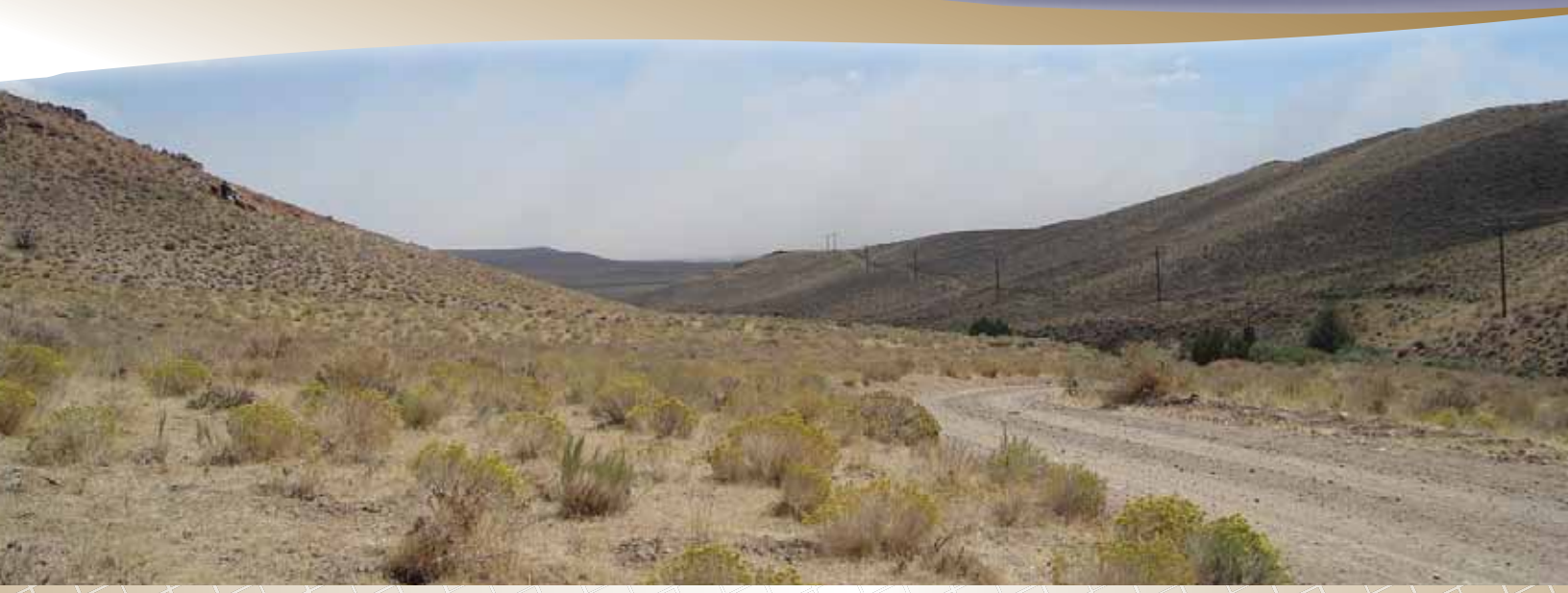

Design Standards Compliance Report

Prepared for: Nevada Department of Transportation

Prepared by: Jacobs Engineering Group Inc.

October 2, 2012

USA Parkway
SR 439

FHWA

NEVADA DOT

DESIGN STANDARDS COMPLIANCE EXECUTIVE SUMMARY

NDOT, with assistance from Jacobs is exploring alternative alignments for the completion of USA Parkway in accordance with the National Environmental Policy Act. As part of this work, Jacobs is tasked to perform a design standards compliance evaluation for the existing paved roadway through the Tahoe-Reno Industrial Center (TRIC).

USA Parkway begins 10 miles east of Reno at an interchange with Interstate 80 and proceeds 5.4 miles southeast serving as the primary access for the Tahoe-Reno Industrial Center. The continued southern extension of USA Parkway to US 50 has been envisioned for some time as a way to more directly link US 95 and US 50 to the Reno metro area and provide a means of access to future developments in the area.

There is a possibility that once the southern extension is complete, ownership of the existing paved portion of USA Parkway will be transferred to NDOT. In order for the Department to make informed decisions regarding potential ownership, the report evaluates compliance with NDOT, AASHTO, and FHWA design guidelines for the existing paved portion of USA Parkway. This evaluation reviewed numerous safety, maintenance, and other design aspects based on nationally accepted roadway design guidelines as well as input provided by NDOT staff. The existing paved portion of the roadway was not required to meet NDOT criteria as it was designed and constructed by the developer.

USA Parkway is considered a rural minor arterial currently carrying 5,000 vehicles per day (vpd) with a truck percentage of 24 percent. Future projections show that in 2037, 38,000 vpd may be using the alignment. The current posted speed limit along roadway is 45 mph with a design speed of 50 mph established to be used as part of the evaluation criteria. Additional evaluation criteria used for this compliance review include the AASHTO Green Book, the AASHTO Roadside Design Guide, the NDOT Road Design Guide, and the MUTCD.

Following multiple field reviews attended by NDOT and Jacobs personnel, a comprehensive list of all noncompliant areas has been created detailing the location and summary of the guidelines evaluated. Following the creation and analysis this list, specific areas of greatest concern and highest priority to the Department have been further detailed. The design compliance field review team identified noncompliant items directly relating to safety as those items of highest priority. These safety items include:

- Narrow or no shoulder width on the right or left edges of pavement
- Guardrail sections without leading or trailing end terminals
- Steep roadside slopes exceeding recommendations in the Roadside Design Guide

- Rip-rap placed in center median or along roadside edges
- Boulders located within the clear-zone
- Unprotected culvert ends located within the clear-zone
- Improperly installed fire hydrants located within the clear-zone
- Insufficient sight distance including stopping site distance and intersection sight triangle distance

Possible solutions to these prioritized safety items were investigated with approximate quantities and approximate order of magnitude costs estimated for each possible solution. Table E-1 summarizes these solutions, the quantity required, and the associated cost for each item.

Table E-1: Prioritized Safety Items

	Item	Approximate Quantity	Cost
Primary Items	Construction of Roadway Shoulders	20 Miles	$$$$
	Placement of Guardrail End Terminals	40 Terminals	$$$
	Placement of New Guardrail	3000 Linear Feet	$$$
	Flatten Roadside Slopes within Clear-zone	10000 Cubic Yards	$$$
	Removal of Boulders and Rip-Rap from Clear-zone	8000 Cubic Yards	$$$
	Culvert in Clear-zone at Approaches	15 Inlets and Outlets	$$
	Fire Hydrant Adjustments	15 Fire Hydrants	$$
	Sight Distance Corrections	2 Sites	$

$ < 50K, $$ < 100K, $$$ < 1M, $$$$ > 1M

The development of this report could not have been completed without extensive collaboration with NDOT personnel both at headquarters and at District II. Their time and effort is greatly appreciated by the Jacobs team.

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1.0 ACKNOWLEDGEMENTS

A design standards compliance evaluation for USA Parkway, conducted on the existing paved portion of the alignment, was performed to determine compliance of the roadway to desirable NDOT, AASHTO, and FHWA standards and design criteria. This evaluation identifies the roadway elements that were found noncompliant and discusses specific items of greatest concern and highest priority where improvements to the existing facility are recommended to meet desirable standards and guidelines.

