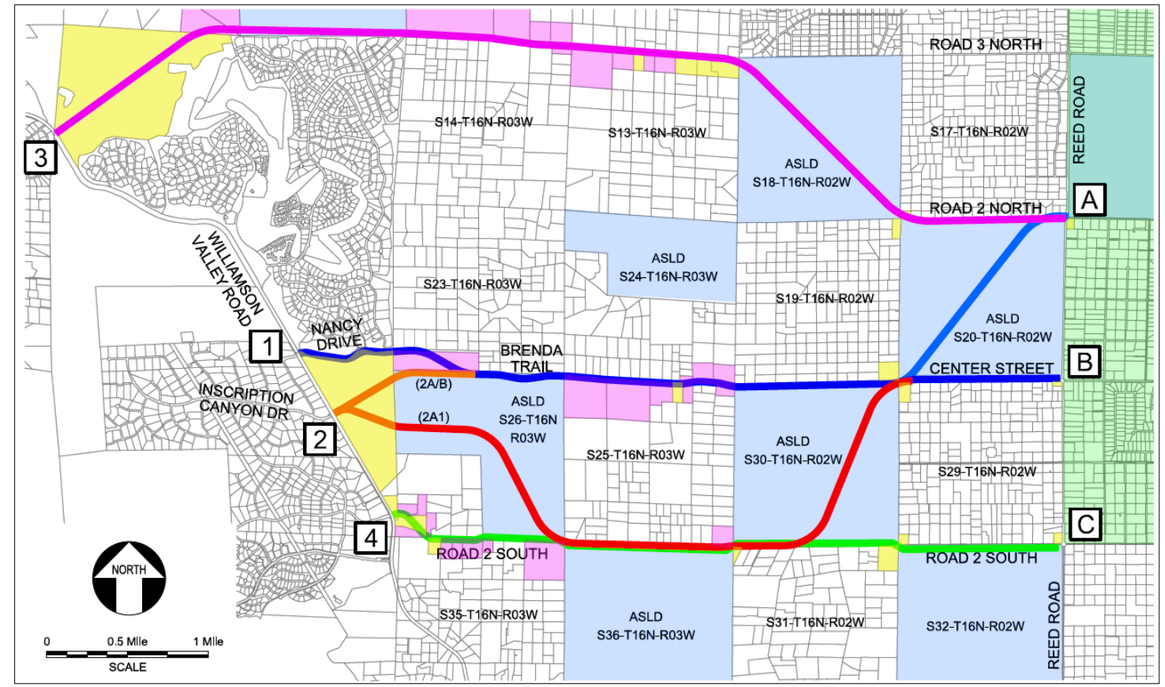
2.3 Description of the Project

The *Project* is a YC Public Works funded roadway and drainage preliminary design project that consists of infrastructure improvements of approximately five miles of new collector roadway (Figures 2-14 and 2-15 contain statewide and local vicinity location maps). The original scope of work for the *Project* was described in the ***Design Concept Report Scope of Work for the Northern Connector Williamson Valley Road to Reed Road in Chino Valley*** published by YC in April 2016. After LE was selected for the *Project* in July 2016, LE and YC staff further refined the Project scope to be included in the final design contract approved by the YC Board of Supervisors on September 7, 2016. The total estimated cost to construct the *Project* based on the 15% design planset included in this study is $15.5M, which is higher than the $12.9M cost developed during the preliminary CAA study process. The increase in estimated cost is due to a higher level of detail provided in the 15% design plans as compared to the CAA preliminary estimates, and it is expected that the other design option cost estimates would be proportionally higher if a more detailed level design were to be completed for each option.

YC previously developed, analyzed, and evaluated five potential corridors within the *Project* area in a report entitled the ***Preliminary Corridor Evaluation/Location Report Williamson Valley to Chino Valley Town Limits, Northern Connector Study*** (PCER study). In 2013, the YC Board of Supervisors (BOS) approved the PCER study and the recommended alignment beginning at the Inscription Canyon Drive/WVR intersection and ending at the Center Street/Reed Road intersection at the western limits of Chino Valley (Alignment 2B). The PCER report roadway cross-section shown in Figure 2-3 was decided to be the proposed roadway for the *Project* by YC staff. Included in this report is the additional evaluation of the five (5) PCER alignments and two (2) new alignment options as shown in Figure 2-2. Below is a list of major project tasks as identified in LE's design contract.

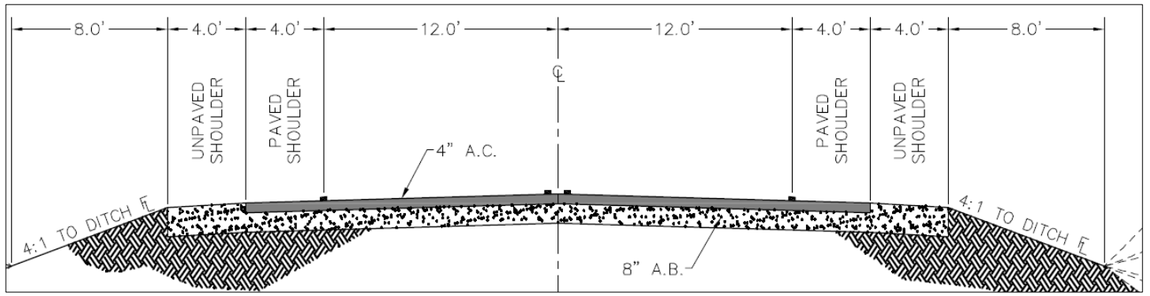
- Preliminary roadway analysis and design between Williamson Valley Road and Reed Road at the Chino Valley Town boundary
- Produce a detailed alignment study that will either validate in more detail the findings of the 2013 YC PCER report or provide a more cost effective alternative alignment
- Produce a Design Concept Report (DCR) in ADOT style format (this document)
- A comprehensive map of existing right-of-ways, property boundaries, and easements that will clearly define any existing utility constraints and provide the basis for future right-of-way acquisition legal descriptions or dedications
- Coordination with private property owners, the Town of Chino Valley, and the Arizona State Land Department
- Precise survey control and aerial mapping for the *Project*
- Waters of the U.S. delineation and Preliminary Jurisdictional Determination documentation
- ESA Compliance
- A detailed drainage report utilizing Yavapai County criteria
- Informative public stakeholder meetings and presentations to address potential concerns and issues that will then be incorporated into the 15% design
- 15% design plans with required detail to satisfy the Arizona State Land Department and provide accurate information for future right-of-way acquisition

Figure 2-2 Project Scope Area



The goal of the new roadway is to provide a supplemental east-west connector for residents, commuters, service providers, and emergency personnel that provides a more direct connection to the Town of Chino Valley (CV) business center located near the intersection of SR89 and Road 2 North. The intersection of existing Outer Loop Road and Road 2 North is approximately three (3) miles from the Town business center at Road 2 North. County staff and Chino Valley staff's preference was to locate the new roadway's connection point with Reed Road as close to the Town business center as practical. Continued development and growth surrounding the *Project* area will result in an increased need for a reliable east-west all-weather access route. The preliminary CAA process provided a means of objectively evaluating multiple route options and selecting a corridor that will best achieve *Project* goals and objectives. All proposed improvements adhere to the YC's adopted standards, development regulations, and drainage criteria. Roadway design components also adhere to AASHTO, MUTCD, and YC roadway standard guidelines.

Figure 2-3 Roadway Typical Cross-Section



2.4 Characteristics of the Project Area

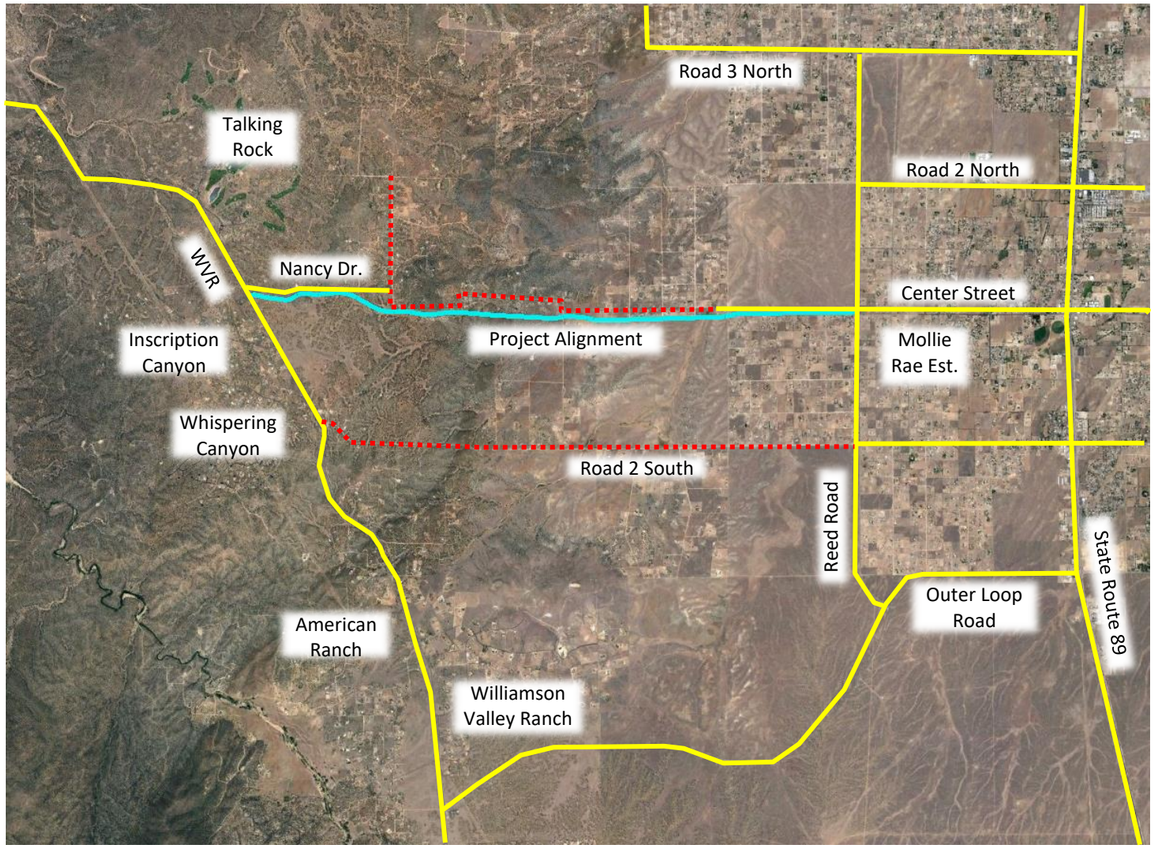
The *Project* is situated between undeveloped rangeland and clusters of large rural residential properties (2-acre minimum) in an upland rangeland environment. The western two-thirds of the *Project* is in a mixed Piñon Pine and Juniper vegetation, with moderately hilly terrain and well defined drainageways as shown in Figure 2-4. The eastern third of the *Project* is located in relative flat upland grassland terrain with broad, poorly defined drainageways as shown in Figure 2-5. Large undeveloped Arizona State Land Department sections (one square mile) checkerboard the *Project* area and are depicted as the blue shaded areas on Figures 2-1 and 2-2. No commercial properties or services exist within the *Project* area between WVR and Reed Road. The closest services and shopping area are in Chino Valley or the Old Stage Stop gas station and convenience store at the intersection of Outer Loop Road and WVR.

Figure 2-4 Western Project Terrain – Mixed Piñon and Juniper Vegetation

Figure 2-5 Eastern Project Terrain – Upland Rangeland

Connectivity between WVR and Chino Valley is very limited north of existing Outer Loop Road. There are no existing all-weather roadway corridors north of Outer Loop Road that connect west Chino Valley to WVR, however, there are two existing unmaintained primitive private dirt roadway routes that provide limited connectivity. Both routes traverse private property and are not maintained by YC. The existing northern alignment connects existing Nancy Drive, Brenda Trail, and Center Street via private roadways, and the existing southern connection follows the Road 2 South alignment as shown in Figure 2-6. The roadways shown in solid yellow are paved roadways within either YC right-of-way or Town of Chino Valley right-of-way. The roadways shown in dashed red are private dirt roadways that are not the maintenance responsibility of YC. Both routes traverse rough terrain and their use required 4-wheel drive high clearance vehicles in adverse weather conditions (if passable at all). Due to the primitive roadway condition, inadequate drainage conveyance infrastructure, required low travel speeds, and the need for 4-wheel drive in adverse weather conditions (rain/snow), neither existing route can be considered an existing viable connector roadway for commuters and emergency response vehicles.

Figure 2-6 Existing Project Land Use and Connectivity Map



2.4.1 Roadway Characteristics

Existing local roadways consists of one lane of traffic in each direction, both striped and non-striped. The majority of local roadways are dirt private roadways that receive infrequent maintenance. Figure 2-6 shows the more heavily traveled roadways in the *Project* area. As previously described, east-west connectivity in the *Project* area is negatively impacted during adverse weather conditions, especially in winter months when freeze/thaw conditions can restrict travel for longer durations in low lying areas with poor drainage conveyance. Figures 2-7 through 2-11 provide examples of the existing roads in the *Project* area.

Figure 2-7 Existing Paved Roadway – Nancy Drive Looking East

Nancy Drive between the intersection of WVR and Brenda Trail is in within Yavapai County ROW and is in good condition. The pavement width along the 0.65-mile alignment between WVR and Brenda Trail is approximately 22' within the 66' wide YC ROW. The roadway has a centerline stripe and is posted at 35 mph. Drainage is routed via surface flow in roadside ditches and culverts route cross drainage beneath the roadway surface within natural drainageways.

Figure 2-8 Existing Paved Roadway – Center Street Looking West

Center Street west of Reed Road is also paved and in good condition up to the low water crossing west of Yuma drive. The pavement width along the 1.2-mile alignment between Reed Road and the western terminus of the paved roadway varies from 22' to 26' within the 50' wide YC ROW. Center Street follows existing YC ROW from the Reed Road intersection two-miles westward to the northwest corner of Section 30-T16N-R02W (1/4 mile west of the intersection with Son Shine Lane). No YC ROW exists between this location and the eastern terminus of the Nancy Drive ROW. Center Street west of Reed Road has a posted speed limit of 35 mph (at the east) and 25 mph (at the west). Advisory signs are located along the roadway corridor.

Figure 2-9 Existing Dirt Roadway – Brenda Trail Looking East

Brenda Trail between Nancy Drive and Center Street is a narrow dirt road with limited maintenance and drainage conveyance infrastructure. The roadway width ranges between 12' and 16' with longitudinal grades in excess of 14% in some locations. Although the roadway is suitable for most 2-wheel drive vehicles (including cars) in dry weather conditions, the roadway can become unpassable for most vehicles (including 4-wheel drive) in severe adverse weather conditions. The roadway surface, width, and grades are not in compliance with International Fire Code (IFC) emergency access roadway requirements (20' minimum width and all-weather surface). Slow travel speeds are required due to the roadway condition.

Figure 2-10 Existing Dirt Roadway – Center Street Looking West

Center Street between the eastern terminus of pavement and Brenda Trial appears to receive maintenance (grading and bar ditch cleaning) on a recurring (however irregular) basis. The dirt roadway is approximately 24' wide with moderate maximum longitudinal slopes. Although the width adheres to IFC requirements, the roadway could become unpassable for 2-wheel drive vehicles during severe rain or snow events. Drainage is conveyed via surface drainage and bar ditches on the sides of the roadways. Although the roadway is in relatively good condition, the irregular surface, potholes, and surface drainage crossings does not allow for high rates of speed. No posted speed limit signs were observed within dirt portion of Center Street.

Figure 2-11 Existing Dirt Roadway – Road 2 South Looking West

Road 2 South is the only other existing east-west connector within the *Project* area, however, it is unmaintained in several areas and impassible following significant rainfall events due to inadequate drainage conveyance infrastructure. The entire reach between WVR and Reed Road is dirt ranging from 14' to 22' wide. The roadway follows irregular and steep terrain at the western half of the 4.25-mile-long corridor. The eastern mile of the corridor between Sandy Drive and Reed Road is within an existing 25' wide YC ROW.

Driveway Access

Residential driveways along the local roadways vary in width and material. The driveways are mainly comprised of native compacted dirt; however, some driveways are composed of gravel, pavement, concrete, or other all-weather materials. Per the underlying RCU-2A zoning designation, front yard and rear yard setbacks to buildings are a minimum of 50'. Due to the large lot sizes in the *Project* area, most homes are situated more than the minimum required 50' from the front and rear property lines.

2.4.2 Drainage Characteristics

Existing drainage within the *Project* limits is generally from the south to north. The majority of stormwater travels via surface swales, meandering through vacant and occupied parcels, and overtops the existing roadways. The 100-year flooding limits are broad and shallow in the eastern portion of the *Project* and include Federal Emergency Management Agency (FEMA) designated floodplains and large contributing drainage basins upstream of the *Project* corridor. In the eastern portion of the *Project*, there are minor signs of erosion and little evidence of sediment transport, although the drainageways convey significant flows during large and infrequent storm events. The roadway crossings of the FEMA watercourses will require substantial drainage infrastructure to convey large storm events.

The western half of the *Project* has well-defined drainageways with significant erosion potential at major drainage crossings. The *Project* corridor is designed on the western portion so that upstream contributing drainage basin sizes are relatively small, therefore runoff impacting the proposed roadway will not be significant. Traditional small to moderate size drainage culverts will convey stormwater drainage on the majority of crossing locations. Figures 2-12 and 2-13 provide examples of existing drainageways that will impact the proposed roadway (one-foot increments on survey rod shown for scale).

Figure 2-12 Typical Drainageway (Western *Project* Limits)

Figure 2-13 Typical Drainageway (Eastern *Project* Limits)

2.4.3 Utilities

Utilities that are located within the *Project* limits are summarized in Table 2-1. This inventory of existing utility information was compiled from the utility provider information and field investigation. Utility potholing and BlueStake was not completed as a part of this project and underground dry utility locations reflected in the preliminary 15% construction drawing are an approximate representation based on information provided by utility providers. The potential need for utility relocations was evaluated during the design process and anticipated conflicts are represented in the 15% planset. Significant additional utility company coordination, investigation, potholing, and as-builts are anticipated to be a part of subsequent stages of design in the future.

Table 2-1 Existing Utilities

Utility Provider	Utility	Contact Person	Phone Number
APS	Electric	Erik Wikman	928-443-6660
UES	Natural Gas	Mali Ross	928-771-7227
CableOne	Cable TV	Ernie Ortega	928-910-3096
CenturyLink	Telephone	Karen Porter	928-776-2510

2.5 Agency and Public Scoping

This *Project* is being managed and funded by YC. The review and approval for the *Project* will be administered by YC. The Arizona State Land Department (ASLD) is the agency responsible for review and approval of the all proposed improvement within or affecting Arizona State Land prior to future ROW acquisition. LE obtained an ASLD right-of-entry (ROE) permit prior to commencing field investigations associated with this study. ASLD correspondence and documentation is located in Appendix I. Although the ASLD has already reviewed and approved the location of the proposed *Project* alignment as a part of this study, significant additional review and coordination with ASLD will be required during subsequent future design stages.

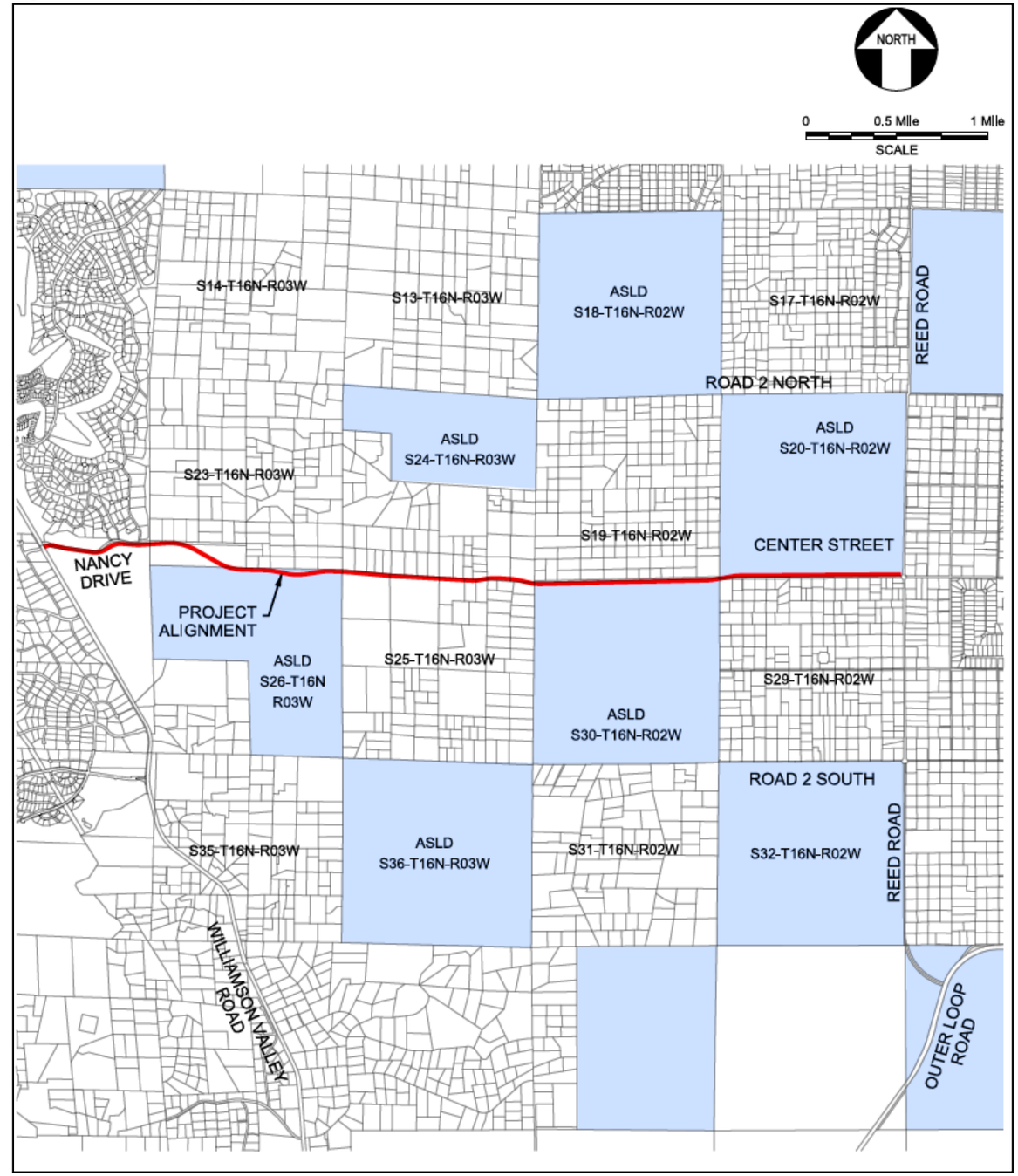
2.6 Stakeholders

Stakeholder perception of the proposed infrastructure and the impact that the Project will have on stakeholders is directly correlated to future feasibility and successful implementation. Positive public perception of the *Project* was deemed critical during design, and will be equally important during implementation. Significant stakeholder outreach was completed during the *Project* as described in Section 12 of this report.

Figure 2-14 State Location Map

[Map Source – ADOT Multimodal Planning Division "State Highway System Map"]

Figure 2-15 Vicinity Map



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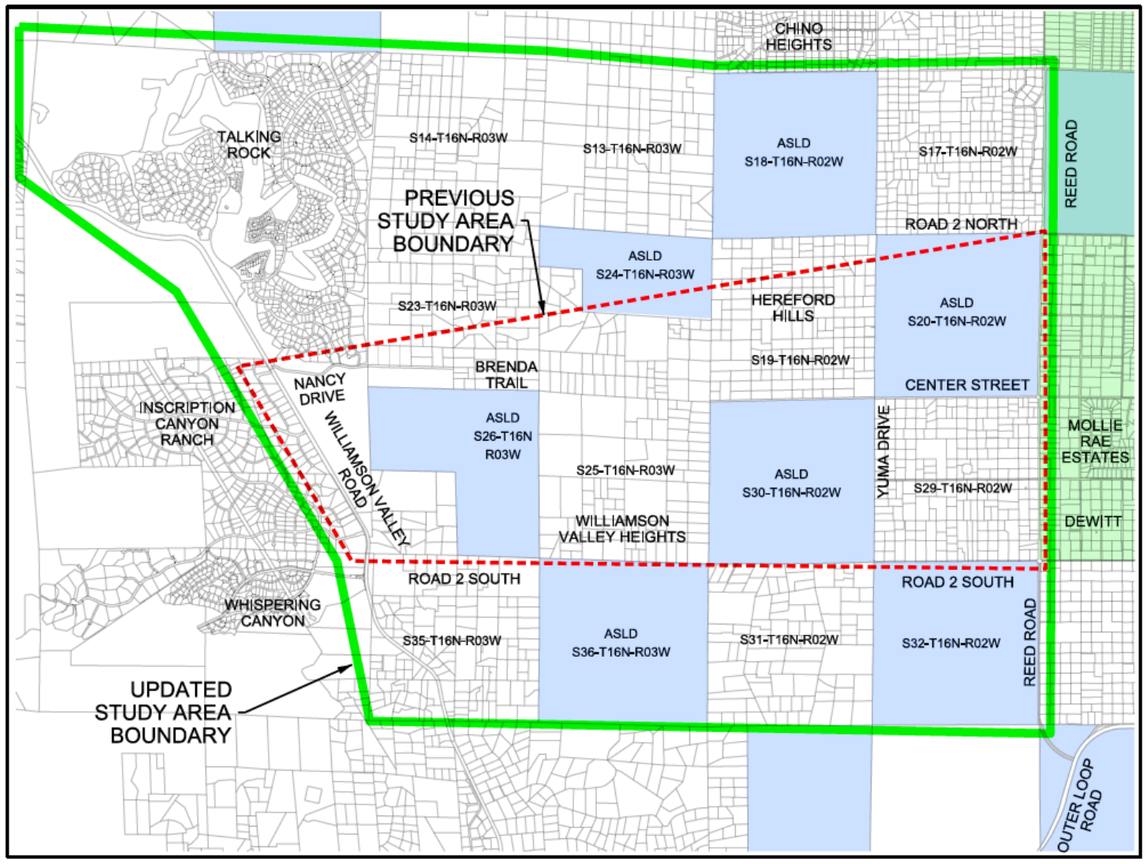
SECTION 3. Conceptual Alignment Alternative (CAA) Analysis

3.1 Overview

The Yavapai County Public Works Department (YC) prepared the Preliminary Corridor Evaluation/Location Report (PCER) in August 2013 to evaluate options for a future roadway connection (Northern Connector) between Williamson Valley Road (WVR) and Reed Road at the western limits of the Town of Chino Valley (CV). The north-south PCER study limits were approximately Nancy Drive to Road 2 North (at the north) and Road 2 South (at the south). Lyon Engineering (LE) was contracted in September 2016 to further evaluate the five (5) alignment options identified in the PCER, investigate additional alignment options within a broader study area, and complete a 15% preliminary design for the preferred corridor alignment as identified during LE's analysis and design process. The original YC ***PCER Northern Connector Corridor Options*** map is shown in Figure 3-11. Figure 3-1 shows the original PCER study area and the updated study area limits considered in this report.

Figure 3-1 PCER and Updated Project Study Area



This Conceptual Alignment Analysis (CAA) was completed with the goal of evaluating the findings of the previous PCER effort developed by YC Public Works and rating the feasibility of two (2) other alternative routes in additional to those presented in the PCER. Figure 3-11 contains the original Corridor Option Map and Figures 3-12 and 3-13 contain LE's supplemented Corridor Option Map and Alignment 3A & 4C Map, respectively. The PCER study contained preliminary engineer's estimates of probable construction cost for each of the five (5) corridor alignment options presented therein. This CAA study re-assessed the PCER cost estimate assumptions, and revised quantities/costs as necessary based on additional property impact, alignment length, and additional right-of-way (ROW) analysis only (Figures 3-15 through 3-21). The preliminary costs contained in the CAA were based on concept-level analysis for comparison between the alternatives only. Subsequent design efforts for the preferred alignment resulted in a higher estimated cost due to the higher level of design, analysis, and 15% construction planset that more accurately quantified required infrastructure. The Feasibility Decision Matrix presented in the PCER (Figure 3-14) was also re-evaluated and supplemented with the two (2) alternate alignments developed as a part of this CAA. Figure 3-22 is the LE updated feasibility decision matrix containing the PCER five alternatives and two additional alternatives described herein.

As with any proposed major transportation upgrade project in a developed or semi-developed area, some level of impact to private property is unavoidable. A major goal of both the original PCER and this CAA is to attempt to minimize private property encroachment, especially occupied private property, as much as practical. Special consideration was given to scoring in regard to encroachments on property with existing dwellings. It was also deemed critical to propose a cost-effective and efficient corridor. Therefore, two categories of the original PCER decision matrix (Private Parcels/State Lane Affected and Total Cost) were adjusted in this report to have a two-times multiplier assigned to each score. This modification to the matrix assigns an even higher score to cost-effective options that minimize encroachments onto private properties.

3.2 Yavapai County PCER Synopsis

The future need for an additional east-west corridor between Williamson Valley Road and west Chino Valley was first identified by the Central Yavapai Metropolitan Planning Organization (CYMPO) in 2006. The CYMPO 2011 Regional Transportation Plan (RTP) further identified the need for an additional east-west corridor north of existing Outer Loop Road, and YC's 2013 PCER study identified the preferred corridor as a western extension of Center Street in west Chino Valley. In 2013, the Yavapai County Board of Supervisors (BOS) approved the PCER findings and approximate location of the Northern Connector. CYMPO completed the RTP Update 2040 in April 2015 and identified the Northern Connector as an improvement project included in the year 2040 recommended network. Section 7 contains relevant CYMPO study excerpts that reference the proposed alignment location, roadway description, anticipated traffic volumes, and desired level of service.

A thorough description of the five previously identified routes and estimates of probable cost is located in the original YC PCER study (Appendix F). Figure 3-14 contains PCER "Exhibit 3 – Williamson Valley Road to Town of Chino Valley Limits Corridor Feasibility Decision Matrix" that contains relevant route data, corridor costs, and a final ranking score used to identify the preferred alternative. The following sections contain a summary of relevant alignment information and LE's evaluation of the PCER findings, assumptions, and results. Figure 3-11 is the Corridor Option Map that corresponds to the options described below. It identifies each of the alignment route alternatives, State land, private land, CV Town limits, impacted vacant private parcels, and impacted private parcels containing an existing dwelling.

3.3 Corridor Alignment 1A – Nancy Drive to Road 2 North

Description

Length = 5.3 miles

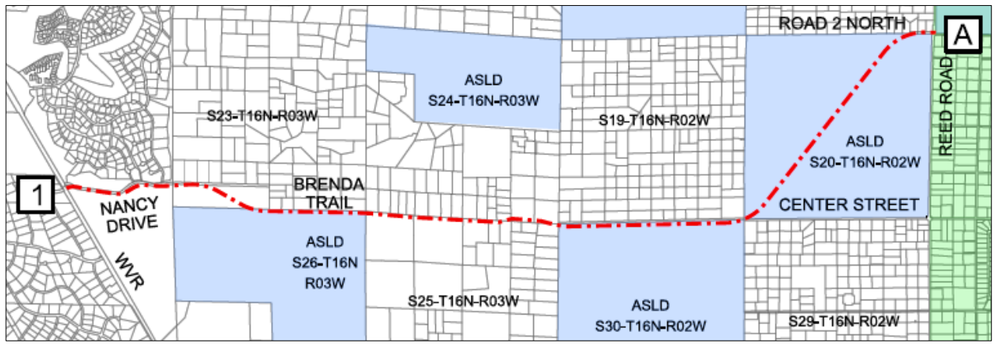
Properties Impacted = 14 private (5 with dwellings) and 3 State Land

Existing YC ROW = 1.7 miles (11.5 acres)

Right-of-Way Required = 59 acres

Estimated Cost = $15.6 million

Figure 3-2 Corridor Alignment 1A Map



Evaluation

This alternative links the PCER northernmost connection point along WVR (Nancy Drive) to the northernmost connection point along Reed Road in CV at existing Road 2 North (Figure 3-2). The intersection of Road 2 North and SR89 is a primary shopping center area that is expected to be a destination point of future roadway users, so the eastern connection point is ideal from a travel management standpoint as identified in the previous YC PCER report. Although the location of the east and west connection points are desirable from a connectivity standpoint, this option has some significant drawbacks regarding length, required right-of-way, existing traffic, and cost. This alignment also bisects the middle of an undeveloped State Land parcel creating an undesirable shaped split and an increase in right-of-way acquisition costs. After review of the YC PCER Decision Matrix, it was concluded that assumptions and scores used to derive the final evaluation rank of fourth (4th) out of the five (5) alternatives were reasonable. When assessed in the updated Feasibility Decision Matrix contained in Figure 3-22, Alignment 1A received an overall ranking of fifth (5th) out of the seven (7) alignment options.

Pros

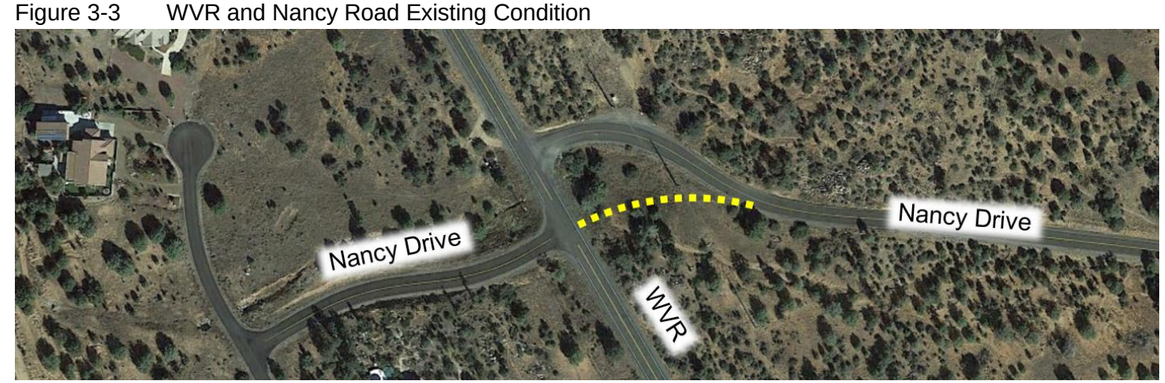
Most desirable connectivity/proximity to CV business center at Road 2 North and SR89, and this option has the northernmost connection along Williamson Valley Road of the original five alternatives considered. Comparatively, this option has an average impact to private property, however, it can utilize approximately 3,500' of the existing Nancy Drive 66' ROW and one mile of existing Center Street 50' ROW, resulting in potential land acquisition savings.

The intersection geometry at the existing Nancy Drive and WVR intersection is not ideal from two standpoints. The existing intersection is offset by 150', as shown in Figure 3-3, and the existing horizontal geometry and approach to WVR from the east does not meet the minimum required design parameters for the new limited access roadway. This alignment would require a new tie-in point at WVR across from the existing western branch of Nancy Drive shown as the dashed-yellow line in Figure 3-3; this would create a safer connection to WVR by eliminating the existing-condition intersection offset.

Cons

Roadway length and right-of-way required leads to a higher cost as compared to other options and an undesirable split of Arizona State Land. The Town CV staff has expressed concern about a connection with Road 2 North because of high traffic volumes already on the roadway, the existing Heritage Middle School and Del Rio Elementary School on Road 2 North near SR89, and existing congestion and turn movement delays at the intersection of Road 2 and SR89. The traffic volumes on Nancy Drive would be expected to increase with the implementation of this alignment.

Figure 3-3 WVR and Nancy Road Existing Condition



3.4 Corridor Alignment 1B – Nancy Drive to Center Street

Description

Length = 4.8 miles

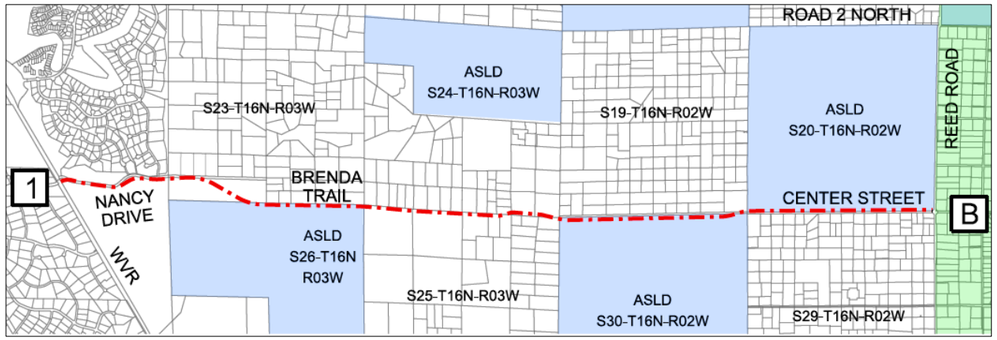
Properties Impacted = 14 private (5 with dwellings) and 3 State Land

Existing YC ROW = 2.7 miles (17.6 acres)

Right-of-Way Required = 52 acres

Estimated Cost = $12.9 million

Figure 3-4 Corridor Alignment 1B Map



Evaluation

This alternative links the PCER northernmost connection point along WVR (Nancy Drive) to a centrally located connection point along Reed Road in Chino Valley at existing Center Street (Figure 3-4). The Center Street Connection is one mile south of the preferred northern connection point in CV at Road 2 North. Although the proximity of the east connection point in Center Street to the CV business center is not ideal, the Center Street connection point has benefits by avoiding the Road 2 North issues previously described in the Alternative Alignment 1A assessment. After review of the YC PCER Decision Matrix, it was concluded that assumptions and scores used to derive the final evaluation rank of second (2nd) out of the five (5) alternatives were reasonable. However, additional analysis regarding property impact, total ROW needed, and total cost resulted in an increased score and final evaluation rank. When assessed in the updated Feasibility Decision Matrix contained in Figure 3-22, Alignment 1B received an overall ranking of first (1st) out of the seven (7) alignment options.

Pros

Comparatively low cost, distance, private property impact and required right-of-way acquisition. The Center Street connection point is preferred by Town of CV municipal stakeholder. This option can utilize approximately 3,500' of the existing Nancy Drive 66' ROW (5 acres) and two (2) miles of existing Center Street 50' ROW (12 acres), totaling over 17 acres in usable existing ROW that could result in significant land acquisition savings. This option avoids an undesirable split of the 185-acre parcel (306-35-203C) adjacent to WVR that would be significantly impacted by Alignment Options 2A, 2A1, and 2B. The Arizona State Land Department prefers and supports this alignment because it conforms to their land management goals.

The intersection geometry situation at the existing Nancy Drive and WVR intersection is the same as Alignment 1A, requiring a realignment of the existing intersection, which will increase safety by eliminating the existing-condition offset.

Cons

As with alignment 1A, the traffic volumes on Nancy Drive would be expected to increase with the implementation of Alignment 1B. As with all options (but to a lesser degree) encroachment onto private property and property acquisition will be required.

3.5 Corridor Alignment 2A - Inscription Canyon to Road 2 North

Description

Length = 5.1 miles

Properties Impacted = 13 private (5 with dwellings) and 3 State Land

Existing YC ROW = 1.0 miles (6.1 acres)

Right-of-Way Required = 62 acres

Estimated Cost = $15.2 million

Figure 3-5 Corridor Alignment 2A Map

Evaluation

This option is identical to Option 1A except the proposed intersection with WVR is approximately one-half mile south at the existing intersection with Inscription Canyon Drive (Figure 3-5). In lieu of connecting to the Nancy Drive intersection, the alignment would connect to WVR at the existing Inscription Canyon Drive, creating a 4-way intersection. After review of the YC PCER Decision Matrix, it was concluded that assumptions and scores used to derive the final evaluation rank of third (3rd) out of the five (5) alternatives were reasonable. When assessed in the updated Feasibility Decision Matrix contained in Figure 3-22, Alignment 2A received an overall ranking of fourth (4th) out of the seven (7) alignment options.

Pros

Most desirable connectivity/proximity to CV business center at Road 2 North and SR89 and this option has the northernmost connection along Williamson Valley Road of the original five alternatives considered.

Cons

Same as Option 1A except for the Nancy Drive intersection and alignment issues. In addition, this alignment bisects private property and creates an undesirable split of the 185-acre parcel (306-35-203C) adjacent to WVR.

3.6 Corridor Alignment 2A1 - Inscription Canyon to Road 2 North via State Land Route

Description

Length = 6.0 miles

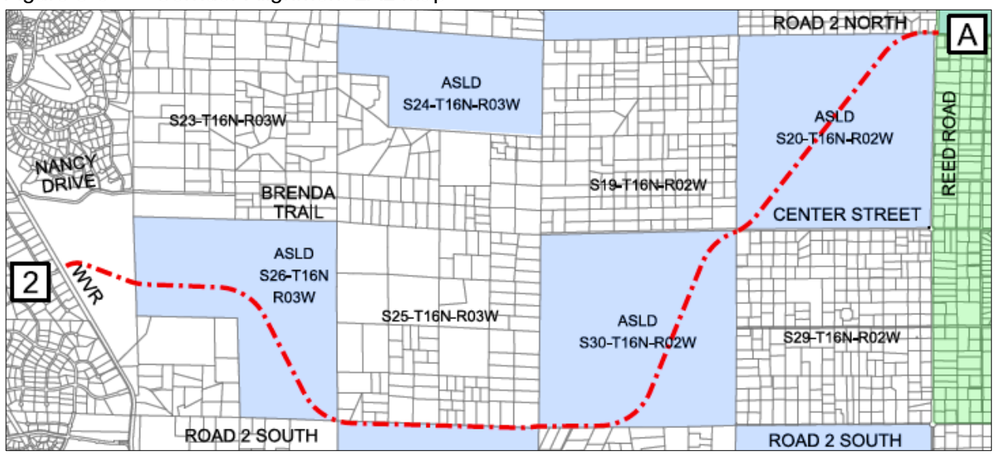
Properties Impacted = 7 private (5 with dwellings) and 4 State Land

Existing YC ROW = none

Right-of-Way Required = 73 acres

Estimated Cost = $16.6 million

Figure 3-6 Corridor Alignment 2A1 Map



Evaluation

To minimize private property impact, Alignment 2A1 utilizes the Alignment 2A WVR and Reed Road connection points while looping southward an extra mile through State Land (Figure 3-6). Although private property impact is reduced with this alternative, the extra roadway has a substantial negative impact on required right-of-way, drainage structures required, and ultimately the total cost. After review of the YC PCER Decision Matrix, it was concluded that assumptions and scores used to derive the final evaluation rank of fifth (5th) out of the five (5) alternatives were reasonable. When assessed in the updated Feasibility Decision Matrix contained in Figure 3-22, Alignment 2A1 received an overall ranking of sixth (6th) out of the seven (7) alignment options.

Pros

The alternative with the least amount of encroachment and impact to private properties.

Cons

The alternative with the second longest route, no existing YC ROW, the highest State Land impact (4 sections impacted), undesirable division of State Land, and second highest cost. In addition, the same Cons as Alignments 1A and 2A regarding the Road 2 North connection point. This alignment also bisects private property and creates an undesirable split of the 185-acre parcel (306-35-203C) adjacent to WVR.

3.7 Corridor Alignment 2B - Inscription Canyon to Center Street

Description

Length = 4.6 miles

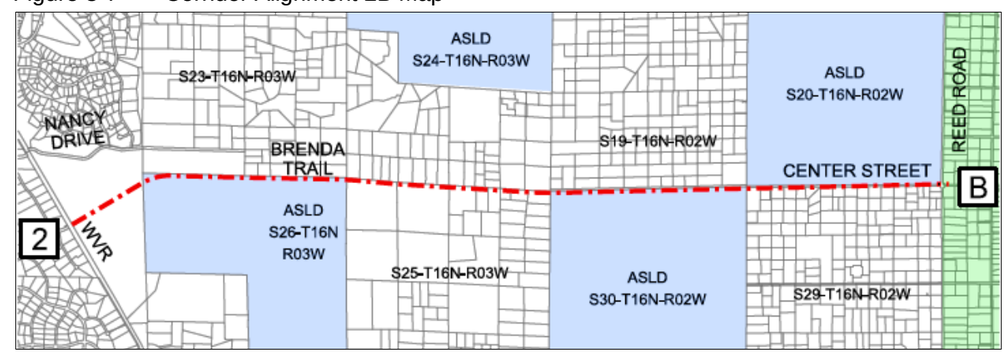
Properties Impacted = 13 private (5 with dwellings) and 3 State Land

Existing YC ROW = 2.0 miles (12.1 acres)

Right-of-Way Required = 55 acres

Estimated Cost = $13.4 million

Figure 3-7 Corridor Alignment 2B Map



Evaluation

This alternative links Inscription Canyon Drive to a centrally located connection point along Reed Road in Chino Valley at existing Center Street (Figure 3-7), creating the most direct route and shortest distance of the original five alignments considered. The direct east-west alignment minimizes State Land impact and can utilize a portion of the existing YC right-of-way for two (2) miles of the eastern portion of the alignment. This option ranked third for the least expensive of the alternatives considered. After review of the YC PCER Decision Matrix, it was concluded that assumptions and scores used to derive the final evaluation rank of first (1st) out of the five (5) alternatives were reasonable. After re-evaluation of the benefits of utilizing the existing Nancy Drive corridor and YC ROW, this alternative ranks slightly lower than Alignment 1B in regard to the total ROW needed to build the *Project*. When assessed in the updated Feasibility Decision Matrix contained in Figure 3-22, Alignment 2B received an overall ranking of second (2nd) out of the seven (7) alignment options.

Pros

Comparatively short distance, right-of-way required, and low cost. The WVR intersection geometry and Center Street connection/impact are desirable as compared to other alternatives.

Cons

This alignment bisects private property and creates an undesirable split of the 185-acre parcel (306-35-203C) adjacent to WVR.

3.8 Additional Alignment Option Analysis

In addition to the five (5) PCER routes identified in 2013, LE explored the options of an additional northern route and southern route with connection points to Williamson Valley Road outside of the scope of the original PCER study as shown in Figure 3-1. The purpose of the additional analysis was to determine the feasibility, efficiency, potential benefits, and costs associated with route options not considered in the PCER study. A broader look at the analysis area was warranted to verify proper corridor placement from a regional connectivity standpoint to ensure that other feasible east-west routes between WVR and Chino Valley were considered.

Figures 3-12 and 3-13 show the two additional alignment corridors that were analyzed. Preliminary horizontal and vertical design was completed for each alignment per the parameters set forth in the YC PCER. Roadway grading and the limits of the cuts and fills were determined to complete an estimate of probable cost as shown in Figures 3-20 and 3-21. To more accurately compare the previous preferred alignment with the new alignments, an updated decision matrix was completed (Figure 3-22). The same evaluation criteria were utilized from the original YC PCER study, however, score weights were modified to place additional importance on private property impact and total project cost.

3.9 Corridor Alignment 3A – North of Talking Rock to Road 2 North

Description

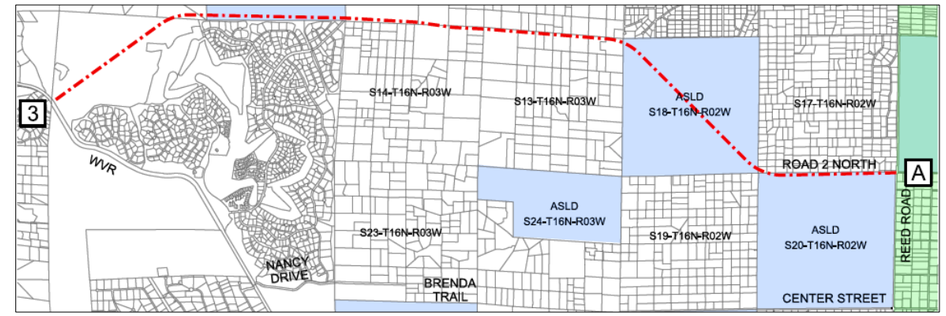
Length = 6.9 miles

Properties Impacted = 18 private (8 with dwellings) and 3 State Land

Existing YC ROW = 0.1 miles (0.8 acres)

Right-of-Way Required = 81 acres

Estimated Cost = $34.6 million



Evaluation

As shown in Figure 3-9, WVR heads in a northwest direction whereas SR 89 heads northward toward Chino Valley. The further north the western connection point for the Northern Connector is moved, the further the route distance becomes. Due to the existing Talking Rock subdivision north and adjacent to Nancy Drive, the closest feasible connection point is approximately 2.2 miles northwest of Nancy Drive near existing Hootenanny Road (Figure 3-8). Routes further northwest of this point were not deemed feasible due to the Williamson Valley Road Crossing of Mint Wash further to the west. Any connector road heading back eastward after the existing Mint Wash bridge would be required to cross Mint Wash again, requiring a bridge due to the extremely high stormwater peak flowrate at that location. This route, which connects existing Hootenanny Road and Road 2 North, is the longest of all routes, and traverses extremely steep terrain north of the Talking Rock subdivision. This alternative ranks as the least preferable of all routes, as shown in Figure 3-22 – Feasibility Decision Matrix.

Pros

The northernmost connection point along Williamson Valley Road and Reed Road at the western limits of Chino Valley.

Cons

This is the longest route, highest cost, has almost no existing YC ROW available along the corridor, and requires the most right-of-way of any of the options. The extreme terrain would require a 60' fill or bridge in one location and a 142 cut in another location. The long route in extreme terrain makes this option cost prohibitive when compared to the other options.

Figure 3-8 Corridor Alignment 3A Map

Figure 3-9 WVR Alignment Heading North

3.10 Corridor Alignment 4C – Southern Route Utilizing Existing Road 2 South

Description

Length = 4.2 miles

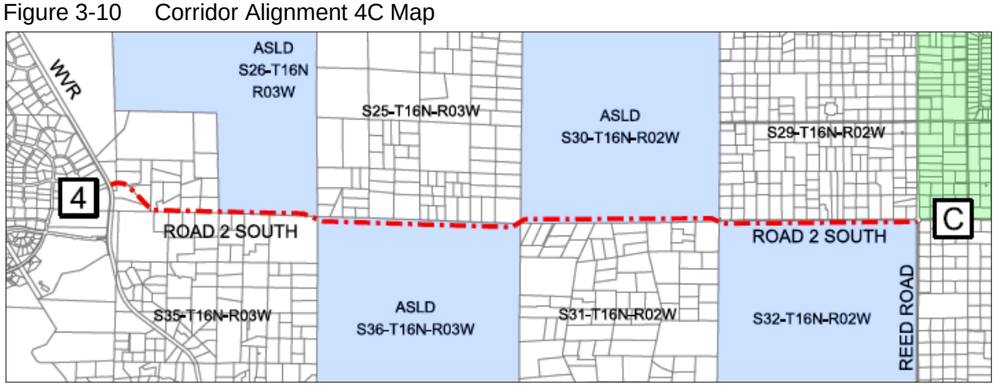
Properties Impacted = 18 private (8 with dwellings) and 3 State Land

Existing YC ROW = 1.0 miles ~ 25' width (3.0 acres)

Right-of-Way Required = 51 acres

Estimated Cost = $12.5 million

Figure 3-10 Corridor Alignment 4C Map



Evaluation

This alternative utilizes the southernmost route while still maintaining an alignment north of existing Outer Loop Road. The existing Road 2 South alignment is followed as closely as practical between WVR and Reed Road (Figure 3-10). Although Road 2 South already exists as an unmaintained primitive dirt road in this location, YC has limited-to-no existing ROW throughout the alignment. The existing primitive roadway traverses rocky and steep terrain on the western third of the corridor and comes close to two existing homes near WVR. A 25' wide "strip" of YC ROW exists in the eastern-most mile of the alignment between Yuma Road and Reed Road. A major downside with this alternative is the two-mile distance from the CV business center at Road 2 North along with the close one-mile proximity to Outer Loop Road to the south. The purpose of the *Project* is to create an additional northern corridor in lieu of Outer Loop Road. Placing the corridor only one mile north of the terminus of Outer Loop Road at the east end of the *Project* is not preferable from a transportation standpoint. Based on these considerations, Alignment 4C is ranked less preferable than Alignments 1B and 2B.

Pros

Short and direct route and lowest cost as compared to the other alternatives.

Cons

Corridor placement furthest south of other alternatives and proximity to Town of CV business center is not ideal. Undesirable curvature, steep terrain, and private property constraints along existing Road 2 South near WVR. The number of properties that the corridor is expected to encroach on is tied for the highest of all alternatives, and the degree of impact to the properties is expected to be substantial. This option is also tied with Alignment 3A for the most impacted occupied parcels.

3.11 Summation and Recommendation

Encroachment and impact to existing private property along with total estimated project cost were considered the most significant of the eight (8) evaluation criteria utilized in this study. After reviewing the seven Northern Connector route alternatives, stakeholder comments, and public comments/feedback, LE and YC Staff supported Route Alignment 1B (Nancy Drive to Center Street) as the preferred alternative to pursue 15% design plans and subsequent ROW acquisition. The decision matrix (Figure 3-22) shows that both Alignments 1B and 2B scored much higher than the other five (5) alternatives. Alignment 1B has the highest overall ranking of the seven alternatives, and is second lowest in cost based on the preliminary CAA engineer's estimates. Both the Town of Chino Valley and ASLD concurrence and support of Alignment 1B is important to the success of the *Project* moving forward, and further reinforced YC and LE's recommendation of 1B as the preferred corridor. The additional northernmost alternative 3A was not feasible from a cost standpoint, whereas the additional southernmost alternative 4C was not deemed preferable due to private property impacts, topographic issues, and proximity to the existing Outer Loop Road at the east and distance from the primary shopping area at the intersection of Road 2 North and SR89.

Figure 3-11 Original YC PCER Corridor Options Map

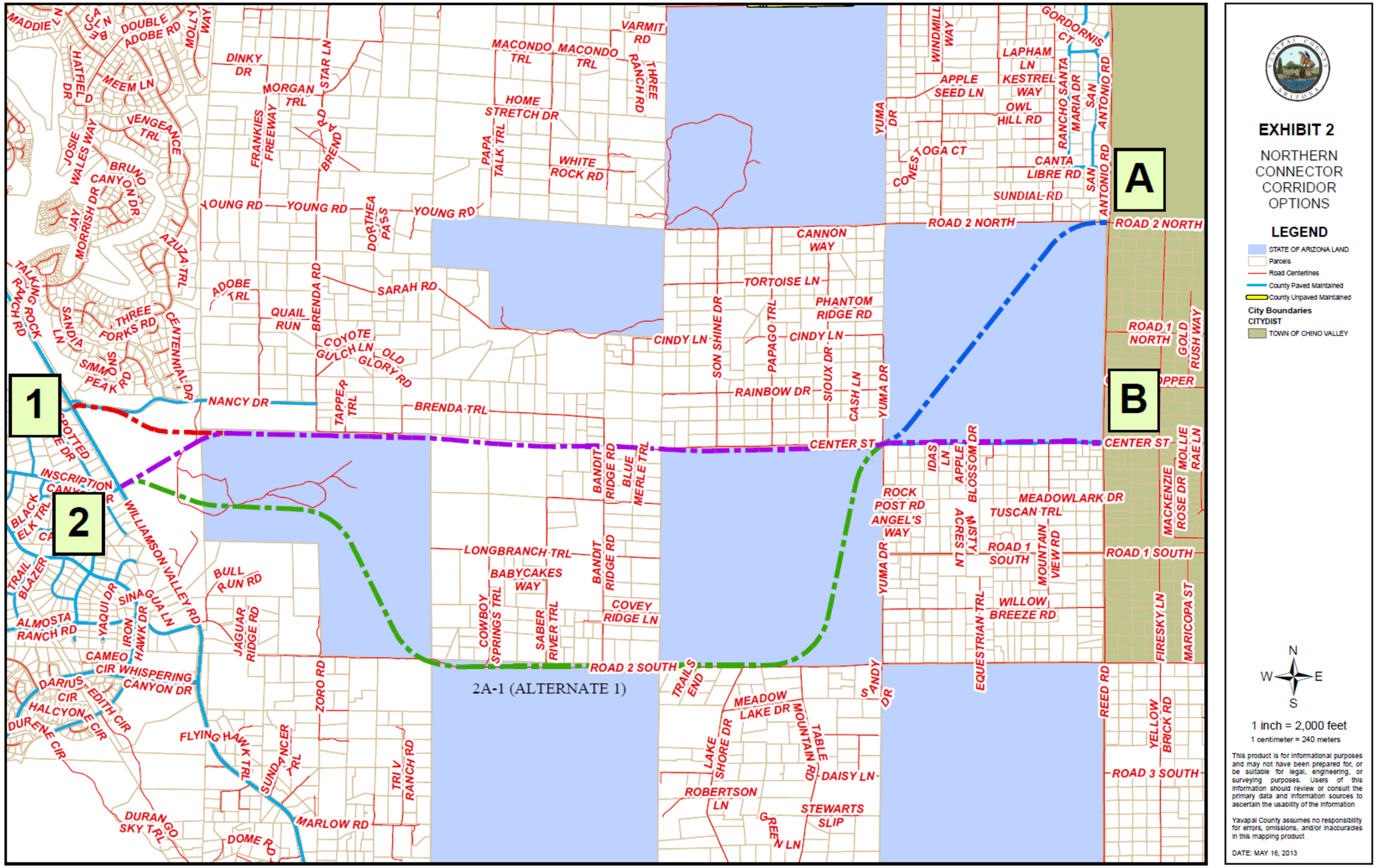
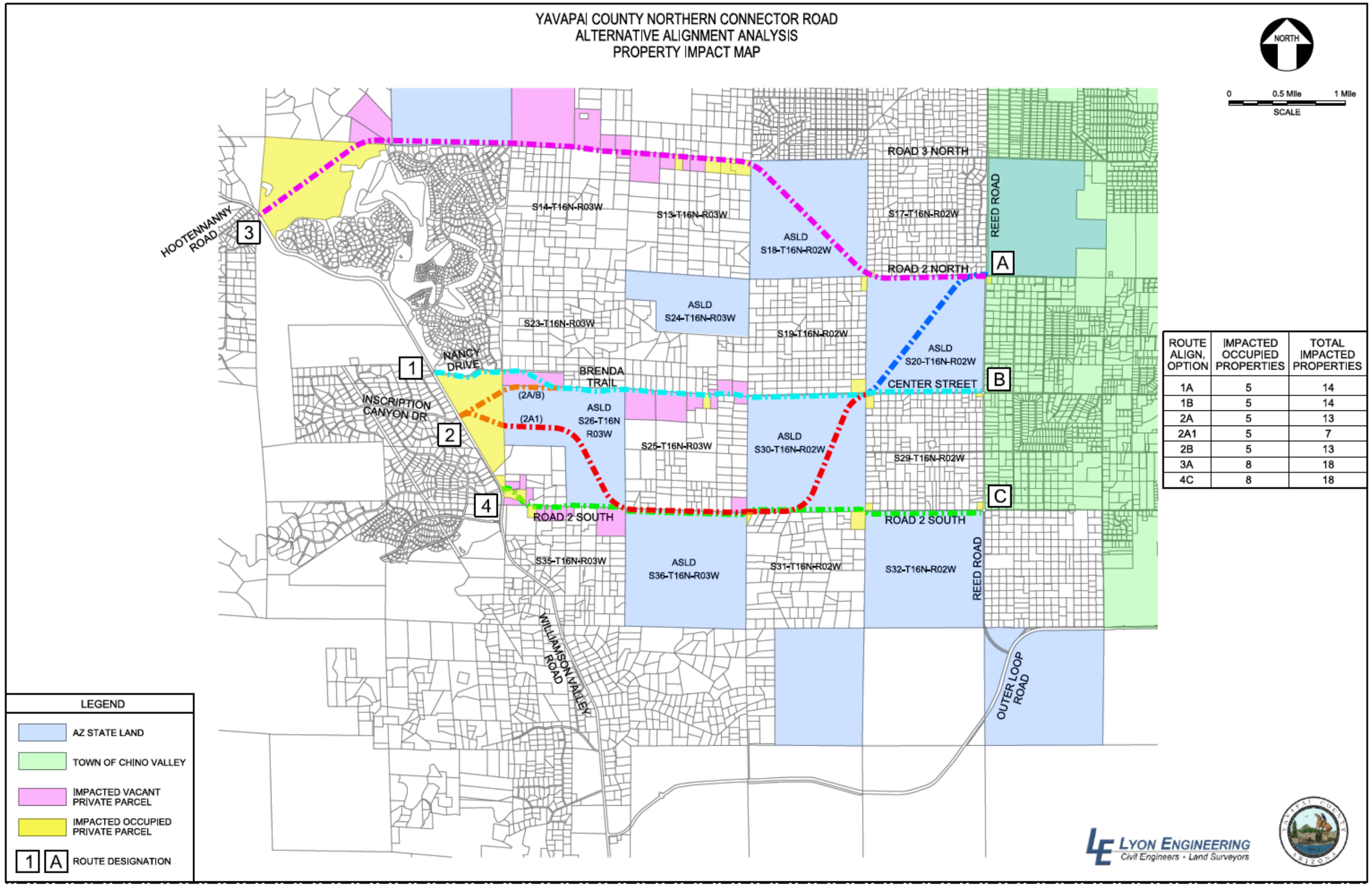


Figure 3-12 Corridor Option Map



ROUTE ALIGN. OPTION	IMPACTED OCCUPIED PROPERTIES	TOTAL IMPACTED PROPERTIES
1A	5	14
1B	5	14
2A	5	13
2A1	5	7
2B	5	13
3A	8	18
4C	8	18

Figure 3-13 Alignment 3B and 4C Map

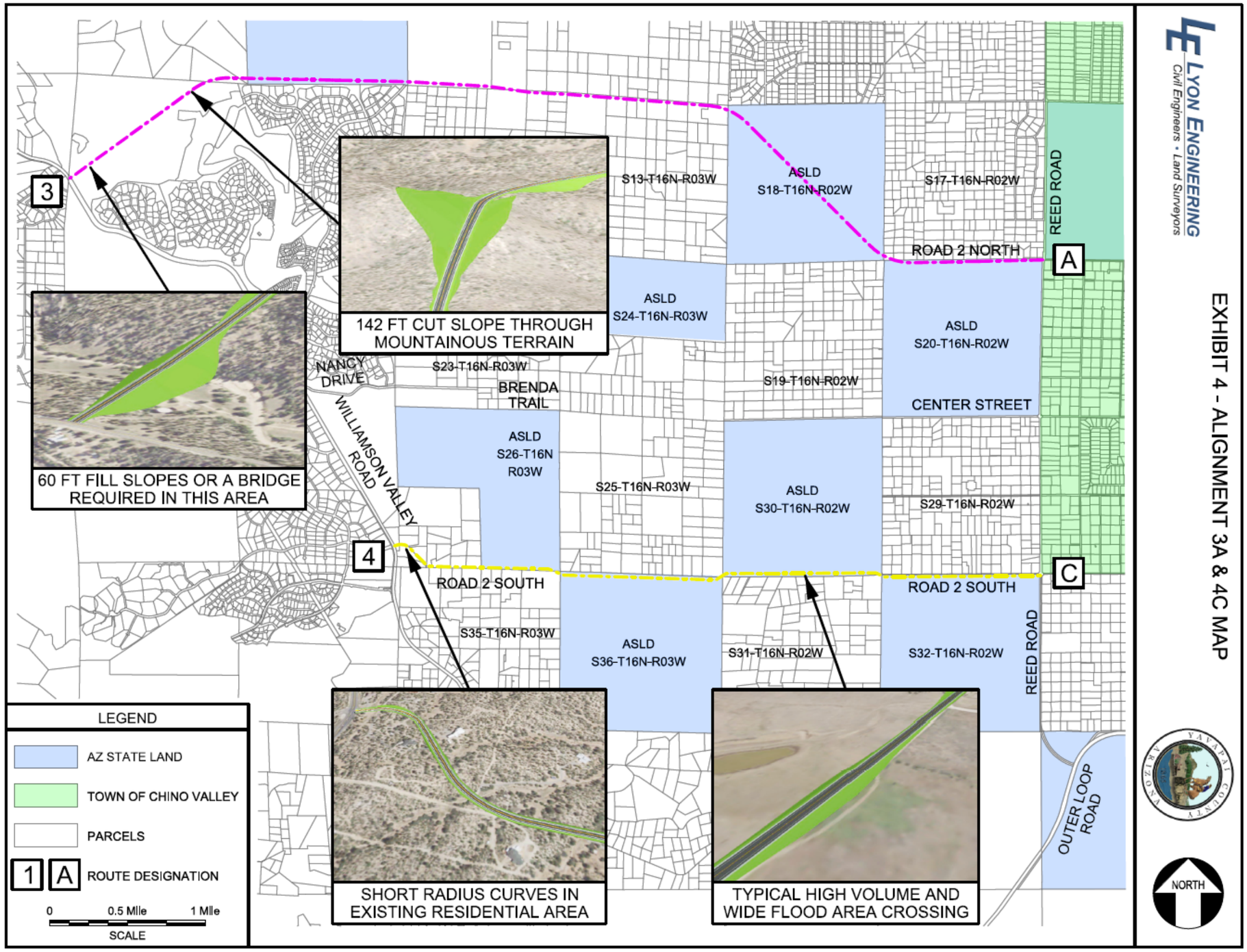


Figure 3-14 Original YC Decision Matrix

EVALUATION CRITERIA	ALIGNMENT 1A	ALIGNMENT 1B	ALIGNMENT 2A	ALIGNMENT 2A1	ALIGNMENT 2B
Private Parcels/State Land Affected	**Neutral (+5)** 18 Private Parcels 3 State Land	**Neutral (+5)** 21 Private Parcels 3 State Land	**Neutral (+5)** 18 Private Parcels 3 State Land	**Most Desirable (+10)** 10 Private Parcels 4 State Land	**Neutral (+5)** 21 Private Parcels 3 State Land
Total ROW Needed	**Neutral (+5)** 64 Acres	**Neutral (+5)** 58 Acres	**Neutral (+5)** 61 Acres	**Least Desirable (+1)** 74 Acres	**Most Desirable (+10)** 55 Acres
Length	**Neutral (+5)** 5.25 Miles	**Neutral (+5)** 4.75 Miles	**Neutral (+5)** 5.07 Miles	**Least Desirable (+1)** 6.10 Miles	**Most Desirable (+10)** 4.57 Miles
Proximity To Town Business Center	**Most Desirable (+10)** Primary Shopping Area Located At Road 2 North	**Neutral (+5)** Located 1 Mile South of Primary Shopping Center Area	**Most Desirable (+10)** Primary Shopping Area Located At Road 2 North	**Most Desirable (+10)** Primary Shopping Area Located At Road 2 North	**Neutral (+5)** Located 1 Mile South of Primary Shopping Center Area
Utility Conflicts	**Less Desirable (+1)** Utility Conflicts Estimated To Be Equal	**Less Desirable (+1)** Utility Conflicts Estimated To Be Equal	**Less Desirable (+1)** Utility Conflicts Estimated To Be Equal	**Neutral (+5)** Utility Conflicts Estimated To Be Less	**Less Desirable (+1)** Utility Conflicts Estimated To Be Equal
FEMA Indentified Crossings (404 Mitigation)	**Less Desirable (+1)** 3 Crossings	**Less Desirable (+1)** 3 Crossings	**Less Desirable (+1)** 3 Crossings	**Neutral (+5)** 1 Crossing	**Less Desirable (+1)** 3 Crossings
Drainage Structures	**Neutral (+5)** 26 Structures	**Neutral (+5)** 22 Structures	**Neutral (+5)** 25 Structures	**Least Desirable (+1)** 42 Structures	**Most Desirable (+10)** 21 Structures
Preliminary Ranking SUBTOTAL SCORE	**32**	**27**	**32**	**33**	**42**
Total Project Cost (Includes R.O.W., Engineering, Construction, etc.)	**Neutral (+5)** **$15,505,502**	**Most Desirable (+10)** **$13,596,172**	**Neutral (+5)** **$15,106,221**	**Least Desirable (+1)** **$16,804,113**	**Most Desirable (+10)** **$13,318,072**
Final Ranking TOTAL SCORE	**37**	**37**	**37**	**34**	**52**
Final Evaluation Rank	**4**	**2**	**3**	**5**	**1**

Ranking - Least Desirable (+1), Neutral (+5), Most Desirable (+10)

Figure 3-15 Alignment 1A Cost Estimate

ALIGNMENT #1A 27,912 LF

ITEM NO	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
1	CLEARING AND GRUBBING	AC	54	$340.00	$18,360
2	REMOVALS	LS	1	$250,000.00	$250,000
3	EXCAVATION	CY	295,000	$9.00	$2,655,000
4	AGGREGATE BASE COURSE (8")	CY	33,798	$40.00	$1,351,906
5	ASPHALT CONCRETE (4")	TN	22,627	$92.00	$2,081,714
6	AR-ACFC	SY	99,243	$3.80	$377,122
7	DRAINAGE STRUCTURES	LF	27,912	$23.00	$641,976
8	SIGNS AND STRIPING	LF	223,296	$0.15	$33,494
9	GUARD RAIL	LF	18,000	$30.00	$540,000
10	GUARD RAIL TERMINATIONS	EA	40	$3,000.00	$120,000
11	RIGHT OF WAY FENCE	LF	55,824	$3.00	$167,472
12	RIGHT OF WAY MONUMENTS	EA	22	$300.00	$6,600
13	SEEDING (CLASS II)	AC	28	$4,000.00	$113,477
14	SWPPP DESIGN AND IMPLEMENTATION	MI	5.29	$20,000.00	$105,727
				SUBTOTAL 1	**$8,462,848**
15	404 MITIGATION (0.5%)	LS	1	$42,314	$42,314
16	MOBILIZATION (10%)	LS	1	$846,285	$846,285
17	SURVEYING (2%)	LS	1	$169,257	$169,257
18	QUALITY CONTROL (2%)	LS	1	$169,257	$169,257
19	TRAFFIC CONTROL (1%)	LS	1	$84,628	$84,628
				SUBTOTAL 2	**$9,774,590**
20	FORCE ACCOUNT (10%)	LS	1	$977,459	$977,459
21	DESIGN ENGINEERING (12%)	LS	1	$1,172,951	$1,172,951
22	CONSTRUCTION ENGINEERING (10%)	LS	1	$977,459	$977,459
23	ENVIRONMENTAL WORK (1%)	LS	1	$97,746	$97,746
24	RIGHT OF WAY	AC	59	$40,000	$2,344,536
				TOTAL	**$15,344,741**

Figure 3-16 Alignment 1B Cost Estimate

ALIGNMENT #1B 25,217 LF

ITEM NO	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
1	CLEARING AND GRUBBING	AC	49	$340.00	$16,660
2	REMOVALS	LS	1	$250,000.00	$250,000
3	EXCAVATION	CY	212,842	$9.00	$1,915,578
4	AGGREGATE BASE COURSE (8")	CY	30,534	$40.00	$1,221,374
5	ASPHALT CONCRETE (4")	TN	20,443	$92.00	$1,880,717
6	AR-ACFC	SY	89,660	$3.80	$340,710
7	DRAINAGE STRUCTURES	LF	25,217	$23.00	$579,991
8	SIGNS AND STRIPING	LF	201,736	$0.15	$30,260
9	GUARD RAIL	LF	11,525	$30.00	$345,750
10	GUARD RAIL TERMINATIONS	EA	38	$3,000.00	$114,000
11	RIGHT OF WAY FENCE	LF	50,434	$3.00	$151,302
12	RIGHT OF WAY MONUMENTS	EA	26	$300.00	$7,800
13	SEEDING (CLASS II)	AC	26	$4,000.00	$103,376
14	SWPPP DESIGN AND IMPLEMENTATION	MI	4.78	$20,000.00	$95,519
				SUBTOTAL 1	**$7,053,038**
15	404 MITIGATION (0.5%)	LS	1	$35,265	$35,265
16	MOBILIZATION (10%)	LS	1	$705,304	$705,304
17	SURVEYING (2%)	LS	1	$141,061	$141,061
18	QUALITY CONTROL (2%)	LS	1	$141,061	$141,061
19	TRAFFIC CONTROL (1%)	LS	1	$70,530	$70,530
				SUBTOTAL	**$8,146,258**
20	FORCE ACCOUNT (10%)	LS	1	$814,626	$814,626
21	DESIGN ENGINEERING (12%)	LS	1	$977,551	$977,551
22	CONSTRUCTION ENGINEERING (10%)	LS	1	$814,626	$814,626
23	ENVIRONMENTAL WORK (1%)	LS	1	$81,463	$81,463
24	RIGHT OF WAY	AC	52	$40,000	$2,097,062
				TOTAL	**$12,931,585**

Figure 3-17 Alignment 2A Cost Estimate

ALIGNMENT #2A 26,915 LF

ITEM NO	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
1	CLEARING AND GRUBBING	AC	53	$340.00	$18,020
2	REMOVALS	LS	1	$250,000.00	$250,000
3	EXCAVATION	CY	290,000	$9.00	$2,610,000
4	AGGREGATE BASE COURSE (8")	CY	32,590	$40.00	$1,303,616
5	ASPHALT CONCRETE (4")	TN	21,819	$92.00	$2,007,357
6	AR-ACFC	SY	95,698	$3.80	$363,652
7	DRAINAGE STRUCTURES	LF	26,915	$23.00	$619,045
8	SIGNS AND STRIPING	LF	215,320	$0.15	$32,298
9	GUARD RAIL	LF	17,800	$30.00	$534,000
10	GUARD RAIL TERMINATIONS	EA	46	$3,000.00	$138,000
11	RIGHT OF WAY FENCE	LF	53,830	$3.00	$161,490
12	RIGHT OF WAY MONUMENTS	EA	18	$300.00	$5,400
13	SEEDING (CLASS II)	AC	28	$4,000.00	$113,139
14	SWPPP DESIGN AND IMPLEMENTATION	MI	5.10	$20,000.00	$101,951
				SUBTOTAL 1	**$8,257,967**
15	404 MITIGATION (0.5%)	LS	1	$41,290	$41,290
16	MOBILIZATION (10%)	LS	1	$825,797	$825,797
17	SURVEYING (2%)	LS	1	$165,159	$165,159
18	QUALITY CONTROL (2%)	LS	1	$165,159	$165,159
19	TRAFFIC CONTROL (1%)	LS	1	$82,580	$82,580
				SUBTOTAL	**$9,537,952**
20	FORCE ACCOUNT (10%)	LS	1	$953,795	$953,795
21	DESIGN ENGINEERING (12%)	LS	1	$1,144,554	$1,144,554
22	CONSTRUCTION ENGINEERING (10%)	LS	1	$953,795	$953,795
23	ENVIRONMENTAL WORK (1%)	LS	1	$95,380	$95,380
24	RIGHT OF WAY	AC	62	$40,000	$2,471,534
				TOTAL	**$15,157,009**

Figure 3-18 Alignment 2A1 Cost Estimate

ALIGNMENT #2A1 31,702 LF

ITEM NO	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
1	CLEARING AND GRUBBING	AC	59	$340.00	$20,060
2	REMOVALS	LS	1	$250,000.00	$250,000
3	EXCAVATION	CY	275,000	$9.00	$2,475,000
4	AGGREGATE BASE COURSE (8")	CY	38,387	$40.00	$1,535,473
5	ASPHALT CONCRETE (4")	TN	25,700	$92.00	$2,364,377
6	AR-ACFC	SY	112,718	$3.80	$428,329
7	DRAINAGE STRUCTURES	LF	31,702	$23.00	$729,146
8	SIGNS AND STRIPING	LF	253,616	$0.15	$38,042
9	GUARD RAIL	LF	15,150	$30.00	$454,500
10	GUARD RAIL TERMINATIONS	EA	64	$3,000.00	$192,000
11	RIGHT OF WAY FENCE	LF	63,404	$3.00	$190,212
12	RIGHT OF WAY MONUMENTS	EA	22	$300.00	$6,600
13	SEEDING (CLASS II)	AC	30	$4,000.00	$119,556
14	SWPPP DESIGN AND IMPLEMENTATION	MI	6.00	$20,000.00	$120,083
				SUBTOTAL 1	**$8,923,379**
15	404 MITIGATION (0.5%)	LS	1	$44,617	$44,617
16	MOBILIZATION (10%)	LS	1	$892,338	$892,338
17	SURVEYING (2%)	LS	1	$178,468	$178,468
18	QUALITY CONTROL (2%)	LS	1	$178,468	$178,468
19	TRAFFIC CONTROL (1%)	LS	1	$89,234	$89,234
				SUBTOTAL	**$10,306,502**
20	FORCE ACCOUNT (10%)	LS	1	$1,030,650	$1,030,650
21	DESIGN ENGINEERING (12%)	LS	1	$1,236,780	$1,236,780
22	CONSTRUCTION ENGINEERING (10%)	LS	1	$1,030,650	$1,030,650
23	ENVIRONMENTAL WORK (1%)	LS	1	$103,065	$103,065
24	RIGHT OF WAY	AC	73	$40,000	$2,911,111
				TOTAL	**$16,618,759**

Figure 3-19 Alignment 2B Cost Estimate

ALIGNMENT #2B 24,170 LF

ITEM NO	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
1	CLEARING AND GRUBBING	AC	47	$340.00	$15,980
2	REMOVALS	LS	1	$250,000.00	$250,000
3	EXCAVATION	CY	250,914	$9.00	$2,258,226
4	AGGREGATE BASE COURSE (8")	CY	29,267	$40.00	$1,170,664
5	ASPHALT CONCRETE (4")	TN	19,594	$92.00	$1,802,631
6	AR-ACFC	SY	85,938	$3.80	$326,564
7	DRAINAGE STRUCTURES	LF	24,170	$23.00	$555,910
8	SIGNS AND STRIPING	LF	193,360	$0.15	$29,004
9	GUARD RAIL	LF	14,755	$30.00	$442,650
10	GUARD RAIL TERMINATIONS	EA	38	$3,000.00	$114,000
11	RIGHT OF WAY FENCE	LF	48,340	$3.00	$145,020
12	RIGHT OF WAY MONUMENTS	EA	20	$300.00	$6,000
13	SEEDING (CLASS II)	AC	25	$4,000.00	$99,221
14	SWPPP DESIGN AND IMPLEMENTATION	MI	4.58	$20,000.00	$91,553
				SUBTOTAL 1	**$7,307,422**
15	404 MITIGATION (0.5%)	LS	1	$36,537	$36,537
16	MOBILIZATION (10%)	LS	1	$730,742	$730,742
17	SURVEYING (2%)	LS	1	$146,148	$146,148
18	QUALITY CONTROL (2%)	LS	1	$146,148	$146,148
19	TRAFFIC CONTROL (1%)	LS	1	$73,074	$73,074
				SUBTOTAL	**$8,440,073**
20	FORCE ACCOUNT (10%)	LS	1	$844,007	$844,007
21	DESIGN ENGINEERING (12%)	LS	1	$1,012,809	$1,012,809
22	CONSTRUCTION ENGINEERING (10%)	LS	1	$844,007	$844,007
23	ENVIRONMENTAL WORK (1%)	LS	1	$84,401	$84,401
24	RIGHT OF WAY	AC	55	$40,000	$2,219,467
				TOTAL	**$13,444,764**

Figure 3-20 Alignment 3A Cost Estimate

ALIGNMENT #3A 36,210 LF

ITEM NO	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
1	CLEARING AND GRUBBING	AC	71	$340.00	$24,140
2	REMOVALS	LS	1	$250,000.00	$250,000
3	EXCAVATION	CY	1,435,398	$9.00	$12,918,582
4	AGGREGATE BASE COURSE (8")	CY	43,845	$40.00	$1,753,816
5	ASPHALT CONCRETE (4")	TN	29,354	$92.00	$2,700,590
6	AR-ACFC	SY	128,747	$3.80	$489,237
7	DRAINAGE STRUCTURES	LF	36,210	$23.00	$832,830
8	SIGNS AND STRIPING	LF	289,680	$0.15	$43,452
9	GUARD RAIL	LF	21,893	$30.00	$656,790
10	GUARD RAIL TERMINATIONS	EA	55	$3,000.00	$165,000
11	RIGHT OF WAY FENCE	LF	72,420	$3.00	$217,260
12	RIGHT OF WAY MONUMENTS	EA	22	$300.00	$6,600
13	SEEDING (CLASS II)	AC	38	$4,000.00	$150,997
14	SWPPP DESIGN AND IMPLEMENTATION	MI	6.86	$20,000.00	$137,159
				SUBTOTAL 1	**$20,346,453**
15	404 MITIGATION (0.5%)	LS	1	$101,732	$101,732
16	MOBILIZATION (10%)	LS	1	$2,034,645	$2,034,645
17	SURVEYING (2%)	LS	1	$406,929	$406,929
18	QUALITY CONTROL (2%)	LS	1	$406,929	$406,929
19	TRAFFIC CONTROL (1%)	LS	1	$203,465	$203,465
				SUBTOTAL	**$23,500,154**
20	FORCE ACCOUNT (10%)	LS	1	$2,350,015	$2,350,015
21	DESIGN ENGINEERING (12%)	LS	1	$2,820,018	$2,820,018
22	CONSTRUCTION ENGINEERING (10%)	LS	1	$2,350,015	$2,350,015
23	ENVIRONMENTAL WORK (1%)	LS	1	$235,002	$235,002
24	RIGHT OF WAY	AC	83	$40,000	$3,325,069
				TOTAL	**$34,580,273**

Figure 3-21 Alignment 4C Cost Estimate

ALIGNMENT #4C 22,328 LF

ITEM NO	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
1	CLEARING AND GRUBBING	AC	47	$340.00	$15,980
2	REMOVALS	LS	1	$250,000.00	$250,000
3	EXCAVATION	CY	236,983	$9.00	$2,132,847
4	AGGREGATE BASE COURSE (8")	CY	27,036	$40.00	$1,081,447
5	ASPHALT CONCRETE (4")	TN	18,101	$92.00	$1,665,252
6	AR-ACFC	SY	79,388	$3.80	$301,676
7	DRAINAGE STRUCTURES	LF	22,328	$23.00	$513,544
8	SIGNS AND STRIPING	LF	178,624	$0.15	$26,794
9	GUARD RAIL	LF	13,389	$30.00	$401,670
10	GUARD RAIL TERMINATIONS	EA	33	$3,000.00	$99,000
11	RIGHT OF WAY FENCE	LF	44,656	$3.00	$133,968
12	RIGHT OF WAY MONUMENTS	EA	14	$300.00	$4,200
13	SEEDING (CLASS II)	AC	26	$4,000.00	$105,987
14	SWPPP DESIGN AND IMPLEMENTATION	MI	4.23	$20,000.00	$84,576
				SUBTOTAL 1	**$6,816,941**
15	404 MITIGATION (0.5%)	LS	1	$34,085	$34,085
16	MOBILIZATION (10%)	LS	1	$681,694	$681,694
17	SURVEYING (2%)	LS	1	$136,339	$136,339
18	QUALITY CONTROL (2%)	LS	1	$136,339	$136,339
19	TRAFFIC CONTROL (1%)	LS	1	$68,169	$68,169
				SUBTOTAL	**$7,873,566**
20	FORCE ACCOUNT (10%)	LS	1	$787,357	$787,357
21	DESIGN ENGINEERING (12%)	LS	1	$944,828	$944,828
22	CONSTRUCTION ENGINEERING (10%)	LS	1	$787,357	$787,357
23	ENVIRONMENTAL WORK (1%)	LS	1	$78,736	$78,736
24	RIGHT OF WAY	AC	51	$40,000	$2,050,321
				TOTAL	**$12,522,165**

Figure 3-22 Final CAA Decision Matrix

EVALUATION CRITERIA	ALIGNMENT 1A	ALIGNMENT 1B	ALIGNMENT 2A	ALIGNMENT 2A1	ALIGNMENT 2B	ALIGNMENT 3A	ALIGNMENT 4C
Private Parcels/State Land Affected (2x Score Weight)	Neutral (+5 x 2 = +10) 14 Private Parcels (5 Occupied) 3 State Land (1.7 mi exist ROW)	Most Desirable (+10 x 2 = +20) 14 Private Parcels (5 Occupied) 3 State Land (2.7 mi exist ROW)	Neutral (+5 x 2 = +10) 13 Private Parcels (5 Occupied) 3 State Land (1.0 mi exist ROW)	Neutral (+5 x 2 = +10) 7 Private Parcels (5 Occupied) 4 State Land (no exist ROW)	Most Desireable (+10 x 2 = +20) 13 Private Parcels (5 Occupied) 3 State Land (2.0 mi exist. ROW)	Less Desirable (+1 x 2 = +2) 18 Private Parcels (8 Occupied) 3 State Land (0.1 mi exist ROW)	Less Desirable (+1 x 2 = +2) 18 Private Parcels (8 Occupied) 3 State Land (1 mile exist. ROW)
Total ROW Needed	Neutral (+5) 59 Acres (Utilize 3,500' Nancy Drive ROW)	Most Desireable (+10) 52 Acres (Utilize 3,500' Nancy Drive ROW)	Neutral (+5) 62 Acres	Least Desirable (+1) 73 Acres	Neutral (+5) 55 Acres	Less Desirable (+1) 81 Acres	Most Desirable (+10) 51 Acres
Length	Neutral (+5) 5.3 Miles	Most Desireable (+10) 4.8 Miles	Neutral (+5) 5.1 Miles	Least Desirable (+1) 6.0 Miles	Most Desirable (+10) 4.6 Miles	Less Desirable (+1) 6.9 Miles	Most Desirable (+10) 4.2 Miles
Proximity To Town Business Center	Most Desirable (+10) Primary Shopping Area Located At Road 2 North	Neutral (+5) Located 1 Mile South of Primary Shopping Center Area	Most Desirable (+10) Primary Shopping Area Located At Road 2 North	Most Desirable (+10) Primary Shopping Area Located At Road 2 North	Neutral (+5) Located 1 Mile South of Primary Shopping Center Area	Most Desirable (+10) Primary Shopping Area Located At Road 2 North	Less Desirable (+1) Located 2 Miles South of Primary Shopping Center Area
Utility Conflicts	Less Desirable (+1) Utility Conflicts Estimated To Be Equal	Less Desirable (+1) Utility Conflicts Estimated To Be Equal	Less Desirable (+1) Utility Conflicts Estimated To Be Equal	Neutral (+5) Utility Conflicts Estimated To Be Less	Less Desirable (+1) Utility Conflicts Estimated To Be Equal	Less Desirable (+1) Utility Conflicts Estimated To Be Equal	Less Desirable (+1) Utility Conflicts Estimated To Be Equal
FEMA Identified Crossings	Less Desirable (+1) 3 Crossings	Less Desirable (+1) 3 Crossings	Less Desirable (+1) 3 Crossings	Neutral (+5) 1 Crossing	Less Desirable (+1) 3 Crossings	Neutral (+5) 2 Crossings	Neutral (+5) 1 Crossing
Drainage Structures	Neutral (+5) 26 Structures	Most Desireable (+10) 22 Structures	Neutral (+5) 25 Structures	Least Desirable (+1) 42 Structures	Most Desirable (+10) 21 Structures	Most Desirable (+10) 19 Structures	Most Desirable (+10) 21 Structures
Preliminary Ranking SUBTOTAL SCORE	37	57	37	33	52	30	39
Total Cost (2x Score Weight) (Includes R.O.W., Engineering, Construction, etc.)	Neutral (+5 x 2 = +10) $15.6 million	Most Desirable (+10 x 2 = +20) $12.9 million	Neutral (+5 x 2 = +10) $15.2 million	Neutral (+5 x 2 = +10) $16.6 million	Most Desirable (+10 x 2 = +20) $13.4 million	Less Desirable (+1 x 2 = +2) $34.6 million	Most Desirable (+10 x 2 = +20) $12.5 million
Final Ranking TOTAL SCORE	47	77	47	43	72	32	59
Total Possible Points = 100							
Final Evaluation Rank	5	1	4	6	2	7	3

Ranking - Least Desirable (+1), Neutral (+5), Most Desirable (+10)

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SECTION 4. Right-of-Way & Parcel Assessment

4.1 Project Area Description

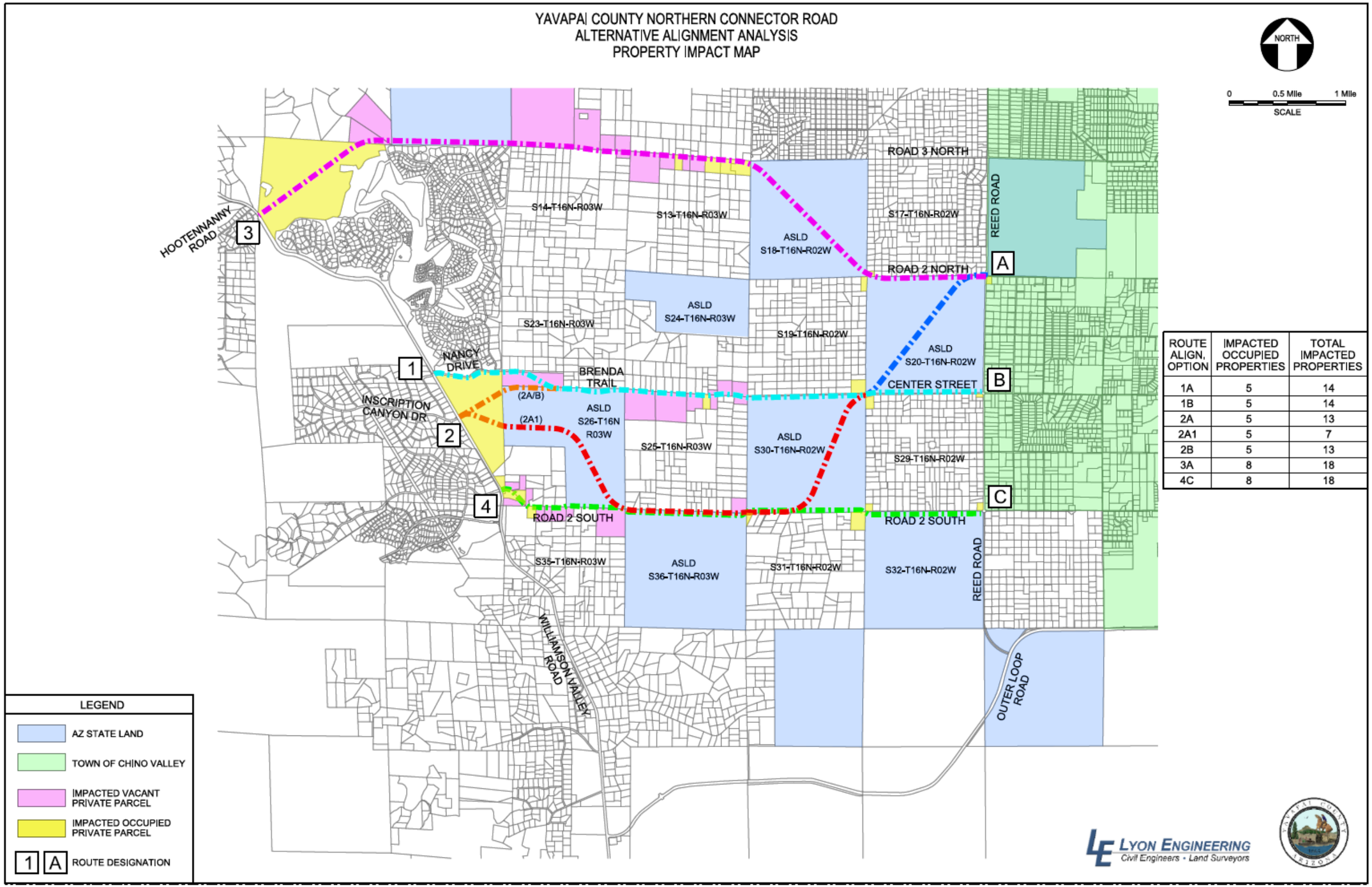
The *Project* is located within Williamson Valley, a rural region in Yavapai County encompassing a large area north of Prescott. Although a significant amount of development in the Williamson Valley Corridor has been in the form of parcel splits per the underlying RCU-2A (2-acre) zoning designation, several large residential subdivisions have recently become established, creating population clusters throughout the surrounding area. Although the *Project* will not directly impact any of the newer subdivisions in the area, it will be near the southern boundary of the Talking Rock subdivision for approximately 0.6 miles east of the WRV and Nancy Drive intersection. An existing large 15-acre Yavapai County owned open space tract will serve as a natural 350' wide buffer between the *Project* and the Talking Rock subdivision for approximately 0.4 of the total 0.6 mile stretch. In addition to private properties, the *Project* is proposed to require additional ROW from State Land that is currently being utilized for livestock grazing and is undeveloped rangeland. Table 4-1 provides a list of zoning designations adjacent to the *Project* corridor and the required setbacks.