The development of this report was conducted by Jacobs with extensive collaboration from NDOT personnel from both headquarters and District II. The coordination and dedication of all team members assigned to this evaluation effort is recognized and appreciated. Those team members key in the development of this report, as well as those attending field reviews, include the following individuals:

NDOT:

Pedro Rodriquez, Project Manager
Fred Shakal, Roadway Design
Sam Dowd Roadway Design
Randy Loff Roadway Design
Steve Williams, District II
Jeromie Sorhouet, District II
Ed Ely, NDOT District II
David Titzel, District II
Brian Wilson, Hydraulics
Roshelle Olson, Materials

Jacobs:

Bryan Gant, Project Manager
Steve Oxoby, Roadway Design
Chris Martinovich, Roadway Design

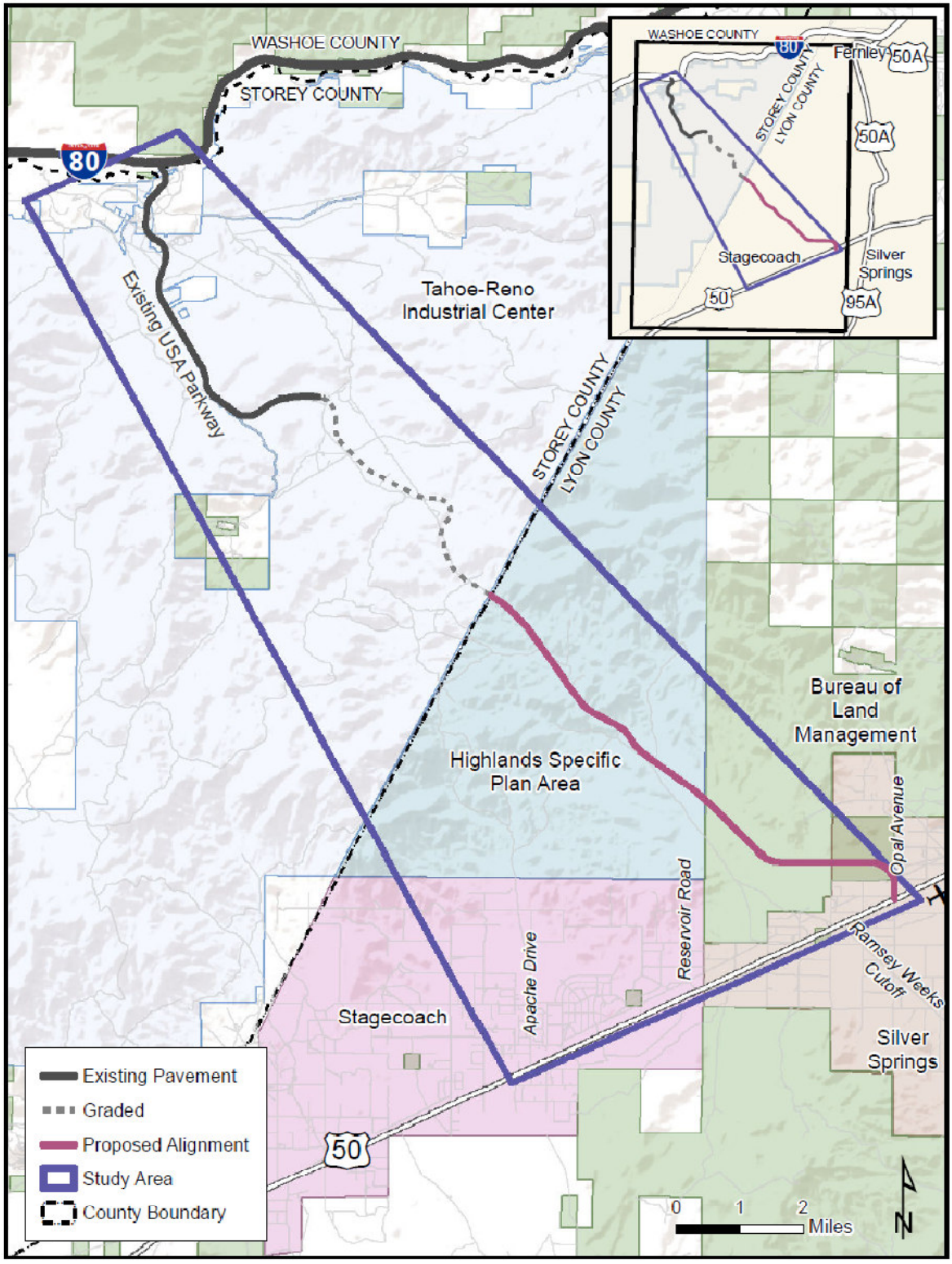
2.0 INTRODUCTION

NDOT, with assistance from Jacobs, is exploring alternative alignments for the completion of USA Parkway in accordance with the National Environmental Policy Act (NEPA). Currently, USA Parkway begins 10 miles east of Reno at an interchange with Interstate 80 and proceeds south for approximately 5.4 miles serving the Tahoe-Reno Industrial Center (TRIC). The continued southern extension of USA Parkway to US 50 has been envisioned for some time as a way to more directly link US 95 and US 50 to

the Reno metro area and provide a means to access future developments in the area. There is a strong possibility that once the southern extension is complete, ownership of the existing developer constructed portion of USA Parkway will be transferred to NDOT, and the Department will assume all operation, liability and maintenance costs associated with the full alignment.

Compliance with NDOT, AASHTO, and FHWA design guidelines is being evaluated to allow NDOT to make informed decisions regarding potential operation and maintenance of the existing paved roadway. This evaluation reviewed numerous safety, maintenance, and other design aspects based on nationally accepted roadway design guidelines as well as input provided by NDOT headquarters and District II staff. Major design elements evaluated include horizontal and vertical geometry, roadside features and clear-zone distances, drainage, AASHTO 13 controlling criteria, signing, and general maintenance requirements.

USA Parkway's current primary function is to provide access to the developments within the TRIC. The roadway, designed by Reno Engineering Corporation, has been constructed in a series of phases with the first being completed in 2002 and the final phase completed in 2009. An interchange at Interstate 80 was constructed in 2006 under NDOT contract 3320. Beyond the end of the 5.4 mile paved section, an additional 4.4 miles of graded roadway extends to the Storey / Lyon County line. At this time, no pavement or other roadway improvements have been constructed along this graded portion. The map on the following page shows the project limits and depicts the extents of the paved and graded portions of the alignment.


WASHOE COUNTY
STOREY COUNTY
80
Existing USA Parkway
Tahoe-Reno
Industrial Center
STOREY COUNTY
LYON COUNTY
Bureau of
Land
Management
Highlands Specific
Plan Area
Opal Avenue
Reservoir Road
Apache Drive
Ramsey Weeks
Cutoff
Stagecoach
Silver
Springs
50
0
1
2
Miles
N
Existing Pavement
Graded
Proposed Alignment
Study Area
County Boundary
WASHOE COUNTY
80
Fernley
50A
STOREY COUNTY
LYON COUNTY
50A
Stagecoach
Silver
Springs
50
95A

3.0 COMPLIANCE CRITERIA AND EVALUATION

3.1 BACKGROUND AND EVALUATION STANDARDS

In September of 2008, following initial completion of USA Parkway, Dennis Coyle of NDOT conducted a Special Standards Compliance Review on the existing paved roadway. His review outlined numerous noncompliant aspects and provided suggested actions to be taken in order to bring the roadway into compliance. The Coyle Report, while used as guidance for this design standards compliance review, outlines general observations and is not specific on the locations of noncompliant elements of the roadway. The review was also completed prior to the final phase of USA Parkway construction.

This current evaluation documents location specific details of non-compliance and provides descriptions of improvements required to meet desired design guidelines. The evaluation also addresses additional items not included in previous reports, and evaluates the most recently constructed phase of USA Parkway completed in 2009.

The design criteria and desirable guidelines used for the compliance review include the following manuals:

NDOT: Road Design Guide, 2010

NDOT: Standard Plans for Road and Bridge Construction, 2010

NDOT: Access Management System and Standards, 1999

AASHTO: A Policy on Geometric Design of Highways and Streets 6th Edition (Green Book), 2011

AASHTO: Roadside Design Guide 4th Edition, 2011

FHWA: Manual on Uniform Traffic Control Devices (MUTCD), 2009

3.1.1 Basis of Evaluation

USA Parkway has been classified as a rural minor arterial. The posted speed limit on the existing portion of USA Parkway is 45 mph, with the northernmost section of the roadway from Venice Drive north to the interchange at I-80 posted at 40 mph for trucks only. Current traffic volumes on USA Parkway are 5,000 vpd (vehicles per day) with 24 percent trucks. The traffic flows on this portion are projected to be 38,000 vpd by 2037 with a truck percentage remaining at or near 24 percent.

Selection of a design speed to be utilized for the evaluation was an important consideration since this factor heavily contributes to the determination of clear zone distances as well as establishment of many other geometric design criteria. Beginning with the functional classification of the roadway, the team analyzed the traffic volumes, truck percentages, driveway and approach spacing, as well as land use and terrain of the existing roadway and surroundings. Based on this information, as well as guidance provided by AASHTO and the NDOT Access Management Systems and Standards, a design speed of 50 mph was selected by the team for the evaluation.

It should be noted that NDOT generally sets the posted speed 10 mph below the design speed or to the approximate 85th percentile speed of traffic. Since the design speed used for the initial design is unknown, and an operating speed study has not been completed, the team consensus was to utilize 50 mph as the design speed for this evaluation.

3.1.2 Evaluated Standards and Design Criteria

Criteria to be evaluated for standards compliance can include a wide range of features. The team focused on the roadway elements and design criteria with the highest importance from a safety and maintenance standpoint. Following is a breakdown of the specific features that were reviewed for standards compliance. In addition, a table outlining the desired and minimum criteria is included immediately following the conclusion of this report.

- Roadway Geometry
  - Curve radius
  - Curve length
  - Lane widths
  - Median widths and type
  - Shoulder widths
  - Grades
  - Vertical curve “K” values
  - Crown
  - Superelevation
  - Sight distance
- Roadside Design
  - Clear-zone
  - Roadside slopes and ditches
  - Guardrail and barrier rail placement
  - Guardrail and barrier rail end treatments
- Drainage and Hydraulics
  - Culvert size and capacity
  - Culvert material
  - Inlet and outlet treatments
  - Channel size and lining
- Utilities
  - Utilities in clear-zone
  - Utilities in pavement
  - RFIDs on existing utilities (Radio Frequency IDs)

- Pavement and materials
  - Structural section
  - Pavement conditions and remaining life
- Signing and striping
  - Placement and foundation type
  - Letter height and reflectivity
  - Readability
  - Guide posts and object markers
  - Rumble strips
- Other items
  - Intersection spacing and sight distances
  - Roadway lighting
  - Landscaping and irrigation
  - Fencing and wildlife control

3.2 Evaluation Process

An initial field compliance review by Steve Oxoby and Chris Martinovich of Jacobs occurred in early April of 2012. During this initial review, information was gathered focusing on the breakdown of items detailed above. Using the construction plans as prepared by Reno Engineering Corporation as a reference, the team evaluated the site over a three day period identifying and measuring potentially noncompliant items using established stationing from the Reno Engineering plan set as reference. A copy of this plan set has been included in Appendix I.

Following the initial field review, a list of all items found to be out of compliance with desired design guidelines was developed along with a photo log of each site showing the location and issue encountered. This comprehensive list is divided into groups to organize the issues based on the criteria being evaluated. The divisions include roadway geometrics, clear-zone distances, roadside slopes, drainage and hydraulics, utilities, and signing and striping. Each divisional list details the location by station, discusses the noncompliant items, outlines pertinent criteria, and includes a photo reference number corresponding to the attached photo logs. These lists and accompanying photo logs are included in Appendices A-F of this report. Locations are organized by order of ascending station with the end of the existing pavement being the lowest station and the interchange at I-80 being the highest station.

Once the preliminary evaluation of all items not meeting desired guidelines had been developed, collaboration with NDOT headquarters and District II occurred. An NDOT field review meeting occurring in mid May included members from District II maintenance and headquarters divisions of Design, Materials and Hydraulics. The meeting summarized general noncompliant items found during initial field visits and reviewed

many of those sites while in the field. The primary goals of the NDOT field review meeting were to identify additional information regarding noncompliant sites, receive input on maintenance items from maintenance staff, and to determine which noncompliant items are to be considered higher priority from a standards compliance, maintenance, and safety perspective.

Based on comments received during the NDOT field review meeting, revisions to the lists of noncompliant items were made. In addition, a second list was developed highlighting those items of greatest concern and highest priority of importance to the Department, both from a safety and maintenance perspective. This high priority list is detailed in section 4.0 of this report.

3.3 EVALUATION RESULTS

Listed below is a general summary and discussion of the noncompliant or non-standard items found during the field reviews. As indicated in the previous section, the detailed list of locations and descriptions of each noncompliant criterion is included in Appendices A-F; however, this section summarizes the major findings in a general format.

3.3.1 Roadway Geometry

Roadway geometry varies along different sections of USA Parkway with respect to the cross section. The roadway has three distinct sections each with differing pavement widths and differing edge conditions. The first section includes the southernmost section, running from the end of the existing pavement north to Sydney Drive, with approximate station limits of 400+00 to 544+00. The middle section from Sydney Drive north to Waltham Way encompasses stations 544+00 to 672+00; and the northernmost curb and gutter section from Waltham Way to the I-80 Interchange runs from stations 672+00 to 718+00. Each of these sections was built during different phases and each have slightly different characteristics from a roadway geometric standpoint. The significant geometric elements identified as noncompliant are listed below. Refer to Appendix A for a comprehensive listing of the specific roadway geometric noncompliant items.

3.3.1.1 Pavement and Shoulder Width

Throughout all the sections, USA Parkway is a four lane divided arterial with pavement widths of 25 to 27 feet in each direction of travel. The median width varies from 12 to 21 feet in different sections of the alignment. The major noncompliant item with respect to the roadway cross section is the lack of sufficient shoulder width. The NDOT Road

Design Guide indicates that for areas without curb and gutter a minimum width of paved shoulder shall be 6 feet on the right and 4 feet on the left with desirable widths being 10 ft and 8 ft respectively. The AASHTO Green Book provides consistent recommendations of a 4 foot paved shoulder on the inside and a minimum 8 foot outside shoulder for divided arterials. The maximum measured paved shoulder on USA Parkway is 2 feet on the right and 1 foot on the left with most locations measuring less than these distances. In addition, there are locations where the stripe is placed directly on the edge of the pavement for both the right and left shoulders.

There is a large amount of variation in both slope as well as surfacing material throughout the alignment for the area between the edge of asphalt and the toe of slope. In limited locations, there is a clear gravel shoulder area with a hinge point and embankment leading down to the toe of slope or flow line of ditch. In many locations, however, there is insufficient shoulder for a motorist to move off the roadway. The southernmost section consists of an 7 to 8 foot wide gravel shoulder, sloping at 10:1 or flatter. The middle portion, from Sydney to Waltham, consists mainly of dirt or worn gravel shoulders of width 5 to 7 feet sloping at 6:1 or flatter. Areas of noncompliant steep slopes adjacent to the pavement in the shoulders were found in limited instances. In addition, the shoulder areas are unmaintained with erosion along the pavement edges and the growth of weeds and bushes beginning to occur.

The northernmost section from Waltham Way to the interchange with I-80 has type 5 curb and gutter and a raised center median filled mainly with small rocks. The distance between the face of curbs vary between 26 to 27 feet. For this standards compliance review, this section of USA Parkway has been considered ‘urban’ because of the spacing of existing and planned driveways and the number of smaller business located along the road. Based on the urban assumption, the NDOT Road Design Guide indicates that for urban arterials with a posted speed limit of 45 mph or less, curbs of 6” in height may be used; although, in areas of snow removal, mountable curbs are preferred. Following those guidelines, the roadway can be considered compliant although additional discussion may be needed.

Along with curb height, curb placement was also examined. The AASHTO Green Book indicates that curbs should be offset 1 to 2 feet from the travel way. Based on the width of pavement in this section, the curbs on both the right and left sides are offset by at least this distance.