Table 4-1 Existing Zoning Designations

Zoning Designation	Minimum Setbacks			Description
	Front	Rear	Exterior	
RCU-2A (87,120 sf minimum lot)	50	50	30	Residential Rural
R1L-175 (175,000 sf minimum lot)	50	50	50	Single Family Residential Limited
R1L-70 (70,000 sf minimum lot)	50	50	30	Single Family Residential Limited
R1L-2A (87,120 sf minimum lot)	50	50	30	Single Family Residential Limited
PAD (Talking Rock Ranch)	20	25	10	Planned Area Development

Extensive additional ROW and property acquisition is anticipated for the *Project*. Existing and proposed ROW is anticipated to contain all roadway, slopes, and drainage infrastructure; therefore, no roadway and drainage easement acquisition is anticipated to be required for the implementation of the *Project*. Figure 4-1 contains a map that was prepared during the CAA process that was used to identify and evaluate property impact that would result from each of the seven alignment options evaluated. Figure 4-2 is a similar map that shows existing YC ROW in the *Project* area. Figure 4-3 is a map of the preferred Alignment 1B and the parcels impacted by the proposed design. A detailed ROW map is contained in the preliminary 15% planset located in Appendix J.

Figure 4-1 Alternative Alignment Analysis Property Impact Map



ROUTE ALIGN. OPTION	IMPACTED OCCUPIED PROPERTIES	TOTAL IMPACTED PROPERTIES
1A	5	14
1B	5	14
2A	5	13
2A1	5	7
2B	5	13
3A	8	18
4C	8	18

Figure 4-2 Land Ownership and Right-of-Way Map

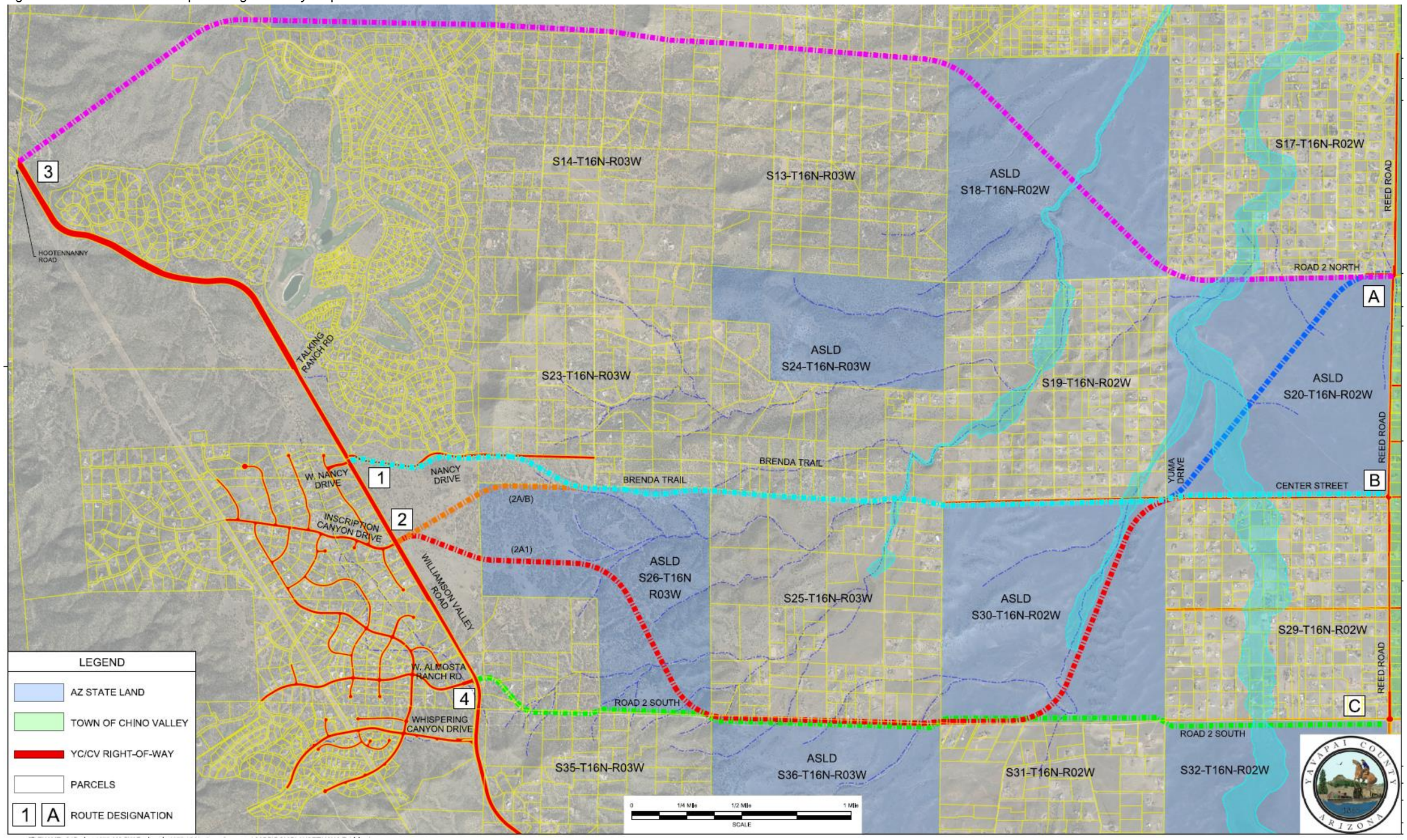
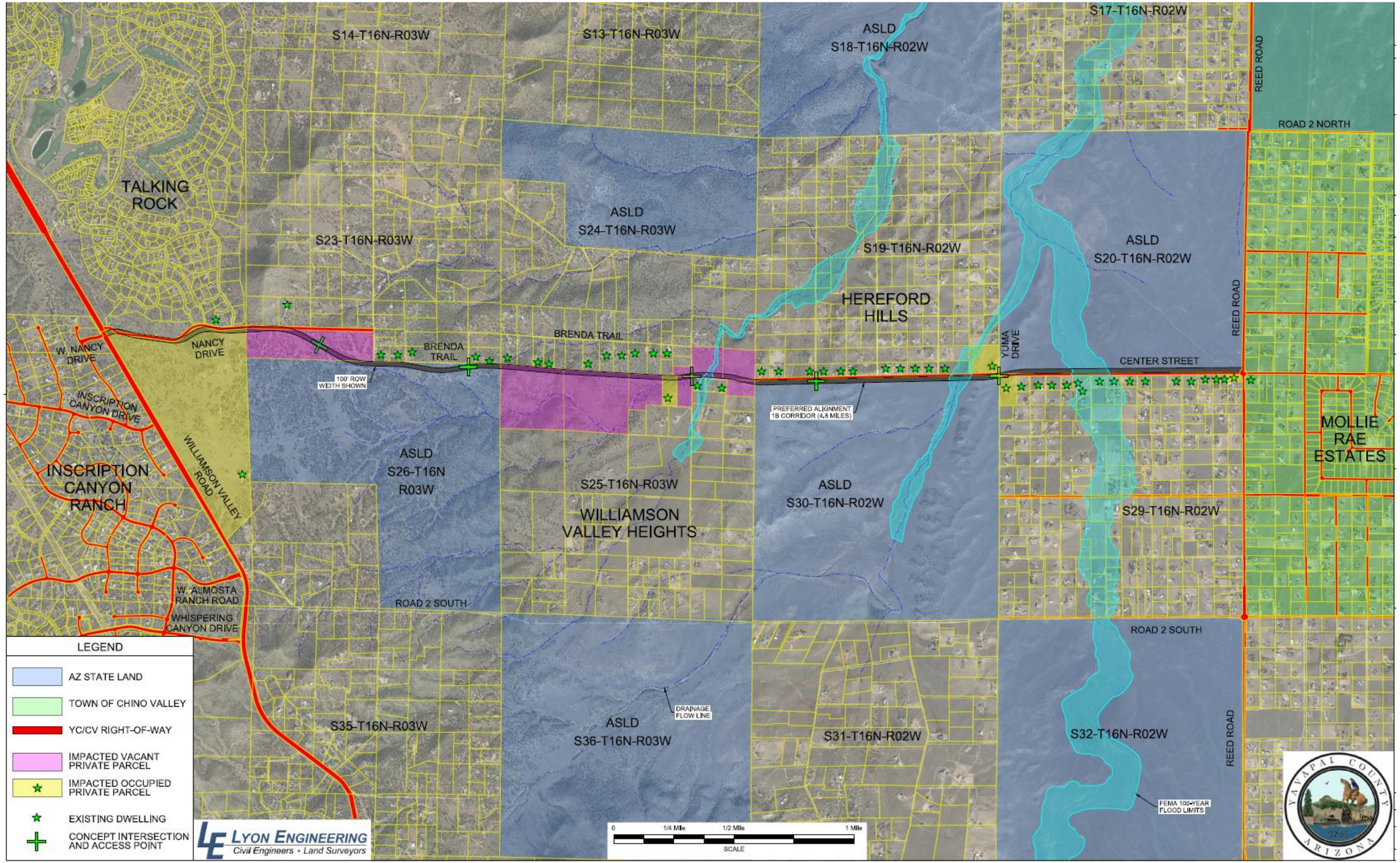


Figure 4-3 Preferred Alignment Corridor Map



SECTION 5. Roadway Analysis

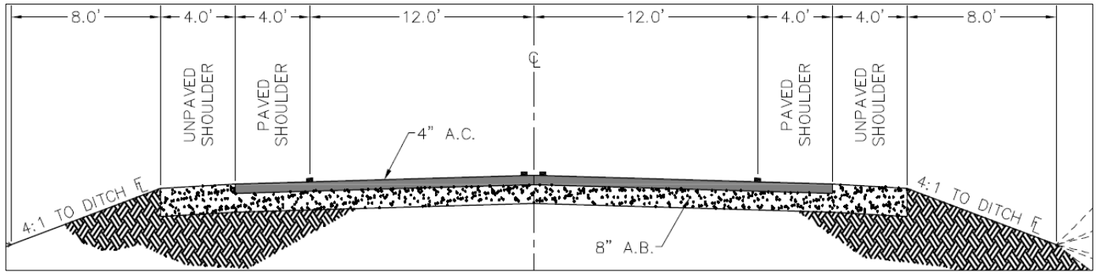
5.1 Introduction

The analysis completed for this preliminary design report focused on the horizontal and vertical design components that will be required for the Northern Connector roadway. Posted speed, design speed, roadway cross-sections, and minimum horizontal/vertical curvature were determined in order to ensure that the proposed alignment will adhere to AASHTO and Yavapai County design standards. The vertical design considerations included the design speed, drainage, and earthwork balance. The design speeds used for the horizontal alignments were also used for the vertical design at vertical points of intersection of the profile design grades. The drainage considerations for the vertical design were to ensure that the proposed roadways would not create adverse drainage on adjoining residential property.

5.2 Roadway Typical Cross-Sections

The roadway cross-section was dictated to LE by the YC Public Works Department. The PCER report roadway cross-section shown in Figure 5-1 was utilized as the proposed roadway for the *Project*. The 15% plans propose a three-lane cross-section to accommodate left turn lanes at anticipated key intersection locations. Although a typical 2-lane roadway section is anticipated to suffice into the distant future, the ROW limits were evaluated for an ultimate 4-lane roadway section with an additional center turn lane at the same key intersection locations to ensure no additional future ROW acquisition will be required. This cross-section exceeds the typical residential collector pavement width as defined in YC Resolution 1036 Schedule 'A'. Per Schedule 'A', the typical residential collector roadway is required to have two 14' travel lanes with 4' unpaved shoulders. The *Project* proposed roadway section consists of two 12' travel lanes, 4' paved shoulders, and an additional 4' unpaved shoulder (to increase safety by providing adequate clear zone per design guidelines).

Figure 5-1 Roadway Typical 2-Lane Cross-Section



5.3 Design Parameters

The design parameters used for the *Project* are consistent with the 2012 Edition of the ADOT Roadway Design Guidelines (RDG) with supplemental data taken from the AASHTO 2011 Green Book and the 2009 MUTCD (current revisions). Figure 5-1 shows the roadway design criteria zones that were developed by LE and YC staff during the preliminary design process. Tables 5-1 and 5-2 contain the roadway design criteria utilized for the two design criteria zones. Due to the density of existing residential properties on the eastern portion of the *Project* (Zone A) and need for direct access to the roadway, the design speeds utilized were reduced vs. originally proposed in the YC PCER study. The western Zone A portion has a reduced design speed due to the proximity of the Talking Rock subdivision, the WVR intersection, and to be able to more closely match the existing Nancy Drive roadway alignment and YC ROW.

Figure 5-2 Roadway Design Criteria Zones

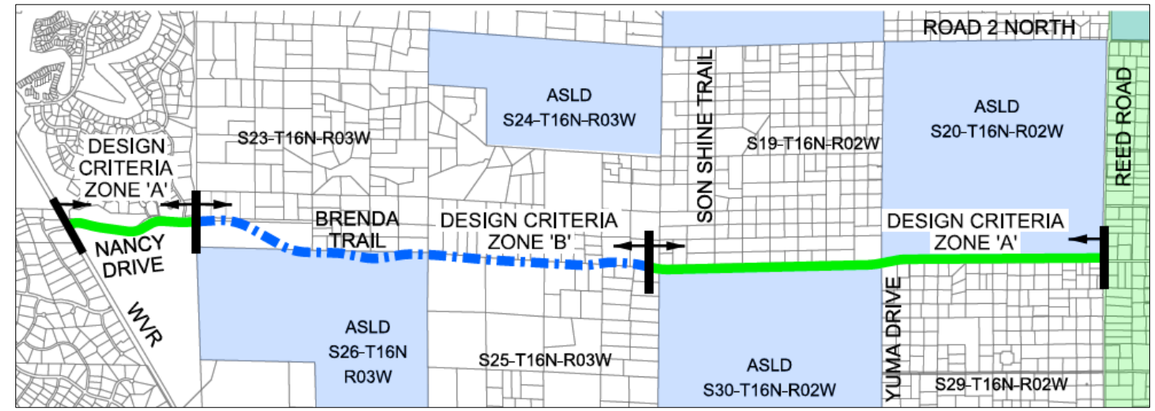


Table 5-1 Roadway Zone A Design Criteria

Category	Value
Roadway Classification	Collector with Driveway Access
Maximum Grade	7%
Maximum Superelevation Rate	8%
Minimum Right-of-Way Width	100'
Design Speed	40 mph
Anticipated Posted Speed Limit	30 – 35 mph
Minimum Horizontal Centerline Radius	550'*
Design Cross-Section	2-lanes (Figure 5-2)
Ultimate Cross-Section (Used for Right-of-Way Width)	4-lanes

*300' and 30mph design speed at intersection with WVR

Table 5-2 Roadway Zone B Design Criteria

Category	Value
Roadway Classification	Collector with Limited Access
Maximum Grade	7%
Maximum Superelevation Rate	6%
Minimum Right-of-Way Width	100'
Design Speed	50 mph
Anticipated Posted Speed Limit	40 - 45 mph
Minimum Horizontal Centerline Radius	1,500'
Design Cross-Section	2-lanes (Figure 5-2)
Ultimate Cross-Section (Used for Right-of-Way Width)	4-lanes

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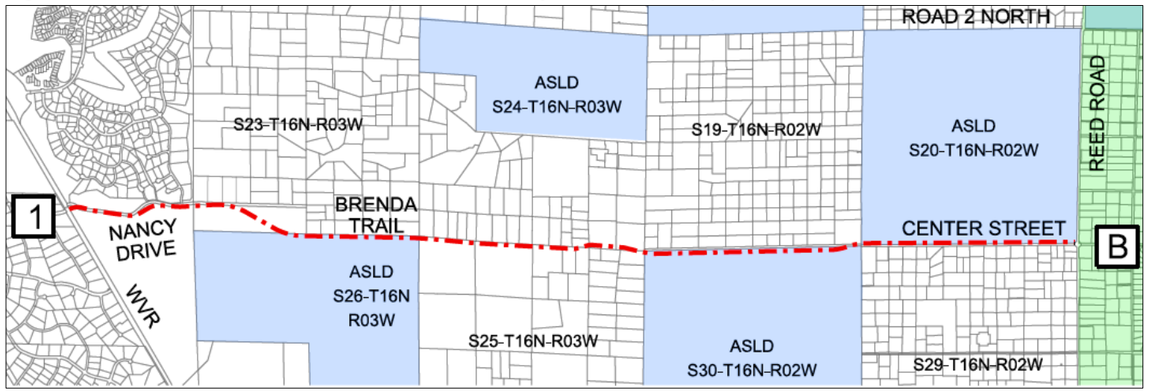
SECTION 6. Drainage Analysis and Design

6.1 Project Location and Description

The Northern Connector Improvement Project (*Project*) is a preliminary roadway design project within Yavapai County (YC) between Williamson Valley Road at Nancy Drive and Reed Road in the Town of Chino Valley (CV) at Center Street. The total roadway is approximately 4.8 miles, and roughly half is along ASLD property. A drainage analysis and preliminary design has been completed for the *Project* corridor. Refer to Figure 6-1 for the *Project* location map.

Figure 6-1 Northern Connector Improvement Project Location Map



6.2 Existing Drainage Structures

The existing roadway is a combination of rural paved (west and east ends) and unimproved dirt (connecting the pavement) sections. However, the existing roadway does not match the proposed alignment for much of the western portion. There are several areas of the proposed alignment that are largely undeveloped, and therefore have no existing drainage structures. The only existing improved drainage structure is a low water crossing at the Chino Valley Stream flowpath. The concrete crossing has several small CMPs underneath to convey nuisance flow. Any significant storm event will overtop the crossing and render the roadway impassable. Further, the existing sedimentation and vegetation have significantly decreased the conveyance efficiency. Photos of the existing structure can be found in Figure 6-2.

Figure 6-2 Chino Valley Stream Existing Low Water Crossing

6.3 Existing Drainage Study and Floodplain Information

The drainage for much of the *Project* area is covered by the West Chino Valley Area Drainage Master Study (ADMS), which was completed for the YCFCD by Project Engineering Consultants, Ltd. in July 2002. This study delineates the contributing basins between Williamson Valley Road and Reed Road. Although it covers the majority of the *Project* area, flows are not utilized from the ADMS. The rainfall data, software used, and some of the methodologies for rainfall loss, hydrograph transform, and basin routing are outdated and do not meet current requirements.

There are three (3) FEMA-effective detailed studies through the *Project* area. Chino Valley Stream, Chino Valley Stream East, and Chino Valley Stream (Tributary) flow from south to north in the eastern portion of the proposed Northern Connector. The detailed information (floodplain and floodway limits, flows, BFEs, etc.) are presented in the LOMR Case No. 10-09-3939P, effective date 12/21/2010. No basins are delineated for these three (3) watercourses, as discharges have been calculated and approved by FEMA. See Table 6-1 for the relevant information on the effective FEMA studies. See Figures 6-4 and 6-5 for the relevant FEMA LOMR FIRMs and floodplain/floodway locations, respectively. See Appendix A for the full LOMR.

Table 6-1 Effective FEMA Studies

Reach Name	Relevant Cross-Sections	Flow at Crossing (cfs)
Chino Valley Stream (Tributary)	N and O	3,273
Chino Valley Stream	Z and AA	8,102
Chino Valley Stream East	G and H	5,248

6.4 Hydrology Modeling

The hydrology for the *Project* has been modeled with the Rational Method, as presented in the ADOT hydrology manual, January 2014. Basins are delineated and are shown in Figure 6-6. For the Northern Connector Improvement Project, the 2, 10, 25, and 100-year events are calculated. The rainfall inputs are obtained directly from the NOAA Atlas 14 Precipitation Data. See Figures 6-7 and 6-8 for rainfall depth and intensity data, respectively.

The topography for the basin delineations is the 2010 Williamson Valley flight by Vertical Mapping, and it was obtained from the Yavapai County GIS Department. The 2' contours are to an accuracy of ±1' per national standards. For the larger basins, 5' topography is obtained from the Topo Depot software.

The soils data utilized for hydrology is taken from the site-specific soils report generated for the basins contributing to the *Project* area. The USDA NRCS Custom Soils Resource Report is for Western Yavapai County. The soil types for the drainage basins generally contain Abra-Balon, Arp-Lynx, Lonti-Wineg, Moano, and Venezia-Thunderbird soils, which have a range of characterizations. The hydrologic soil groups (HSGs) can be classified as A, B, and D. See Appendix B for the USDA NRCS custom soil resource report and Figure 6-6 for soil types.

In determining the runoff coefficients, Figure 2-3 from the ADOT manual was used. A 10% cover is assumed based on aerial imagery and site visits. The relevant curves (A&B-10% and D-10%) were used for the appropriate soil types. This chart is shown in Figure 6-9. The variation of HSGs throughout the basins is accounted for by determining a composite C coefficient. The Rational Method basin data and composite C coefficient calculations can be found in Figure 6-10.

A 10-minute minimum time of concentration is utilized, as presented in the ADOT hydrology manual. Time of concentration calculations are shown in Figures 6-11 and 6-12. Runoff summary calculations are shown in Figure 6-13.

6.5 Hydraulics and Proposed Structures

The intent of the drainage design for Northern Connector is to maintain the flow in existing and historical drainageways. Drainage structures are sized to convey the 100-year storm through the three (3) FEMA crossings without negatively affecting upstream or downstream properties. Per the YCDDM, Section 11.4.3, the other crossings must convey, at a minimum, the 25-year storm with maximum 12" of roadway overtopping in sags. If only the 25-year event is conveyed, the additional 100-year runoff would have been detained on the south side of the roadway. Since the majority of the crossings will back up drainage in Arizona State Land Department (ASLD) property, all structures are sized for the 100-year flows. Although adding minimal cost (sizing for the 100-year instead of the 25-year), it will greatly reduce the acreage of ASLD land impacted, which will reduce the ROW acquisition and overall cost required for the *Project*.

Proposed drainage structures are sized using CulvertMaster. The FEMA crossings are box culverts, and all the other crossings are circular HDPE culverts. Because the Chino Valley Stream East is very flat along the flowpath and wide along the roadway, the crossing cannot be filled, as upstream properties would be negatively impacted. The final design of this crossing will need to be a ford crossing (with a variance of the YCDDM criteria) or a bridge. All other alternatives (and corridors, including crossing at Road 2 South) were evaluated regarding this watercourse, and the flows and topography do not make it feasible to either create backwater upstream or concentrate flow downstream of a raised roadway crossing. Photos of the existing ford crossing can be found in Figure 6-3.

Figure 6-3 Chino Valley Stream East Existing Ford Crossing

Throughout the corridor, there are a few proposed culverts in potential low areas of ponding. During final roadway design, these nuisance culverts can either be designed or eliminated, depending on final grading. See Table 6-2 for a culvert summary and Appendix C for the CulvertMaster worksheets.

Table 6-2 Proposed Culverts Summary

Basin	100-Year Flow at Outlet (cfs)	Number of Barrels	Shape	Size
1	234.55 (Includes Basin 2)	3	Circular	48”
2	134.96	3	Circular	36”
3	72.31	2	Circular	36”
4	51.83	Used to Size Roadside Channel		
5	309.97	3	Circular	48”
6	24.80	1	Circular	24”
7	27.94	1	Circular	24”
8	119.16	3	Circular	30”
9	3,273	12	Box	10’ x 5’
10	224.86	3	Circular	42”
11	66.48	2	Circular	30”
12	8,102	12	Box	10’ x 8’
13	5,248	Ford Crossing or Bridge		

The roadway crossings at the FEMA-detailed studies will require a CLOMR to be completed, submitted to, and approved by FEMA during final design stages. After construction, a LOMR based on as-builts will need to be completed and submitted to FEMA for approval. These submittals will have to include the duplicate effective, corrected effective, pre-project, and post-project hydraulic models, as required by FEMA in the CLOMR-LOMR MT-2 process. Since the effective hydraulic models contain several profiles (multiple-frequency events and floodway), the pre-project and post-project models will be required to follow suit. The CLOMR submittal will also require Endangered Species Act (ESA) compliance documentation from the U.S. Fish and Wildlife Service.

6.6 References

Arizona Department of Transportation, Highway Drainage Design Manual, Volume 2, Hydrology, Second Edition, January 2014.

FEMA Flood Insurance Study, LOMR Case No. 10-09-3939P, Yavapai County, December 21, 2010.

West Chino Valley Area Drainage Master Study, Project Engineering Consultants, Ltd., July 2002.

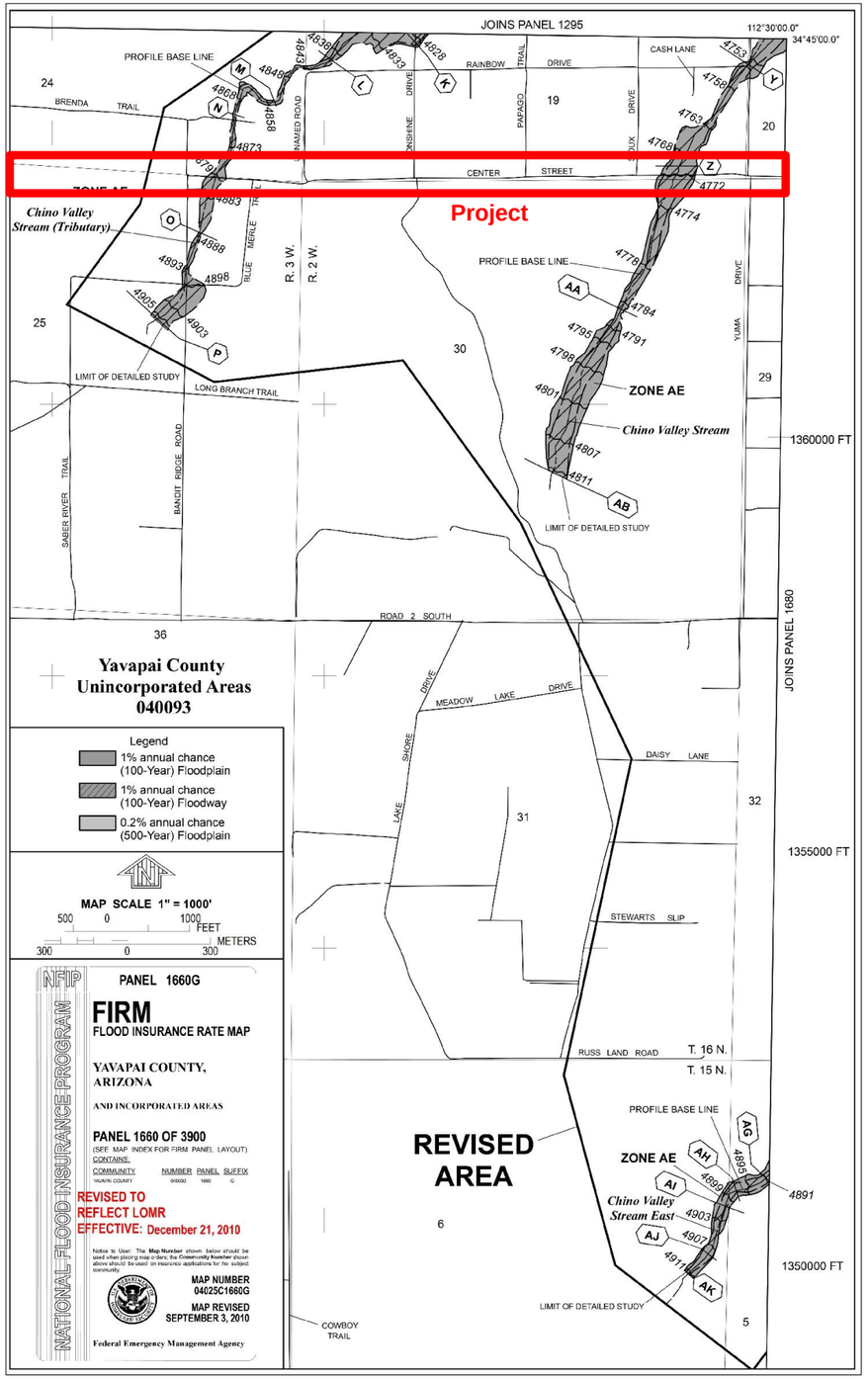
Williamson Valley topography, Yavapai County GIS, Vertical Mapping, 2010.

Yavapai County Drainage Design Manual, Yavapai County, July 1, 2015.

6.7 Software Used

Bentley CulvertMaster v3.3, 2009.

Figure 6-4 Effective FEMA LOMR Relevant Maps



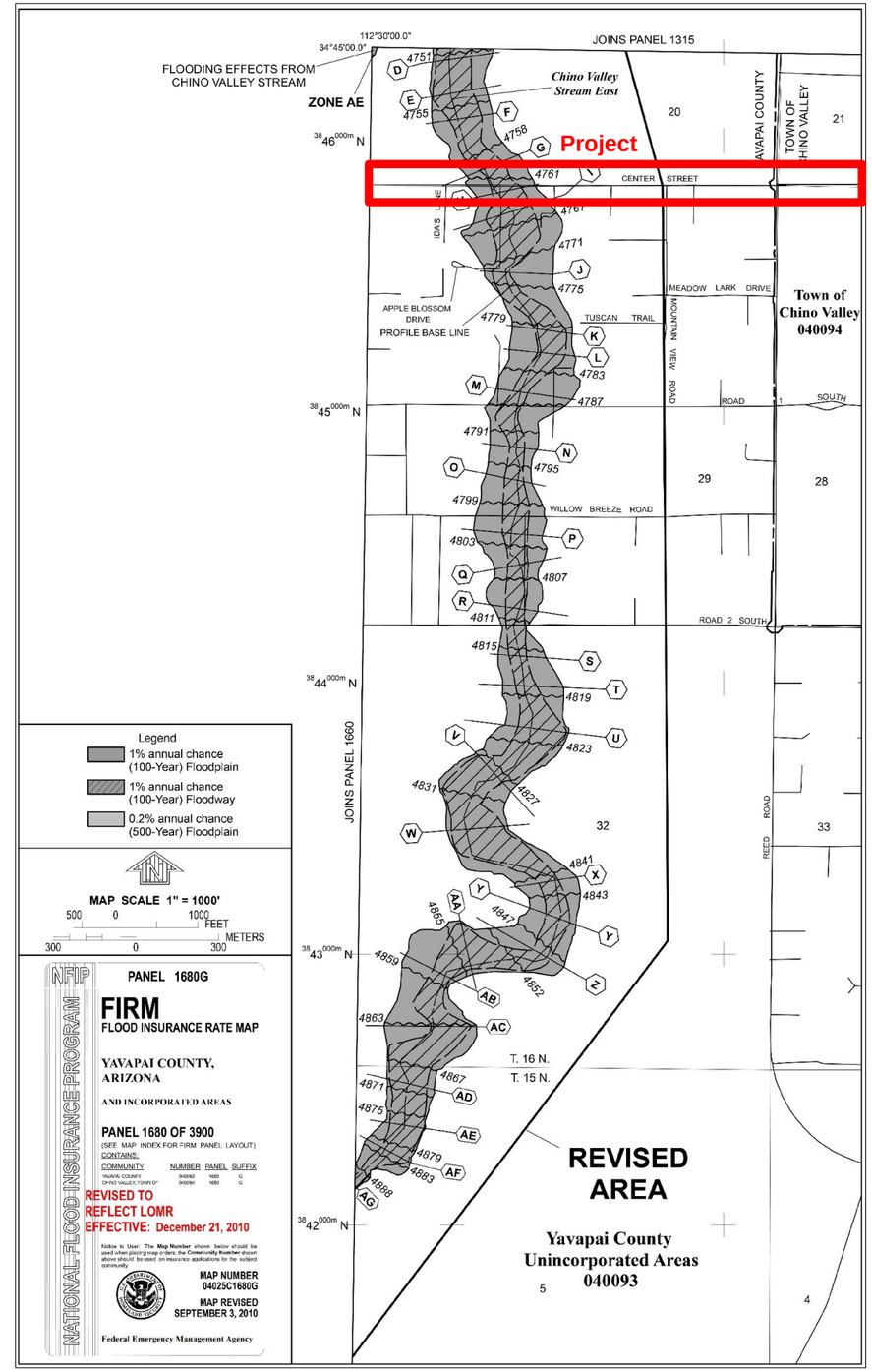


Figure 6-5 Effective FEMA Floodplains and Floodways

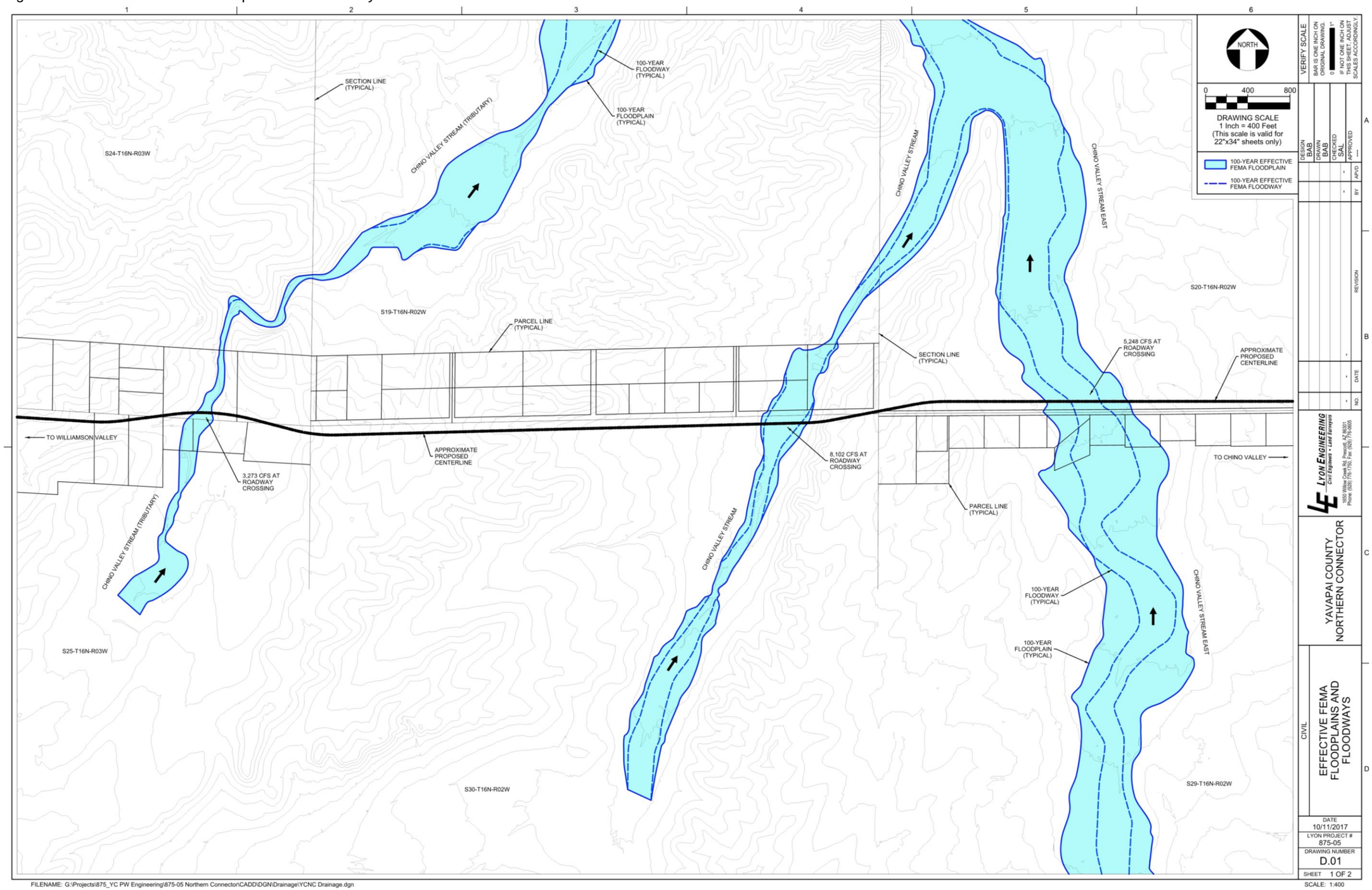
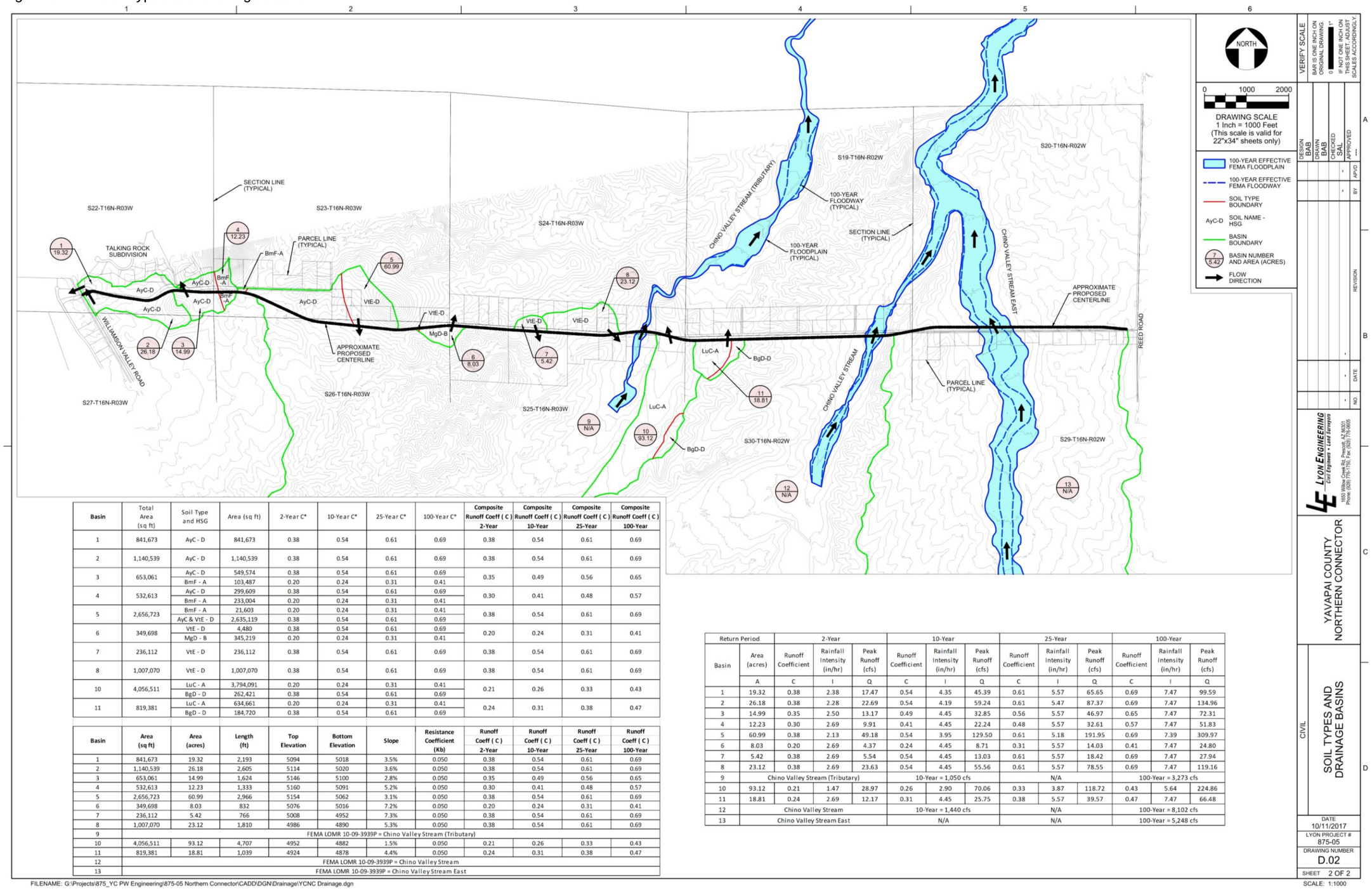


Figure 6-6 Soil Types and Drainage Basins



Basin	Total Area (sq ft)	Soil Type and HSG	Area (sq ft)	2-Year C*	10-Year C*	25-Year C*	100-Year C*	Composite Runoff Coeff (C) 2-Year	Composite Runoff Coeff (C) 10-Year	Composite Runoff Coeff (C) 25-Year	Composite Runoff Coeff (C) 100-Year
1	841,673	AyC - D	841,673	0.38	0.54	0.61	0.69	0.38	0.54	0.61	0.69
2	1,140,539	AyC - D	1,140,539	0.38	0.54	0.61	0.69	0.38	0.54	0.61	0.69
3	653,061	AyC - D	549,574	0.38	0.54	0.61	0.69	0.35	0.49	0.56	0.65
		BmF - A	103,487	0.20	0.24	0.31	0.41				
4	532,613	AyC - D	299,609	0.38	0.54	0.61	0.69	0.30	0.41	0.48	0.57
		BmF - A	233,004	0.20	0.24	0.31	0.41				
5	2,656,723	BmF - A	21,603	0.20	0.24	0.31	0.41	0.38	0.54	0.61	0.69
		AyC & VtE - D	2,635,119	0.38	0.54	0.61	0.69				
6	349,698	VtE - D	4,480	0.38	0.54	0.61	0.69	0.20	0.24	0.31	0.41
		MgD - B	345,219	0.20	0.24	0.31	0.41				
7	236,112	VtE - D	236,112	0.38	0.54	0.61	0.69	0.38	0.54	0.61	0.69
8	1,007,070	VtE - D	1,007,070	0.38	0.54	0.61	0.69	0.38	0.54	0.61	0.69
10	4,056,511	LuC - A	3,794,091	0.20	0.24	0.31	0.41	0.21	0.26	0.33	0.43
		BgD - D	262,421	0.38	0.54	0.61	0.69				
11	819,381	LuC - A	634,661	0.20	0.24	0.31	0.41	0.24	0.31	0.38	0.47
		BgD - D	184,720	0.38	0.54	0.61	0.69				

Basin	Area (sq ft)	Area (acres)	Length (ft)	Top Elevation	Bottom Elevation	Slope	Resistance Coefficient (Kb)	Runoff Coeff (C) 2-Year	Runoff Coeff (C) 10-Year	Runoff Coeff (C) 25-Year	Runoff Coeff (C) 100-Year
1	841,673	19.32	2,193	5094	5018	3.5%	0.050	0.38	0.54	0.61	0.69
2	1,140,539	26.18	2,605	5114	5020	3.6%	0.050	0.38	0.54	0.61	0.69
3	653,061	14.99	1,624	5146	5100	2.8%	0.050	0.35	0.49	0.56	0.65
4	532,613	12.23	1,333	5160	5091	5.2%	0.050	0.30	0.41	0.48	0.57
5	2,656,723	60.99	2,966	5154	5062	3.1%	0.050	0.38	0.54	0.61	0.69
6	349,698	8.03	832	5076	5016	7.2%	0.050	0.20	0.24	0.31	0.41
7	236,112	5.42	766	5008	4952	7.3%	0.050	0.38	0.54	0.61	0.69
8	1,007,070	23.12	1,810	4986	4890	5.3%	0.050	0.38	0.54	0.61	0.69
9	FEMA LOMR 10-09-3939P = Chino Valley Stream (Tributary)										
10	4,056,511	93.12	4,707	4952	4882	1.5%	0.050	0.21	0.26	0.33	0.43
11	819,381	18.81	1,039	4924	4878	4.4%	0.050	0.24	0.31	0.38	0.47
12	FEMA LOMR 10-09-3939P = Chino Valley Stream										
13	FEMA LOMR 10-09-3939P = Chino Valley Stream East										

Return Period		2-Year			10-Year			25-Year			100-Year		
Basin	Area (acres)	Runoff Coefficient	Rainfall Intensity (in/hr)	Peak Runoff (cfs)	Runoff Coefficient	Rainfall Intensity (in/hr)	Peak Runoff (cfs)	Runoff Coefficient	Rainfall Intensity (in/hr)	Peak Runoff (cfs)	Runoff Coefficient	Rainfall Intensity (in/hr)	Peak Runoff (cfs)
	A	C	I	Q	C	I	Q	C	I	Q	C	I	Q
1	19.32	0.38	2.38	17.47	0.54	4.35	45.39	0.61	5.57	65.65	0.69	7.47	99.59
2	26.18	0.38	2.28	22.69	0.54	4.19	59.24	0.61	5.47	87.37	0.69	7.47	134.96
3	14.99	0.35	2.50	13.17	0.49	4.45	32.85	0.56	5.57	46.97	0.65	7.47	72.31
4	12.23	0.30	2.69	9.91	0.41	4.45	22.24	0.48	5.57	32.61	0.57	7.47	51.83
5	60.99	0.38	2.13	49.18	0.54	3.95	129.50	0.61	5.18	191.95	0.69	7.39	309.97
6	8.03	0.20	2.69	4.37	0.24	4.45	8.71	0.31	5.57	14.03	0.41	7.47	24.80
7	5.42	0.38	2.69	5.54	0.54	4.45	13.03	0.61	5.57	18.42	0.69	7.47	27.94
8	23.12	0.38	2.69	23.63	0.54	4.45	55.56	0.61	5.57	78.55	0.69	7.47	119.16
9	Chino Valley Stream (Tributary)				10-Year = 1,050 cfs			N/A			100-Year = 3,273 cfs		
10	93.12	0.21	1.47	28.97	0.26	2.90	70.06	0.33	3.87	118.72	0.43	5.64	224.86
11	18.81	0.24	2.69	12.17	0.31	4.45	25.75	0.38	5.57	39.57	0.47	7.47	66.48
12	Chino Valley Stream				10-Year = 1,440 cfs			N/A			100-Year = 8,102 cfs		
13	Chino Valley Stream East				N/A			N/A			100-Year = 5,248 cfs		

Figure 6-7 NOAA Atlas 14 Rainfall Depth Table

NOAA Atlas 14, Volume 1, Version 5
Location name: Prescott, Arizona, USA*
Latitude: 34.7422°, Longitude: -112.5221°
Elevation: 4907.36 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.227 (0.193-0.267)	0.294 (0.250-0.346)	0.400 (0.340-0.470)	0.487 (0.410-0.569)	0.610 (0.508-0.710)	0.710 (0.587-0.827)	0.818 (0.668-0.954)	0.933 (0.752-1.09)	1.10 (0.868-1.30)	1.24 (0.961-1.47)
10-min	0.346 (0.294-0.407)	0.449 (0.381-0.528)	0.609 (0.517-0.715)	0.741 (0.625-0.866)	0.928 (0.774-1.08)	1.08 (0.893-1.26)	1.25 (1.02-1.45)	1.42 (1.15-1.66)	1.67 (1.32-1.97)	1.88 (1.46-2.23)
15-min	0.429 (0.365-0.505)	0.556 (0.472-0.654)	0.756 (0.641-0.886)	0.918 (0.775-1.07)	1.15 (0.959-1.34)	1.34 (1.11-1.56)	1.54 (1.26-1.80)	1.76 (1.42-2.06)	2.08 (1.64-2.44)	2.34 (1.81-2.76)
30-min	0.578 (0.491-0.680)	0.749 (0.636-0.881)	1.02 (0.863-1.19)	1.24 (1.04-1.45)	1.55 (1.29-1.81)	1.80 (1.49-2.10)	2.08 (1.70-2.42)	2.37 (1.91-2.78)	2.80 (2.21-3.29)	3.15 (2.44-3.72)
60-min	0.715 (0.608-0.842)	0.927 (0.787-1.09)	1.26 (1.07-1.48)	1.53 (1.29-1.79)	1.92 (1.60-2.24)	2.23 (1.85-2.60)	2.57 (2.10-3.00)	2.94 (2.37-3.44)	3.46 (2.73-4.07)	3.89 (3.02-4.61)
2-hr	0.837 (0.716-0.978)	1.07 (0.912-1.25)	1.42 (1.21-1.66)	1.70 (1.45-1.99)	2.12 (1.78-2.47)	2.47 (2.05-2.87)	2.84 (2.33-3.31)	3.25 (2.63-3.79)	3.84 (3.04-4.49)	4.33 (3.37-5.08)
3-hr	0.888 (0.772-1.04)	1.13 (0.977-1.32)	1.46 (1.26-1.71)	1.74 (1.50-2.03)	2.14 (1.83-2.50)	2.48 (2.09-2.89)	2.86 (2.38-3.33)	3.27 (2.68-3.82)	3.86 (3.11-4.52)	4.35 (3.43-5.13)
6-hr	1.06 (0.925-1.25)	1.33 (1.15-1.56)	1.67 (1.45-1.96)	1.96 (1.69-2.29)	2.38 (2.03-2.79)	2.72 (2.30-3.18)	3.09 (2.58-3.62)	3.48 (2.87-4.09)	4.06 (3.27-4.78)	4.53 (3.58-5.37)
12-hr	1.28 (1.10-1.52)	1.59 (1.37-1.89)	1.97 (1.69-2.33)	2.27 (1.95-2.69)	2.69 (2.29-3.19)	3.01 (2.55-3.58)	3.35 (2.81-3.98)	3.70 (3.07-4.40)	4.19 (3.43-5.02)	4.60 (3.73-5.55)
24-hr	1.43 (1.29-1.59)	1.79 (1.61-2.00)	2.24 (2.02-2.50)	2.60 (2.34-2.90)	3.09 (2.77-3.44)	3.47 (3.10-3.86)	3.86 (3.43-4.30)	4.26 (3.76-4.74)	4.79 (4.20-5.34)	5.20 (4.53-5.82)

https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_printpage.html?lat=34.7422&lon=-112.5221&data=depth&units=english&series=pds 1/1

Figure 6-8 NOAA Atlas 14 Rainfall Intensity Table

NOAA Atlas 14, Volume 1, Version 5
Location name: Prescott, Arizona, USA*
Latitude: 34.7422°, Longitude: -112.5221°
Elevation: 4907.36 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	2.72 (2.32-3.20)	3.53 (3.00-4.15)	4.80 (4.08-5.64)	5.84 (4.92-6.83)	7.32 (6.10-8.52)	8.52 (7.04-9.92)	9.82 (8.02-11.4)	11.2 (9.02-13.1)	13.2 (10.4-15.6)	14.9 (11.5-17.6)
10-min	2.08 (1.76-2.44)	2.69 (2.29-3.17)	3.65 (3.10-4.29)	4.45 (3.75-5.20)	5.57 (4.64-6.49)	6.49 (5.36-7.55)	7.47 (6.10-8.71)	8.53 (6.88-9.98)	10.0 (7.93-11.8)	11.3 (8.78-13.4)
15-min	1.72 (1.46-2.02)	2.22 (1.89-2.62)	3.02 (2.56-3.54)	3.67 (3.10-4.29)	4.60 (3.84-5.36)	5.36 (4.43-6.24)	6.17 (5.04-7.20)	7.04 (5.68-8.24)	8.30 (6.56-9.78)	9.34 (7.25-11.1)
30-min	1.16 (0.982-1.36)	1.50 (1.27-1.76)	2.04 (1.73-2.39)	2.47 (2.09-2.89)	3.10 (2.58-3.61)	3.61 (2.98-4.20)	4.16 (3.39-4.85)	4.74 (3.82-5.55)	5.59 (4.41-6.58)	6.29 (4.88-7.44)
60-min	0.715 (0.608-0.842)	0.927 (0.787-1.09)	1.26 (1.07-1.48)	1.53 (1.29-1.79)	1.92 (1.60-2.24)	2.23 (1.85-2.60)	2.57 (2.10-3.00)	2.94 (2.37-3.44)	3.46 (2.73-4.07)	3.89 (3.02-4.61)
2-hr	0.418 (0.358-0.489)	0.534 (0.456-0.626)	0.708 (0.602-0.828)	0.852 (0.723-0.994)	1.06 (0.892-1.24)	1.23 (1.02-1.44)	1.42 (1.17-1.65)	1.63 (1.32-1.90)	1.92 (1.52-2.25)	2.16 (1.68-2.54)
3-hr	0.296 (0.257-0.346)	0.375 (0.325-0.439)	0.487 (0.421-0.570)	0.580 (0.499-0.677)	0.714 (0.608-0.832)	0.827 (0.697-0.962)	0.951 (0.793-1.11)	1.09 (0.894-1.27)	1.28 (1.03-1.51)	1.45 (1.14-1.71)
6-hr	0.177 (0.154-0.208)	0.222 (0.192-0.260)	0.279 (0.241-0.327)	0.328 (0.282-0.383)	0.398 (0.339-0.466)	0.455 (0.384-0.532)	0.516 (0.431-0.604)	0.582 (0.478-0.683)	0.677 (0.545-0.799)	0.757 (0.598-0.897)
12-hr	0.106 (0.092-0.126)	0.132 (0.114-0.157)	0.163 (0.141-0.194)	0.189 (0.162-0.223)	0.223 (0.190-0.264)	0.250 (0.212-0.297)	0.278 (0.234-0.331)	0.307 (0.255-0.365)	0.348 (0.285-0.417)	0.382 (0.309-0.460)
24-hr	0.059 (0.054-0.066)	0.075 (0.067-0.083)	0.093 (0.084-0.104)	0.108 (0.097-0.121)	0.129 (0.115-0.143)	0.145 (0.129-0.161)	0.161 (0.143-0.179)	0.177 (0.157-0.197)	0.200 (0.175-0.223)	0.217 (0.189-0.242)

https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_printpage.html?lat=34.7422&lon=-112.5221&data=intensity&units=english&series=pds 1/1

Figure 6-9 Runoff “C” Coefficient Chart

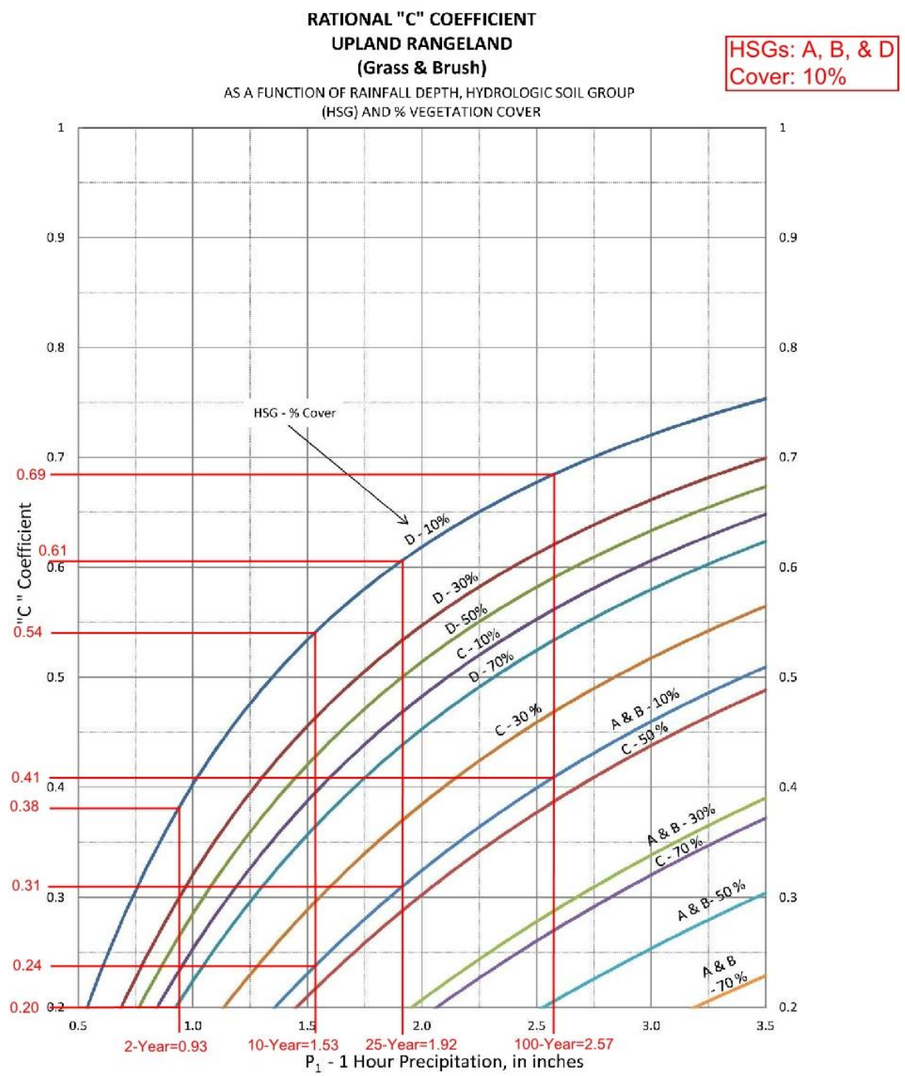


Figure 2–3 Rational “C” Coefficient – Upland Rangeland

Figure 6-10 Composite Runoff "C" Coefficient Calculations and Basin Data

Basin	Total Area (sq ft)	Soil Type and HSG	Area (sq ft)	2-Year C*	10-Year C*	25-Year C*	100-Year C*	Composite Runoff Coeff (C) 2-Year	Composite Runoff Coeff (C) 10-Year	Composite Runoff Coeff (C) 25-Year	Composite Runoff Coeff (C) 100-Year
1	841,673	AyC - D	841,673	0.38	0.54	0.61	0.69	0.38	0.54	0.61	0.69
2	1,140,539	AyC - D	1,140,539	0.38	0.54	0.61	0.69	0.38	0.54	0.61	0.69
3	653,061	AyC - D	549,574	0.38	0.54	0.61	0.69	0.35	0.49	0.56	0.65
		BmF - A	103,487	0.20	0.24	0.31	0.41				
4	532,613	AyC - D	299,609	0.38	0.54	0.61	0.69	0.30	0.41	0.48	0.57
		BmF - A	233,004	0.20	0.24	0.31	0.41				
5	2,656,723	BmF - A	21,603	0.20	0.24	0.31	0.41	0.38	0.54	0.61	0.69
		AyC & VtE - D	2,635,119	0.38	0.54	0.61	0.69				
6	349,698	VtE - D	4,480	0.38	0.54	0.61	0.69	0.20	0.24	0.31	0.41
		MgD - B	345,219	0.20	0.24	0.31	0.41				
7	236,112	VtE - D	236,112	0.38	0.54	0.61	0.69	0.38	0.54	0.61	0.69
8	1,007,070	VtE - D	1,007,070	0.38	0.54	0.61	0.69	0.38	0.54	0.61	0.69
10	4,056,511	LuC - A	3,794,091	0.20	0.24	0.31	0.41	0.21	0.26	0.33	0.43
		BgD - D	262,421	0.38	0.54	0.61	0.69				
11	819,381	LuC - A	634,661	0.20	0.24	0.31	0.41	0.24	0.31	0.38	0.47
		BgD - D	184,720	0.38	0.54	0.61	0.69				

Basin	Area (sq ft)	Area (acres)	Length (ft)	Top Elevation	Bottom Elevation	Slope	Resistance Coefficient (Kb)	Runoff Coeff (C) 2-Year	Runoff Coeff (C) 10-Year	Runoff Coeff (C) 25-Year	Runoff Coeff (C) 100-Year
1	841,673	19.32	2,193	5094	5018	3.5%	0.050	0.38	0.54	0.61	0.69
2	1,140,539	26.18	2,605	5114	5020	3.6%	0.050	0.38	0.54	0.61	0.69
3	653,061	14.99	1,624	5146	5100	2.8%	0.050	0.35	0.49	0.56	0.65
4	532,613	12.23	1,333	5160	5091	5.2%	0.050	0.30	0.41	0.48	0.57
5	2,656,723	60.99	2,966	5154	5062	3.1%	0.050	0.38	0.54	0.61	0.69
6	349,698	8.03	832	5076	5016	7.2%	0.050	0.20	0.24	0.31	0.41
7	236,112	5.42	766	5008	4952	7.3%	0.050	0.38	0.54	0.61	0.69
8	1,007,070	23.12	1,810	4986	4890	5.3%	0.050	0.38	0.54	0.61	0.69
9	FEMA LOMR 10-09-3939P = Chino Valley Stream (Tributary)										
10	4,056,511	93.12	4,707	4952	4882	1.5%	0.050	0.21	0.26	0.33	0.43
11	819,381	18.81	1,039	4924	4878	4.4%	0.050	0.24	0.31	0.38	0.47
12	FEMA LOMR 10-09-3939P = Chino Valley Stream										
13	FEMA LOMR 10-09-3939P = Chino Valley Stream East										

*Note: C-Factors assumed as Upland Rangeland, 10% Vegetation

Figure 6-11 Time of Concentration Calculations (1 of 2)

$$T^C = 11.4 L^{0.5} K_b^{\ 0.52} S^{-0.31} i^{-0.38}$$

Sub-Basin Name	Area acres A	Flowline feet l	Flowline miles L	Resistance Coefficient Kb	Trial Time of Concentration Tc in hours	Intensity in/hr I	Calc Time of Concentration Tc in hours	Tc in Minutes	Return Period
1	19.32	2193	0.415	0.050					2-year
					0.167	2.69	0.211	12.7	
					0.221	2.38	0.221	13.3	OK
									10-year
					0.167	4.45	0.175	10.5	
					0.176	4.35	0.176	10.6	OK
	Top Elevation ft	Bottom Elevation ft	Difference feet H	Slope feet/mile S					25-year
					0.167	5.57	0.160	9.6	
					0.159	5.67	0.159	9.5	OK
	5094	5018	76	183					
									100-year
					0.167	7.47	0.143	8.6	
					0.140	8.01	0.140	8.4	OK
2	A	l	L	Kb					2-year
	26.18	2605	0.493	0.050	0.167	2.69	0.227	13.6	
					0.242	2.28	0.242	14.5	OK
									10-year
					0.167	4.45	0.188	11.3	
					0.192	4.19	0.192	11.5	OK
	Top Elevation ft	Bottom Elevation ft	Difference feet H	Slope feet/mile S					25-year
					0.167	5.57	0.172	10.3	
					0.174	5.47	0.174	10.4	OK
	5114	5020	94	191					
									100-year
					0.167	7.47	0.154	9.3	
					0.152	7.77	0.152	9.1	OK
3	A	l	L	Kb					2-year
	14.99	1624	0.308	0.050	0.167	2.69	0.194	11.6	
					0.199	2.50	0.199	11.9	OK
									10-year
					0.167	4.45	0.160	9.6	
					0.159	4.53	0.159	9.5	OK
	Top Elevation ft	Bottom Elevation ft	Difference feet H	Slope feet/mile S					25-year
					0.167	5.57	0.147	8.8	
					0.144	5.89	0.144	8.6	OK
	5146	5100	46	150					
									100-year
					0.167	7.47	0.131	7.9	
					0.126	8.31	0.126	7.6	OK

$$T^C = 11.4 L^{0.5} K_b^{\ 0.52} S^{-0.31} i^{-0.38}$$

Sub-Basin Name	Area acres A	Flowline feet l	Flowline miles L	Resistance Coefficient Kb	Trial Time of Concentration Tc in hours	Intensity in/hr I	Calc Time of Concentration Tc in hours	Tc in Minutes	Return Period
4	12.23	1333	0.252	0.050					2-year
					0.167	2.69	0.145	8.7	
					0.142	2.86	0.142	8.5	OK
									10-year
					0.167	4.45	0.120	7.2	
					0.114	5.08	0.114	6.9	OK
	Top Elevation ft	Bottom Elevation ft	Difference feet H	Slope feet/mile S					25-year
					0.167	5.57	0.110	6.6	
					0.104	6.55	0.104	6.2	OK
	5160	5091	69	273					
									100-year
					0.167	7.47	0.099	5.9	
					0.091	9.17	0.091	5.5	OK
5	A	l	L	Kb					2-year
	60.99	2966	0.562	0.050	0.167	2.69	0.254	15.3	
					0.278	2.13	0.278	16.7	OK
									10-year
					0.167	4.45	0.210	12.6	
					0.220	3.95	0.220	13.2	OK
	Top Elevation ft	Bottom Elevation ft	Difference feet H	Slope feet/mile S					25-year
					0.167	5.57	0.193	11.6	
					0.198	5.18	0.198	11.9	OK
	5154	5062	92	164					
									100-year
					0.167	7.47	0.173	10.4	
					0.173	7.39	0.173	10.4	OK
6	A	l	L	Kb					2-year
	8.03	832	0.158	0.050	0.167	2.69	0.104	6.2	
					0.097	3.23	0.097	5.8	OK
									10-year
					0.167	4.45	0.086	5.1	
					0.078	5.63	0.078	4.7	OK
	Top Elevation ft	Bottom Elevation ft	Difference feet H	Slope feet/mile S					25-year
					0.167	5.57	0.079	4.7	
					0.071	7.22	0.071	4.3	OK
	5076	5016	60	381					
									100-year
					0.167	7.47	0.070	4.2	
					0.063	10.00	0.063	3.8	OK

Figure 6-12 Time of Concentration Calculations (2 of 2)

$$T^C = 11.4 L^{0.5} K_b^{\ 0.52} S^{-0.31} i^{-0.38}$$

Sub-Basin Name	Area acres A	Flowline feet l	Flowline miles L	Resistance Coefficient Kb	Trial Time of Concentration Tc in hours	Intensity in/hr I	Calc Time of Concentration Tc in hours	Tc in Minutes	Return Period
7	5.42	766	0.145	0.050					2-year
					0.167	2.69	0.099	5.9	
					0.092	3.28	0.092	5.5	OK
									10-year
					0.167	4.45	0.082	4.9	
					0.074	5.70	0.074	4.5	OK
	Top Elevation ft	Bottom Elevation ft	Difference feet H	Slope feet/mile S					25-year
					0.167	5.57	0.075	4.5	
					0.068	7.28	0.068	4.1	OK
	5008	4952	56	386					
									100-year
					0.167	7.47	0.067	4.0	
					0.060	10.09	0.060	3.6	OK
8	A	l	L	Kb					2-year
	23.12	1810	0.343	0.050	0.167	2.69	0.168	10.1	
					0.168	2.69	0.168	10.1	OK
									10-year
					0.167	4.45	0.139	8.3	
					0.135	4.81	0.135	8.1	OK
	Top Elevation ft	Bottom Elevation ft	Difference feet H	Slope feet/mile S					25-year
					0.167	5.57	0.128	7.7	
					0.122	6.23	0.122	7.3	OK
	4986	4890	96	280					
									100-year
					0.167	7.47	0.114	6.8	
					0.107	8.76	0.107	6.4	OK
10	A	l	L	Kb					2-year
	93.12	4707	0.891	0.050	0.167	2.69	0.402	24.1	
					0.504	1.49	0.504	30.2	OK
									10-year
					0.167	4.45	0.332	19.9	
					0.391	2.90	0.391	23.5	OK
	Top Elevation ft	Bottom Elevation ft	Difference feet H	Slope feet/mile S					25-year
					0.167	5.57	0.305	18.3	
					0.350	3.87	0.350	21.0	OK
	4952	4882	70	79					
									100-year
					0.167	7.47	0.273	16.4	
					0.304	5.64	0.304	18.2	OK

$$T^C = 11.4 L^{0.5} K_b^{\ 0.52} S^{-0.31} i^{-0.38}$$

Sub-Basin Name	Area acres A	Flowline feet l	Flowline miles L	Resistance Coefficient Kb	Trial Time of Concentration Tc in hours	Intensity in/hr I	Calc Time of Concentration Tc in hours	Tc in Minutes	Return Period
11	18.81	1039	0.197	0.050					2-year
					0.167	2.69	0.135	8.1	
					0.130	2.95	0.130	7.8	OK
									10-year
					0.167	4.45	0.111	6.7	
					0.105	5.21	0.105	6.3	OK
	Top Elevation ft	Bottom Elevation ft	Difference feet H	Slope feet/mile S					25-year
					0.167	5.57	0.102	6.1	
					0.095	6.72	0.095	5.7	OK
	4924	4878	46	234					
									100-year
					0.167	7.47	0.091	5.5	
					0.084	9.36	0.084	5.0	OK

Figure 6-13 Runoff Summary Calculations

Return Period		2-Year			10-Year			25-Year			100-Year		
Basin	Area (acres)	Runoff Coefficient	Rainfall Intensity (in/hr)	Peak Runoff (cfs)	Runoff Coefficient	Rainfall Intensity (in/hr)	Peak Runoff (cfs)	Runoff Coefficient	Rainfall Intensity (in/hr)	Peak Runoff (cfs)	Runoff Coefficient	Rainfall Intensity (in/hr)	Peak Runoff (cfs)
	A	C	I	Q	C	I	Q	C	I	Q	C	I	Q
1	19.32	0.38	2.38	17.47	0.54	4.35	45.39	0.61	5.57	65.65	0.69	7.47	99.59
2	26.18	0.38	2.28	22.69	0.54	4.19	59.24	0.61	5.47	87.37	0.69	7.47	134.96
3	14.99	0.35	2.50	13.17	0.49	4.45	32.85	0.56	5.57	46.97	0.65	7.47	72.31
4	12.23	0.30	2.69	9.91	0.41	4.45	22.24	0.48	5.57	32.61	0.57	7.47	51.83
5	60.99	0.38	2.13	49.18	0.54	3.95	129.50	0.61	5.18	191.95	0.69	7.39	309.97
6	8.03	0.20	2.69	4.37	0.24	4.45	8.71	0.31	5.57	14.03	0.41	7.47	24.80
7	5.42	0.38	2.69	5.54	0.54	4.45	13.03	0.61	5.57	18.42	0.69	7.47	27.94
8	23.12	0.38	2.69	23.63	0.54	4.45	55.56	0.61	5.57	78.55	0.69	7.47	119.16
9	Chino Valley Stream (Tributary)				10-Year = 1,050 cfs			N/A			100-Year = 3,273 cfs		
10	93.12	0.21	1.47	28.97	0.26	2.90	70.06	0.33	3.87	118.72	0.43	5.64	224.86
11	18.81	0.24	2.69	12.17	0.31	4.45	25.75	0.38	5.57	39.57	0.47	7.47	66.48
12	Chino Valley Stream				10-Year = 1,440 cfs			N/A			100-Year = 8,102 cfs		
13	Chino Valley Stream East				N/A			N/A			100-Year = 5,248 cfs		

SECTION 7. Traffic Study

7.1 Introduction

Lee Engineering (Lee) was contracted as a sub-consultant to conduct traffic and safety analysis for the proposed *Project* and surrounding major roadways. Lee Engineering worked with both YC and LE staff to establish land use and roadway connectivity assumptions based on the best information available at the time of this study. The Lee Engineering *Northern Connector Traffic Projections and Safety Analysis* is included in Appendix D, and Sections 7.2 and 7.3 summarize the analysis and safety components of the study.

7.2 Traffic Analysis

Lee coordinated with CYMPO and the multimodal planning division of ADOT to review and revise (as needed) the model that was used in preparing the 2040 regional transportation plan (RTP). The Lee team provided the following traffic analysis components:

- Reduced the size of the Traffic Analysis Zones (TAZs), as needed, that are in the Northern Connector study area in order to obtain reasonable planning year traffic projections to the roadway network.
- Edited the network file by re-assigning the connector/traffic loading points as needed. There needed to be an adequate roadway network in the study area (including TAZ centroid connectors) to reasonably load the study area network in a realistic manner.
- Prepared the model network file for the preferred alignment as agreed by the stakeholders for model runs.
- Revisited the assumptions that were made in predicting the 2040 socio-economic (SE) data projection while preparing the RTP. Predicted 2040 SE data based on updated census and/or American Community Survey (ACS) information (e.g. 2010 and 2015). Coordinated with stakeholders (Yavapai County, CYMPO, and ADOT) and finalized the assumptions needed to predict reasonable 2040 SE data.
- Coordinated with stakeholders to include recent development in the study area and any planned future developments in the area. Verified the land use information contained in the CYMPO model (residential, commercial, or mixed), and update employment information for the model run.
- Prepared the updated model's input files and assisted CYMPO and ADOT in running the model for the preferred alignment.
- Reviewed the model outputs and made any revision needed to correct illogical trip generation, distribution and assignment. Assisted CYMPO/ADOT in re-running the model with revisions.
- Obtained the final projected modeled volumes on the study corridor, and performed capacity analysis to determine required number of lanes, level of service, etc.
- Provided a report with the assumptions made, analysis done, and findings.

7.3 Safety Analysis

Lee Engineering coordinated with LE and YC to implement the recently developed predictive models/concepts as contained in AASHTO Highway Safety Manual to evaluate anticipated safety performance of different design features. Lee utilized the FHWA Interactive Highway Safety Design Model (IHSDM) Software to perform this analysis. According to FHWA:

"IHSDM is a decision-support tool, which provides estimates of a highway design's expected safety and operational performance and checks existing or proposed highway designs against relevant design policy values. Results of the IHSDM support decision making in the highway design process. Intended users include highway project managers, designers, and traffic and safety reviewers in State and local highway agencies and in engineering consulting firms." The items that the Lee team performed are as follows:

- Extracted the modeled predicted traffic volume and Level of Service information for the Northern Connector study corridor.
- Incorporated land use type information (residential, commercial, or mixed) and proposed corridor's geometric characteristics such as roadside fixed objects (i.e. clear zones), lane width, median width (where appropriate), shoulder width, lighting, intersection geometric and operational elements, anticipated number of driveways, presence of on-street parking, anticipated speed enforcement, etc.
- Provided a summary of benefits for different combinations of characteristics to Lyon Engineering.
- Provided a brief report containing assumptions made, analysis done, and findings to Lyon Engineering.

7.4 Safety Analysis Recommendations

The Lee Engineering *Northern Connector Traffic Projections and Safety Analysis* located in Appendix D recommended that the following safety design aspects be considered during subsequent design stages:

- *As part of project development, a left-turn lane should be considered on southbound Williamson Valley Road approaching the new Northern Connector alignment. The left-turning volume is not currently known, but it is probable that the intersection will warrant a left-turn lane due to the speed and volume on Williamson Valley Road and the increase in turning traffic at this intersection after the Northern Connector is constructed. (It is possible that other traffic control measures at this intersection, such as a roundabout, may also be appropriate.) If a turn lane is constructed in just one direction on Williamson Valley Road, the through lanes should be tapered appropriately through the intersection to avoid an abrupt transition.*
- *Left-turn lanes are recommended on the Northern Connector in both directions approaching the Yuma Road intersection. IHSDM showed a significant safety benefit of left-turn lanes due to the intersection's geometric characteristics and expected traffic volume. In the base case, Yuma Road is expected to experience the most crashes of any intersection on the corridor (about four crashes per year), so this intersection stands to benefit most from the addition of dedicated space for left-turning vehicles. However, left-turn lanes should also be considered at other intersections with more than a trivial amount of traffic because of the safety benefits.*

- *While centerline rumble strips offer crash reduction potential, the characteristics of the Northern Connector are not ideally suited to their use. The roadway has a modest length of less than 5 miles and posted speeds are assumed to range from 35 to 45 mph, less than typical rural highways. Most importantly, the roadway passes through an area with residential development and where considerable additional development is likely in the future. ADOT's Traffic Guidelines and Processes No. 480 recommends against using rumble strips within 2000 feet of a residential structure. While Yavapai County is not required to comply with this ADOT guideline on the Northern Connector, compliance is advisable because noise complaints can occur when longitudinal rumble strips are installed too close to homes. The entire length of the Northern Connector is within 2000 feet of an existing residence, and it is likely that residential development will increase in the future. As such, centerline rumble strips are not currently recommended. However, it is recommended that rumble strips be considered as a future countermeasure if crash characteristics so warrant, particularly if a design can be developed that is less noise intensive.*

- *Shoulder rumble strips are also not recommended because of the residential nature of the corridor. ADOT TGP No. 480 also recommends against the use of shoulder rumble strips on paved shoulders less than 5 feet wide because of their impacts on bicycle traffic. Consequently, shoulder rumble strips are not recommended on the Northern Connector.*

7.5 Previous Planning and Analysis

Previous planning and analysis documents that reference the *Project* and need for the Northern Connector were utilized as a guide during the preliminary design process. Figures 7-1 and 7-2 contain relevant excerpts from the CYMPO 2015 update. Below is a timeline of previous analysis and planning efforts that pertain to the *Project*.

- 2006 - CYMPO identified the need for an additional east-west corridor north of Outer Loop Road
- 2011 – CYMPO Regional Transportation Plan referenced *Project* corridor need
- 2013 – YC PCER Report and BOS approval of preferred alignment
- 2015 – CYMPO Regional Transportation Plan Update identified YC PCER *Project* corridor

Figure 7-1 CYMPO 2015 Report Table 10 – 2040 Recommended Networks

Table 10 – Improvement Projects Included in 2040 Recommended Network

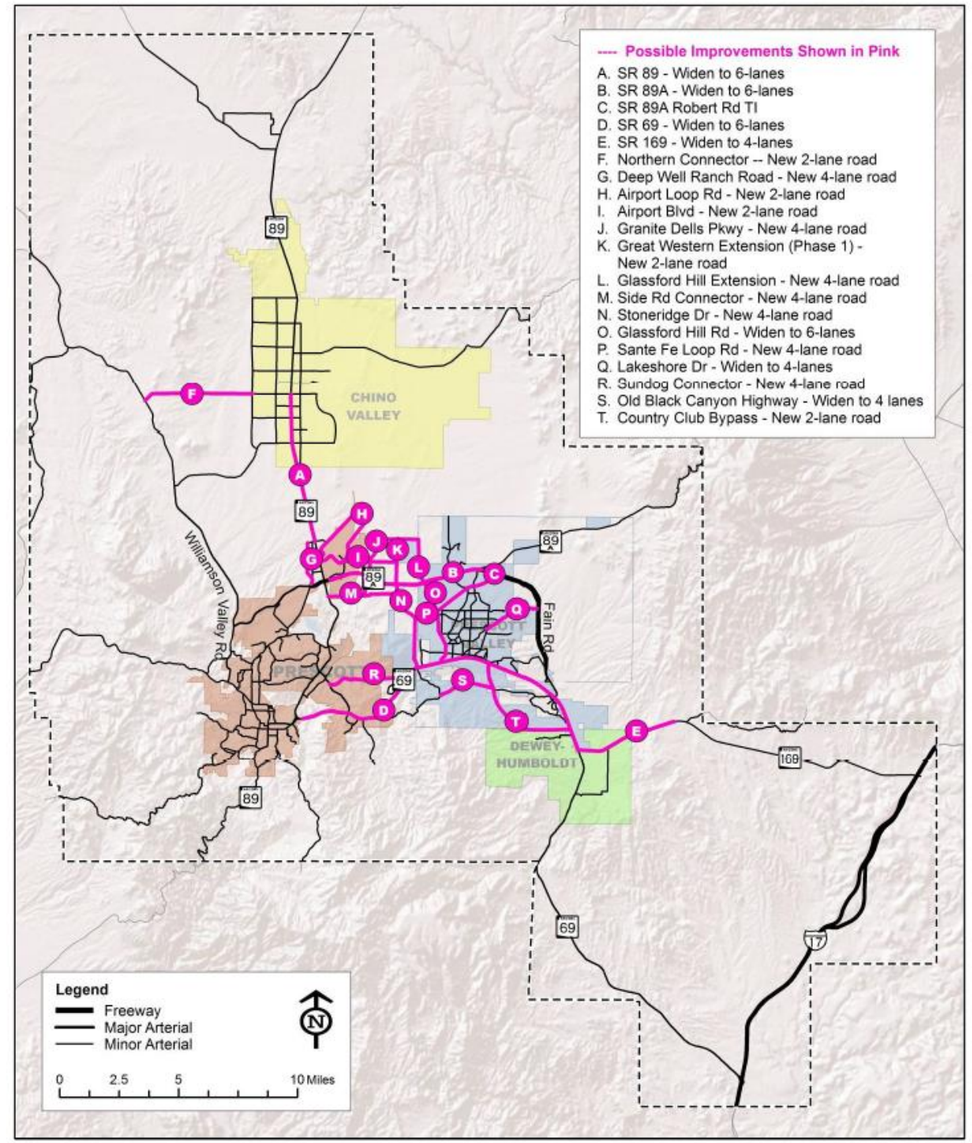
Project name	Description	Jurisdiction
SR 89 Widening	Widen to 6 lanes (Deep Well Ranch Road to Center Street)	ADOT
SR 89A Widening	Widen to 6 lanes (SR 89 to Robert Road)	ADOT
SR89A/Robert Road Traffic Interchange (TI)	New Robert Road (TI), includes portion of Santa Fe Loop Road, grade separation of Robert Road, and new ramps	ADOT/Local Jurisdiction
SR 69 Widening	Complete widening to 6 lanes (SR 89 to SR 169)	ADOT
SR 169 Widening	Widen to 6 lanes (SR 69 to Old Cherry Road)	ADOT
Northern Connector	New 2-lane facility between Reed Road and Williamson Valley Road	Yavapai County
Deep Well Ranch Road	New 4-lane facility between existing Deep Well Ranch Road and Willow Creek Road	Prescott
Airport Loop Road	New 2-lane facility looping around the airport	Prescott
Airport Boulevard	New 4-lane facility between SR 89A and Great Western Extension	Prescott
Granite Dells Parkway	New 4-lane facility between SR 89A and Great Western Extension	Prescott
Great Western Extension (Phase 1)	Phase 1 includes new 2-lane facility to the north of SR 89A	Yavapai County
Glassford Hill Extension	New 4-lane facility between SR 89A and Great Western Extension	Prescott Valley
Side Road Connector	New 4-lane facility between SR 89A and Stoneridge Drive	Prescott
Stoneridge Drive	New 4-lane facility between SR 69 and SR 89A	Prescott Valley

CYMPO Regional Transportation Plan Update Page 75

Source: CYMPO Regional Transportation Plan Update 2040, April 2015, AECOM

Figure 7-2 CYMPO 2015 Report Figure 37 – 2040 Regional Network

Figure 37 – CYMPO 2040 Recommended Regional Network



CYMPO Regional Transportation Plan Update Page 77

Source: CYMPO Regional Transportation Plan Update 2040, April 2015, AECOM

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SECTION 8. Waters of the United States Preliminary Delineation

8.1 Project Description

In the interest of creating a viable preliminary roadway corridor plan for the Yavapai County (YC) *Project* alignment shown in Figure 8-1, Lyon Engineering (LE) has prepared a Preliminary Jurisdictional Determination (PJD) assessment that identifies the ordinary high-water mark (OHWM) associated with visible watercourses potentially impacted by the ROW limits for approximately 4.8 miles of the Northern Connector roadway (Alignment 1B). LE staff completed a field walk of the entire alignment and investigated approximately one-mile of drainageways and adjoining tributaries within and adjacent to the anticipated ROW limits. Since future permitting of roadway infrastructure may be affected by the extent of the Waters of the United States (WoUS) throughout *Project* alignment, both LE and YC understand the importance of avoidance and minimized proposed disturbance to potential WoUS where practical.

The *Project* is within the jurisdiction of both the YC and the Arizona State Land Department. The total anticipated length of improvements along the *Project* corridor is approximately 4.8 miles, beginning at the existing WVR and Nancy Drive intersection and terminating at the intersection of Center Street and Reed Road at the western boundary of Chino Valley. Included in the *Project* design are preliminary roadway and drainage plans for approximately 4.8 miles of the future Northern Connector Roadway. The watercourses investigated are within the "Jerome Canyon - 1979" and "Chino Valley South - 1973" USGS quad maps. Figures 8-2 and 8-3 contains excerpts from the USGS quad maps of the *Project* and surrounding area. Figure 6-4 contains the FEMA FIRM Maps that show significant watercourses that impact the *Project* corridor. As shown in Figures 6-4 and 6-5, three drainages that impact the *Project* alignment are designated Zone AE that have FEMA 100-year floodplain and floodway limits.

8.2 Purpose

To ensure future compliance with Section 404 of the Clean Water Act, a preliminary jurisdictional determination analysis of the *Project* area was completed per the requirements of Nationwide Permit Number 14 (*Linear Transportation Projects*) and the U.S. Army Corps of Engineers (USACE) Los Angeles District Regulatory Division/Arizona branch to identify the lateral limits of non-wetland waters. Ground surveys to identify potential waters of the U.S. (WoUS) in the *Project* area were completed on September 29, 2017 by Kevin Horton, P.E., CFM with LE. Figures 8-9 through 8-13 contain ground level photos taken by LE staff during the field investigation. The aerial photograph used during the ground survey was obtained from Cooper Aerial Mapping and was obtained on August 17, 2017. Figures 8-4 through 8-8 contain a reduction of the full size PJD workmaps (11" x 17" formatted) prepared per current USACE mapping standards.

8.3 Potential Waters of the U.S.

LE utilized field investigations and high-resolution aerial photography to delineate the lateral limits of the potential waters of the U.S. (WoUS). The aerial photography (1.4" pixel resolution) and 1' interval was used to verify the delineation of all potential drainageways within the *Project* boundary that were documented during the field investigation. The ordinary high-water mark (OHWM) delineation for all drainageways was determined utilizing the guidelines presented in "A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States" (August 2008) and "Updated Datasheet for the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States" (July 2010). Both guidelines utilized for the delineation are USACE publications. Typical OHWM identifiers looked for during field investigations include (but are not limited to): destruction or lack of upland vegetation, changes in soil characteristics, waterline or shelving/cut banks, water stains, exposed roots, sediment deposits, and the presence of litter or debris. Table 8-2 contains a summary of the OHWM indicators identified during the field investigation.

All drainageways located within the *Project* boundary are classified as ephemeral waterways, and no stream gauge data is available. The Chino Valley Stream (Tributary), Chino Valley Stream, and Chino Valley Stream East are all drainages within the *Project* area that are defined as FEMA 100-year floodplains that flow from south to north, across existing Center Street, and continue northward, eventually flowing into the headwaters of the Verde River about 10 miles north of the site.

Most of the significant unnamed ephemeral drainageways in the *Project* area exhibit some (not all) OHWM identifiers and are classified as potential WoUS in this PJD study due to ensure compliance with CWA Section 404 requirements. Both the Chino Valley Stream (Tributary) (Wash H) and Chino Valley Stream (Wash K) are wide and flat drainageways that have limited WoUS identifiers observed during the field investigation. The aerial imagery reflects vegetation differences between the channel bottom and upland areas that were utilized in delineating the WoUS limits. The Chino Valley Stream East was thoroughly investigated for WoUS indicators, with minimal OHWM indicators observed in field within and adjacent to the *Project* limits (see Figure 8-14). Due to the lack of any visible signs of drainage conveyance infrastructure (culverts) beneath Center street, recent flow, and a lack of WoUS indicators, this area was not delineated in the PJD workmap exhibits.

8.4 Potential Waters of the U.S. Impact

The disturbance to potential WoUS associated with this improvement *Project* will be due to the installation of roadway and drainage infrastructure for the purposes of the proposed 2-lane roadway and resulting cut and fill slopes. Figures 8-4 through 8-8 show the preliminary roadway cut and fill limits that bound the areas of potential WoUS impact based on 15% design planset. Table 8-1 summarizes the approximate impact of the proposed improvements on each wash classified as a potential WoUS in this study. Per Nationwide Permits (NWP) 14 (Appendix E), no notification to the USACE is required for disturbance resulting in the loss of less than or equal to 0.10 acres for each individual crossing. Per NWP 14 (Arizona 2017), "For linear transportation projects crossing a single waterbody more than one time at separate and distant locations, or multiple waterbodies at separate and distant locations, each crossing is considered a single and complete project for purposes of NWP authorization. Linear transportation projects must comply with 33 CFR 330.6(d)."

Project disturbance that results in loss of potential WoUS in excess of 0.10 acres but less than or equal to 0.50-acres requires notification to the USACE under the conditions of NWP 14. Loss of greater than 0.50 acres at a single drainage crossing triggers Individual Permitting per CWA Section 404, which is a time-consuming and expensive process that should be avoided if feasible. Individual permitting is not anticipated to be required for this *Project*.

Due to the scope and size of the roadway infrastructure proposed in the 15% planset, it should be the goal of future YC staff and the design team for non-notification per the conditions of NWP 14. If future design efforts or changes in CWA or USACE rules result in USACE notification to be required, documentation will be required by the USACE that demonstrates avoidance and minimization of impact to potential WoUS was attempted to the best extent practical. USACE notification and NWP 14 compliance (if approved by the USACE) may require in-lieu mitigation fees paid for all potential WoUS disturbed in excess of 0.10 acres. According to State Land Right-of-Way department staff, recent projects on ASLD Land have been required to pay in-lieu fees up to $30,000 per acre of disturbance.

Table 8-1 Potential WoUS Anticipated Impact Summary

Alternative Option	Anticipated Impact (acres)	USACE Notification Required (NWP 14)	Estimated In-Lieu Fee
Wash A	0.030	No	$0
Wash B	0.030	No	$0
Wash C & D	0.085	No	$0
Wash E	0.019	No	$0
Wash F	0.002	No	$0
Wash G	No Impact	No	$0
Wash H – West X-ing	0.058	No	$0
Wash H – East X-ing	0.051	No	$0
Wash I	0.033	No	$0
Wash J	0.042	No	$0
Wash K	0.091	No	$0

8.5 Investigation for Potential Wetlands

All drainageways through the *Project* boundary were investigated for potential wetlands by searching for the presence of obligate and facultative wetland species. The field investigation also included the digging of small test holes at several locations to determine if any hydric soils were present on-site. The U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory and USGS Topographic maps were also investigated to determine if any wetlands were previously identified within the *Project* boundary. The field investigation, USFWS inventory, and USGS maps revealed no evidence of wetlands or wetland indicators in the *Project* area. The presence of well-draining soils and positive outfall in the drainageways results in little to no accumulation of surface or sub-surface waters for sustained periods.