3.3.1.2 Alignment

Horizontal and vertical alignment data is based on information received from Reno Engineering. Horizontal curve radii, vertical curve data, grades, and superelevation rates along USA Parkway were evaluated to determine if the planned design and existing field conditions met AASHTO guidelines for the established design speed of 50 mph.

Many of the existing horizontal curves do not have adequate superelevation for their designed radius. Most curves are under-superelevated by 1 or 2 percent and three curves along the alignment have an adverse superelevation occurring throughout the radius of the curve.

South of Sydney Drive there are several reverse curves with unique superelevation transitions. These transitions appear to occur abruptly resulting in steep grade changes in the outer pavement edge. While reversing curves are not ideal, the design can be such that the superelevation transitions occur more gradually allowing for better driver comfort.

Based on the plans, the USA Parkway vertical alignment easily accommodates a 50 mph design speed with the exception of one sag vertical curve located south of Sydney Drive. The curve length results in a k-value of 70 which is less than the required 96. In addition to this vertical curve, a grade break near Pittsburgh Drive is indicated on the plans to have a change of grade of 0.31 percent. NDOT's desirable maximum is 0.2 percent with changes in grade greater than 0.2 percent to be transitioned by a vertical curve.

3.3.1.3 Sight Distance

Two locations along USA Parkway appear to not meet sight distance criteria. The first location is along the curve just south of the interchange and the railroad tracks in the southbound direction. This location has several pine trees located 5' behind the curb. These trees have the effect of blocking the view of drivers in the right hand lane and limit the sight stopping distance for this curve.

The second location occurs at the intersection with Pittsburgh Drive. As a vehicle approaches USA Parkway on eastbound Pittsburgh, the driver does not have adequate sight distance on the left because of the steep cut slope located near the pavement edge of USA Parkway. Using the most conservative value, the Green Book indicates 620 feet are required for a truck entering USA Parkway following Case B2. The measured distance was found to be only 270.

3.3.2 Clear-zone Obstructions

Clear-zone obstructions pertain to those structures and objects that exist within the clear-zone area. For USA Parkway these obstructions include guardrail, power poles, boulders, and culverts. Other items such as roadside slopes, signs and fire hydrants are included in separate sections of this report. The AASHTO Roadside Design Guide details the clear-zone area to be "the unobstructed, traversable area provided beyond the edge of the through traveled way for the recovery of errant vehicles." Chapter 3 of the Guide outlines the minimum width of the clear-zone to be between 14 and 28 feet at the established 50 mph design speed and projected traffic volumes depending on the direction of slope and the slope steepness. Any noncompliant objects offset less than this distance are therefore located within the clear-zone and require removal or protection by accepted guidelines. Refer to Appendix B for specific noncompliant clear-zone objects.

3.3.2.1 Guardrail and Barrier Rail

Accepted clear-zone protection methods can include the use of guardrail and barrier rail. Most existing sections of guardrail along USA Parkway were not installed compliant with the NDOT standard plans. The most prominent noncompliant item deals with the end terminals. Per the NDOT Standard Plans, all guardrail sections shall have crash worthy end terminals and be offset the required shy distance. Of all the existing sections of guardrail, only one has a leading end terminal and none have proper trailing end terminals. In addition, many of the guardrail sections have improper flare rates and inadequate length of need. These guardrail sections do not extend far enough beyond the hazard to adequately protect a vehicle from impacting or falling into that hazard. Guardrail offsets for each section vary from about 1 foot to 1.5 feet from the stripe with one section just north of Sydney Drive placed at the white stripe.

Some of the sections of guardrail also have gaps intended to provide access to fire hydrants located behind. These gaps of approximately 4 feet in length do not have end terminals. Two potential solutions exist to remedy this problem. The first would be to simply replace a section of guardrail with the proper end terminals at each end per NDOT's Standard Plans. The second potential solution, while still maintaining access to the fire hydrants, would be to end the previous rail section at the hydrant with the proper terminal, and offset the beginning of the next section of rail behind the hydrant thus protecting the hydrant and eliminating the leading end of the rail from impact. Trailing ends would still be needed at both ends of the guardrail.

A lone barrier rail segment located just prior to the railroad bridge at the northern end of the alignment does not have an end terminal. The existing barrier rail curves around

and ends behind a section of curb and gutter. While the end of the rail is not a danger, the position of the rail located behind 6" curb and gutter is a potential issue. Should a vehicle lose control, upon impact of the curb, it may be vaulted into the air and impact the barrier rail high on the face. This could limit the barrier's ability to prevent an errant vehicle from continuing down the slope to railroad tracks below. Typically, rail should either be flush with the curb face, or be offset an accepted distance to allow the vehicle's suspension to rebound prior to impacting the rail. This offset distance is determined by the posted speed of the road. At this location with the posted speed limit of 45 mph, having the barrier flush with the face of curb could be considered acceptable. In addition to the proper offset distance, the curved portion of the rail should be removed and replaced with a guardrail end terminal per details R-8.1.1 and R-8.4.3 of the Standard Plans.

3.3.2.2 Culverts

For the section of USA Parkway north of Sydney Drive, many of the cross streets and driveway approaches have culverts of various shapes and sizes present. All of these culverts parallel to USA Parkway are located within the clear-zone and do not have flared end sections or protection of any kind. Chapter 3 of the AASHTO Roadside Design Guide details requirements to be followed if the ends of large culverts fall within the clear-zone. The guide indicates that ideally, parallel culverts, which cross approaches are to be located outside the clear-zone area and if that cannot be achieved, traversable grates shall be installed to protect the inlet.

In addition, many culverts have large concrete headwalls and ditches lined with large rip-rap side slopes. These headwalls also fall within the clear-zone and many of the channel slopes are steep and begin generally less than 8 feet from the travel lane. In one location, the rip-rap slope is beginning to erode and undermine the edge of pavement. Re-grading of some of these ditches may be possible in select locations and would have to be evaluated on a case by case basis.

3.3.2.3 Boulders

Many rocks and large boulders are located along the pavement edges and slopes of the roadway. There are several instances where boulders greater than 2 feet in diameter have been placed for either landscaping purposes or to indicate the limits of driveway approaches. In other areas, boulders have been placed as slope support to prevent erosion or placed to prevent vehicles from impacting more sensitive objects such as buildings. In all cases, large rocks and boulders should be removed from the clear-zone along the shoulders, from the median, and from slopes as these immovable objects pose a significant safety concern.

3.3.3 Roadside Slopes

Chapter 3 of the AASHTO Roadside Design Guide outlines the requirements for roadside slopes falling within the clear-zone. In general, foreslopes of 4:1 or flatter and backslopes of 3:1 or flatter are considered acceptable provided they are free of fixed obstacles. Traversable foreslopes steeper than 4:1 but not more than 3:1 are considered acceptable provided there is sufficient runout beyond the toe of the foreslope. Both foreslopes and backslopes within the clear-zone steeper than 3:1 are not allowed and require re-grading or protection. Table 3-1 of the Roadside Design Guide shows the minimum clear-zone distance for a design speed of 50 mph with traffic volumes of 6000 ADT is 20 to 22 feet at a 6:1 foreslope and 24 to 28 feet for a 5:1 or 4:1 foreslope. While these are highly recommended guidelines to be followed, the Roadside Design Guide does allow the engineer and ultimately NDOT to make the final determination for areas falling near the limits of the recommendations. Regardless of any waiver, all individual roadside slopes on USA Parkway not meeting the guidelines of the Roadside Design Guide are detailed in Appendix C of this report with more general comments provided below.

There are many specific locations along USA Parkway where the roadside foreslopes and ditches fail to meet the Roadside Design Guide clear-zone requirements. Most noncompliant slopes have hinge locations 6 to 10 feet from the shoulder stripe with foreslopes steeper than the required 3:1, and most steeper than 2:1 without protection. One area of particular concern occurs just north of Denmark Drive where foreslopes of approximately 1:1 exist 6' from the shoulder stripe. The slope at this location leads down to culverts which cross beneath USA Parkway on a slight skew. The inlets and outlets of the culvert at this particular location are 12 to 15 feet below the pavement edge with no object markers indicating the culverts presence. Should a vehicle pull off the road for any reason at this location, overturning of the vehicle is likely.

Many foreslopes along the edge of USA Parkway lead into small shallow ditches. However, many of these ditches are filled with rip-rap beginning less than 10 feet from the stripe. While the foreslopes leading into some of these ditches are compliant, the size of the rip-rap and its proximity to the traveled way may not be. NDOT guidelines indicate that Class 150 rip-rap is acceptable in the clear-zone area as long as it is properly placed and bedded. Some ditches have rip-rap of sizes greater than 6 inches and increase up to more than 1 foot in diameter. Pending a review by NDOT hydraulics as to the need for rip-rap at particular locations, its size, unevenness, and proximity to the pavement edge decreases the likelihood of an errant vehicles ability to recover. Other shallow roadside ditches, of depth less than 2 feet, with side slopes of 3:1 or steeper are present within the clear-zone. These ditches violate the preferred cross

sections for drainage channels provided in the Roadside Design Guide requirements, however, they may not adversely affect errant vehicles due to the shallowness of the ditch. These locations would have to be further evaluated by NDOT on a case by case basis.

3.3.4 Utilities

Utilities along USA Parkway primarily consist of water, sewer and gas. Two main noncompliant items common with those utilities are present, with other minor issues being observed during the field reviews. Detailed in Appendix D are the specific locations of noncompliant utility items.

The first issue is the location of the water and sewer lines. These facilities have valve boxes and manholes located in the travel lanes. The vast majority of these valves and manholes are positioned in the right lane of the southbound direction mainly north of Sydney Drive. Other valves are present at other locations but not to nearly the degree or quantity as the southbound side. It is typically NDOT's policy not to have utilities in the travel lanes. Should access to these utilities be required for maintenance or for an emergency, traffic control and lane restrictions would be needed. In addition, utilities located in the pavement section require adjustment during reconstruction increasing the cost of such work. Ideally, all utilities should be placed in a utility corridor outside the paved roadway surface or at least positioned in the shoulder of the road.

The second issue is with respect to the location of the fire hydrants. While it appears that the hydrants were offset following Storey County standards, all of the fire hydrants fall within the clear-zone of USA Parkway and are generally offset between 5 and 10 feet from the shoulder stripe. While the hydrants appear capable of breaking away, most have been installed above the surrounding ground leaving the riser pipe sticking above the shoulders in some cases by more than 2 feet. Some hydrants have been situated behind guardrail, but as mentioned previously, gaps in the guardrail without the proper end terminals may fail and not provide adequate protection for an errant vehicle. If fire hydrants installed improperly above existing ground cannot be moved out of the clear-zone or replaced to the proper elevation, alternate forms of protection other than the guardrail gap should be provided.

Other minor utility issues exist at specific locations along USA Parkway. One such item is the unfinished valve risers located in the median between Waltham Way and the I-80 interchange. The PVC risers for water and gas valves stick above the surrounding ground with many risers broken preventing the valve lids from fitting properly. Risers are filled with dirt and other debris and it is unclear if access to these valves can occur.

3.3.5 Drainage

A report entitled *Preliminary (Pass / Fail) Drainage Analysis* completed by Wood Rodgers details the size, material, current capacity and required capacity of the culverts that exist along USA Parkway. A copy of this report is included in Appendix G. The report indicates that the culverts at four locations fail to meet the capacity requirements of the offsite drainage basins. The report also indicates that 11 channels are of insufficient capacity to convey the 25-year peak flow rates.

Other drainage issues not mentioned in the Wood Rodgers report mainly pertain to possible erosion, maintenance access, and non-standard structures. One particular culvert located in the hills south of Sydney Drive at station 502+00 has a unique design. Two 72 inch corrugated metal pipes are located well below the roadway in a section of the roadway falling in cut. As a result, the inlet to these pipes is surrounded by steep rocky slopes on three sides sloping at more than 1:1 with guardrail present on the road side. Because of these slopes, access is nearly impossible by foot, and due to the depth of the inlet, may also limit the ability for machinery access for the purposes of cleanout or repair. During reviews of this site, District staff expressed their concerns regarding maintenance access.

At the outlet side of the same culvert, there appears to be a substantial barrier rail headwall supporting the soil around the pipes. It is unclear however, if this headwall fully surrounds the pipes as additional rip-rap has been placed to support the slope. Having slightly longer pipes would eliminate this threat of erosion and the need for any headwall.

Most culverts along the roadway do not have proper inlet and outlet protection. Inlets do not have headwalls, end sections or other silt prevention protection, and outlets do not have rip-rap or other erosion protection present.

In other locations along USA Parkway, non-standard drop inlet types have been constructed. One location just south of the railroad has a round inlet that does not conform to any standard NDOT inlet. In addition, the inlet visually does not collect all the required flows from the area. Water appears to bypass the inlet and continue down onto the railroad tracks below. Grading of a ditch or berm at this location may assist in the conveying of flows to the inlet.

A drainage basin in the same vicinity is filled with weeds and other debris. The basin, consisting of one inlet pipe and inlet channel with a 36 inch outlet pipe, is located behind barrier rail and behind the landscaped area along the shoulder of the road. There is no access road to this location making maintenance access a challenge. Refer to Appendix E for additional specific noncompliant items.

3.3.6 Signing and Striping

Signs throughout USA Parkway generally do not meet MUTCD or NDOT offset location standards. Figure 2A-2 of the MUTCD shows the desirable placement of signs in rural areas. Many of the signs on USA Parkway are located less than 12' from the edge of pavement with some being as close as 4' from the shoulder stripe. Sign offsets along the curb and gutter section were found to be compliant.

Many signs located between Sydney Drive and the interchange at I-80 are mounted on round metal posts embedded directly into concrete. These posts do not have multi-directional slip bases as recommended by NDOT and AASHTO guidelines. In addition to the sign post deficiencies, large rocks chiseled to provide street names are located in the median. These signs violate clear-zone requirements, lack adherence to NDOT or MUTCD standards, and should be removed from the median.

The large overhead sign located at the northern end of USA Parkway has many noncompliant items. The font and height of the text as well as the destinations listed are inconsistent with standards for highway guide signs. Also, the number of destinations indicated on the sign does not conform to MUTCD requirements. The maximum number of destinations to be shown is three.

Guild posts are present throughout the roadway. However, in the median, these posts are white, not yellow as required by the NDOT Standard Plans. The roadway also does not have any object markers or type 2 reflectors at any of the approaches along the alignment.

Lastly, there are several private signs located along the alignment mainly attached to wooden posts. These private signs, potentially located in future NDOT right-of-way, do not have proper assemblies and do not conform to NDOT or MUTCD standards. It is typically NDOT's policy that private signs be removed from NDOT owned right-of-way. Appendix F details all the locations of sign non-compliance.

Striping along USA Parkway appears faded and worn. Stretches of the roadway alignment no longer have white shoulder striping visible and other sections are lacking clear definition due to wear.

3.3.7 Additional Items

Additional noncompliant items not fitting into the categories above are detailed in this section.

3.3.7.1 Pavement and Materials

In May of 2012, NDOT performed cores at various locations along the existing pavement as a way to determine the existing structural section as well as determine the remaining pavement life. The original construction plans as prepared by Reno Engineering show that the pavement section to be constructed was 5 inches of asphalt on 12 inches of aggregate base from the end of pavement near Portofino north to Sydney Way, and 4 inches of asphalt on 10 inches of aggregate base from Sydney Way north to Interstate 80. Preliminary observations show some areas of deterioration beginning to occur along the northern portion. Additional inspection indicates the presence of pavement patches where utilities have been installed for newer developments, although a future overlay was planned following build out in along the roadway. In addition, USA Parkway was not constructed with an open grade friction and wearing course as is typical with new NDOT construction. It should also be noted that the roadway embankment, aggregate base, and asphalt pavement were designed and constructed without NDOT oversight or inspection thus making it difficult to accurately determine all the existing pavement and sub-grade characteristics.