8.6 Recommendation

Due to the anticipated impact to potential WoUS within the *Project* boundary, non-notification per the conditions of NWP 14 appears to be feasible for the proposed 15% planset improvements presented in this study. USACE notification per NWP 14 is not anticipated to be necessary, and individual permitting is highly unlikely unless future design efforts substantially modify the proposed scope of improvements and/or alignment. It is recommended that YC keep this study, field photos, and PJD workmaps on file, and final planning and design efforts be cognizant of the fact that Corps of Engineer's notification and permitting should be avoidable. The individual permitting process can take up to a year to complete and will need to demonstrate an effort to avoid and minimize disturbance to potential WoUS, so large (greater than 0.50 acre) disturbances to potential WoUS at a single crossing location should be avoided if feasible. Below is a summary of what future CWA Section 404 compliance efforts should entail at the final design stages:

- Avoidance and minimization of impact to potential WoUS (as practical)
- Review current EPA and USACE Section 404 permits and requirements at the time of future design work (regulations, rules, and interpretations of rules change over time)
- Review final potential WoUS disturbance areas vs. thresholds for non-notification, notification and NWP 14 compliance, and individual permitting
- USACE notification and PJD submittal (not anticipated to be required) if notification thresholds are exceeded in the final design planset
- In-lieu mitigation fee and coordination (not anticipated to be required)

Figure 8-1 PJD Location Map

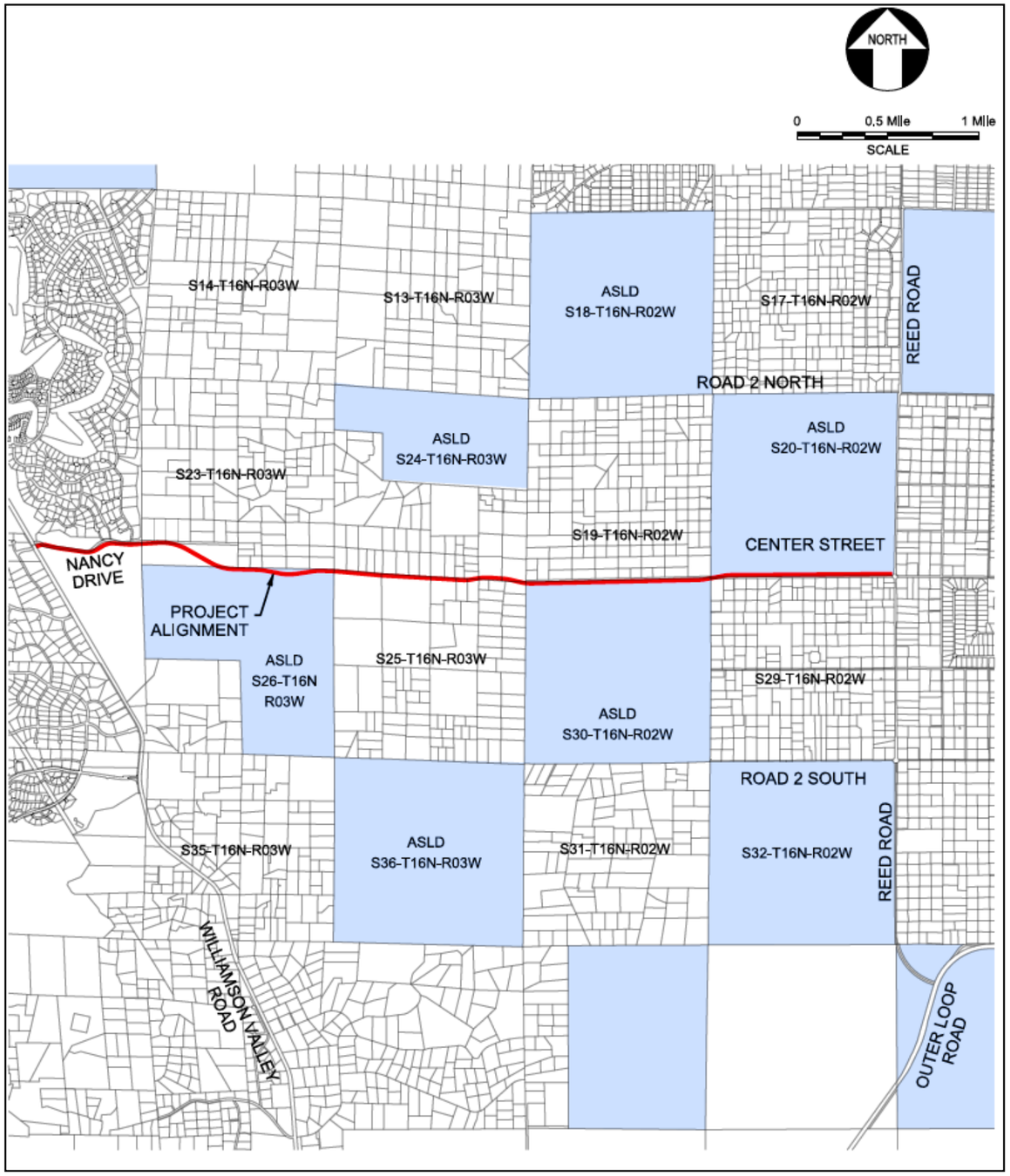
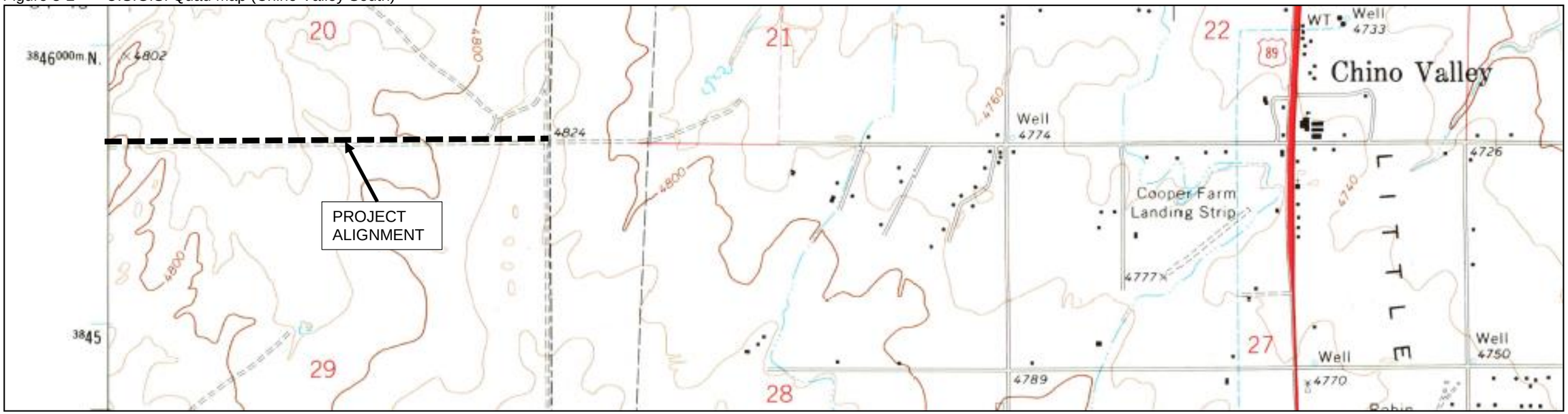
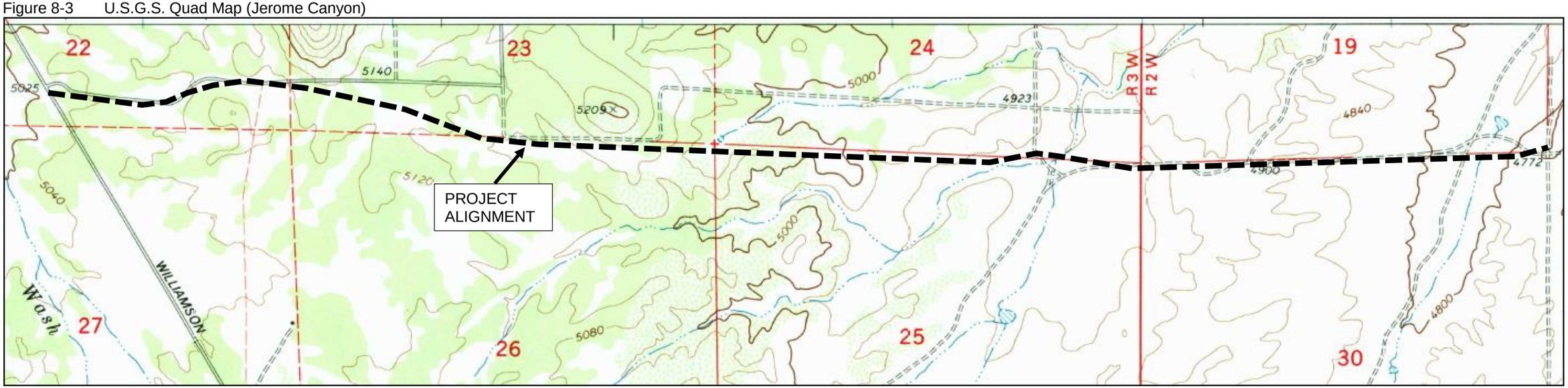


Figure 8-2 U.S.G.S. Quad Map (Chino Valley South)



[Map Source – USGS 15' Chino Valley South Quadrangle 1973

Figure 8-3 U.S.G.S. Quad Map (Jerome Canyon)



[Map Source – USGS Jerome Canyon 15' Quadrangle 1979

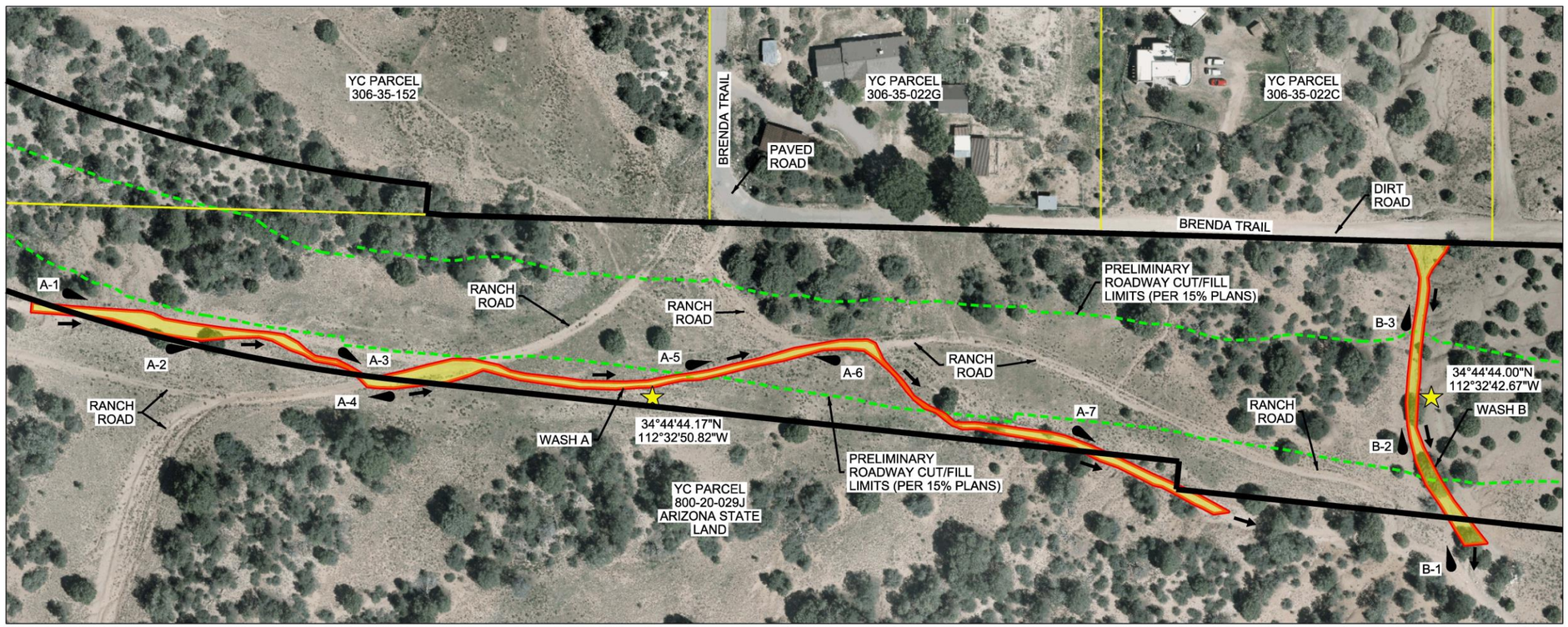
Table 8-2 PJD Physical Characteristics Table

		YES / NO												YES/NO
Wash Name	Impacted Area (ac)	Vegetation Difference Between Wash & Upland	Change in Soil Characteristics	Waterline Mark on Bank	Water Stains	Shelving or Cut Banks	Exposed Roots	Sediments Deposits	Presence of Litter or Debris	Wash Width (ft)	Wash Depth (ft)	Ground Photo Numbers	Existing Drainage Structure Type	WOUS
Wash A	0.030	YES	YES	NO	NO	YES	YES	NO	NO	2 - 15	0 - 2	A-1 - A-7	N/A	YES
Wash B	0.030	YES	YES	NO	NO	YES	YES	NO	NO	6 - 12	0 - 2	B-1 - B-3	CMP	YES
Wash C	0.051	YES	YES	NO	NO	YES	YES	NO	NO	1 - 6	0 - 2	C-1 - C-4	N/A	YES
Wash D	0.009	YES	YES	NO	NO	YES	YES	NO	NO	1 - 3	0 - 3	D-1 - D-2	N/A	YES
Wash E	0.019	YES	YES - MINIMAL	NO	NO	YES	NO	NO	NO	2 - 8	0 - 2	AERIAL	N/A	YES
Wash F	0.002	YES-MINIMAL	YES-MINIMAL	NO	NO	YES	NO	NO	NO	1 - 4	0 - 1	F-1 - F-2	N/A	YES
Wash G	0.000	NO	YES-MINIMAL	NO	NO	NO	NO	NO	NO	1 - 3	0 - 1	AERIAL	N/A	YES
Wash H	0.108	YES	YES	NO	NO	YES	NO	NO	YES	10 - 15	2 - 4	H-1 - H-3	CMP	YES
Wash I	0.033	YES	YES-MINIMAL	NO	NO	YES	NO	YES	YES	6 - 25'	2 - 3	I1 - I3	N/A	YES
Wash J	0.042	YES	YES-MINIMAL	NO	NO	NO	NO	YES	YES	12 - 25	1 - 2	J1 - J2	N/A	YES
Wash K	0.091	YES	YES-MINIMAL	NO	NO	NO	NO	NO	NO	15 - 40	0 - 2	K1 - K3	CMP	YES

Table 8-3 Potential WoUS Data Table

	UNNAMED WASH A	UNNAMED WASH B	UNNAMED WASH C	UNNAMED WASH D	UNNAMED WASH E	UNNAMED WASH F	UNNAMED WASH G	UNNAMED WASH H	UNNAMED WASH I	UNNAMED WASH J	UNNAMED WASH K	COMBINED TOTAL
LAT/LONG @ DRAINAGE MID-POINT (NAD83)	34°44'44.17"N 112°32'50.82"	34°44'44.00"N 112°32'42.67"	34°44'43.49"N 112°32'19.37"	34°44'43.08"N 112°32'20.92"	34°44'43.76"N 112°32'15.95"	34°44'44.46"N 112°32'17.68"	34°44'44.94"N 112°32'17.27"	34°44'42.18"N 112°31'25.97"W	34°44'41.35"N 112°31'0.78"W	34°44'41.53"N 112°30'57.40"	34°44'42.18"N 112°30'15.78"	N/A
DRAINAGEWAY TOTAL LENGTH (FT)	1,125	289	654	173	242	211	93	1,300	236	171	234	4,728
DRAINAGEWAY WoUS LENGTH (FT)	1,125	289	654	173	242	211	93	1,300	236	171	234	4,728
POTENTIAL WoUS AREA (SQ FT)	8,261	3,310	2,853	378	1,565	610	205	18,528	3,719	3,265	7,971	50,664
POTENTIAL WoUS AREA (ACRES)	0.190	0.076	0.065	0.009	0.036	0.014	0.005	0.425	0.085	0.075	0.183	1.163
POTENTIAL WETLAND AREA (SQ FT)	0	0	0	0	0	0	0	0	0	0	0	0
POTENTIAL WETLAND AREA (ACRES)	0	0	0	0	0	0	0	0	0	0	0	0

Figure 8-4 PJD Exhibit Sheet 1 of 5



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DRAWING SCALE
1 Inch = 100 Feet
(This scale is valid for 11"x17" sheets only)

VERIFY SCALE
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IF NOT 1/2 INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

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NO.	DATE	REVISION	BY	APVD

LYON ENGINEERING
Civil Engineers • Land Surveyors
1960 Willow Creek Rd, Prescott, AZ 86301
Phone: (928) 776-1750, Fax: (928) 776-0605

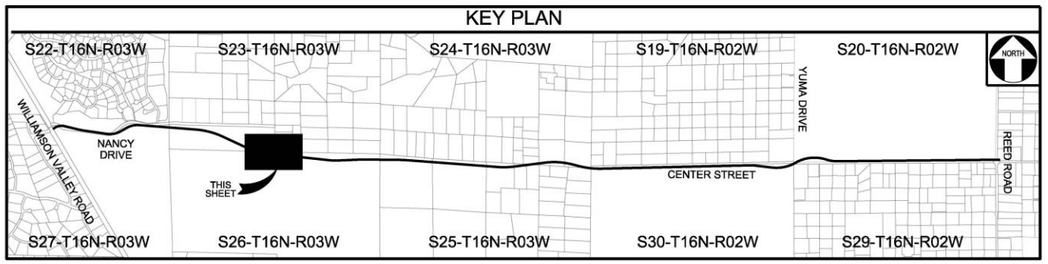
YAVAPAI COUNTY
NORTHERN CONNECTOR

CIVIL

PRELIMINARY JURISDICTIONAL DETERMINATION EXHIBIT

DATE OCTOBER 2017
LYON PROJECT # 875-05
DRAWING NUMBER PJD.01
SHEET 1 OF 5

KEY PLAN



SYMBOL LEGEND

	PROPERTY LINE
	GROUND PHOTO LOCATION AND DIRECTION OF PHOTO
A-1	GROUND PHOTO ID NUMBER
	DRAINAGE FLOW DIRECTION
	APPROXIMATE DRAINAGEWAY MIDPOINT AND COORDINATES (WGS84)

* * * * *PRELIMINARY (RGL 16-01)* * * *
SECTION 404 JURISDICTIONAL DELINEATION
U.S. Army Corps of Engineers, Los Angeles District
Application No.
Boundary of area surveyed for jurisdictional waters of the United States
Approximate Ordinary High Water Mark
Potential Waters of the United States
Potential Wetlands (If legend is blank no wetlands occur with survey area.)
Scale: See scale bar Photograph Date: 8/17/2017
Site Visit by Corps(Y/N) Date:
Determination Issued:
Corps Project Manager: Sheet 1 of 5

FOR EXHIBIT USE ONLY

Figure 8-5 PJD Exhibit Sheet 2 of 5

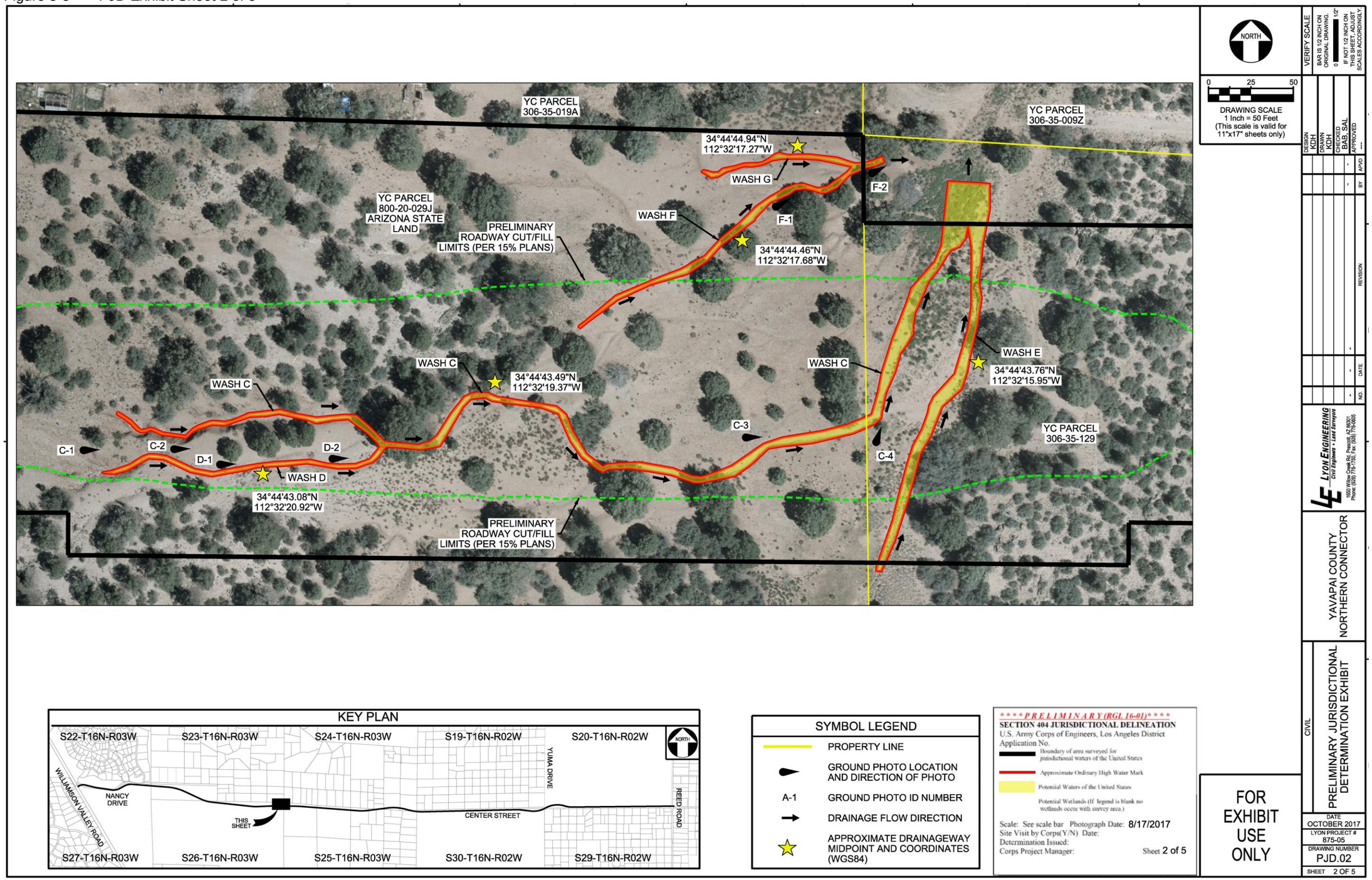
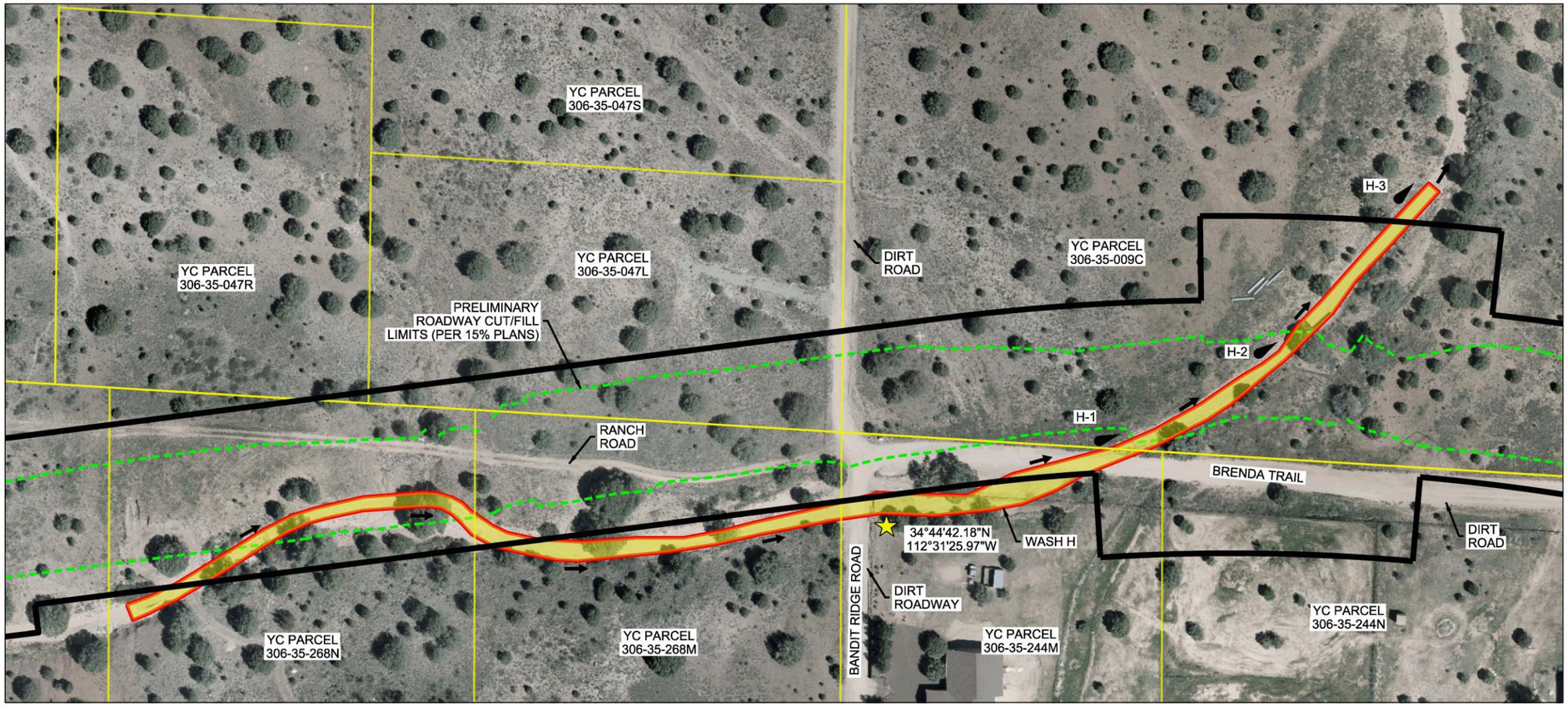


Figure 8-6 PJD Exhibit Sheet 3 of 5



NORTH

0 50 100

DRAWING SCALE
1 Inch = 100 Feet
(This scale is valid for 11"x17" sheets only)

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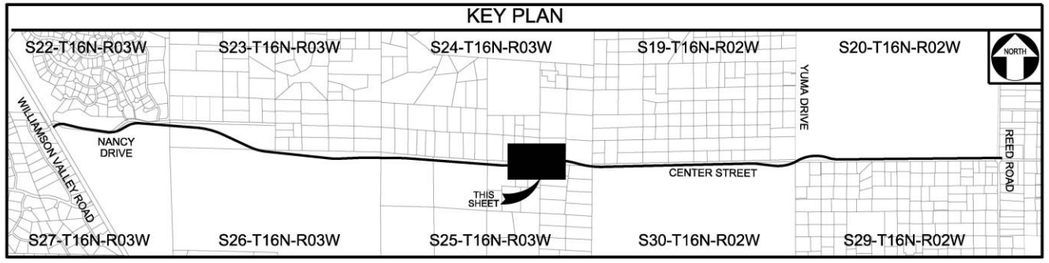
0 1/2"
IF NOT 1/2 INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

KEY PLAN



SYMBOL LEGEND

	PROPERTY LINE
	GROUND PHOTO LOCATION AND DIRECTION OF PHOTO
A-1	GROUND PHOTO ID NUMBER
	DRAINAGE FLOW DIRECTION
	APPROXIMATE DRAINAGEWAY MIDPOINT AND COORDINATES (WGS84)

* * * * PRELIMINARY (RGL 16-01) * * *
SECTION 404 JURISDICTIONAL DELINEATION
U.S. Army Corps of Engineers, Los Angeles District
Application No.
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Approximate Ordinary High Water Mark
Potential Waters of the United States
Potential Wetlands (If legend is blank no wetlands occur with survey area.)
Scale: See scale bar Photograph Date: 8/17/2017
Site Visit by Corps(Y/N) Date:
Determination Issued:
Corps Project Manager: Sheet 3 of 5

FOR EXHIBIT USE ONLY

DESIGN KDH
DRAWN KDH
CHECKED BAB
APPROVED —

NO.	DATE	REVISION	BY	APVD
-	-	-	-	-

LYON ENGINEERING
Civil Engineers • Land Surveyors
1600 Willow Creek Rd, Prescott, AZ 86301
Phone: (928) 778-1793, Fax: (928) 778-0805

YAVAPAI COUNTY
NORTHERN CONNECTOR

CIVIL

PRELIMINARY JURISDICTIONAL DETERMINATION EXHIBIT

DATE OCTOBER 2017
LYON PROJECT # 875-05
DRAWING NUMBER PJD.03
SHEET 3 OF 5

Figure 8-7 PJD Exhibit Sheet 4 of 5

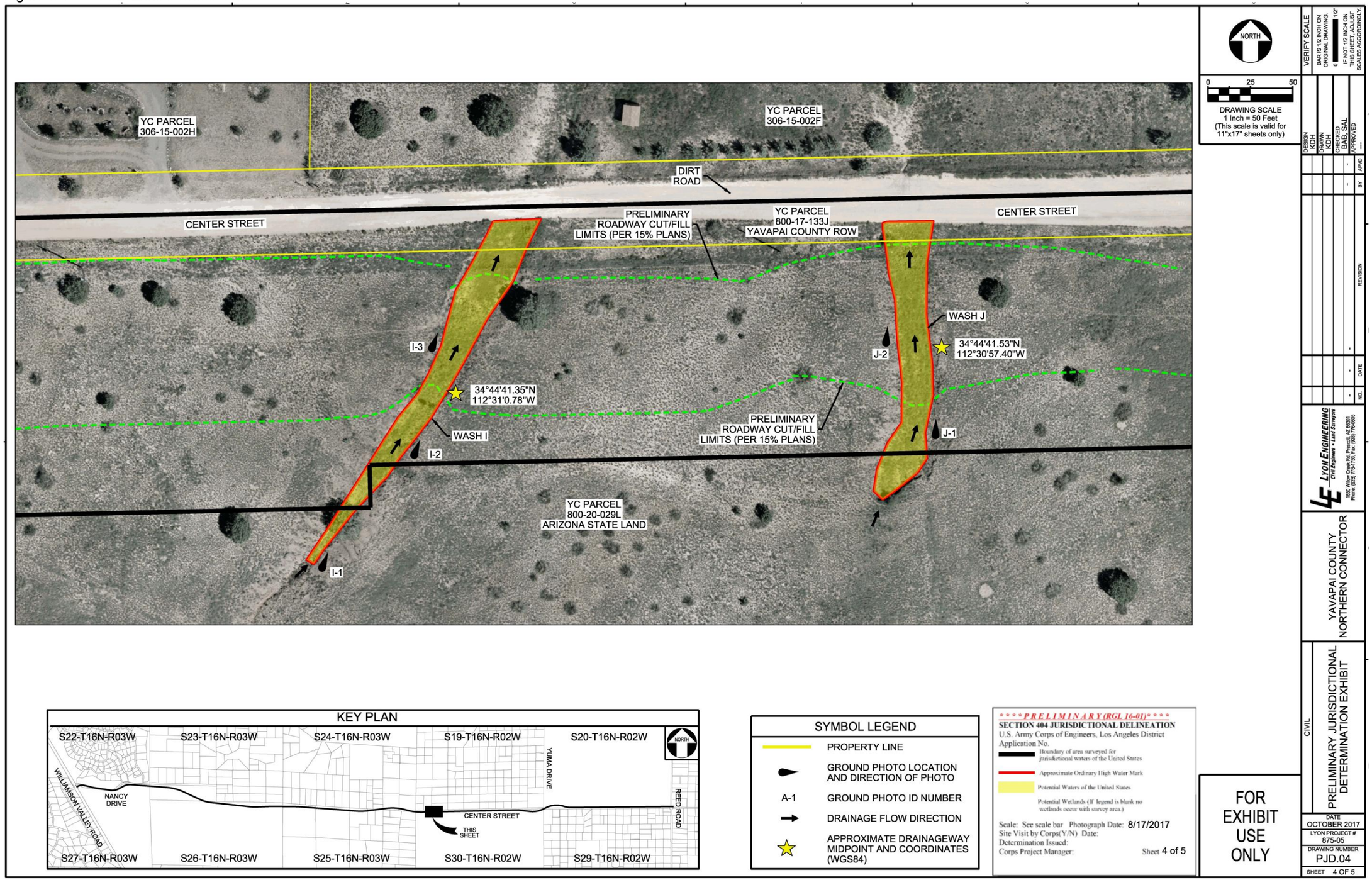


Figure 8-8 PJD Exhibit Sheet 5 of 5

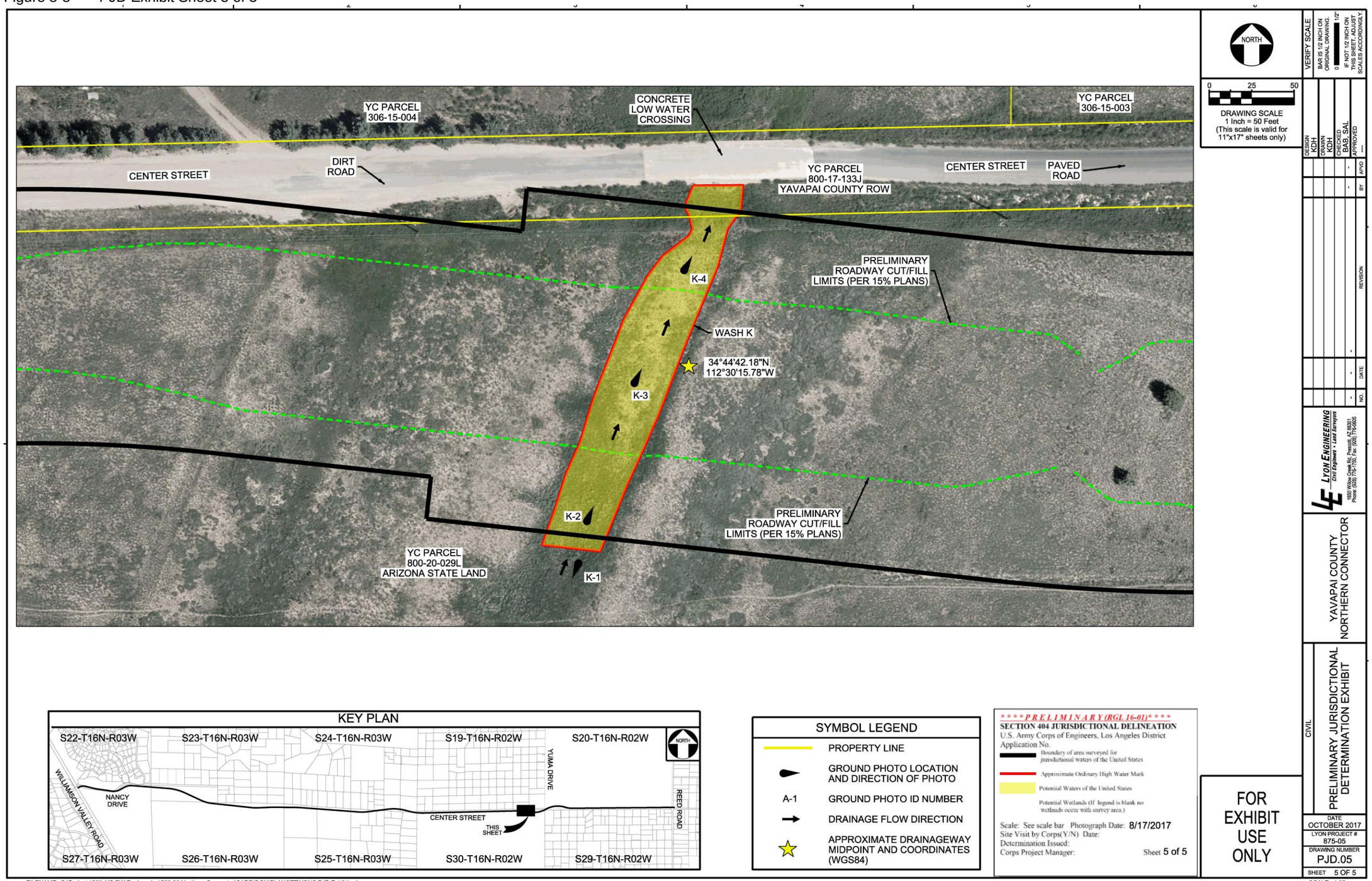


Figure 8-9 PJD Ground Photos A-1 – A-6

Photo A-1 – Looking east downstream along Unnamed Wash A.

Photo A-2 – Looking east downstream along Unnamed Wash A.

Photo A-3 – Looking east downstream along Unnamed Wash A.

Photo A-4 – Looking west upstream along Unnamed Wash A (right) and two-track unnamed ranch road (left).

Photo A-5 – Looking east downstream along Unnamed Wash A.

Photo A-6 – Looking west upstream along Unnamed Wash A (left) and two-track unnamed ranch road (right).

Figure 8-10 PJD Ground Photos A-7 – C-2

Photo A-7 – Looking southeast downstream along Unnamed Wash A.

Photo B-1 – Looking northwest upstream along Unnamed Wash B (right) and two-track unnamed ranch road (left).

Photo B-2 – Looking north upstream along Unnamed Wash B.

Photo B-3 – Looking north upstream along Unnamed Wash B. A drainage culvert beneath Brenda Trail is visible in the background.

Photo C-1 – Looking east downstream along Unnamed Wash C (left) and D (right). These drainages are erosional features on a steep hillside that deposit sediment in the valley below. OHWM identifiers are minimal in the valley floor.

Photo C-2 – Looking east downstream along Unnamed Wash C (left) and D (right). The flat valley floor below can be seen in the background. The drainages become shallow, braided, poorly defined watercourses in the valley floor.

Figure 8-11 PJD Ground Photos C-3 – F-2

Photo C-3 – Looking east downstream along Unnamed Wash C. Connectivity with downstream drainageways is intermittent and poorly defined in this area.

Photo C-4 – Looking northeast downstream along Unnamed Wash C (left) and E (right). OHWM indicators are difficult to identify in this area, however, the USGS map on Figure 8-3 shows a streamline downstream of this location.

Photo D-1 – Looking east downstream along Unnamed Wash D. Wash D is more of an erosional feature than a defined watercourse, however OHWM limits are defined for the purpose of this study.

Photo D-2 – Looking east downstream along Unnamed Wash D. is more of an erosional feature than a defined watercourse, however OHWM limits are defined for the purpose of this study

Photo F-1 – Looking east downstream along Unnamed Wash F.

Photo F-2 – Looking east downstream along Unnamed Wash F. A dirt driveway is visible on the left of the photo. In the background of the photo is a broad, shallow area where Washes C, E, and F converge.

Figure 8-12 PJD Ground Photos H-1 – I-3

Photo H-1 – Looking northeast downstream along Wash H (Chino Valley Stream Tributary). OHWM indicators are clearly defined for this significant watercourse

Photo H-2 – Looking northeast downstream along Wash H (Chino Valley Stream Tributary).

Photo H-3 – Looking east downstream along Wash H (Chino Valley Stream Tributary).

Photo I-1 – Looking northeast downstream along Unnamed Wash I.

Photo I-2 – Looking northeast downstream along Unnamed Wash I.

Photo I-3 – Looking northeast downstream along Unnamed Wash I.

Figure 8-13 PJD Ground Photos J-1 – K-4

Photo J-1 – Looking north downstream along Unnamed Wash J.

Photo J-2 – Looking north downstream along Unnamed Wash J.

Photo K-1 – Looking south upstream along Unnamed Wash K (Chino Valley Stream).

Photo K-2 – Looking north downstream along Wash K (Chino Valley Stream). This is a significant watercourse with a substantial 100-year peak flow rate.

Photo K-3 – Looking north downstream along Wash K (Chino Valley Stream).

Photo K-4 – Looking north downstream along Wash K (Chino Valley Stream).

Figure 8-14 Chino Valley Stream East Ground Photos

Looking south upstream at the low-point on the north Side of Center Street along Chino Valley Stream East.

Looking north downstream at the low-point on the north Side of Center Street along Chino Valley Stream East. A manmade swale to facilitate nuisance drainage northward away from the roadway is visible.

Looking north downstream along Chino Valley Stream East. A manmade swale to facilitate nuisance drainage northward away from the roadway is visible.

Looking south upstream at the low-point on the north Side of Center Street along Chino Valley Stream East. Residential homes, yards, vehicles, and material storage lies within the FEMA designated floodplain. No WoUS indicators are present.

SECTION 9. Preliminary Pavement Structural Section

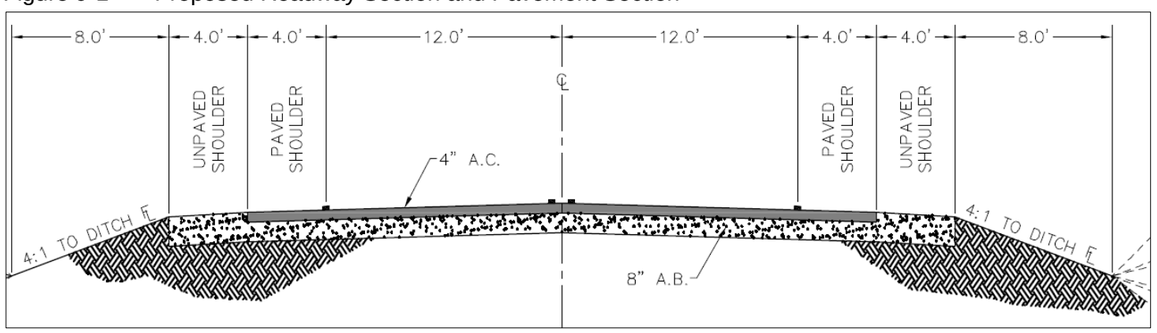
9.1 Introduction

Geotechnical investigation and reporting was included in LE's project scope and it was the original intent of both YC and LE to conduct limited preliminary geotechnical investigations and borings to develop a proposed roadway structural section(s) for the *Project*. It is understood by both YC and LE that the limited geotechnical investigation would need to be supplemented by extensive future investigations to determine a final pavement structure section(s) and accurately identify underlying rock layers as applicable. Due to the lack of future project funding and uncertainty regarding the timing of future design efforts, both YC and LE decided to forego geotechnical investigations as a part of this preliminary design effort.

9.2 Roadway Typical Cross-Sections

The pavement structural section utilized in the preliminary design and cost estimate is consistent with the original YC PCER study conceptual pavement section. The final pavement section will be required to comply with YC Resolution 1036 design standards and will be evaluated and refined during future design efforts. Figure 9-1 contains the proposed roadway cross-section and preliminary pavement structural section. The proposed section utilized for design consists of 4" asphaltic concrete (AC) and 8" aggregate base (AB). A prepared subgrade section is anticipated to be incorporated in the final structural design.

Figure 9-1 Proposed Roadway Section and Pavement Section



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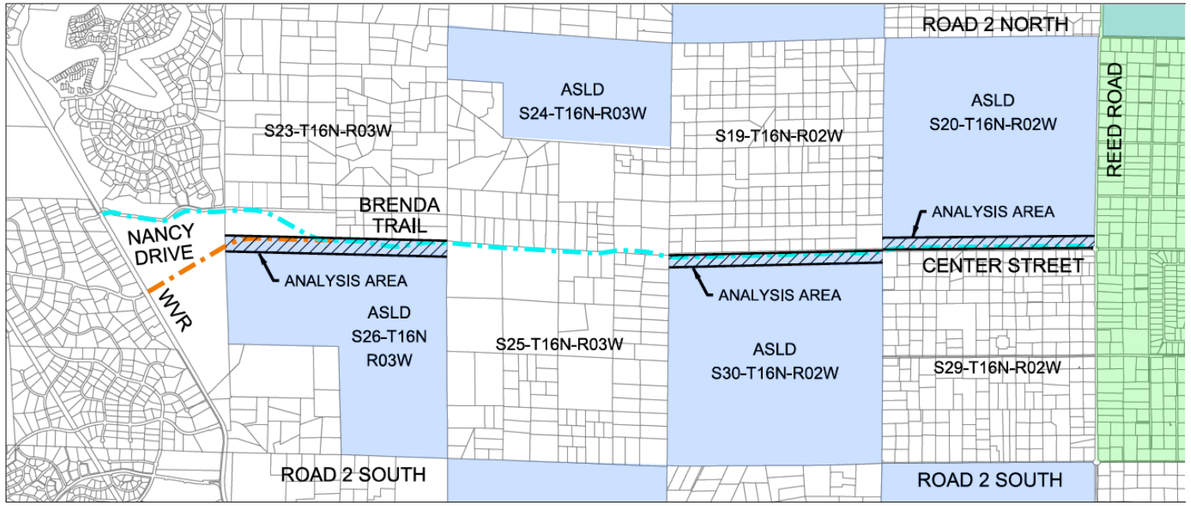
SECTION 10. Biological Assessment

10.1 Biological Assessment

Biozone, Inc. conducted field investigations within Arizona State Land along corridors for the two highest ranking alternatives (1B and 2B) to further assess the possible impact to potentially significant resources. A 400'-wide swath along the northern boundary of S26-T16N-R03W, a 300'-wide swath along the north boundary of S30-T16N-R02W, and a 300'-wide swath along the southern boundary of S20-T16N-R02W was investigated; see Figure 10-1. Biozone's assessment provides LE and YC an understanding of potential future mitigation efforts (if any) that may be required for each of the route options. Biological fieldwork was conducted on 4/25/2017, and a corresponding Biological Assessment – Yavapai County Northern Connector was completed on 5/15/2017 (Appendix G). The biological assessment concluded that neither Routes 1B or 2B would directly impact threatened or endangered species or habitat. However, LE recommends future design efforts be coordinated with Arizona Game and Fish Department (AZGFD) planning staff for input regarding wildlife corridors and potential design considerations that may help reduce negative impact(s) to local fauna and the surrounding biotic community. United States Fish and Wildlife Service (USFWS) Endangered Species Act (ESA) compliance has also been completed and obtained, and it can also be found in Appendix G. No threatened or endangered species or critical habitat was identified within the *Project* area by the USFWS. Although the *Project* will not have an impact on threatened or endangered species habitat, consideration should still be given toward impacts to wildlife and wildlife corridors.

Figure 10-1 Biological Assessment Area Map



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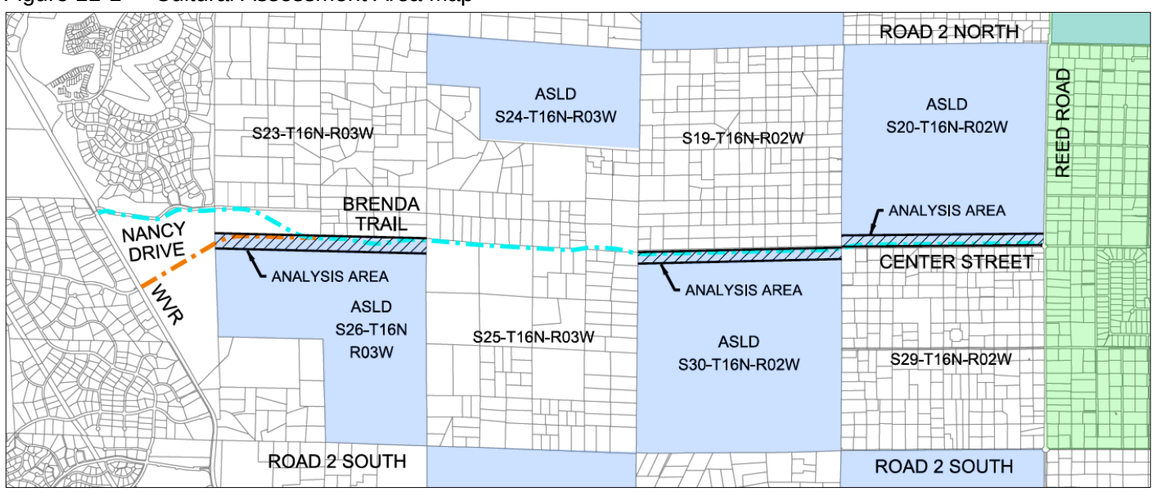
SECTION 11. Archeological Assessment

11.1 Archaeological (Cultural) Assessment

Biozone staff also conducted multiple site visits and research between 4/11/17 and 5/5/17 to prepare *A Cultural Resource Survey of the State Land Portion of the Northern Connector Corridor Study, Yavapai County, Arizona* dated 5/12/17. Due to the sensitive nature of the materials contained therein, a copy of the cultural survey is not included in this document so that the locations of potentially significant cultural sites are not revealed to the general public. Per Biozone's survey, it was determined that "…a systematic archaeological survey across the State Trust land portion of a prospective road improvement and extension *Project* revealed two prehistoric and one historic site." Furthermore, "…disturbance of either (prehistoric site) as part of this *Project* would require archaeological testing and/or data recovery work."

Although the exact location of potentially significant sites cannot be disclosed as a part of this study, a general statement can be made that the preferred Alignment 1B is located away from the two potentially significant prehistoric sites and that Alignment 2B would directly impact both sites. It should be noted that "cultural significance" can only be determined by the State Historic Preservation Office (SHPO), and until submittal to and approval by SHPO, "cultural significance" can only be referred to as "potential". A copy of Biozone archaeological (cultural) resource study can be found in Appendix H, and sensitive excerpts have been censored and/or removed for this document.

Figure 11-1 Cultural Assessment Area Map



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SECTION 12. Public Relations and Stakeholder Coordination

12.1 Introduction

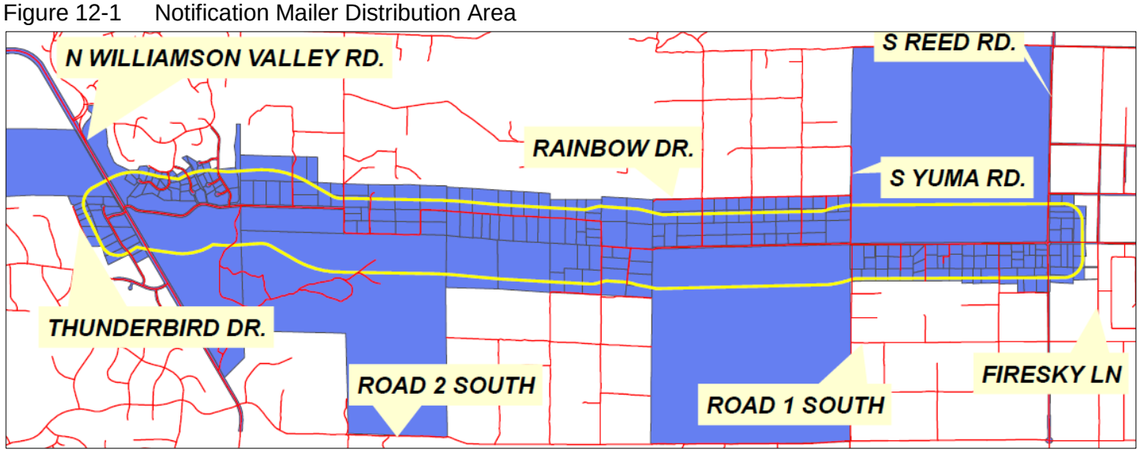
LE teamed with Beta Public Relations (BetaPr) for public relations (PR) and notifications for the *Project*. It was the goal of both YC and LE to keep the *Project* stakeholders and general public informed during the conceptual design process. Significant effort was given to inform the public and stakeholders about the *Project* and solicit input and feedback to help in the route selection process. Direct mailers, newspaper advertisements, a website, a phone hotline, and public meetings were all utilized as a part of the four-month (January 2017 – April 2017) *Project* PR campaign, as described below.

12.2 Public Notices

Beginning in January 2017, BetaPr established a *Project* website (www.northernconnectorstudy.com) that provided a direct public link to the Yavapai County Public Works Public Notices web page that contained updated information about the *Project*. A *Project* phone hotline (928-277-8010) and email address (info@northernconnectorstudy.com) were also established in January for public comments and questions. A public meeting notification was mailed to all residents (235) within a 1000' (Figure 12-1) buffer around the most preferred *Project* corridors (1B/2B) on 1/24/2017. Notice regarding the first public meeting (2/7/2017) was provided in the mailer and a YC Press Release was included in the 2/1/2017 Chino Valley Review newspaper. Meeting information was also published in the Prescott Daily Courier newspaper on 2/3 and 2/5/2017. In addition to the mailer distribution area shown in Figure 12-1, notices were mailed to the following:

- Chino Valley School District
- Chino Valley Town Council
- Chino Valley Public Works Department
- Williamson Valley Community Organization
- Talking Rock Homeowners Association

Figure 12-1 Notification Mailer Distribution Area



12.3 Public Meetings

Three public meetings were held during the *Project* comment period (January 2017 – April 2017). Both YC and LE staff were present at all three meetings to provide informative materials and answer questions from the public. Meeting dates and locations are listed below.

- February 7, 2017 – Public Open House Meeting – Chino Valley Senior Center
- February 14, 2017 – Chino Valley Town Council Meeting and Presentation
- March 8, 2017 – Public Open House Meeting – Talking Rock Clubhouse

12.4 Public Comment Period

Public comments were collected, documented, reviewed, and evaluated by the *Project* team between February 2017 and April 2017 by the following methods:

- Comment sheets at the public meetings
- Direct mail to YC, LE, or BetaPr
- Email to YC, LE, or BetaPr
- Phone calls to the *Project* hotline

A total of 162 comments were received during the comment period. BetaPr prepared a comment summary spreadsheet on 4/26/2017 that is located in Appendix I. Of the 162 comments, 59 were in support of the proposed *Project* and 47 of those 59 supporters were in in favor of the proposed alignment 1B. Of the 162 comments, 94 were in opposition to the *Project* in general (with no alignment preference) and the remaining nine comments were neutral or indifferent. In addition to the public comments from YC residents, the *Project* received letters of support from the following:

- Chino Valley Chamber of Commerce
- Chino Valley Town Council
- Chino Valley Unified School District
- Yavapai Office of Emergency Management
- Prescott Area Wildland Interface Commission
- Central Arizona Fire and Medical Authority
- Williamson Valley Community Organization
- Patriot Disposal and Best Pick Disposal Companies

A group called the "No Northern Connector Road Organization" provided YC staff with a petition containing 1,463 signatures in opposition to the *Project*, claiming the "…road is unnecessary and is too much money for not enough benefit." The petition is 138 pages and is on file at the Yavapai County Public Works Department.

12.5 Service Provider Coordination and Feedback

LE and YC received feedback from area service providers via phone conversation and email correspondence. In general, service provider feedback was very positive due to the poor existing roadway conditions and limited connectivity in the *Project* area. Both solid waste disposal and propane service providers informed LE staff that service is disrupted during rain and snow event that make the existing roadways temporarily impassible.

12.6 Emergency Response Agencies Coordination and Feedback

As previously listed in Section 12.4, the Yavapai County Office of Emergency Management, Central Arizona Fire and Medical Authority, and the Prescott Area Wildland Urban Interface Commission all wrote letters in support of the *Project*. The route was deemed necessary to reduce emergency response times and provide an additional maintained all-weather route for residents in the event of an emergency. Some of the existing dirt roadways are impassable in wet weather conditions, and a reliable means of maintained access would benefit emergency operation of all three organizations.

12.7 Arizona State Land Department Evaluation Committee

Since over 60% of the *Project* will be required to traverse and impact State of Arizona Land, receiving Arizona State Land Department (ASLD) input and feedback on the different alignment options was critical. On 3/20/2017, LE provided ASLD staff with a copy of the maps, exhibits, and figures. A draft version of the CAA was provided to present ASLD staff with the different alignments that were considered and evaluated. ASLD staff presented the materials to the State Land Department Scoring Committed on 4/21/2017.

ASLD staff notified LE staff by email on 4/21/2017 "…that the Scoring Committee discussed the proposed road alignments and their preference is Alignment 1B." According to ASLD "Evaluation Criteria", potential projects "…must be in accordance with the Trust's mandate to assure the highest and best use of the land, and act in the best interest of the Trust." ASLD "…takes into consideration: viability of the proposed use; extent of improvements necessary for the use; compatibility with surrounding uses; local land use; planning and zoning; access; hydrology; geology; archaeology; and environmental implications."

SECTION 13. Project Permitting and Approval

13.1 Introduction

Based on the improvements shown in the 15% design plans for the preferred *Project* alignment, successful implementation of the future final design will require acceptance and approval from both private stakeholders and various public agencies. A list of anticipated local, state, and federal review agencies is listed in Table 13.1. Due to the potential for changes in local, state, and federal regulations, this list should be reevaluated and updated prior to subsequent design stages.

Table 13-1 Government Agency Review

Review Agency	Jurisdiction	Relevant Regulation
Arizona Department of Environmental Quality	State	AZPDES, A.A.C., and A.R.S.
Arizona Department of Transportation	State	N/A
Arizona Game and Fish Department	State	N/A
Arizona State Historic Preservation Office	State	NHPA Section 106
Arizona State Land Department	State	A.R.S. and Lease Agreements
Federal Emergency Management Agency	Federal	44 C.F.R. 65
Town of Chino Valley	Local	N/A
U.S. Army Corps of Engineers	Federal	CWA Section 404
U.S. Fish and Wildlife Service	Federal	N/A
Yavapai County	Local	Resolution 1036

Due to the potential for impact on private stakeholders, it is anticipated that YC will coordinate with various private stakeholders prior to and during final design efforts. Below is a list of impacted private stakeholders that future coordination should be considered prior to the finalization of the preliminary designs proposed in this study.

Table 13-2 Private Agency and Landowner Review

Stakeholder	Relevant Regulation
Arizona Public Service	Overhead and Underground Utility Lines
CableOne	Overhead and Underground Utility Lines
CenturyLink	Overhead and Underground Utility Lines
Various Ranchers	Grazing Leases
Private Property Owners	Private Property within Project Area

The following sections describe future coordination anticipated as a part of the final design process. Section 12 of this report contains stakeholder notifications and correspondence completed as a part of this study. Permitting for the preliminary designs presented in this study was not a part of the project scope, and will need to be addressed in the future by YC staff.

13.2 Government Agency Review

During subsequent design stages, the preliminary 15% design presented in this study may require review and approval from multiple regulatory agencies. The following agencies are anticipated to be involved in the project permitting process based on the preliminary construction plans prepared to date. Future planning and design efforts should verify that all local, state, and federal requirements are satisfied prior to construction.

13.2.1 Arizona Department of Environmental Quality

The Arizona Department of Environmental Quality (ADEQ) will be the review agency for all water and wastewater infrastructure per Arizona Administrative Code Title 18. The preliminary 15% planset does not propose water distribution or wastewater collection infrastructure relocations or replacement and it is not anticipated that the *Project* will warrant review and approval by ADEQ. However, the final design stage shall ensure that the proposed improvements do not impact existing (or future) wells or septic systems. Relocated wells and/or septic systems will require both YC and ADEQ approval.

ADEQ is also responsible for review and approval of all Stormwater Construction General Permit (CGP) activities as a part of the Arizona Pollutant Discharge Elimination System (AZPDES). Prior to construction, YC and the contractor must complete a Stormwater Pollution Prevention Plan (SWPPP) and Notice of Intent to be submitted to ADEQ per the terms of the current CGP. The current CPG became effective on May 29, 2013, and expires on June 2, 2018. The *Project* is not within ¼ mile of outstanding or impaired waters; however, future design efforts shall review the most current ADEQ and EPA listings.

13.2.2 United States Fish and Wildlife Service

As a part of the preliminary design process, the United States Fish and Wildlife Service (USFWS) was contacted regarding Endangered Species Act (ESA) compliance, and compliance documentation is located in Appendix G. No threatened or endangered species or critical habitat was identified within the *Project* area by the USFWS. Although the *Project* will not have an impact on threatened or endangered species habitat, consideration should still be given toward impacts to wildlife and wildlife corridors.

13.2.3 Arizona Game and Fish Department

Due to the impact to currently undeveloped rangeland by the *Project*, it is recommended that YC coordinate with the Arizona Game and Fish Department (AZGFD) during subsequent stages of design. The proposed *Project* may have potential impacts to existing wildlife habitat and wildlife corridors. Special design features may be recommended by the AZGFD to minimize disturbance and potential negative impact to wildlife in and around the *Project* area.

13.2.4 Arizona State Historic Preservation Office

Historic evaluation of the subject property to comply with Section 106 of the National Historic Preservation Act (NHPA) may be required during the permitting process for both the Arizona State Land Department and the U.S. Army Corps of Engineers. It is anticipated that historic assessments completed by Biozone, Inc. (Appendix G) may need to be reviewed and approved by the Arizona State Historic Preservation Office (SHPO) and the Tribal Historic Preservation Office (THPO). Due to the need for SHPO approval as a part of

the permitting process, it is recommended that subsequent stages of design make compliance and review a priority to avoid potential delays in the agency review process.

13.2.5 Arizona State Land Department

Per the requirements of the Arizona State Land Department (ASLD) and existing lease agreements within the *Project* area, the ASLD shall review and approve all proposed infrastructure improvement designs, drainage studies, and other state/federal permits prior to being submitted to another permitting agency (if other than the ASLD). All ASLD permitting requirements (environmental, cultural, etc.) will apply to portions of the proposed *Project* within State Land.

As a part of the preliminary design process, ASLD Right-of-Way (ROW) section staff reviewed and approved the CAA study and preferred alignment. Future design efforts shall provide the U.S. Army Corps of Engineers (USACE) Preliminary Jurisdictional Determination (PJD) submittal to ASLD staff for review and concurrence before being reviewed and approved by USACE staff. The ASLD will also need to review and approve all FEMA Conditional Letter of Map Revision (CLOMR) documentation that affects State of Arizona Land prior to FEMA submittal, review, and approval.

Future planning, budgeting, and design efforts made by YC staff need to account for permitting time frames that should be expected for a project of this size within ASLD. According to ASLD right-of-way staff, future planners and designers should expect an 18-month to two-year time frame to achieve final permitting.

13.2.6 Federal Emergency Management Agency

As described in Section 6 of this report, a Conditional Letter of Map Revision (CLOMR) for the proposed roadway crossings and impact to Federal Emergency Management Agency (FEMA) watercourses will be required. Once the *Project* improvements are constructed in substantial conformance with the CLOMR, YC can submit as-builts and a Letter of Map Revision (LOMR) to FEMA for review and approval. Once the LOMR is approved, FEMA will update the Flood Insurance Study (FIS) and Flood Insurance Rate Maps (FIRMs) for the subject area. YC staff and future designers need to be aware that the ASLD will require review and concurrence with all CLOMR and LOMR submittal documentation prior to the submittal to FEMA.

13.2.7 U.S. Army Corps of Engineers

As described in Section 8 of this report, a Preliminary Jurisdictional Determination (PJD) was completed for the *Project* corridor and adjacent tributaries for the *Project* area. The PJD identified potential Waters of the U.S. (WoUS) that may be subject to the requirements of Section 404 of the Clean Water Act (CWA). Prior to construction, U.S. Army Corps of Engineers (USACE) Pre-Construction Notification under Nationwide Permit Number 14 (linear transportation projects) may be required depending on extent of proposed disturbance to potential WoUS. Both the environmental and historic assessments of the *Project* boundary will be required to accompany a request for USACE permitting. Due to the lack of funding for subsequent stages of design and construction, it may be several years until future design efforts commence. The current administration is in the process of attempting to establish more clear Section 404 guidelines by issuing an Executive Order (February 28, 2017) for the EPA to review the Clean Water Rule and rescind or revise the rule. Although the Executive Order has no current legal effect on defining Potential WoUS, potential changes to the definition of WoUS and delineation of potential WoUS in ephemeral upland drainageways may occur in the future. For this reason, YC and LE staff decided not to submit PJD limits to the USACE for approval as a part of the *Project*, and future design efforts shall evaluate the CWA rules and regulations at the time of subsequent design and planning efforts.

13.2.8 Yavapai County

Yavapai County (YC) review and approval of all subsequent stages of roadway and drainage conveyance infrastructure design and associated utility relocations design will be required. YC has reviewed and approved all preliminary plans prepared to date, but no construction permits or final approvals were a part of this study. YC right-of-way permits, grading/drainage, and other relevant permits will be required prior to construction.

SECTION 14. 15% Design Cost Estimate

The 15% design cost estimate for improvements proposed in the 15% construction planset is located in Figure 14-1. The estimate shown is for the 15% preliminary plans only and will need be refined when future design is completed. Depending on when construction commences, unit prices shown in Figure 14-1 may need to be updated based on cost of materials and adjusted for inflation as applicable.

Figure 14-1 15% Design Cost Estimate

PRELIMINARY COST ESTIMATE

YAVAPAI COUNTY NORTHERN CONNECTOR

LYON ENGINEERING
Civil Engineers • Land Surveyors

			LENGTH OF ROUTE (LF)	25,331	
ITEM NO	ITEM DESCRIPTION	UNIT	UNIT PRICE	ESTIMATED QUANTITY	TOTAL PRICE
1	CLEARING AND GRUBBING	AC	$340.00	49	$16,806
2	REMOVALS	LS	$250,000.00	1	$250,000
3	EXCAVATION	CY	$9.00	254,748	$2,292,732
4	AGGREGATE BASE COURSE (8")	CY	$40.00	20,015	$800,600
5	ASPHALT CONCRETE (4")	TN	$92.00	19,200	$1,766,400
6	AR-ACFC	SY	$3.80	90,066	$342,250
8	36" CMP	LF	$84.00	540	$45,360
9	48" CMP	LF	$92.00	375	$34,500
10	24" CMP	LF	$75.00	520	$39,000
11	18" CMP	LF	$65.00	123	$7,995
12	30" CMP	LF	$80.00	279	$22,320
13	12 BARREL 10'x5' RCBC w/ APRONS & WING WALLS	LS	$750,000.00	1	$750,000
14	13 BARREL 10'x8' RCBC w/ APRONS & WING WALLS	LS	$825,000.00	1	$825,000
15	4" PCCP w/ FORD CROSSING AND CUT-OFF WALLS	CY	$325.00	1,333	$433,141
15	SIGNS AND STRIPING	LF	$0.15	25,331	$3,800
16	GUARD RAIL	LF	$30.00	15,199	$455,958
17	GUARD RAIL TERMINATIONS	EA	$3,000.00	38	$113,990
18	RIGHT OF WAY FENCE	LF	$3.00	50,662	$151,986
19	RIGHT OF WAY MONUMENTS	EA	$300.00	20	$6,000
20	SEEDING (CLASS II)	AC	$4,000.00	26	$104,674
21	SWPPP DESIGN AND IMPLEMENTATION	MI	$20,000.00	4.80	$95,951
			SUBTOTAL 1		**$8,558,461**
22	404 MITIGATION (0.5%)	LS			$42,792
23	MOBILIZATION (10%)	LS			$855,846
24	SURVEYING (2%)	LS			$171,169
25	QUALITY CONTROL (2%)	LS			$171,169
26	TRAFFIC CONTROL (1%)	LS			$85,585
			SUBTOTAL 2		**$9,885,023**
27	FORCE ACCOUNT (10%)	LS			$988,502
28	DESIGN ENGINEERING (12%)	LS			$1,186,203
29	CONSTRUCTION ENGINEERING (10%)	LS			$988,502
30	ENVIRONMENTAL WORK (1%)	LS			$98,850
31	RIGHT OF WAY	AC	$40,000.00	58	$2,326,079
			GRAND TOTAL		**$15,473,159**

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SECTION 15. Project Summary

This section of the report provides a summary of the *Project* analysis, design components, recommendations, and action items necessary to select a preferred *Project* corridor and prepare 15% preliminary design plans for the Northern Connector alignment. Anticipated action items required to move forward with the final design are also summarized in this section.

15.1 Analysis Tasks

The preliminary analysis items listed below were completed by the design team to document and fully identify constraints and potential impacts (both tangible and intangible) to stakeholders and the environment due to the *Project*. The analysis tasks allowed the team to make an educated decision when selecting the preferred alignment of the *Project* corridor that was deemed most beneficial to the public, stakeholders, and YC.

1. Property boundary field survey
2. Biological and cultural evaluation
3. Potential Waters of the United States (WoUS) evaluation
4. Detailed aerial imagery and topography
5. Stormwater runoff and floodplain analysis
6. Traffic analysis including CYMPO model update and recommendations
7. Safety analysis
8. Dry utility impact assessment
9. Preliminary grading and cost estimates for the seven (7) Conceptual Alignment Analysis (CAA) corridor options
10. CAA evaluation, State Land concurrence, and public participation process
11. CAA preferred alternative decision matrix and selection process

15.2 Preliminary Design Tasks

The goal of the preliminary design effort was to quantify the scope of required infrastructure, future agency coordination, and approximate cost of *Project* implementation for future budgeting purposes. The following tasks were completed as a part of this study:

1. Preliminary drainage infrastructure design and sizing
2. Preliminary 15% design planset
3. Preliminary 15% cross-section planset
4. Design concept report

15.3 Action Items

The following is a list of critical action items that will need to be completed during the final stage design stage(s) of the *Project*:

1. Analysis of future roadway design standards, constraints, and requirements vs. those utilized in this study
2. EPA Clean Water Act compliance and comparison of future rules/regulations vs. those in effect during this study and USACE permitting (as necessary)
3. Evaluation of future vs. 2017 effective FEMA regulatory documents and potential impact on the *Project*, and FEMA CLOMR submittal
4. ASLD right-of-way acquisition and plan review/approval
5. Utility company potholing, conflict verification, relocations, review, and coordination
6. Private property and ROW acquisition
7. Final design and phasing of the *Project* based on the YC budget for construction
8. Geotechnical fieldwork and report (stable slopes, pavement structural section, subsurface rock identification, etc.)
9. Detailed drainage report and hydraulic structure design – special attention toward FEMA designated watercourses and no adverse impact to adjacent properties
10. Final traffic analysis or traffic connectivity plan
11. Preparation of final design plans, specifications, and special provisions

15.4 Conclusion

Future implementation of the *Project* will be based on availability of funding and its priority compared to other planned future roadway projects throughout Yavapai County. Since funding for design and construction is not allocated or planned for at the time this report was prepared, subsequent design efforts may not occur for several years (if at all). Future YC staff and design consultants will need to carefully evaluate changes in land use, regulations, existing conditions, and roadway connectivity in the area before commencing with final design plans. The intent of this study was to determine *Project* feasibility and cost at a preliminary level while identifying critical action items necessary for successful future implementation. Due to the various stakeholders and regulatory agencies involved in the success of the *Project*, it is imperative that future YC staff and design professionals take into consideration the significant lead time necessary for final design and post-design critical path items.

At the completion of the *Project*, LE and the design team have prepared analysis and preliminary design documentation to be used as a roadmap for future final design efforts for YC staff and design professionals. The proposed route was chosen in accordance with evaluation criteria that demonstrates efficiency, comparatively low cost, and minimized negative impact to adjacent property owners. A thorough safety evaluation of the proposed roadway configuration and geometry was completed to ensure compliance with current design and safety standards. The proposed Northern Connector *Project* corridor will improve regional connectivity, emergency response times, and access to amenities in Chino Valley for northern Williamson Valley residents.

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Appendix A

Effective LOMR Case No. 10-09-3939P

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Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	Yavapai County Arizona (Unincorporated Areas)	NO PROJECT	REISSUANCE
	COMMUNITY NO.: 040093		
IDENTIFIER	West Chino Valley Floodplain Delineation Restudy	APPROXIMATE LATITUDE & LONGITUDE: 34.750, -112.500 SOURCE: FIRM Panel DATUM: NAD 27	

ANNOTATED MAPPING ENCLOSURES	ANNOTATED STUDY ENCLOSURES
TYPE: FIRM* NO.: 04025C1680G DATE: September 3, 2010 TYPE: FIRM* NO.: 04025C1315G DATE: September 3, 2010 TYPE: FIRM* NO.: 04025C1295G DATE: September 3, 2010 TYPE: FIRM* NO.: 04025C1660G DATE: September 3, 2010	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: September 3, 2010 PROFILE(S): 69P-81P FLOODWAY DATA TABLE: 9 SUMMARY OF DISCHARGES TABLE: 5

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES)

Chino Valley Stream - from immediately upstream of Hill View Drive to approximately 3,900 feet upstream of Center Street

Chino Valley Stream East - from the confluence with Chino Valley Stream to approximately 16,600 feet upstream of Center Street

Chino Valley Stream (Tributary) - from the confluence with Chino Valley Stream to approximately 1,800 feet upstream of Belinda Trail

SUMMARY OF REVISIONS

This Letter of Map Revision (LOMR) reissues a LOMR dated November 15, 2010 (Case No. 10-09-2672P), which revised the flood hazard data for the above-referenced flooding sources. A new FIRM and FIS report for Yavapai County, Arizona and Incorporated Areas became effective on September 3, 2010. Because the flood hazard modifications associated with the November 15 LOMR were shown on the previous effective FIRM and FIS report dated June 6, 2001, the November 15 LOMR is not valid. This LOMR shows those flood hazard modifications on the new effective FIRM and FIS report.

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076 Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Beth A Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

122451 PT202.BKR.10093939P.H15 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

COMMUNITY REMINDERS

We based this determination on the base (1-percent-annual-chance) flood discharges computed in the FIS for your community without considering subsequent changes in watershed characteristics that could increase flood discharges. Future development of projects upstream could cause increased flood discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on flood discharges subsequent to the publication of the FIS report for your community and could, therefore, establish greater flood hazards in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

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122451 PT202.BKR.10093939P.H15 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Sally M. Ziolkowski
Director, Mitigation Division
Federal Emergency Management Agency, Region IX
1111 Broadway Street, Suite 1200
Oakland, CA 94607-4052
(510) 627-7175

STATUS OF THE COMMUNITY NFIP MAPS

We will not physically revise and republish the FIRM and FIS report for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panel(s) and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

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Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

122451 PT202.BKR.10093939P.H15 102-I-A-C

Federal Emergency Management Agency
Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

PUBLIC NOTIFICATION

A notice of BFE changes for the November 15 LOMR was published in your local newspaper on July 9 and July 16, 2010, and a 90-day appeal period was provided. This revision is effective as of the date of this letter. We will not republish the BFE changes in the newspaper.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Information eXchange (FMIX) toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMC Clearinghouse, 7390 Coca Cola Drive, Suite 204, Hanover, MD 21076. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Beth A Norton

Beth A. Norton, Program Specialist
Engineering Management Branch
Federal Insurance and Mitigation Administration

122451 PT202.BKR.10093939P.H15 102-I-A-C

TABLE 5 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-PERCENT	2-PERCENT	1-PERCENT	0.2-PERCENT
CHINO VALLEY STREAM					
Approximately 8,000 feet upstream of U.S. Route 89	31.50	1,950	5,355	13,761	22,500
Above confluence with Chino Valley Stream(Tributary)	18.00	1 ,440	3,985	8,102	14,389
CHINO VALLEY STREAM EAST	11.40	-- [1]	-- [1]	5,248	-- [1]
CHINO VALLEY STREAM (TRIBUTARY)					
At confluence with Chino Valley Stream	10.00	2,975	5,599	6,850	10,715
At upstream limit of detailed study	4.00	1,050	2,320	3,273	5,850
CLIPPER WASH					
At confluence with Agua Fria River	8.00	1,300	4,200	6,400	11,000
COPPER CANYON WASH					
Above confluence with Verde River	7.80	-- [1]	-- [1]	7,600	-- [1]
DEAD MULE CANYON WASH					
At confluence with Ramsgate Wash	8.00	1,050	2,625	3,660	5,790
DECEPTION WASH					
At confluence with Verde River	6.17	2,513	3,696	4,583	12,000
DEL MONTE WASH					
Upstream of East Main Street	5.70	3,086	4,537	5,627	15,000
DRY BEAVER CREEK					
Approximately 2,900 feet upstream of U. S. Highway 17	202.00	-- [1]	-- [1]	32,750	-- [1]

REVISED DATA

[1] Data not available
[2] Data not applicable
[3] Data not computed

REVISED TO
REFLECT LOMR
EFFECTIVE: December 21, 2010

REVISED DATA

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION (FEET NAVD)		
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
Chino Valley Stream								
A	0	750	2,083	3.7	4,407.9	4,407.9	4,407.9	0.0
B	2,125	1,261	1,923	4.1	4,417.3	4,417.3	4,418.0	0.7
C	3,840	163	662	11.8	4,435.9	4,435.9	4,435.9	0.0
D	5,430	693	1,551	5.0	4,447.3	4,447.3	4,447.7	0.4
E	7,500	250	903	8.6	4,464.0	4,464.0	4,464.0	0.0
F	9,600	390	1,264	6.2	4,481.2	4,481.2	4,481.6	0.4
G	11,655	183	717	10.9	4,497.9	4,497.9	4,498.1	0.2
H	14,315	370	886	8.8	4,524.4	4,524.4	4,524.8	0.4
I	16,770	350	988	7.8	4,548.9	4,548.9	4,549.4	0.5
J	18,656	263	1,419	11.5	4,565.6	4,565.6	4,566.5	0.9
K	20,621	215	1,173	15.1	4,585.5	4,585.5	4,586.0	0.5
L	22,765	337	1,599	10.5	4,607.0	4,607.0	4,607.8	0.8
M	23,804	1,002	1,470	9.4	4,615.3	4,615.3	4,615.3	0.0
N	25,891	197	756	13.0	4,631.2	4,631.2	4,631.4	0.2
O	27,550	334	914	9.6	4,645.8	4,645.8	4,645.9	0.1
P	28,475	332	1,700	6.0	4,656.9	4,656.9	4,657.2	0.3
Q	30,898	257	1,275	7.8	4,677.6	4,677.6	4,677.8	0.2
R	32,206	296	1,367	6.9	4,686.8	4,686.8	4,687.5	0.7
S	33,188	286	960	8.8	4,694.1	4,694.1	4,694.2	0.1
T	33,856	383	1,413	5.8	4,700.3	4,700.3	4,700.6	0.3
U	35,483	291	849	9.7	4,710.7	4,710.7	4,711.0	0.3
V	36,789	351	950	10.0	4,720.2	4,720.2	4,720.3	0.1
W	37,753	303	855	10.1	4,727.8	4,727.8	4,728.5	0.7
X	39,504	280	522	7.9	4,739.9	4,739.9	4,740.0	0.1
Y	41,131	102	330	9.2	4,752.9	4,752.9	4,753.0	0.1
Z	42,733	364	939	3.6	4,770.4	4,770.4	4,770.4	0.0

[1]Feet above a point 640 feet upstream of confluence with Santa Cruz Wash

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FLOODWAY DATA

CHINO VALLEY STREAM

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ
AND INCORPORATED AREAS

TABLE 9

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NAVD)			
Chino Valley Stream (Continued)								
AA	44,658	70	257	11.0	4,785.1	4,785.1	4,785.1	0.0
AB	46,704	237	443	8.4	4,811.0	4,811.0	4,811.1	0.1
Chino Valley Stream (With Levee)								
A	520	385	890	8.8	4,379.5	4,379.5	4,379.5	0.0
B	2,010	320	1,174	6.6	4,395.5	4,395.5	4,395.7	0.2
C	4,325	650	1,555	5.0	4,412.9	4,412.9	4,413.3	0.4
D	6,530	157	1,013	7.7	4,427.8	4,427.8	4,427.8	0.0
E	8,300	170	1,874	4.2	4,439.8	4,439.8	4,439.8	0.0

REVISED DATA

[1]Feet above a point 640 feet upstream of confluence with Santa Cruz Wash

REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ AND INCORPORATED AREAS

FLOODWAY DATA

CHINO VALLEY STREAM-CHINO VALLEY STREAM (WITH LEVEE)

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NAVD)			
Chino Valley Stream East								
A	0.122	535	803	7.4	4,741.8	4,741.8	4,741.8	0.0
B	0.181	550	1,075	4.6	4,744.5	4,744.5	4,744.5	0.0
C	0.256	477	913	5.2	4,746.7	4,746.7	4,746.7	0.0
D	0.419	430	881	5.5	4,750.9	4,750.9	4,751.1	0.2
E	0.497	479	940	5.5	4,753.7	4,753.7	4,753.9	0.2
F	0.557	397	855	6.2	4,755.8	4,755.8	4,756.0	0.2
G	0.692	300	787	6.0	4,760.1	4,760.1	4,760.6	0.5
H	0.752	289	693	6.9	4,762.3	4,762.3	4,762.9	0.6
I	0.811	570	1,024	4.6	4,765.1	4,765.1	4,765.6	0.5
J	0.957	212	534	9.3	4,773.0	4,773.0	4,773.1	0.1
K	1.090	397	835	5.7	4,778.9	4,778.9	4,779.0	0.1
L	1.149	335	784	6.0	4,781.0	4,781.0	4,781.4	0.4
M	1.246	178	518	9.9	4,785.3	4,785.3	4,786.1	0.8
N	1.375	183	528	9.4	4,792.8	4,792.8	4,793.2	0.4
O	1.452	256	741	6.5	4,796.4	4,796.4	4,797.4	1.0
P	1.575	309	661	7.4	4,801.6	4,801.6	4,302.3	0.7
Q	1.654	253	695	6.7	4,805.4	4,805.4	4,306.2	0.8
R	1.760	231	764	6.6	4,809.8	4,809.8	4,310.6	0.8
S	1.872	209	524	9.3	4,815.3	4,815.3	4,315.6	0.3
T	1.941	258	831	5.8	4,818.2	4,818.2	4,319.2	1.0
U	2.041	590	1,093	4.3	4,821.8	4,821.8	4,322.1	0.3
V	2.185	441	860	5.5	4,827.7	4,827.7	4,328.0	0.3
W	2.346	644	877	5.3	4,833.4	4,833.4	4,333.5	0.1
X	2.620	239	756	6.3	4,841.9	4,841.9	4,342.8	0.9
Y	2.712	307	810	6.0	4,844.7	4,844.7	4,345.5	0.8
Z	2.810	230	732	6.6	4,848.2	4,848.2	4,348.6	0.4

[1]Miles above confluence with Chino Valley Stream

REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ AND INCORPORATED AREAS

FLOODWAY DATA

CHINO VALLEY STREAM EAST

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NAVD)			
Chino Valley Stream East (Continued)								
AA	2.969	580	1,159	4.0	4,853.7	4,853.7	4,853.7	0.0
AB	3.036	246	568	8.7	4,857.1	4,857.1	4,857.5	0.4
AC	3.171	480	1,009	4.7	4,862.9	4,862.9	4,863.1	0.2
AD	3.307	460	883	5.3	4,870.3	4,870.3	4,870.4	0.1
AE	3.405	420	723	7.2	4,875.6	4,875.6	4,875.7	0.1
AF	3.465	370	574	8.3	4,880.3	4,880.3	4,880.4	0.1
AG	3.575	117	531	10.1	4,890.6	4,890.6	4,891.1	0.5
AH	3.649	125	444	11.8	4,896.9	4,896.9	4,897.3	0.4
AI	3.695	73	373	13.0	4,900.5	4,900.5	4,900.7	0.2
AJ	3.811	140	661	8.9	4,907.4	4,907.4	4,908.1	0.7
AK	3.875	51	337	15.6	4,911.0	4,911.0	4,911.1	0.1

[1]Miles above confluence with Chino Valley Stream

REVISED TO
REFLECT LOMR
EFFECTIVE: December 21, 2010

TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ
AND INCORPORATED AREAS

FLOODWAY DATA

CHINO VALLEY STREAM EAST

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NAVD)			
Chino Valley Stream (Tributary)								
A	1,986	173	1,338	6.2	4,628.7	4,628.7	4,628.7	0.0
B	3,967	103	399	16.0	4,656.6	4,656.6	4,657.2	0.6
C	6,024	176	850	5.8	4,678.6	4,678.6	4,678.6	0.0
D	7,805	104	383	12.9	4,700.5	4,700.5	4,700.5	0.0
E	9,637	75	332	12.7	4,723.8	4,723.8	4,723.8	0.0
F	11,547	69	520	9.5	4,752.4	4,752.4	4,752.4	0.0
G	12,456	114	359	12.2	4,764.2	4,764.2	4,764.4	0.2
H	13,993	403	777	4.9	4,779.4	4,779.4	4,779.5	0.1
I	16,139	95	247	14.5	4,801.5	4,801.5	4,802.0	0.5
J	16,992	476	1,001	3.4	4,814.7	4,814.7	4,814.7	0.0
K	17,877	557	377	4.7	4,828.4	4,828.4	4,828.4	0.0
L	18,793	127	259	8.7	4,839.4	4,839.4	4,839.4	0.0
M	19,753	58	177	10.3	4,856.0	4,856.0	4,856.1	0.1
N	20,533	50	96	8.9	4,868.4	4,868.4	4,868.5	0.1
O	22,081	31	78	9.4	4,887.4	4,887.4	4,887.5	0.1
P	23,331	262	156	5.7	4,905.3	4,905.3	4,905.3	0.0

[1]Feet above confluence with Chino Valley Stream

REVISED TO
REFLECT LOMR
EFFECTIVE: December 21, 2010

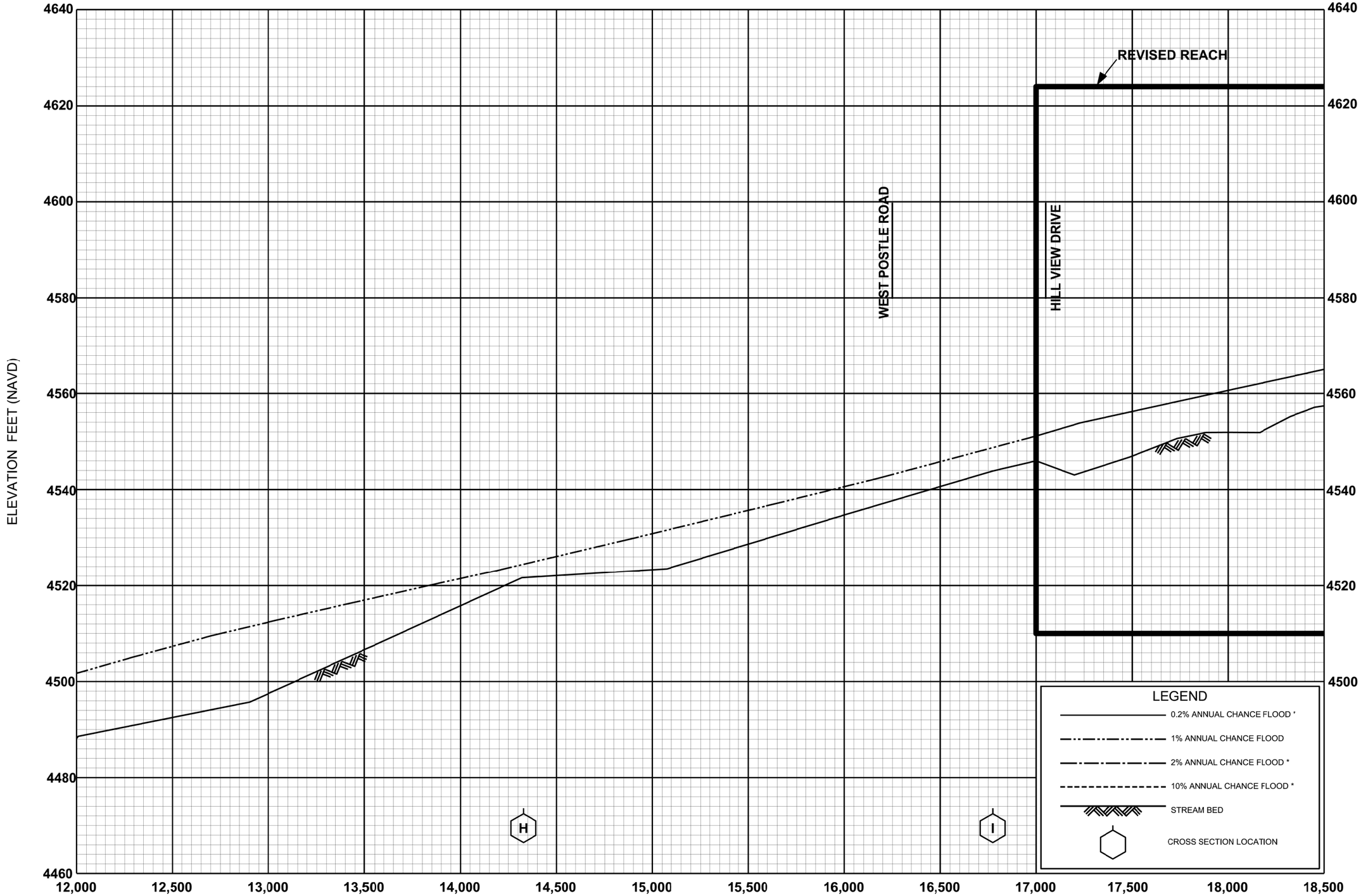
TABLE 9

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ
AND INCORPORATED AREAS

FLOODWAY DATA

CHINO VALLEY STREAM (TRIBUTARY)



REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

FLOOD PROFILES

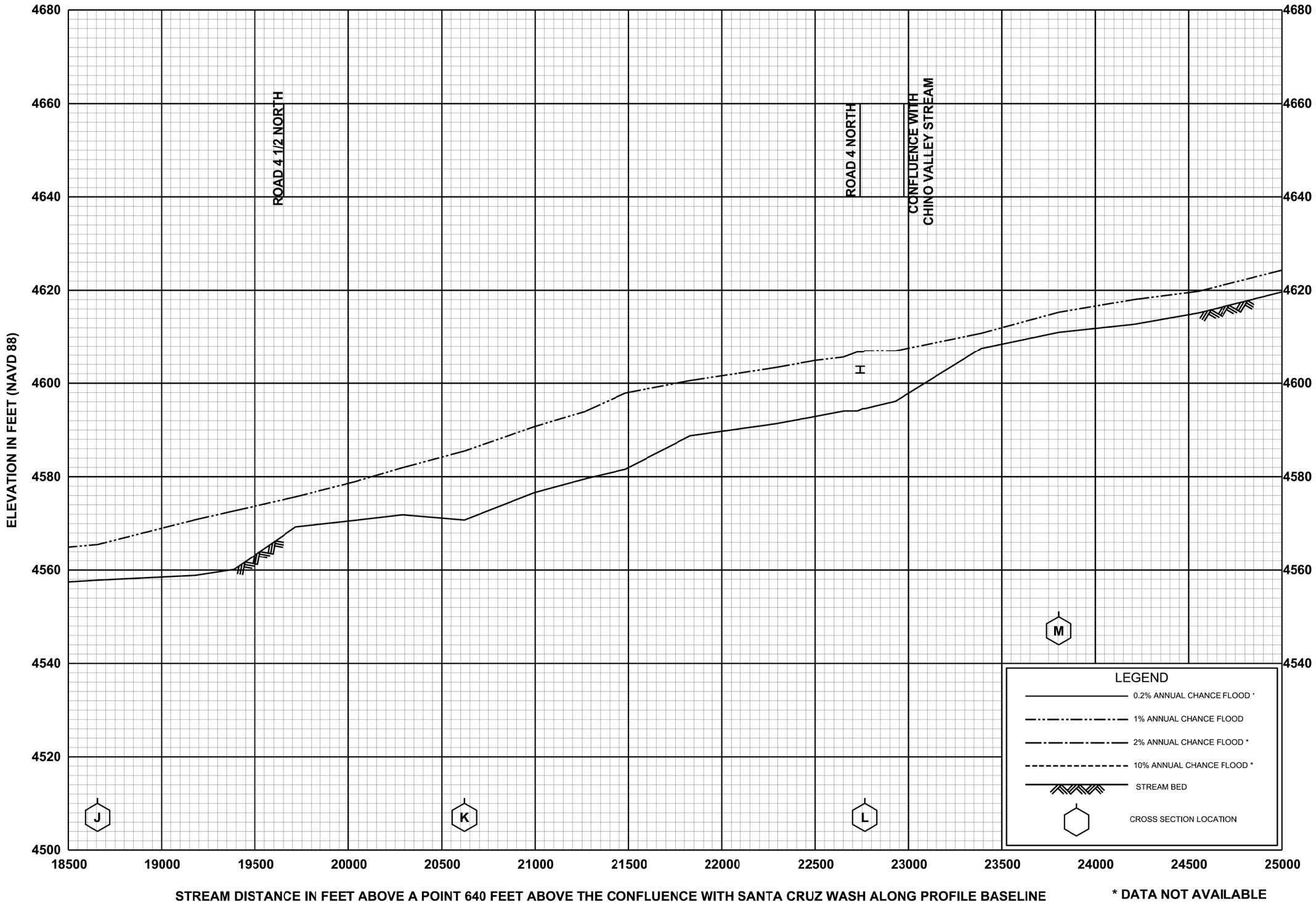
CHINO VALLEY STREAM

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ

AND INCORPORATED AREAS

69P



FLOOD PROFILES

REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

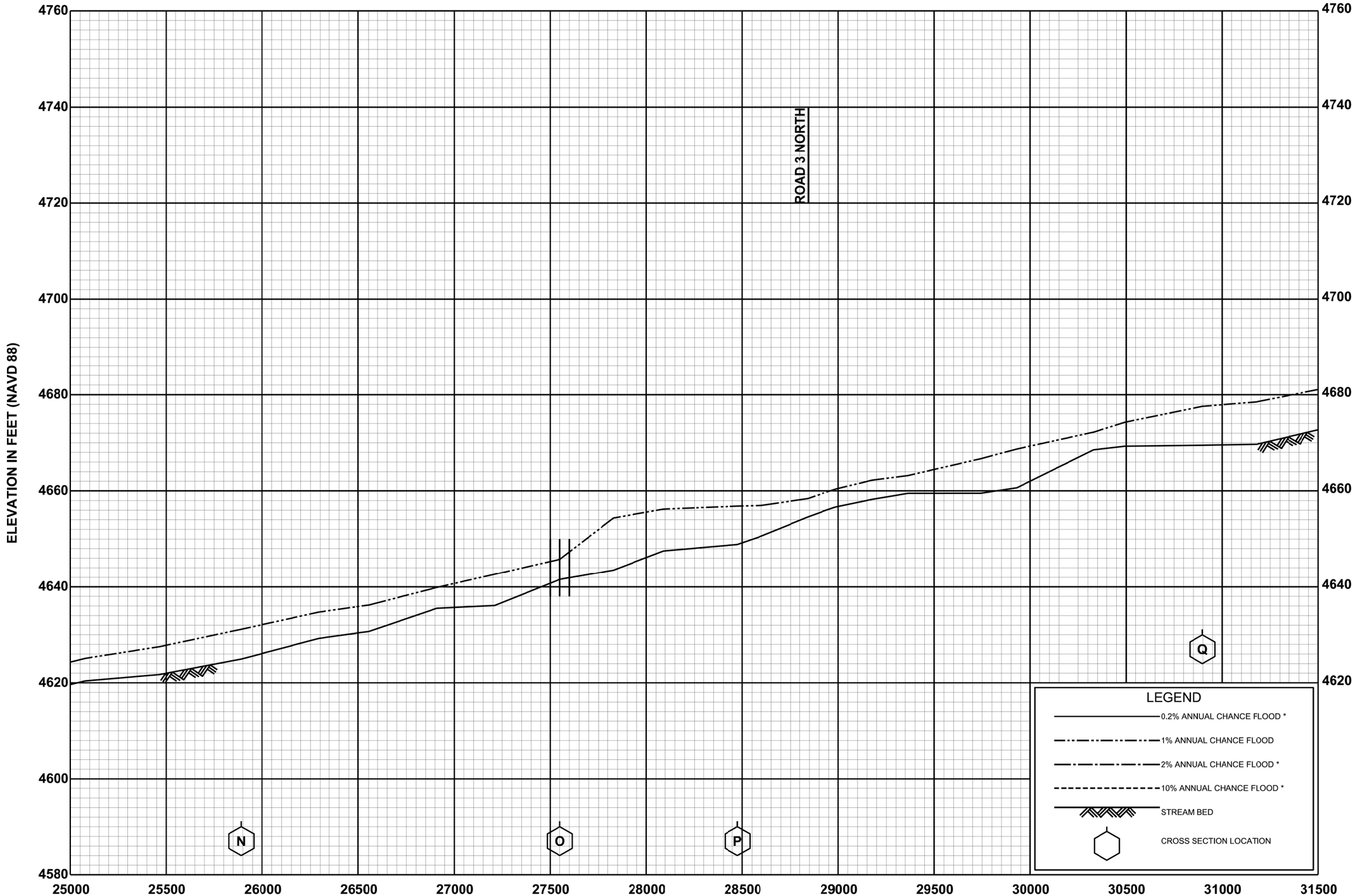
CHINO VALLEY STREAM

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ

AND INCORPORATED AREAS

70P



REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

FLOOD PROFILES

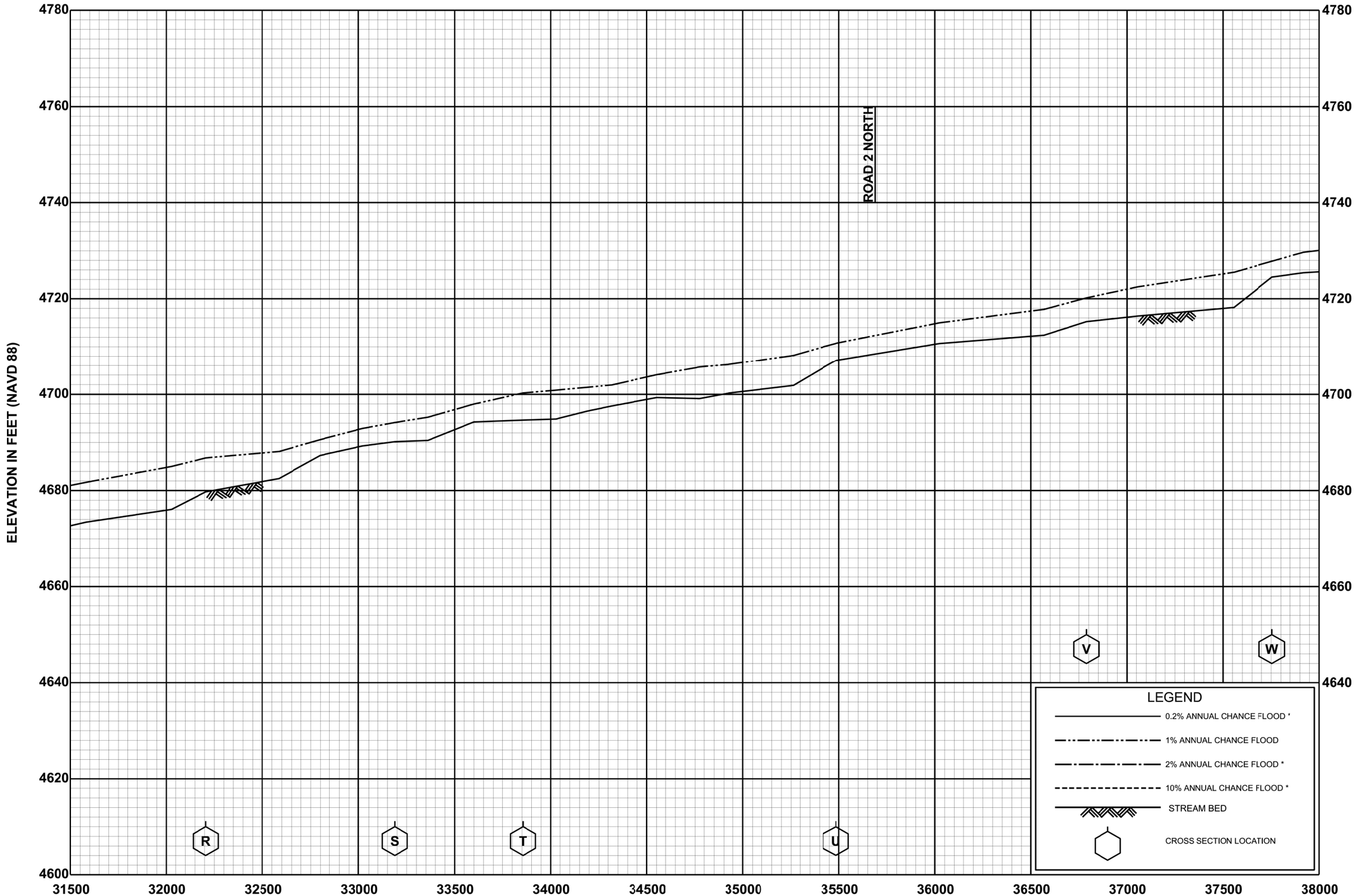
CHINO VALLEY STREAM

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ

AND INCORPORATED AREAS

71P



STREAM DISTANCE IN FEET ABOVE A POINT 640 FEET ABOVE THE CONFLUENCE WITH SANTA CRUZ WASH ALONG PROFILE BASELINE

* DATA NOT AVAILABLE

FLOOD PROFILES

CHINO VALLEY STREAM

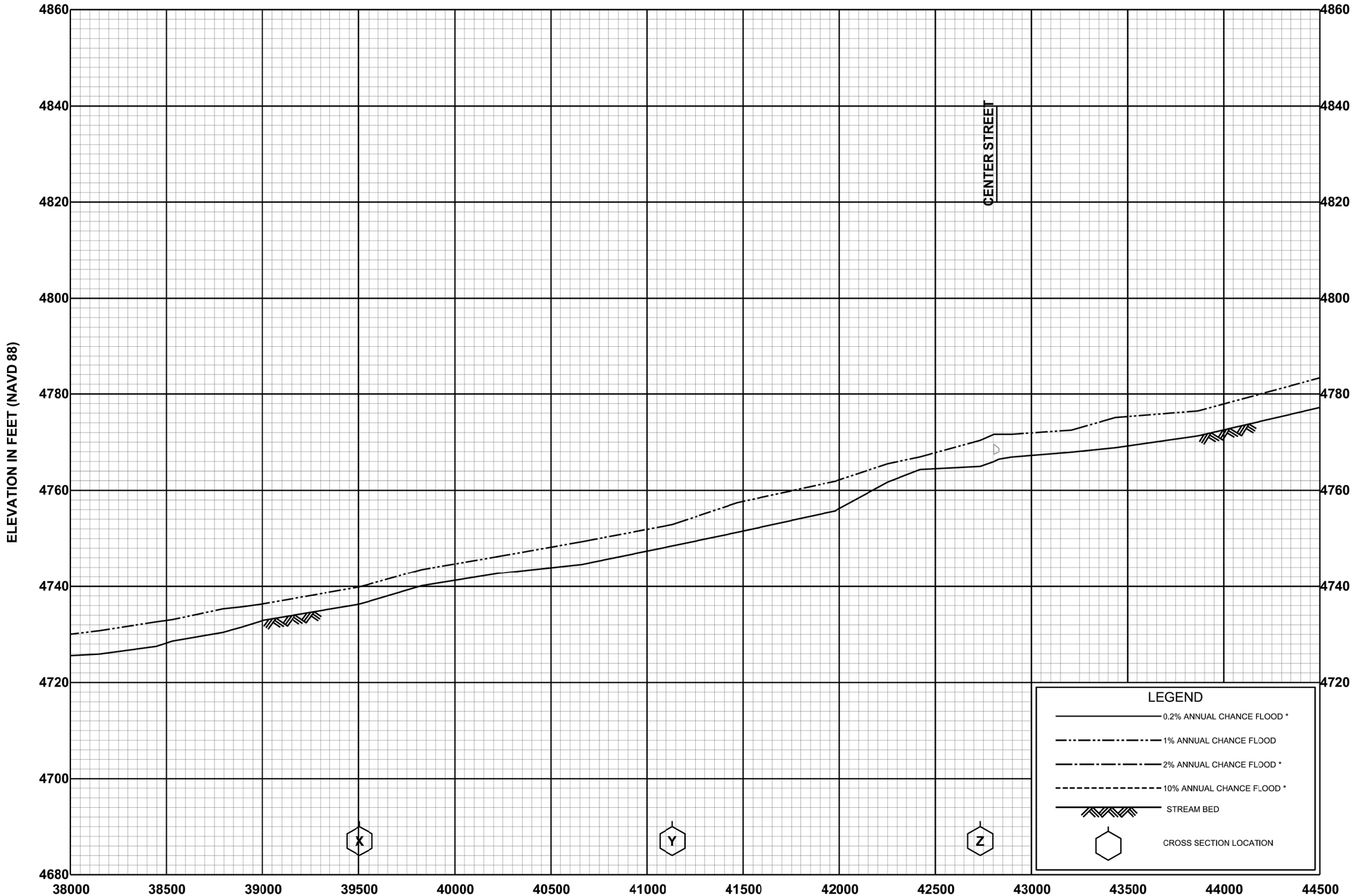
REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ

AND INCORPORATED AREAS

72P



FLOOD PROFILES

REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

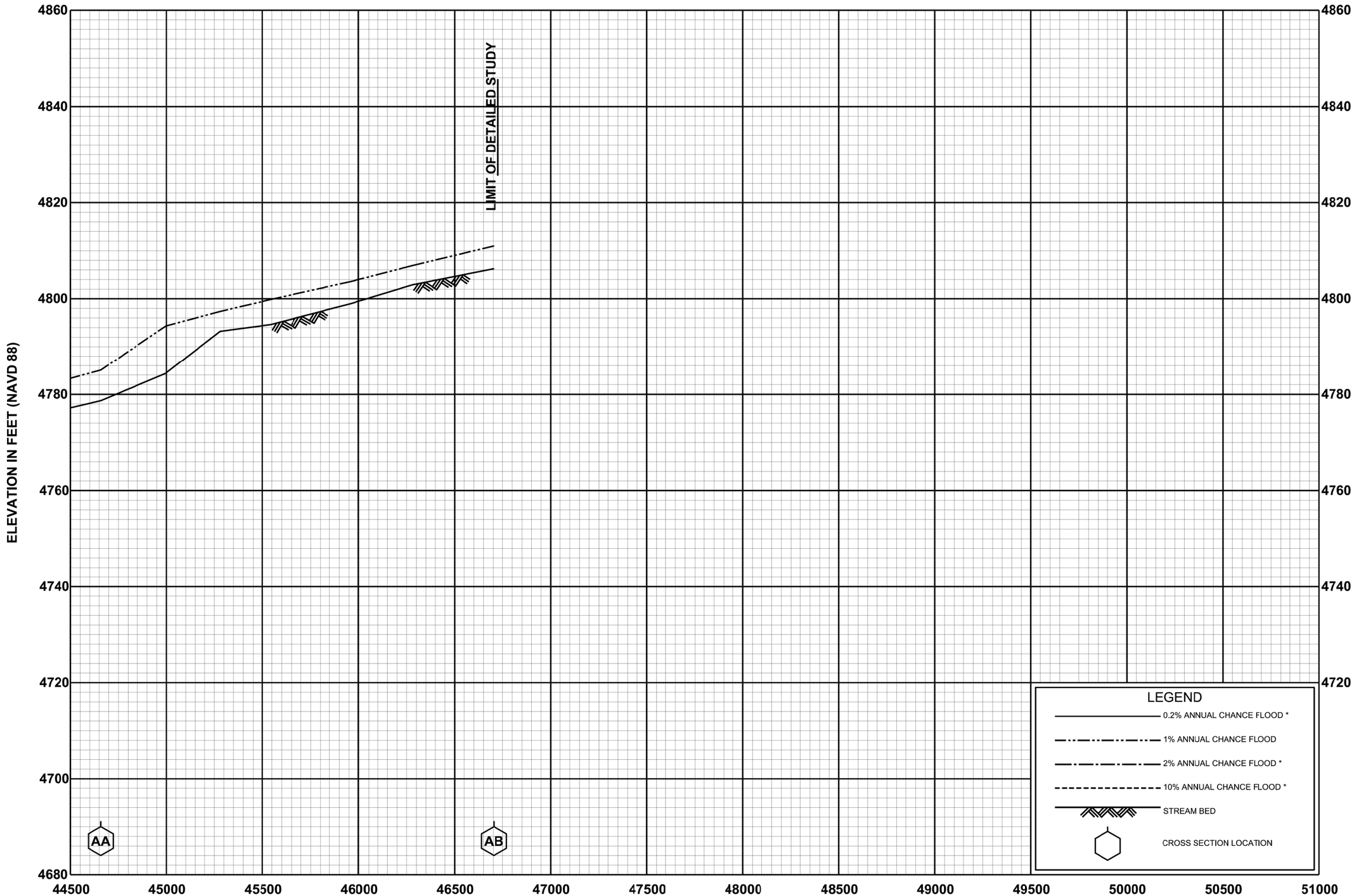
CHINO VALLEY STREAM

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ

AND INCORPORATED AREAS

73P



FLOOD PROFILES

REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

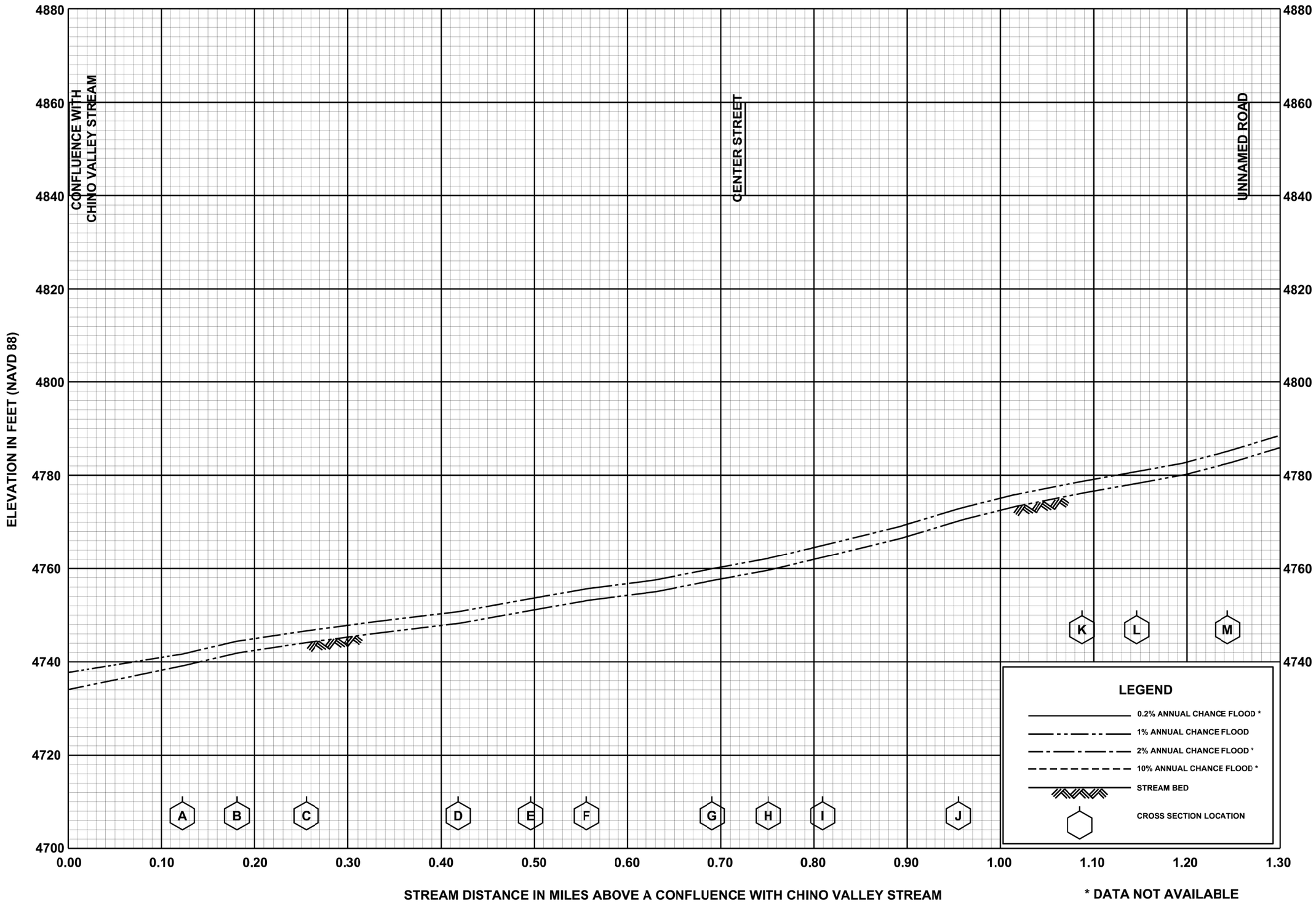
CHINO VALLEY STREAM

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ

AND INCORPORATED AREAS

74P



FLOOD PROFILES

REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

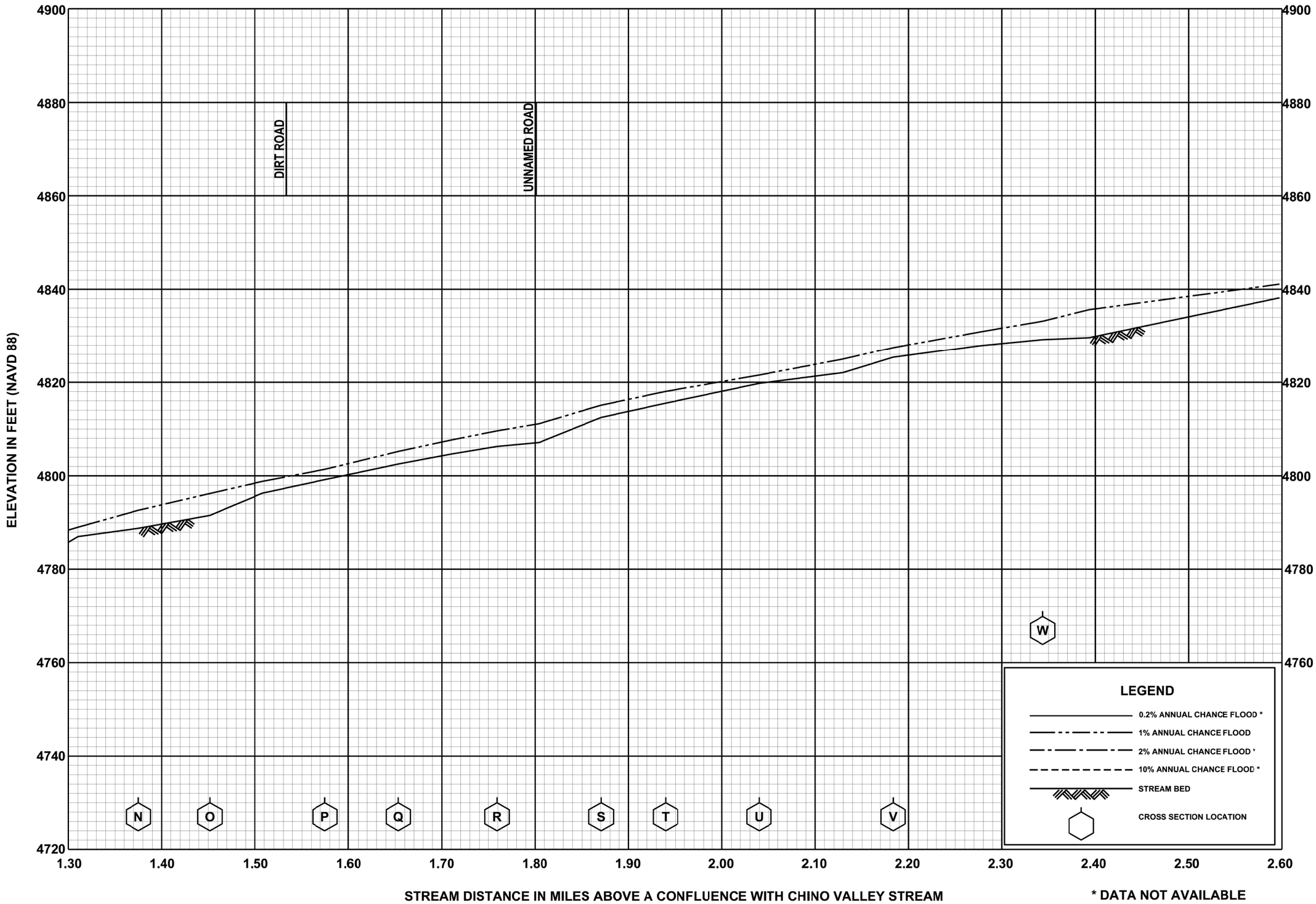
CHINO VALLEY STREAM - EAST

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ

AND INCORPORATED AREAS

75P



* DATA NOT AVAILABLE

REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

FLOOD PROFILES

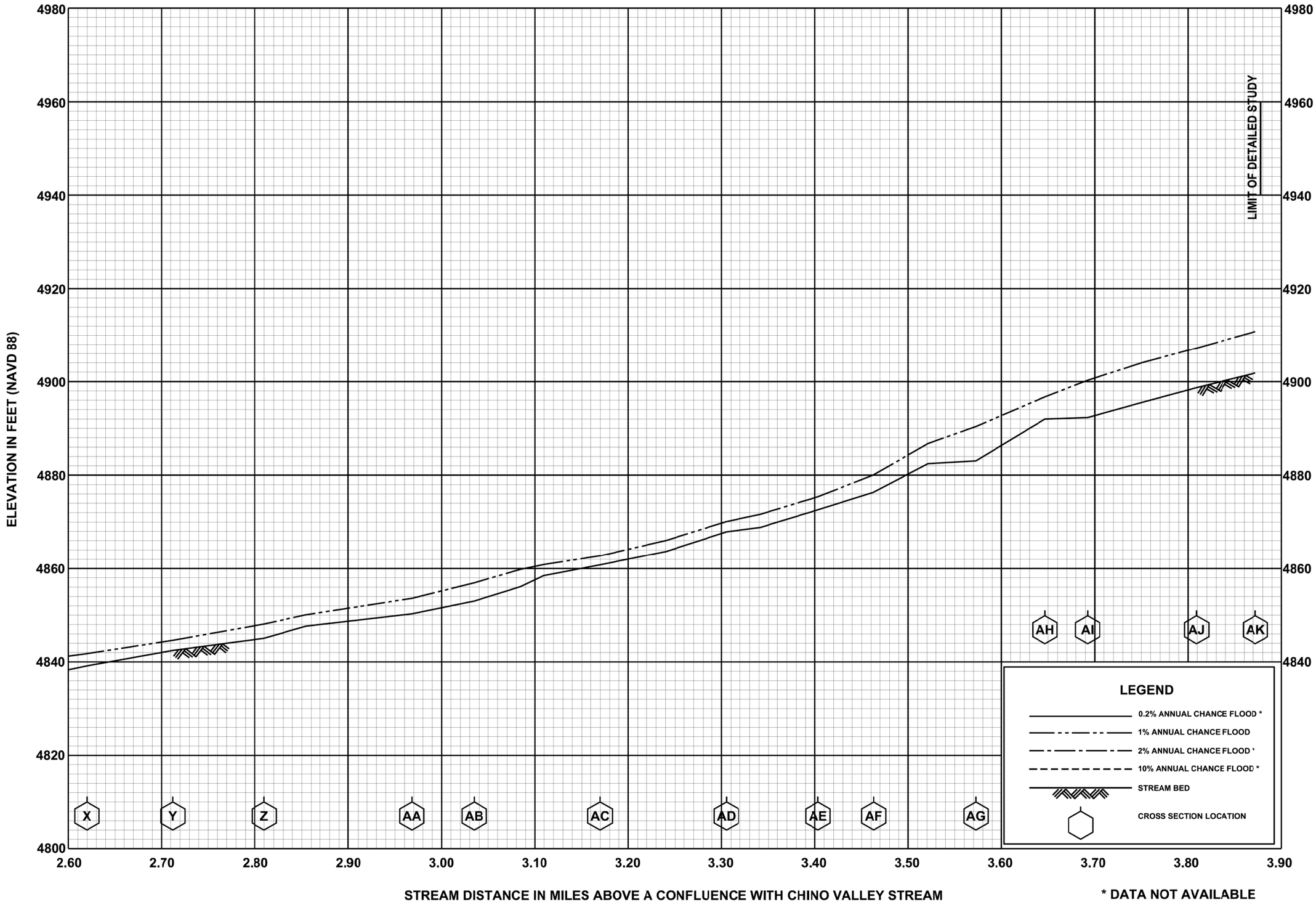
CHINO VALLEY STREAM - EAST

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ

AND INCORPORATED AREAS

76P



REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

FLOOD PROFILES

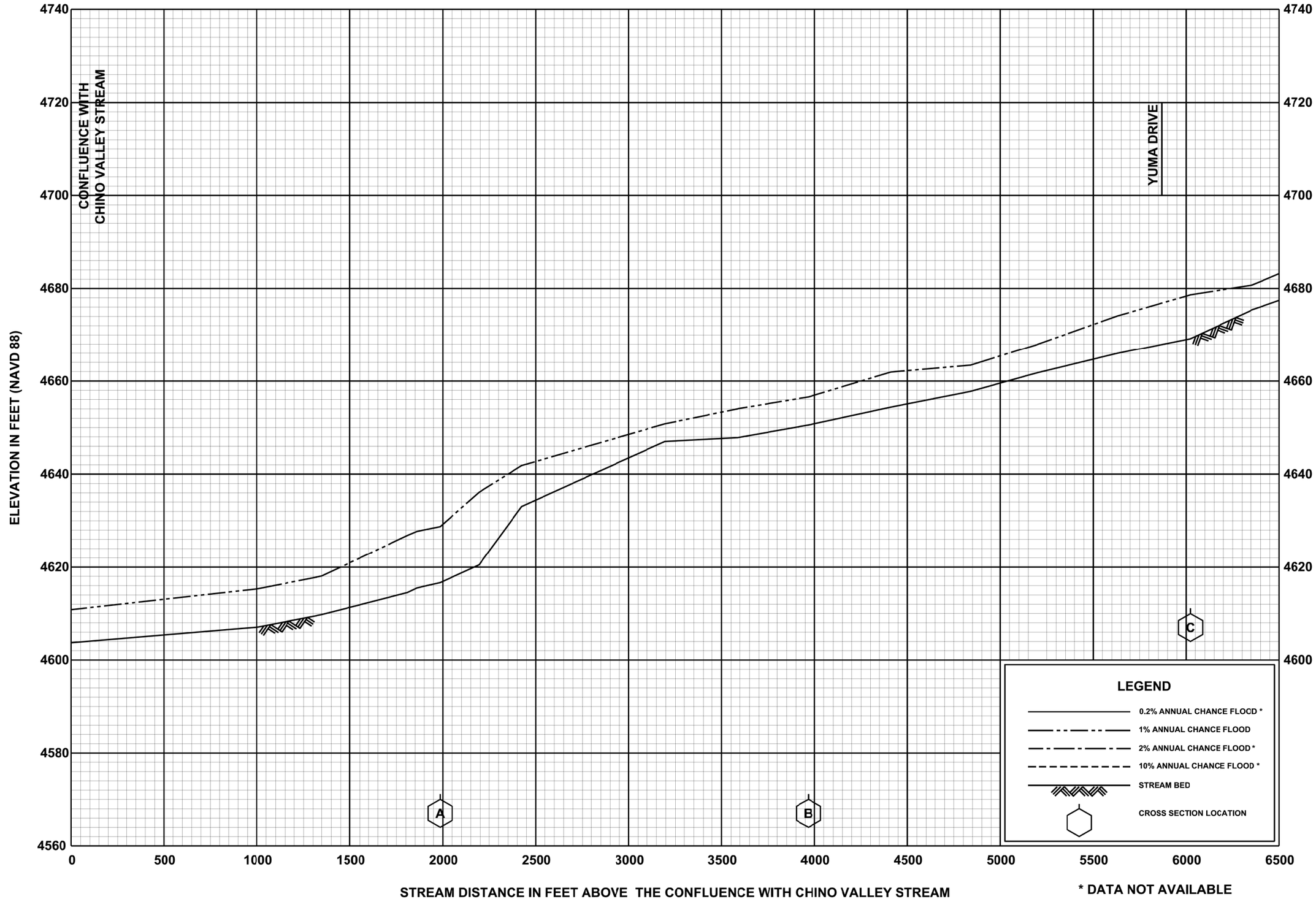
CHINO VALLEY STREAM - EAST

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ

AND INCORPORATED AREAS

77P



FLOOD PROFILES

REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

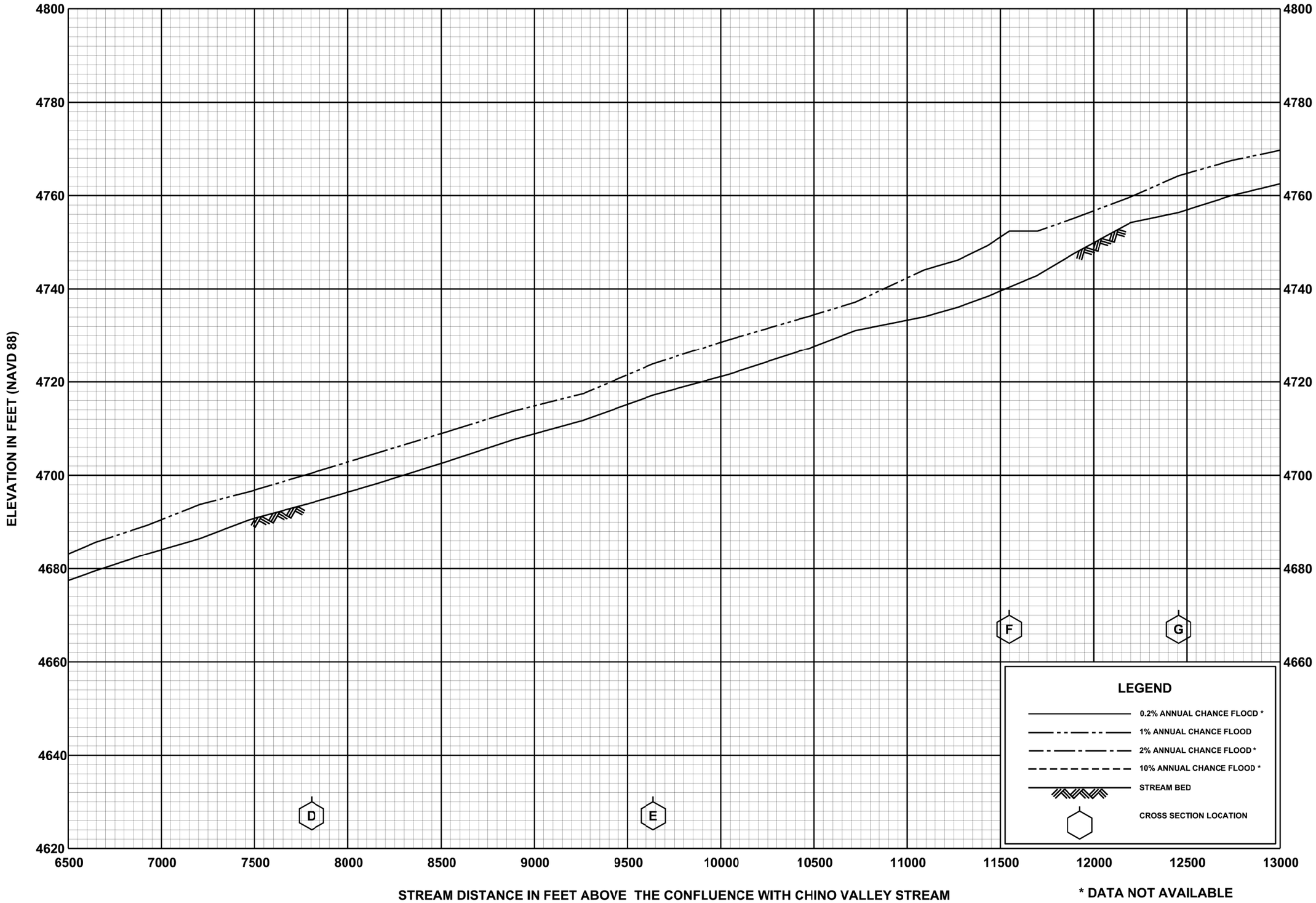
CHINO VALLEY STREAM (TRIBUTARY)

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ

AND INCORPORATED AREAS

78P



FLOOD PROFILES

REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

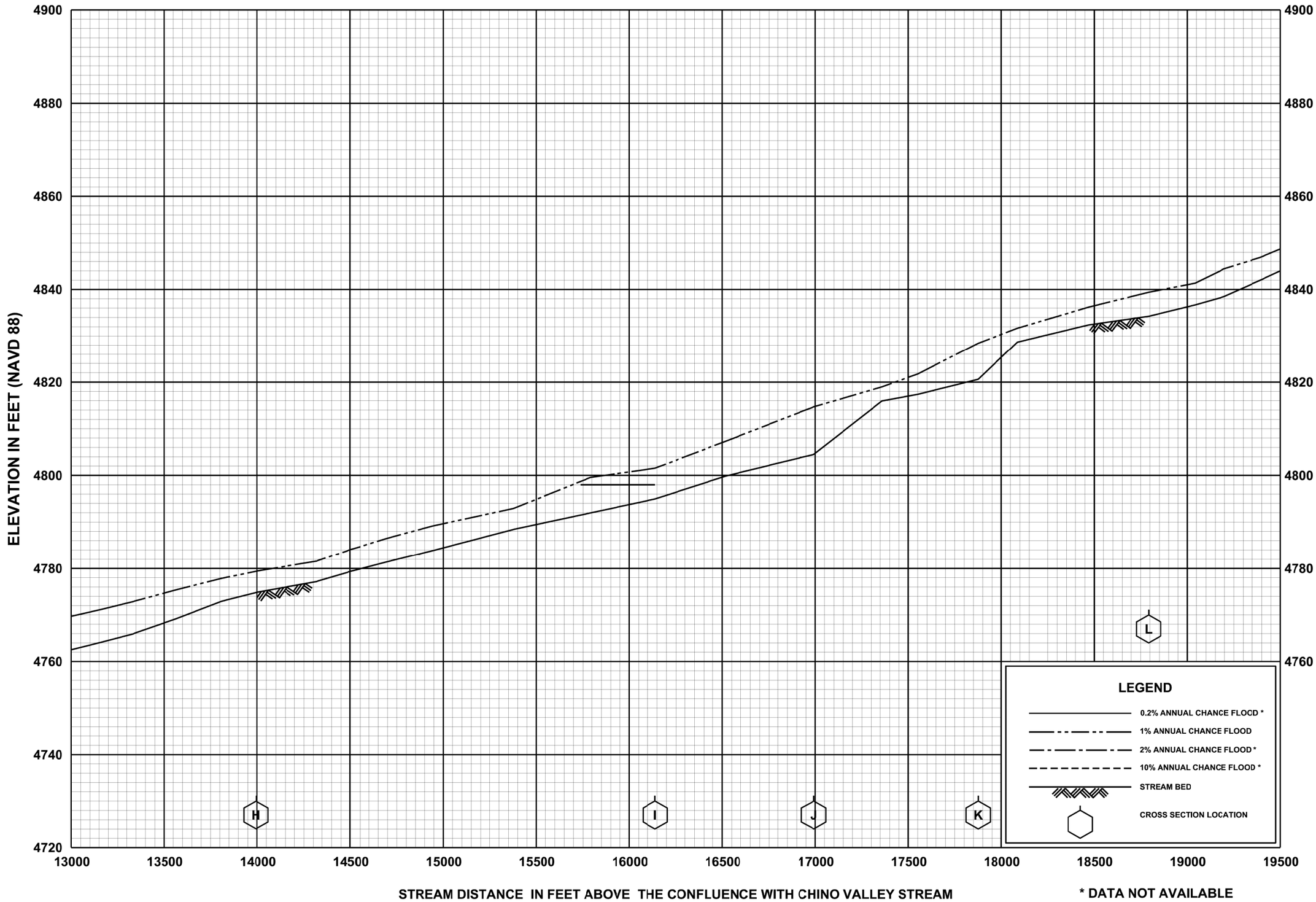
CHINO VALLEY STREAM (TRIBUTARY)

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ

AND INCORPORATED AREAS

79P



FLOOD PROFILES

REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

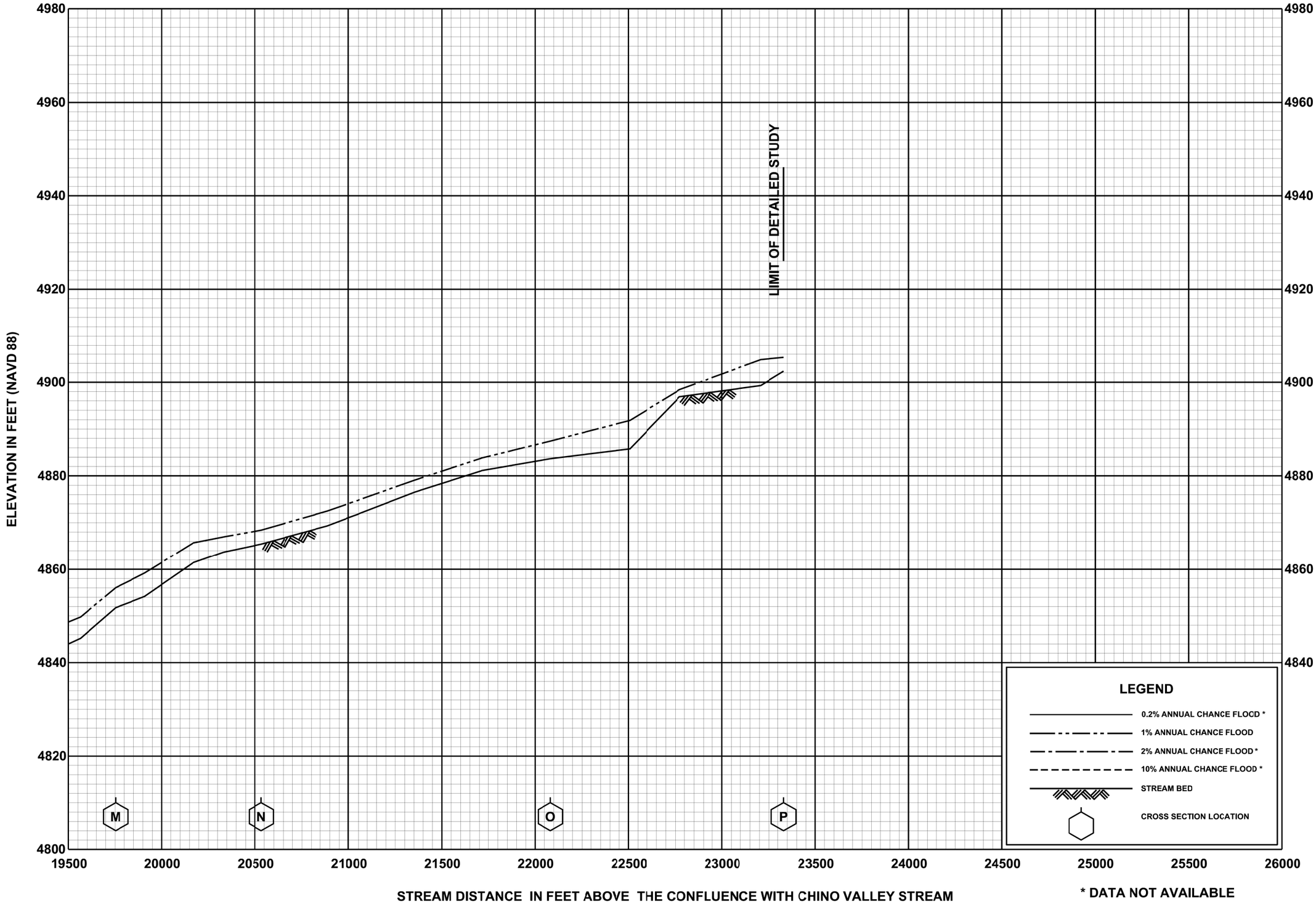
CHINO VALLEY STREAM (TRIBUTARY)

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ

AND INCORPORATED AREAS

80P



REVISED TO
REFLECT LOMR
EFFECTIVE: December 21, 2010

FLOOD PROFILES

CHINO VALLEY STREAM (TRIBUTARY)

FEDERAL EMERGENCY MANAGEMENT AGENCY

YAVAPAI COUNTY, AZ

AND INCORPORATED AREAS

81P

Legend

1% annual chance (100-Year) Floodplain

1% annual chance (100-Year) Floodway

0.2% annual chance (500-Year) Floodplain

MAP SCALE 1" = 1000'

500 0 1000 FEET

300 0 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1295G

FIRM

FLOOD INSURANCE RATE MAP

YAVAPAI COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 1295 OF 3900

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
YAVAPAI COUNTY	040093	1295	G

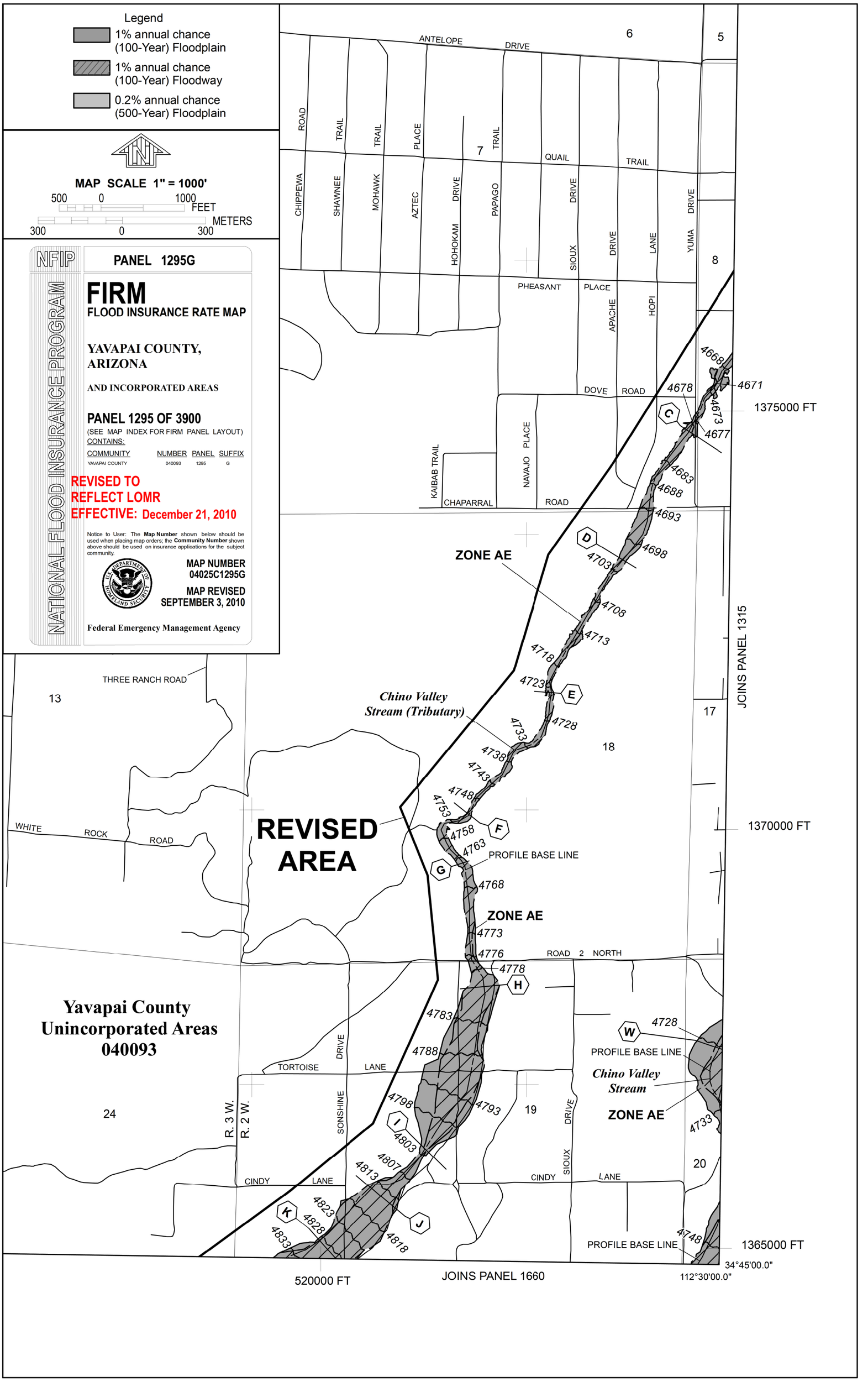
REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

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 04025C1295G

MAP REVISED SEPTEMBER 3, 2010

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.

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 map was Universal Transverse Mercator (UTM) zone 12. The **horizontal datum** was NAD83, GRS80 spheroid. Differences in datum, spheroid, projection or UTM 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, N/NGS12
National Geodetic Survey
SSMC- 3, #9202
1315 East- West Highway
Silver Spring, MD 20910- 3282

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 provided by Yavapai County. This data, produced in 2003, was provided in digital format at a scale of 1:12,000.

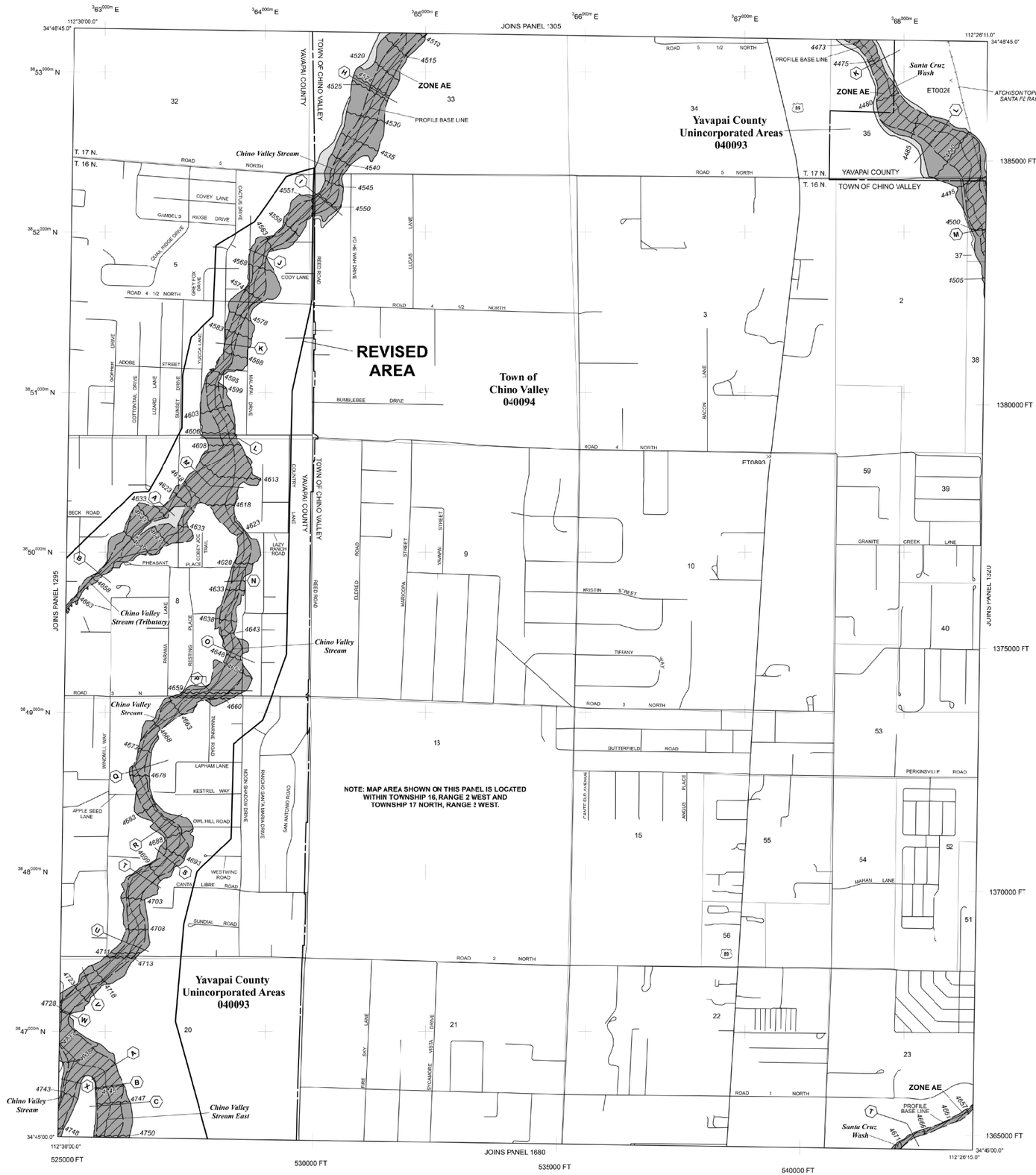
This map reflects more detailed and up- to- date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a 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 in 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/.



LEGEND

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

The 1% annual chance 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.

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 (NAVD 88)

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
$^{42}75^{000m}$N	1000-meter Universal Transverse Mercator grid ticks, zone 12N
6000000 FT	5000-foot grid ticks: Arizona State Plane coordinate system, central zone (FIPSZONE 0202), Transverse Mercator projection
DX5510	Bench mark (see explanation in Notes to Users section of this FIRM panel)
• M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
June 6, 2001
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

September 3, 2010 - to update corporate limits, to change Special Flood Hazard Areas, to update roads and road names, and to incorporate previously issued Letters of Map Revision.

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- 800- 638- 6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1315G

FIRM
FLOOD INSURANCE RATE MAP

YAVAPAI COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 1315 OF 3900

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
YAVAPAI COUNTY	040093	1315	G
CHINO VALLEY, TOWN OF	040094	1315	G

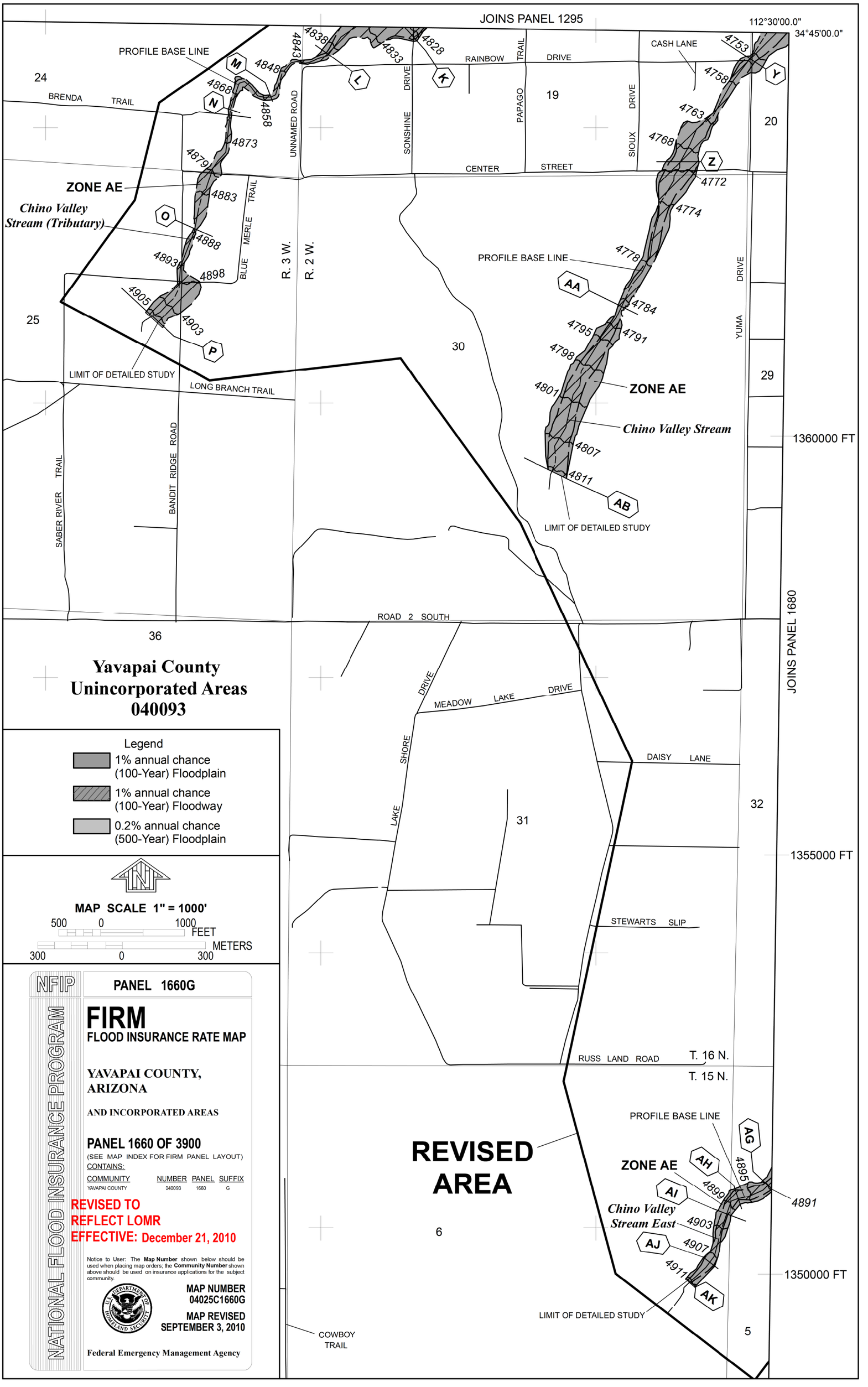
REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010

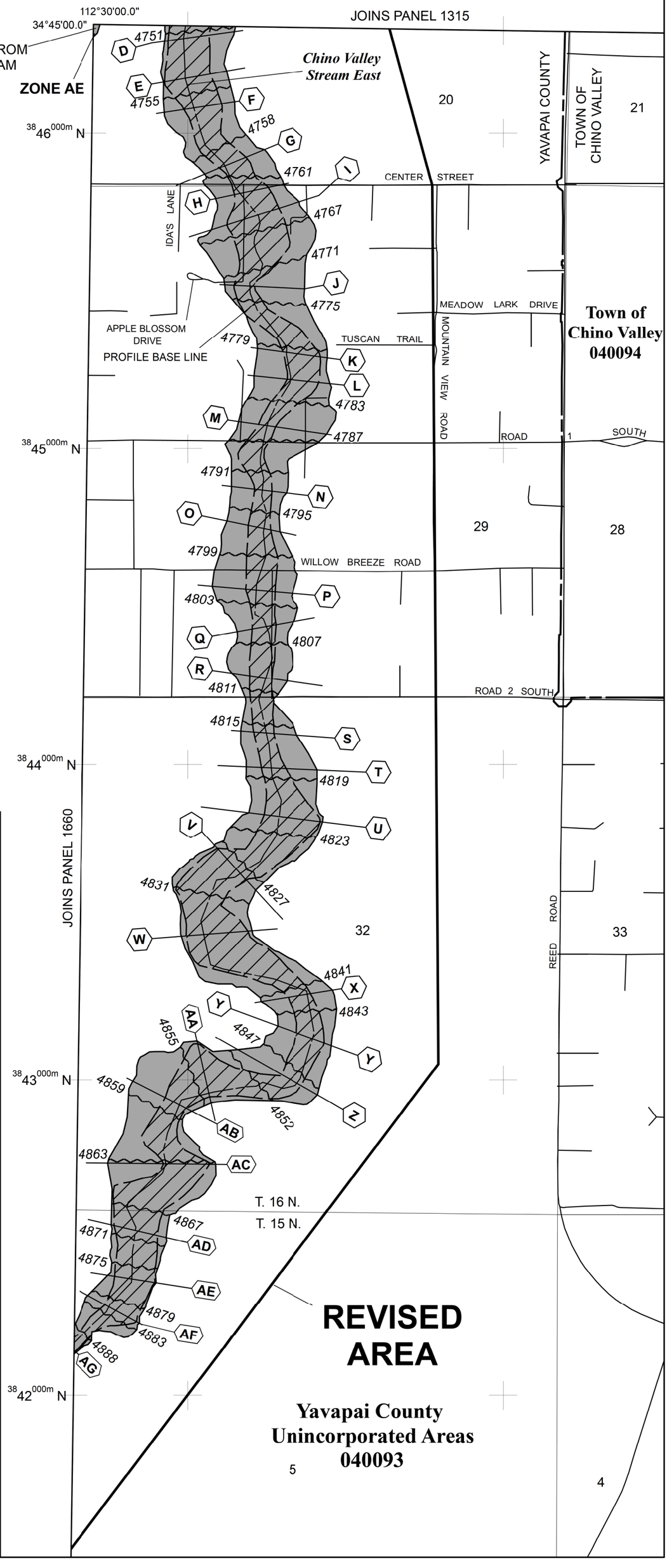
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
04025C1315G

MAP REVISED
SEPTEMBER 3, 2010

Federal Emergency Management Agency


JOINS PANEL 1295
112°30'00.0"
34°45'00.0"
PROFILE BASE LINE
BRENDA TRAIL
RAINBOW TRAIL
DRIVE
CASH LANE
UNNAMED ROAD
SONSHINE DRIVE
PAPAGO DRIVE
SIOUX DRIVE
CENTER STREET
ZONE AE
Chino Valley Stream (Tributary)
BLUE MERLE TRAIL
R. 3 W.
R. 2 W.
YUMA DRIVE
LIMIT OF DETAILED STUDY
LONG BRANCH TRAIL
SABER RIVER TRAIL
BANDIT RIDGE ROAD
Chino Valley Stream
1360000 FT
ROAD 2 SOUTH
JOINS PANEL 1680
MEADOW LAKE DRIVE
SHORE DRIVE
LAKE DRIVE
DAISY LANE
STEWARTS SLIP
RUSS LAND ROAD
T. 16 N.
T. 15 N.
1355000 FT
REVISED AREA
Chino Valley Stream East
1350000 FT
COWBOY TRAIL
24
25
30
19
20
29
36
31
32
6
5
Yavapai County
Unincorporated Areas
040093
Legend
1% annual chance (100-Year) Floodplain
1% annual chance (100-Year) Floodway
0.2% annual chance (500-Year) Floodplain
MAP SCALE 1" = 1000'
500 0 1000 FEET
300 0 300 METERS
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 1660G
FIRM
FLOOD INSURANCE RATE MAP
YAVAPAI COUNTY, ARIZONA
AND INCORPORATED AREAS
PANEL 1660 OF 3900
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
YAVAPAI COUNTY 040093 1660 G
REVISED TO REFLECT LOMR EFFECTIVE: December 21, 2010
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 04025C1660G
MAP REVISED SEPTEMBER 3, 2010
Federal Emergency Management Agency



Legend

- 1% annual chance (100-Year) Floodplain
- 1% annual chance (100-Year) Floodway
- 0.2% annual chance (500-Year) Floodplain

MAP SCALE 1" = 1000'

500 0 1000 FEET

300 0 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1680G

FIRM

FLOOD INSURANCE RATE MAP

YAVAPAI COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 1680 OF 3900

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
YAVAPAI COUNTY	040093	1680	G
CHINO VALLEY, TOWN OF	040094	1680	G

REVISED TO
REFLECT LOMR
EFFECTIVE: December 21, 2010

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
04025C1680G

MAP REVISED
SEPTEMBER 3, 2010

Federal Emergency Management Agency

Appendix B

USDA NRCS Custom Soil Resource Report

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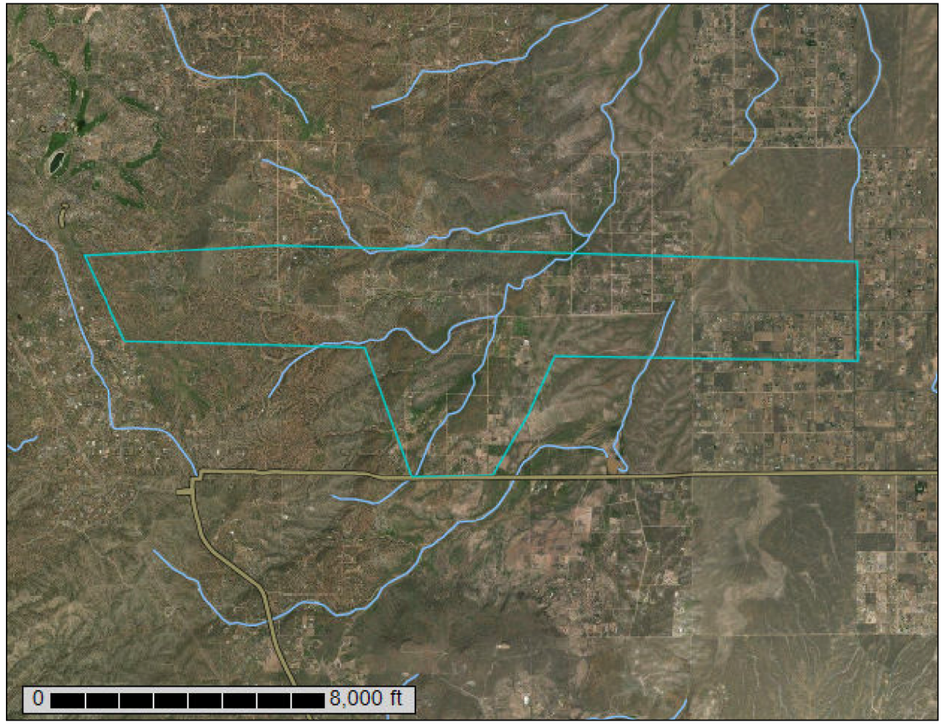
United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Yavapai County, Arizona, Western Part



September 1, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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AnC—Abra-Wineg association, rolling..... 11
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BmF—Barkerville cobbly sandy loam, 20 to 60 percent slopes..... 16
LuC—Lonti-Wineg complex, 3 to 15 percent slopes..... 17
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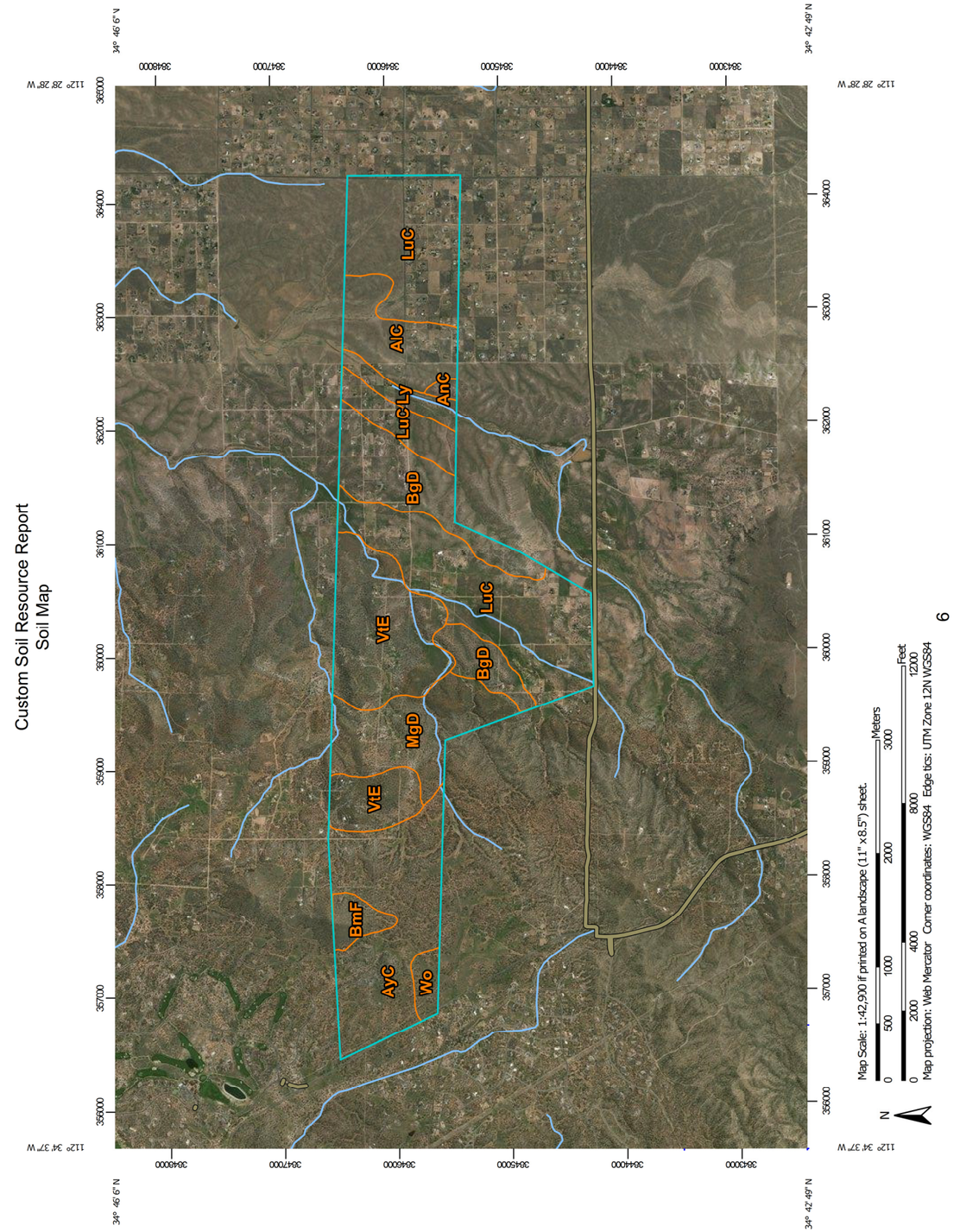
Wo—Wineg-Lynx association.....22

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:31,700.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Yavapai County, Arizona, Western Part
Survey Area Data: Version 8, Sep 14, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 28, 2014—Feb 13, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Yavapai County, Arizona, Western Part (AZ637)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
AlC	Abra-Balon association, rolling	156.6	6.8%
AnC	Abra-Wineg association, rolling	9.2	0.4%
AyC	Arp-Lynx association, rolling	370.4	16.1%
BgD	Balon gravelly sandy clay loam, 5 to 30 percent slopes	265.2	11.5%
BmF	Barkerville cobbly sandy loam, 20 to 60 percent slopes	42.4	1.8%
LuC	Lonti-Wineg complex, 3 to 15 percent slopes	768.4	33.4%
Ly	Lynx soils	49.2	2.1%
MgD	Moano gravelly loam, 0 to 30 percent slopes	231.6	10.1%
VtE	Venezia-Thunderbird complex, 15 to 40 percent slopes	378.9	16.4%
Wo	Wineg-Lynx association	31.8	1.4%
Totals for Area of Interest		**2,303.6**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas

are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Yavapai County, Arizona, Western Part

AIC—Abra-Balon association, rolling

Map Unit Setting

National map unit symbol: 1ryc
Elevation: 4,500 to 5,500 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 145 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Abra and similar soils: 50 percent
Balon and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Abra

Setting

Landform: Ridges
Landform position (two-dimensional): Backslope, summit, toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 3 inches: gravelly loam
H2 - 3 to 18 inches: loam
H3 - 18 to 50 inches: loam
H4 - 50 to 60 inches: loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: Limy Upland 12-16" p.z. (R038XA106AZ)
Hydric soil rating: No

Description of Balon

Setting

Landform: Plains
Landform position (two-dimensional): Backslope, summit, toeslope
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 3 inches: gravelly sandy clay loam
H2 - 3 to 15 inches: gravelly clay loam
H3 - 15 to 23 inches: gravelly sandy clay loam
H4 - 23 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Loamy Upland 12-16 p.z. (R038XA109AZ)
Hydric soil rating: No

AnC—Abra-Wineg association, rolling

Map Unit Setting

National map unit symbol: 1ryg
Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 51 to 55 degrees F
Frost-free period: 145 to 180 days
Farmland classification: Not prime farmland

Map Unit Composition

Abra and similar soils: 55 percent
Wineg and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Abra

Setting

Landform: Ridges
Landform position (two-dimensional): Backslope, summit, toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 3 inches: gravelly loam
H2 - 3 to 18 inches: loam
H3 - 18 to 50 inches: loam
H4 - 50 to 60 inches: loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 30 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: High (about 10.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: B
Ecological site: Limy Upland 12-16" p.z. (R038XA106AZ)
Hydric soil rating: No

Description of Wineg

Setting

Landform: Ridges
Landform position (two-dimensional): Backslope, summit, toeslope
Landform position (three-dimensional): Base slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 2 inches: sandy loam
H2 - 2 to 14 inches: gravelly sandy clay loam
H3 - 14 to 60 inches: sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 25 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 12.0
Available water storage in profile: Moderate (about 6.4 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: Loamy Upland 12-16 p.z. (R038XA109AZ)
Hydric soil rating: No

AyC—Arp-Lynx association, rolling

Map Unit Setting
National map unit symbol: 1ryv
Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 52 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition
Arp and similar soils: 60 percent
Lynx and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arp

Setting
Landform: Ridges
Landform position (two-dimensional): Backslope, summit, toeslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum and/or colluvium derived from schist

Typical profile
H1 - 0 to 2 inches: gravelly clay loam
H2 - 2 to 18 inches: clay
H3 - 18 to 34 inches: weathered bedrock
H4 - 34 to 38 inches: unweathered bedrock

Properties and qualities
Slope: 2 to 15 percent
Depth to restrictive feature: 12 to 22 inches to paralithic bedrock; 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to low (0.00 to 0.01 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: Clay Loam Upland 12-16" p.z. (R038XA103AZ)
Hydric soil rating: No

Description of Lynx

Setting
Landform: Drainageways
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile
H1 - 0 to 14 inches: loam
H2 - 14 to 60 inches: clay loam

Properties and qualities
Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: High (about 10.6 inches)

Interpretive groups
Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Loamy Bottom 12-16 p.z. (R038XA107AZ)
Hydric soil rating: No

BgD—Balon gravelly sandy clay loam, 5 to 30 percent slopes

Map Unit Setting

National map unit symbol: 1ryz
Elevation: 4,000 to 5,000 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 50 to 58 degrees F
Frost-free period: 145 to 225 days
Farmland classification: Not prime farmland

Map Unit Composition

Balon and similar soils: 95 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Balon

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope, summit, toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 3 inches: gravelly sandy clay loam
H2 - 3 to 15 inches: gravelly clay loam
H3 - 15 to 23 inches: gravelly sandy clay loam
H4 - 23 to 60 inches: gravelly sandy loam

Properties and qualities

Slope: 5 to 30 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Loamy Upland 12-16 p.z. (R038XA109AZ)
Hydric soil rating: No

BmF—Barkerville cobbly sandy loam, 20 to 60 percent slopes

Map Unit Setting

National map unit symbol: 1rz0
Elevation: 4,000 to 6,500 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 140 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Barkerville and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Barkerville

Setting

Landform: Hills, mountains
Landform position (two-dimensional): Backslope, summit, toeslope
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from granite and/or colluvium derived from granite

Typical profile

H1 - 0 to 10 inches: cobbly sandy loam
H2 - 10 to 25 inches: very gravelly loamy sand
H3 - 25 to 30 inches: weathered bedrock

Properties and qualities

Slope: 20 to 60 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: B
Ecological site: Granitic Hills 12-16" p.z. (R038XA104AZ)
Hydric soil rating: No

LuC—Lonti-Wineg complex, 3 to 15 percent slopes

Map Unit Setting

National map unit symbol: 1s0t
Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 52 to 55 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition

Lonti and similar soils: 50 percent
Wineg and similar soils: 35 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lonti

Setting

Landform: Fan terraces
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 5 inches: gravelly sandy loam
H2 - 5 to 45 inches: gravelly clay
H3 - 45 to 68 inches: very gravelly sandy clay loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 20 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Moderate (about 7.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Loamy Upland 12-16 p.z. (R038XA109AZ)
Hydric soil rating: No

Description of Wineg

Setting

Landform: Fan terraces
Landform position (two-dimensional): Summit, backslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 2 inches: sandy loam
H2 - 2 to 14 inches: gravelly sandy clay loam
H3 - 14 to 60 inches: sandy loam

Properties and qualities

Slope: 3 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 25 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 12.0
Available water storage in profile: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: Loamy Upland 12-16 p.z. (R038XA109AZ)
Hydric soil rating: No

Ly—Lynx soils

Map Unit Setting

National map unit symbol: 1s0x
Elevation: 4,000 to 6,000 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 51 to 57 degrees F
Frost-free period: 140 to 220 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Lynx and similar soils: 45 percent

Lynx and similar soils: 40 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lynx

Setting
Landform: Drainageways, alluvial fans
Landform position (two-dimensional): Summit, backslope, toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Concave, linear
Across-slope shape: Linear, convex
Parent material: Mixed alluvium

Typical profile
H1 - 0 to 14 inches: loam
H2 - 14 to 60 inches: clay loam

Properties and qualities
Slope: 1 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: High (about 10.6 inches)

Interpretive groups
Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 6c
Hydrologic Soil Group: C
Ecological site: Loamy Bottom 12-16 p.z. (R038XA107AZ)
Hydric soil rating: No

Description of Lynx

Setting
Landform: Alluvial fans, drainageways
Landform position (two-dimensional): Backslope, summit, toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear, concave
Across-slope shape: Convex, linear
Parent material: Mixed alluvium

Typical profile
H1 - 0 to 14 inches: clay loam
H2 - 14 to 60 inches: clay loam

Properties and qualities
Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional

Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 3.0
Available water storage in profile: High (about 10.9 inches)

Interpretive groups
Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 6c
Hydrologic Soil Group: C
Ecological site: Loamy Bottom 12-16 p.z. (R038XA107AZ)
Hydric soil rating: No

MgD—Moano gravelly loam, 0 to 30 percent slopes

Map Unit Setting
National map unit symbol: 1s15
Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Not prime farmland

Map Unit Composition
Moano and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Moano

Setting
Landform: Hills
Landform position (two-dimensional): Backslope, summit, toeslope
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum and/or colluvium derived from schist

Typical profile
H1 - 0 to 9 inches: gravelly loam
H2 - 9 to 16 inches: unweathered bedrock

Properties and qualities
Slope: 0 to 30 percent
Depth to restrictive feature: 6 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to low (0.00 to 0.01 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Available water storage in profile: Very low (about 1.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Ecological site: Granitic Hills 12-16" p.z. (R038XA104AZ)
Hydric soil rating: No

VtE—Venezia-Thunderbird complex, 15 to 40 percent slopes

Map Unit Setting

National map unit symbol: 1s2w
Elevation: 4,000 to 5,500 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 52 to 56 degrees F
Frost-free period: 140 to 210 days
Farmland classification: Not prime farmland

Map Unit Composition

Venezia and similar soils: 60 percent
Thunderbird and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Venezia

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, summit, toeslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Residuum weathered from basalt and/or colluvium derived from basalt

Typical profile

H1 - 0 to 2 inches: gravelly loam
H2 - 2 to 10 inches: loam
H3 - 10 to 12 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 40 percent
Depth to restrictive feature: 5 to 16 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to low (0.00 to 0.01 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: Volcanic Hills 12-16" p.z. Clayey (R038XA117AZ)
Hydric soil rating: No

Description of Thunderbird

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, summit, toeslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Alluvium derived from basalt and/or colluvium derived from basalt

Typical profile

H1 - 0 to 2 inches: cobbly clay loam
H2 - 2 to 28 inches: clay
H3 - 28 to 31 inches: gravelly clay loam
H4 - 31 to 33 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to low (0.00 to 0.01 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 35 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: D
Ecological site: Clayey Slopes 12-16" p.z. (R038XA108AZ)
Hydric soil rating: No

Wo—Wineg-Lynx association

Map Unit Setting

National map unit symbol: 1s2y
Elevation: 4,000 to 6,000 feet
Mean annual precipitation: 12 to 16 inches
Mean annual air temperature: 51 to 55 degrees F
Frost-free period: 140 to 200 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Wineg and similar soils: 60 percent
Lynx and similar soils: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wineg

Setting

Landform: Alluvial fans
Landform position (two-dimensional): Backslope, summit, toeslope
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 2 inches: sandy loam
H2 - 2 to 14 inches: gravelly sandy clay loam
H3 - 14 to 60 inches: sandy loam

Properties and qualities

Slope: 1 to 8 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 25 percent
Gypsum, maximum in profile: 2 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 12.0
Available water storage in profile: Moderate (about 6.4 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 6s
Hydrologic Soil Group: C
Ecological site: Loamy Upland 12-16 p.z. (R038XA109AZ)
Hydric soil rating: No

Description of Lynx

Setting

Landform: Swales
Landform position (two-dimensional): Summit
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 14 inches: loam
H2 - 14 to 60 inches: clay loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Calcium carbonate, maximum in profile: 5 percent
Available water storage in profile: High (about 10.6 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: Loamy Bottom 12-16 p.z. (R038XA107AZ)
Hydric soil rating: No

Appendix C

CulvertMaster Calculation Worksheets

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Culvert Calculator Report
Basin 01 (with 02)

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	0.00	ft	Headwater Depth/Height	1.03	
Computed Headwater Elevation	14.10	ft	Discharge	234.55	cfs
Inlet Control HW Elev.	13.92	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	14.10	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	10.00	ft	Downstream Invert	9.25	ft
Length	75.00	ft	Constructed Slope	1.00	%

Hydraulic Profile					
Profile	S2		Depth, Downstream	2.17	ft
Slope Type	Steep		Normal Depth	2.01	ft
Flow Regime	Supercritical		Critical Depth	2.68	ft
Velocity Downstream	11.24	ft/s	Critical Slope	0.41	%

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	14.10	ft	Upstream Velocity Head	1.19	ft
Ke	0.20		Entrance Loss	0.24	ft

Inlet Control Properties					
Inlet Control HW Elev.	13.92	ft	Flow Control	N/A	
Inlet Type	Groove end w/headwall		Area Full	37.7	ft^2
K	0.00180		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Culvert Calculator Report
Basin 02

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	0.00	ft	Headwater Depth/Height	1.14	
Computed Headwater Elevation	13.43	ft	Discharge	134.96	cfs
Inlet Control HW Elev.	13.32	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	13.43	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	10.00	ft	Downstream Invert	9.25	ft
Length	75.00	ft	Constructed Slope	1.00	%

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.80	ft
Slope Type	Steep		Normal Depth	1.71	ft
Flow Regime	Supercritical		Critical Depth	2.19	ft
Velocity Downstream	10.19	ft/s	Critical Slope	0.50	%

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	13.43	ft	Upstream Velocity Head	1.03	ft
Ke	0.20		Entrance Loss	0.21	ft

Inlet Control Properties					
Inlet Control HW Elev.	13.32	ft	Flow Control	N/A	
Inlet Type	Groove end w/headwall		Area Full	21.2	ft^2
K	0.00180		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Culvert Calculator Report
Basin 03

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	0.00	ft	Headwater Depth/Height	0.99	
Computed Headwater Elevation	12.98	ft	Discharge	72.31	cfs
Inlet Control HW Elev.	12.84	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	12.98	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	10.00	ft	Downstream Invert	9.25	ft
Length	75.00	ft	Constructed Slope	1.00	%

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.57	ft
Slope Type	Steep		Normal Depth	1.50	ft
Flow Regime	Supercritical		Critical Depth	1.96	ft
Velocity Downstream	9.64	ft/s	Critical Slope	0.43	%

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	12.98	ft	Upstream Velocity Head	0.85	ft
Ke	0.20		Entrance Loss	0.17	ft

Inlet Control Properties					
Inlet Control HW Elev.	12.84	ft	Flow Control	N/A	
Inlet Type	Groove end w/headwall		Area Full	14.1	ft^2
K	0.00180		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Culvert Calculator Report
Basin 05

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	0.00	ft	Headwater Depth/Height	1.23	
Computed Headwater Elevation	14.93	ft	Discharge	309.97	cfs
Inlet Control HW Elev.	14.91	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	14.93	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	10.00	ft	Downstream Invert	9.25	ft
Length	75.00	ft	Constructed Slope	1.00	%

Hydraulic Profile					
Profile	S2		Depth, Downstream	2.57	ft
Slope Type	Steep		Normal Depth	2.38	ft
Flow Regime	Supercritical		Critical Depth	3.08	ft
Velocity Downstream	12.10	ft/s	Critical Slope	0.50	%

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	14.93	ft	Upstream Velocity Head	1.54	ft
Ke	0.20		Entrance Loss	0.31	ft

Inlet Control Properties					
Inlet Control HW Elev.	14.91	ft	Flow Control	N/A	
Inlet Type	Groove end w/headwall		Area Full	37.7	ft^2
K	0.00180		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Culvert Calculator Report
Basin 06

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	0.00	ft	Headwater Depth/Height	1.64	
Computed Headwater Elevation	13.29	ft	Discharge	24.80	cfs
Inlet Control HW Elev.	13.29	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	13.10	ft	Control Type	Inlet Control	

Grades					
Upstream Invert	10.00	ft	Downstream Invert	9.25	ft
Length	75.00	ft	Constructed Slope	1.00	%

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.66	ft
Slope Type	Steep		Normal Depth	1.66	ft
Flow Regime	Supercritical		Critical Depth	1.76	ft
Velocity Downstream	8.88	ft/s	Critical Slope	0.92	%

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	13.10	ft	Upstream Velocity Head	1.12	ft
Ke	0.20		Entrance Loss	0.22	ft

Inlet Control Properties					
Inlet Control HW Elev.	13.29	ft	Flow Control	N/A	
Inlet Type	Groove end w/headwall		Area Full	3.1	ft^2
K	0.00180		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Culvert Calculator Report
Basin 07

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	0.00	ft	Headwater Depth/Height	1.89	
Computed Headwater Elevation	13.78	ft	Discharge	27.94	cfs
Inlet Control HW Elev.	13.78	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	13.59	ft	Control Type	Inlet Control	

Grades					
Upstream Invert	10.00	ft	Downstream Invert	9.25	ft
Length	75.00	ft	Constructed Slope	1.00	%

Hydraulic Profile					
Profile	CompositeM2PressureProfile		Depth, Downstream	1.83	ft
Slope Type	Mild		Normal Depth	N/A	ft
Flow Regime	Subcritical		Critical Depth	1.83	ft
Velocity Downstream	9.28	ft/s	Critical Slope	1.13	%

Section					
Section Shape	Circular		Mannings Coefficient	0.012	
Section Material	Corrugated HDPE (Smooth Interior)		Span	2.00	ft
Section Size	24 inch		Rise	2.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	13.59	ft	Upstream Velocity Head	1.23	ft
Ke	0.20		Entrance Loss	0.25	ft

Inlet Control Properties					
Inlet Control HW Elev.	13.78	ft	Flow Control	N/A	
Inlet Type	Groove end w/headwall		Area Full	3.1	ft^2
K	0.00180		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Culvert Calculator Report
Basin 08

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	0.00 ft	Headwater Depth/Height	1.50
Computed Headwater Elevation	13.75 ft	Discharge	119.16 cfs
Inlet Control HW Elev.	13.75 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	13.61 ft	Control Type	Inlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.25 ft
Length	75.00 ft	Constructed Slope	1.00 %

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.88 ft
Slope Type	Steep	Normal Depth	1.84 ft
Flow Regime	Supercritical	Critical Depth	2.12 ft
Velocity Downstream	10.03 ft/s	Critical Slope	0.75 %

Section			
Section Shape	Circular	Mannings Coefficient	0.012
Section Material	Corrugated HDPE (Smooth Interior)	Span	2.50 ft
Section Size	30 inch	Rise	2.50 ft
Number Sections	3		

Outlet Control Properties			
Outlet Control HW Elev.	13.61 ft	Upstream Velocity Head	1.24 ft
Ke	0.20	Entrance Loss	0.25 ft

Inlet Control Properties			
Inlet Control HW Elev.	13.75 ft	Flow Control	N/A
Inlet Type	Groove end w/headwall	Area Full	14.7 ft²
K	0.00180	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	2
C	0.02920	Equation Form	1
Y	0.74000		

Culvert Calculator Report
Basin 09

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	0.00 ft	Headwater Depth/Height	1.00
Computed Headwater Elevation	14.99 ft	Discharge	3,273.00 cfs
Inlet Control HW Elev.	14.50 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	14.99 ft	Control Type	Entrance Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.25 ft
Length	75.00 ft	Constructed Slope	1.00 %

Hydraulic Profile			
Profile	S2	Depth, Downstream	2.18 ft
Slope Type	Steep	Normal Depth	1.92 ft
Flow Regime	Supercritical	Critical Depth	2.85 ft
Velocity Downstream	12.49 ft/s	Critical Slope	0.32 %

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	10.00 ft
Section Size	10 x 5 ft	Rise	5.00 ft
Number Sections	12		

Outlet Control Properties			
Outlet Control HW Elev.	14.99 ft	Upstream Velocity Head	1.42 ft
Ke	0.50	Entrance Loss	0.71 ft

Inlet Control Properties			
Inlet Control HW Elev.	14.50 ft	Flow Control	N/A
Inlet Type	45° non-offset wingwall flares	Area Full	600.0 ft²
K	0.49700	HDS 5 Chart	12
M	0.66700	HDS 5 Scale	1
C	0.03390	Equation Form	2
Y	0.80300		

Culvert Calculator Report
Basin 10

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	0.00 ft	Headwater Depth/Height	1.24
Computed Headwater Elevation	14.35 ft	Discharge	224.86 cfs
Inlet Control HW Elev.	14.34 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	14.35 ft	Control Type	Entrance Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.25 ft
Length	75.00 ft	Constructed Slope	1.00 %

Hydraulic Profile			
Profile	S2	Depth, Downstream	2.27 ft
Slope Type	Steep	Normal Depth	2.13 ft
Flow Regime	Supercritical	Critical Depth	2.71 ft
Velocity Downstream	11.37 ft/s	Critical Slope	0.53 %

Section			
Section Shape	Circular	Mannings Coefficient	0.012
Section Material	Corrugated HDPE (Smooth Interior)	Span	3.50 ft
Section Size	42 inch	Rise	3.50 ft
Number Sections	3		

Outlet Control Properties			
Outlet Control HW Elev.	14.35 ft	Upstream Velocity Head	1.37 ft
Ke	0.20	Entrance Loss	0.27 ft

Inlet Control Properties			
Inlet Control HW Elev.	14.34 ft	Flow Control	N/A
Inlet Type	Groove end w/headwall	Area Full	28.9 ft²
K	0.00180	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	2
C	0.02920	Equation Form	1
Y	0.74000		

Culvert Calculator Report
Basin 11

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	0.00 ft	Headwater Depth/Height	1.27
Computed Headwater Elevation	13.18 ft	Discharge	66.48 cfs
Inlet Control HW Elev.	13.18 ft	Tailwater Elevation	0.00 ft
Outlet Control HW Elev.	13.17 ft	Control Type	Inlet Control

Grades			
Upstream Invert	10.00 ft	Downstream Invert	9.25 ft
Length	75.00 ft	Constructed Slope	1.00 %

Hydraulic Profile			
Profile	S2	Depth, Downstream	1.66 ft
Slope Type	Steep	Normal Depth	1.61 ft
Flow Regime	Supercritical	Critical Depth	1.96 ft
Velocity Downstream	9.61 ft/s	Critical Slope	0.61 %

Section			
Section Shape	Circular	Mannings Coefficient	0.012
Section Material	Corrugated HDPE (Smooth Interior)	Span	2.50 ft
Section Size	30 inch	Rise	2.50 ft
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev.	13.17 ft	Upstream Velocity Head	1.01 ft
Ke	0.20	Entrance Loss	0.20 ft

Inlet Control Properties			
Inlet Control HW Elev.	13.18 ft	Flow Control	N/A
Inlet Type	Groove end w/headwall	Area Full	9.8 ft²
K	0.00180	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	2
C	0.02920	Equation Form	1
Y	0.74000		

Culvert Calculator Report
Basin 12

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	0.00	ft	Headwater Depth/Height	1.14	
Computed Headwater Elevation	19.12	ft	Discharge	8,102.00	cfs
Inlet Control HW Elev.	18.24	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	19.12	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	10.00	ft	Downstream Invert	9.25	ft
Length	75.00	ft	Constructed Slope	1.00	%

Hydraulic Profile					
Profile	S2		Depth, Downstream	4.26	ft
Slope Type	Steep		Normal Depth	3.61	ft
Flow Regime	Supercritical		Critical Depth	5.21	ft
Velocity Downstream	15.86	ft/s	Critical Slope	0.37	%

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	10.00	ft
Section Size	10 x 8 ft		Rise	8.00	ft
Number Sections	12				

Outlet Control Properties					
Outlet Control HW Elev.	19.12	ft	Upstream Velocity Head	2.61	ft
Ke	0.50		Entrance Loss	1.30	ft

Inlet Control Properties					
Inlet Control HW Elev.	18.24	ft	Flow Control	N/A	
Inlet Type	45° non-offset wingwall flares		Area Full	960.0	ft²
K	0.49700		HDS 5 Chart	12	
M	0.66700		HDS 5 Scale	1	
C	0.03390		Equation Form	2	
Y	0.80300				

Appendix D

Lee Engineering Traffic and Safety Study

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ARIZONA
TEXAS
NEW MEXICO
OKLAHOMA

November 22, 2017

Mr. Kevin Horton, P.E., CFM
Lyon Engineering
1650 Willow Creek Road
Prescott, AZ 86031

RE: Northern Connector Traffic Projections and Safety Analysis

Dear Mr. Horton:

As a part of the Lyon Engineering Northern Connector Design Concept Report, Lee Engineering has been contracted to provide the following analysis:

- A traffic analysis with a refined Traffic Analysis Zone (TAZ) and roadway network structure in the study area to project 2040 volumes; and
- A safety analysis using the FHWA Interactive Highway Safety Design Model (IHSDM) software to evaluate expected safety and operational performance of the new roadway.