Coring for the structural section was evaluated in three zones based on pavement and sub-grade conditions found in the field. Zone A begins at I-80 and continues to 0.5 miles south of Waltham Way, Zone B continues southward to just past of Denmark Drive, and Zone C extends from Denmark Drive to the end of the paved section at Portofino. The average values by zone resulting from the coring are shown in Table 3-2.

Table 3-2: Average Existing Structural Section Data

	PBS Depth	Base Depth	R-Value
Zone A	4.95 in	9.4 in	30.8
Zone B	4.67 in	7.33 in	13.67
Zone C	5.16 in	9.69 in	50.25

Using DARWin Pavement Design and Analysis Software, analysis was performed to determine the required structural section based on known sub-grade characteristics and both current and projected traffic volumes. The output produced was then used as a comparison to determine if the existing section met 20 year lifespan design requirements and to determine what rehabilitation strategy should be used for pavement upgrades.

Table 3-3: Required Structural Section

	Open Grade	PBS Depth	Base Depth	Borrow*
Zone A	3/4 in	8 in	12 in	8 in
Zone B	3/4 in	8 in	12 in	20 in
Zone C	3/4 in	8 in	12 in	0 in

* = Material removed and replaced to meet R-Value of 45.

In addition, each zone would require the placement of a nonwoven geotextile.

Because the existing structural section does not meet the recommended structural section, a rehabilitation strategy was developed and analyzed using the DARWin software. The following is the suggested rehabilitation strategy for each zone to achieve the 20 year design life.

- Zone A: Cold mill 1-1/2 inches, overlay with 7 inches bituminous plantmix with 3/4 inch open graded surface.
- Zone B: Full depth reconstruction of 40-3/4 inches to meet the recommended structural section developed by DARWin. Includes a geotextile fabric.
- Zone C: Cold mill 1-1/2 inches, overlay with 5 inches bituminous plantmix with 3/4 inch open graded surface.

Appendix I of this report includes the coring results for each zone and the detailed DARWin analysis for the required pavement section and rehabilitation strategy.

3.3.7.2 Fencing and Access Control

There is no fencing or access control along the length of USA Parkway. During the compliance review, horses were observed several times crossing the roadway and many other herds were seen passing between the businesses at various points along the road.

There are also no cattle guards located on the project either at the approaches, or at the interchange with I-80. Currently, it is possible for a horse of other animal to access Interstate 80 by walking along USA Parkway.

3.3.7.3 Landscaping and Irrigation

Very little in the way of landscaping exists along USA Parkway. Along the northernmost portion of the alignment, near the railroad bridge, several trees and other shrubs line an area behind the curb and gutter. As mentioned previously, some of these trees create a sight distance problem for drivers in the southbound direction. These landscaping features are irrigated, with the meter, valve and control boxes being located directly behind the curb on the right side of the road.

3.3.7.4 Intersections and Approaches

Most of the approaches and driveways to USA Parkway are paved with the exception of a few sporadically located throughout the roadway alignment. Typically approaches

shall be paved to prevent pavement edge deterioration and prevent loose material such as rocks and other debris from entering the travel lanes.

3.3.7.5 Pedestrian and Bicycle Facilities

Currently USA Parkway does not have any pedestrian or bicycle facilities along the existing paved portion. Features such as sidewalks, pedestrian ramps and bike lanes are not present. In some locations, features such as depressed curbs have been installed, with the intent of installing pedestrian ramps but that construction never occurred.

Due to the rural industrial nature of the roadway, it is not considered unusual for these facilities not to be installed; however, with the continued commercial development of the northern end of USA Parkway to a more urban condition, construction of these types of facilities may be desired.

3.3.7.6 Roadway Lighting

There are no roadway lights along USA Parkway.

4.0 PRIORITIZATION

The primary outcome of the NDOT Field Review Meeting was the determination of those noncompliant items of greatest concern and highest priority to the Department. Prior to the possible future NDOT ownership of USA Parkway, some initial corrective measures may be taken to improve the roadway and bring specific elements into compliance with NDOT and AASHTO guidelines. The design compliance field review team identified those items directly relating to safety as the items of highest priority; however, it will ultimately be NDOTs decision as to which and how many items may be corrected prior to NDOT ownership. While safety can be applied to a broad range of the noncompliant items found along USA Parkway, the list below itemizes those noncompliant items of greatest safety concern.

- Narrow or no shoulder width on the right or left edges of pavement
- Guardrail sections without leading or trailing end terminals
- Steep roadside slopes exceeding recommendations in the Roadside Design Guide
- Rip-rap placed in center median or along roadside edges
- Boulders located within the clear-zone

- Unprotected culvert ends located within the clear-zone
- Improperly installed fire hydrants located within the clear-zone
- Insufficient sight distance including stopping site distance and intersection sight triangle distance

In order to bring these noncompliant safety related items into compliance with guidelines, possible solutions were investigated. These solutions include adding standard guardrail end terminals to existing guardrail sections, constructing new sections of guardrail to protect slopes or other objects, flattening or re-grading roadside slopes and shoulders in areas where possible, removing boulders and rip-rap from the clear-zone, adjusting fire hydrants to the proper elevation, installing protection to culvert ends, trimming trees, and re-grading slopes to improve sight distance. Because it is unclear if all aspects of the roadway will be brought into compliance prior to future NDOT ownership, potential solutions simply based on the existing roadway conditions have been developed. While additional solutions likely exist for different locations that utilize a variety of resources, these initial potential solutions are intended as a way to immediately address some of the safety concerns. Additional analysis is needed to determine design details and if these potential solutions provide the greatest benefit based on an estimated cost to the overall project. Additional analysis is also required to ensure potential solutions are compliant with the ongoing USA Parkway environmental process. These analyses would need to be completed as part of a detailed breakdown of the comprehensive list with solutions provided for each item of noncompliance not just those items of highest priority.

Following determination of initial potential solutions to noncompliant areas of highest priority, approximate quantities and rough order of magnitude costs were developed. Based on the number of noncompliant locations and measurements taken during the initial field review, estimated quantities have been shown in table 4-1. Items such as guardrail end terminals or fire hydrant locations are simply estimated by counting the number of noncompliant sites, while items such as rip-rap removal and slope flattening were developed using the established Reno Engineering stationing, aerial photography, and slope measurements taken during the initial field review and detailed in the appendices of this report. Preliminary magnitude of cost estimates for the noncompliant items are also shown in table 4-1. These costs only represent an approximate order of magnitude as to the estimated cost required to correct these prioritized items.

Table 4-1: Prioritized Safety Items

	Item	Approximate Quantity	Cost
Primary Items	Construction of Roadway Shoulders	20 Miles	$$$$
	Placement of Guardrail End Terminals	40 Terminals	$$$
	Placement of New Guardrail	3000 Linear Feet	$$$
	Flatten Roadside Slopes within Clear-zone	10000 Cubic Yards	$$$
	Removal of Boulders and Rip-Rap from Clear-zone	8000 Cubic Yards	$$$
	Culvert in Clear-zone at Approaches	15 Inlets and Outlets	$$
	Fire Hydrant Adjustments	15 Fire Hydrants	$$
	Sight Distance Corrections	2 Sites	$

$ < 50K, $$ < 100K, $$$ < 1M, $$$$ > 1M

5.0 CONCLUSION

While ultimate ownership of a completed USA Parkway is unclear, it is clear that the existing facility does not fully meet all of NDOT, AASHTO or FHWA guidelines. Based on the field reviews completed and input received from NDOT staff at both headquarters and District II, a detailed list of noncompliant items has been developed with specific safety related items being determined as those items of highest priority. While the comprehensive list of noncompliant items details all areas, only the high priority items have been analyzed for potential solutions and associated costs. Further analysis and discussion is needed to determine potential solutions and the resulting costs associated to bring all items, not just priorities, into compliance. It is anticipated that the additional cost analysis could easily be completed based on the quantity of information contained within the comprehensive list of noncompliance. In any case, this report provides NDOT with information on which to base discussions moving forward and to assist in the decision making process regarding the potential operation, maintenance and safety of the existing roadway for the further advancement of the USA Parkway and the benefit of the traveling public.