Background

The most recent Central Yavapai Metropolitan Planning Organization *Regional Transportation Plan Update 2040* (CTMPO RTPU2040) by AECOM dated April 2015, recommended the Northern Connector project as one of a number of roadway network improvements to accommodate the growth in the regional Yavapai County area. Yavapai County along with the help from Lyon Engineering developed a preferred Northern Connector alignment to be studied in greater detail, extending west from Reed Road and terminating at Williamson Valley Road near the Nancy Drive alignment. The approximate 4.8-mile preferred alignment that has been requested for analysis by Lyon Engineering is shown in Figure 1.

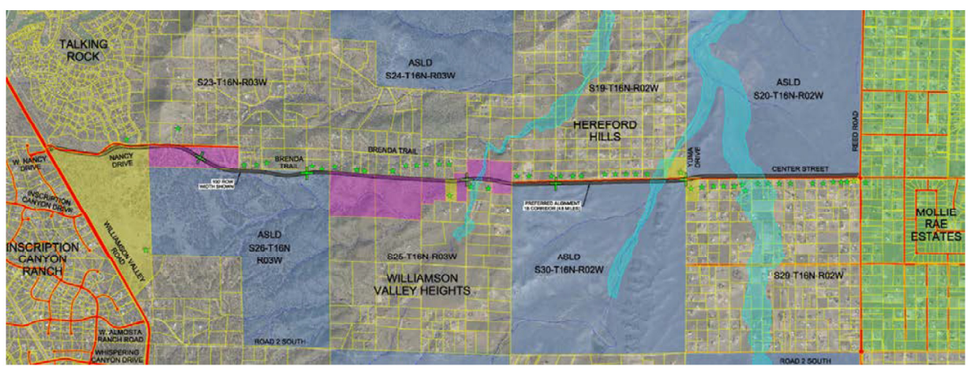


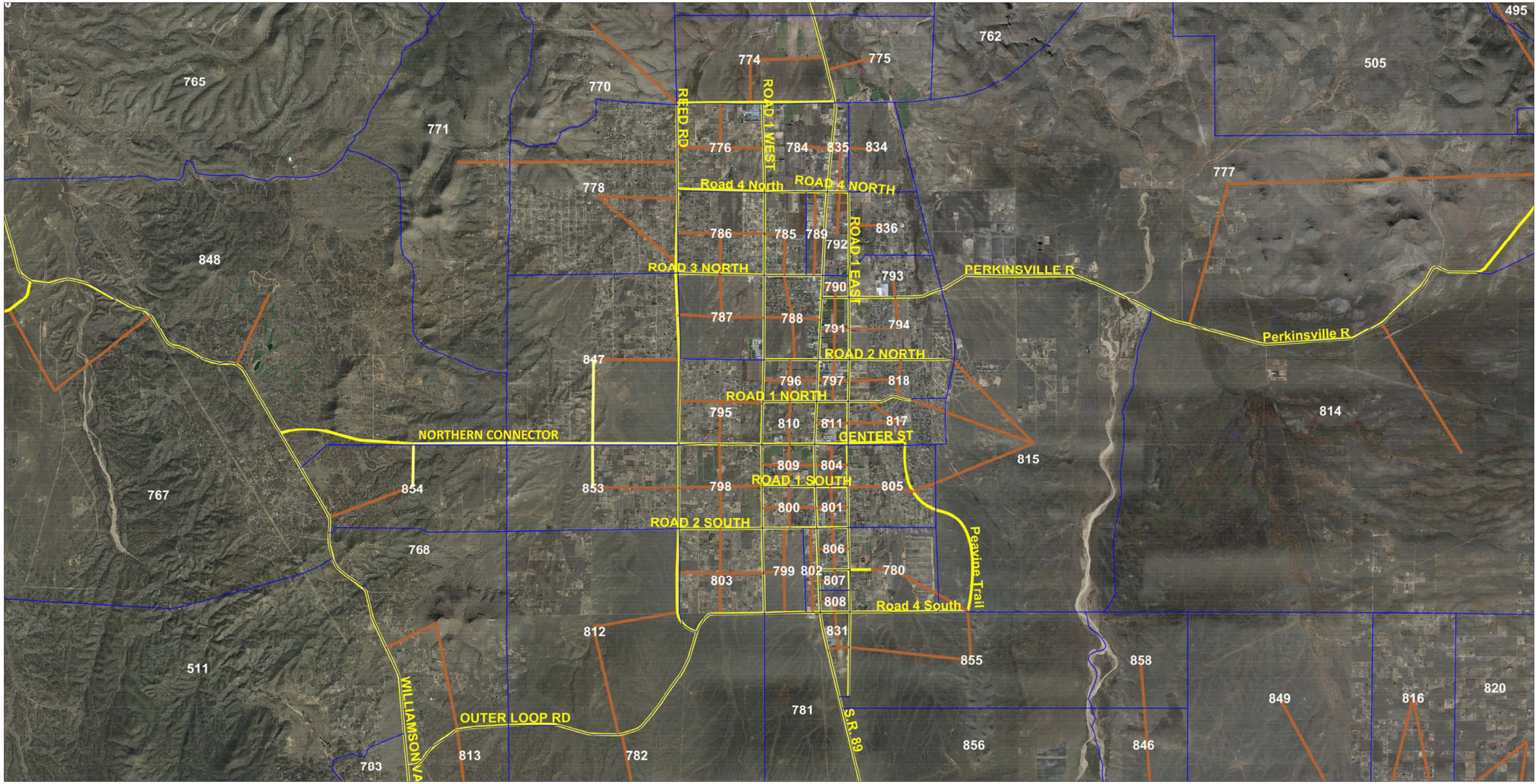
Figure 1. Northern Connector Preferred Alignment to be Analyzed

Study Area

Upon review of the preferred roadway alignment and latest CYMPO RUTP2040 report, it was identified that the traffic analysis zones (TAZ's) adjacent to the Northern Connector project, especially in the western end, are relatively large in scale with limited locations that generated traffic could access the adjacent roadway network. Figure 2 provides an image representing the TAZ configurations and roadway network that existed adjacent to the study area for the 2040 CYMPO Recommended model run.

It was postulated that a more representative roadway network as well as a refinement to the adjacent TAZ's may result in a more accurate representation of the daily traffic volumes that are forecasted to use the proposed roadway in 2040.

From comparing the roadway network used in the development of the 2040 transportation plan to a more recent aerial image of the study area as well as the land use development in the area, it was suggested that a number of additional roadway segments could be added to the general study area to more reasonably distribute vehicles across the roadway network. Additionally, the adjacent 6 TAZs could be split into smaller subareas so that the vehicles generated from these TAZ centroids could access the Northern Connector in a more representative manner and at the designated concept access point. Figure 3 presents a representation of the roadway and TAZ configuration changes that was prepared for the Northern Connector modeling runs.



LEGEND

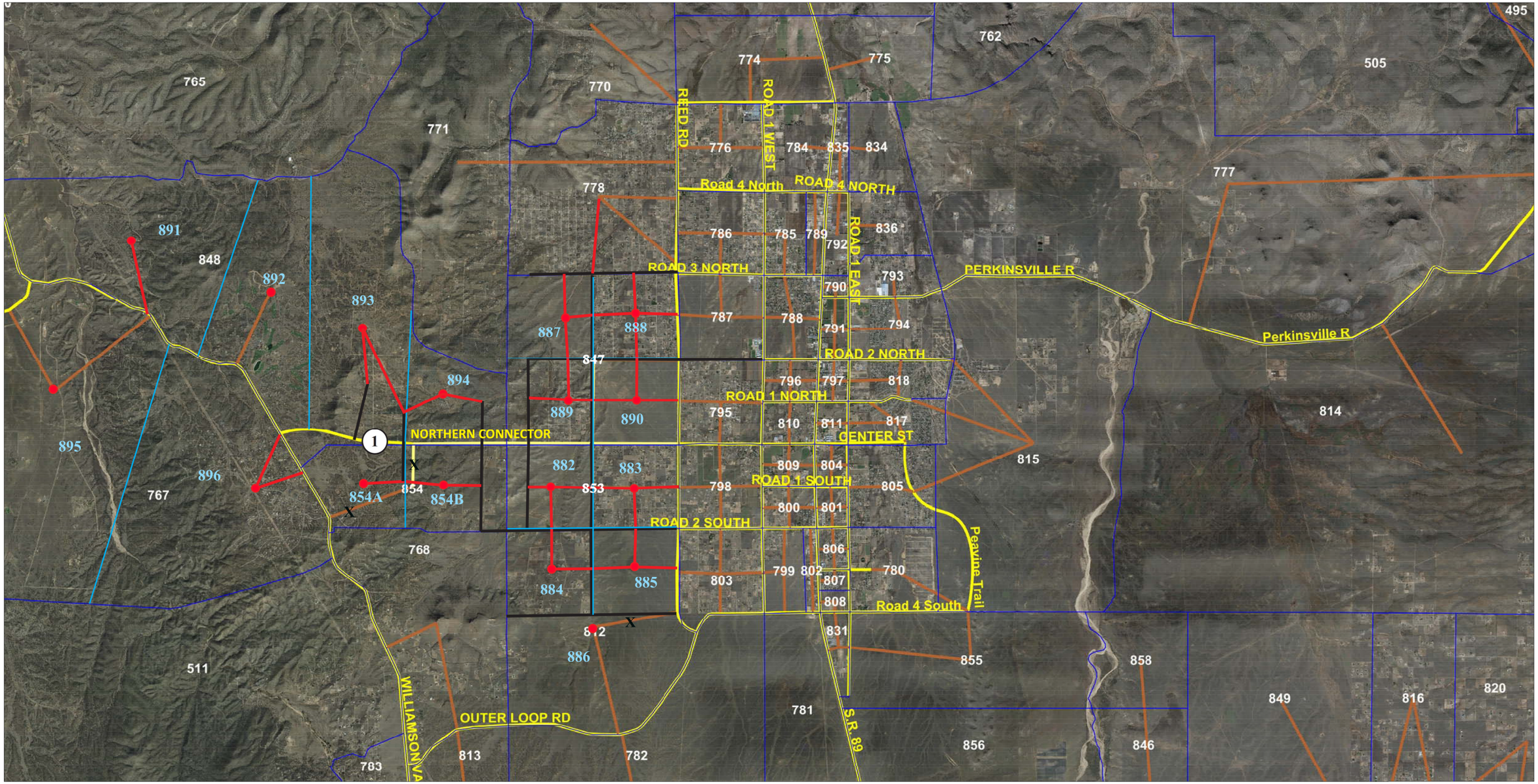
800	TAZ Number
	2040 Roadway Netowrk
	2040 Centroid Connector
	Existing TAZ Boundary

Not to scale

LEE ENGINEERING

Representation of the 2040 CYMPO Recommended Network

Figure 2



LEGEND

1	Northern Connector; Preferred Alignment
	2040 model network
	2040 centroid connector
	Existing TAZ boundary
XXX	Modified TAZ numbering
X	Deleted feature
•	Modified TAZ centroid
	New centroid connector
	Modified TAZ boundary
	New roadway link

Not to scale

LEE ENGINEERING

Representation of the 2040 Northern Connector Build Network

Figure 3

Modification of the 2040 Transportation Model

The socioeconomic (SE) data, by TAZ, that was used in the 2040 CYMPO RUTP2040 transportation model runs for CYMPO was reviewed. The three major SE categories; number of households, population, and employment were reviewed for the six TAZ's that could influence the traffic volumes on the new Northern Connector segment. A potential split of the 2040 SE data was provided to Lyon Engineering in seeking Yavapai County agreement to the proposed division and/or the need to modify/add/subtract as they considered appropriate based on the local knowledge they have of the area.

In the interim, the State's Demographer Office developed new SE data for the 2040 horizon year. When comparing the population and employment between the CYMPO RUTP2040 run model and the new information, it was identified that the new demographer's data resulted in a population and employment reduction for the study area. In the 6 TAZ's adjacent to the study area, a combined population reduction from 4,946 people to 3,662 was identified, or a population reduction of 26% (with this area being mostly residential, employment dropped from 104 jobs to 98 jobs). Table 1 shows the change to the population and employment of the individual TAZ's adjacent to the new Northern Connector roadway.

Lee Engineering coordinated with ADOT to run their latest 2040 No-Build model (utilizing the latest SE data) for use and modification in the Northern Connector effort. It was noted from the CYMPO 2040 Recommended network, that no other major roadway improvements were anticipated for the Chino Valley area that would have a significant impact to volume conditions in the 2040 design year. In addition to the Northern Connector, the only CYMPO 2040 recommended project in the immediate area is the widening of SR 89 from 4 lanes to 6 lanes south of Center Street. Because SR 89 and the two-lane Williamson Valley Road are the only two north/south roadways connecting the Chino Valley area to the other population and employment centers to the south, insignificant vehicle diversion is anticipated to

Table 1. Population and Employment Change

TAZ	Population	Employment
854	839	6
854	687	6
Difference	-152	0
853	782	20
853	640	19
Difference	-142	-1
812	232	16
812	190	15
Difference	-42	-1
847	1174	30
847	961	28
Difference	-213	-2
848	566	0
848	76	0
Difference	-490	0
767	1353	32
767	1108	30
Difference	-245	-2
Subtotals		
Previous CYMPO 2040 TAZ's	4946	104
New ADOT 2040 TAZ's	3662	98
Difference	-1284	-6
Percent Change	-26.0%	-5.8%

Percent Increase of New Population to Match Previous Population	**35.1%**

occur with or without improvement to SR 89 or from other recommended CYMPO roadway improvements outside of the immediate study area.

It was envisioned that Lee Engineering would provide ADOT the initial modifications to the roadway network, TAZ structure, and SE changes for incorporation into a new ADOT 2040 No Build model run. Several model runs were anticipated to better define, to modify the network characteristics, or to evaluate alternative design conditions, if required. A suggestion was made by ADOT to minimize the model run variables by using the SE data which ADOT had successfully used on recently completed model runs. This SE data is lower than previously used in the 2040 CYMPO model runs done for the 2015 Regional Transportation Plan Update. The modeling for the Northern Connector was done by running the new roadway links, splitting of the TAZ zones, and using the reduced ADOT SE data.

Table 2 presents the SE data, divided into the separate TAZ zones that were used in the 2015 CYMPO model (gray) and run by ADOT (blue). The SE values indicated in green represent the same distribution percentage approved by Yavapai County for use in this study, albeit with reduced values. Figure 4 presents the daily traffic volumes on the study area roadways that ADOT completed for the Northern Connector using the reduced SE data based on the State Demographer values and division of the TAZ's.

When reviewing the model output, it was determined that the coding of the roadway network was appropriate and the daily model results did not produce any unrealistic traffic projections, representative of a properly coded network. The daily volumes of the Northern Connector model were compared to the CYMPO 2040 Recommended model output volumes to identify if there were any significant volume differences. Table 3 presents the results of that comparison.

Table 2. SE Data Modifications and TAZ Splits

Model	TAZ	Households	Population	Employment
Previous CYMPO TAZ	854	410	839	6
New SE Data	854	359	687	6
New SE TAZ Division	863	179	343	3
	864	180	344	3
Previous CYMPO TAZ	853	346	782	20
New SE Data	853	283	640	19
New SE TAZ Division	865	155	352	10
	866	128	288	9
Previous CYMPO TAZ	812	108	232	16
New SE Data	812	89	190	15
New SE TAZ Division	868	18	38	3
	869	9	19	2
	870	62	133	10
Previous CYMPO TAZ	847	520	1174	30
New SE Data	847	428	961	28
New SE TAZ Division	873	107	240	7
	874	85	192	5
	875	129	289	9
	876	107	240	7
Previous CYMPO TAZ	848	280	566	0
New SE Data	848	40	76	0
New SE TAZ Division	878	4	7	0
	880	28	55	0
	882	4	7	0
	883	4	7	0
Previous CYMPO TAZ	767	684	1353	32
New SE Data	767	595	1108	30
New SE TAZ Division	885	200	372	10
	886	395	736	20

LEGEND

XXXX	2040 Daily Model Volume (rounded)
	Roadway/Concept Intersection and Access Point
	Study Modified Centroid Connector
	Other Roadway/Centroid Connector

Not to scale

LEE ENGINEERING

2040 Northern Connector Roadway Daily Volume Results (Unadjusted)

Figure 4

Table 3. 2040 Model Output Comparison

Roadway Segment		CYMPO 2040 Recommended*	Northern Connector Model	Difference	% Change
Individual Links					
Northern Connector					
West of SR 89		3700	3400	-300	-8.1%
West of Reed Road		6700	3300	-3400	-50.7%
East of WVR		2700	2500	-200	-7.4%
Outer Loop Road					
West of SR 89		8800	5200	-3600	-40.9%
West of Reed Road		1900	4300	2400	126.3%
East of WVR		1900	1100	-800	-42.1%
N/S Cutline (selected roadways only)					
East of WVR					
Northern Connector		2700	2500	-200	-7.4%
Outer Loop Road		1900	1100	-800	-42.1%
	Total	4600	3600	-1000	-21.7%
West of Reed Road					
Northern Connector		6700	3300	-3400	-50.7%
Outer Loop Road		1900	4300	2400	126.3%
	Total	8600	7600	-1000	-11.6%
West of SR 89					
Northern Connector		3700	3400	-300	-8.1%
Outer Loop Road		8800	5200	-3600	-40.9%
	Total	12500	8600	-3900	-31.2%
E/W Cutline (selected roadways only)					
South of Outer Loop Rd					
WVR		5200	3700	-1500	-28.8%
SR 89		39500	30900	-8600	-21.8%
	Total	44700	34600	-10100	-22.6%
North of Outer Loop Rd					
WVR		3700	3500	-200	-5.4%
SR 89		32300	29400	-2900	-9.0%
	Total	36000	32900	-3100	-8.6%
North of Northern Connector					
WVR		5100	3600	-1500	-29.4%
SR 89		27600	25700	-1900	-6.9%
	Total	32700	29300	-3400	-10.4%

(*) - Roadway volume estimated based on graphical values presented on roadway segment closest to location

In review of Table 3, the mostly negative volume differences can be attributed to the lower SE values run for this study as compared to the CYMPO RTPU2040 model. Individually, the most drastic volume change, by percentage, are to the Outer Loop Road and Northern Connector roadway segments west of Reed Road. Volume differences on the individual links can partially be attributed to the splitting of the TAZ, where the centroid connectors access the roadway network, and a more robust local roadway network. It is Lee Engineering's belief that the more defined roadway network conducted for this study results in a more balanced volume network, better representing travel path alternatives available to the public. It is noted that in both models, the Outer Loop Road and Northern Connector level of service remain in the LOS A-C category.

Using the lower estimates of SE data from the new demographer's data resulted in a reduction of projected volume due to the overall reduction to the 2040 SE data for the general area and modification/split of the Traffic Analysis Zones within the immediate Northern Connector study area.

It was concerning, however, that the new demographer's SE data used in the model run was lower than the data used to run the CYMPO RUTP2040 model and did not reflect Yavapai County's approved population/employment division for the 6 TAZ's adjacent to the subject roadway. Without the ability to re-run the Northern Connector model with the higher SE values and having knowledge of the accelerating development demands in the larger CYMPO study area, it was estimated that all traffic volumes on and accessing the Northern Connector be increased 35%. This 35% increase is based on the information presented in Table 1 and would account for the reduction in projected population with the new SE data from what Yavapai County previously reviewed and agreed as a part of the Northern Connector model run. For the purposes of presenting the 2040 daily model estimates for the subject corridor, the roadway segment volumes in tabular format are presented in Table 4.

Table 4. 2040 Projected Daily Study Area Roadway Segment Volumes

Roadway Segment	2040 Model Volume	Adjustment Factor	Adjusted 2040 Model Volume for Analysis	Level of Service
Northern Connector bet. WVR and Roadway 1	2480	1.35	3350	A - C
Northern Connector bet. Roadway 1 and Roadway 2	2470	1.35	3330	A - C
Northern Connector bet. Roadway 2 and Bandit Ridge Road	2700	1.35	3650	A - C
Northern Connector bet. Bandit Ridge Road and Sun Shine Lane	3740	1.35	5050	A - C
Northern Connector bet. Sun Shine Lane and Yuma Drive	3240	1.35	4370	A - C
Northern Connector bet. Yuma Drive and Reed Road	3260	1.35	4400	A - C
Roadway 1 North of Northern Connector	20	1.35	30	A - C
Roadway 2 North of Northern Connector	50	1.35	70	A - C
Roadway 2 South of Northern Connector	1560	1.35	2110	A - C
Bandit Ridge Road North of Northern Connector	30	1.35	40	A - C
Bandit Ridge Road South of Northern Connector	1010	1.35	1360	A - C
Sun Shine Lane North of Northern Connector	300	1.35	410	A - C
Sun Shine Lane South of Northern Connector	310	1.35	420	A - C
Yuma Road North of Northern Connector	1530	1.35	2070	A - C
Yuma Road South of Northern Connector	990	1.35	1340	A - C
Reed Road North of Northern Connector	1430	1.35	1930	A - C
Reed Road South of Northern Connector	1040	1.35	1400	A - C

Analysis indicates the Northern Connector and its intersecting side streets will operate at a Level of Service C (LOS C) or better using the adjusted daily model volumes, a 2-lane cross-section design, and planning level capacity values for each roadway facility type.

Predictive Safety Analysis

A virtual model of the proposed Northern Connector alignment was constructed using the Interactive Highway Safety Design Model (IHSDM) software, developed and promulgated by the Federal Highway Administration. The software allows the model to reflect proposed geometric characteristics, intersections, traffic controls, cross-section elements, traffic volume, and many other features.

Model Development

Following are the inputs used for the Northern Connector IHSDM model:

- Horizontal Alignment. The horizontal alignment of the roadway was taken from draft 15% roadway plans prepared by Lyon Engineering (LE) and dated September 2017. The plans were supplemented by detailed curve data relating to every horizontal curve along the corridor. IHSDM can account for the bearing at the roadway termini and reflects the station locations of each curve's point of curvature (PC) and point of tangency (PT) as well as the radius and direction.

- Vertical Alignment. The vertical configuration was also taken from the draft 15% plans. The model accounts for the elevation at the terminus and the entry and exit slopes, curve lengths, and station locations of every crest and sag vertical curve along the project limits.

- General Characteristics. The roadway was designated in the model with a collector classification, rural area type, and rolling terrain, reflecting the features of the facility.

- Design Speed. As discussed in the corridor's Design Concept Report (DCR), the Northern Connector is segmented according to design criteria. Design Criteria A apply in the western and eastern zones of the corridor, and Design Criteria B apply in the center zone. Design speed has been determined to be 40 mph in Design Criteria Zone A and 50 mph in Design Criteria Zone B.

- Posted Speed Limit. According to the DCR, the posted speed limit is anticipated to be 5 to 10 mph below the design speed. For safety modeling purposes, the speed limit is assumed to be 5 mph below the design speed; however, a sensitivity analysis showed that the changing the speed limit to 10 mph below the design speed would not affect the results of the IHSDM analysis.

- Traffic Volume. The amount of traffic using the roadway is a key input to the IHSDM model, since the number of crashes along a corridor tend to strongly correlate with traffic volume. Traffic volumes were determined as discussed earlier. The travel demand model provided traffic volume for the year 2040; this analysis year was used in the IHSDM model. Volumes were rounded to the nearest 100 vehicles per day (vpd). The modeled 2040 volumes on the Northern Connector range from 3300 to 5000 vpd, with a weighted average volume of about 4000 vpd.

- Cross Section. The cross section presented in the DCR was used as input in the IHSDM model. This cross section consists of one 12' travel lane in each direction, a 4' paved shoulder, a 4' graded shoulder, and a 4:1 cross-slope to the ditch line. The travel lanes and shoulders use a nominal 2% cross slope but are superelevated in horizontal curves according to AASHTO criteria.

- Intersection Configuration. It is envisioned that the roadway would be widened to provide left-turn lanes at key intersections. Most of the intersections along the corridor are very low-volume unpaved roadways that are unlikely to warrant left-turn lanes. However, a westbound left-turn lane was assumed approaching Williamson Valley Road and an eastbound left-turn lane was assumed approaching Reed Road. Each turn bay was assumed to be 300' long with a 150' taper, but the safety analysis is not sensitive to these dimensions.

- Roadside Hazard Rating. IHSDM requires a "Roadside Hazard Rating" to determine a crash prediction for a roadway segment. The Roadside Hazard Rating is assessed on a scale of 1 to 7. Rating 1 represents very wide clear zones of at least 30 feet and recoverable side slopes flatter than 1:4. Rating 7 represents clear zones less than 5 feet, non-recoverable side slopes of 1:2 or steeper, with high likelihood of severe injuries from a roadside collision. Based on a review of the proposed Northern Connector, a Roadside Hazard Rating of 2 was assumed. This rating perfectly matches the project's proposed 1:4 side slopes. Rating 2 is intended for roadways with 20 to 25 feet clear zones from the pavement edgeline. The Northern Connector has at least 16 feet of clear zone to the ditch line, including a 4' paved shoulder, 4' unpaved shoulder, and 8' side slope. It is likely that in much of the corridor the recoverable clear zone would exceed 16 feet based on topography, but in some fill sections the clear zone may be less than the 20 feet associated with Roadside Hazard Rating 2. However, Rating 2 is assumed to be more accurate for most of the corridor than Rating 3, which is associated with "marginally recoverable" side slopes as steep as 1:3, steeper than proposed on the Northern Connector.

- Driveway Density. A review of the existing parcel boundaries and access was conducted to determine the density of driveways in the different segments of the Northern Connector. The western portion of the corridor is intended to provide access to adjacent parcels, but there are few adjacent parcels, and the review determined a density of 2 driveways per mile. Very few driveways are located in the center segment; a density was assumed to be 1 driveway per mile. However, in the eastern segment, many parcels would front onto the Northern Connector and a review determined that there are about 11 driveways per mile. It should be noted that an intersecting roadway facility that provides access to a few parcels was considered a driveway for the purposes of the IHSDM analysis. This is true even if the roadway is publicly maintained and has, for instance, a street name. Such low-volume roadways are operationally more similar to driveways than streets.

- Side Street Characteristics. Existing streets that intersect the Northern Connector corridor were assumed to remain. The IHSDM model also includes new streets shown in the 2040 Travel Demand Model. The safety evaluation is not as sensitive to the features of side streets as to features on the Northern Connector itself. However, for modeling purposes, side streets were assumed to have 10'

travel lanes and a Roadside Hazard Rating of 4. They were coded with 25-mph design speeds and most were assumed to be stop-controlled where they intersect the Northern Connector. Some side streets were included in the CYMPO model; traffic volume on these side streets were taken from the model output, adjusted as discussed above. Side streets that were not included in the CYMPO model were assumed to have traffic volume of 250 vpd.

- Termini Characteristics. The traffic control at the western terminus of the Northern Connector assumes that the existing side-street-stop traffic control would remain. At this location, the Northern Connector is proposed to have lower traffic volume than Williamson Valley Road, so the side-street stop is logical for analysis purposes. Williamson Valley Road is coded with the existing 50-mph speed limit and an assumed 55-mph design speed. At the eastern terminus, the existing intersection with Reed Road uses all-way stop control. The IHSDM model assumes that this all-way stop control would remain. Reed Road is coded with its existing 40-mph speed limit and an assumed 45-mph design speed.

Evaluation Criteria

The following roadway features were evaluated using IHSDM to assess their safety impacts:

- Lane and shoulder width. While the total pavement width was assumed to be fixed at 32 feet wide, the position of the right edgeline can have safety consequences. Two options were considered: 12' travel lanes with 4' shoulders (as shown in the existing cross-section) and 11' lanes with 5' shoulders.

- Longitudinal rumble strips. Rumble strips are designated by FHWA as "proven safety countermeasures" because of their low cost but high value at preventing lane departure crashes. Rumble strips can be used on the right edge of a roadway, the centerline, or both.

- Yuma Road left-turn lanes. While most intersecting roadways along the Northern Connector are expected to carry very little traffic, even in 2040, the intersection with Yuma Road carries the highest cross traffic, with approximately 2100 vehicles per day north of the Northern Connector and 1300 vehicles per day to the south. In addition, this intersection is located in a part of the corridor with considerable horizontal curvature that might limit the view of approaching motorists to the presence of stopped vehicles ahead. As such, this intersection was evaluated to determine the safety benefit that would be achieved by providing mainline left-turn lanes in both directions.

IHSDM Limitations

IHSDM is based on the most current safety research available, but there remain gaps in the industry's understanding of a roadway's expected safety performance. As such, it was not possible to evaluate the following features of the corridor:

- Lighting. It is uncommon to install continuous roadway lighting in rural areas, and in fact it is so uncommon that there is insufficient safety data elsewhere in the U.S. to determine the impact of

lighting on a rural two-lane collector. Lighting evaluation in urban and suburban areas suggests that lighting can reduce a significant percentage of nighttime crashes, but it is not known if this trend would also be true of the Northern Connector.

- All-way-stop-controlled intersections. The existing intersection of Center Street and Reed Road, the future eastern terminus of the Northern Connector, is currently controlled with an all-way stop. IHSDM does not have enough safety data to make crash predictions about all-way-stop-controlled intersections. It is assumed that the intersection would continue to use this traffic control, and hence, no safety prediction is provided for this intersection.

- IHSDM can conduct a full Empirical Bayes analysis, which would account for existing crash data along a corridor. Because the Northern Connector does not yet exist and there is no existing relevant crash data, an Empirical Bayes analysis could not be undertaken, and the crash prediction is based entirely on non-site data.

Results

The base-case model is defined as the Northern Connector with lane and shoulder widths as shown in the DCR and no rumble strips. Results of the base-case model are presented in Table 1, and a detailed report is included as an Appendix.

The results show that the corridor is expected to experience about 102 crashes over the course of the 5-year analysis period, or about 20 crashes per year. The overall crash rate of 2.95 crashes per million vehicle-miles is in line with expectations for the facility type. By comparison, in 2016, ADOT roadways experienced an average crash rate of about 1.93 crashes per million vehicle miles.[1] However, this rate includes the much lower rates that are common on interstates and other divided highways. Crash rates on collector streets, such as the Northern Connector, are almost always higher than the statewide average rate. For example, in Massachusetts, a state where crash rate data is subdivided by functional classification, rural major collector streets have an average crash rate of 2.41 per million vehicle miles and rural minor collectors have an average rate of 4.40 per million vehicle miles.[2] Overall crash rates are lower in Massachusetts than in Arizona, but the crash rate on rural major collectors is approximately 1.6 times the statewide average, and the crash rate on rural minor collectors is approximately 3.0 times the statewide average. The rate on the Northern Connector is approximately 1.5 times the statewide average. With this context, the crash rate predicted on the Northern Connector is neither unusually high nor low.

[1] Arizona Motor Vehicle Crash Facts: 2016, Arizona Department of Transportation, Transportation Systems Management and Operations, Traffic Safety Section.
[2] Crash Rates by Roadway Functional Classification, Massachusetts Department of Transportation, 2014.

Table 1: Northern Connector Expected Highway Crash Rates and Frequencies

First Year of Analysis	2040
Last Year of Analysis	2044
Evaluated Length (mi)	4.7976
Average Future Road AADT (vpd)	3,954
Expected Crashes	
Total Crashes	102.27
Fatal and Injury Crashes	40.24
Property-Damage-Only Crashes	62.02
Percent of Total Expected Crashes	
Percent Fatal and Injury Crashes (%)	39
Percent Property-Damage-Only Crashes (%)	61
Expected Crash Rate	
Crash Rate (crashes/mi/yr)	4.2633
Fatal and Injury Crash Rate (crashes/mi/yr)	1.6777
Property-Damage-Only Crash Rate (crashes/mi/yr)	2.5856
Expected Travel Crash Rate	
Total Travel (million veh-mi)	34.62
Travel Crash Rate (crashes/million veh-mi)	2.95
Travel Fatal and Injury Crash Rate (crashes/million veh-mi)	1.16
Travel Property-Damage-Only Crash Rate (crashes/million veh-mi)	1.79

In the absence of local data, the predicted crashes are distributed by severity according to nationwide trends on two-way, two-lane rural roadways. Likewise, the predicted crashes are allocated to crash type according to national data.

11'-Lane-Width Case

The 11'-lane-width case is defined as the Northern Connector with the same conditions as in the base case, except that the edge stripes are moved 1 foot closer to the centerline. This has the effect of narrowing the travel lanes from 12' to 11' and widening the paved shoulders from 4' to 5'.

Reducing lane width from 12' to 11' can increase the likelihood of certain crash types, but increasing the shoulder width can provide a considerable safety benefit. IHSDM was used to determine whether the benefits of the wider shoulder are enough to offset the disadvantages of narrower travel lanes.

The IHSDM evaluation shows that the 11'-lane-width case, when accounting for the safety effects of both narrowed lanes and widened shoulders, is expected to operate with slightly degraded safety performance when compared to the base case. The difference between the two cases is less than one percent, amounting to less than one crash over the 5-year analysis period. However, based on the IHSDM results, the 11'-lane-width case does not appear to offer a quantitative safety advantage.

Rumble Strip Case

The rumble-strip case is defined as the 11'-lane-width case with the addition of shoulder and centerline rumble strips. The HSM shows that centerline rumble strips are expected to achieve a CMF of 0.94, applied to head-on, opposite-direction and sideswipe crashes.

The 11'-lane-width case was used to test rumble strips, rather than the base case, because some agencies limit the use of shoulder rumble strips to projects with paved shoulders wider than 4 feet. (Rumble strips on a narrow shoulder impede use of the shoulder by bicyclists.)

The IHSDM results trend in the same direction as the HSM. The addition of longitudinal rumble strips on the Northern Connector could be expected to reduce overall crashes by about 1 percent when compared to the base case, amounting to a reduction of about 1 crash in the 5-year analysis period.

A sensitivity analysis was also conducted to determine whether safety would improve if the lane widths reverted to the base case and the shoulder rumble strips were omitted but the centerline rumble strips remain. Indeed, this option performed slightly better than the Rumble Strip Case, reducing crashes by about an additional 1 percent.

Yuma Left-Turn Lanes Case

The Yuma Road left-turn-lanes case is defined as the base case with the addition of left-turn lanes approaching Yuma Road in both directions on the Northern Connector. The left-turn lanes were modeled as 12' wide for a length of 300 feet with a 150-foot taper in each direction, but the IHSDM model is not sensitive to the turn bay or taper length.

IHSDM shows that left-turn lanes approaching Yuma Road significantly reduce crashes at the intersection, an overall crash reduction of about 48 percent. The reduction at the Yuma intersection alone is expected to reduce the number of crashes at this intersection by about 9 during the 5-year analysis period.

Safety Recommendations

The IHSDM analysis leads to the following safety recommendations in the corridor:

- As part of project development, a left-turn lane should be considered on southbound Williamson Valley Road approaching the new Northern Connector alignment. The left-turning volume is not currently known, but it is probable that the intersection will warrant a left-turn lane due to the speed and volume on Williamson Valley Road and the increase in turning traffic at this intersection

after the Northern Connector is constructed. (It is possible that other traffic control measures at this intersection, such as a roundabout, may also be appropriate.) If a turn lane is constructed in just one direction on Williamson Valley Road, the through lanes should be tapered appropriately through the intersection to avoid an abrupt transition.

- Left-turn lanes are recommended on the Northern Connector in both directions approaching the Yuma Road intersection. IHSDM showed a significant safety benefit of left-turn lanes due to the intersection's geometric characteristics and expected traffic volume. In the base case, Yuma Road is expected to experience the most crashes of any intersection on the corridor (about four crashes per year), so this intersection stands to benefit most from the addition of dedicated space for left-turning vehicles. However, left-turn lanes should also be considered at other intersections with more than a trivial amount of traffic because of the safety benefits.

- While centerline rumble strips offer crash reduction potential, the characteristics of the Northern Connector are not ideally suited to their use. The roadway has a modest length of less than 5 miles and posted speeds are assumed to range from 35 to 45 mph, less than typical rural highways. Most importantly, the roadway passes through an area with residential development and where considerable additional development is likely in the future. ADOT's Traffic Guidelines and Processes No. 480 recommends against using rumble strips within 2000 feet of a residential structure. While Yavapai County is not required to comply with this ADOT guideline on the Northern Connector, compliance is advisable because noise complaints can occur when longitudinal rumble strips are installed too close to homes. The entire length of the Northern Connector is within 2000 feet of an existing residence, and it is likely that residential development will increase in the future. As such, centerline rumble strips are not currently recommended. However, it is recommended that rumble strips be considered as a future countermeasure if crash characteristics so warrant, particularly if a design can be developed that is less noise intensive.

- Shoulder rumble strips are also not recommended because of the residential nature of the corridor. ADOT TGP No. 480 also recommends against the use of shoulder rumble strips on paved shoulders less than 5 feet wide because of their impacts on bicycle traffic. Consequently, shoulder rumble strips are not recommended on the Northern Connector.

Closure

If further discussion of the above or attached information is required, or if the information provided herein is required to be provided in a different format, please don't hesitate to call us at your earliest convenience.

Respectfully submitted,

Jim C. Lee, PhD, P.E., PTOE
Attachments

Registered Professional Engineer (Civil)
CERTIFICATE NO. 18418
JIM C. LEE
Date Signed 11-22-20
ARIZONA, U.S.A.

Appendix

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

Base Case Model

November 9, 2017

Interactive Highway Safety Design Model

Crash Prediction Evaluation Report

November 9, 2017

Disclaimer

The Interactive Highway Design Model (IHSDM) software is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its content or use thereof. This document does not constitute a standard, specification, or regulation.

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Report Overview

Report Generated: Nov 9, 2017 11:29 AM
Report Template: System: Multi-Page, 508 Compliant [System] (mlcpm4, Oct 5, 2017 2:10 PM)

Evaluation Date: Thu Nov 09 11:29:33 MST 2017
IHSDM Version: v13.0.0 (Sep 13, 2017)
Crash Prediction Module: v8.0.0 (Sep 13, 2017)

User Name: rdittberner
Organization Name:
Phone:
E-Mail:

Project Title: YCNC
Project Comment: Created Mon Oct 30 10:35:22 MST 2017
Project Unit System: U.S. Customary

Highway Title: Northern Connector
Highway Comment: Created Mon Oct 30 10:35:32 MST 2017
Highway Version: 1

Evaluation Title: Base Case
Evaluation Comment: Created Thu Nov 09 11:29:09 MST 2017

Minimum Station: 10+00.000
Maximum Station: 263+31.130
Policy for Superelevation: AASHTO 2011 U.S. Customary
Calibration: HSM Configuration
Crash Distribution: HSM Configuration
Model/CMF: HSM Configuration
Empirical-Bayes Analysis: None
First Year of Analysis: 2040
Last Year of Analysis: 2044

Section 1 Evaluation

Section: Section 1
Evaluation Start Location: 10+00.000
Evaluation End Location: 263+31.130
Area Type: Rural
Functional Class: Collector
Type of Alignment: Undivided, Two Lane
Model Category: Rural, Two Lane
Calibration Factor: 2U=1.0; 3ST=1.0; 4ST=1.0;

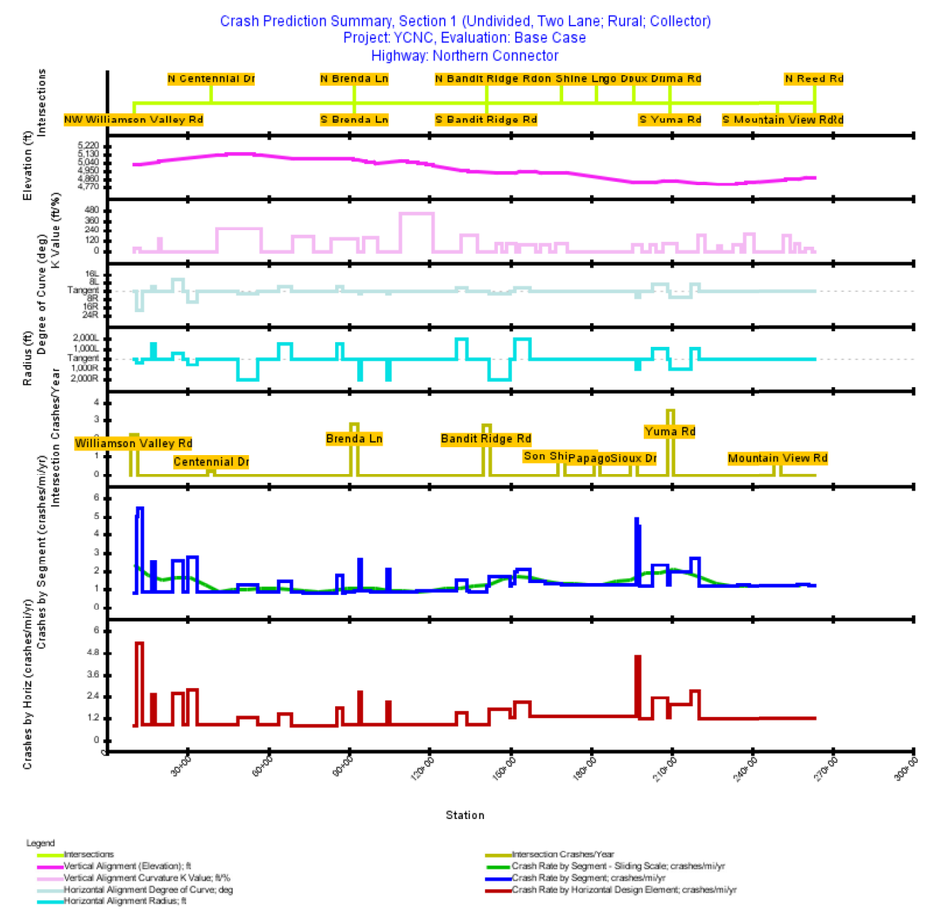

Figure 1. Crash Prediction Summary (Section 1)

Table 1. Evaluation Highway - Homogeneous Segments (Section 1)

Seg. No.	Type	Start Location	End Location	Length (ft)	Length(mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Hazard Rating	Centerline Rumble Strip	Pasing Lanes	TWLT Lane	Lighting	Automated Speed Enforcement	Radius (ft)	Superelevation (%)	Adverse	Deign Sped (mph)
1	2U	10+00.000	18+84.320	84.32	0.0160	2040-2044: 3,300	12.00	12.00	16.00	16.00	2.00	2.0	2	false	0	false	false	false				
2	2U	10+84.320	11+42.000	57.68	0.0109	2040-2044: 3,300	12.00	12.00	16.00	16.00	2.00	2.0	2	false	0	false	false	false	300.00	2.0	true	40
3	2U	11+42.000	13+00.000	158.00	0.0299	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.83	2.0	2	false	0	false	false	false	300.00	2.0	true	40
4	2U	13+00.000	13+12.240	12.24	0.0023	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.83	2.0	2	false	0	false	false	false	300.00	2.0	true	40
5	2U	13+12.240	14+50.000	137.76	0.0261	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.83	2.0	2	false	0	false	false	false				
6	2U	14+50.000	16+87.910	237.91	0.0451	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.83	2.0	2	false	0	false	false	false				
7	2U	16+87.910	18+11.950	124.04	0.0235	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.83	2.0	2	false	0	false	false	false	1,500.00	2.0	true	40
8	2U	18+11.950	19+61.360	149.41	0.0283	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.83	2.0	2	false	0	false	false	false				
9	2U	19+61.360	24+66.210	504.85	0.0956	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.17	2.0	2	false	0	false	false	false				
10	2U	24+66.210	28+33.850	367.64	0.0696	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.17	2.0	2	false	0	false	false	false	550.00	2.0	true	40
11	2U	28+33.850	30+26.730	192.88	0.0365	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.17	2.0	2	false	0	false	false	false				
12	2U	30+26.730	33+54.000	327.27	0.0620	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.17	2.0	2	false	0	false	false	false	550.00	2.0	true	40
13	2U	33+54.000	42+00.000	846.00	0.1602	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.17	2.0	2	false	0	false	false	false				
14	2U	42+00.000	44+77.080	677.08	0.1282	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.17	1.0	2	false	0	false	false	false				
15	2U	48+77.080	49+30.000	52.92	0.0100	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.17	1.0	2	false	0	false	false	false	2,000.00	2.0	true	50
16	2U	49+30.000	55+91.760	661.76	0.1253	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.04	1.0	2	false	0	false	false	false	2,000.00	2.0	true	50
17	2U	55+91.760	63+65.880	774.12	0.1466	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.04	1.0	2	false	0	false	false	false				
18	2U	63+65.880	68+60.310	494.43	0.0936	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.04	1.0	2	false	0	false	false	false	1,500.00	2.0	true	50
19	2U	68+60.310	73+00.000	439.69	0.0833	2040-2044: 3,300	12.00	12.00	16.00	16.00	3.04	1.0	2	false	0	false	false	false				
20	2U	73+00.000	85+43.110	1,243.11	0.2354	2040-2044: 3,300	12.00	12.00	16.00	16.00	1.32	1.0	2	false	0	false	false	false				
21	2U	85+43.110	87+55.750	212.64	0.0403	2040-2044: 3,300	12.00	12.00	16.00	16.00	1.32	1.0	2	false	0	false	false	false	1,500.00	2.0	true	50
22	2U	87+55.750	88+50.000	94.25	0.0179	2040-2044: 3,300	12.00	12.00	16.00	16.00	1.32	1.0	2	false	0	false	false	false				
23	2U	88+50.000	92+00.000	350.00	0.0663	2040-2044: 3,300	12.00	12.00	16.00	16.00	5.56	1.0	2	false	0	false	false	false				
24	2U	92+00.000	93+66.700	166.70	0.0316	2040-2044: 3,600	12.00	12.00	16.00	16.00	5.56	1.0	2	false	0	false	false	false				
25	2U	93+66.700	94+61.040	94.34	0.0179	2040-2044: 3,600	12.00	12.00	16.00	16.00	5.56	1.0	2	false	0	false	false	false	2,000.00	2.0	true	50
26	2U	94+61.040	98+00.720	339.68	0.0643	2040-2044: 3,600	12.00	12.00	16.00	16.00	5.56	1.0	2	false	0	false	false	false				
27	2U	98+00.720	104+08.250	607.53	0.1151	2040-2044: 3,600	12.00	12.00	16.00	16.00	2.49	1.0	2	false	0	false	false	false				
28	2U	104+08.250	105+39.600	131.35	0.0249	2040-2044: 3,600	12.00	12.00	16.00	16.00	2.49	1.0	2	false	0	false	false	false	2,000.00	2.0	true	50
29	2U	105+39.600	115+50.000	1,010.40	0.1914	2040-2044: 3,600	12.00	12.00	16.00	16.00	2.49	1.0	2	false	0	false	false	false				
30	2U	115+50.000	129+90.300	1,440.30	0.2728	2040-2044: 3,600	12.00	12.00	16.00	16.00	5.16	1.0	2	false	0	false	false	false				
31	2U	129+90.300	133+95.140	404.84	0.0767	2040-2044: 3,600	12.00	12.00	16.00	16.00	5.16	1.0	2	false	0	false	false	false	2,000.00	2.0	true	50
32	2U	133+95.140	134+70.000	74.86	0.0142	2040-2044: 3,600	12.00	12.00	16.00	16.00	5.16	1.0	2	false	0	false	false	false				
33	2U	134+70.000	141+25.000	655.00	0.1240	2040-2044: 3,600	12.00	12.00	16.00	16.00	1.87	1.0	2	false	0	false	false	false				
34	2U	141+25.000	142+21.690	96.69	0.0183	2040-2044: 5,000	12.00	12.00	16.00	16.00	1.87	1.0	2	false	0	false	false	false				
35	2U	142+21.690	145+84.210	362.52	0.0687	2040-2044: 5,000	12.00	12.00	16.00	16.00	1.87	1.0	2	false	0	false	false	false	2,000.00	2.0	true	50
36	2U	145+84.210	149+85.940	401.73	0.0761	2040-2044: 5,000	12.00	12.00	16.00	16.00	0.48	1.0	2	false	0	false	false	false	2,000.00	2.0	true	50
37	2U	149+85.940	150+50.000	64.06	0.0121	2040-2044: 5,000	12.00	12.00	16.00	16.00	0.48	1.0	2	false	0	false	false	false				
38	2U	150+50.000	151+66.130	116.13	0.0220	2040-2044: 5,000	12.00	12.00	16.00	16.00	4.27	1.0	2	false	0	false	false	false				
39	2U	151+66.130	152+50.000	83.87	0.0159	2040-2044: 5,000	12.00	12.00	16.00	16.00	4.27	1.0	2	false	0	false	false	false	2,000.00	2.0	true	50
40	2U	152+50.000	156+50.000	400.00	0.0758	2040-2044: 5,000	12.00	12.00	16.00	16.00	4.27	11.0	2	false	0	false	false	false	2,000.00	2.0	true	40

Seg. No.	Type	Start Location	End Location	Length (ft)	Length(mi)	AADT	Left Lane Width (ft)	Right Lane Width (ft)	Left Shoulder Width (ft)	Right Shoulder Width (ft)	Grade (%)	Driveway Density (driveways/mi)	Hazard Rating	Centerline Rumble Strip	Pasing Lanes	TWLT Lane	Lighting	Automated Speed Enforcement	Radius (ft)	Superelevation (%)	Adverse	Design Speed (mph)
41	2U	156+50.000	157+19.670	69.67	0.0132	2040-2044: 5,000	12.00	12.00	16.00	16.00	3.54	11.0	2	false	0	false	false	false	2,000.00	2.0	true	40
42	2U	157+19.670	163+00.000	580.33	0.1099	2040-2044: 5,000	12.00	12.00	16.00	16.00	3.54	11.0	2	false	0	false	false	false				
43	2U	163+00.000	169+00.000	600.00	0.1136	2040-2044: 5,000	12.00	12.00	16.00	16.00	0.83	11.0	2	false	0	false	false	false				
44	2U	169+00.000	196+62.210	2,762.21	0.5232	2040-2044: 4,400	12.00	12.00	16.00	16.00	4.01	11.0	2	false	0	false	false	false				
45	2U	196+62.210	197+00.000	37.79	0.0072	2040-2044: 4,400	12.00	12.00	16.00	16.00	4.01	11.0	2	false	0	false	false	false	1,000.00	2.0	true	40
46	2U	197+00.000	197+92.720	92.72	0.0176	2040-2044: 4,400	12.00	12.00	16.00	16.00	0.80	11.0	2	false	0	false	false	false	1,000.00	2.0	true	40
47	2U	197+92.720	202+65.740	473.02	0.0896	2040-2044: 4,400	12.00	12.00	16.00	16.00	0.80	11.0	2	false	0	false	false	false				
48	2U	202+65.740	203+00.000	34.26	0.0065	2040-2044: 4,400	12.00	12.00	16.00	16.00	0.80	11.0	2	false	0	false	false	false	1,000.00	2.0	true	40
49	2U	203+00.000	208+44.660	544.66	0.1032	2040-2044: 4,400	12.00	12.00	16.00	16.00	3.32	11.0	2	false	0	false	false	false	1,000.00	2.0	true	40
50	2U	208+44.660	209+50.000	105.34	0.0199	2040-2044: 4,400	12.00	12.00	16.00	16.00	3.32	11.0	2	false	0	false	false	false				
51	2U	209+50.000	217+22.310	772.31	0.1463	2040-2044: 4,400	12.00	12.00	16.00	16.00	2.98	11.0	2	false	0	false	false	false	1,000.00	2.0	true	40
52	2U	217+22.310	220+32.690	310.38	0.0588	2040-2044: 4,400	12.00	12.00	16.00	16.00	2.98	11.0	2	false	0	false	false	false	1,000.00	2.0	true	40
53	2U	220+32.690	220+90.000	57.31	0.0109	2040-2044: 4,400	12.00	12.00	16.00	16.00	2.98	11.0	2	false	0	false	false	false				
54	2U	220+90.000	227+60.000	670.00	0.1269	2040-2044: 4,400	12.00	12.00	16.00	16.00	1.64	11.0	2	false	0	false	false	false				
55	2U	227+60.000	234+20.000	660.00	0.1250	2040-2044: 4,400	12.00	12.00	16.00	16.00	0.61	11.0	2	false	0	false	false	false				
56	2U	234+20.000	238+80.000	460.00	0.0871	2040-2044: 4,400	12.00	12.00	16.00	16.00	4.13	11.0	2	false	0	false	false	false				
57	2U	238+80.000	253+00.000	1,420.00	0.2689	2040-2044: 4,400	12.00	12.00	16.00	16.00	2.43	11.0	2	false	0	false	false	false				
58	2U	253+00.000	257+00.000	400.00	0.0758	2040-2044: 4,400	12.00	12.00	16.00	16.00	1.12	11.0	2	false	0	false	false	false				
59	2U	257+00.000	258+81.130	181.13	0.0343	2040-2044: 4,400	12.00	12.00	16.00	16.00	3.19	11.0	2	false	0	false	false	false				
60	2U	258+81.130	260+31.130	150.00	0.0284	2040-2044: 4,400	12.00	12.00	16.00	16.00	3.19	11.0	2	false	0	false	false	false				
61	2U	260+31.130	260+20.000	88.87	0.0168	2040-2044: 4,400	12.00	12.00	16.00	16.00	3.19	11.0	2	false	0	false	false	false				
62	2U	261+20.000	263+31.130	211.13	0.0400	2040-2044: 4,400	12.00	12.00	16.00	16.00	2.44	11.0	2	false	0	false	false	false				

Table 2. Evaluation Intersection - Section 1

Inter. No.	Title	Location	Major AADT	Minor AADT	Legs	Traffic Control	Intersection Type	Major road approaches w/Left Turn Lanes	Major road approaches w/Right Turn Lanes	Skew1	Skew2	Lighted at Night
1	Williamson Valley Rd	10+00.000	2040-2044: 4,800	2040-2044: 3,300	3	Stop-Controlled	Three-Legged w/STOP control	0	0	0.25		false
2	Centennial Dr	38+75.000	2040-2044: 3,300	2040-2044: 50	3	Stop-Controlled	Three-Legged w/STOP control	0	0	4.37		false
3	Brenda Ln	92+00.000	2040-2044: 3,600	2040-2044: 2,100	4	Stop-Controlled	Four-Legged w/STOP control	0	0	2.17	2.17	false
4	Bandit Ridge Rd	141+25.000	2040-2044: 5,000	2040-2044: 1,400	4	Stop-Controlled	Four-Legged w/STOP control	0	0	7.30	7.30	false
5	Son Shine Ln	169+00.000	2040-2044: 5,000	2040-2044: 400	3	Stop-Controlled	Three-Legged w/STOP control	0	0	1.26		false
6	Papago Dr	182+25.000	2040-2044: 4,400	2040-2044: 250	3	Stop-Controlled	Three-Legged w/STOP control	0	0	1.26		false
7	Sioux Dr	195+75.000	2040-2044: 4,400	2040-2044: 250	3	Stop-Controlled	Three-Legged w/STOP control	0	0	1.26		false
8	Yuma Rd	209+50.000	2040-2044: 4,400	2040-2044: 2,100	4	Stop-Controlled	Four-Legged w/STOP control	0	0	26.95	26.37	false
9	Mountain View Rd	249+75.000	2040-2044: 4,400	2040-2044: 250	3	Stop-Controlled	Three-Legged w/STOP control	0	0	0.47		false
10	Reed Rd	263+31.127	2040-2044: 4,400	2040-2044: 1,900	3	All-Way Stop	Unknown	1	0			false

Table 3. Expected Highway Crash Rates and Frequencies (Section 1)

First Year of Analysis	2040
Last Year of Analysis	2044
Evaluated Length (mi)	4.7976
Average Future Road AADT (vpd)	3,954
Expected Crashes	
Total Crashes	102.27
Fatal and Injury Crashes	40.24
Property-Damage-Only Crashes	62.02
Percent of Total Expected Crashes	
Percent Fatal and Injury Crashes (%)	39
Percent Property-Damage-Only Crashes (%)	61
Expected Crash Rate	
Crash Rate (crashes/mi/yr)	4.2633
Fatal and Injury Crash Rate (crashes/mi/yr)	1.6777
Property-Damage-Only Crash Rate (crashes/mi/yr)	2.5856
Expected Travel Crash Rate	
Total Travel (million veh-mi)	34.62
Travel Crash Rate (crashes/million veh-mi)	2.95
Travel Fatal and Injury Crash Rate (crashes/million veh-mi)	1.16
Travel Property-Damage-Only Crash Rate (crashes/million veh-mi)	1.79

Table 4. Expected Crash Frequencies and Rates by Highway Segment (Section 1)

Segment Number/Intersection Name/Cross Road	Start Location	End Location	Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)	Expected No. Crashes/Year (crashes/million veh)	Expected Crash Rate (crashes/yr)
Williamson Valley Rd	10+00.000			11.208			1.07	2.2416
1	10+00.000	10+84.320	0.0160	0.061	0.7673	0.64		
2	10+84.320	11+42.000	0.0109	0.272	4.9828	4.14		
3	11+42.000	13+00.000	0.0299	0.820	5.4811	4.55		
4	13+00.000	13+12.240	0.0023	0.064	5.4811	4.55		
5	13+12.240	14+50.000	0.0261	0.110	0.8440	0.70		
6	14+50.000	16+87.910	0.0451	0.190	0.8440	0.70		
7	16+87.910	18+11.950	0.0235	0.293	2.4958	2.07		
8	18+11.950	19+61.360	0.0283	0.119	0.8440	0.70		
9	19+61.360	24+66.210	0.0956	0.404	0.8440	0.70		

Segment Number/Intersection Name/Cross Road	Start Location	End Location	Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)	Expected No. Crashes/Year (crashes/million veh)	Expected Crash Rate (crashes/yr)
10	24+66.210	28+33.850	0.0696	0.894	2.5678	2.13		
11	28+33.850	30+26.730	0.0365	0.154	0.8440	0.70		
12	30+26.730	33+54.000	0.0620	0.852	2.7498	2.28		
13	33+54.000	42+00.000	0.1602	0.676	0.8440	0.70		
Centennial Dr	38+75.000			1.088			0.18	0.2176
14	42+00.000	48+77.080	0.1282	0.541	0.8440	0.70		
15	48+77.080	49+30.000	0.0100	0.061	1.2225	1.01		
16	49+30.000	55+91.760	0.1253	0.766	1.2225	1.01		
17	55+91.760	63+65.880	0.1466	0.619	0.8440	0.70		
18	63+65.880	68+60.310	0.0936	0.674	1.4390	1.20		
19	68+60.310	73+00.000	0.0833	0.351	0.8440	0.70		
20	73+00.000	85+43.110	0.2354	0.903	0.7673	0.64		
21	85+43.110	87+55.750	0.0403	0.357	1.7749	1.47		
22	87+55.750	88+50.000	0.0179	0.069	0.7673	0.64		
23	88+50.000	92+00.000	0.0663	0.280	0.8440	0.70		
Brenda Ln	92+00.000			14.022			1.69	2.8045
24	92+00.000	93+66.700	0.0316	0.145	0.9207	0.70		
25	93+66.700	94+61.040	0.0179	0.237	2.6490	2.02		
26	94+61.040	98+00.720	0.0643	0.296	0.9207	0.70		
27	98+00.720	104+08.250	0.1151	0.482	0.8370	0.64		
28	104+08.250	105+39.600	0.0249	0.258	2.0763	1.58		
29	105+39.600	115+50.000	0.1914	0.801	0.8370	0.64		
30	115+50.000	129+90.300	0.2728	1.256	0.9207	0.70		
31	129+90.300	133+95.140	0.0767	0.574	1.4974	1.14		
32	133+95.140	134+70.000	0.0142	0.065	0.9207	0.70		
33	134+70.000	141+25.000	0.1241	0.519	0.8370	0.64		
Bandit Ridge Rd	141+25.000			13.710			1.32	2.7420
34	141+25.000	142+21.690	0.0183	0.106	1.1625	0.64		
35	142+21.690	145+84.210	0.0687	0.572	1.6663	0.91		
36	145+84.210	149+85.940	0.0761	0.634	1.6663	0.91		
37	149+85.940	150+50.000	0.0121	0.070	1.1625	0.64		
38	150+50.000	151+66.130	0.0220	0.141	1.2788	0.70		
39	151+66.130	152+50.000	0.0159	0.154	1.9388	1.06		
40	152+50.000	156+50.000	0.0758	0.797	2.1037	1.15		
41	156+50.000	157+19.670	0.0132	0.139	2.1037	1.15		
42	157+19.670	163+00.000	0.1099	0.790	1.4372	0.79		
43	163+00.000	169+00.000	0.1136	0.742	1.3066	0.72		
Son Shine Ln	169+00.000			4.133			0.46	0.8265
44	169+00.000	196+62.210	0.5231	3.336	1.2754	0.79		
Papago Dr	182+25.000			2.967			0.36	0.5934
Sioux Dr	195+75.000			2.967			0.36	0.5934
45	196+62.210	197+00.000	0.0072	0.175	4.8922	3.05		
46	197+00.000	197+92.720	0.0176	0.391	4.4475	2.77		
47	197+92.720	202+65.740	0.0896	0.519	1.1595	0.72		
48	202+65.740	203+00.000	0.0065	0.069	2.1163	1.32		
49	203+00.000	208+44.660	0.1032	1.201	2.3279	1.45		
50	208+44.660	209+50.000	0.0200	0.127	1.2754	0.79		
Yuma Rd	209+50.000			18.054			1.62	3.6107
51	209+50.000	217+22.310	0.1463	1.423	1.9462	1.21		
52	217+22.310	220+32.690	0.0588	0.795	2.7033	1.68		

Segment Number/Intersection Name/Cross Road	Start Location	End Location	Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)	Expected No. Crashes/Year (crashes/million veh)	Expected Crash Rate (crashes/yr)
53	220+32.690	220+90.000	0.0109	0.063	1.1595	0.72		
54	220+90.000	227+60.000	0.1269	0.736	1.1595	0.72		
55	227+60.000	234+20.000	0.1250	0.725	1.1595	0.72		
56	234+20.000	238+80.000	0.0871	0.556	1.2754	0.79		
57	238+80.000	253+00.000	0.2689	1.559	1.1595	0.72		
Mountain View Rd	249+75.000			2.958			0.36	0.5915
58	253+00.000	257+00.000	0.0758	0.439	1.1595	0.72		
59	257+00.000	258+81.130	0.0343	0.219	1.2754	0.79		
60	258+81.130	260+31.130	0.0284	0.181	1.2754	0.79		
61	260+31.130	261+20.000	0.0168	0.107	1.2754	0.79		
62	261+20.000	263+31.130	0.0400	0.232	1.1595	0.72		

Table 5. Expected Crash Frequencies and Rates by Horizontal Design Element (Section 1)

Title	Start Location	End Location	Length (mi)	Expected No. Crashes for Evaluation Period	Crash Rate (crashes/mi/yr)	Travel Crash Rate (crashes/million veh-mi)
Tangent	10+00.000	10+84.320	0.0160	0.061	0.7673	0.64
Simple Curve 1	10+84.320	13+12.240	0.0432	1.156	5.3550	4.45
Tangent	13+12.240	16+87.910	0.0711	0.300	0.8440	0.70
Simple Curve 2	16+87.910	18+11.950	0.0235	0.293	2.4958	2.07
Tangent	18+11.950	24+66.210	0.1239	0.523	0.8440	0.70
Simple Curve 3	24+66.210	28+33.850	0.0696	0.894	2.5678	2.13
Tangent	28+33.850	30+26.730	0.0365	0.154	0.8440	0.70
Simple Curve 4	30+26.730	33+54.000	0.0620	0.852	2.7498	2.28
Tangent	33+54.000	48+77.080	0.2885	1.217	0.8440	0.70
Simple Curve 5	48+77.080	55+91.760	0.1354	0.827	1.2225	1.01
Tangent	55+91.760	63+65.880	0.1466	0.619	0.8440	0.70
Simple Curve 6	63+65.880	68+60.310	0.0936	0.674	1.4390	1.20
Tangent	68+60.310	85+43.110	0.3187	1.255	0.7873	0.65
Simple Curve 7	85+43.110	87+55.750	0.0403	0.357	1.7749	1.47
Tangent	87+55.750	93+66.700	0.1157	0.494	0.8531	0.69
Simple Curve 8	93+66.700	94+61.040	0.0179	0.237	2.6490	2.02
Tangent	94+61.040	104+08.250	0.1794	0.778	0.8670	0.66
Simple Curve 9	104+08.250	105+39.600	0.0249	0.258	2.0763	1.58
Tangent	105+39.600	129+90.300	0.4641	2.057	0.8862	0.67
Simple Curve 10	129+90.300	133+95.140	0.0767	0.574	1.4974	1.14
Tangent	133+95.140	142+21.690	0.1565	0.691	0.8827	0.64
Simple Curve 11	142+21.690	149+85.940	0.1447	1.206	1.6663	0.91
Tangent	149+85.940	151+66.130	0.0341	0.211	1.2375	0.68
Simple Curve 12	151+66.130	157+19.670	0.1048	1.090	2.0787	1.14
Tangent	157+19.670	196+62.210	0.7467	4.868	1.3040	0.78
Simple Curve 13	196+62.210	197+92.720	0.0247	0.566	4.5762	2.85
Tangent	197+92.720	202+65.740	0.0896	0.519	1.1595	0.72
Simple Curve 14	202+65.740	208+44.660	0.1096	1.269	2.3154	1.44
Tangent	208+44.660	209+49.700	0.0199	0.127	1.2754	0.79
Simple Curve 15	209+49.700	217+22.310	0.1463	1.424	1.9459	1.21
Simple Curve 16	217+22.310	220+32.690	0.0588	0.795	2.7033	1.68
Tangent	220+32.690	263+31.130	0.8141	4.816	1.1832	0.74

Table 6. Expected Segment Crash Type Distribution (Section 1)

Element Type	Crash Type	FI Crashes	Percent FI (%)	PDO Crashes	Percent PDO (%)	Total Crashes	Percent Total (%)
Highway Segment	Collision with Animal	0.38	0.4	3.89	3.8	3.77	3.7
Highway Segment	Collision with Bicycle	0.04	0.0	0.02	0.0	0.06	0.1
Highway Segment	Other Single-vehicle Collision	0.07	0.1	0.61	0.6	0.65	0.6
Highway Segment	Overturned	0.37	0.4	0.32	0.3	0.78	0.8
Highway Segment	Collision with Pedestrian	0.07	0.1	0.02	0.0	0.09	0.1
Highway Segment	Run Off Road	5.45	5.3	10.69	10.5	16.23	15.9
Highway Segment	Total Single Vehicle Crashes	6.38	6.3	15.55	15.2	21.59	21.2
Highway Segment	Angle Collision	1.01	1.0	1.52	1.5	2.65	2.6
Highway Segment	Head-on Collision	0.34	0.3	0.06	0.1	0.50	0.5
Highway Segment	Other Multiple-vehicle Collision	0.26	0.3	0.64	0.6	0.84	0.8
Highway Segment	Rear-end Collision	1.65	1.6	2.58	2.5	4.42	4.3
Highway Segment	Sideswipe	0.38	0.4	0.80	0.8	1.15	1.1
Highway Segment	Total Multiple Vehicle Crashes	3.64	3.6	5.61	5.5	9.57	9.4
Highway Segment	Total Highway Segment Crashes	10.02	9.8	21.16	20.7	31.16	30.5
Intersection	Collision with Animal	0.20	0.2	0.75	0.7	0.94	0.9
Intersection	Collision with Bicycle	0.03	0.0	0.04	0.0	0.07	0.1
Intersection	Other Single-vehicle Collision	0.20	0.2	0.56	0.5	0.57	0.6
Intersection	Overturned	0.35	0.3	0.21	0.2	0.56	0.5
Intersection	Collision with Pedestrian	0.03	0.0	0.04	0.0	0.07	0.1
Intersection	Run Off Road	4.38	4.3	7.41	7.3	11.76	11.5
Intersection	Total Single Vehicle Crashes	5.18	5.1	9.01	8.8	13.97	13.7
Intersection	Angle Collision	13.39	13.1	12.33	12.1	25.73	25.2
Intersection	Head-on Collision	2.04	2.0	1.12	1.1	3.15	3.1
Intersection	Other Multiple-vehicle Collision	1.35	1.3	1.45	1.4	2.85	2.8
Intersection	Rear-end Collision	6.88	6.7	11.26	11.0	18.12	17.8
Intersection	Sideswipe	1.40	1.4	5.69	5.6	7.08	6.9
Intersection	Total Multiple Vehicle Crashes	25.06	24.6	31.86	31.2	56.93	55.8
Intersection	Total Intersection Crashes	30.24	29.6	40.86	40.0	70.90	69.5
	Total Crashes	40.26	39.5	62.02	60.8	102.06	100.0

Note: *Fatal and Injury Crashes* and *Property Damage Only Crashes* do not necessarily sum up to *Total Crashes* because the distribution of these three crashes had been derived independently.

Table 7. Evaluation Message

Start Location	End Location	Message
263+31.127	263+31.127	for intersection #10 (263+31.127 to 263+31.127), The intersection Reed Rd (vl) is an all-way stop controlled intersection which is unsupported, no intersection crash prediction computed.

Appendix E

Waters of the US Preliminary Determination Information

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NATIONWIDE PERMIT NUMBER 14

LINEAR TRANSPORTATION PROJECTS

US Army Corps of Engineers
Los Angeles District
Regulatory Division/Arizona Branch

A. General Information

This document is an aid to understanding the terms and conditions of your nationwide permit (NWP) by bringing together information issued separately in; (1) the Federal Register (82 FR 1860-2008)*, (2) the Special Public Notice for NWP "Reissuance of the Nationwide Permits and Issuance of Final Regional Conditions for the Los Angeles District"*, and (3) the Clean Water Act Section 401 water quality certification decisions (401 WQCs)* issued by the White Mountain Apache Tribe, Hopi Tribe, Hualapai Tribe, Navajo Nation, U.S. Environmental Protection Agency, and Arizona Department of Environmental Quality. Please note that website addresses enclosed herein may have been changed and updated since publication of the original document.

1) Pursuant to Section 404 of the Clean Water Act (33 U.S.C. 1344) and/or Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. 401 et seq) the U.S. Army Corps of Engineers (Corps) published the "Issuance and Reissuance of Nationwide Permits" in the Federal Register (82 FR 1860-2008) on January 6, 2017. These NWPs are in effect from March 19, 2017 through March 18, 2022 unless modified, reissued, or revoked before that time. It is incumbent upon the permittee to remain informed of changes to the NWPs.
2) The Los Angeles District of the Corps issued a Special Public Notice (March 22, 2017) announcing final regional conditions for NWPs to ensure protection of high value waters within the State of Arizona.
3) The Los Angeles District of the Corps requested and obtained for the entire State of Arizona the 401 WQC decision for all NWPs on all tribal lands from the White Mountain Apache Tribe, Hopi Tribe, Hualapai Tribe, Navajo Nation, and U.S. Environmental Protection Agency and on all non-tribal lands from the Arizona Department of Environmental Quality.

A description of all NWPs and 401 WQCs can be found in the "Nationwide Permits for Arizona" Special Public Notice.*

***Note:** The Federal Register can be accessed at https://www.gpo.gov/fdsys/pkg/FR-2017-01-06/pdf/2016-31355.pdf

Key Sections:
B. Nationwide Permit Terms (page 1)
C. Nationwide Permit General Conditions (page 2)
D. District Engineer's Decision (page 7)
E. Nationwide Permit Regional Conditions (page 8)
F. 401 Water Quality Certifications (page 8)

B. Nationwide Permit Terms

14. Linear Transportation Projects. Activities required for crossings of waters of the United States associated with the construction, expansion, modification, or improvement of linear transportation projects (*e.g.,* roads, highways, railways, trails, airport runways, and taxiways) in waters of the United States. For linear transportation projects in non-tidal waters, the discharge cannot cause the loss of greater than 1/2-acre of waters of the United States. For linear transportation projects in tidal waters, the discharge cannot cause the loss of greater than 1/3-acre of waters of the United States. Any stream channel modification, including bank stabilization, is limited to the minimum necessary to construct or protect the linear transportation project; such modifications must be in the immediate vicinity of the project.

This NWP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to construct the linear transportation project. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. Temporary fills must be removed in their entirety and the affected areas returned to preconstruction elevations. The areas affected by temporary fills must be revegetated, as appropriate.

This NWP cannot be used to authorize non-linear features commonly associated with transportation projects, such as vehicle maintenance or storage buildings, parking lots, train stations, or aircraft hangars.

Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity if: **(1)** the loss of waters of the United States exceeds 1/10-acre; or **(2)** there is a discharge in a special aquatic site, including wetlands. (See general condition 32.) (Authorities: Sections 10 and 404)

Note 1: For linear transportation projects crossing a single waterbody more than one time at separate and distant locations, or multiple waterbodies at separate and distant locations, each crossing is considered a single and complete project for purposes of NWP authorization. Linear transportation projects must comply with 33 CFR 330.6(d).

Note 2: Some discharges for the construction of farm roads or forest roads, or temporary roads for moving mining equipment, may qualify for an exemption under section 404(f) of the Clean Water Act (see 33 CFR 323.4).

Note 3: For NWP 14 activities that require pre-construction notification, the PCN must include any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings that require Department of the Army authorization but do not require preconstruction notification (see paragraph (b) of general condition 32). The district engineer will evaluate the PCN in accordance with Section D, ''District Engineer's Decision.'' The district engineer may require mitigation to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see general condition 23).

C. Nationwide Permit General Conditions

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as applicable, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/ or Coastal Zone Management Act consistency for a NWP. Every person who may wish to obtain permit authorization under one or more NWPs, or who is currently relying on an existing or prior permit authorization under one or more NWPs, has been and is on notice that all of the provisions of 33 CFR 330.1 through 330.6 apply to every NWP authorization. Note especially 33 CFR 330.5 relating to the modification, suspension, or revocation of any NWP authorization.

1. Navigation. (a) No activity may cause more than a minimal adverse effect on navigation. **(b)** Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States. **(c)** The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. Aquatic Life Movements. No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species. If a bottomless culvert cannot be used, then the crossing should be designed and constructed to minimize adverse effects to aquatic life movements.

3. Spawning Areas. Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. Migratory Bird Breeding Areas. Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. Shellfish Beds. No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. Suitable Material. No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see Section 307 of the Clean Water Act).

7. Water Supply Intakes. No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. Adverse Effects from Impoundments. If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. Management of Water Flows. To the maximum extent practicable, the preconstruction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization, storm water management activities, and temporary and permanent road crossings, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the preconstruction course, condition, capacity, and location of open waters if it benefits the aquatic environment (*e.g.,* stream restoration or relocation activities).

10. Fills Within 100-Year Floodplains. The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. Equipment. Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. Soil Erosion and Sediment Controls. Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow, or during low tides.

13. Removal of Temporary Fills. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. Proper Maintenance. Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. Single and Complete Project. The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. Wild and Scenic Rivers. (a) No NWP activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a ''study river'' for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status. **(b)** If a proposed NWP activity will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a ''study river'' for possible inclusion in the system while the river is in an official study status, the permittee must submit a pre-construction notification (see general condition 32). The district engineer will coordinate the PCN with the Federal agency with direct management responsibility for that river. The permittee shall not begin the NWP activity until notified by the district engineer that the Federal agency with direct management responsibility for that river has determined in writing that the proposed NWP activity will not adversely affect the Wild and Scenic River designation or study status. **(c)** Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (*e.g.,* National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service). Information on these rivers is also available at: *http://www.rivers.gov/.*

17. Tribal Rights. No NWP activity may cause more than minimal adverse effects on tribal rights (including treaty rights), protected tribal resources, or tribal lands.

18. Endangered Species. (a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify the critical habitat of such species. No activity is authorized under any NWP which "may affect" a listed species or critical habitat, unless ESA section 7 consultation addressing the effects of the proposed activity has been completed. Direct effects are the immediate effects on listed species and critical habitat caused by the NWP activity. Indirect effects are those effects on listed species and critical habitat that are caused by the NWP activity and are later in time, but still are reasonably certain to occur. **(b)** Federal agencies should follow their own procedures for complying with the requirements of the ESA. If pre-construction notification is required for the proposed activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation has not been submitted, additional ESA section 7 consultation may be necessary for the activity and the respective federal agency would be responsible for fulfilling its obligation under section 7 of the ESA. **(c)** Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species or designated critical habitat, the pre-construction notification must include the name(s) of the endangered or threatened species that might be affected by the proposed activity or that utilize the designated critical habitat that might be affected by the proposed activity. The district engineer will determine whether the proposed activity "may affect" or will have "no effect" to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. In cases where the non-Federal applicant has identified listed species or critical habitat that might be affected or is in the vicinity of the activity, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification that the proposed activity will have "no effect" on listed species or critical habitat, or until ESA section 7 consultation has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps. **(d)** As a result of formal or informal consultation with the FWS or NMFS the district engineer may add species-specific permit conditions to the NWPs. **(e)** Authorization of an activity by an NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the FWS or the NMFS, the Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word "harm" in the definition of "take" means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering. **(f)** If the non-federal permittee has a valid ESA section 10(a)(1)(B) incidental take permit with an approved Habitat Conservation Plan for a project or a group of projects that includes the proposed NWP activity, the non-federal applicant should provide a copy of that ESA section 10(a)(1)(B) permit with the PCN required by paragraph (c) of this general condition. The district engineer will coordinate with the agency that issued the ESA section 10(a)(1)(B) permit to determine whether the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation conducted for the ESA section 10(a)(1)(B) permit. If that coordination results in concurrence from the agency that the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation for the ESA section 10(a)(1)(B) permit, the district engineer does not need to conduct a separate ESA section 7 consultation for the proposed NWP activity. The district engineer will notify the non-federal applicant within 45 days of receipt of a complete pre-construction notification whether the ESA section 10(a)(1)(B) permit covers the proposed NWP activity or whether additional ESA section 7 consultation is required. **(g)** Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the FWS and NMFS or their World Wide Web pages at http://www.fws.gov/ or http://www.fws.gov/ipac and http://www.nmfs.noaa.gov/pr/species/esa/ respectively. (Note: Arizona endangered species information is available at http://www.fws.gov/southwest/es/arizona/Threatened.htm#County List)

19. Migratory Birds and Bald and Golden Eagles. The permittee is responsible for ensuring their action complies with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The permittee is responsible for contacting appropriate local office of the U.S. Fish and Wildlife Service to determine applicable measures to reduce impacts to migratory birds or eagles, including whether "incidental take" permits are necessary and available under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act for a particular activity.

20. Historic Properties. (a) In cases where the district engineer determines that the activity may have the potential to cause effects to properties listed, or eligible for listing, in the National Register of Historic Places, the activity is not authorized, until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied. **(b)** Federal permittees should follow their own procedures for complying with the requirements of section 106 of the National Historic Preservation Act. If pre-construction notification is required for the proposed NWP activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation is not submitted, then additional consultation under section 106 may be necessary. The respective federal agency is responsible for fulfilling its obligation to comply with section 106. **(c)** Non-federal permittees must submit a pre-construction notification to the district engineer if the NWP activity might have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties might have the potential to be affected by the proposed NWP activity or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of, or potential for, the presence of historic properties can be sought from the State Historic Preservation Officer, Tribal Historic Preservation Officer, or designated tribal representative, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts, which may include background research, consultation, oral history interviews, sample field investigation, and field survey. Based on the information submitted in the PCN and these identification efforts, the district engineer shall determine whether the proposed NWP activity has the potential to cause effects on the historic properties. Section 106 consultation is not required when the district engineer determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR 800.3(a)). Section 106 consultation is required when the district engineer determines that the activity has the potential to cause effects on historic properties. The district engineer will conduct consultation with consulting parties identified under 36 CFR 800.2(c) when he or she makes any of the following effect determinations for the purposes of section 106 of the NHPA: no historic properties affected, no adverse effect, or adverse effect. Where the non-Federal applicant has identified historic properties on which the activity might have the potential to cause effects and so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects to historic properties or that NHPA section 106 consultation has been completed. **(d)** For non-

federal permittees, the district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA section 106 consultation is required. If NHPA section 106 consultation is required, the district engineer will notify the non-Federal applicant that he or she cannot begin the activity until section 106 consultation is completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps. **(e)** Prospective permittees should be aware that section 110k of the NHPA (54 U.S.C. 306113) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

21. Discovery of Previously Unknown Remains and Artifacts. . If you discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by this permit, you must immediately notify the district engineer of what you have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal, and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. Designated Critical Resource Waters. Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment, additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment. **(a)** Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, and 52 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters. **(b)** For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, 38, and 54, notification is required in accordance with general condition 32, for any activity proposed in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after it is determined that the impacts to the critical resource waters will be no more than minimal.

23. Mitigation. The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal: **(a)** The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site). **(b)** Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal. **(c)** Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse environmental effects of the proposed activity are no more than minimal, and provides an activity-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in only minimal adverse environmental effects. **(d)** For losses of streams or other open waters that require pre-construction notification, the district engineer may require compensatory mitigation to ensure that the activity results in no more than minimal adverse environmental effects. Compensatory mitigation for losses of streams should be provided, if practicable, through stream rehabilitation, enhancement, or preservation, since streams are difficult-to-replace resources (see 33 CFR 332.3(e)(3)). **(e)** Compensatory mitigation plans for NWP activities in or near streams or other open waters will normally include a requirement for the restoration or enhancement, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, the restoration or maintenance/protection of riparian areas may be the only compensatory mitigation required. Restored riparian areas should consist of native species. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to restore or maintain/protect a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or maintaining/protecting a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of minimization or compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses. **(f)** Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332. (1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in no more than minimal adverse environmental effects. For the NWPs, the preferred mechanism for providing compensatory mitigation is mitigation bank credits or in-lieu fee program credits (see 33 CFR 332.3(b)(2) and (3)). However, if an appropriate number and type of mitigation bank or in-lieu credits are not available at the time the PCN is submitted to the district engineer, the district engineer may approve the use of permittee-responsible mitigation. (2) The amount of compensatory mitigation required by the district engineer must be sufficient to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.1(e)(3)). (See also 33 CFR 332.3(f)). (3) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, aquatic resource restoration should be the first compensatory mitigation option considered for permittee-responsible mitigation. (4) If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4(c)(2) through (14) must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)). (5) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan only needs to address the baseline conditions at the impact site and the number of credits to be provided.(6) Compensatory mitigation requirements (e.g., resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan (see 33 CFR 332.4(c)(1)(ii)). **(g)** Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used

to authorize any NWP activity resulting in the loss of greater than 1/2-acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that an NWP activity already meeting the established acreage limits also satisfies the no more than minimal impact requirement for the NWPs. **(h)** Permittees may propose the use of mitigation banks, in-lieu fee programs, or permittee-responsible mitigation. When developing a compensatory mitigation proposal, the permittee must consider appropriate and practicable options consistent with the framework at 33 CFR 332.3(b). For activities resulting in the loss of marine or estuarine resources, permittee-responsible mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee-responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management. **(i)** Where certain functions and services of waters of the United States are permanently adversely affected by a regulated activity, such as discharges of dredged or fill material into waters of the United States that will convert a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse environmental effects of the activity to the no more than minimal level.

24. Safety of Impoundment Structures. To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. Water Quality. Where States and authorized Tribes, or EPA where applicable, have not previously certified compliance of an NWP with CWA section 401, individual 401 Water Quality Certification must be obtained or waived (see 33 CFR 330.4(c)). The district engineer or State or Tribe may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. Coastal Zone Management. In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). The district engineer or a State may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. Regional and Case-By-Case Conditions. The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. Use of Multiple Nationwide Permits. The use of more than one NWP for a single and complete project is prohibited, except when the acreage loss of waters of the United States authorized by the NWPs does not exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1/3-acre.

29. Transfer of Nationwide Permit Verifications. If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:

"When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below."

_____

(Transferee)

_____

(Date)

30. Compliance Certification. Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and implementation of any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include: **(a)** A statement that the authorized activity was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions; **(b)** A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and **(c)** The signature of the permittee certifying the completion of the activity and mitigation. The completed certification document must be submitted to the district engineer within 30 days of completion of the authorized activity or the implementation of any required compensatory mitigation, whichever occurs later.

31. <u>Activities Affecting Structures or Works Built by the United States</u>. If an NWP activity also requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers (USACE) federally authorized Civil Works project (a "USACE project"), the prospective permittee must submit a pre-construction notification. See paragraph (b)(10) of general condition 32. An activity that requires section 408 permission is not authorized by NWP until the appropriate Corps office issues the section 408 permission to alter, occupy, or use the USACE project, and the district engineer issues a written NWP verification.

32. <u>Pre-Construction Notification</u>. (a) <u>Timing</u>: Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to

request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either: (1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or (2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or are in the vicinity of the activity, or to notify the Corps pursuant to general condition 20 that the activity might have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is "no effect" on listed species or "no potential to cause effects" on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)) has been completed. Also, work cannot begin under NWPs 21, 49, or 50 until the permittee has received written approval from the Corps. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2). **(b) <u>Contents of Pre-Construction Notification</u>:** The PCN must be in writing and include the following information: (1) Name, address and telephone numbers of the prospective permittee; (2) Location of the proposed activity; (3) Identify the specific NWP or NWP(s) the prospective permittee wants to use to authorize the proposed activity; (4) A description of the proposed activity; the activity's purpose; direct and indirect adverse environmental effects the activity would cause, including the anticipated amount of loss of wetlands, other special aquatic sites, and other waters expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; a description of any proposed mitigation measures intended to reduce the adverse environmental effects caused by the proposed activity; and any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings for linear projects that require Department of the Army authorization but do not require pre-construction notification. The description of the proposed activity and any proposed mitigation measures should be sufficiently detailed to allow the district engineer to determine that the adverse environmental effects of the activity will be no more than minimal and to determine the need for compensatory mitigation or other mitigation measures. For single and complete linear projects, the PCN must include the quantity of anticipated losses of wetlands, other special aquatic sites, and other waters for each single and complete crossing of those wetlands, other special aquatic sites, and other waters. Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the activity and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans); (5) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial, intermittent, and ephemeral streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many wetlands, other special aquatic sites, and other waters. Furthermore, the 45 day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;(6) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining why the adverse environmental effects are no more than minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan. (7) For non-Federal permittees, if any listed species or designated critical habitat might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat, the PCN must include the name(s) of those endangered or threatened species that might be affected by the proposed activity or utilize the designated critical habitat that might be affected by the proposed activity. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with the Endangered Species Act; (8) For non-Federal permittees, if the NWP activity might have the potential to cause effects to a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, the PCN must state which historic property might have the potential to be affected by the proposed activity or include a vicinity map indicating the location of the historic property. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with section 106 of the National Historic Preservation Act; (9) For an activity that will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a "study river" for possible inclusion in the system while the river is in an official study status, the PCN must identify the Wild and Scenic River or the "study river" (see general condition 16); and (10) For an activity that requires permission from the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project, the pre-construction notification must include a statement confirming that the project proponent has submitted a written request for section 408 permission from the Corps office having jurisdiction over that USACE project. **(c) <u>Form of Pre-Construction Notification</u>:** The standard individual permit application form (Form ENG 4345) may be used, but the completed application form must clearly indicate that it is an NWP PCN and must include all of the applicable information required in paragraphs (b)(1) through (10) of this general condition. A letter containing the required information may also be used. Applicants may provide electronic files of PCNs and supporting materials if the district engineer has established tools and procedures for electronic submittals. **(d) <u>Agency Coordination</u>:** (1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity's compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the activity's adverse environmental effects so that they are no more than minimal. (2) Agency coordination is required for: (i) all NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States; (ii) NWP 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52 activities that require pre-construction notification and will result in the loss of greater than 300 linear feet of stream bed; (iii) NWP 13 activities in excess of 500 linear feet, fills greater than one cubic yard per running foot, or involve discharges of dredged or fill material into special aquatic sites; and (iv) NWP 54 activities in excess of 500 linear feet, or that extend into the waterbody more than 30 feet from the mean low water line in tidal waters or the ordinary high water mark in the Great Lakes. (3) When agency coordination is required, the district engineer will immediately provide (e.g., via e-mail, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (FWS, state natural resource or water quality agency, EPA, and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to notify the district engineer via telephone, facsimile transmission, or e-mail that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse environmental effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district

engineer will fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure the net adverse environmental effects of the proposed activity are no more than minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5. (4) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act. (5) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre-construction notifications to expedite agency coordination.

D. District Engineer's Decision

1. In reviewing the PCN for the proposed activity, the district engineer will determine whether the activity authorized by the NWP will result in more than minimal individual or cumulative adverse environmental effects or may be contrary to the public interest. If a project proponent requests authorization by a specific NWP, the district engineer should issue the NWP verification for that activity if it meets the terms and conditions of that NWP, unless he or she determines, after considering mitigation, that the proposed activity will result in more than minimal individual and cumulative adverse effects on the aquatic environment and other aspects of the public interest and exercises discretionary authority to require an individual permit for the proposed activity. For a linear project, this determination will include an evaluation of the individual crossings of waters of the United States to determine whether they individually satisfy the terms and conditions of the NWP(s), as well as the cumulative effects caused by all of the crossings authorized by NWP. If an applicant requests a waiver of the 300 linear foot limit on impacts to streams or of an otherwise applicable limit, as provided for in NWPs 13, 21, 29, 36, 39, 40, 42, 43, 44, 50, 51, 52, or 54, the district engineer will only grant the waiver upon a written determination that the NWP activity will result in only minimal individual and cumulative adverse environmental effects. For those NWPs that have a waivable 300 linear foot limit for losses of intermittent and ephemeral stream bed and a 1/2-acre limit (i.e., NWPs 21, 29, 39, 40, 42, 43, 44, 50, 51, and 52), the loss of intermittent and ephemeral stream bed, plus any other losses of jurisdictional waters and wetlands, cannot exceed 1/2-acre.

2. When making minimal adverse environmental effects determinations the district engineer will consider the direct and indirect effects caused by the NWP activity. He or she will also consider the cumulative adverse environmental effects caused by activities authorized by NWP and whether those cumulative adverse environmental effects are no more than minimal. The district engineer will also consider site specific factors, such as the environmental setting in the vicinity of the NWP activity, the type of resource that will be affected by the NWP activity, the functions provided by the aquatic resources that will be affected by the NWP activity, the degree or magnitude to which the aquatic resources perform those functions, the extent that aquatic resource functions will be lost as a result of the NWP activity (e.g., partial or complete loss), the duration of the adverse effects (temporary or permanent), the importance of the aquatic resource functions to the region (e.g., watershed or ecoregion), and mitigation required by the district engineer. If an appropriate functional or condition assessment method is available and practicable to use, that assessment method may be used by the district engineer to assist in the minimal adverse environmental effects determination. The district engineer may add case-specific special conditions to the NWP authorization to address site-specific environmental concerns.

3. If the proposed activity requires a PCN and will result in a loss of greater than 1/10-acre of wetlands, the prospective permittee should submit a mitigation proposal with the PCN. Applicants may also propose compensatory mitigation for NWP activities with smaller impacts, or for impacts to other types of waters (e.g., streams). The district engineer will consider any proposed compensatory mitigation or other mitigation measures the applicant has included in the proposal in determining whether the net adverse environmental effects of the proposed activity are no more than minimal. The compensatory mitigation proposal may be either conceptual or detailed. If the district engineer determines that the activity complies with the terms and conditions of the NWP and that the adverse environmental effects are no more than minimal, after considering mitigation, the district engineer will notify the permittee and include any activity-specific conditions in the NWP verification the district engineer deems necessary. Conditions for compensatory mitigation requirements must comply with the appropriate provisions at 33 CFR 332.3(k). The district engineer must approve the final mitigation plan before the permittee commences work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation. If the prospective permittee elects to submit a compensatory mitigation plan with the PCN, the district engineer will expeditiously review the proposed compensatory mitigation plan. The district engineer must review the proposed compensatory mitigation plan within 45 calendar days of receiving a complete PCN and determine whether the proposed mitigation would ensure the NWP activity results in no more than minimal adverse environmental effects. If the net adverse environmental effects of the NWP activity (after consideration of the mitigation proposal) are determined by the district engineer to be no more than minimal, the district engineer will provide a timely written response to the applicant. The response will state that the NWP activity can proceed under the terms and conditions of the NWP, including any activity-specific conditions added to the NWP authorization by the district engineer.

4. If the district engineer determines that the adverse environmental effects of the proposed activity are more than minimal, then the district engineer will notify the applicant either: **(a)** that the activity does not qualify for authorization under the NWP and instruct the applicant on the procedures to seek authorization under an individual permit; **(b)** that the activity is authorized under the NWP subject to the applicant's submission of a mitigation plan that would reduce the adverse environmental effects so that they are no more than minimal; or **(c)** that the activity is authorized under the NWP with specific modifications or conditions. Where the district engineer determines that mitigation is required to ensure no more than minimal adverse environmental effects, the activity will be authorized within the 45-day PCN period (unless additional time is required to comply with general conditions 18, 20, and/or 31, or to evaluate PCNs for activities authorized by NWPs 21, 49, and 50), with activity-specific conditions that state the mitigation requirements. The authorization will include the necessary conceptual or detailed mitigation plan or a requirement that the applicant submit a mitigation plan that would reduce the adverse environmental effects so that they are no more than minimal. When compensatory mitigation is required, no work in waters of the United States may occur until the district engineer has approved a specific mitigation plan or has determined that prior approval of a final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation.

E. Nationwide Permit Regional Conditions

Of the ten regional conditions effective within the Los Angeles District of the Corps, six apply to projects within Arizona (1-4, 9 and 10). The remaining four regional conditions apply to specific geographic areas, resources, or species not located in Arizona.

The following regional conditions must be complied with for any authorization by a NWP to be valid in the State of Arizona:

Regional Condition 1. For all activities in waters of the U.S. that are suitable habitat for federally listed fish species, including designated critical habitat for such species, the permittee shall design all new or substantially reconstructed linear transportation crossings (e.g. roads, highways, railways, trails, bridges, culverts) to ensure that the passage and/or spawning of fish is not hindered. In these areas, the permittee shall employ bridge designs that span the stream or river, including pier- or pile-supported spans, or designs that use a bottomless arch culvert with a natural stream bed, unless determined to be impracticable by the Corps.

Regional Condition 2. Nationwide Permits (NWP) 3, 7, 12-15, 17-19, 21, 23, 25, 29, 35, 36, or 39-46, 48-54 cannot be used to authorize structures, work, and/or the discharge of dredged or fill material that would result in the "loss" of wetlands, mudflats, vegetated shallows or riffle and pool complexes as defined at 40 CFR Part 230.40-45. The definition of "loss" for this regional condition is the same as the definition of "loss of waters of the United States" used for the Nationwide Permit Program. Furthermore, this regional condition applies only within the State of Arizona and within the Mojave and Sonoran (Colorado) desert regions of California. The desert regions in California are limited to four USGS Hydrologic Unit Code (HUC) accounting units (Lower Colorado -150301, Northern Mojave-180902, Southern Mojave- 181001, and Salton Sea-181002).

Regional Condition 3. When a pre-construction notification (PCN) is required, the appropriate U.S. Army Corps of Engineers (Corps) District shall be notified in accordance with General Condition 32 using either the South Pacific Division PCN Checklist or a signed application form (ENG Form 4345) with an attachment providing information on compliance with all of the General and Regional Conditions. The PCN Checklist and application form are available at: http://www.spl.usace.army.mil/Missions/Regulatory/PermitProcess.aspx. In addition, unless specifically waived by the Los Angeles District, the PCN shall include: **a)** A written statement describing how the activity has been designed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States; **b)** Drawings, including plan and cross-section views, clearly depicting the location, size and dimensions of the proposed activity as well as the location of delineated waters of the U.S. on the site. The drawings shall contain a title block, legend and scale, amount (in cubic yards) and area (in acres) of fill in Corps jurisdiction, including both permanent and temporary fills/structures. The ordinary high water mark or, if tidal waters, the mean high water mark and high tide line, should be shown (in feet), based on National Geodetic Vertical Datum (NGVD) or other appropriate referenced elevation. All drawings shall follow the Updated Map and Drawing Standards for the South Pacific Division Regulatory Program (Feb 2016), or most recent update (available at the South Pacific Division website at: http://www.spd.usace.army.mil/Missions/Regulatory/PublicNoticesandReferences.aspx); **c)** Numbered and dated pre-project color photographs showing a representative sample of waters proposed to be impacted on the project site, and all waters proposed to be avoided on and immediately adjacent to the project site. The compass angle and position of each photograph shall be documented on the plan-view drawing required in subpart b of this regional condition. **d)** Delineation of aquatic resources in accordance with the current Los Angeles District's Minimum Standards for Acceptance of Aquatic Resources Delineation Reports (available at: http://www.spl.usace.army.mil/Missions/Regulatory/Jurisdictional-Determination/).

Regional Condition 4. Submission of a PCN pursuant to General Condition 32 and Regional Condition 3 shall be required for specific regulated activities in the following locations: **a)** All perennial waterbodies and special aquatic sites throughout the Los Angeles District as well as intermittent waters within the State of Arizona for any regulated activity that would result in a loss of waters of the United States. The definition of "loss of waters of the United States" for this regional condition is the same as the definition used for the Nationwide Permit Program. **b)** All areas designated as Essential Fish Habitat (EFH) by the Pacific Fishery Management Council, and that would result in an adverse effect to EFH, in which case the PCN shall include an EFH assessment and extent of proposed impacts to EFH. EFH Assessment Guidance and other supporting information can be found at: http://www.westcoast.fisheries.noaa.gov/habitat/fish_habitat/efh_consultations_go.html. **c)** All watersheds in the Santa Monica Mountains in Los Angeles and Ventura counties bounded by Calleguas Creek on the west, by Highway 101 on the north and east, and by Sunset Boulevard and Pacific Ocean on the south. **d)** The Santa Clara River watershed in Los Angeles and Ventura counties, including but not limited to Aliso Canyon, Agua Dulce Canyon, Sand Canyon, Bouquet Canyon, Mint Canyon, South Fork of the Santa Clara River, San Francisquito Canyon, Castaic Creek, Piru Creek, Sespe Creek and the main-stem of the Santa Clara River. **e)** The Murrieta and Temecula Creek watersheds in Riverside County, California for any regulated activity that would result in a loss of waters of the U.S. The definition of "loss of waters of the United States" for this regional condition is the same as the definition used for the Nationwide Permit Program. **f)** All waterbodies designated by the Arizona Department of Environmental Quality as Outstanding Arizona Waters (OAWs), within 1600 meters (or 1 mile) upstream and/or 800 meters (1/2 mile) downstream of a designated OAW, and on tributaries to OAWs within 1600 meters of the OAW (see http://www.azdeq.gov/index.html). **g)** All waterbodies designated by the Arizona Department of Environmental Quality as 303(d)-impaired surface waters, within 1600 meters (or 1 mile) upstream and/or 800 meters (1/2 mile) downstream of a designated impaired surface water, and on tributaries to impaired waters within 1600 meters of the impaired water (see http://www.azdeq.gov/index.html).

Regional Condition 9. Any requests to waive the applicable linear foot limitations for NWPs 13, 21, 29, 39, 40 and 42, 43, 44, 51, 52, and 54, must include the following: **a)** A narrative description of the affected aquatic resource. This should include known information on: volume and duration of flow; the approximate length, width, and depth of the waterbody and characters observed associated with an Ordinary High Water Mark (e.g. bed and bank, wrack line, or scour marks) or Mean High Water Line; a description of the adjacent vegetation community and a statement regarding the wetland status of the associated vegetation community (i.e. wetland, non- wetland); surrounding land use; water quality; issues related to cumulative impacts in the watershed, and; any other relevant information. **b)** An analysis of the proposed impacts to the waterbody in accordance with General Condition 32 and Regional Condition 3; **c)** Measures taken to avoid and minimize losses, including other methods of constructing the proposed project; and **d)** A compensatory mitigation plan describing how the unavoidable losses are proposed to be compensated, in accordance with 33 CFR Part 332.

Regional Condition 10. The permittee shall complete the construction of any compensatory mitigation required by special condition(s) of the NWP verification before or concurrent with commencement of construction of the authorized activity, except when specifically determined to be impracticable by the Corps. When mitigation involves use of a mitigation bank or in-lieu fee program, the permittee shall submit proof of payment to the Corps prior to commencement of construction of the authorized activity.

F. 401 Water Quality Certification (401 WQC)

A 401 WQC is mandatory for any activity that requires a Clean Water Act Section 404 permit. A 401 WQC is required prior to discharging any dredged or fill material into a water of the United States. Only one of the following 401 WQCs listed below will apply to your project. The geographical location of your project will determine which 401 WQC is applicable. The 401 WQCs issued for this NWP will remain in effect through March 18, 2022.

On all "Non-Tribal Lands", lands that are not part of federally recognized Indian Reservation, the Arizona Department of Environmental Quality (ADEQ) is the agency responsible for issuing the 401 WQC.

On all "Tribal Lands", lands that are part of a federally recognized Indian Reservation, the U.S. Environmental Protection Agency (EPA) is responsible for issuing the 401 WQC except where EPA has delegated the 401 WQC authority to the White Mountain Apache Tribe (Fort Apache Indian Reservation), Hopi Tribe (Hopi Indian Reservation), Hualapai Tribe (Hualapai Indian Reservation), or Navajo Nation (Navajo Indian Reservation).

If "Individual Certification" is required you must apply for, receive, and comply with the 401 WQC issued by ADEQ, EPA, or the appropriate Tribe.

Non-tribal Lands - 401 ADEQ WQCs*

ADEQ 401 WQC definitions:

Not Attaining Waters are surface waters that are identified pursuant to CWA Section 305(b) as not attaining (e.g. not meeting surface water quality standards) and as a result, merit special consideration. The current list of Not Attaining Waters (Category 4A, 4B and 4C) is available on the ADEQ website at www.azdeq.gov.

Native Fill means soil, sand, gravel and other natural materials that are similar in physical, chemical and biological composition to existing natural materials in the project area; and which are free from pollutants in quantities and concentrations that can cause or contribute to an exceedance of applicable Surface Water Quality Standards (SWQS).

ADEQ requires that an applicant submit an application to ADEQ for a Water Quality Certification if the proposed activity will occur within the ordinary high water mark of any of the following: An Outstanding Arizona Water; an impaired water; a water that is listed as not attaining; or a lake.

The following 401 water quality conditions apply to regulated discharges of dredged or fill material occurring within the ordinary high water mark (OHWM) of Waters of the US (WUS) under all applicable NWPs (hereinafter referred to as "certified activities"):

1. Submission of a PCN pursuant to General Condition 32 and Regional Condition 3 shall be required for all waterbodies designated by ADEQ as Not Attaining, within 1600 meters (or 1 mile) upstream and/or 800 meters (or 1/2 mile) downstream of a not attaining water.
2. Any discharge occurring as a result of certified activities of the project shall not cause an exceedance of any Surface Water Quality Standard (SWQS). Applicability of this condition is as defined in A.A.C. R18-11-102.
3. This certification does not authorize the discharge of wastewater, process residues or other waste to any WUS.
4. Runoff of water used for irrigation or dust control for certified activities within WUS shall be limited to the extent practicable and shall not cause downstream erosion, flooding or an exceedance of applicable surface water quality standards (SWQS) in any WUS.
5. Clearing, grubbing, scraping or otherwise exposing erodible surfaces in WUS shall be minimized to the extent necessary for each construction phase or location.
6. Dredged or fill material in WUS shall be placed so that it is stable, meaning after placement, the material does not show signs of excessive erosion, such as gullying, head cutting, caving, block slippage, material sloughing, etc. Dredged or fill material placed in WUS shall not discharge (e.g., via leaching, runoff) pollutants into streams or wetlands at levels exceeding any applicable SWQS.
7. The effectiveness of all pollution control measures, including sediment and erosion control measures, shall be inspected, maintained and modified (as necessary) to reduce pollutants and ensure compliance with SWQS in any WUS.
8. Except where certified activities are intended to permanently alter any WUS, all disturbed areas within WUS shall be restored and (re)vegetated or stabilized. Vegetation shall be maintained on unarmored banks and slopes to stabilize soil and prevent erosion.
9. Silt laden or turbid water resulting from certified activities shall managed in a manner to reduce sediment load prior to discharging so as not to exceed SWQS in any WUS.
10. Any washing or dewatering of fill material must occur outside of any WUS prior to placement.
11. Acceptable fill material that can be placed in any WUS includes: untreated logs and lumber; natural stone (crushed or not), crushed clean concrete (recycled concrete); native fill; precast, sprayed or cast-in-place concrete (including soil cement and unmodified grouts); steel (including galvanized); plastic; aluminum; and other material that is free from pollutants in quantities or combinations that can cause an exceedance of applicable SWQS. Other fill materials may be placed in WUS with prior written approval from ADEQ.
12. Upon completion of the certified activities, areas within any WUS shall be promptly cleared of all forms, pilings, construction residues, equipment, debris and other obstructions, including temporary structures.
13. If fully, partially or occasionally submerged structures in WUS are constructed of cast-in- place concrete instead of pre-cast concrete, applicant will take steps; e.g., sheet piling or temporary dams, to prevent contact between water (instream and runoff) and the concrete until it cures and until any curing agents have evaporated or otherwise cease to be available; i.e., are no longer a pollutant source.
14. Any permanent WUS crossings other than fords, shall be equipped with conveyances that direct untreated runoff away from WUS.
15. Permanent and temporary pipes and culvert crossings in WUS shall be adequately sized to handle expected flow and properly set with end section, splash pads, headwalls or other structures that dissipate water energy to control erosion.
16. Debris will be cleared as needed from culverts, ditches, dips and other drainage structures in any WUS to prevent clogging or conditions that may lead to washout.
17. All temporary structures in WUS constructed of imported materials and all permanent structures, including but not limited to, access roadways; culvert crossings; staging areas; material stockpiles; berms, dikes and pads, shall be constructed so as to accommodate overtopping and resist washout by streamflow.
18. Any temporary WUS crossing, other than fords on native material, shall be constructed in such a manner so as to provide armoring of the stream channel. Materials used to provide this armoring shall not include anything easily transportable by flow.

Tribal Lands - 401 WQCs

Fort Apache Indian Reservation (White Mountain Apache Tribe):	Individual Certification required for all projects.*
Hopi Indian Reservation (Hopi Tribe):	Individual Certification required for all projects.*
Hualapai Indian Reservation (Hualapai Tribe):	Individual Certification required for all projects.*
Navajo Indian Reservation (Navajo Nation):	Individual Certification required for all projects.*
All other Indian Reservations (EPA):	401 WQCs issued by EPA: Contact PM

401 WQC Contact Information

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Appendix F

YC 2013 Preliminary Corridor Evaluation/Location Report (PCER)

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Yavapai County Board of Supervisors
Rowle Simmons - District-1
Thomas Thurman - District-2
A.G. "Chip" Davis - District-3
Craig Brown - District-4
Jack Smith – District-5

Preliminary Corridor Evaluation/Location Report

Williamson Valley to Chino Valley Town Limits
Northern Connector Study

(Williamson Valley Road to Reed Road)

Prepared By

Yavapai County Public Works Department
Byron Jaspers, P.E. – Public Works Director
1100 Commerce Dr. Prescott, AZ 86305
928-771-3183 (FAX 928-771-3167)

Registered Professional Engineer (Civil)
CERTIFICATE NO. 54387
DANIEL A. CHERRY
Date Signed 9-19-2013
ARIZONA, U.S.A.
Expires 3-31-16

Revised 9/19/2013

August 2013

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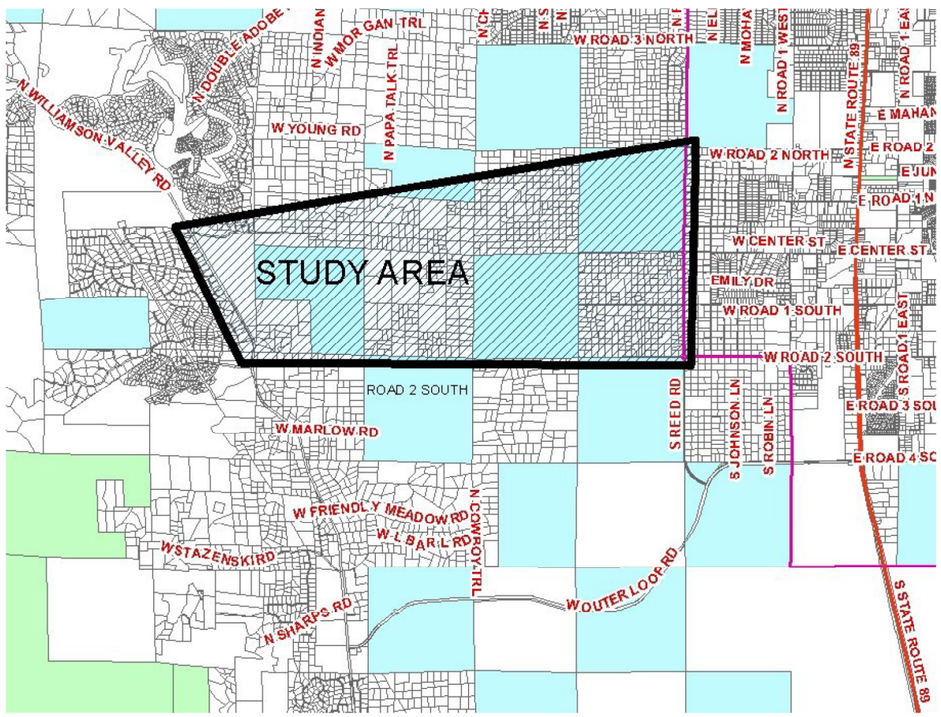
PROJECT DESCRIPTION

Yavapai County Public Works has evaluated possible corridor options for a northern connecting road between the Williamson Valley area and the Town of Chino Valley. The east/west limits of the corridor study area lie between Williamson Valley Road on the west end and Reed Road at the Town of Chino Valley limits on the east end. The north/south limits are defined as Nancy Drive to Road 2 North for the north and Road 2 South for the south. The final recommended corridor alignment will be used as part of the upcoming Central Yavapai Metropolitan Planning Organization transportation planning traffic model scheduled to be started in 2013. A total of 5 different alignments between Williamson Valley Road and Reed Road were taken into consideration. On the west end access points off of Williamson Valley Road included the existing road, Nancy Drive, and a proposed new location directly across from West Inscription Canyon Drive. On the east end two main connection points were evaluated for access to Chino Valley Town limits, with the first connection point being Road 2 North at Reed Road and the second being Center Street at Reed Road.



PROJECT DESIGN CRITERIA

The intent of the connector road is to function as a limited access roadway. When constructed, the road will have managed access points through the use of frontage roads or other acceptable means to divert side/local traffic to common access points. The infrequent access to the new roadway will allow higher speeds and better mobility between the two intended locations, while at the same time increasing safety along the corridor. The majority of the corridor can utilize a 100' right of way width; however, it will be necessary in all of the considered corridors to increase the right of way width to 200' for large cut/fill areas. The typical roadway section is shown on Exhibit 1.

One of the design controls for the vertical alignment is a "K- value" that is a function of the length of a vertical curve divided by the algebraic difference in grades of the curve. In general, the larger the K-value, the "flatter" the vertical curve and is used primarily to ensure adequate stopping sight distance and acceptable values will vary based upon the design speed. Crest vertical curves were designed to a K-value of 151 for stopping sight distance and not for the 357 which is needed for passing sight distance. The resulting cuts and fills for a road utilizing a K-value of 357 for passing sight distance were deemed to be too large to be practical. Sag vertical curves used a target K-value of 136 for design. The following items were used as design criteria:

TYPE OF ROADWAY:	LIMITED ACCESS
CROSS DRAINAGE:	25-YEAR STORM
MAXIMUM GRADE:	7%
MAXIMUM SUPERELEVATION:	4%
MINIMUM RIGHT OF WAY:	100 FT
MINIMUM DESIGN SPEED:	60 MPH
MINIMUM RADIUS:	1500 FT
CROSS SECTION:	2 LANES (EXHIBIT 1)

CORRIDOR OPTIONS

Five different corridor alignments were considered during the feasibility study. At the western side of the study area, all of the alignments start at the intersections of Nancy Drive or Inscription Canyon Drive and Williamson Valley Road, point 1 or point 2, respectively. At the eastern side of the study area, the alignments end at Road 2 North or Center Street, where each intersects Reed Road. These termini are identified as point A or point B, respectively. Two alignments were considered that traverse from point 2 to point A, so the longer of the two alignments is referred to as alignment 2A-1. The preceding alignment naming system results in the following alignment names (see Exhibit 2).

ALIGNMENT 1A – NANCY DR. TO ROAD 2 NORTH
ALIGNMENT 1B – NANCY DR. TO CENTER ST
ALIGNMENT 2A – INSCRIPTION CANYON TO ROAD 2 NORTH
ALIGNMENT 2B – INSCRIPTION CANYON TO CENTER ST
ALIGNMENT 2A-1 – INSCRIPTION CANYON TO ROAD 2 NORTH (ALTERNATE 1- State Land Route)

DECISION MATRIX

In order to rank the five different corridor alignments a decision matrix was created to compare the pros and cons of each corridor. Some of the categories used in the matrix are number of drainage crossings, private versus state land acquisition, length, and utility conflicts. The matrix in its entirety can be referenced in Exhibit 3. The decision matrix uses a system of less desirable, neutral, and most desirable with correlating numbers of 1, 5, and 10 respectively. For example, a most desirable option would receive a value of 10 whereas the least desirable option would get a value of 1. The total points in all categories were subtotaled and used in the final decision in ranking the best alignment option. Also included in the decision matrix was the overall cost of the project. The project cost was not included with the other categories that were used in the preliminary ranking system of 1, 5, or 10 because it was determined that the cost carries more weight in the decision process and should be evaluated separately from the others for the overall ranking. Therefore, cost is included at the bottom of the matrix to utilize in the final ranking of the corridors. The corridors were ranked 1 through 5 with 5 being the lowest ranked choice and 1 being the highest ranked or the recommended alignment/corridor.

RESULTS AND RECOMMENDATIONS

The alignment with the highest ranking in the decision matrix is alignment 2B. Along with having the highest preliminary ranking score from the various assessed categories, it also had the lowest estimated total cost of the five alignments. The estimated total cost of alignment 2B, including right of way, design, permitting, and construction costs, came to $13.3 million. The remaining corridors rank in the following order from most preferred to least preferred :

1) ALIGNMENT 2B
2) ALIGNMENT 1B
3) ALIGNMENT 2A
4) ALIGNMENT 1A
5) ALIGNMENT 2A-1

Cost was a significant factor in determining the final ranking of the studied corridor alternatives. The top two corridor alternatives were approximately $278,000 apart in total estimated project cost whereas the bottom three where $1.8 million, $2.2 million, and $3.5 million more than the preferred Alignment 2B. The preliminary ranking of alignment 2A-1 was

second-highest out of the five alternatives, but after including scores for total project cost, alignment 2A-1 became the least preferred alternative, due to it being the most expensive option. After consideration of the results developed through this feasibility study it is the recommendation of the Yavapai County Public Works Department that alignment 2B be considered for further study and insertion into the Central Yavapai Metropolitan Planning Organization's long range plan traffic model to evaluate how a northern connector would further benefit residents in the Williamson Valley and Chino Valley areas. The engineer's estimates for each corridor are included in Exhibit 4.

Preliminary Corridor Evaluation/Location Report

Williamson Valley to Chino Valley Town Limits

Appendix

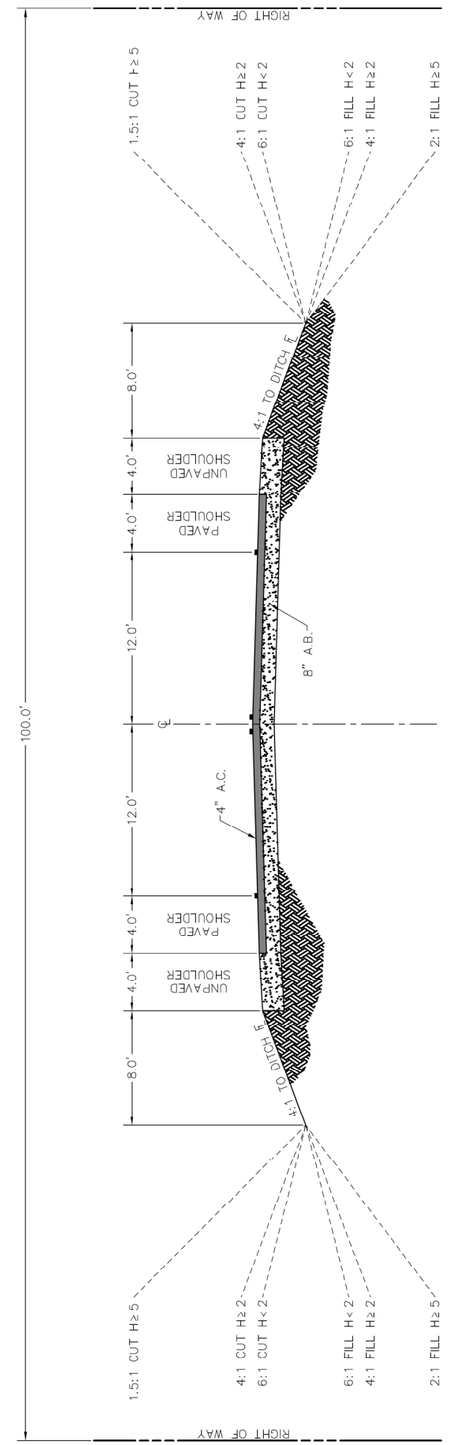


EXHIBIT 1. TYPICAL ROADWAY SECTION

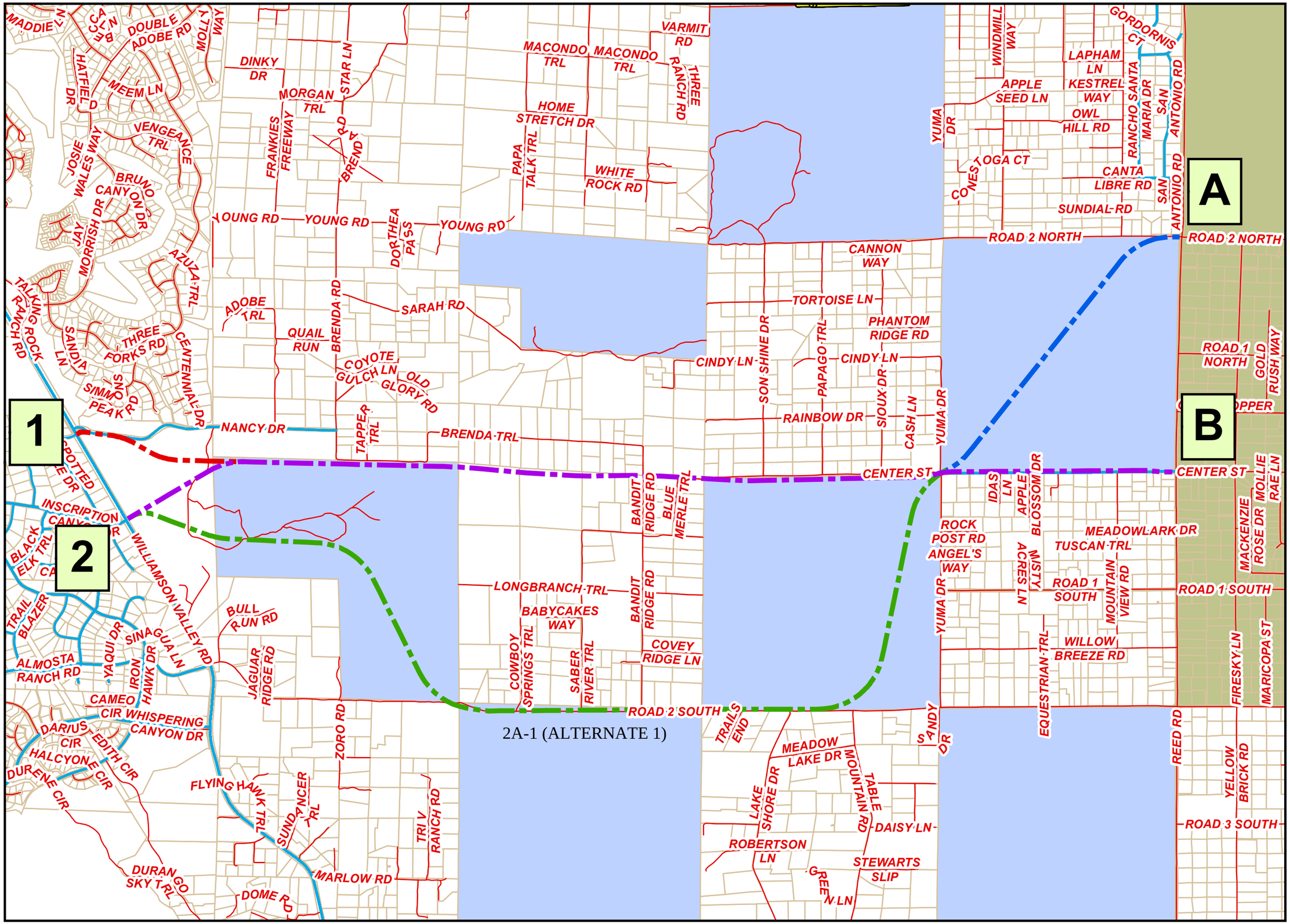


EXHIBIT 2

NORTHERN CONNECTOR CORRIDOR OPTIONS

LEGEND

- STATE OF ARIZONA LAND
- Parcels
- Road Centerlines
- County Paved Maintained
- County Unpaved Maintained

City Boundaries

CITYDIST

- TOWN OF CHINO VALLEY

N
W E
S

1 inch = 2,000 feet

1 centimeter = 240 meters

This product is for informational purposes and may not have been prepared for, or be suitable for legal, engineering, or surveying purposes. Users of this information should review or consult the primary data and information sources to ascertain the usability of the information

Yavapai County assumes no responsibility for errors, omissions, and/or inaccuracies in this mapping product

DATE: MAY 16, 2013

EXHIBIT 3 - WILLIAMSON VALLEY ROAD TO TOWN OF CHINO VALLEY LIMITS CORRIDOR FEASIBILITY DECISION MATRIX

EVALUATION CRITERIA	ALIGNMENT 1A	ALIGNMENT 1B	ALIGNMENT 2A	ALIGNMENT 2A1	ALIGNMENT 2B
Private Parcels/State Land Affected	**Neutral (+5)** 18 Private Parcels 3 State Land	**Neutral (+5)** 21 Private Parcels 3 State Land	**Neutral (+5)** 18 Private Parcels 3 State Land	**Most Desirable (+10)** 10 Private Parcels 4 State Land	**Neutral (+5)** 21 Private Parcels 3 State Land
Total ROW Needed	**Neutral (+5)** 64 Acres	**Neutral (+5)** 58 Acres	**Neutral (+5)** 61 Acres	**Least Desirable (+1)** 74 Acres	**Most Desirable (+10)** 55 Acres
Length	**Neutral (+5)** 5.25 Miles	**Neutral (+5)** 4.75 Miles	**Neutral (+5)** 5.07 Miles	**Least Desirable (+1)** 6.10 Miles	**Most Desirable (+10)** 4.57 Miles
Proximity To Town Business Center	**Most Desirable (+10)** Primary Shopping Area Located At Road 2 North	**Neutral (+5)** Located 1 Mile South of Primary Shopping Center Area	**Most Desirable (+10)** Primary Shopping Area Located At Road 2 North	**Most Desirable (+10)** Primary Shopping Area Located At Road 2 North	**Neutral (+5)** Located 1 Mile South of Primary Shopping Center Area
Utility Conflicts	**Less Desirable (+1)** Utility Conflicts Estimated To Be Equal	**Less Desirable (+1)** Utility Conflicts Estimated To Be Equal	**Less Desirable (+1)** Utility Conflicts Estimated To Be Equal	**Neutral (+5)** Utility Conflicts Estimated To Be Less	**Less Desirable (+1)** Utility Conflicts Estimated To Be Equal
FEMA Indentified Crossings (404 Mitigation)	**Less Desirable (+1)** 3 Crossings	**Less Desirable (+1)** 3 Crossings	**Less Desirable (+1)** 3 Crossings	**Neutral (+5)** 1 Crossing	**Less Desirable (+1)** 3 Crossings
Drainage Structures	**Neutral (+5)** 26 Structures	**Neutral (+5)** 22 Structures	**Neutral (+5)** 25 Structures	**Least Desirable (+1)** 42 Structures	**Most Desirable (+10)** 21 Structures
Preliminary Ranking SUBTOTAL SCORE	**32**	**27**	**32**	**33**	**42**
Total Project Cost (Includes R.O.W., Engineering, Construction, etc.)	**Neutral (+5)** **$15,505,502**	**Most Desirable (+10)** **$13,596,172**	**Neutral (+5)** **$15,106,221**	**Least Desirable (+1)** **$16,804,113**	**Most Desirable (+10)** **$13,318,072**
Final Ranking TOTAL SCORE	**37**	**37**	**37**	**34**	**52**
Final Evaluation Rank	**4**	**2**	**3**	**5**	**1**

Ranking - Least Desirable (+1), Neutral (+5), Most Desirable (+10)

Exhibit 4

Corridor Cost Estimates

ENGINEER'S ESTIMATE WILLIAMSON VALLEY RD/REED RD FEASIBILITY STUDY

ALIGNMENT #1A 27,746 LF

ITEM NO	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
1	CLEARING AND GRUBBING	AC	54	$340.00	$18,360
2	REMOVALS	LS	1	$250,000.00	$250,000
3	EXCAVATION	CY	295,000	$9.00	$2,655,000
4	AGGREGATE BASE COURSE (8")	CY	33,597	$40.00	$1,343,866
5	ASPHALT CONCRETE (4")	TN	22,493	$92.00	$2,069,334
6	AR-ACFC	SY	98,652	$3.80	$374,879
7	DRAINAGE STRUCTURES	LF	27,746	$23.00	$638,158
8	SIGNS AND STRIPING	LF	221,968	$0.15	$33,295
9	GUARD RAIL	LF	18,000	$30.00	$540,000
10	GUARD RAIL TERMINATIONS	EA	40	$3,000.00	$120,000
11	RIGHT OF WAY FENCE	LF	55,492	$3.00	$166,476
12	RIGHT OF WAY MONUMENTS	EA	22	$300.00	$6,600
13	SEEDING (CLASS II)	AC	29	$4,000.00	$114,086
14	SWPPP DESIGN AND IMPLEMENTATION	MI	5.25	$20,000.00	$105,098
				SUBTOTAL 1	**$8,435,152**
15	404 MITIGATION (0.5%)	LS	1	$42,176	$42,176
16	MOBILIZATION (10%)	LS	1	$843,515	$843,515
17	SURVEYING (2%)	LS	1	$168,703	$168,703
18	QUALITY CONTROL (2%)	LS	1	$168,703	$168,703
19	TRAFFIC CONTROL (1%)	LS	1	$84,352	$84,352
				SUBTOTAL 2	**$9,742,601**
20	FORCE ACCOUNT (10%)	LS	1	$974,260	$974,260
21	DESIGN ENGINEERING (12%)	LS	1	$1,169,112	$1,169,112
22	CONSTRUCTION ENGINEERING (10%)	LS	1	$974,260	$974,260
23	ENVIRONMENTAL WORK (1%)	LS	1	$97,426	$97,426
24	RIGHT OF WAY	AC	64	$40,000	$2,547,842
				TOTAL	**$15,505,502**

ENGINEER'S ESTIMATE WILLIAMSON VALLEY RD/REED RD FEASIBILITY STUDY

ALIGNMENT #1B 25,102 LF

ITEM NO	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
1	CLEARING AND GRUBBING	AC	49	$340.00	$16,660
2	REMOVALS	LS	1	$250,000.00	$250,000
3	EXCAVATION	CY	248,000	$9.00	$2,232,000
4	AGGREGATE BASE COURSE (8")	CY	30,395	$40.00	$1,215,805
5	ASPHALT CONCRETE (4")	TN	20,349	$92.00	$1,872,141
6	AR-ACFC	SY	89,252	$3.80	$339,156
7	DRAINAGE STRUCTURES	LF	25,102	$23.00	$577,346
8	SIGNS AND STRIPING	LF	200,816	$0.15	$30,122
9	GUARD RAIL	LF	11,525	$30.00	$345,750
10	GUARD RAIL TERMINATIONS	EA	38	$3,000.00	$114,000
11	RIGHT OF WAY FENCE	LF	50,204	$3.00	$150,612
12	RIGHT OF WAY MONUMENTS	EA	26	$300.00	$7,800
13	SEEDING (CLASS II)	AC	26	$4,000.00	$103,798
14	SWPPP DESIGN AND IMPLEMENTATION	MI	4.75	$20,000.00	$95,083
				SUBTOTAL 1	**$7,350,273**
15	404 MITIGATION (0.5%)	LS	1	$36,751	$36,751
16	MOBILIZATION (10%)	LS	1	$735,027	$735,027
17	SURVEYING (2%)	LS	1	$147,005	$147,005
18	QUALITY CONTROL (2%)	LS	1	$147,005	$147,005
19	TRAFFIC CONTROL (1%)	LS	1	$73,503	$73,503
				SUBTOTAL	**$8,489,565**
20	FORCE ACCOUNT (10%)	LS	1	$848,957	$848,957
21	DESIGN ENGINEERING (12%)	LS	1	$1,018,748	$1,018,748
22	CONSTRUCTION ENGINEERING (10%)	LS	1	$848,957	$848,957
23	ENVIRONMENTAL WORK (1%)	LS	1	$84,896	$84,896
24	RIGHT OF WAY	AC	58	$40,000	$2,305,051
				TOTAL	**$13,596,172**

ENGINEER'S ESTIMATE WILLIAMSON VALLEY RD/REED RD FEASIBILITY STUDY

ALIGNMENT #2A 26,769 LF

ITEM NO	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
1	CLEARING AND GRUBBING	AC	53	$340.00	$18,020
2	REMOVALS	LS	1	$250,000.00	$250,000
3	EXCAVATION	CY	290,000	$9.00	$2,610,000
4	AGGREGATE BASE COURSE (8")	CY	32,414	$40.00	$1,296,550
5	ASPHALT CONCRETE (4")	TN	21,701	$92.00	$1,996,476
6	AR-ACFC	SY	95,179	$3.80	$361,680
7	DRAINAGE STRUCTURES	LF	26,769	$23.00	$615,689
8	SIGNS AND STRIPING	LF	214,153	$0.15	$32,123
9	GUARD RAIL	LF	17,800	$30.00	$534,000
10	GUARD RAIL TERMINATIONS	EA	46	$3,000.00	$138,000
11	RIGHT OF WAY FENCE	LF	53,538	$3.00	$160,615
12	RIGHT OF WAY MONUMENTS	EA	18	$300.00	$5,400
13	SEEDING (CLASS II)	AC	28	$4,000.00	$113,675
14	SWPPP DESIGN AND IMPLEMENTATION	MI	5.07	$20,000.00	$101,398
				SUBTOTAL 1	**$8,233,626**
15	404 MITIGATION (0.5%)	LS	1	$41,168	$41,168
16	MOBILIZATION (10%)	LS	1	$823,363	$823,363
17	SURVEYING (2%)	LS	1	$164,673	$164,673
18	QUALITY CONTROL (2%)	LS	1	$164,673	$164,673
19	TRAFFIC CONTROL (1%)	LS	1	$82,336	$82,336
				SUBTOTAL	**$9,509,838**
20	FORCE ACCOUNT (10%)	LS	1	$950,984	$950,984
21	DESIGN ENGINEERING (12%)	LS	1	$1,141,181	$1,141,181
22	CONSTRUCTION ENGINEERING (10%)	LS	1	$950,984	$950,984
23	ENVIRONMENTAL WORK (1%)	LS	1	$95,098	$95,098
24	RIGHT OF WAY	AC	61	$40,000	$2,458,136
				TOTAL	**$15,106,221**

ENGINEER'S ESTIMATE WILLIAMSON VALLEY RD/REED RD FEASIBILITY STUDY

ALIGNMENT #2A1 32,234 LF

ITEM NO	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
1	CLEARING AND GRUBBING	AC	59	$340.00	$20,060
2	REMOVALS	LS	1	$250,000.00	$250,000
3	EXCAVATION	CY	275,000	$9.00	$2,475,000
4	AGGREGATE BASE COURSE (8")	CY	39,032	$40.00	$1,561,261
5	ASPHALT CONCRETE (4")	TN	26,131	$92.00	$2,404,088
6	AR-ACFC	SY	114,611	$3.80	$435,523
7	DRAINAGE STRUCTURES	LF	32,234	$23.00	$741,392
8	SIGNS AND STRIPING	LF	257,876	$0.15	$38,681
9	GUARD RAIL	LF	15,150	$30.00	$454,500
10	GUARD RAIL TERMINATIONS	EA	64	$3,000.00	$192,000
11	RIGHT OF WAY FENCE	LF	64,469	$3.00	$193,407
12	RIGHT OF WAY MONUMENTS	EA	22	$300.00	$6,600
13	SEEDING (CLASS II)	AC	29	$4,000.00	$117,600
14	SWPPP DESIGN AND IMPLEMENTATION	MI	6.11	$20,000.00	$122,100
				SUBTOTAL 1	**$9,012,212**
15	404 MITIGATION (0.5%)	LS	1	$45,061	$45,061
16	MOBILIZATION (10%)	LS	1	$901,221	$901,221
17	SURVEYING (2%)	LS	1	$180,244	$180,244
18	QUALITY CONTROL (2%)	LS	1	$180,244	$180,244
19	TRAFFIC CONTROL (1%)	LS	1	$90,122	$90,122
				SUBTOTAL	**$10,409,105**
20	FORCE ACCOUNT (10%)	LS	1	$1,040,910	$1,040,910
21	DESIGN ENGINEERING (12%)	LS	1	$1,249,093	$1,249,093
22	CONSTRUCTION ENGINEERING (10%)	LS	1	$1,040,910	$1,040,910
23	ENVIRONMENTAL WORK (1%)	LS	1	$104,091	$104,091
24	RIGHT OF WAY	AC	74	$40,000	$2,960,004
				TOTAL	**$16,804,113**

ENGINEER'S ESTIMATE WILLIAMSON VALLEY RD/REED RD FEASIBILITY STUDY

ALIGNMENT #2B 24,125 LF

ITEM NO	ITEM DESCRIPTION	UNIT	ESTIMATED QUANTITY	UNIT PRICE	TOTAL PRICE
1	CLEARING AND GRUBBING	AC	47	$340.00	$15,980
2	REMOVALS	LS	1	$250,000.00	$250,000
3	EXCAVATION	CY	242,750	$9.00	$2,184,750
4	AGGREGATE BASE COURSE (8")	CY	29,212	$40.00	$1,168,484
5	ASPHALT CONCRETE (4")	TN	19,557	$92.00	$1,799,275
6	AR-ACFC	SY	85,778	$3.80	$325,956
7	DRAINAGE STRUCTURES	LF	24,125	$23.00	$554,875
8	SIGNS AND STRIPING	LF	193,000	$0.15	$28,950
9	GUARD RAIL	LF	14,775	$30.00	$443,250
10	GUARD RAIL TERMINATIONS	EA	38	$3,000.00	$114,000
11	RIGHT OF WAY FENCE	LF	48,250	$3.00	$144,750
12	RIGHT OF WAY MONUMENTS	EA	22	$300.00	$6,600
13	SEEDING (CLASS II)	AC	25	$4,000.00	$99,387
14	SWPPP DESIGN AND IMPLEMENTATION	MI	4.57	$20,000.00	$91,383
				SUBTOTAL 1	**$7,227,638**
15	404 MITIGATION (0.5%)	LS	1	$36,138	$36,138
16	MOBILIZATION (10%)	LS	1	$722,764	$722,764
17	SURVEYING (2%)	LS	1	$144,553	$144,553
18	QUALITY CONTROL (2%)	LS	1	$144,553	$144,553
19	TRAFFIC CONTROL (1%)	LS	1	$72,276	$72,276
				SUBTOTAL	**$8,347,922**
20	FORCE ACCOUNT (10%)	LS	1	$834,792	$834,792
21	DESIGN ENGINEERING (12%)	LS	1	$1,001,751	$1,001,751
22	CONSTRUCTION ENGINEERING (10%)	LS	1	$834,792	$834,792
23	ENVIRONMENTAL WORK (1%)	LS	1	$83,479	$83,479
24	RIGHT OF WAY	AC	55	$40,000	$2,215,335
				TOTAL	**$13,318,072**

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Appendix G

ESA Compliance Documentation and Biological Assessment

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United States Department of the Interior
Fish and Wildlife Service
Arizona Ecological Services Office
9828 N. 31st Avenue Ste C3
Phoenix, AZ 85051
Telephone: (602) 242-0210 Fax: (602) 242-2513

In reply refer to:
AESO/SE
02EAAZ00-2018-TA-0093

November 2, 2017

Mr. Brian Bucholtz, Project Engineer
Lyon Engineering
1650 Willow Creek Road
Prescott, Arizona 86301

Dear Mr. Bucholtz:

Thank you for your October 24, 2017, correspondence, received in our office the same day via electronic mail. You requested our review of the proposed Yavapai County Northern Connector Project in Prescott Valley, Yavapai County, Arizona, in compliance with section 7 of the Endangered Species Act of 1973 (ESA) as amended (16 U.S.C. 1531 et seq.). The project area is located along approximately 5.5 miles between Williamson Valley Road and Reed Road within the Chino Valley city limits.

Based on the information that you have provided, it is our opinion that no endangered or threatened species or critical habitat will be affected by this project. No further review is required for this project at this time. Should project plans change, or if additional information on the distribution of listed or proposed species becomes available, this determination may need to be reconsidered.

Please note, some projects may potentially impact species that are protected under the Migratory Bird Treaty Act (MBTA) of 1918, as amended (16 U.S.C. sec. 703-712) and/or bald and golden eagles protected under the Bald and Golden Eagle Protection Act (BGEPA). Prohibitions under the MBTA include the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except as specifically authorized by the FWS. If you believe that migratory birds may be affected by the project, we recommend you contact our Migratory Bird Permit Office, P.O. Box 709, Albuquerque, NM 87103, (505) 248-7882 or by email *FW2_birdpermits@fws.gov*. For more information regarding the MBTA and permitting process, please visit the following web site: *http://www.fws.gov/migratorybirds/mbpermits.html*. For information on protections for bald and golden eagles under the BGEPA, please refer to the regulatory definition of the term "disturb" (72 FR 31132) that was published in the Federal Register on June 5, 2007, and FWS's National Bald Eagle Management Guidelines (72 FR 31156). Additional information regarding bald and golden eagles is available at: http://www.fws.gov/migratorybirds/BaldAndGoldenEagleManagement.htm.

We appreciate your coordination with us on this matter. We also encourage you to coordinate the review of this project with the Arizona Game and Fish Department. Should you require further assistance or if you have any questions, please contact Brian J. Wooldridge at (928) 556-2106 or Shaula Hedwall at (928) 556-2118.

Sincerely,

Brenda H. Smith Digitally signed by Brenda H. Smith
Date: 2017.11.02 11:58:30 -07'00'

Steven L. Spangle
Field Supervisor

cc: Chief Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ
Regional Supervisor, Arizona Game and Fish Department, Kingman, AZ

W:\Wooldridge\Final Docs\2018\Chino Valley Yavapai County Northern Connector Road.docx

Brian Bucholtz

From: Brian Bucholtz <brianbucholtz@lyonengineering.com>
Sent: Tuesday, October 24, 2017 12:19 PM
To: 'incomingazcorr@fws.gov'; 'Wooldridge, Brian'
Subject: ESA Compliance Letter Request
Attachments: 2017-10-24 ESA Compliance Request.pdf

Steve, Brian, or other biologist:

Please see attached letter and maps requesting an ESA compliance letter. Please feel free to contact me with any questions.

Thank you.

Brian A. Bucholtz, P.E., CFM
Floodplain Manager
Project Engineer
FAA Certified Remote Pilot

LYON ENGINEERING
Civil Engineers • Land Surveyors

Lyon Engineering & Surveying
1650 Willow Creek Road
Prescott, AZ 86301
928-776-1750 (Office)
928-776-0605 (Fax)

LYON ENGINEERING
Civil Engineers • Land Surveyors

October 24, 2017

Steve Spangle, Field Supervisor
or Brian Wooldridge, Biologist
U.S. Fish and Wildlife Service
Arizona Ecological Services Office
2321 W. Royal Palm Rd., Suite 103
Phoenix, AZ 85021-4951
602-242-0210
(Submitted via email to incomingazcorr@fws.gov and brian_wooldridge@fws.gov)

Re: ESA Compliance Letter Request for Proposed Yavapai County Northern Connector in Yavapai County, Arizona

Mr. Spangle, Mr. Wooldridge, or Current Supervisor:

I am requesting an ESA compliance letter (ideally a "No Effect") for a proposed project that we are completing for Yavapai County, Arizona. The official letter on USFWS letterhead should state that the USFWS concurs that there is "No effect on proposed or listed species or designated critical habitat". In order to expedite the process, it would be faster to coordinate with me by email or phone instead of mail for anything additional you may need.

- Project Name: Yavapai County Northern Connector
- State: Arizona
- County: Yavapai
- Municipality: Yavapai County
- Description: This project is 5.5-mile proposed roadway, connecting Williamson Valley Road at Nancy Drive with Reed Road at Center Street in west Chino Valley, Arizona. The project is generally located within Sections 19, 20, 29, and 30, Township 16N, Range 2 West and Sections 22, 23, 24, 25, and 26, Township 16N, Range 3 West of the Gila & Salt River Base & Meridian. See the State Location Map and Vicinity on the following pages.

Thank you. Please contact me if you should have any questions.

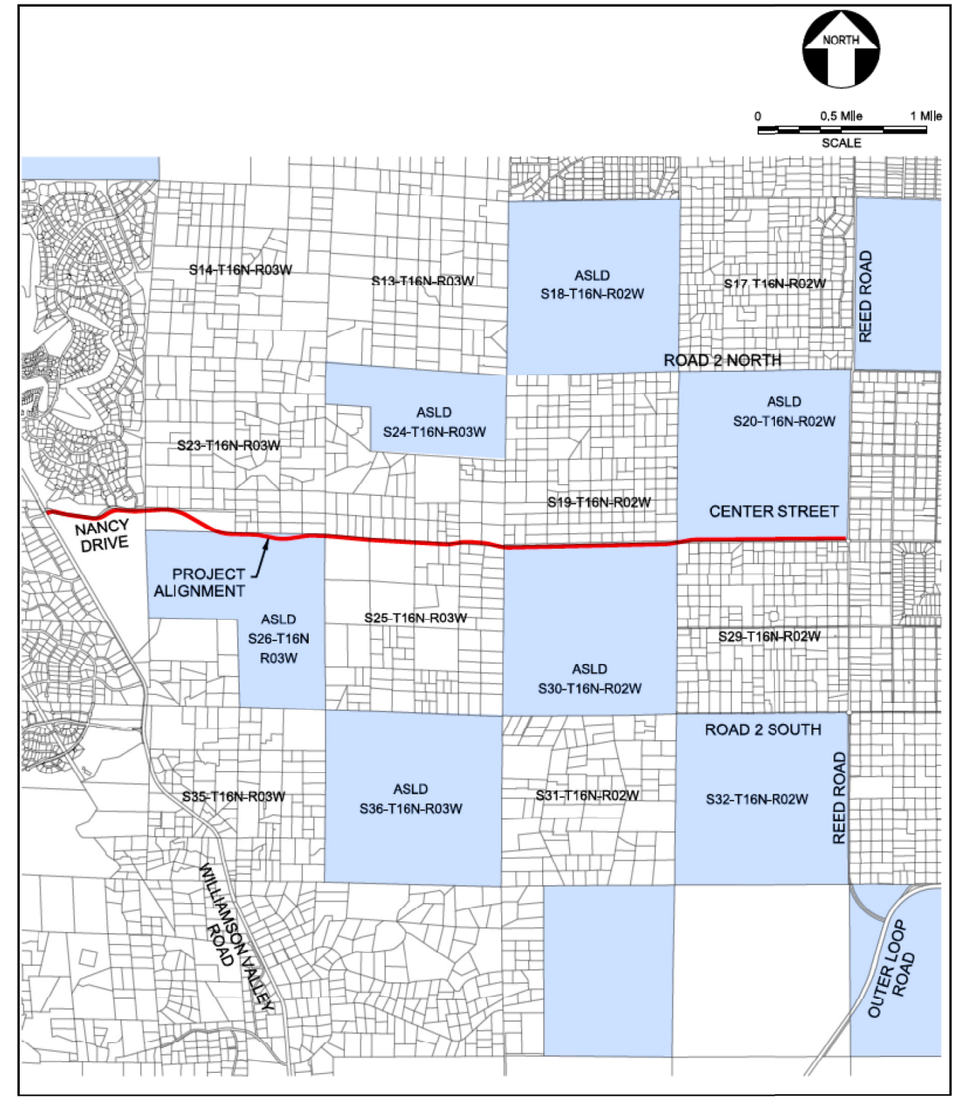
Respectfully Submitted,

Brian A. Bucholtz, P.E., CFM
Project Engineer
brianbucholtz@lyonengineering.com

State Location Map

LYON ENGINEERING
Civil Engineers • Land Surveyors

Vicinity Map



1650 Willow Creek Road • Prescott, Arizona 86301 • Phone 928-776-1750 • Fax 928-776-0605

BIOLOGICAL ASSESSMENT

Yavapai County Northern Connector

Prepared For:

Yavapai County

AND

Lyon Engineering

Prescott, AZ

Prepared by:

BIOZONE, Inc.

PO Box 13027

Prescott, AZ 86304

May 2017

I. PROJECT LOCATION

The proposed project is located west of Chino Valley, Yavapai County, Arizona following the east/west alignment of Center Street from Reed Road to Williamson Valley Road. The proposed new roadway will be built on State of Arizona Trust Land, existing Yavapai County right-of-way, and private property where necessary. The State of Arizona Trust Land is in the following sections: Township 16 North, Range 2 West, Sections 20 & 30 and Township 16 North, Range 3 West, Section 26. Sections of private land included in the potential project plan include: Township 16 North, Range 3 West, Sections 22, 23, 24, & 25. Minimal impact is expected to occur involving private properties located at intersections and locations where the new roadway passes from one State of Arizona Trust Land parcel to another. These properties are located in Township 16 North, Range 2 West, Sections 19 & 29.

II. PROJECT DESCRIPTION

The proposed project follows the existing Center Street alignment to Bandit Ridge Road. There is approximately one mile of land, mostly private, from this point west where the usable road, (Brenda Trail), traverses to the north rejoining the Center Street alignment adjacent to State of Arizona Trust Land in Section 26 (T16N, R3W). This segment passes through private land which has been minimally disturbed for construction of low-density housing. To the west of where Brenda Trail rejoins the Center Street alignment, the proposed project follows the existing roadway to the intersection with Brenda Drive where it crosses a private parcel to join Nancy Drive to Williamson Valley drive. (See Map in Appendix)

The proposed project will require widening and improvement of the existing roadways as well as creation of a completely new section through undisturbed land. The elevation at the east end (Reed Road) is 4830 feet; UTM 12S 364193E by 3845836N. The elevation at the west end (Williamson Valley Road) is 5030 feet; UTM 12S 356532E by 3846200N. Elevation through the proposed project ranges from a low of 4760 feet

between Reed Road and Yuma Drive to a high of 5165 where the proposed project joins Nancy Drive.

III. SPECIES IDENTIFICATION

The proposed project is a linear roadway of approximately 4.5 miles. Because of this distance and the associated elevation differences, the vegetation changes along the route. At the east end of the proposed project, for the first 2.5 miles, the vegetation is Plains Grassland (Brown, 1982). In this ecozone, there are little to no woody plant species other than the occasional Whipple cholla (*Cylindropuntia whipplei*), Soaptree yucca (*Yucca elata*), or Apache Plume (*Fallugia paradoxa*).

As the elevation increases to the west, the dominant vegetation changes to Pinyon-Juniper Woodland and Inland Chaparral (Brown, 1982). In the transition areas between these zones there are ecotones which show a mixture of these vegetation types. For example, where the elevation increases to about 5000 feet, Utah juniper (*Juniperus osteosperma*) is mixed with the predominant grassland. Further west, woody vegetation increases to include Colorado pinyon pine (*Pinus edulis*), Scrub oak (*Quercus turbinella*), Desert-olive (*Forestiera neomexicana*), and Skunkbush (*Rhus trilobata*). On the hillsides above 5000 feet in the western segment of the proposed project, the vegetation becomes a mosaic of Pinyon-Juniper Woodland and Inland Chaparral with the lowland areas between consisting of primarily grassland.

IV. THREATENED AND ENDANGERED SPECIES

U.S. Fish and Wildlife Service list of T&E species was reviewed prior to the site visit and while onsite. USFWS online tool (IPaC) was consulted and the results include species which "may occur" on this site. The following table includes listed species and the reason they are not expected to occur on this site.

Common Name	***Scientific Name***	**Status**	**Habitat Requirements**	**Reason for Exclusion**
Mexican Spotted Owl	*Strix occidentalis lucida*	Threatened	Old growth forests or canyons with riparian vegetation.	Site does not contain the required habitat.
Yellow-billed Cuckoo	*Coccyzus americanus*	Threatened	Wooded areas with dense vegetation and water nearby.	Site does not contain the required habitat.
Northern Mexican Gartersnake	*Thamnophis eques megalops*	Threatened	Wetlands, stock tanks, and large riparian woodlands and forests	Site does not contain the required habitat.

If any listed species is encountered during operations, activity will cease and a qualified biologist will be consulted before operations can resume.

V. MIGRATORY BIRDS

The USFWS online tool (IPaC) lists several species of migratory birds which "could occur" in the proposed project area. Observations by Biozone staff revealed resources for migratory birds, including nesting sites. Care should be taken to avoid any potential nesting sites such as trees and shrubs during nesting periods for migratory birds common to the area.

VI. CONCLUSION

A review of possible effects on species listed by federal agencies indicates that the project will not directly affect any species or habitat.

SIGNATURES

PREPARER:

_____May 15, 2017

Archie M. Dickey, Ph.D. **Date**
President
Biozone, Inc.

Disclaimer

This document provides data regarding natural conditions and biotic organisms existing Tuesday, April 25, 2017. Descriptions and data concerning the natural resources associated with the designated survey area do not reflect changes that have occurred since the termination of the study or future changes that occur as a result of flooding, natural events, population changes, or human-initiated activities.

References

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Kearney, T.H., & Peebles, R.H. (1996). Arizona flora. Berkeley, CA: University of California Press.

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Rutman, S. (1992). Handbook of Arizona's endangered, threatened, and candidate plants. Phoenix, AZ: U.S. Fish and Wildlife Service.

U.S. Fish and Wildlife Service. (2016). Information for Planning and Conservation (IPaC) online resource. https://ecos.fws.gov/ipac/ Accessed March 23, 2017.

APPENDIX

State Map

Site Map/Aerial

Site Photos

Arizona State Trust Land Looking West From Reed Road at the East End of the Proposed Project (T16N, R02W, S20)

Arizona State Trust Land Looking East From Near Yuma Drive (T16N, R02W, S20)

Arizona State Trust Land Looking West From Near Yuma Drive (T16N, R02W, S30)

Arizona State Trust Land Looking South Near the Northwest Corner (T16N, R02W, S30)

View Looking South at Intersection of Bandit Ridge Road and Brenda Trail

View Looking South Near the Northeast Corner State of Arizona Trust Land (T16N, R03W, S26)

State of Arizona Trust Land Looking South at the Intersection of Brenda Trail and Brenda Drive (T16N, R03W, S26)

View Looking South at the Intersection of Nancy Drive and Williamson Valley Road; West End of the Proposed Project

Appendix H

Archeological Assessment

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A Cultural Resource Survey of the State Land Portion of the Northern Connector

Corridor Study, Yavapai County, Arizona

by

Andrew L. Christenson, Ph. D.
Archaeological Consultant
746 Redondo Road
Prescott, AZ 86303
(928) 308-5758

Conducted under Arizona Antiquities Permit #2017-043bl

Arizona State Land Department Application No.

Biozone, Inc.
P. O. Box 13027
Prescott, AZ 86304

for

Lyon Engineering and Surveying Inc.
1650 Willow Creek Road
Prescott, AZ 86305

and

Yavapai County Public Works Department
1100 Commerce Drive
Prescott, AZ 86305

May 12, 2017

ABSTRACT

Report Title: A Cultural Resource Survey of the State Land Portion of the Northern Connector Corridor Study, Yavapai County, Arizona

Project Name: Northern Connector Corridor Study - State Portion

Project Location: Chino Valley, Yavapai

Project Locator UTM: Z12 357893E 3845984N

Project Sponsor: Yavapai County

Sponsor Project Number(s):

Lead Agency: Arizona State Land Department

Other Involved Agencies: Arizona State Museum

Applicable Regulations: Arizona State Historic Preservation Act (A.R.S 41-861 to 865)

Funding Source: Yavapai County

ASLD ROW Application Number:

Description of the Project/Undertaking: road improvement and construction. Exact alignment of project not yet determined

Project Area/Area of Potential Effects (APE): 2 mile-long stretches 300 ft. wide and one mile-long stretch 400 ft. wide

Legal Description: T16N R2W S20, along S edge & S30, along N edge; T16N R3W S26, along N edge; G&SB&M

Land Jurisdiction: Arizona State Land Dept.

Total Acres: 121

Acres Surveyed: 121

Acres Not Surveyed: 0

Consultant Firm/Organization: Andrew L. Christenson

Project Number:

Permit Number(s): 2017-043bl

Date(s) of Fieldwork: 4/11/17 to 5/5/17

Number of IOs Recorded: 18

Number of Sites Recorded: 3

Eligible Sites: AZ N:6:97 (ASM)

Ineligible Sites: AZ N:7:493 (ASM)

Unevaluated Sites: AZ N:6:98 (ASM)

Sites Not Relocated: none

Site Summary Table

Land Jurisdiction	Identification Status	Site Number/ Property Address	Eligibility Status/ Criterion/Criteria	Recommended Treatment
ASLD	newly recorded	AZ N:6:97 (ASM)	recommended eligible, D	unknown
“	“	AZ N:6:98 (ASM)	unevaluated; requires testing	“
“	“	AZ N:7:493 (ASM)	recommended not eligible	none

Comments: This report includes only State Land portions of proposed project. As specific alignment of road is not determined, recommended treatment can not be made for the two prehistoric sites.

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PROJECT DESCRIPTION

At the request of the Lyon Engineering under contract with Yavapai County, I conducted an archaeological survey of areas of Arizona State Trust Land being considered for road improvement and construction. The survey is required by the Arizona State Land Department through the Arizona State Historic Preservation Act (A.R.S 41-861 to 865). This survey covers only the State land portion of the project which includes two one mile long segments that are 300 ft. wide and another one mile segment that is 400 ft. wide. Once an alignment is selected the road easement will be 100 ft. wide. This report provides background information, the results of the survey, and recommendations for the proposed project.

PROJECT LOCATION

The project is immediately west of the town limits of Chino Valley, Yavapai County, Arizona. It includes the southern 300 ft. of T16N R2W Sec. 20 and the northern 300 ft. of T16N R2W Sec. 30 (both following Center Street), and the southern 400 ft. of T16N R3W Sec. 26, G&SRB&M (partly following Brenda Trail) (Maps 1 and 2). The total project area is 121 acres. For ease of discussion below, the project area will be divided into the eastern two sections (Sections 20 and 30) and the western section (Section 26).

The project area is Arizona State Trust land managed by the Arizona State Land Department (Map 3).

PREVIOUS RESEARCH/RECORD SEARCHES

A record search of AZSITE revealed three previous archaeological projects, one with two phases (Maps 1 and 2; Table 1), and 11 recorded archaeological sites within one-half mile (Map 4; Table 2).

The GLO map surveyed in 1871 of the western section (T16N R3W S26) shows a road running diagonally southeast to northwest across the section (Figure 1). No evidence of this road was seen. The GLO of the same year for the eastern two sections (T16N R2W S20 and 30) shows a road running through the corner of Section 20 and one running through the center of Section 30, but no evidence of these features was noted on the ground. The GLO map of 1914 for the same sections shows a road running along a drainage to the northeast, through the corner of Sec. 19 (not in the project area) and north in Sec. 30 to a house (W. E. Johnson) and windmill are within a very large fenced area (Figure 2). The project area crosses the road in Sec. 30, which is visible on the ground, and seems to include the fence line in Sec. 20 that runs along Center Street.

There are no properties on the National Register of Historic Places within one-half mile of the project area. There are no structures in the project area.

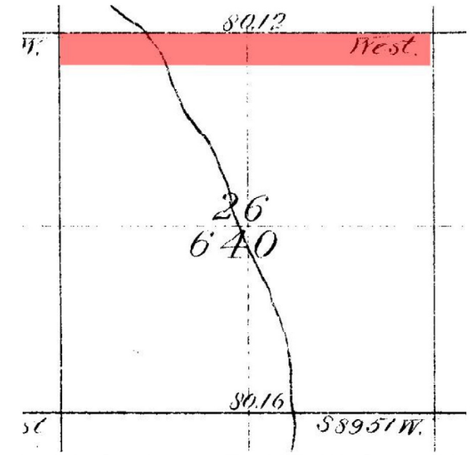

Figure 1. Project area (red) in Section 26, T16N R3W. General Land Office map surveyed in 1871 showing road. Scale 1:24000.

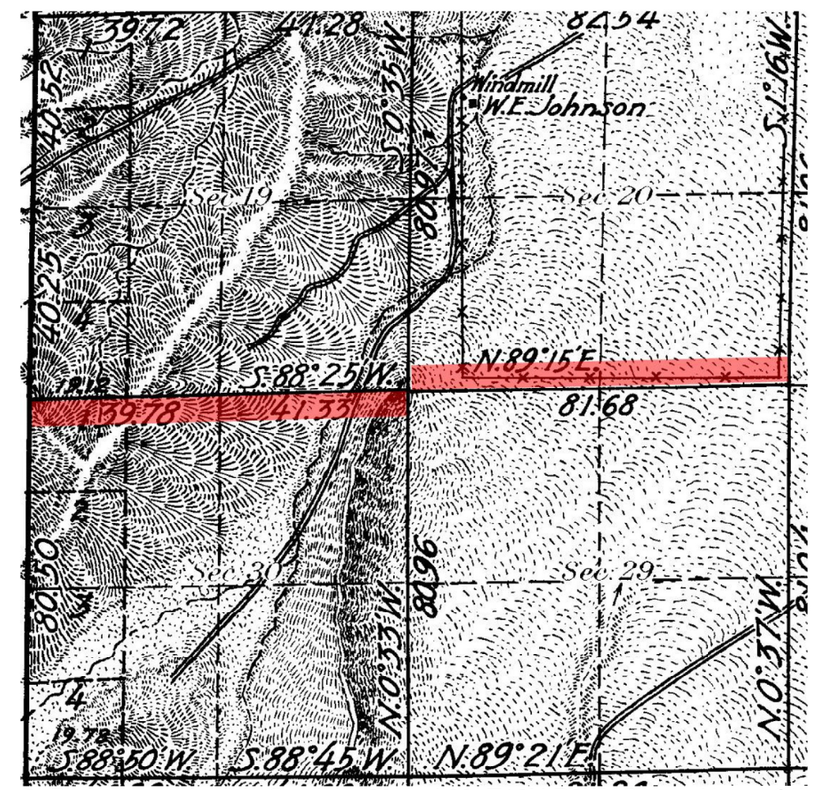

Figure 2. Project area (red) in Sections 20 and 30, T16N R2W. General Land Office map surveyed in 1914 showing road. Scale 1:24000.

ENVIRONMENTAL CONTEXT

Geology in the eastern two sections is mostly Quaternary sand and gravel, with some of the hilltops covered in pebbles. The western section is mostly metamorphosed sedimentary rocks represented as schist, but some phyllite is present. Trachyandesite outcrops in the northeast corner of Section 26 (DeWitt et al. 2008).

Figure 3. View to west across grassland in Section 30 (T16N R2W).

Figure 4. View of pinyon/juniper and chaparral in Section 26 (T16N R3W). Note broken quartz, none of which appears to be of cultural origin.

Elevation ranges from 4825 ft. on the east end of the project to 5125 ft. near the western end.

Much of the project area is drained northeastward by tributaries of Granite Creek which flows into the Verde River. The westernmost end of the project area drains into tributaries of Big Chino Wash which becomes the Verde River.

The eastern two sections of the project are grassland, with cholla and yucca and an occasional juniper (Figure 3). The eastern section has fairly heavy pinyon and juniper and chaparral coverage (Figure 4). Fauna seen include antelope, coyote, jackrabbit, cottontail, and bull snake, plus various small birds.

CULTURE HISTORY

As with nearly everywhere else in Arizona, the earliest recorded occupation in Yavapai County is represented by rare PaleoIndian points. One possible fluted point base was found up Big Chino Valley and a possible late PaleoIndian/Early Archaic Eden point was found in the same area (Weaver et al. 1993).

Archaic occupation in the area is represented mostly by Pinto, San Pedro, Gypsum and other types dated to the Middle to Late Archaic periods that indicate significant use of the area by mobile hunters and gatherers over millennia (Formby 1986). The few sites that have been excavated from this period look like short-term camps of mobile populations, but one of the sites excavated at StoneRidge in Prescott Valley, dated at 2000 BP, had pithouses, burials, and maize suggesting that movement toward some sedentism and agriculture had already occurred by then (Leonard 2008:4.27).

The earliest decorated ceramics in the area are Hohokam buffware and whiteware or redware from northeastern Arizona and southeastern Utah. Most abundant is plain brownware pottery called, somewhat confusingly, Prescott Gray, because it was sometimes fired in a reducing atmosphere. Recent work at Watson and Willow lakes north of Prescott indicates an agricultural population using Hohokam-style pithouses and mortuary ritual at ca. AD 800 and this pattern continued until ca. AD 1100, with reduced use of buffware (Neily 2006:392-393). The term Prescott Culture is used for these prehistoric people.

Perhaps near the end of the eleventh century, exchange of pottery with the south was reduced and most decorated pottery coming in came from the Kayenta or Little Colorado areas. Although perhaps as early as AD 900 a decorated brownware, Prescott Black-on-gray, was produced, it did not become important until late in the 1100s (Christenson 2005:8.63). Use of above-ground masonry structures began, although there was still some pithouse use. It is thought that hilltop masonry sites, for which the term “fort” was suggested (Austin 2000; Fewkes 1913), were being built in this period. These sites often have no or few artifacts and are intervisible with other such sites. Ken Austin and later Dave Wilcox became interested in these sites as possible evidence of intercommunication between populations subject to raiding and warfare (see Wilcox et al. 2001). One of Austin’s sites, NA 13012, called a “retreat,” is on private land overlooking both prehistoric sites recorded in this project.

By 1200, the population of the Prescott region was mostly concentrated in “pueblos” ranging from 5 to perhaps 80 rooms, concentrated in Lonesome Valley, Chino Valley, and Williamson Valley (Christenson 2013: Figure 66). Agriculture, especially maize, was the major livelihood, but hunting was important as probably was procurement of wild plant foods such as agave. These pueblos continued to have some occupation into the early 1300s, as which point the area was abandoned by sedentary populations (Christenson 2013:193-198).

Scarce evidence of possible occupation by possible Yavapai ancestors begins to show up at about the time the Prescott Culture is leaving (Christenson 2013:198-199). By the time Europeans arrived, the area was occupied by the Northeastern Yavapai (Khera and Mariella 1983: Figure 1).

Europeans arrived in the area in 1863 looking for gold. The military soon followed to protect the miners, first at Del Rio at the north end of Chino Valley and soon after to Prescott, which became the territorial capital. The general route currently taken by Williamson Valley road was the main wagon road to the Colorado River, the region’s main link to the world for products coming in or going out. This end of the project area has been ranching country from the beginning (Lopez 2011), but recently many of the larger, privately-owned ranches such as the Cooper-Morgan, have been subdivided as mini-ranches.

Chino Valley was a major supplier of agricultural products and meat to the mining community and once the railroad arrived in 1886, the wagon routes lost their importance and the region became an exporter of cattle, vegetables, and dairy products, as well a transfer point for copper from the Jerome mines. This general economic character remained through the twentieth century, with increased use of the area as a bedroom community for Prescott and by the turn of the millennium as a retirement location (above information summarized from Stein 1995:13-30).

The only use the project area has seen is grazing of livestock.

SURVEY METHODS

The project area was surveyed by Andrew L. Christenson under Arizona Antiquities Permit 2017-043bl from April 11 through May 5, 2017. The area was walked in parallel transects 20 m apart. Ground visibility was generally quite good with perhaps 50% or more of the ground being visible in the eastern two sections and 70% or more in the pinyon/juniper/chaparral area in the western section. Isolated finds were plotted with a GPS. Sites were recorded using ASM standards with boundaries mapped using a GPS. Project biologist David Eiker helped with mapping the two prehistoric sites recorded.

The project area has large amounts of broken quartz on the surface, either near bedrock in the western section (Figure 4), or in lag gravels on hilltops in the eastern two sections. Although occasional pieces of presumed culturally created quartz flakes (e.g., platform, bulb of percussion, sharp edges) were observed, most quartz is chunky, has rounding, and often a patinalike frosting of the surface.

Sherds on the surface are fairly small because of livestock trampling.

For the two prehistoric sites located, a 5x5 m square was selected and all definite cultural items were counted (see Tables 4 and 5).

SURVEY FINDINGS

Eighteen isolated finds and three sites were recorded (Map 5). The isolates are mostly single pieces of prehistoric chipped stone or isolated historic-period artifacts (Table 3). The three sites recorded are discussed in detail below.

AZ N:6:97 (ASM). This is a large Prescott Culture site about 130 m (NW/SE) by 60 m (NE/SW) (Map 7; Figure 5). It runs along a low ridge that has a slight saddle (habitation sites in the vicinity are typically on hills or ridges; Deats and Haynes 2010:16.24) (Figure 6). Two rock clusters on either side of the saddle are probably masonry structures. Schist outcrops on the surface of the site but can be distinguished from likely cultural schist features by having the rock bedding sticking out at an angle. Quartz also outcrops on the site, creating dense scatters of broken quartz (Figure 6). The southern 1/3 of this site is outside the project area (Figure 5).

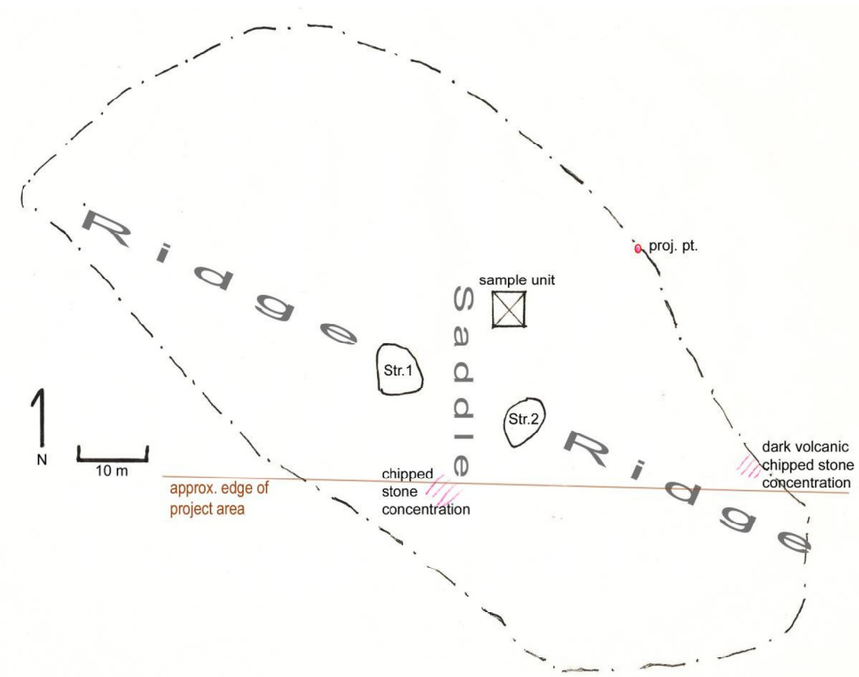

Figure 5. AZ N:6:97 (ASM). Site Plan. Approximate edge of project area shown.

Figure 6. AZ N:6:97 (ASM). Relationship of Structures 1 and 2 on either side of low saddle. View southeast. Note natural broken quartz scatter in foreground.

Artifact density is high. The 5x5 m sample square located in an area of high density had 4 artifacts per m^2, about half sherds and half chipped stone (sherds of any size were counted) (Table 4). If the average artifact density on the site were, say one-eighth of that density, that would give 3000-4000 total surface artifacts.

Structure 1 is an oval of schist cobbles about 5.4 by 5.25 m and the stones stick up around 30 cm (Figure 7). No obvious pothole is visible in this structure, but a can fragment is present and a shoe is located outside the structure to the south.

Structure 2 is an elongated oval of schist cobbles about 9.2 by 6.5 m with the length oriented at 13°. Cobbles stick up about 45 cm, probably in part because they were thrown out of the pothole in the center of the structure (Figure 8).

Because of the presence of pinyon or juniper needles on the surface of these structures, no artifacts were visible, except for the can fragment in Str. 1.

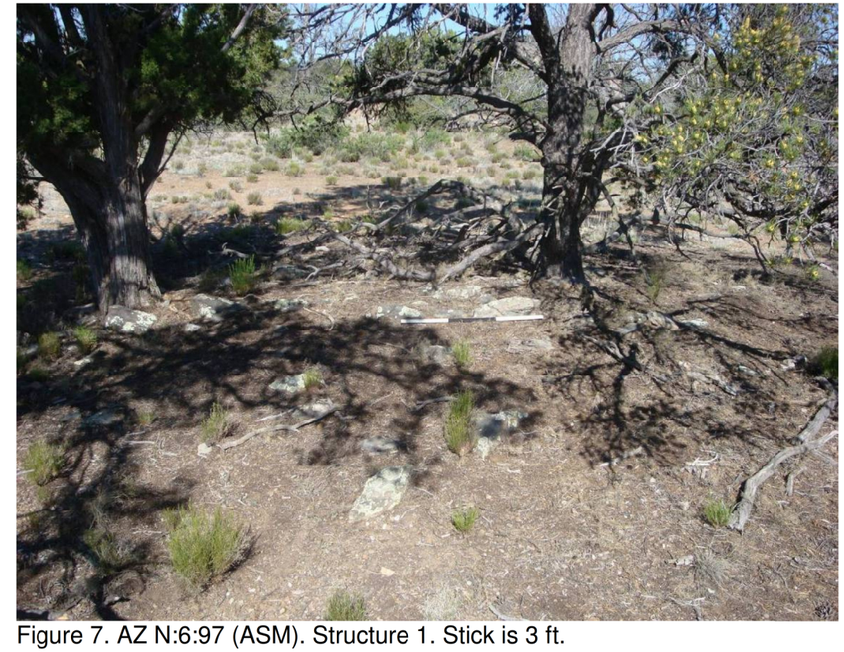

Figure 7. AZ N:6:97 (ASM). Structure 1. Stick is 3 ft.

Figure 8. AZ N:6:97 (ASM). Structure 2. Stick is 3 ft. long.

Nearly all of the pottery seen on the site was Prescott Gray Ware, although one smudged Verde Brown bowl sherd was present as was a San Juan Red Ware bowl

sherd, probably Deadmans Black-on-red. This latter type has a date range in northeastern Arizona of about 780 to 1040 (Christenson 1994: Table 2). Near this sherd was an unnotched obsidian triangular point (16x10x2 mm), a type which had a wide range of use from AD 900 until the historic period (Justice 2002: 265) (Figure 9).

Figure 9. AZ N:6:97 (ASM). Unnotched obsidian projectile point.

A couple of chipped stone concentrations were noted in the process of defining the site perimeter and are noted on the map. One possible biface retouch flake of obsidian was also noted on the site.

AZ N:6:98 (ASM). This is a medium-size artifact scatter about 65 by 50 m (Figures 10 and 11) (Map 7; Figure 10). It extends an unknown distance on to private property to the north. A horse trail runs along the west edge of the site and along the fence line that cuts through the north side.

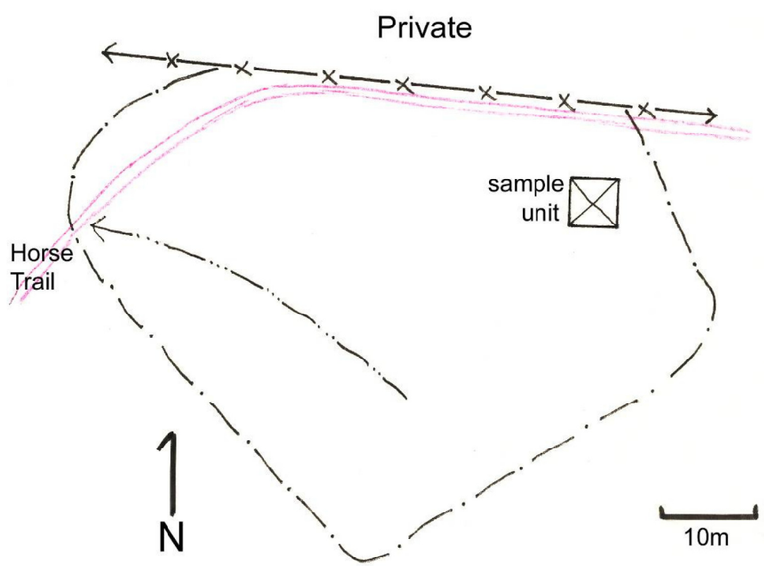

Figure 10. AZ N:6:98 (ASM) Site Plan. Note that section line is not true east-west.

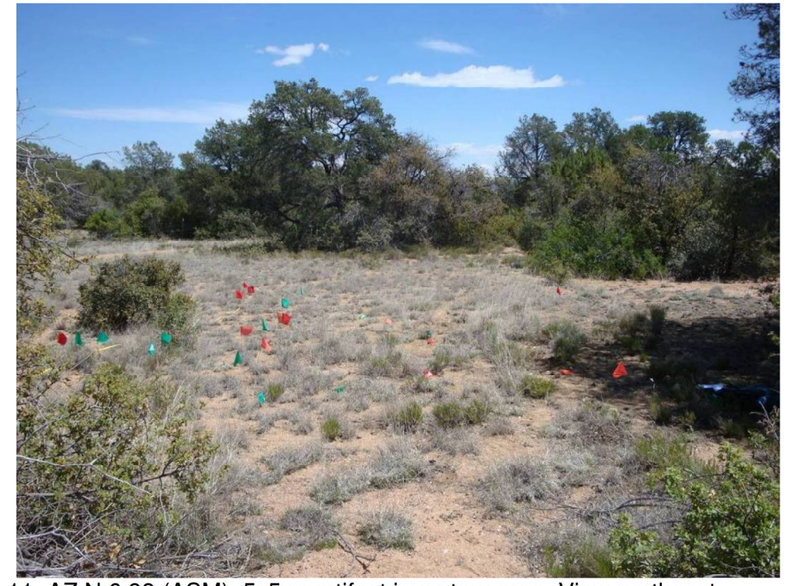

Figure 11. AZ N:6:98 (ASM). 5x5 m artifact inventory area. View northeast.

No features were observed within the scatter. A 5x5 m inventory area had 2.6 artifacts/m^2 most of them sherds (Table 5). One piece of burned bone was also present. As with the previous site, the sample area was higher density than the site as a whole, so perhaps there are 500-800 surface artifacts total.

AZ N:7:493 (ASM). This is a trash dump consisting of pieces of perhaps one canning jar with glass lid liner, at least four cans, two porcelain dish fragments, two pieces of clear glass, and two pieces of SCA glass (Map 6; Figures 12 and 13; Table 6). A total of 64 artifacts were counted, although tiny can fragments were not included. The area is only 3.5 by 4 m and is located about 10 m north of the fence that borders Center St. One broken cow bone located a few meters from the edge of the scatter is probably later and was not counted as part of the site.

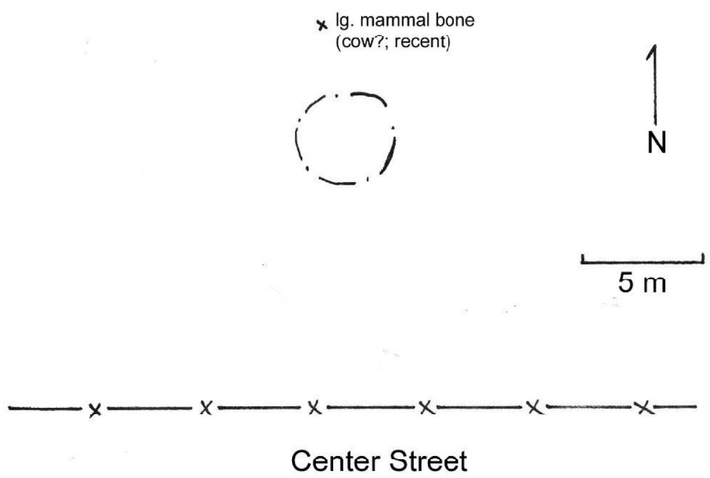

Figure 12. AZ N:7:493 (ASM) Site Map.

The only well-dated artifacts on the site are the pieces of SCA glass that had to have been made prior to 1920 when manganese was still being used to make clear glass (stockpiles of manganese probably were used up prior to using new ways to make clear glass) (Goodman 1998:1). However, the presence of clear glass suggests the probability that the site was deposited after the end of use of manganese in glass. Deposition of the trash was probably a single event no earlier than the later part of World War I.

Figure 13. AZ N:6:98 (ASM). Can and glass dump.

SUMMARY AND RECOMMENDATIONS

A systematic archaeological survey across the State Trust land portion of a prospective road improvement and extension project revealed two prehistoric and one historic site. These cultural resources will be evaluated for the National Register of Historic Places below.

AZ N:6:97 (ASM). This large prehistoric site has an extensive surface scatter of chipped stone and pottery sherds. Two areas of piled up rock are certainly the remains of prehistoric habitation structures. Although the southern quarter of the site is outside the project area, both structures are within it.

Excavations at Talking Rock Ranch within a mile northwest revealed two such one-room structures that were about 4.5 m in diameter. These were thought to have consisted of a low masonry wall foundation with a wood or brush superstructure (Deats et al. 2010: 6.42, 6.95). Both structures were considered to be Prescott Culture, with one dating to the AD 1070-1150 period (p. 6.42).

This site is in good shape and except for a pothole in Structure 2 and trampling breakage of surface artifacts by livestock, it has potential to provide information about past cultures in the area. Although bedrock is on the surface in portions of the site, potential for buried artifacts or features is high. The site is certainly eligible for the National Register under criterion D.

AZ N:6:98 (ASM). This small prehistoric site has a medium-density scatter of chipped stone and pottery sherds. No structural evidence was evident. An unknown portion of the site is on private land to the north.

It is not uncommon for sites in the area with surface artifacts in this quantity to find subsurface pithouses, or other features, when test trenches are excavated (e.g. AZ N:2:68 (ASM) and AZ N:2:91 (ASM) at Talking Rock Ranch - Deats et al. 2010: Chapter 6; see also Deats and Haynes 2010:16.20-21). For this reason, testing is required to determine if this site is eligible for the National Register.

AZ N:7:493 (ASM). This site seems to be a small, single-event trash dump from the end of World War I or later. It has no information potential beyond what was recorded in this survey and is not eligible for the National Register.

Because the specific route for the proposed road has not been determined, no specific recommendations can be made. A generalized statement can be made that disturbance of either AZ N:6:97 (ASM) or AZ N:6:98 (ASM) as part of this project would require archaeological testing and/or data recovery work. No further work at AZ N:7:493 (ASM) is recommended.

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Table 1. List of Previous Projects within One-half Mile.

ASM Number	Project Name	Reference
1993-121	Caucci Survey	Euler 1993
1997-186	Arc. Survey of Reed Road	Ziem 1997
1999-562	Talking Rock Ranch, testing	Potter 2001
none	Talking Rock Ranch data recovery	Deats 2010

Table 2. List of Previously-recorded Sites within One-half Mile.

ASM Site No.	Site Type	Cultural/Temporal Affiliation	NR Eligibility	Reference
N:2:97	fence	EuroAmerican, 1910-1930	determined not eligible	Potter 2001
N:2:99	habitation; trash scatter	prehistoric; EuroAmerican ranching/logging camp	determined eligible	"
N:2:102	habitation	Prescott Culture; EuroAmerican	determined eligible	"
N:6:42	ceramic and lithic scatter	Prescott Culture	determined eligible	"
N:6:44	artifact scatter	EuroAmerican; early 20th century	determined not eligible	"
N:6:45	ranch road	EuroAmerican	"	"
N:6:46	ceramic and lithic scatter	Prescott Culture, 900-1300	tested; determined not eligible	"
N:6:47	masonry structure	"	determined eligible	"
N:6:48	artifact scatter	prehistoric	testerd; determined not eligible	"
N:6:66	dump	EuroAmerican, after 1915	determined not eligible	"
NA 13213 (MNA)	hilltop retreat	Prescott Culture, 900-1300	not evaluated	Ken Austin - John T. site; Wilcox et al. 2001

Appendix I

Stakeholder Notifications and Comments

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September 2016

Northern Connector
Design Concept Report

Design Duration: September 2016 – September 2017

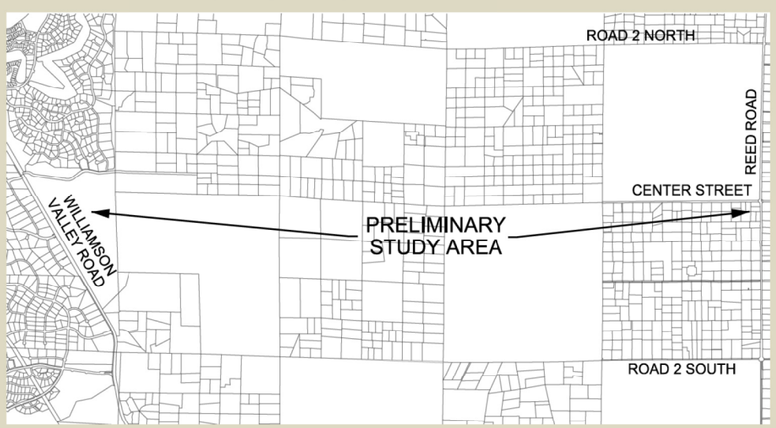
Design Consultant: Lyon Engineering & Surveying, Inc.

The Yavapai County Public Works Department hired Lyon Engineering & Surveying as the design engineer for the Preliminary Northern Connector Roadway Design Concept Report in September 2016. Lyon Engineering staff and survey crews will be present in the proximity of Williamson Valley Road, Nancy Drive, Brenda Trail, Bandit Ridge Road, Center Street, Yuma Road, and Reed Road contacting homeowners and conducting preliminary field research.

For questions regarding this project please contact Kevin Horton at Lyon Engineering by e-mail or phone.