Table 3.1: Design Criteria Used to meet a 50 mph Design Speed

Design Element	**Desirable Criteria**	**Minimum Criteria**	**Reference**
Shoulder Width (rt)	10 ft	6 ft	NDOT Road Design Guide
Shoulder Width (lt)	8 ft	4 ft	NDOT Road Design Guide
Crest Vertical Curve "K" value	85	n/a	AASHTO Green Book
Sag Vertical Curve "K" value	96	n/a	AASHTO Green Book
Minimum Length of Vertical Curve	600 ft	3X design speed	NDOT Road Design Guide
Superelevation	Maximum 6%	Maximum 4%	NDOT Road Design Guide
Grade	7% Maximum (rural)	9% Maximum (urban)	NDOT Road Design Guide
Grade Break	0.2% max	n/a	NDOT Road Design Guide
Stopping Sight Distance	425 ft	n/a	AASHTO Green Book
Intersection Site Triangles	625 ft (truck)	480 ft (passenger car)	AASHTO Green Book
Sign Offset in Rural Areas	12 ft from EOP	6 ft if paved shoulder exists	MUTCD, NDOT Standard Plans
Sign Offset in Urban Areas	2 ft behind curb face	n/a	MUTCD

Clear-Zone Distances	**Foreslopes**			**Backslopes**			**Reference**
Design Speed = 50 mph Traffic Volume = above 6000 vpd	1V:6H or flatter	1V:5H or 1V:4H	1V:3H	1V:3H	1V:5H or 1V:4H	1V:6H or flatter	AASHTO Roadside Design Guide
	20-22 ft	24-28 ft	varies*	14-16 ft	18-20 ft	20-22 ft	

*Refer to page 3-3 of the Roadside Design Guide

APPENDIX A: ROADWAY GEOMETRY

USA Parkway Design Compliance Appendix A - Roadway Geometry Compliance Summary

Site #	Station	Details of Non-Compliance	Additional Discussion	Photo Reference
1	400+00	Roadway section at end of pavement: 66.5' EOP to EOP, no striping or median at this point. Gravel shoulders on either side of about 5'. Guard rail on left.	Shoulder width does not meet NDOT guidelines. See Note 1.	161
2	Curve at 405+00	From the information provided by Reno Engineering, the radius is 1575 ft. The measured superelevation in the SB direction is 4.0%. The measured superelevation in the NB direction is 4.0%.	Using the NDOT desired criteria of 6% maximum superelevation, the Green Book indicates that a curve of this radius would require superelevation of 5.0% at a design speed of 50 mph. The current superelevation on the roadway does not meet the requirements.	170
3	408+00	Roadway section: NB - Two 12' lanes with 20" paved shoulder on right. SB - Two 12' lanes with 24" paved shoulder on right. Median width is 15', no paved shoulder outside of yellow stripe, Median filled rip-rip of size 6"-8". Guard rail offset about 10" from EOP.	See Notes 1, 2 and 3.	178-179
4	455+00 - 510+00	In areas on reversing curves, the superelevation transition is non-standard. The transitions appear to be abrupt with short sections of steep grades present on the outside or inside lanes depending on the direction of superelevation.	Reversing curves are usually not desired especially for new construction, however they are acceptable and are more or less a driver comfort issue.	
5	Curve at 456+00	From the information provided by Reno Engineering, the radius is 1800 ft. The measured superelevation in the SB direction is 4.2%. The measured superelevation in the NB direction is 4.7%.	Using the NDOT desired criteria of 6% maximum superelevation, the Green Book indicates that a curve of this radius would require superelevation of 4.6% at a design speed of 50 mph. The current superelevation in the SB direction does not meet the requirements.	195
6	Curve at 468+00	From the information provided by Reno Engineering, the radius is 1450 ft. The measured superelevation in the SB direction is 3.0%. The measured superelevation in the NB direction is 3.5%.	Using the NDOT desired criteria of 6% maximum superelevation, the Green Book indicates that a curve of this radius would require superelevation of 5.2% at a design speed of 50 mph. The current superelevation on the roadway does not meet the requirements.	198
7	478+00	Road grade at this location is at 6.2% in both travel directions.	Maximum desirable grade is 5.0% for rolling hills on a rural minor arterial. Maximum allowable is 7%. This section could also be classified as mountainous.	203
8	Curve at 506+00	From the information provided by Reno Engineering, the radius is 1650 ft. The measured superelevation in the SB direction is 4.0%. The measured superelevation in the NB direction is 3.0%.	Using the NDOT desired criteria of 6% maximum superelevation, the Green Book indicates that a curve of this radius would require superelevation of 4.8% at a design speed of 50 mph. The current superelevation on the roadway does not meet the requirements.	220
9	Curve at 512+00	From the information provided by Reno Engineering, the radius is 1400 ft. The measured superelevation in the SB direction is 3.0%. The measured superelevation in the NB direction is 4.0%.	Using the NDOT desired criteria of 6% maximum superelevation, the Green Book indicates that a curve of this radius would require superelevation of 5.2% at a design speed of 50 mph. The current superelevation on the roadway does not meet the requirements.	226
10	515+80.60	As indicated on the plans, the length of vertical curve fails to meet a 50 mph design speed. Length = 108.45'	Per NDOT guidelines, the minimum length of vertical curve is 3 times the design speed which equals 150' in this case.	
11	515+80.60	As indicated on the plans, the k-value of the sag vertical curve fails to meet a 50 mph design speed. K = 70.0	Per the Green Book, the minimum k-value for a sag vertical curve at 50 mph is 96.	
12	524+00	Roadway section: NB - Two 12' lanes with 2' paved shoulder on right side, 4" on inside shoulder. SB - Two 12' lanes with 2' paved shoulder on right side, 6" on inside shoulder. Median width is 15.5' stripe to stripe with gravel.	See Notes 1 and 2.	255-257
13	534+00 lt	Short rise, or mound in profile of southbound lanes. Short steep rise then drops back slightly on other side. Roadside ditch appears to do the same and it is unclear if ditch remains in positive drainage.	This mound is not detailed in information received from Reno Engineering. Not a major safety concern, mainly a driver comfort issue.	328-329