Phone: 928-776-1750

e-mail: kevinhorton@lyonengineering.com



Lyon Engineering & Surveying

1650 Willow Creek Road
Prescott, AZ 86301

Phone (928) 776-1750
www.lyonengineering.com

LYON ENGINEERING
Civil Engineers • Land Surveyors

Northern Connector Corridor Study

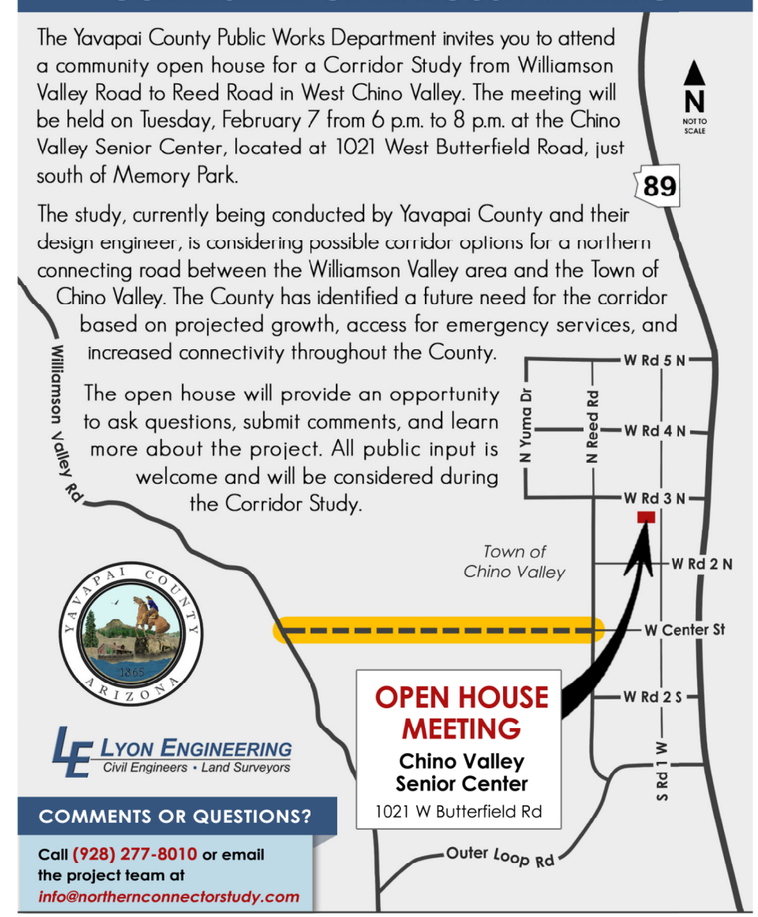
Williamson Valley Road to Reed Road in West Chino Valley

COMMUNITY OPEN HOUSE MEETING

The Yavapai County Public Works Department invites you to attend a community open house for a Corridor Study from Williamson Valley Road to Reed Road in West Chino Valley. The meeting will be held on Tuesday, February 7 from 6 p.m. to 8 p.m. at the Chino Valley Senior Center, located at 1021 West Butterfield Road, just south of Memory Park.

The study, currently being conducted by Yavapai County and their design engineer, is considering possible corridor options for a northern connecting road between the Williamson Valley area and the Town of Chino Valley. The County has identified a future need for the corridor based on projected growth, access for emergency services, and increased connectivity throughout the County.

The open house will provide an opportunity to ask questions, submit comments, and learn more about the project. All public input is welcome and will be considered during the Corridor Study.



COMMENTS OR QUESTIONS?

Call (928) 277-8010 or email the project team at *info@northernconnectorstudy.com*

Byron Jaspers
Public Works Director
Yavapai County

Roger McCormick
Assistant Public Works Director
Yavapai County

Kevin Horton
Project Manager
Lyon Engineering & Surveying, Inc.

Visit *www.northernconnectorstudy.com* for additional project information

Yavapai County • Public Works Department • 1100 Commerce Drive • Prescott, Arizona 86305

Yavapai County Northern Connector

Public Comment Summary Sheet

Comment Number	Name	Contact Information	Physical Address	Date Received	Received Via	Project Preference
1	Jezairian, Joe	jjezinaz@gmail.com		3/5/2017	Website Email	Against
2	Foster, Robert P. & Jane	rpricefos@aol.com		3/5/2017	Website Email	For
3	Mathews, Kathleen	kathy.mathews@verizon.net	4775 W Young Rd, Prescott, AZ, 86305	3/8/2017	Website Email	For
4	Lucescu, Lavinia	agrtrn33@yahoo.com		3/19/2017	Website Email	Against
5	Hahn, John & Bridget	be_jwhahn@yahoo.com	5080 W. Billy Jack Way, Prescott, AZ 86305	2/28/2017	Website Email	Against
6	Brown, Robert	robertb17543@yahoo.com	14801 N Dragons Breath Ln, Prescott, AZ, 86305	3/8/2017	website Email	For, but against preferred alignment
7	Miller, Michael & Pam	millrml@aol.com	13737 N Iron Hawk Dr, Prescott, AZ, 86305	3/6/2017	Website Email	For, but against preferred alignment
8	Morrison, Glen & Julie	morrisonglenn72@gmail.com	1716 Alpine Meadows Lane, Prescott, AZ, 86303	2/21/2017	Website Email	Against
9	McFerron, Michael J	mjm.jmm.mcferron@gmail.com		3/8/2017	Website Email	Against
10	Craswell, Dede	deder57@me.com		3/9/2017	Website Email	For, but against preferred alignment
11	Meyer, Lew	Lewmeyer@hotmail.com		3/14/2017	Website Email	For
12	Parker, Larry	leparker34@gmail.com		3/16/2017	Website Email	Against
13	Wells, Sharon	sharonw636@yahoo.com		2/12/2017	Website Email	For, but against preferred alignment
14	Mensing, Pete & Karen	oldnorth5@gmail.com		3/7/2017	Website Email	Neutral
15	Giertmann, Carol	cmgierma@gmail.com		3/6/2017	Website Email	Against
16	Pirtle, Joan	pirtlejoan@yahoo.com		3/6/2017	Website Email	For, but against preferred alignment
17	Nelson, Jeff	jeff@nelsoncommercial.org		3/4/2017	Website Email	Against
18	Pawel Jr, Dave	928-308-2796	10825 Strickland Wash Road, Prescott, AZ	2/22/2017	Yavapai County	Against
19	Lacey, Dave & Kris	928-771-0660	3315 W Brenda Trail, Prescott, AZ, 86305	3/1/2017	Yavapai County	Against
20	Frank, Christopher & Patti	chrisandpattifrank@gmail.com		2/25/2017	Yavapai County	Against
21	Sweeney, Tom & Michelle	itsmsweeney@gmail.com		2/27/2017	Yavapai County	Against
22	Briody, Pat		3590 W Brenda Trail, Prescott, AZ, 86305	2/27/2017	Yavapai County	Against
23	Baumgartner, Kristin	kristinb77@gmail.com	5150 W Johnny Guitar Road, Prescott, AZ, 86305	3/1/2017	Yavapai County	Against
24	Flood, Jeannie		3595 W Brenda Trl, Prescott AZ, 86305	3/1/2017	Yavapai County	Against
25	Knowles, Ken & Charlene	triooftrust@gmail.com	14451 N Hawkins Trail, Prescott, AZ, 86305	2/23/2017	Yavapai County	For, but against preferred alignment
26	Williams, Don & Karen		3030 West Center Street, Chino Valley, AZ, 86323	2/28/2017	Mail	Against
27	Alen, Arlene	director@chinovalley.org	PO Box 419, Chino Valley AZ, 86323	3/20/2017	Mail	For
28	Spate, Stan		14065 N Thunderbird Rd, Prescott, AZ, 86305	3/6/2017	Mail	Against
29	McElroy, Kim	928-308-2796	11325 Strickland Wash Road, Prescott, AZ	3/1/2017	Mail	Against
30	Erps, Ronald H.		13533 North Warpaint Place, Prescott, AZ, 86305	3/5/2017	Mail	For, but against preferred alignment
31	Cocherell, Doreen	909-263-6912, 1fluffybunny@earthlink.net	13950 N Warbonnet Lane, Prescott, AZ	3/7/2017	Mail	Against
32	Green, Sandra		1264 Crown Ridge Dr, Prescott, AZ, 86301	3/11/2017	Mail	Against
33	Jablow, Andrew	andrewjablow6@gmail.com		3/1/2017	Yavapai County	Against
34	Bianca, Andrew	abianca1@gmail.com		3/25/2017	Yavapai County	For
35	Rumble, Richard T.	928-445-5659, r.rumble@hotmail.com	3300 W L Bar L Rd, Prescott, AZ	3/28/2017	Yavapai County	Against
36	Ritzer, Jim	custserve@patriotdisposal.com		3/2/2017	Lyon Engineering	For
37	Grambusch, Steve & Mary	mgrambusch3@aol.com	14220 N Brenda, Prescott, AZ	3/4/2017	Website Email	Against
38	Heller, Tom	928-277-1614, tom.heller@live.com	12870 N. Chancella Circle, Prescott, AZ, 86305	3/9/2017	Website Email	For
39	N/A	oldbutgood@q.com		3/6/2017	Website Email	Against
40	McFerron, Jennifer	mcferron.sc@gmail.com		3/8/2017	Website Email	Against
41	Snyder, Stephen	sjnaz@gmail.com		3/7/2017	Website Email	Against
42	Fletcher, James	jlfcpaaz@gmail.com		3/7/2017	Website Email	Against
43	Oliver, Tim & Roseanne	techspec@qwestoffice.net		3/6/2017	Website Email	Against
44	Webb, Lori	sunnyloriw@yahoo.com	8450 Valley Oak, Prescott, AZ, 86305	3/6/2017	Website Email	Against
45	Robbins, Scott & Janet	jsrkatz5@cableone.net	5125 W Vengeance Trail, Prescott, AZ, 86305	3/5/2017	Website Email	Against
46	Lehr, Charles	charleslehr@gmail.com	13572 N Warpaint Pl, Prescott, AZ, 86395	3/7/2017	Yavapai County	Against
47	Carter, Carol	cbjasperjack@gmail.com		3/14/2017	Website Email	Against
48	Howerton, Sandi	928-541-9021, howertonnj@gmail.com	8955 N Valley Oak Dr, Prescott, AZ, 86305	3/6/2017	Website Email	Against
49	Eigenauer, Carla	mingusmtarabians@hotmail.com	2835 W love Lane, Prescott, AZ, 86305	3/7/2017	Website Email	Against
50	McIntyre, Steve	zpsteve@yahoo.com		3/8/2017	Website Email	Against
51	Hamada, Kenneth	559-709-8901, kenneth.hamada@live.com	5745 W Halcyone Circle, Prescott, AZ, 86305	3/8/2017	Website Email	Against
52	Benson, David	dbenson@pacificvetgroup.com		2/20/2017	Website Email	Against
53	Regelbrugge, Jim & Willi	jimandwilli@gmail.com	5250 W Vengeance Trail, Prescott, AZ, 86305	3/9/2017	Website Email	For, but against preferred alignment
54	Penn, Bradley	brad.penn@outlook.com	4676 W. Tomahawk Ridge Lane, Prescott, AZ, 86305	3/4/2017	Website Email	For, but against preferred alignment
55	Spalding, Alan	aldar964@frontier.com		3/6/2017	Website Email	For
56	Pearson, John N.	928-227-1874, johnnpearson@cableone.net	2920 W Glen Haven Drive, Prescott, AZ, 86305	3/5/2017	Website Email	Neutral
57	Wales, Carla	carlamwrn@gmail.com		3/9/2017	Website Email	Against
58	Woodbury, Greg	g.v.woodbury@gmail.com		3/4/2017	Website Email	Against
59	Price, George	pricegeo@gmail.com		3/5/2017	Website Email	For
60	Ashforth, Greg	928-899-8664, greg.ashforth@verizon.net		3/8/2017	Website Email	Against
61	Hahn, Baron	8grateful@gmail.com		3/14/2017	Website Email	Against

Yavapai County Northern Connector

Public Comment Summary Sheet

Comment Number	Name	Contact Information	Physical Address	Date Received	Received Via	Project Preference
62	Larson, Daniel	redoak14@icloud.com		3/9/2017	Website Email	Against
63	Miller, Mark & Katherine	sgthammy@yahoo.com	14650 Falcon Ridge Road, Prescott, AZ, 86305	3/8/2017	Website Email	Against
64	Clark, James & Christine	kimodog@earthlink.net		3/8/2017	Website Email	For
65	Corlett, Christopher	chris@adahotelsigns.com	3965 W Running Iron Drive, Prescott, AZ, 86305	3/8/2017	Website Email	Against
66	Dickinson, Robert	shrksfn99@aol.com		3/8/2017	Website Email	Against
67	Winsor, Patrick & Barbara	pwinsor@commspeed.net		3/7/2017	Website Email	Against
68	Bornyasz, Matt	designs@brensan.com		3/6/2017	Website Email	Against
69	Carson, Debbie	928-533-7527, kdcarson@gmail.com	3257 W Chipmunk Road, Prescott, AZ, 86305	3/6/2017	Website Email	Against
70	Fulkerson, Derril	derrillfulkerson@gmail.com		3/5/2017	Website Email	Against
71	Tobia, Connie	tobiarv@gmail.com		3/5/2017	Website Email	For
72	Gonczy, Richard & Rosemary	rgrg14@live.com		3/4/2017	Website Email	For
73	Damesek, Ray & Linda	805-485-9397, raydamesek@yahoo.com	14180 N Warbonnet Lane, Prescott, AZ, 86305	3/4/2017	Website Email	Against
74	Blyth, Barry	barryblyth54@gmail.com		3/4/2017	Website Email	For
75	Rauchfuss, Paul	928-445-4617, smokefoot55@yahoo.com	2440 W Twinoaks Dr	3/4/2017	Website Email	Against
76	Brereton, Justin	justin.brereton@yc.edu		3/3/2017	Website Email	Neutral
77	Myers, Richard & Tracie	rick@rkmdesign.net	3235 W Blackjack Ridge Rd	3/7/2017	Website Email	Against
78	Sweeney, Michelle	itsmsweeney@gmail.com		2/27/2017	Website Email	Against
79	Lind, Deirdre	deirdrelind@hotmail.com		3/16/2017	Website Email	Against
80	Ryan, Tom	tomryan30518@yahoo.com		3/6/2017	Website Email	For, but against preferred alignment
81	Burnett, Robert & Kate	r2blt@juno.com	2305 W Live Oak Dr, Prescott, AZ, 86305	3/5/2017	Website Email	For
82	Lohr, Helene	928-925-5338, hsl2@aol.com	10725 N Patina Rd, Prescott, AZ, 86305	3/9/2017	Website Email	Against
83	Holmes, Crystal	crystyholmes@outlook.com		3/8/2017	Website Email	Against
84	Sebastia, Leoner	928-899-9655, leonor.sebastia@gmail.com	11100 N Williamson Valley Ranch Road, Prescott, AZ, 86305	3/7/2017	Website Email	Against
85	Cooperrider, Neil & Paula	928-899-3321, neil@cooperrider.org	8925 W Long Meadow Dr, Prescott, AZ, 86305	3/6/2017	Website Email	For
86	Redwine, Bon & Anne	928-445-5768, bredwine@wilburellis.com	13075 N Trail Blazer, Prescot, AZ, 86305	3/7/2017	Website Email	Against
87	Maldonado, John & Sue	maldo22@q.com		3/6/2017	Website Email	Neutral
88	Watson, Rebecca	watson_88@msn.com		3/9/2017	Website Email	For
89	Hall, Jade	jlhall4@yahoo.com		3/4/2017	Website Email	Against
90	Redford, Rob & Chris	rd_redford@hotmail.com		3/4/2017	Website Email	For
91	Davis, Erin	coveyridgearabians@gmail.com		3/5/2017	Website Email	For
92	Butterfield, Barbara	928-379-0856, bbutter@umich.edu		3/5/2017	Website Email	For
93	Helm, Percy R.	928-899-3925, percy7sos@gmail.com	5542 W Indian Camp Rd, Prescott, AZ, 86305	3/7/2017	Yavapai County	For
94	Rushbrook, Pete	slowcreek54@gmail.com		3/7/2017	Yavapai County	Against
95	St. Amour, Gary	928-379-0199, gstenterprises@cableone.net		3/6/2017	Yavapai County	For
96	Wilbur, Anita	702-250-7282, wilburanita@gmail.com		3/6/2017	Yavapai County	For
97	Johnson, Joe	jjohnson5675@gmail.com	5675 W Almosta Ranch Rd	3/6/2017	Yavapai County	For
98	Lamerson, Nettie	mamalamerson@yahoo.com		3/2/2017	Yavapai County	For
99	Natale, Anthony & Maricris	prayabouteverything@icloud.com	4800 W Nancy Dr, Prescott, AZ, 86305	3/2/2017	Yavapai County	Against
100	Peterson, Jim	jpeterson@empirera.com		3/6/2017	Yavapai County	For
101	Patterson, Greg & Linda	lindylou1974@yahoo.com		3/6/2017	Yavapai County	For
102	LaFee, Kathi	kathi7744@hotmail.com	1005 Talia Way, Chino Valley, AZ	3/8/2017	Yavapai County	Against
103	Wills, Jabe & Cathy	jabe757@gmail.com		3/7/2017	Yavapai County	Against
104	Hap, Joe & Stephanie	joehap@earthlink.com		3/8/2017	Yavapai County	For
105	Hill, Kevin & Sylvia	915-497-0344, slhill1981@gmail.com		3/8/2017	Yavapai County	For
106	Moshier, Ken & Gidgette	ken@moshier.org	12730 N Sundancer Trail, Prescott, AZ, 86305	3/8/2017	Yavapai County	Against
107	Baumgartner, Stephen M.	908-616-2580, steve4az@gmail.com	5150 W Johnny Guitar Road, Prescott, AZ	2/26/2017	Yavapai County	Against
108	Bob & Carol	bnckay@msn.com		3/6/2017	Yavapai County	For
109	Kervin, Julia	928-713-6754, kervindivers@gmail.com	910 S Cowboy Springs Trail, Prescott, AZ, 86305	3/9/2017	Yavapai County	Against
110	Hull, Danielle	mrsdaniellerhull@icloud.com		3/9/2017	Yavapai County	Against
111	Evans, Edna L.	ednaevans2434@gmail.com		3/10/2017	Yavapai County	Against
112	Spencer, Carol	928-775-0113		3/10/2017	Yavapai County	Against
113	Coykendall, Michael	mikecoykendall@sbcglobal.net	5214 W Palace Place, Prescott, AZ, 86305	3/3/17 (A) & 4/3/17 (B)	Mail	Against
114	Patterson, Katherine		6900 W Almosta Ranch Rd, Prescott, AZ, 86305	3/9/2017	Mail	Against
115	Keyes, Gary R.	Gkeyes@verizon.net	14000 N Warbonnet Lane, Prescott, AZ, 86305	3/4/2017	Mail	Against
116	Hinchey, Laura		6650 N Harris Dr, Prescott, AZ, 86305	3/4/2017	Mail	Against
117	Black, Bill	928-717-1874, jebwcb@cableone.net	5920 Williamson Valley Road	3/19/2017	Yavapai County	Against
118	Chesney, George	Gchesney47@gmail.com	14905 N Double Adobe Rd, Prescott, AZ, 86305	3/17/2017	Yavapai County	For
119	Radford, Kelly	radfordkelly@cableone.net		3/10/2017	Yavapai County	Against
120	Ross, Carol	carolross10@mindspring.com		3/11/2017	Yavapai County	For
121	Lacey, Dave	928-771-0660, davelacey1941@gmail.com	3315 W Brenda Trl, Prescott, AZ	2/28/2017	Mail	Against
122	Leahy, Rob & Jan		3555 W Brenda Trl, Prescott, AZ, 86305	3/3/2017	Mail	Against

Yavapai County Northern Connector

Public Comment Summary Sheet

Comment Number	Name	Contact Information	Physical Address	Date Received	Received Via	Project Preference
123	Martin, Terri	602-615-8956, terri2357@gmail.com		3/7/2017	Yavapai County	Against
124	Amend, Bill	billamend@q.com	1616 S Cathedral Pines Dr, Prescott, AZ, 86303	3/7/2017	Yavapai County	Against
125	Von Rohr, William	starview1825@gmail.com	1825 Starview, Prescott, AZ, 86305	3/7/2017	Yavapai County	Against
126	Dickinson, Misa		8700 W Lower Pass, Prescott, AZ, 86305	3/2/2017	Mail	For
127	Streetz, Marijo		18800 N Sullivan Buttes Road, Prescott, AZ, 86305	3/2/2017	Mail	For
128	Veltri, John		18800 N Sullivan Buttes Road, Prescott, AZ, 86305	3/2/2017	Mail	For
129	Briody, Jim		3590 W Brenda Trail, Prescott, AZ, 86305	3/1/2017	Mail	Against
130	Haile, Sondra	sondra0926@gmail.com		3/21/2017	Yavapai County	Against
131	Williams, Tom		200 South Bandit Ridge Road, Prescott, AZ, 86305	4/5/2017	Mail	Against
132	McCarthy, Tom & Lori	lorimccarthy25@yahoo.com		4/5/2017	Yavapai County	Against
133	Croft, Darryl	dcroft@chinoaz.net	202 N State Route 89, Chino Valley, AZ, 86323	3/20/2017	Mail	For
134	Galloway, Bob	rgadcm@cableone.net		3/16/2017	Yavapai County	For
135	Croll, Bryan C.		3031 Dollar Mark Way, Suite B, Prescott, AZ, 86305	4/7/2017	Website Email	For
136	Scholl, John	jscholl@chinovalleyschools.com, 928-636-2458		4/11/2017	Yavapai County	For
137	No Northern Connector Road Petition	northernconnectorroad@gmail.com		4/10/2017	Yavapai County	Against
138	Brown, Craig	clbsnr@msn.com	13240 N Iron Hawk Dr, Prescott, 86305	2/10/2017	Public Meeting	For
139	Pierce, Daniel	dpierce@414@aol.com	4400 W Brenda Trl, Prescott, AZ, 86305	2/7/2017	Public Meeting	Against
140	Harris, Alex		1300 W Center St	2/7/2017	Public Meeting	Against
141	Dolan, Richard	richdolan@aol.com	3035 W Cindy Lane	2/7/2017	Public Meeting	Neutral
142	McKnight, Gerald	gergmck@gmail.com	150 S Bandit Ridge Rd, Prescott	2/7/2017	Public Meeting	For
143	Smith, Will & Corrie	WDsmith13@verron.net	1580 Audry Drive, Chino Valley	2/7/2017	Public Meeting	Against
144	Pill, Robert & Patricia	tpill@live.com	5600 W Dillion Wash Rd	2/7/2017	Public Meeting	For, but against preferred alignment
145	Frederick, Gerald L.	courtasy@commsprrad.net	110 N Papago Trail, Chino Valley	2/7/2017	Public Meeting	For
146	Swift, Jason & Morgan	mjks05@gmail.com	2025 W Center St	2/7/2017	Public Meeting	Neutral
147	Naus, Guy & Diane	naushouse@cableone.net	693 W Center St	2/7/2017	Public Meeting	Neutral
148	Steinberg, Al & Allee	uncleal81@aol.com	912 W Center St, Chino Valley, AZ	2/7/2017	Public Meeting	Against
149	Carter, Ray	rayhcarter@gmail.com	230 N Sioux	2/7/2017	Public Meeting	Against
150	Brown, Pandi	clbsnr@msn.com		2/7/2017	Public Meeting	For
151	Long, Ann		Longmarel Trail	2/7/2017	Public Meeting	For
152	Austin, KL	nomomemoryman@gmail.com	PO BOX 10062, Prescott, AZ, 86304	2/7/2017	Public Meeting	For, but against preferred alignment
153	Hills, Baier	baierhills@gmail.com	6600 W Box Canyon Rd	2/7/2017	Public Meeting	Neutral
154	Foulk, Denny L.		1100 Commerce Drive, Yavapai County	4/8/2017	Yavapai County	For
155	Betts, Bob			4/12/2017	Yavapai County	For
156	Freitag, Scott A.	928-772-7711	8555 E Yavapai Road, Prescott Valley	4/13/2017	Yavapai County	For
157	Kruse, Keith	928-541-1064		3/8/2017	Phone Call	For
158	Devalck, Bill	928-460-1918		3/8/2017	Phone Call	Against
159	Anonomous Caller	928-277-4588		3/4/2017	Phone Call	Against
160	Darby, Penny	928-445-4269		3/4/2017	Phone Call	Against
161	Matt	designs@brensan.com		3/3/2017	Phone Call	Against
162	Chino Valley Resident	928-593-0020		3/3/2017	Phone Call	Neutral

CHINO VALLEY
Unified School District # 51
innovate - connect - educate

Office of the Superintendent

Byron Jaspers
Director
Yavapai County Public Works Department
1100 Commerce Drive
Prescott, AZ 86305

Re: Proposed Northern Connector

Dear Mr. Jaspers,

As the superintendent of the Chino Valley Unified School District, I am writing in support of the proposed Northern Connector which will connect Williamson Valley Road to Chino Valley via Center Street.

A number of the District's students and staff live in Williamson Valley and have to travel to school or work via Outer Loop Road. If the Northern Connector is completed, it could save 40 minutes to an hour daily for these students and staff.

In addition, the District has contemplated sending a bus to the intersection of Williamson Valley Road and Outer Loop Road to pick up students wishing to come to Chino Valley Schools. We have been unable to do this because it would be too far off of a current route and we don't have the bus resources to include that location as a stop. If the Northern Connector were to open, we could easily add a stop to an existing route at Williamson Valley Road and the Northern Connector. This would provide better access to Chino Valley Schools for existing students and provide another choice for students who currently do not attend Chino Valley Schools.

Lastly, the success of Chino Valley Schools is tied with the success of the Town of Chino Valley. Opening the Northern Connector would increase retail traffic in Chino Valley thus providing increasing sales tax revenue. This increased revenue could help the Town better maintain its infrastructure and better address the impact of future growth.

Thank you for your consideration and please do not hesitate to call or email if you have any questions.

Sincerely,

John E Scholl

John Scholl
Superintendent

650 East Center Street • Chino Valley, AZ 86323-0225
Phone (928) 636-2458 • FAX (928) 636-3897 • jscholl@chinovalleyschools.com

CENTRAL ARIZONA FIRE

Central Arizona Fire and Medical Authority
8555 E. Yavapai Road
Prescott Valley, Arizona 86314
Phone: (928) 772-7711
Fax: (928) 772-8800
www.cazfire.org

April 13, 2017

Yavapai County Supervisors
Attn. Board Chair
1015 Fair Street
Prescott, AZ 86305

Dear Sir,

It is my understanding that they Board of Supervisors is considering a northern connector between Williamson Valley Road and the Town of Chino Valley. From an emergency services perspective, paved roads improve our ability to respond. Additionally, living in the wildland urban interface we rely heavily on multiple means of ingress and egress for both the public and emergency responders. A newly paved road between Williamson Valley and the Town of Chino Valley will help satisfy that need. To that end, I support the County's efforts to provide an additional improved roadway.

Respectfully Submitted,

Scott A. Freitag
Fire Chief
Central Arizona Fire and Medical Authority

yavapaifirewise•org

Bob Betts
Chairman

April 12, 2017

Yavapai County Board of Supervisors
1015 Fair Street
Prescott AZ 86305

Gentlemen:

Following the request of Denny Foulk, I convened a meeting with Vice Chairman Jim Buchanan and Fire Marshal Rick Chase to review the proposal for the Chino Valley to Williamson Valley corridor connector.

We discussed the 2006 CYMPO study, the personal observations of traffic during the Doce Fire, the Lyon Engineering review and current emergency response times for Central Arizona Fire and Medical in this coverage area. Mr. Chase conducted a physical review of the alternative routes.

Route 2 South was impassable in wet weather and in dry weather would still be unacceptable for fire apparatus passage. That leaves the West Center Street/Brenda Trail/West Nancy Drive as the best solution. This route would reduce the distance between West Center/N. Reed intersection and Williamson Valley Rd/W. Nancy intersection by just under six miles. It would half the estimated travel time via the Outer Loop Rd currently at fourteen minutes.

We believe that the proposed route is necessary to provide: 1)an additional evacuation route for residents of the Williamson Valley corridor; and 2)significantly reduced emergency response times from fire station 62 in Chino Valley.

Respectfully submitted,

PRESCOTT AREA WILDLAND URBAN INTERFACE COMMISSION
P.O. Box 11085 Prescott, AZ 86304
Cell: 847-309-4499 Office: 928-277-8032
yavapaifirewise•org
PAWUICChair@gmail.com

MAYOR DARRYL CROFT
202 N. State Route 89
Chino Valley, AZ 86323

(928) 379-3938
Fax: (928) 636-2144
dcroft@chinoaz.net

March 20, 2017

Bryon Jaspers,
Director of Public Works
Yavapai County
1100 Commerce Drive
Prescott, AZ 86305

Dear Mr. Jaspers,

On behalf of the Town Council of Chino Valley, please accept this letter as support to Yavapai County for pursuit of the long-range road improvement project, commonly called the Northern Connector Road. This proposed roadway will provide a valuable transportation link in Yavapai County, between Williamson Valley Road south of Nancy Drive and Reed Road in the area of Center Street, in the Town of Chino Valley.

Chino Valley offers opportunity for shopping, business opportunities and great schools. We welcome improved travel access into our town, as well as adding another route of travel out of Chino Valley. Our Town is seeing expansion of both residential and commercial development. Consideration of safety and well-being for our community is at the top of our priority list. This additional roadway would provide another route available for use in emergency situations, thus helping to further promote safety in our community. It would also provide another means for people to travel into or out of Chino Valley, for possibly further educational or employment opportunities. We believe not only the citizens of the Town of Chino Valley would benefit from this Connector Road, but the project would bring added convenience and benefit to those in the surrounding communities, Yavapai County as a whole, and beyond.

In conclusion, we fully support the efforts of Yavapai County as the County continues to pursue this Northern Connector Road project. Working toward improvement in the lives of each member of our community, will take all stakeholders working in partnership to effectively produce a positive outcome.

Sincerely,

Darryl Croft
Mayor, Town of Chino Valley

DC/lb

RECEIVED
APR 05 2017
Yavapai County
Public Works

YAVAPAI COUNTY

Office of Emergency Management

Yavapai County Board of Supervisors
1015 S. Fair Street
Prescott, AZ 86303

Re: Northern Connector

April 8, 2017

Gentlemen,

Yavapai County is considering developing the "Northern Connector" from Hwy 89 and Center Street in Chino Valley over to Williamson Road and Nancy. In consideration of the benefits, Yavapai County Office of Emergency Management makes the following observations. There are several hundred residents which will benefit from this project. In addition, this project will enhance response accessibility into several under developed areas along Nancy, as well as the western portion of the project area. This project when completed will benefit response from three perspectives.

1. Enhance response times into the area.
2. Enhance mutual aid response.
3. Provide a definitive evacuation route/option for the residents on either side of the project area.

Williamson Valley Fire District and Central Arizona Fire and Medical Authority provide service in Williamson Valley. Response times could be reduced significantly into the western side of the proposed connector through the construction of a hard surfaced road. When time is of the essence those few minutes may be the difference.

To support calls for service additional units deploy from either Prescott or Chino Valley. Those units dispatched out of Chino add approximately 14 minutes travel time to calls in Chino. The proposed connector would reduce response times significantly overall impacting life safety.

Finally, the connector will provide a definitive route for evacuation for both ingress and egress to the area. This connector when completed will address several areas associated with response and evacuation and I am in favor of its construction.

Best wishes,

Denny L. Foulk, MS, EMHS
County Emergency Manager
Yavapai County
1100 Commerce Drive

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Appendix J

Northern Connector 15% Preliminary Planset

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UTILITY INFORMATION

COMPANY	CONTACT	TELEPHONE
ARIZONA PUBLIC SERVICE CO. 120 N. MARINA STREET PRESCOTT, ARIZONA 86301	ERIC WIKMAN	(928) 443-6660
CENTURYLINK 1445 MASONRY WAY PRESCOTT, AZ 86301	KAREN PORTER	(928) 776-2510
UNISOURCE ENERGY SERVICES 6405 WILKINSON DRIVE PRESCOTT, ARIZONA 86301	MALI ROSS	(928) 771-7227
CABLE ONE 3201 TOWER ROAD PRESCOTT, ARIZONA 86305	ERNIE ORTEGA	(928) 910-3096
YAVAPAI COUNTY PUBLIC WORKS DEPARTMENT 1100 COMMERCE DRIVE PRESCOTT, ARIZONA 86305	ROGER McCORMICK	(928) 771-3183

LYON ENGINEERING
Civil Engineers • Land Surveyors
1650 Willow Creek Road, Prescott, Arizona 86301
Phone: (928) 776-1750, Fax: (928) 776-0605

SUBMITTED BY

Kevin D. Horton, P.E., CFM	NOVEMBER 2017
NAME	DATE
Project Manager	43818
TITLE	ARIZONA REGISTRATION NO.

GENERAL NOTES

CONTRACTOR IS TO USE EXTREME CAUTION WHEN WORKING NEAR HIGH VOLTAGE OVERHEAD POWER LINES AND HIGH PRESSURE GAS MAINS.

CONTRACTOR TO LOCATE AND DELINEATE TEMPORARY CONSTRUCTION EASEMENTS. NO ACTIVITY SHALL OCCUR OUTSIDE OF TEMPORARY CONSTRUCTION EASEMENTS.

ALL EASEMENTS CALLED OUT IN THESE CONSTRUCTION DRAWINGS SHALL BE DEDICATED BY A RECORDED LEGAL DESCRIPTION UNLESS OTHERWISE NOTED AS "EXISTING" WITH BOOK & PAGE LOCATION OF RECORDING.

BENCHMARK

GENERAL LAND OFFICE BRASS CAP, NORTH OF EDGE OF PAVEMENT OF CENTER STREET APPOXIMATELY 1 MILE WEST OF YUMA DRIVE
MODIFIED STATE PLANE (AZ CENTRAL, NAD83)
VERTICAL DATUM: NAVD 1988

N:1,363,035.163 E:518,957.279 EL:4901.30

Contact Arizona 811 at least two full working days before you begin excavation

ARIZONA811 BLUE STAKE, INC.

Call 811 or click Arizona811.com

CONTRACTOR CAUTION NOTE

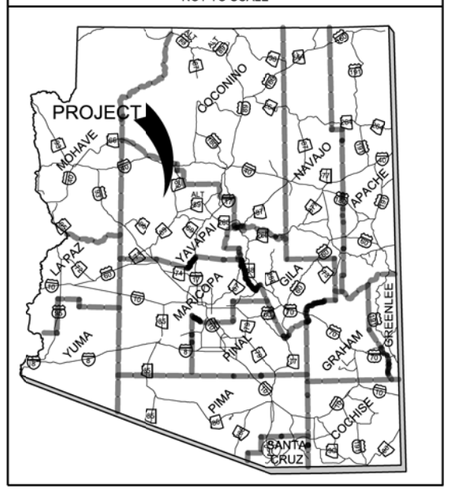
A THOROUGH ATTEMPT AND COORDINATION HAS BEEN COMPLETED WITH THE DRY UTILITY PROVIDERS TO IDENTIFY EXISTING LOCATIONS AND POTENTIAL CONFLICTS. ALL IDENTIFIED LINES AND CONFLICTS ARE SHOWN IN THE IMPROVEMENT PLANS. CONTRACTOR TO USE EXTREME CAUTION REGARDING UNIDENTIFIED EXISTING DRY UTILITY LINES AND CONFLICTS.

NORTHERN CONNECTOR IMPROVEMENT PROJECT WILLIAMSON VALLEY ROAD TO REED ROAD - 15% DESIGN PLANS

YAVAPAI COUNTY PUBLIC WORKS DEPARTMENT

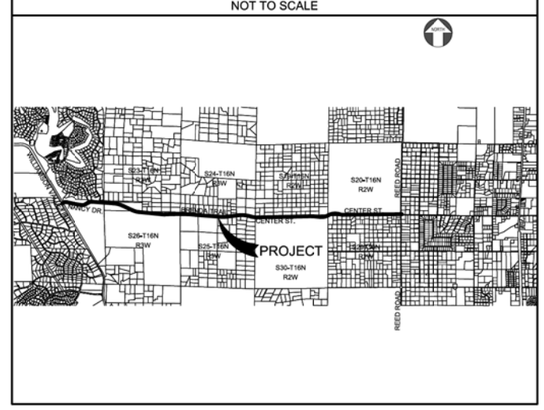
VICINITY MAP

NOT TO SCALE



LOCATION MAP

NOT TO SCALE



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2	G.02	TYPICAL SECTIONS
		SURVEY CONTROL
3	SVY.01	SURVEY CONTROL PLAN
4	SVY.02	GEOMETRICS CONTROL PLAN
5	SVY.03	GEOMETRICS CONTROL PLAN
		CIVIL
6	C.01	YCNCR STA. 10+00 TO 22+50 IMPROVEMENT PLAN
7	C.02	YCNCR STA. 22+50 TO 35+00 IMPROVEMENT PLAN
8	C.03	YCNCR STA. 35+00 TO 47+50 IMPROVEMENT PLAN
9	C.04	YCNCR STA. 47+50 TO 60+00 IMPROVEMENT PLAN
10	C.05	YCNCR STA. 60+00 TO 75+50 IMPROVEMENT PLAN
11	C.06	YCNCR STA. 75+50 TO 85+00 IMPROVEMENT PLAN
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13	C.08	YCNCR STA. 97+50 TO 110+00 IMPROVEMENT PLAN
14	C.09	YCNCR STA. 110+00 TO 122+50 IMPROVEMENT PLAN
15	C.10	YCNCR STA. 122+50 TO 135+00 IMPROVEMENT PLAN
16	C.11	YCNCR STA. 135+00 TO 147+50 IMPROVEMENT PLAN
17	C.12	YCNCR STA. 147+50 TO 160+00 IMPROVEMENT PLAN
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21	C.16	YCNCR STA. 197+50 TO 210+00 IMPROVEMENT PLAN
22	C.17	YCNCR STA. 210+00 TO 222+50 IMPROVEMENT PLAN
23	C.18	YCNCR STA. 222+50 TO 235+00 IMPROVEMENT PLAN
24	C.19	YCNCR STA. 235+00 TO 247+50 IMPROVEMENT PLAN
25	C.20	YCNCR STA. 247+50 TO 260+00 IMPROVEMENT PLAN
26	C.21	YCNCR STA. 260+00 TO 272+50 IMPROVEMENT PLAN

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NORTHERN CONNECTOR ROAD
CIP#: 16-19419

GENERAL

COVER SHEET

DATE NOVEMBER 2017
LYON PROJECT # 875-05
DRAWING NUMBER G.01
SHEET 1 OF 26

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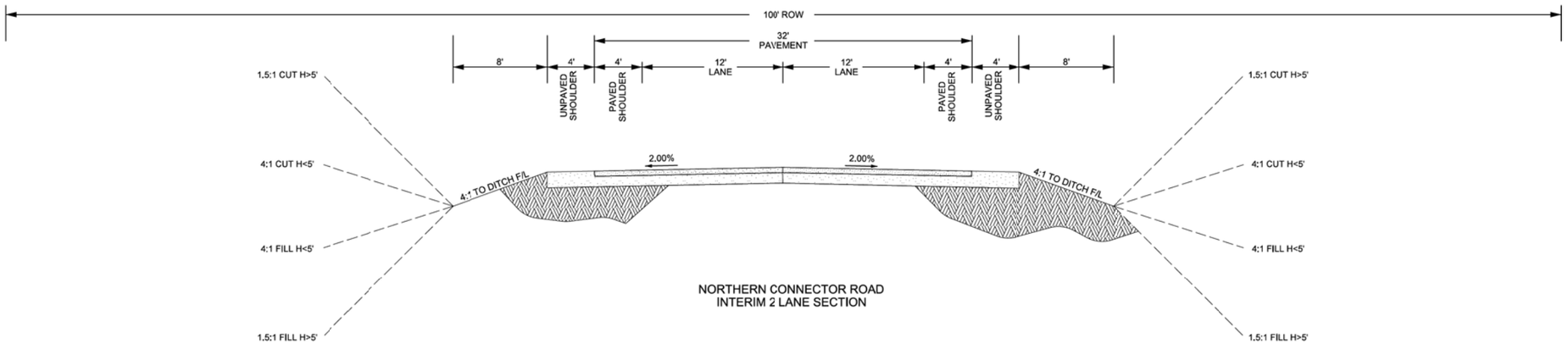
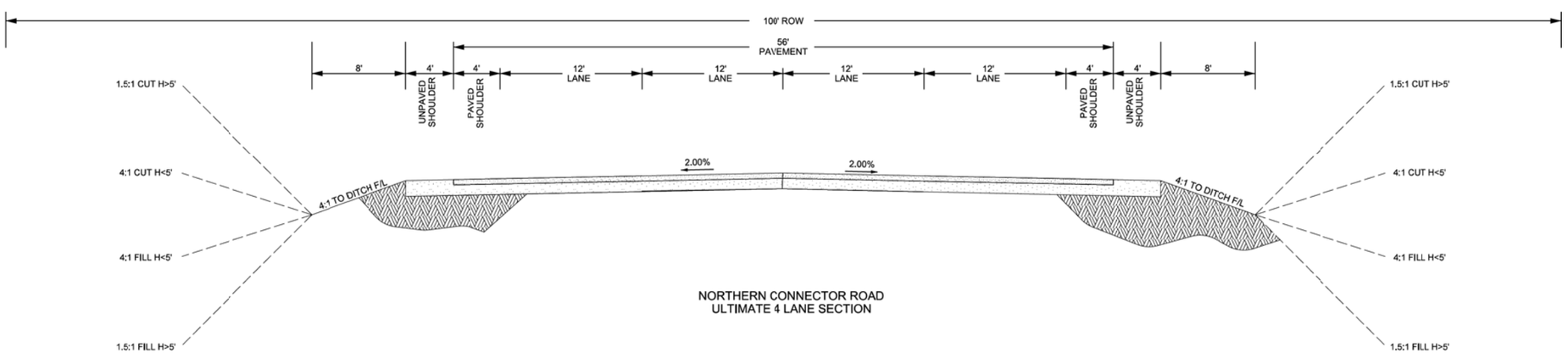
FILENAME: G:\Projects\875_YC PW Engineering\875-05 Northern Connector\CADD\DGN\PLANSET\YCNCR 15 Percent Plan&Sheets.dgn



NORTHERN CONNECTOR ROAD
INTERIM 2 LANE SECTION



NORTHERN CONNECTOR ROAD
ULTIMATE 4 LANE SECTION

A CENTER 12-FOOT TURN LANE WILL BE REQUIRED AT CRITICAL INTERSECTIONS

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NORTHERN CONNECTOR ROAD
CIP#: 16-19419

GENERAL

TYPICAL SECTIONS

DATE NOVEMBER 2017
LYON PROJECT # 875-05
DRAWING NUMBER G.02
SHEET 2 OF 26

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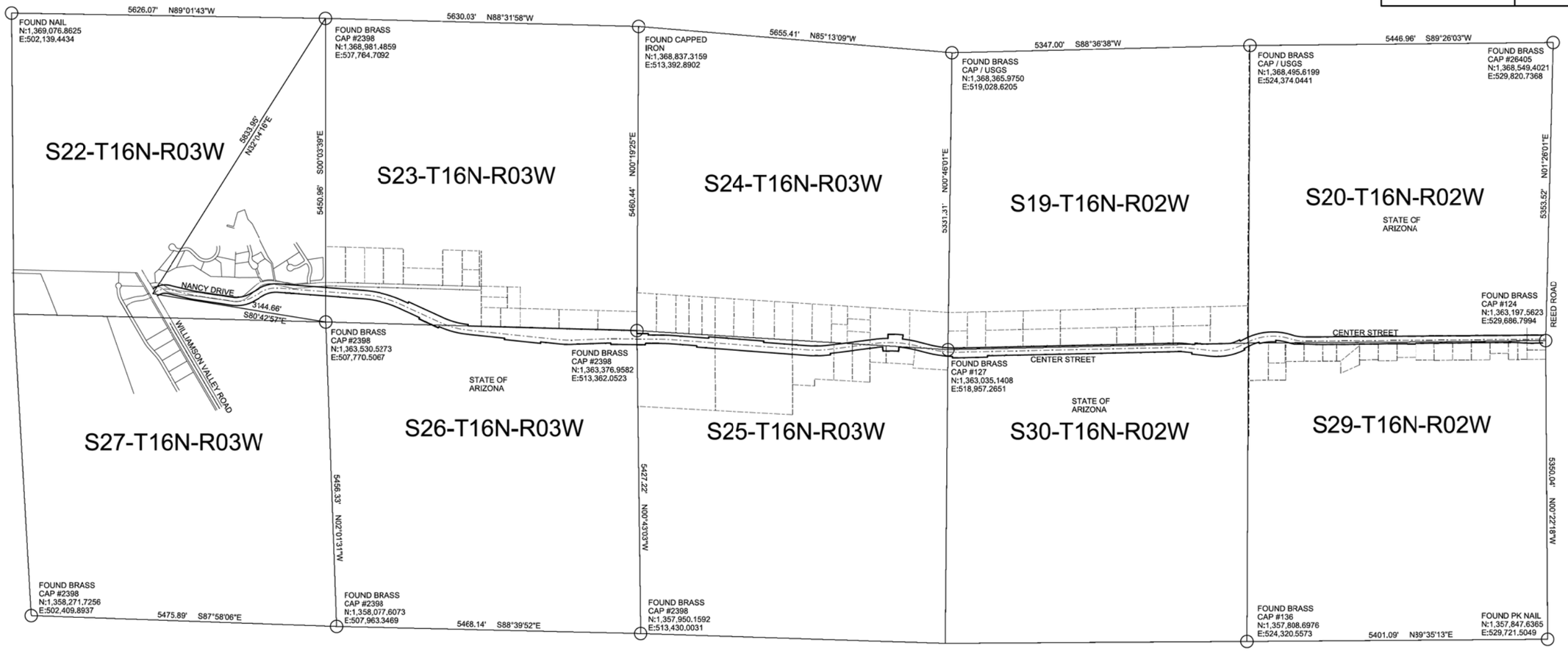

0 1000 2000
DRAWING SCALE
1 Inch = 1000 Feet
(This scale is valid for 22"x34" sheets only)

NORTH

GENERAL LAND OFFICE BRASS CAP, NORTH OF EDGE OF PAVEMENT OF CENTER STREET APPOXIMATELY 1 MILE WEST OF YUMA DRIVE
MODIFIED STATE PLANE (AZ CENTRAL, NAD83)
VERTICAL DATUM: NAVD 1988

N:1,363,035.163 E:518,957.279 EL:4901.30

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NORTHERN CONNECTOR ROAD
CIP#: 16-19419

GENERAL

SURVEY CONTROL PLAN

DATE NOVEMBER 2017
LYON PROJECT # 875-05
DRAWING NUMBER SVY.01
SHEET 3 OF 26

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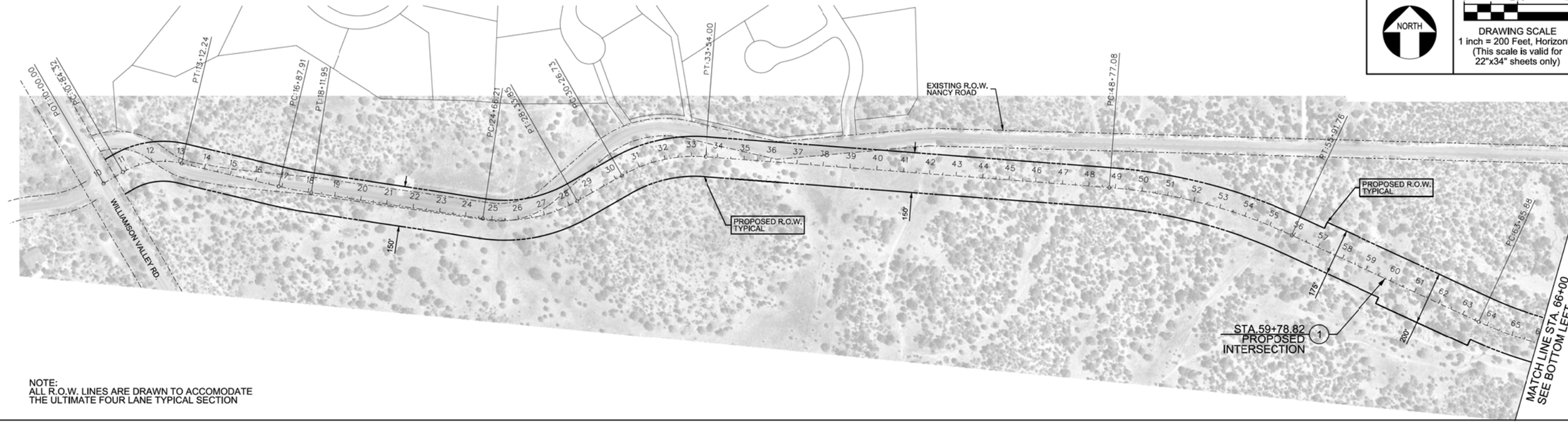
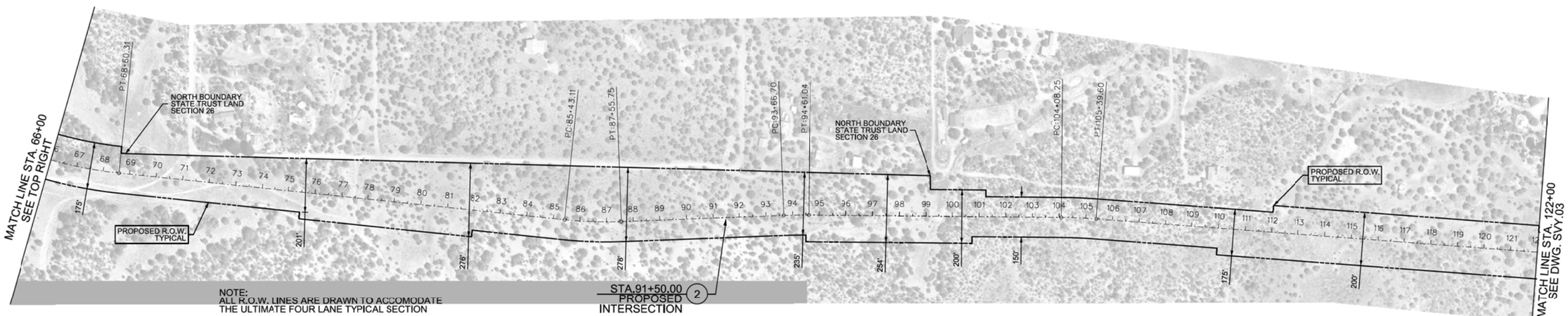


NOTE:
ALL R.O.W. LINES ARE DRAWN TO ACCOMODATE
THE ULTIMATE FOUR LANE TYPICAL SECTION



NOTE:
ALL R.O.W. LINES ARE DRAWN TO ACCOMODATE
THE ULTIMATE FOUR LANE TYPICAL SECTION

PROJECT CENTERLINE GEOMETRICS

N 1,364,037.859 E 504,667.037 Sta 10+00.00

N 59° 46' 59" E Dist 84.319

P.I. Station 12+04.10 N 1,364,140.576 E 504,843.402
Delta = 43° 31' 46" (RT)
Tangent = 119.777
Length = 227.919
Radius = 300.000

S 76° 41' 15" E Dist 375.671

P.I. Station 17+49.96 N 1,364,012.204 E 505,385.924
Delta = 4° 44' 16" (LT)
Degree = 3° 49' 11"
Tangent = 62.054
Length = 124.037
Radius = 1,500.000

S 81° 25' 31" E Dist 654.264

P.I. Station 26+57.20 N 1,363,876.926 E 506,283.086
Delta = 38° 17' 56" (LT)
Degree = 10° 25' 03"
Tangent = 190.987
Length = 367.644
Radius = 550.000

N 60° 16' 33" E Dist 192.878

P.I. Station 31+95.37 N 1,364,150.874 E 506,732.895
Delta = 34° 05' 36" (RT)
Degree = 10° 25' 03"
Tangent = 168.642
Length = 327.272
Radius = 550.000

S 85° 37' 51" E Dist 1,523.072

P.I. Station 52+38.27 N 1,363,994.483 E 508,809.836
Delta = 20° 28' 27" (RT)
Degree = 2° 51' 53"
Tangent = 361.192
Length = 714.682
Radius = 2,000.000

S 65° 09' 25" E Dist 774.122

P.I. Station 66+15.36 N 1,363,412.684 E 510,066.479
Delta = 18° 53' 08" (LT)
Degree = 3° 49' 11"
Tangent = 249.476
Length = 494.425
Radius = 1,500.000

S 84° 02' 33" E Dist 1,682.807

P.I. Station 86+49.61 N 1,363,201.078 E 512,094.247
Delta = 8° 07' 20" (LT)
Degree = 3° 49' 11"
Tangent = 106.496
Length = 212.836
Radius = 1,500.000

N 87° 50' 07" E Dist 610.951

P.I. Station 94+13.88 N 1,363,229.958 E 512,858.327
Delta = 2° 42' 09" (RT)
Degree = 2° 51' 53"
Tangent = 47.179
Length = 94.340
Radius = 2,000.000

S 89° 27' 43" E Dist 947.207

P.I. Station 104+73.95 N 1,363,220.004 E 513,918.367
Delta = 3° 45' 47" (RT)
Degree = 2° 51' 53"
Tangent = 65.701
Length = 131.356
Radius = 2,000.000

S 85° 41' 56" E Dist 2,450.698

P.I. Station 131+93.42 N 1,363,016.047 E 516,630.223
Delta = 11° 35' 52" (LT)
Degree = 2° 51' 53"
Tangent = 203.116
Length = 404.843
Radius = 2,000.000

N 82° 42' 11" E Dist 826.544

P.I. Station 146+08.53 N 1,363,195.956 E 518,035.257
Delta = 21° 53' 39" (RT)
Degree = 2° 51' 53"
Tangent = 386.845
Length = 764.253
Radius = 2,000.000

S 75° 24' 09" E Dist 180.193

P.I. Station 154+44.68 N 1,362,982.847 E 518,853.547
Delta = 15° 51' 27" (LT)
Degree = 2° 51' 53"
Tangent = 278.547
Length = 553.533
Radius = 2,000.000

N 88° 44' 23" E Dist 3,942.545

P.I. Station 197+27.56 N 1,363,077.114 E 523,138.947
Delta = 7° 28' 38" (RT)
Degree = 5° 43' 46"
Tangent = 65.345
Length = 130.505
Radius = 1,000.000

S 83° 46' 58" E Dist 473.022

P.I. Station205+63.56 N 1,362,986.556 E 523,970.223
Delta = 33° 10' 11" (LT)
Degree = 5° 43' 46"
Tangent = 297.826
Length = 578.923
Radius = 1,000.000

N 63° 02' 51" E Dist 105.036

P.I. Station 213+56.44 N 1,363,353.511 E 524,691.889
Delta = 44° 16' 02" (RT)
Degree = 5° 43' 46"
Tangent = 406.741
Length = 772.608
Radius = 1,000.000

P.I. Station 218+78.76 N 1,363,185.896 E 525,229.559
Delta = 17° 47' 02" (LT)
Degree = 5° 43' 46"
Tangent = 156.451
Length = 310.386
Radius = 1,000.000

N 89° 31' 51" E Dist 4,298.440

N 1,363,222.383 E 529,684.301 Sta 263+31.13

PROPOSED INTERSECTION LOCATIONS:
1. STA. 59+78.82
2. STA. 91+50.00
3. STA. 141+28.01
4. STA. 168+86.02
5. STA. 168+86.02

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NORTHERN CONNECTOR ROAD
CIP#: 16-19419

GENERAL

GEOMETRICS CONTROL PLAN
STA. 10+00 TO 122+00

DATE
NOVEMBER 2017
LYON PROJECT #
875-05
DRAWING NUMBER
SVY.02
SHEET 4 OF 26

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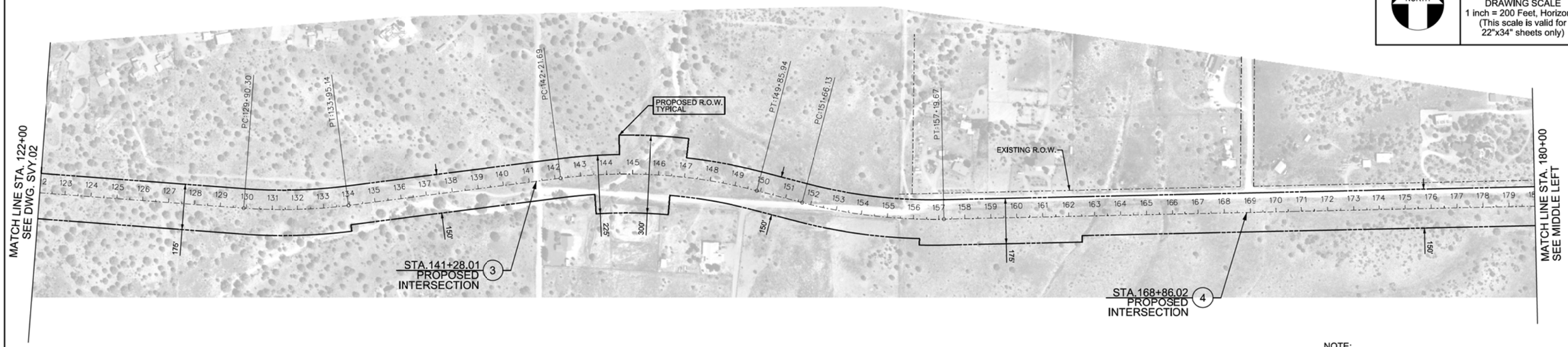
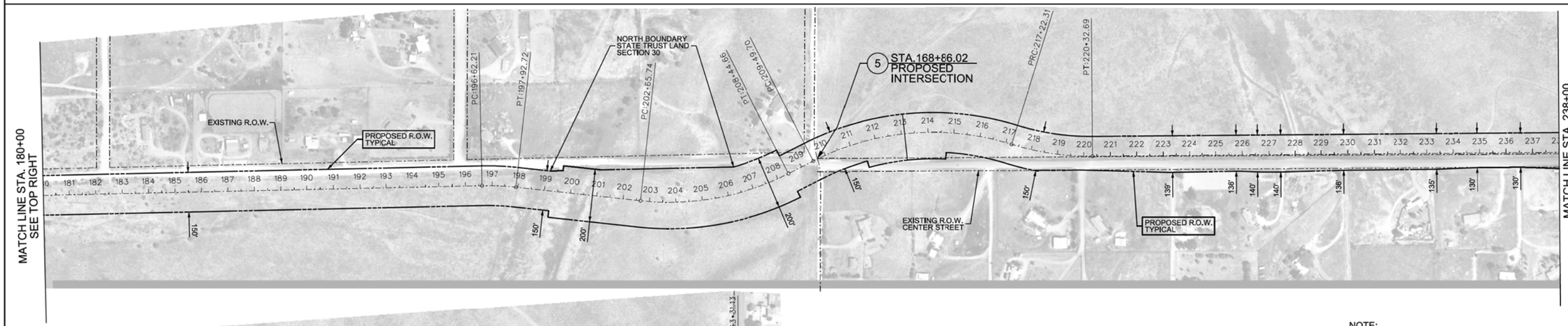


NOTE:
ALL R.O.W. LINES ARE DRAWN TO ACCOMODATE
THE ULTIMATE FOUR LANE TYPICAL SECTION



NOTE:
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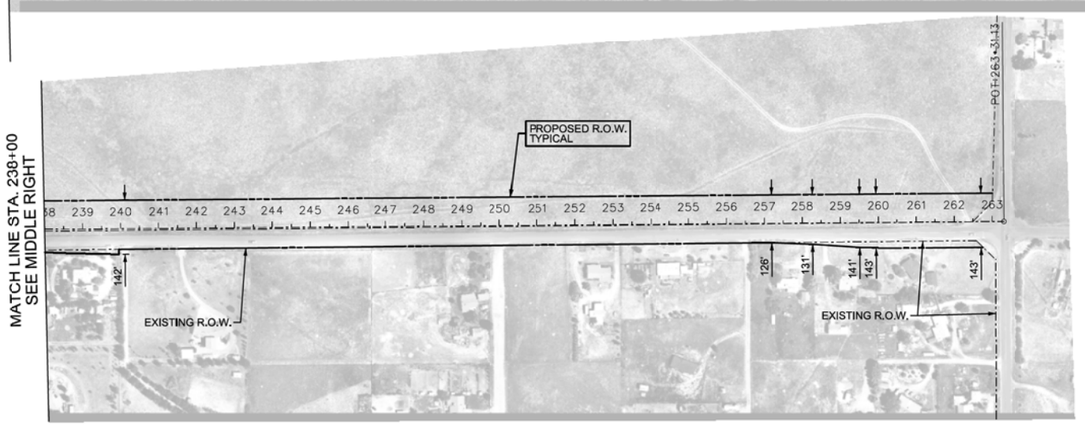
THE ULTIMATE FOUR LANE TYPICAL SECTION



PROPOSED INTERSECTION
LOCATIONS:
1. STA. 59+78.82
2. STA. 91+50.00
3. STA. 141+28.01
4. STA. 168+86.02
5. STA. 168+86.02

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NO.	DATE	REVISION	BY	AP'D
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NORTHERN CONNECTOR ROAD
CIP#: 16-19419

GENERAL

GEOMETRICS CONTROL PLAN
STA. 122+00 TO 263+31

DATE
NOVEMBER 2017
LYON PROJECT #
875-05
DRAWING NUMBER
SVY.03
SHEET 5 OF 26

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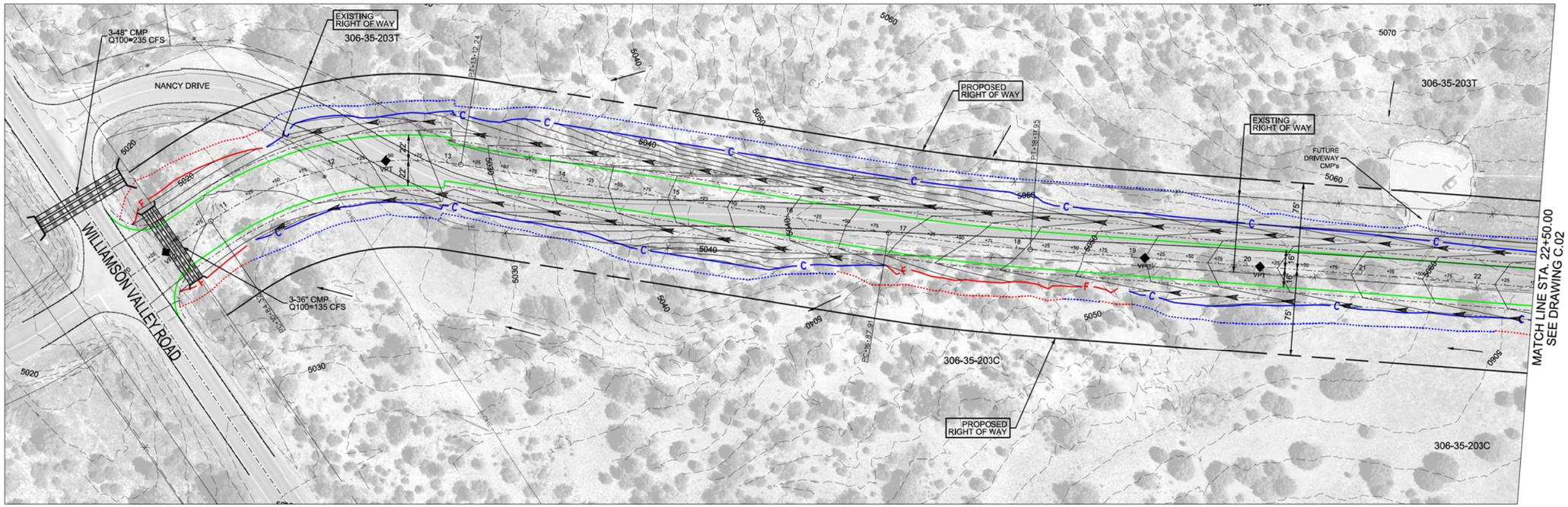

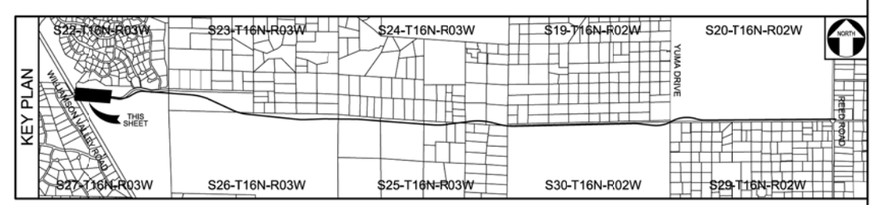

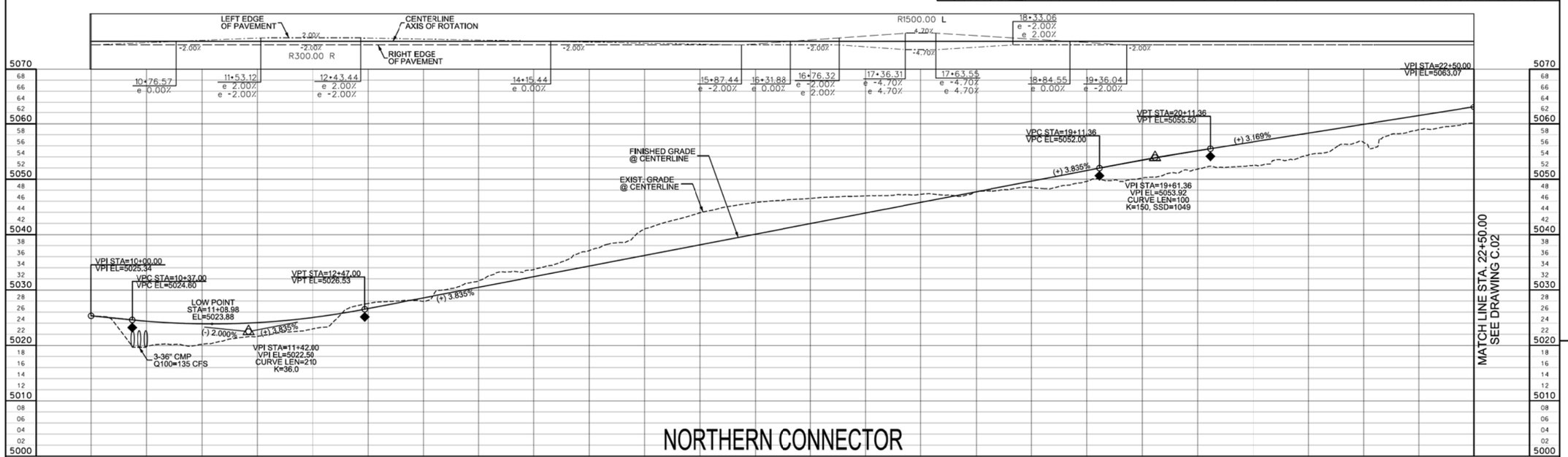

NORTHERN CONNECTOR

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
DRAWING SCALE
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1" = 10 ft, Vertical
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NORTHERN CONNECTOR ROAD
CIP#: 16-19419

CIVIL

15% ROADWAY IMPROVEMENTS
STA. 10+00.00 TO 22+50.00

WARNING! OVERHEAD POWER LINES
CONTRACTOR TO USE EXTREME CAUTION

15% SUBMITTAL

NOT FOR CONSTRUCTION

DATE
NOVEMBER 2017
LYON PROJECT #
875-05
DRAWING NUMBER
C.01
SHEET 6 OF 26

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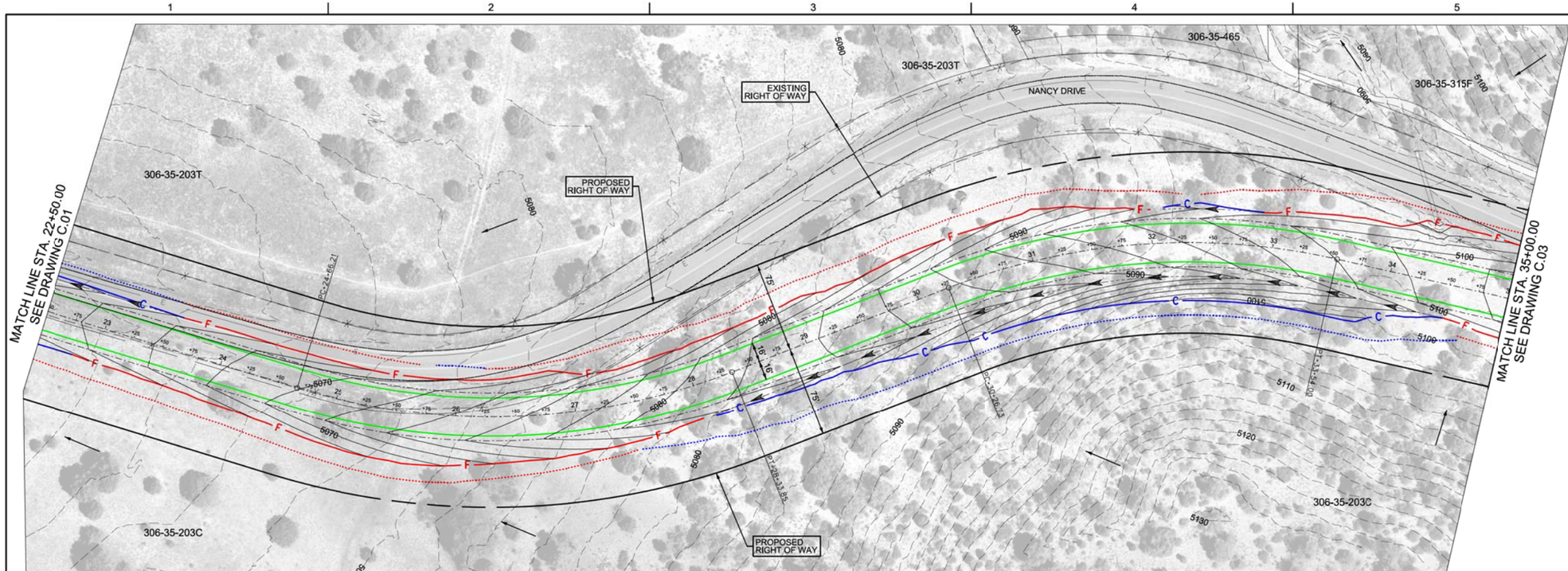

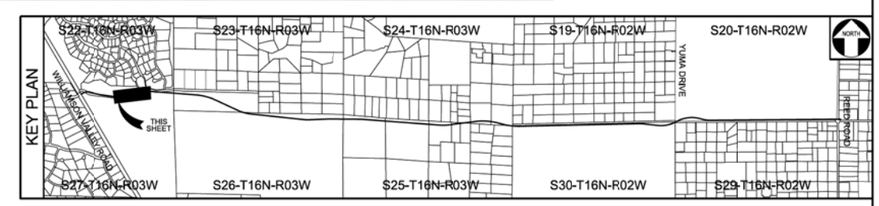

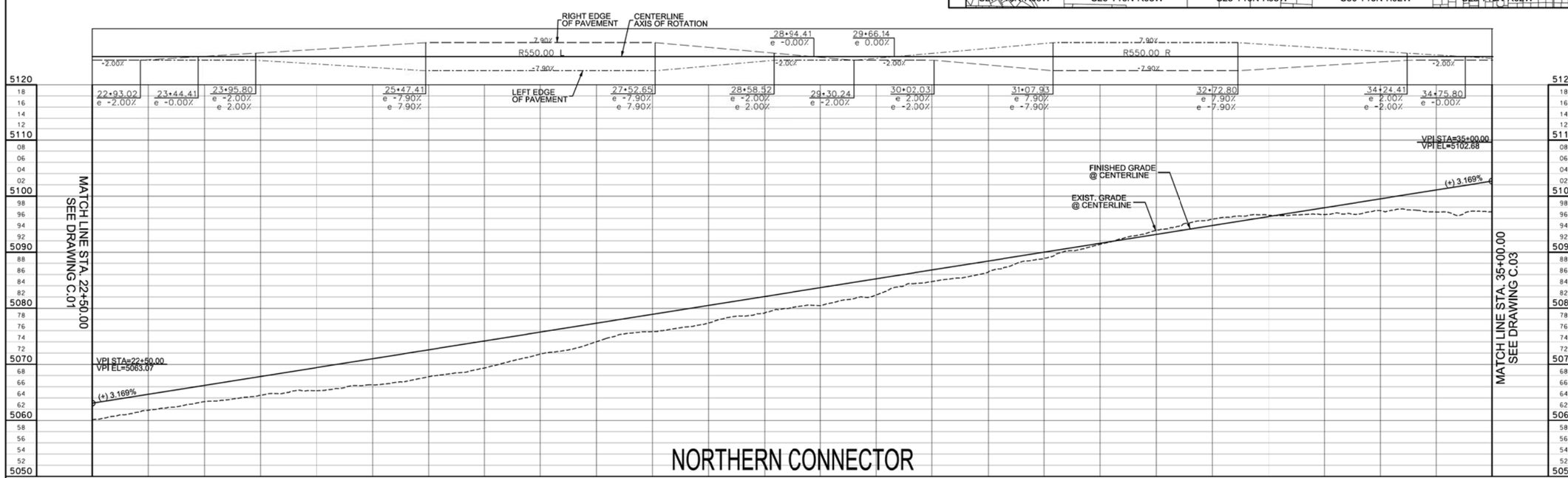

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
DRAWING SCALE
1" = 50 ft. Horizontal
1" = 10 ft. Vertical
(This scale is valid for 22"x34" sheets only)

VERIFY SCALE
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0 1"
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DESIGN	DRAWN	CHECKED	APPROVED
KDH		KDH	

NO.	DATE	REVISION	BY	APV'D
-	-	-	-	-

WARNING! OVERHEAD POWER LINES
CONTRACTOR TO USE EXTREME CAUTION

15% SUBMITTAL

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NORTHERN CONNECTOR ROAD
CIP#: 16-19419

CIVIL

15% ROADWAY IMPROVEMENTS
STA. 22+50.00 TO 35+00.00

DATE: NOVEMBER 2017
LYON PROJECT #: 875-05
DRAWNG NUMBER: C.02
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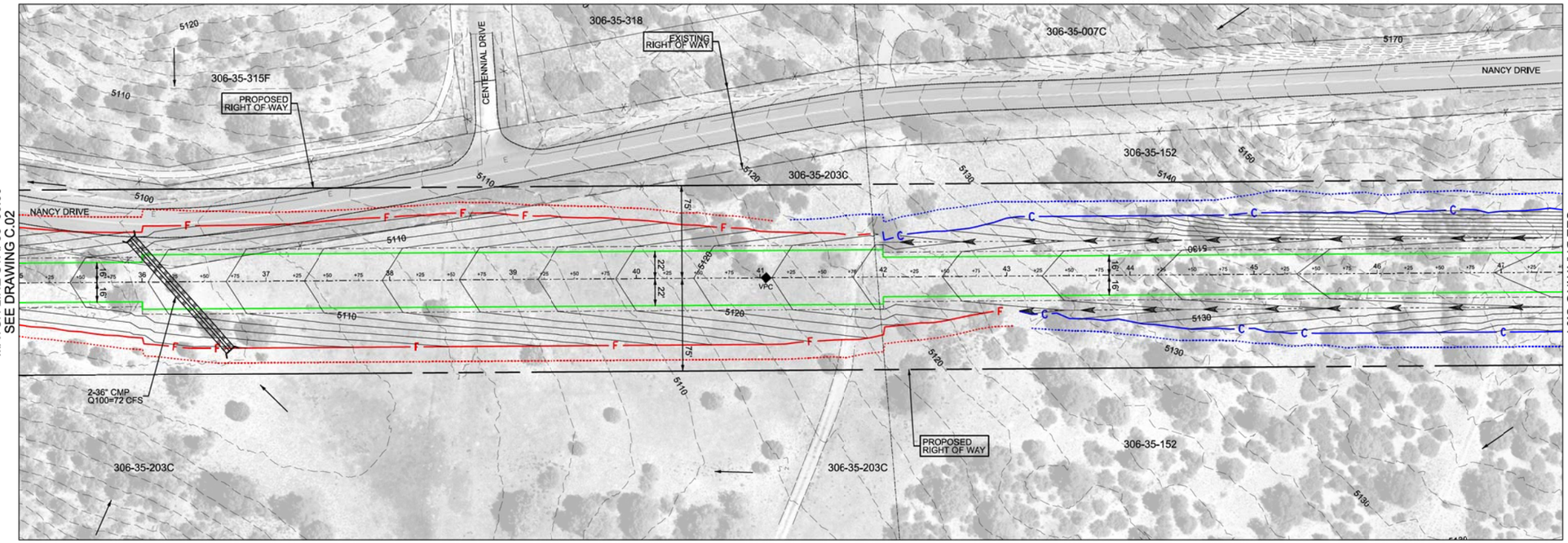

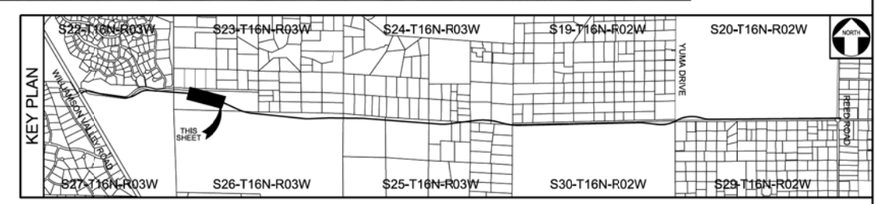

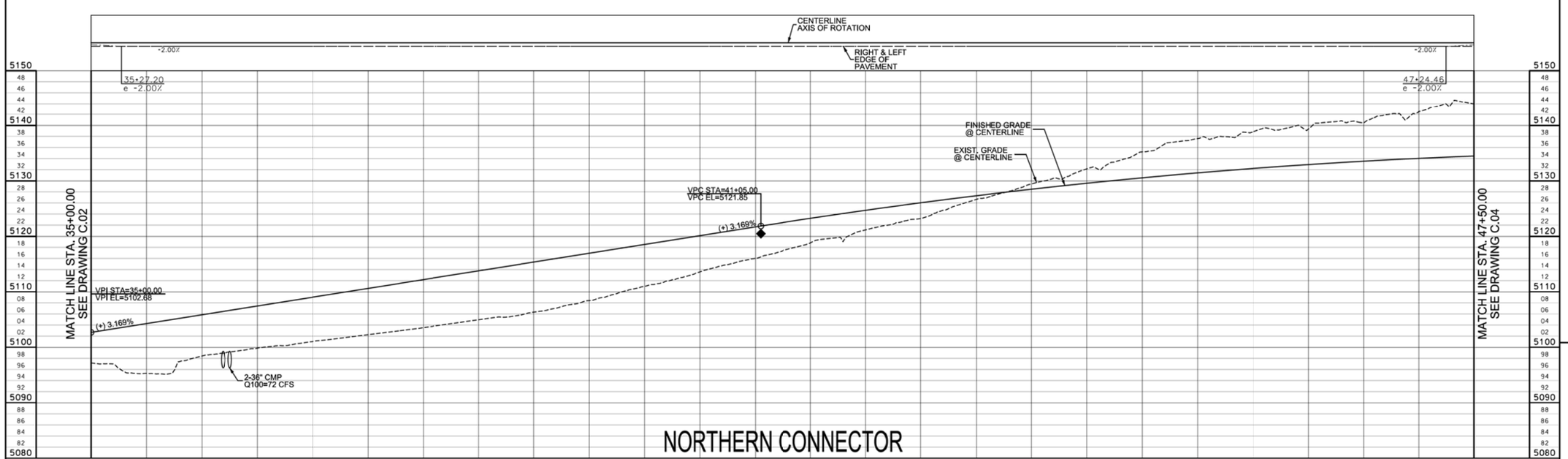

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
DRAWING SCALE
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KDH	KDH	KDH	

NO.	DATE	REVISION	BY	APVD
-	-	-	-	-

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CIP#: 16-19419

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DATE
NOVEMBER 2017

LYON PROJECT #
875-05

DRAWING NUMBER
C.03

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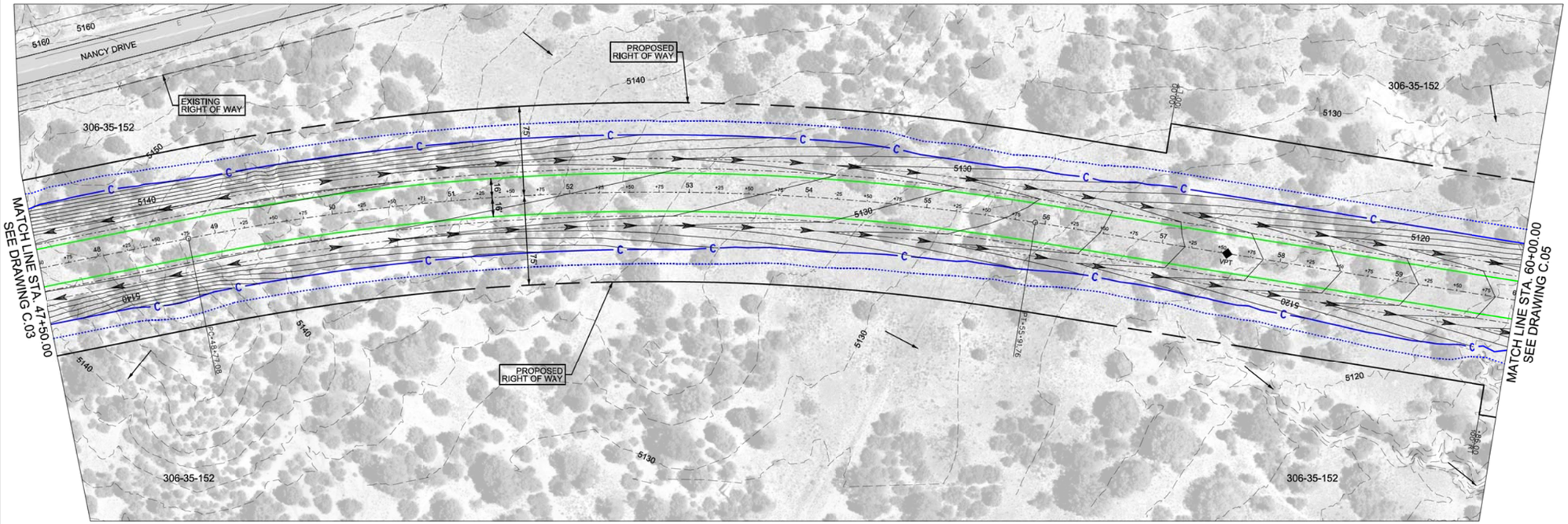

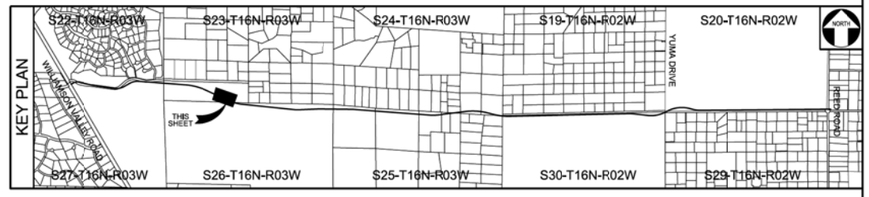

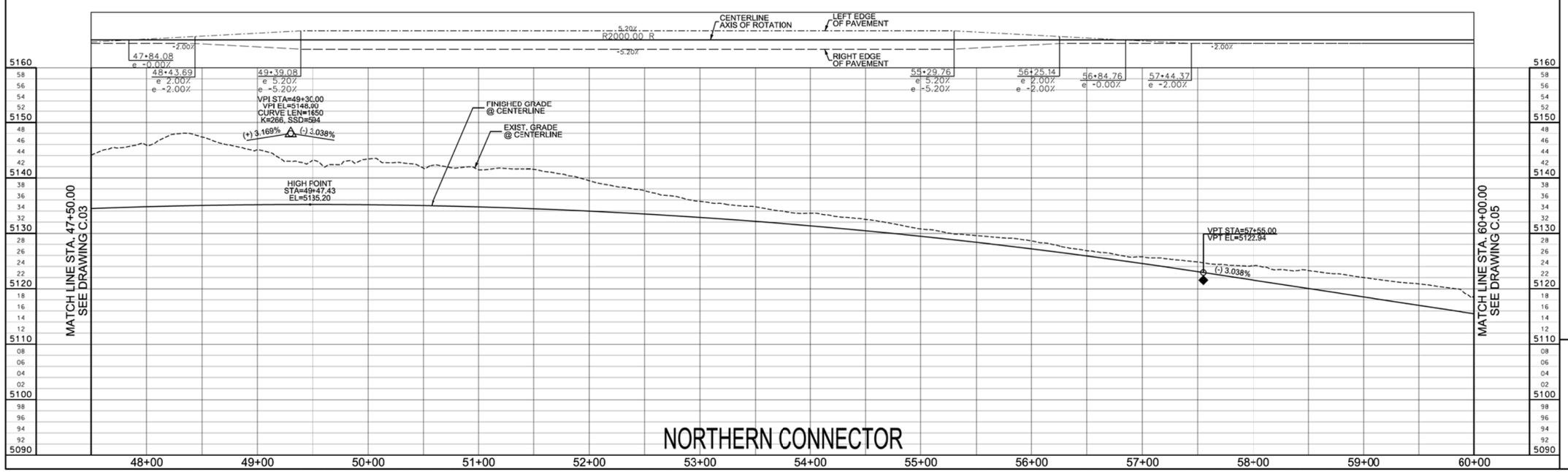

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
DRAWING SCALE
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1" = 10 ft. Vertical
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VERIFY SCALE
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0 1"
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DESIGN	DRAWN	CHECKED	APPROVED
KDH		KDH	

NO.	DATE	REVISION	BY	APV'D
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CONTRACTOR TO USE EXTREME CAUTION

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15% ROADWAY IMPROVEMENTS STA. 47+50.00 TO 60+00.00

DATE
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LYON PROJECT #
875-05

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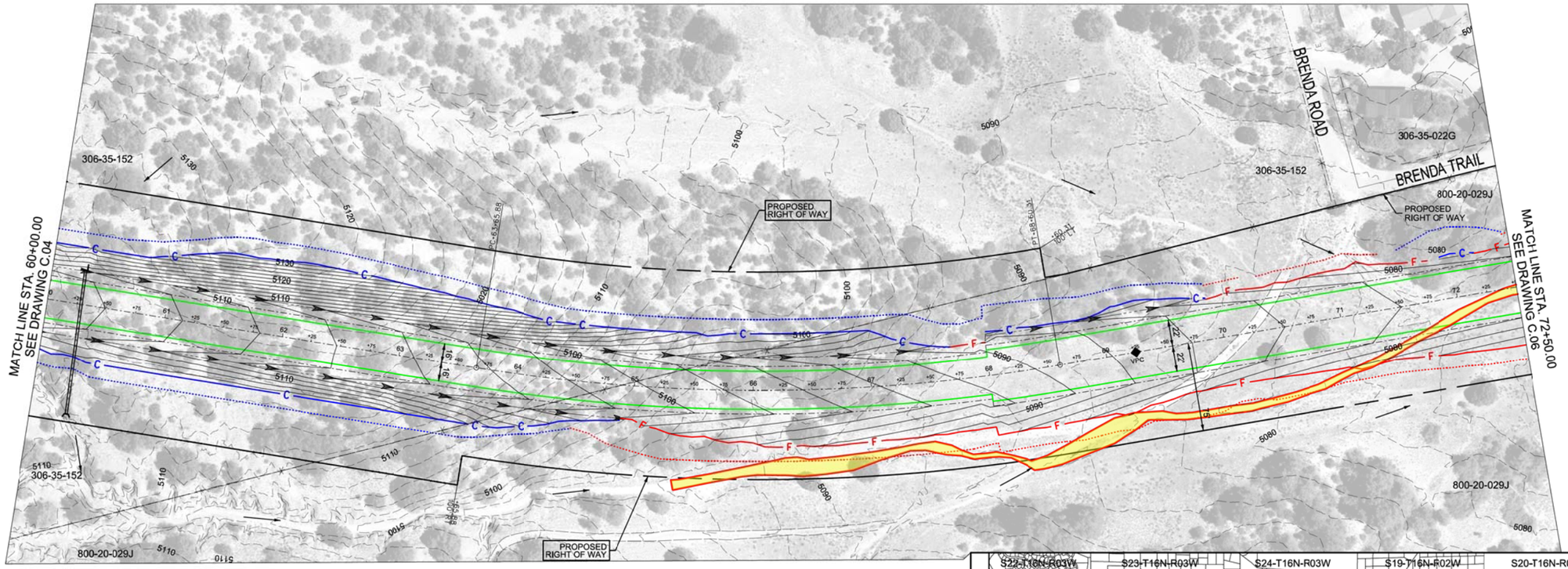

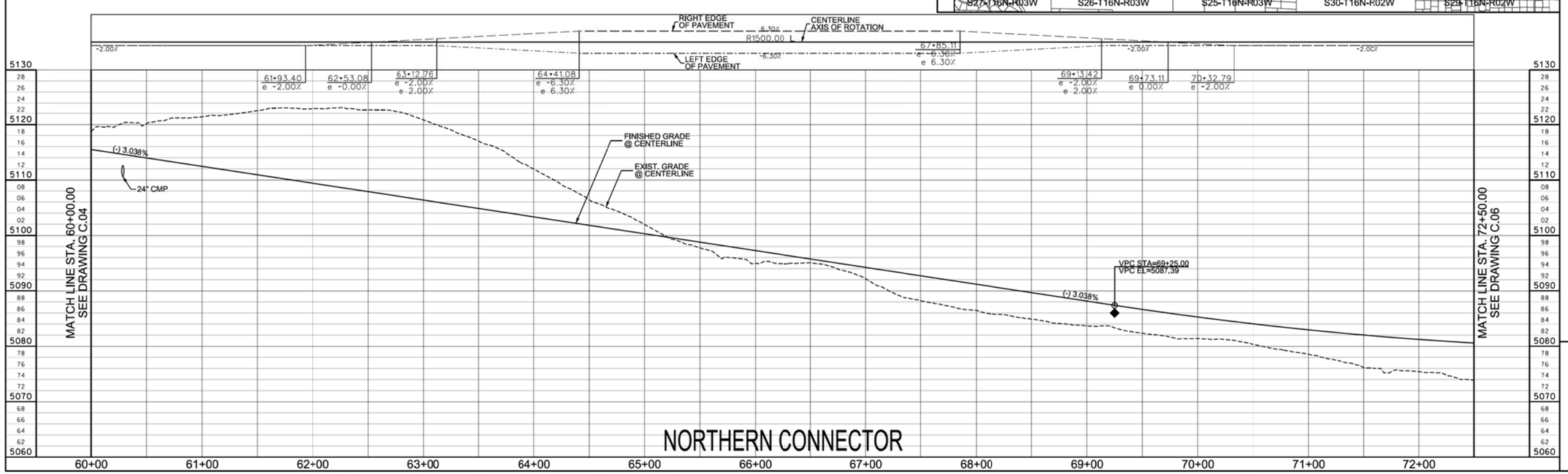

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
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KDH	KDH	KDH	

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15% ROADWAY IMPROVEMENTS STA. 60+00.00 TO 72+50.00

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DRAWNG NUMBER
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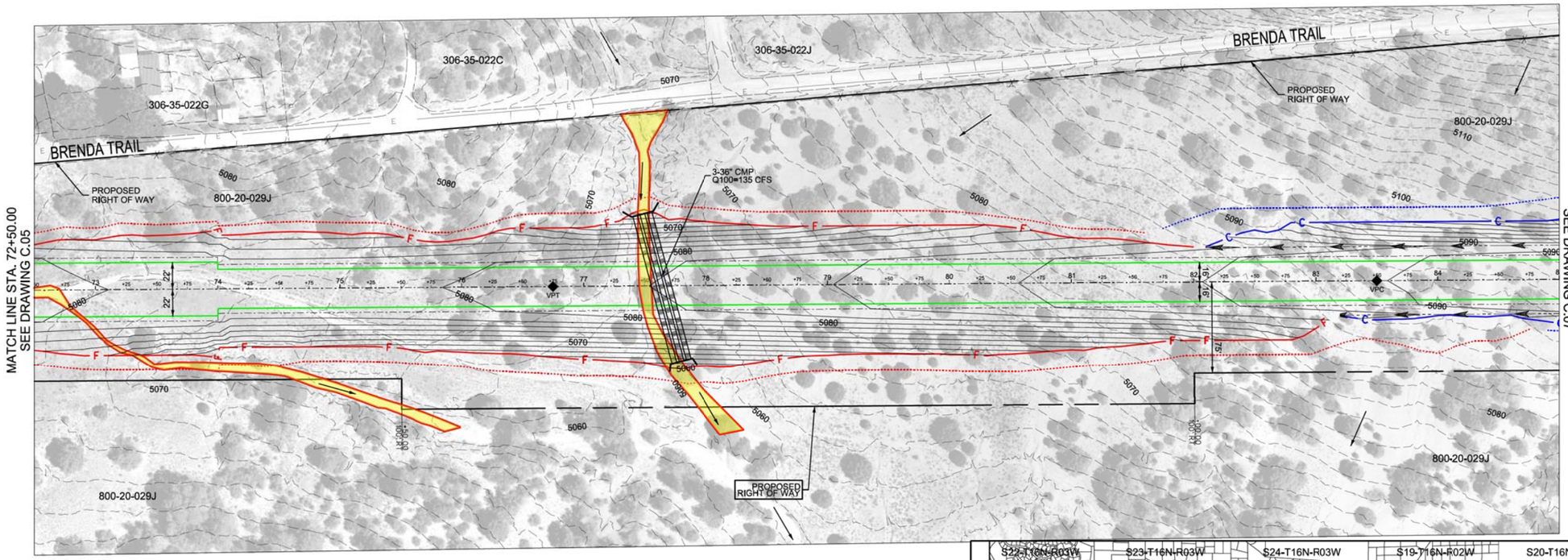

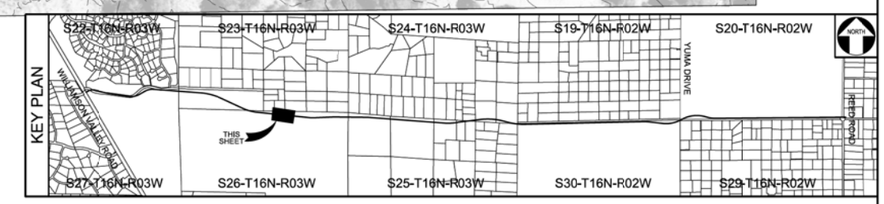

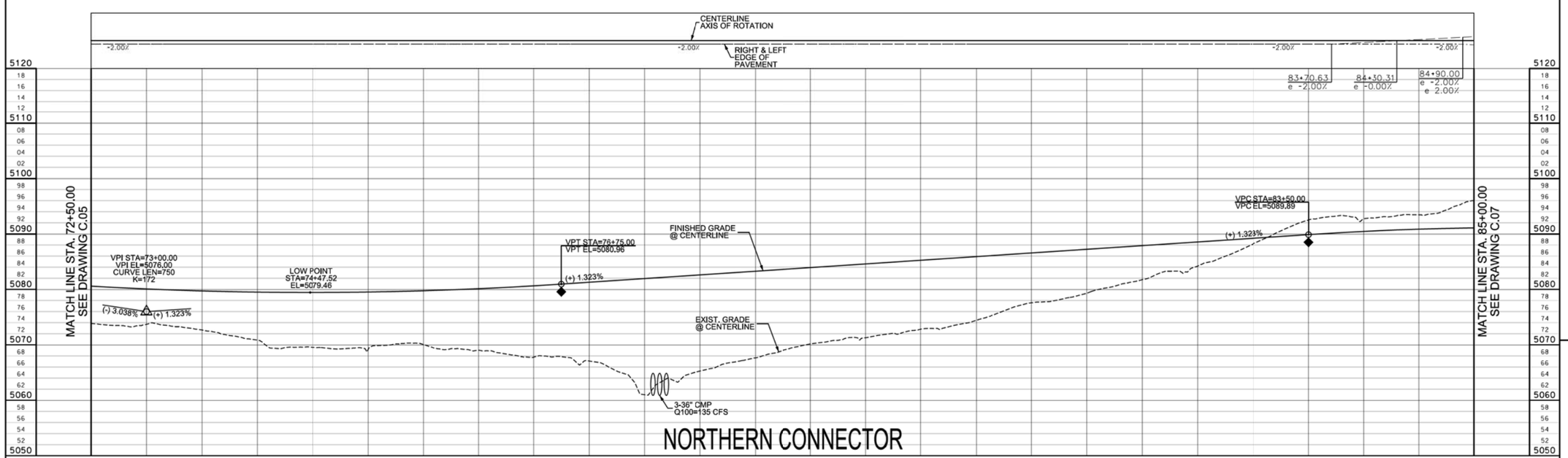

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
DRAWING SCALE
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1" = 10 ft, Vertical
(This scale is valid for 22"x34" sheets only)

VERIFY SCALE
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KDH	KDH	KDH	

NO.	DATE	REVISION	BY	APV'D

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CIP#: 16-19419

CIVIL

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DATE
NOVEMBER 2017
LYON PROJECT #
875-05
DRAWNG NUMBER
C.06
SHEET 11 OF 26

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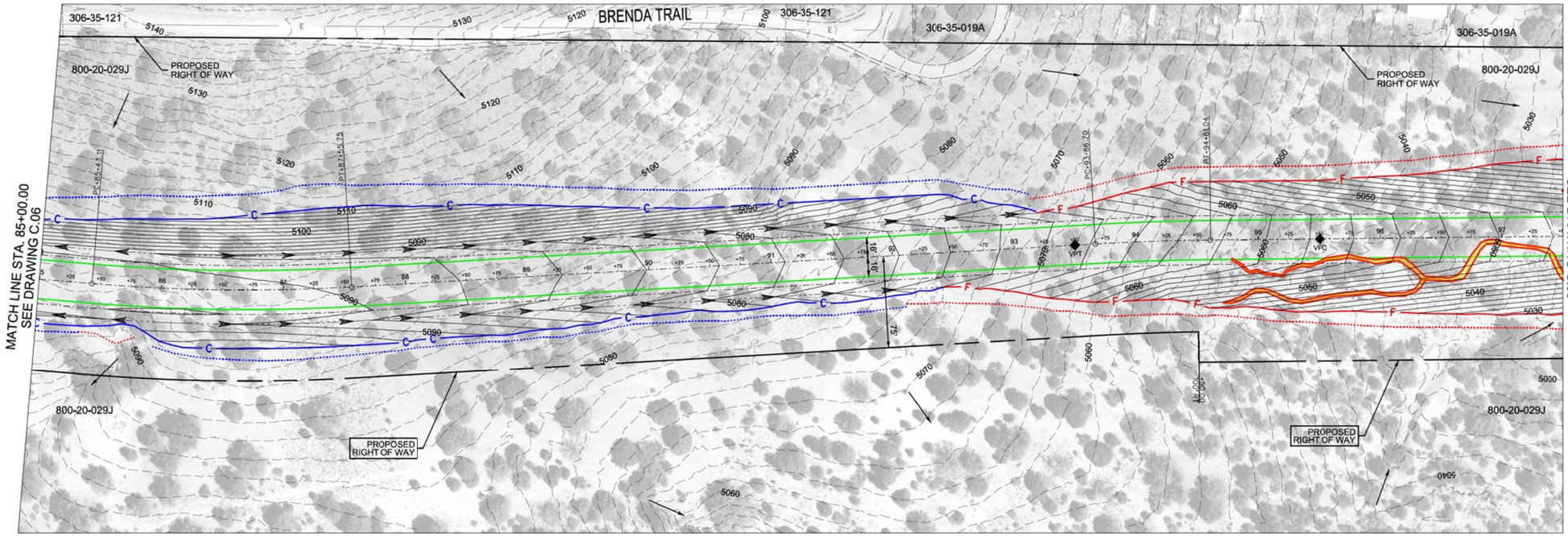

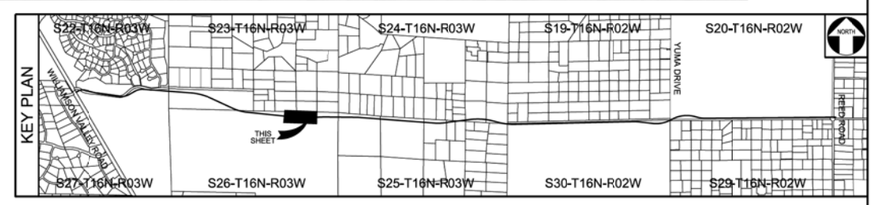

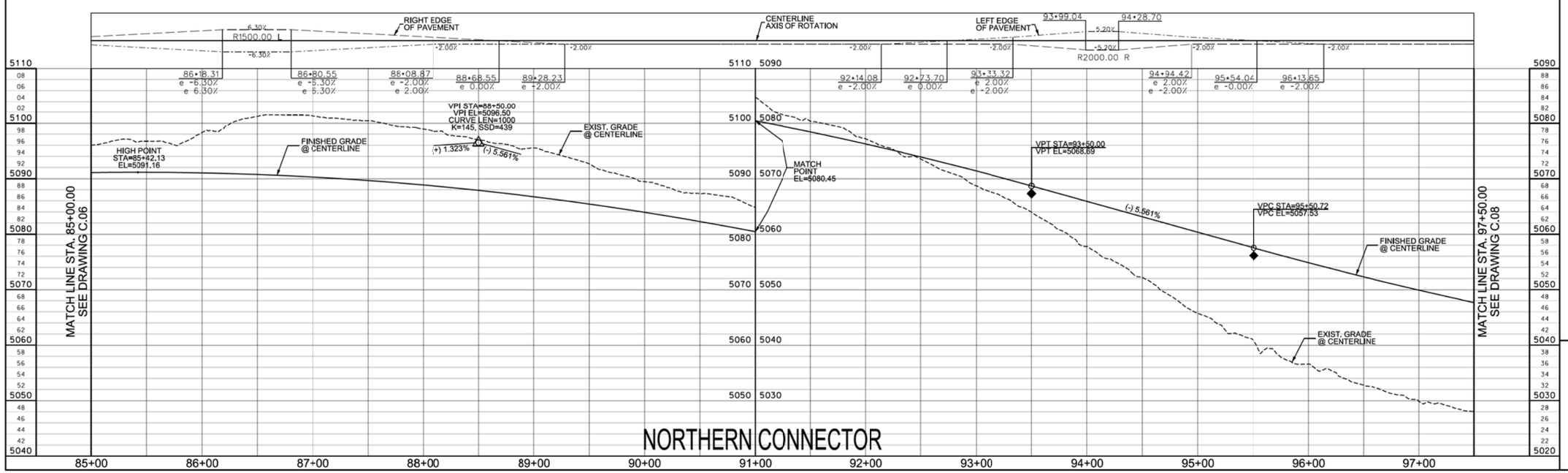

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
DRAWING SCALE
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KDH	KDH	KDH	

NO.	DATE	REVISION	BY	APV'D

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CIP#: 16-19419

CIVIL

15% ROADWAY IMPROVEMENTS
STA. 85+00.00 TO 97+50.00

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DATE
NOVEMBER 2017
LYON PROJECT #
875-05
DRAWING NUMBER
C.07
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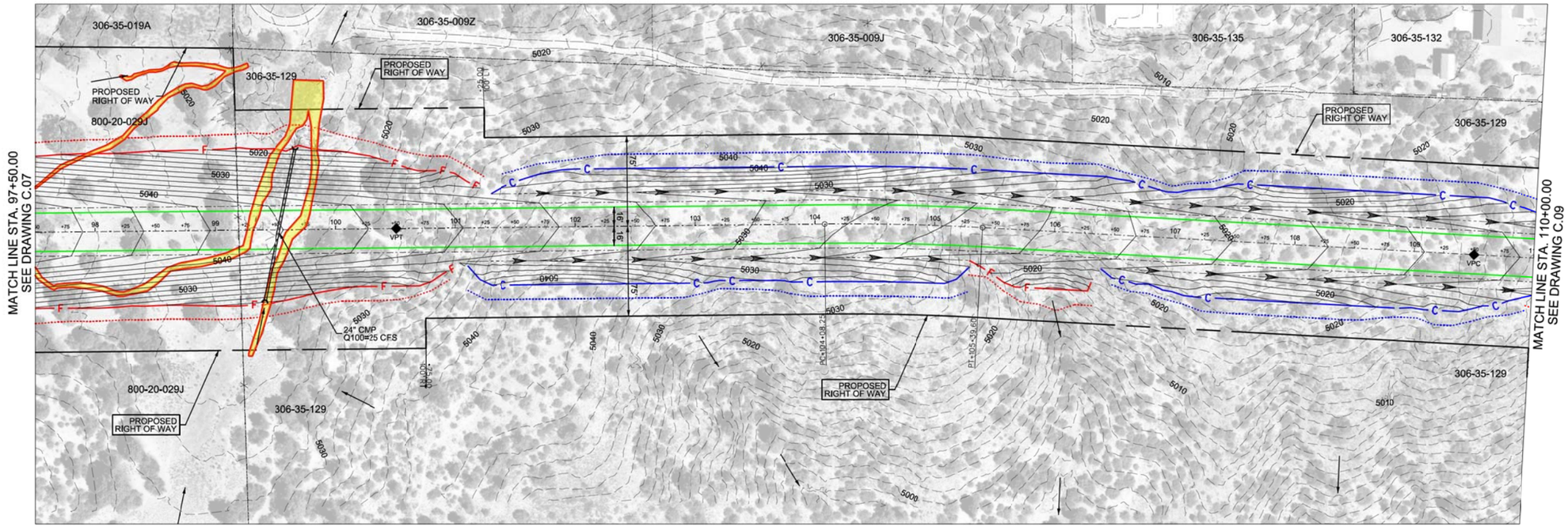

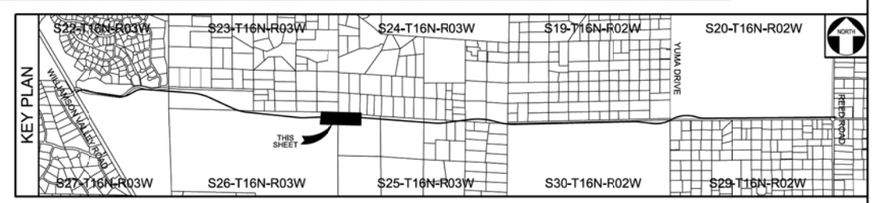

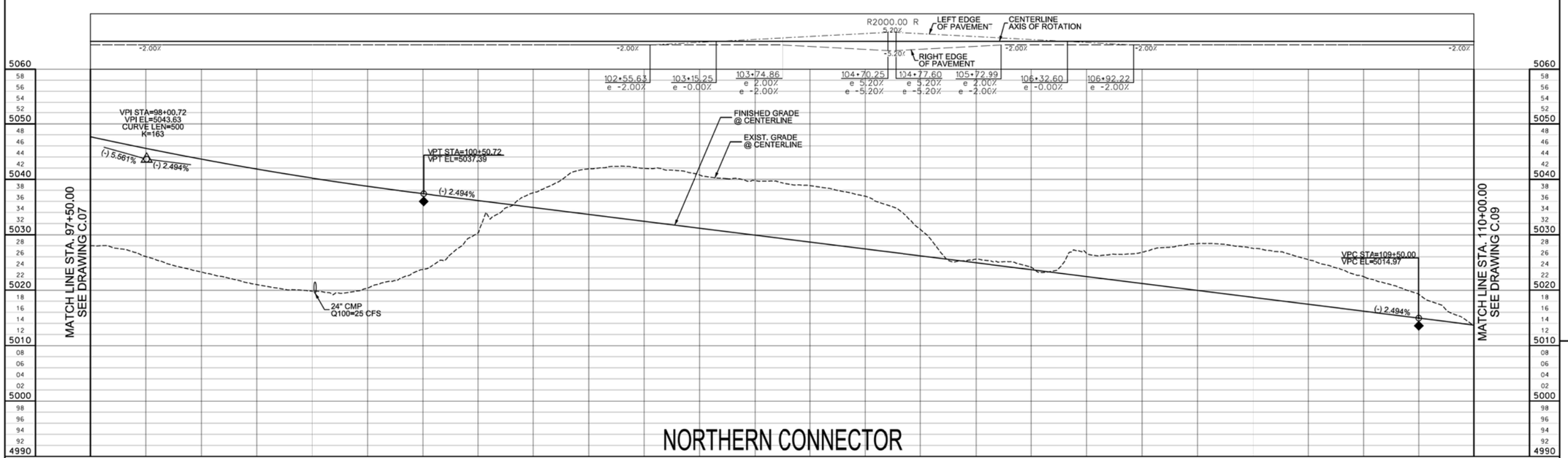

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
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DESIGN	DRAWN	CHECKED	APPROVED
KDH		KDH	

NO.	DATE	REVISION	BY	APV'D
-	-	-	-	-

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CONTRACTOR TO USE EXTREME CAUTION

15% SUBMITTAL

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CIP#: 16-19419

CIVIL

15% ROADWAY IMPROVEMENTS STA. 97+50.00 TO 110+00.00

DATE
NOVEMBER 2017
LYON PROJECT #
875-05
DRAWING NUMBER
C.08
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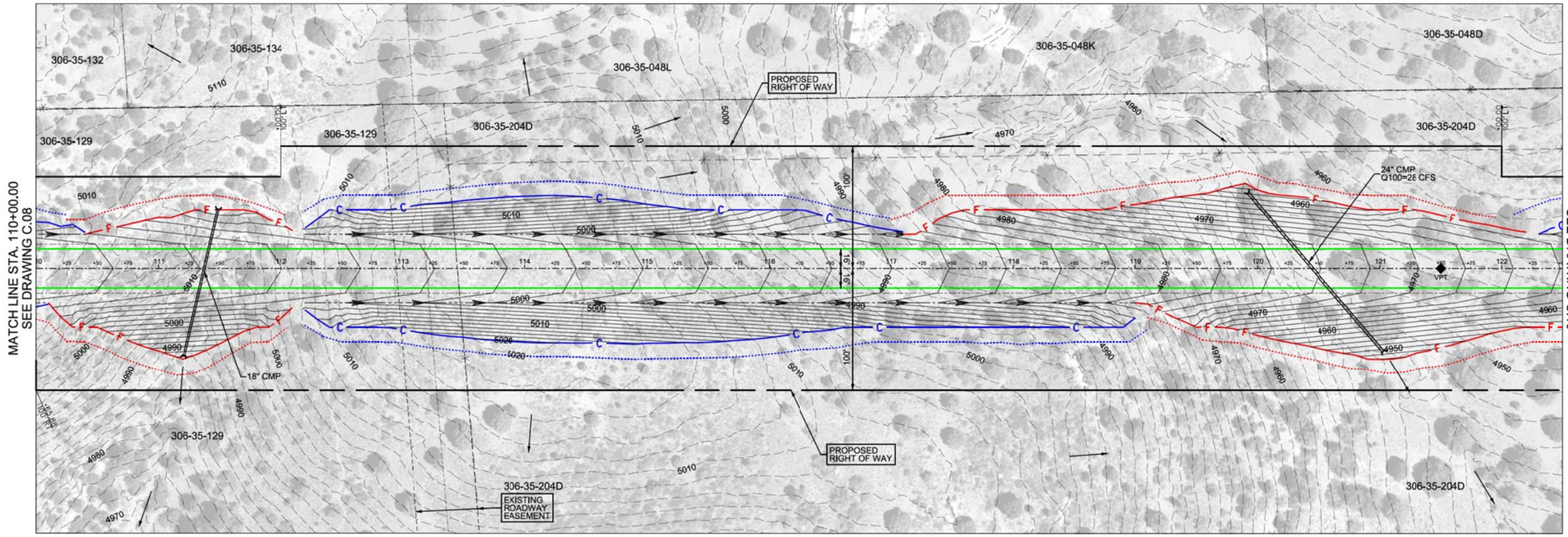

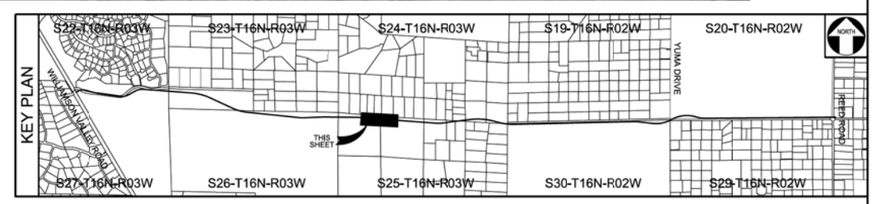

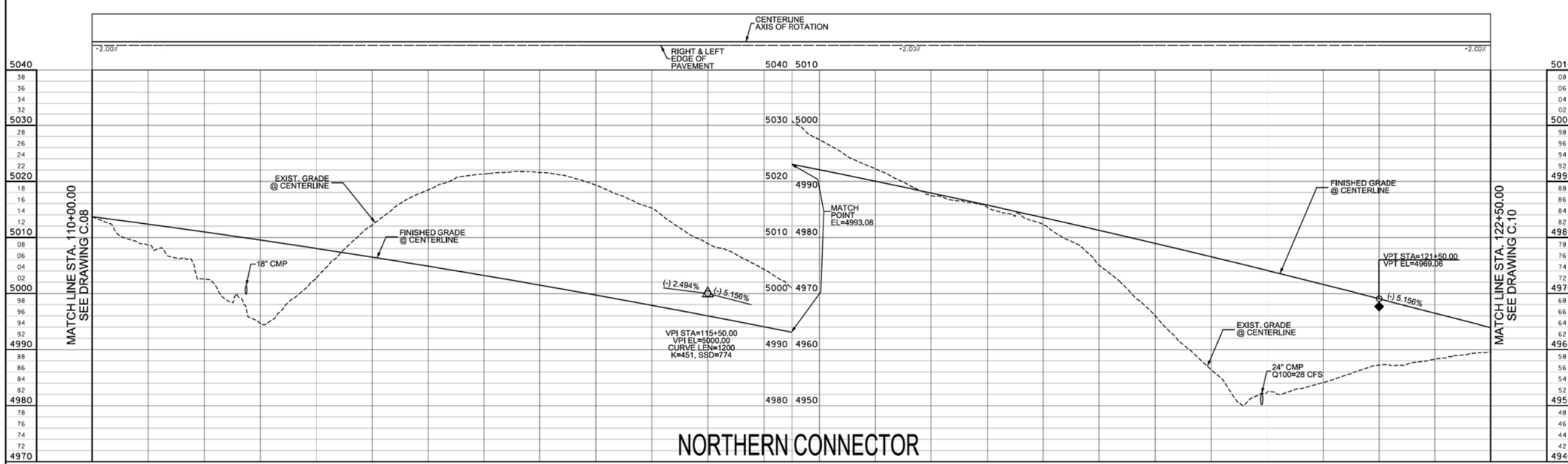

NORTHERN CONNECTOR

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
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- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
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DESIGN	DRAWN	CHECKED	APPROVED
KDH	KDH	KDH	

NO.	DATE	REVISION	BY	APV'D

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CONTRACTOR TO USE EXTREME CAUTION

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CIVIL

15% ROADWAY IMPROVEMENTS
STA. 110+00.00 TO 122+50.00

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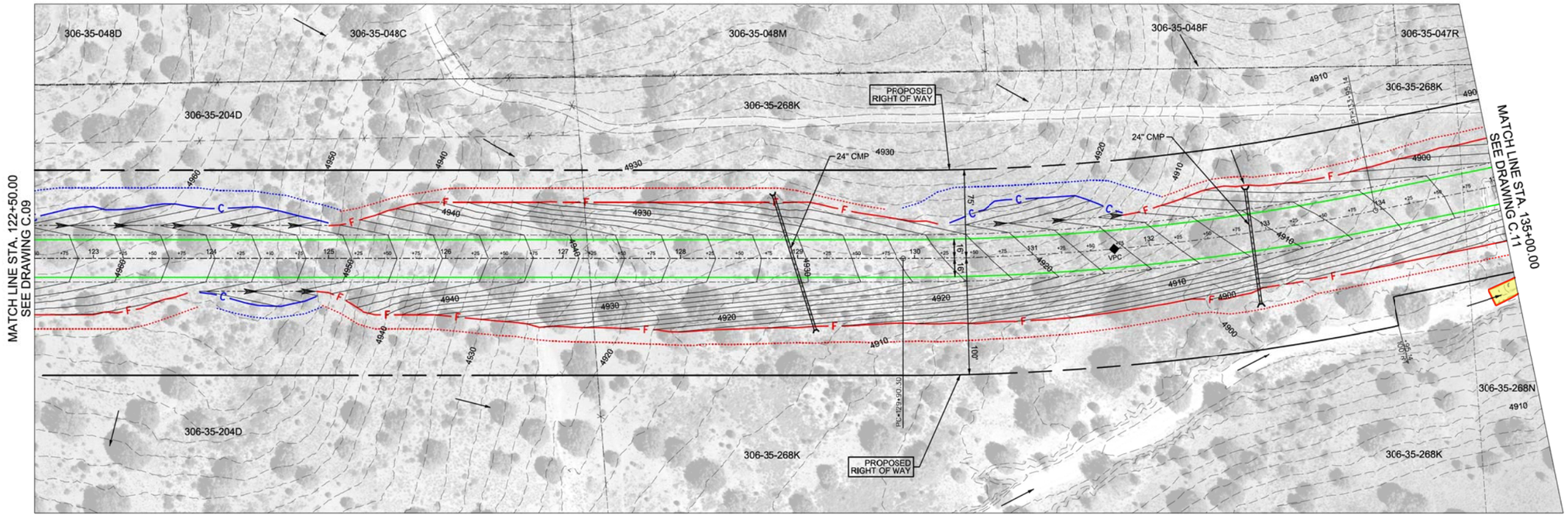

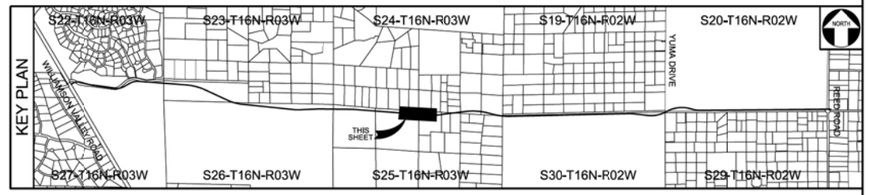

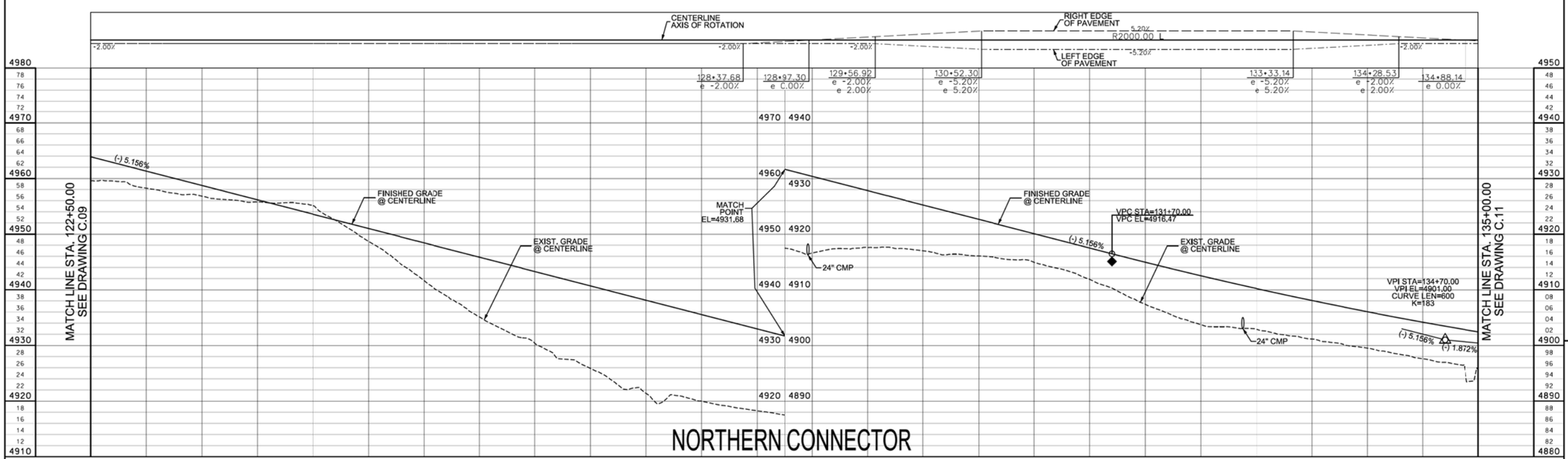

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
DRAWING SCALE
1" = 50 ft. Horizontal
1" = 10 ft. Vertical
(This scale is valid for 22"x34" sheets only)

VERIFY SCALE
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DESIGN	DRAWN	CHECKED	APPROVED
KDH	KDH	KDH	

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WARNING! OVERHEAD POWER LINES
CONTRACTOR TO USE EXTREME CAUTION

15% SUBMITTAL

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NORTHERN CONNECTOR ROAD
CIP#: 16-19419

CIVIL

15% ROADWAY IMPROVEMENTS STA. 122+50.00 TO 135+00.00

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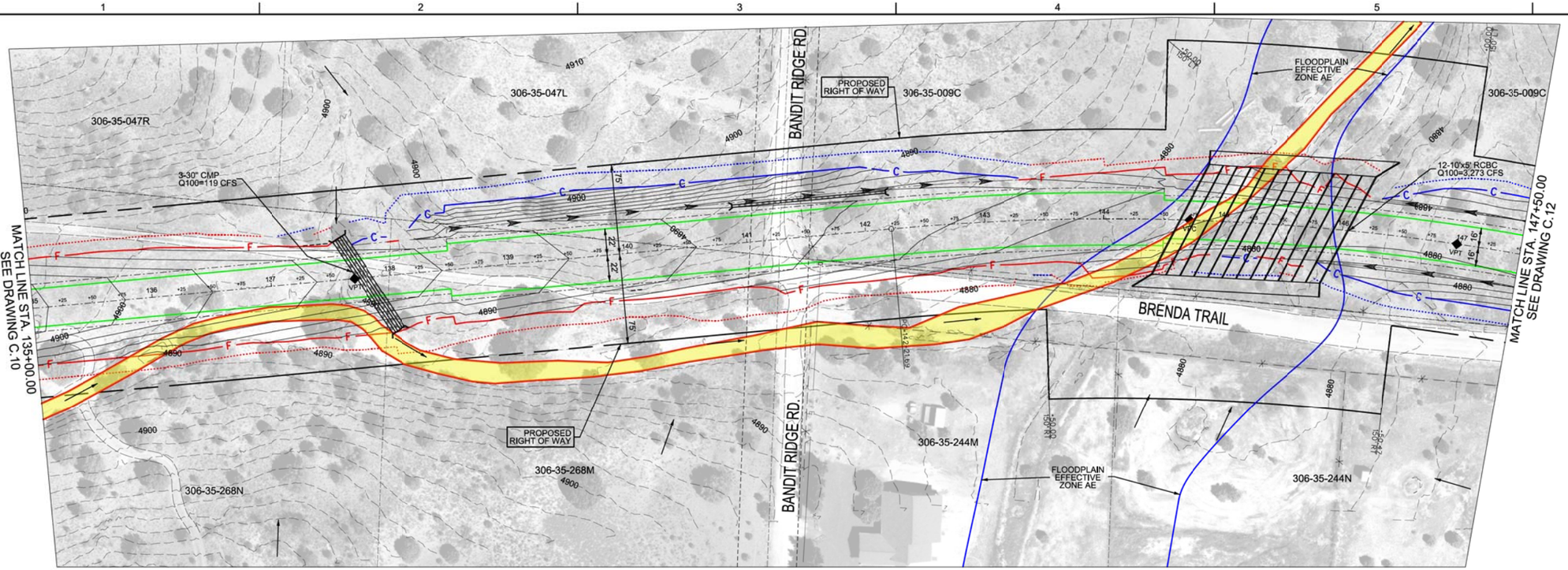

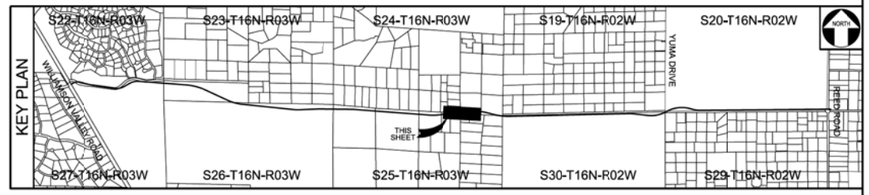

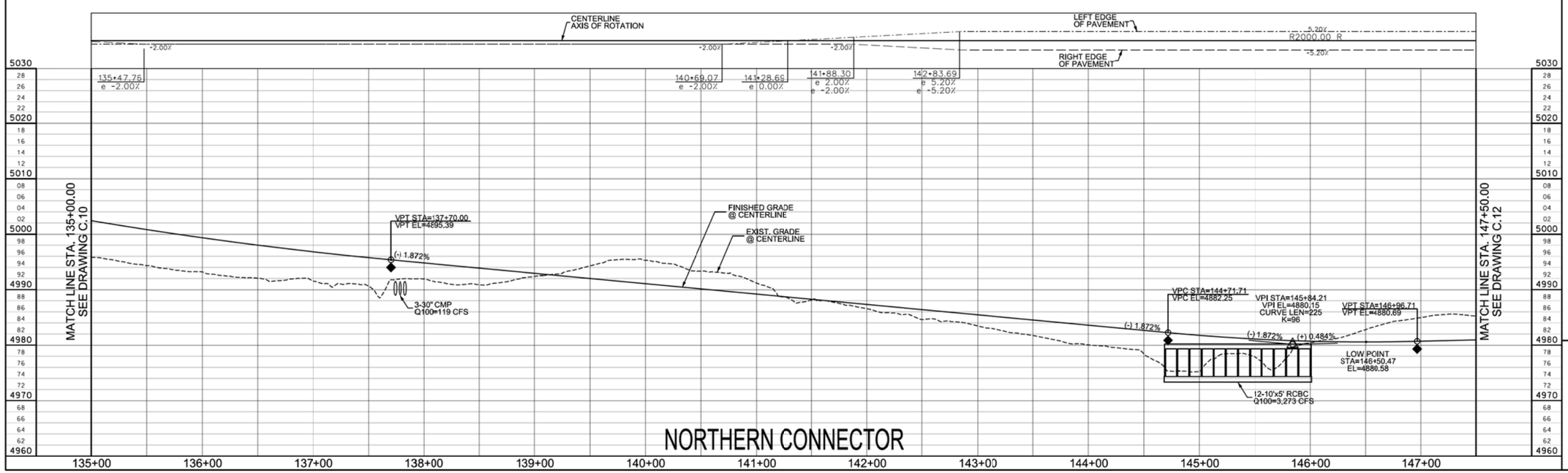

NORTHERN CONNECTOR

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EXCAVATION/ EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
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CIP#: 16-19419

CIVIL

15% ROADWAY IMPROVEMENTS
STA. 135+00.00 TO 147+50.00

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LYON PROJECT # 875-05
DRAWNG NUMBER C.11
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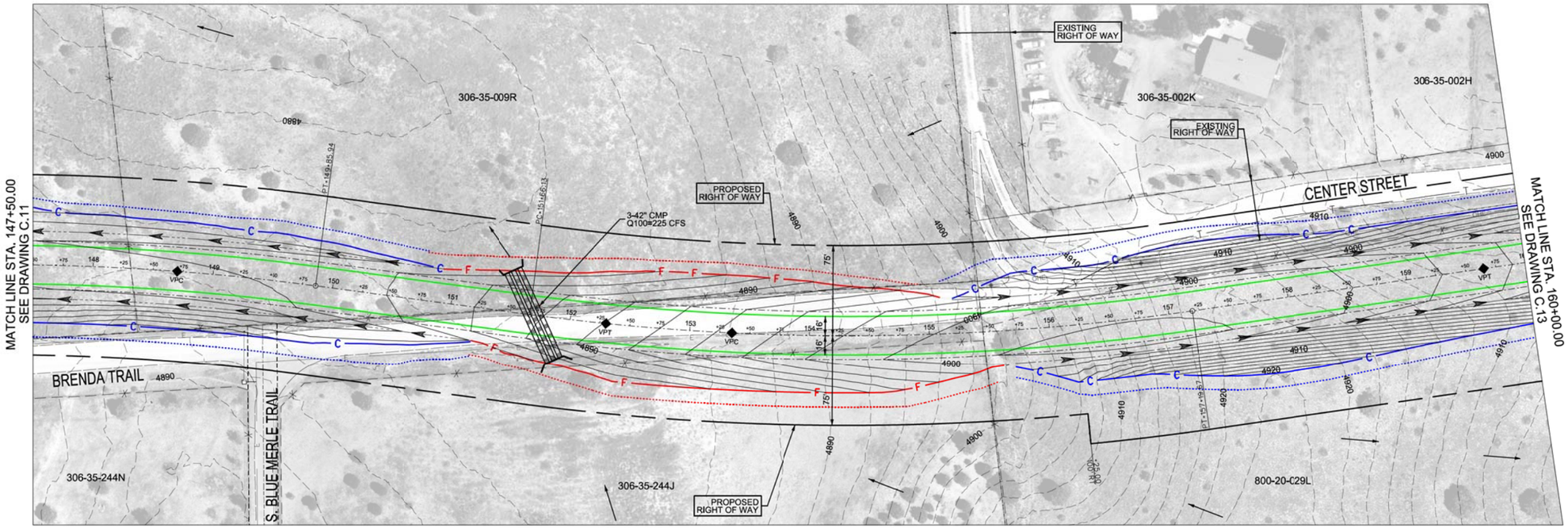

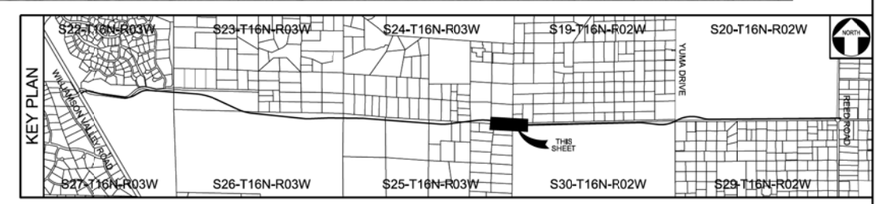

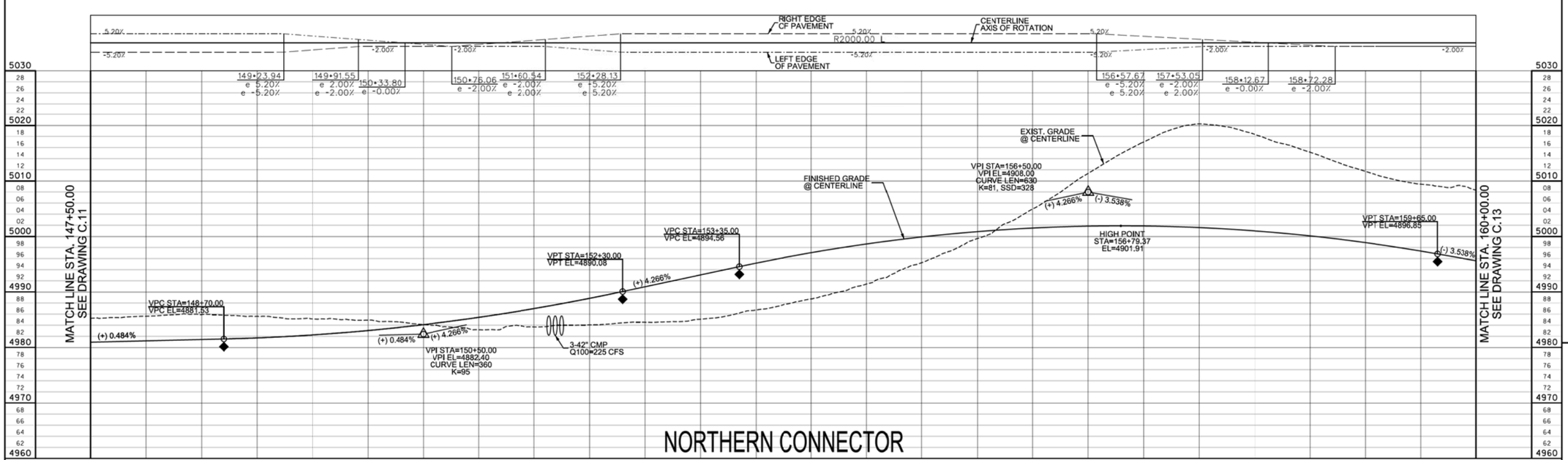

NORTHERN CONNECTOR

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
DRAWING SCALE
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CIVIL

15% ROADWAY IMPROVEMENTS
STA. 147+50.00 TO 160+00.00

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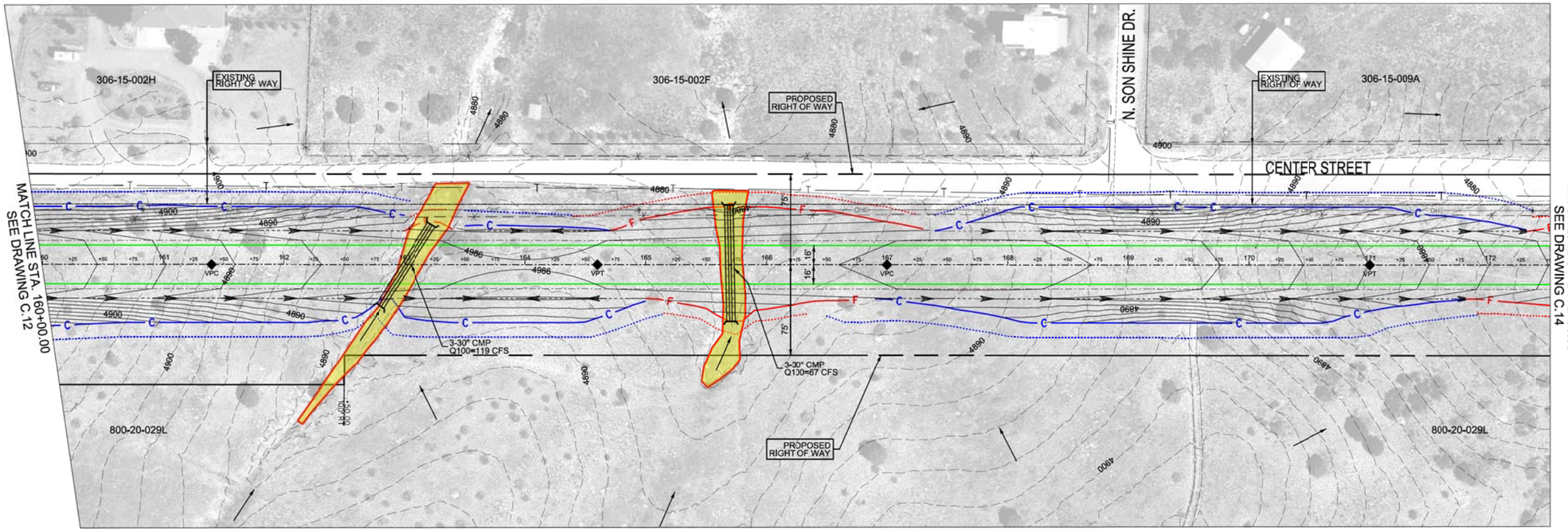

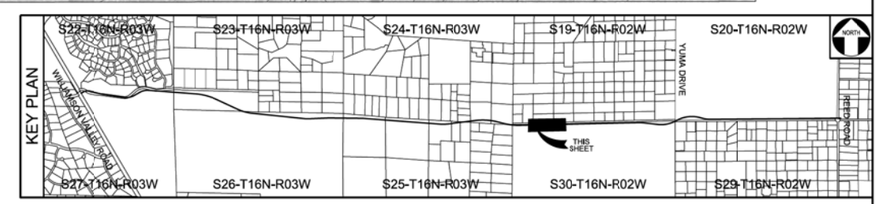

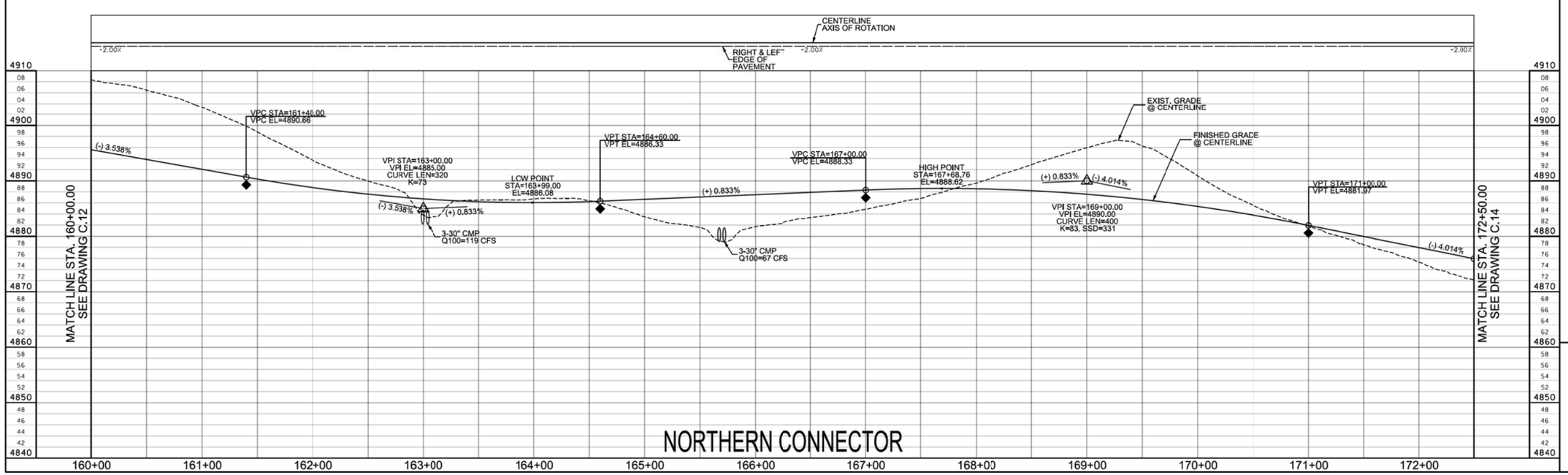

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
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CIVIL

15% ROADWAY IMPROVEMENTS
STA. 160+00.00 TO 172+50.00

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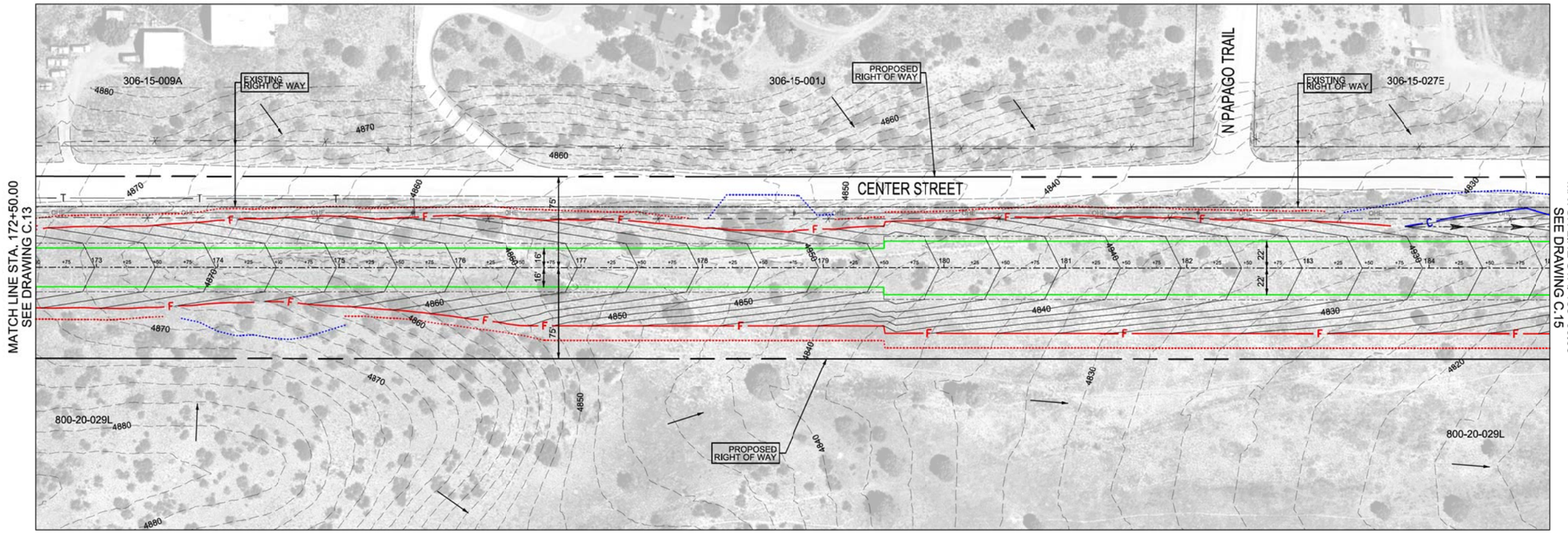

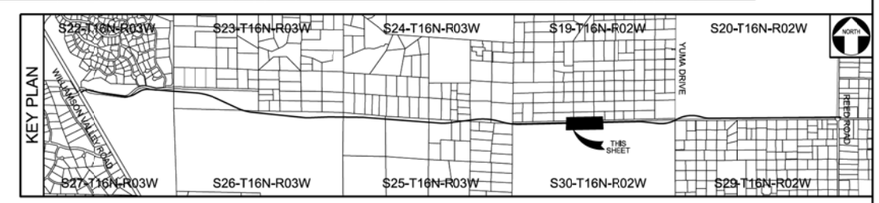

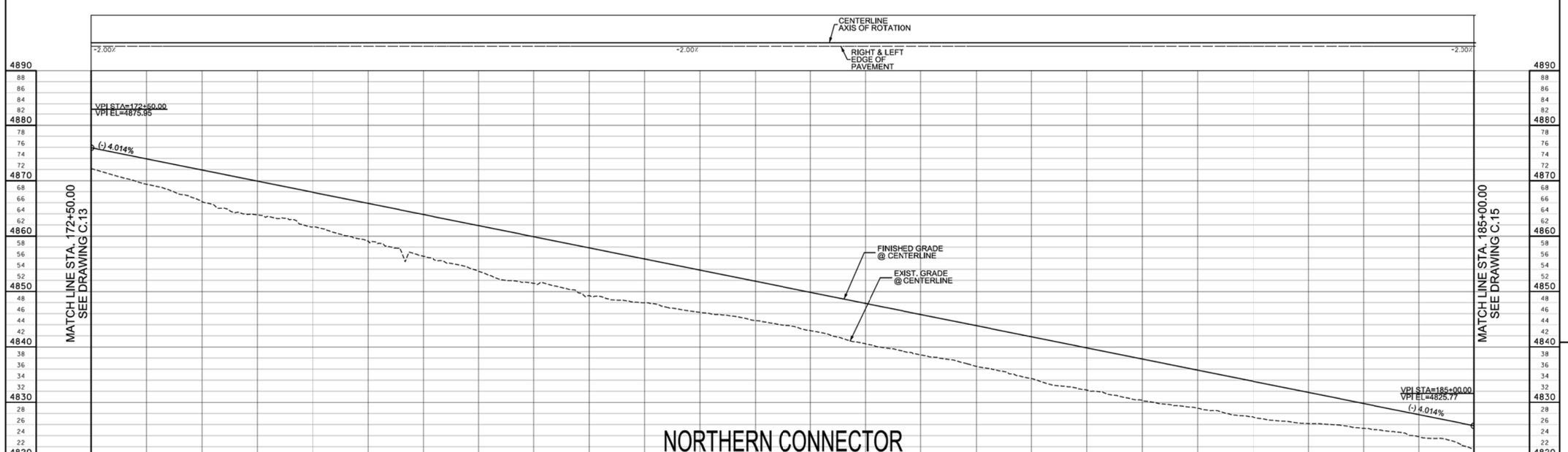

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
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WARNING! OVERHEAD POWER LINES
CONTRACTOR TO USE EXTREME CAUTION

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CIVIL

15% ROADWAY IMPROVEMENTS STA. 172+50.00 TO 185+00.00

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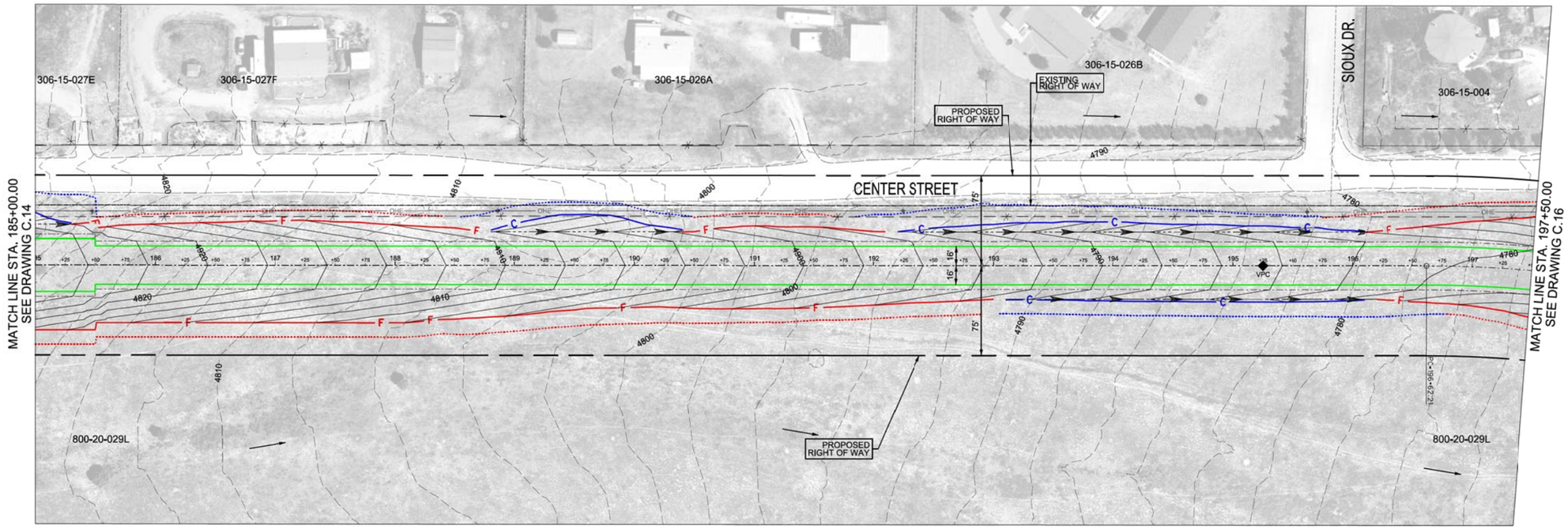

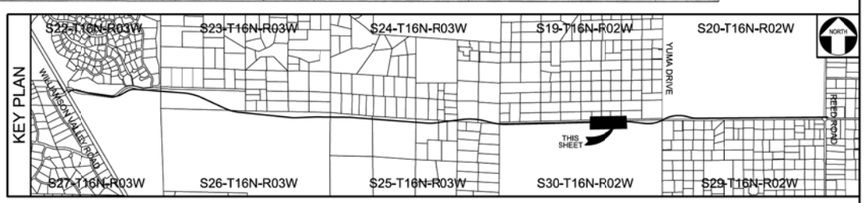

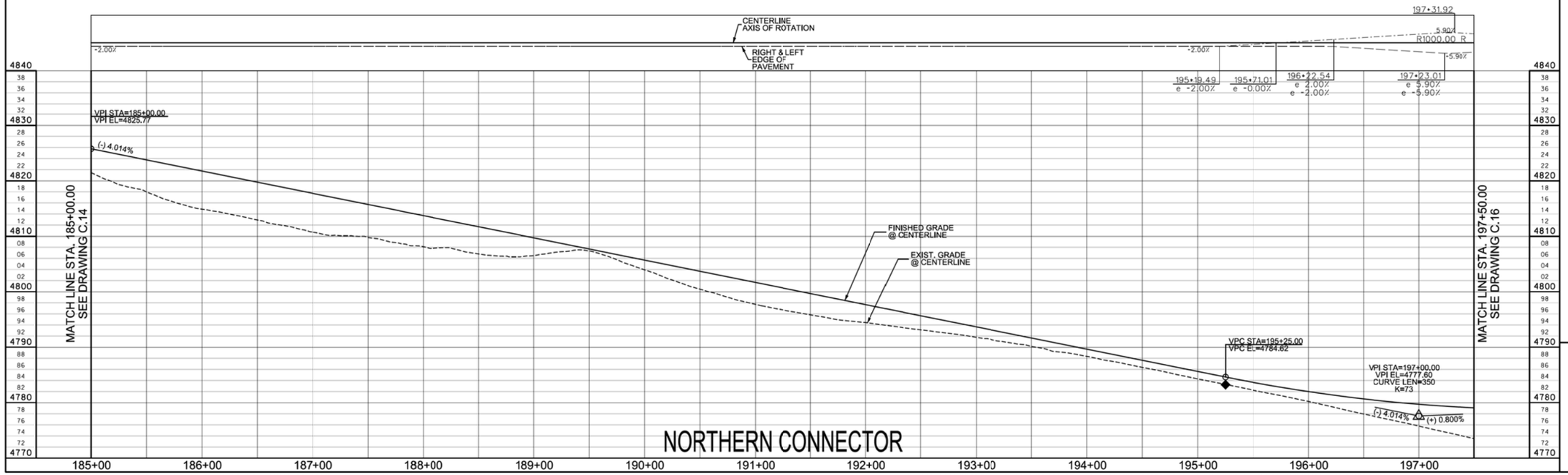

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
DRAWING SCALE
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CIVIL

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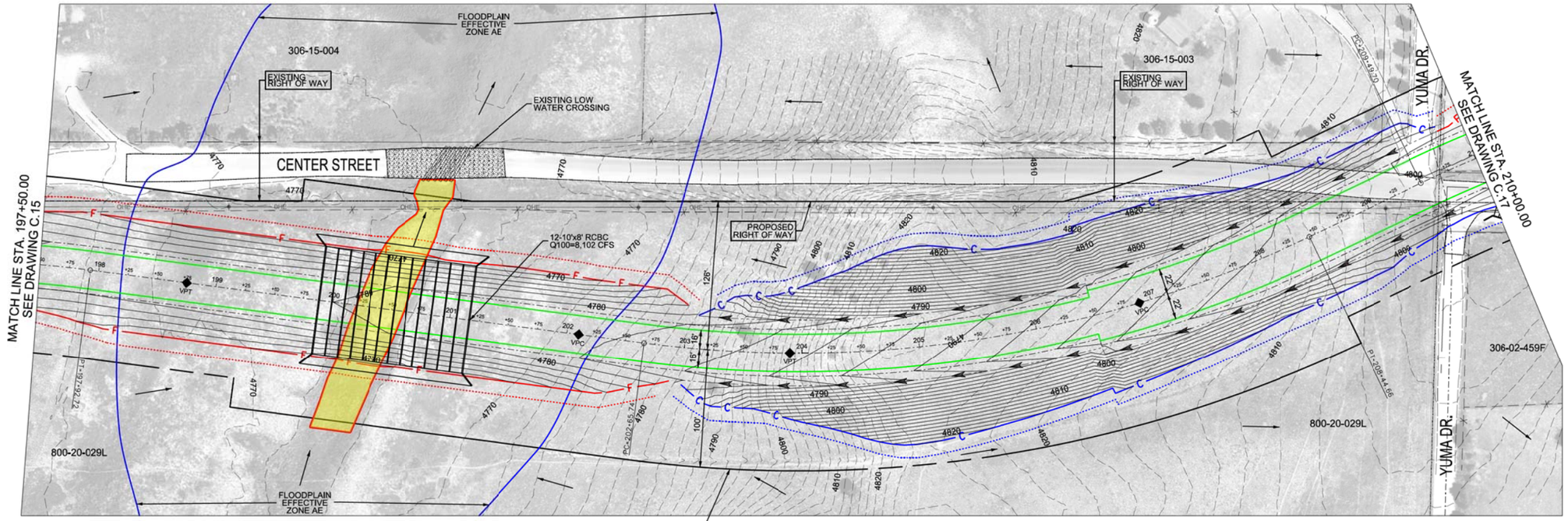

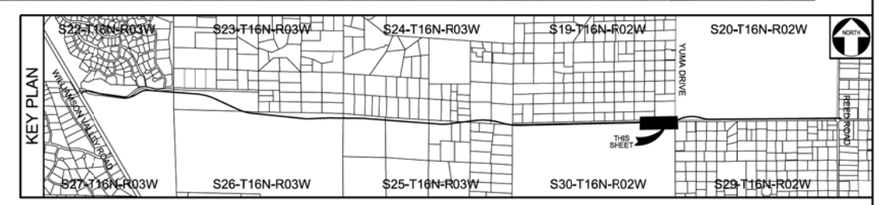

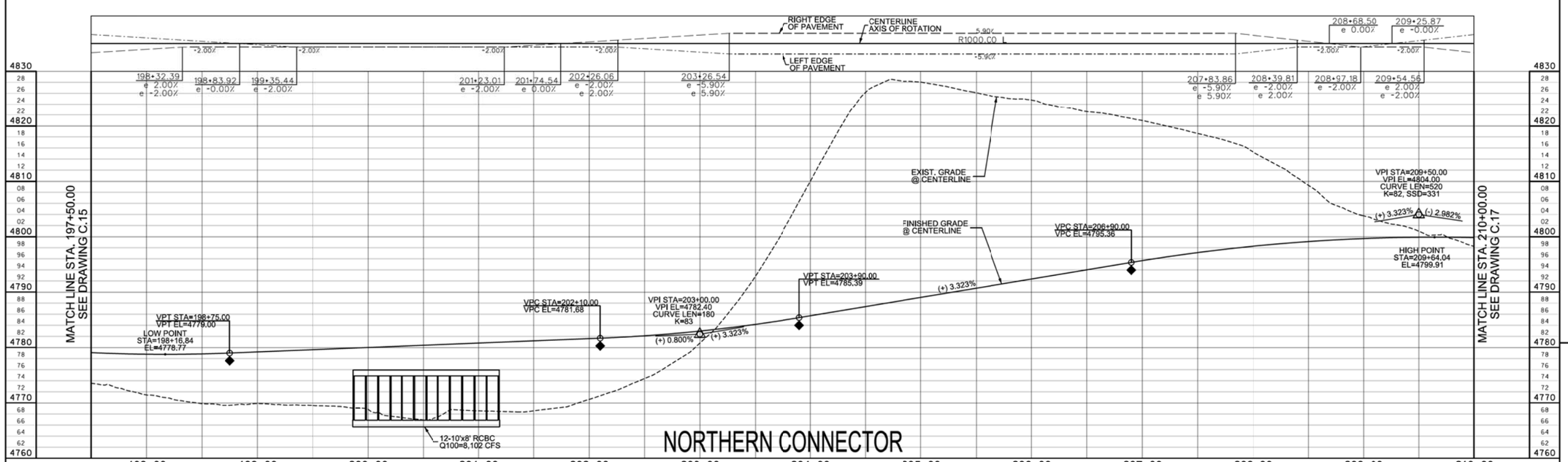

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

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DESIGN	DRAWN	CHECKED	APPROVED
KDH	KDH	KDH	

NO.	DATE	REVISION	BY	APV'D

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CIP#: 16-19419

CIVIL

15% ROADWAY IMPROVEMENTS STA.197+50.00 TO 210+00.00

DATE NOVEMBER 2017

LYON PROJECT # 875-05

DRAWING NUMBER C.16

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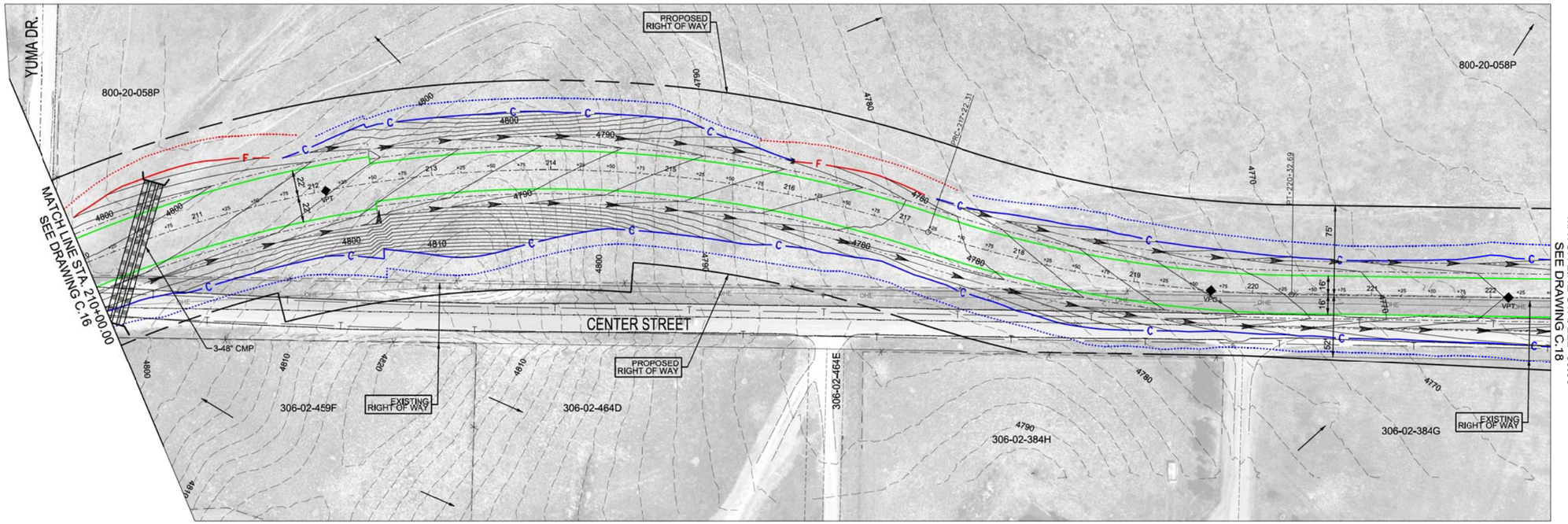

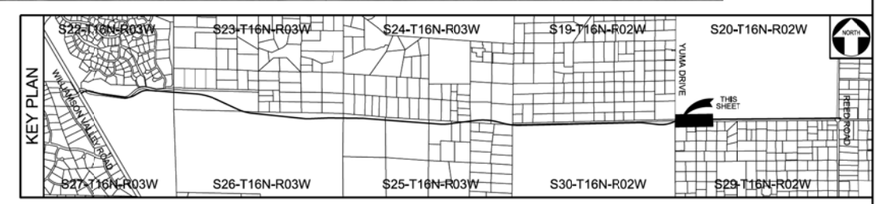

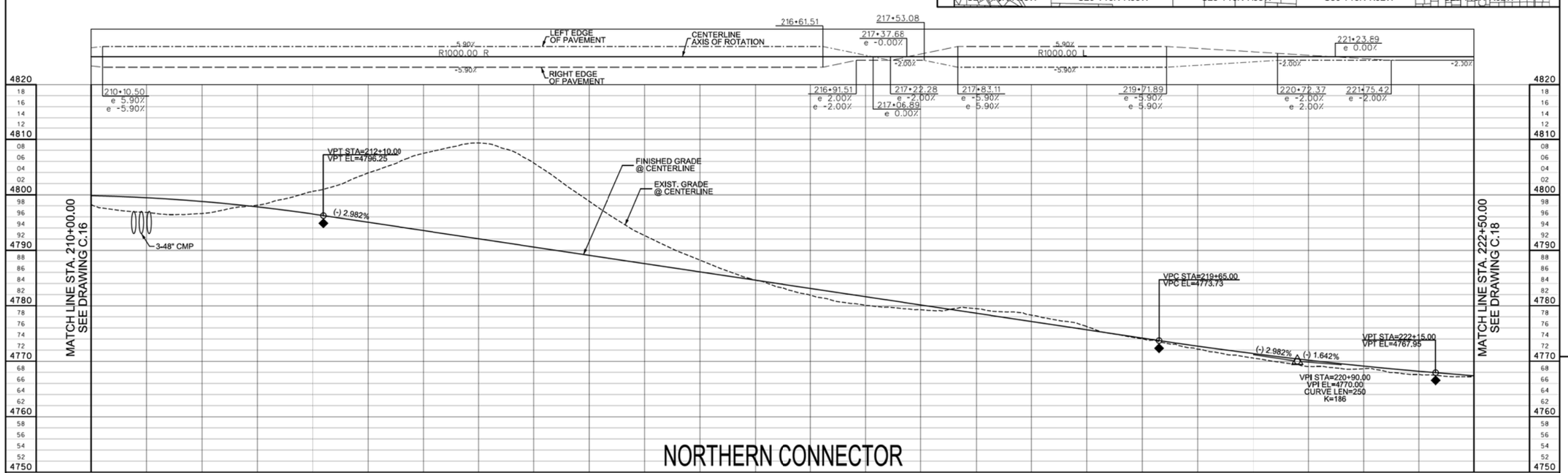

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
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DESIGN	DRAWN	CHECKED	APPROVED
KDH	KDH		

NO.	DATE	REVISION	BY	APV'D
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NORTHERN CONNECTOR ROAD
CIP#: 16-19419

CIVIL

15% ROADWAY IMPROVEMENTS
STA. 210+00.00 TO 222+50.00

WARNING! OVERHEAD POWER LINES
CONTRACTOR TO USE EXTREME CAUTION

15% SUBMITTAL

NOT FOR CONSTRUCTION

DATE
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LYON PROJECT #
875-05
DRAWING NUMBER
C.17
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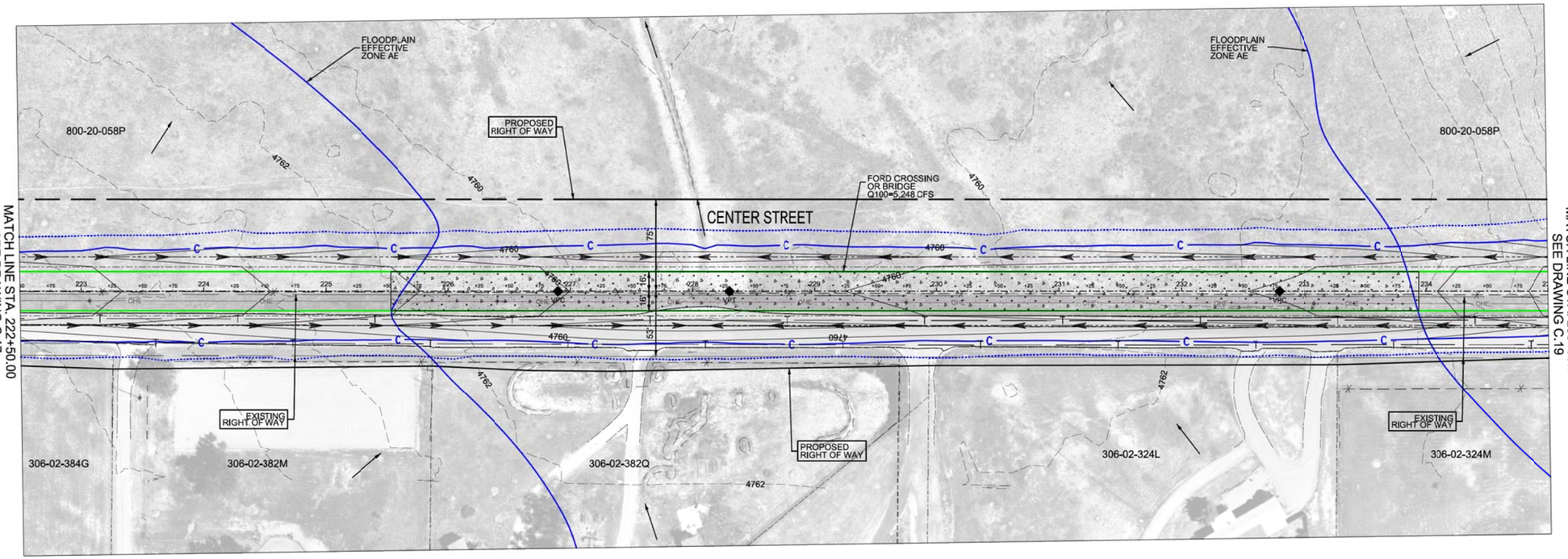

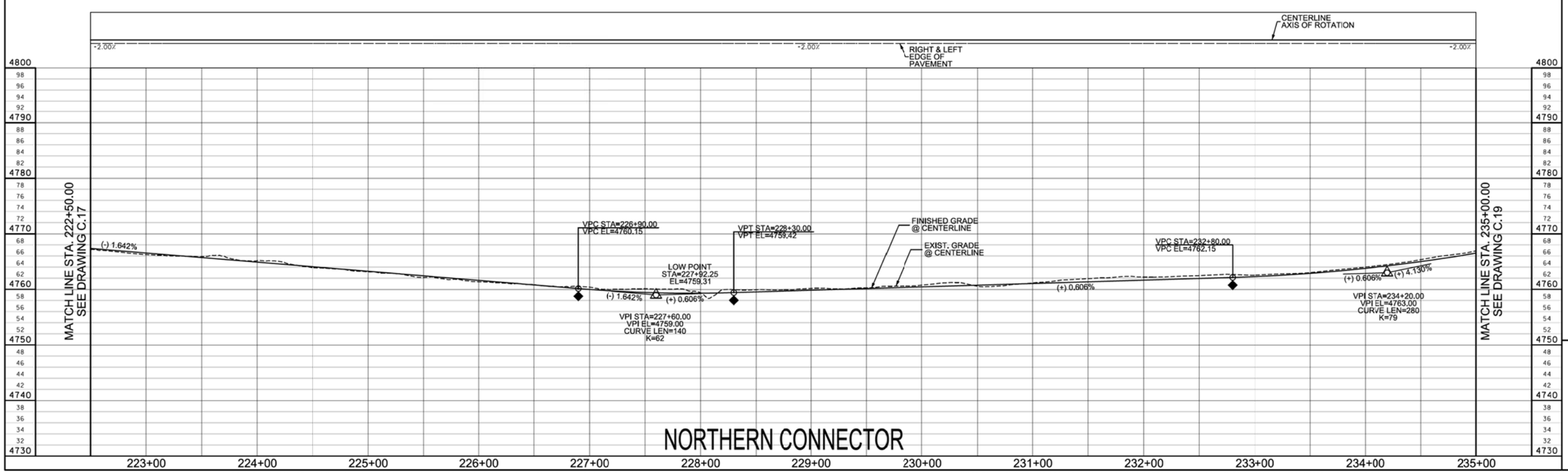

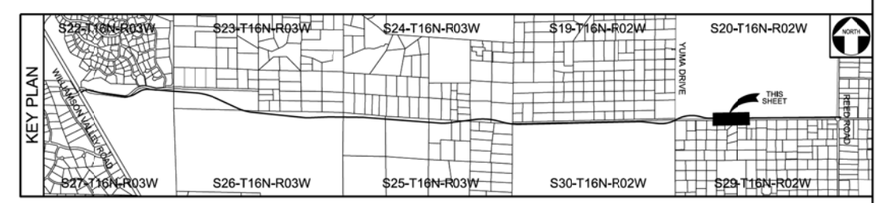

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
- C — 2-LANE ROADWAY LIMITS OF EXCAVATION
- ROADWAY DITCH FLOW LINE
- EXISTIN GDRAINAGE FLOW PATH
- LIMITS OF THE WATERS OF THE UNITED STATES (404)

NORTH

0 50
DRAWING SCALE
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CIVIL

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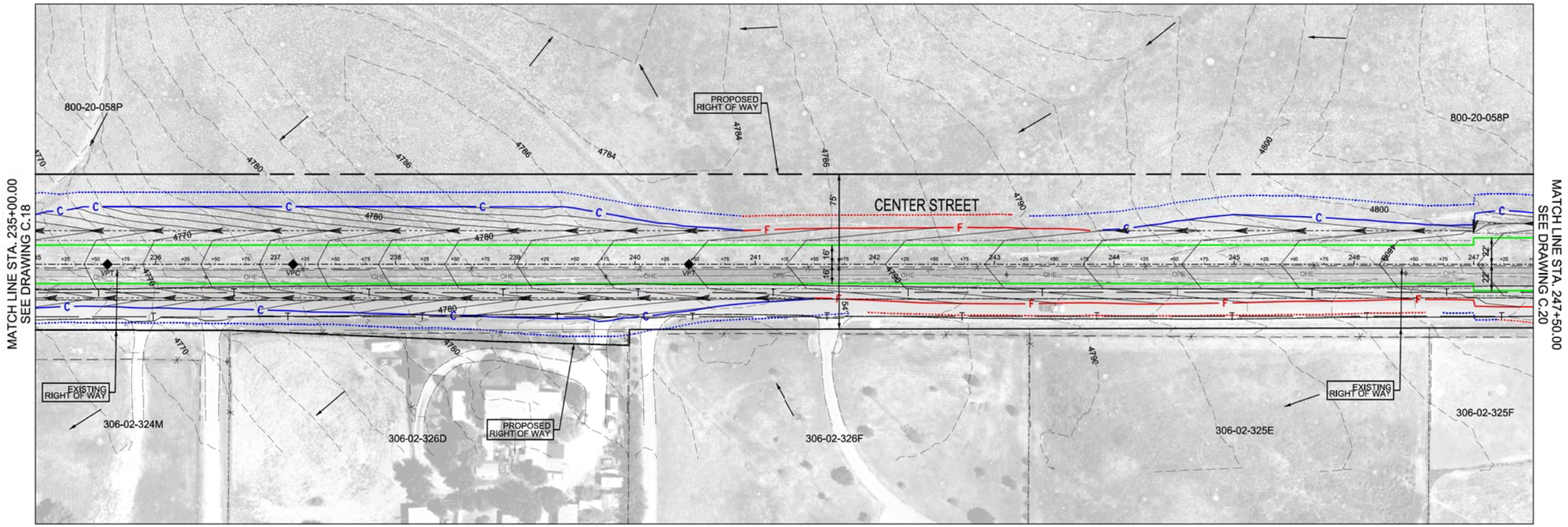

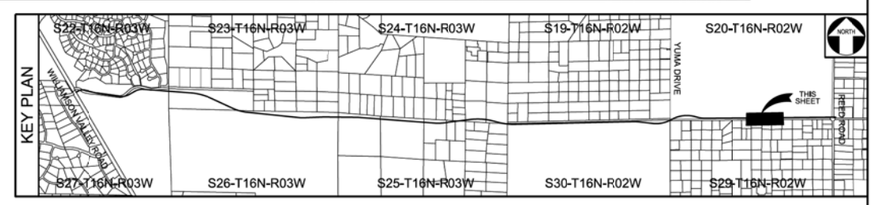

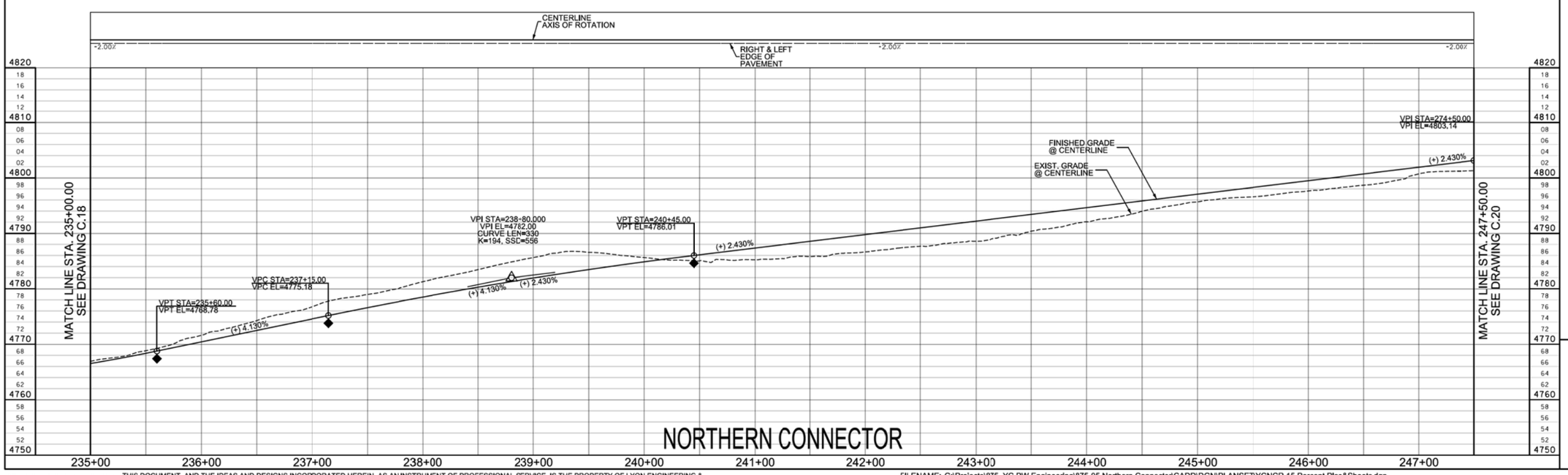

ROADWAY & DRAINAGE KEY NOTES

- 4-LANE ROADWAY LIMITS OF EMBANKMENT
- 4-LANE ROADWAY LIMITS OF EXCAVATION
- EDGE OF PROPOSED PAVEMENT
- F — 2-LANE ROADWAY LIMITS OF EMBANKMENT
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NORTH

0 50
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CIP#: 16-19419

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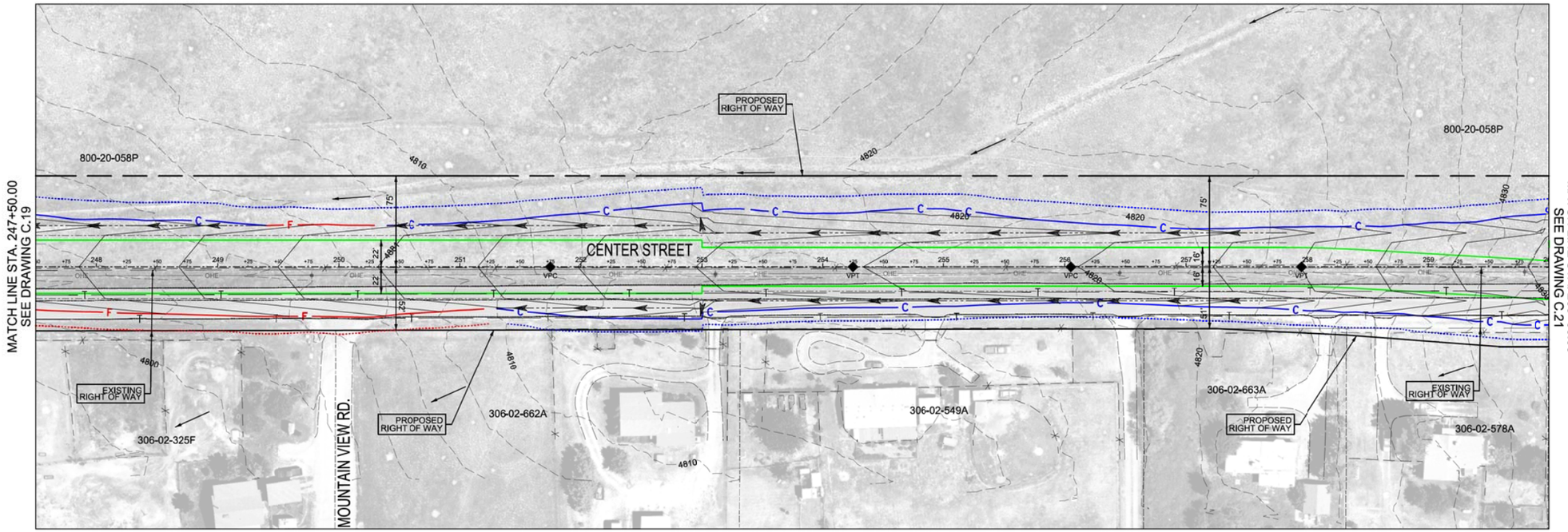

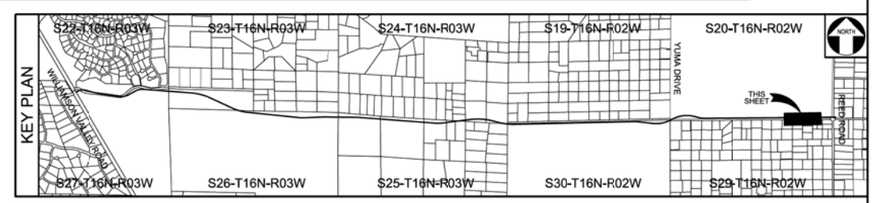

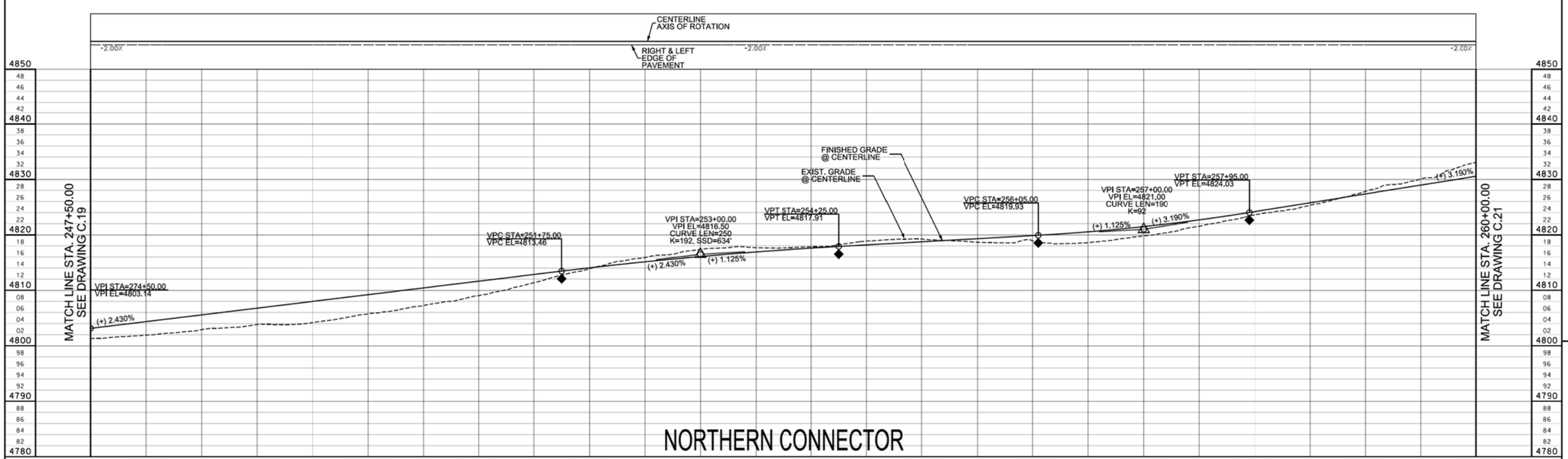

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NORTH

0 50
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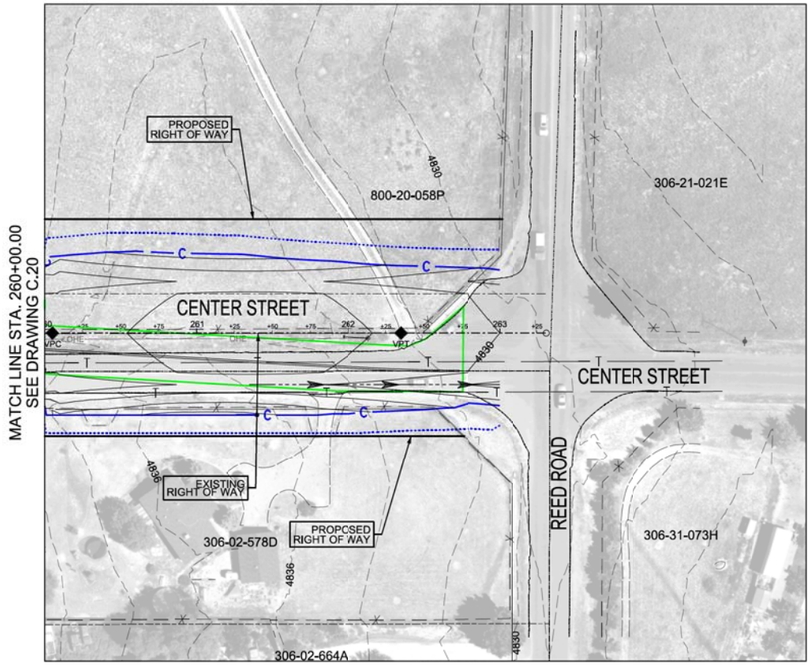

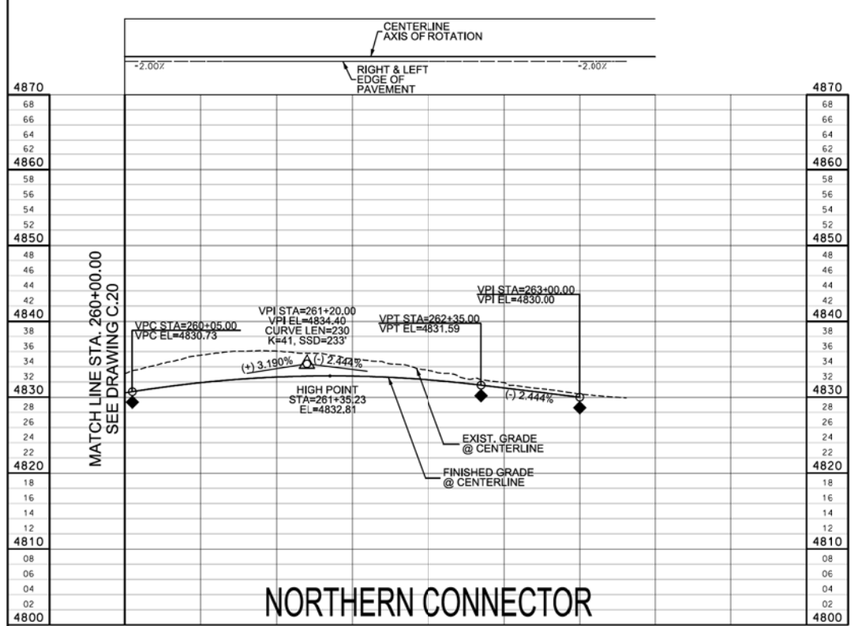

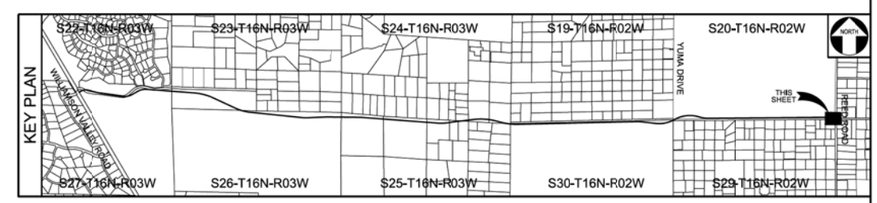

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