14	539+00	Roadway section: NB - Two 12 ft lanes with a 1.5' paved right shoulder and a 1.3' paved left shoulder. Additional 2' of graded gravel shoulder (rt). SB - Two 12 ft lanes with 0.9' paved right shoulder and 1.0' paved left shoulder. Additional 2' of graded gravel shoulder (rt). Median is 17.5' wide filled with rip-rap 4"-6" in size. Sits above pavement. Roadway is crowned at 2-3%.	See Notes 1, 2 and 3.	47-51
15	549+00	Roadway section similar to above with the exception of median width. Median width is 20.5'.	The median width in this location is acceptable however paved shoulders are still required.	
16	569+50 rt	Incomplete approach, apron is not paved on the left side pulling gravel on to roadway.	Incomplete approaches will eventually lead to early pavement deterioration. Approaches are to be paved to limit the intrusion on dirt and mud onto the paved surface. The minimum radius on approaches shall be 25'.	76-77
17	Curve at 600+00	From the plans provided by Reno Engineering, the radius is 1400 ft. The measured superelevation in the SB direction is 2.0%. The measured superelevation in the NB direction is -2.5% (adverse).	Using the NDOT desired criteria of 6% maximum superelevation, the Green Book indicates that a curve of this radius would require superelevation of 5.2% at a design speed of 50 mph. The current superelevation on the roadway does not meet the requirements.	107
18	Curve at 612+00	From the plans provided by Reno Engineering, the radius is 1400 ft. The measured superelevation in the SB direction is -1.5% (adverse). The measured superelevation in the NB direction is 2.1%.	Using the NDOT desired criteria of 6% maximum superelevation, the Green Book indicates that a curve of this radius would require superelevation of 5.2% at a design speed of 50 mph. The current superelevation on the roadway does not meet the requirements.	117
19	625+00	Roadway section: NB - Two 12' lanes with 1' paved shoulders on left and right sides of stripe. SB - Same as NB lanes. Median width is 15.5' stripe to stripe with gravel.	See Notes 1 and 2.	134-135
20	Curve at 641+00	From the plans provided by Reno Engineering, the radius is 1400 ft. The measured superelevation in the SB direction is 2.0%. The measured superelevation in the NB direction is 2.0%.	Using the NDOT desired criteria of 6% maximum superelevation, the Green Book indicates that a curve of this radius would require superelevation of 5.2% at a design speed of 50 mph. The current superelevation on the roadway does not meet the requirements.	136
21	643+50.00	Grade break in vertical centerline alignment. Shown on plans to be 0.31%. Because break is located in horizontal curve it is not visible in field, nor noticeable by vehicle.	NDOT Road Design Guide allows a maximum of 0.2% break in grade.	
22	644+50	At Pittsburgh Drive, there is a possible sight distance issue for vehicles approaching USA Parkway on eastbound Pittsburg. The measured distance was found to be 270'.	Following Chapter 9 of the Green Book, the sight triangle at Pittsburgh is type Case B. The most conservative value, Case B2, has a minimum sight distance for trucks of 620'. This exceeds the measured field distance.	330
23	Curve at 665+00	From the plans provided by Reno Engineering, the radius is 1400 ft. The measured superelevation in the SB direction is 2.5%. The measured superelevation in the NB direction is 3.0%. Median sloped at -0.5% (adverse).	Using the NDOT desired criteria of 6% maximum superelevation, the Green Book indicates that a curve of this radius would require superelevation of 5.2% at a design speed of 50 mph. The current superelevation on the roadway does not meet the requirements.	143
24	671+00 SB	Upon visual inspection, there appears to be a flat spot in the curve at this station.	Likely a result of a change in median width.	153
25	671+48	Begin curb along roadsides and median: 6" vertical face. Roadway section at this point: NB - 40' from lip of gutter at right to face of curb in median. There is a left turn lane at this location. Gutter pan is 18" wide. SB - 26' section from face of curb at right to lip of gutter in median. Gutter pan is 18" wide.	See Note 4.	156-160

26	680+00	Roadway section: NB - 25.75' from FC to FC with 18" of gutter pan included on right side. SB - 27.75' from FC to FC with 18" of gutter pan included on right side. Median is 36' wide filled with gravel.	See Note 4.	278
27	Curve at 690+00	From the plans provided by Reno Engineering, the radius is 1400 ft. The measured superelevation in the SB direction is -3.3% (adverse). The measured superelevation in the NB direction is 2.1%.	Using the NDOT desired criteria of 6% maximum superelevation, the Green Book indicates that a curve of this radius would require superelevation of 5.2% at a design speed of 50 mph. The current superelevation on the roadway does not meet the requirements.	
28	Curve at 714+00	From the plans provided by Reno Engineering, the radius is 925 ft. The measured superelevation in the SB direction is 3.0%. The measured superelevation in the NB direction is 2.3%. Roadway width in both directions including the 18" pan is 27.5'	it is unclear what the actual posted speed limit in this area is. In the southbound direction the previous sign indicated 40 mph, but the northbound direction indicates 45 mph. Regardless of which one, using the 6% maximum superelevation and a radius of 925', the curve requires at least 5.0% superelevation, which it does not have.	283-284
29	713+50 - 715+00	Raised median of width less than 4' is not paved.	NDOT Standard Plans indicate that medians with a width of 4' or less be paved with concrete.	296
30	711+00 - 716+00 lt	Possible sight distance issue because of landscaping. Trees, with branches located 5' behind curb interfere with views of traffic traveling in the right lane. Tree height is approximated to be 20' and the curve radius is 920'.	From the Green Book, the HSO dist at a 50 mph design speed = 20.4'. The actual distance measured from the center of the travel lane to tree branches is 13' meaning at 50 mph, there is insufficient sight distance.	295

Note 1: For minor arterials, the NDOT Road Design Guide indicates that usable shoulders of 10' shoulders on right and 8' shoulders on left should be used. Acceptable minimums are 6' and 4' respectively. Although preferred by NDOT, the Green Book indicates that not all usable shoulder width is required to be paved. Some of the width could consist of aggregate base or other material of sufficient stability to allow a vehicle to recover. There are few, if any locations on USA Parkway that have shoulders, paved or un-paved, meeting the width requirements of the Road Design Guide.
In areas of divided roads, the Green Book indicates that a minimum paved shoulder width of 4' be used in the median. The median shoulder in this section does not meet the 4' requirement.

Note 2: In addition to median shoulders, the median width in this section does not meet the clear-zone requirements as indicated by table 3-1 of the Roadside Design Guide. That table indicates that 20-22 feet should be provided for clear-zone area based on the design speed and traffic volume.

Note 3: The uneven nature of the rip-rap in the median may increase the stopping distance and decrease the likelihood of an errant vehicle's ability to recover. In addition, rip-rap of located in the median near the edge of pavement may be disturbed by passing vehicles or snowplows.

Note 4: NDOT allows vertical curb heights of 6" or less on non-freeway arterials where the posted speed limit is 45 mph or less. The Green Book indicates that curbs be offset at least 1', preferably 2' from the traveled way. The Green Book generally indicates that curbs are mainly used in lower speed situations however with the posted speed limit at 45, having curb may be considered acceptable is offsets are met. For this location, the offset distance of 1' is met on both the left and right lanes. It is also worth noting that this section of USA Parkway may be considered urban due to the driveway spacing and nature of the businesses.

ROADWAY GEOMETRY – PHOTO LOG

Site 1 – Station 400+00, photo 161 looking south

Site 2 – Station 405+00, photo 170 looking north

Site 3 – Station 408+00, photo 178 looking north

Site 5 – Station 456+00 photo 195 looking north

Site 6 – Station 468+00, photo 198 looking north

Site 7 – Station 478+00, photo 203 looking north

Site 8 – Station 506+00, photo 220 looking north

Site 9 – Station 512+00, photo 226 looking north

Site 12 – Station 524+00, photo 256 looking north

Photo 48 looking north

Site 14 – Station 539+00, photo 47 looking north

Site 16 – Station 569+50 RT, photo 76 looking north

Site 17 – Station 600+00, photo 107 looking north

Site 18 – Station 612+00, photo 117 looking north

Site 19 – Station 625+00, photo 134 looking north

Site 20 – Station 641+00, photo 136 looking south

Site 22 – Station 644+50, photo 330 looking north at intersection

Site 23 – Station 665+00, photo 143 looking west

Site 24 – Station 671+00, photo 153 looking south

Site 25 – Station 671+48, photo 157 looking north

Site 25 cont. - photo 159

Photo 158 looking north

Site 26 – Station 680+00, photo 278 looking north

Site 28 – Station 714+00, photo 283 looking south

Site 29 – Station 713+50 - 715+00, photo 296 looking north

Site 30 – Station 711+00 – 716+00 LT, photo 295 looking north

APPENDIX B: CLEAR-ZONE

USA Parkway Design Compliance Appendix B - Clear-zone Objects Compliance Summary

Site #	Station	Description of Non-Compliance	Additional Discussion	Photo Reference
1	400+00 lt	Guard rail does not have proper trailing end terminal treatment. Rail is offset 1.5' from EOP. Height of Guardrail is 30" meaning it does not meet height standards.	See Note 4. Minimum required guardrail height is 32" for triple corrugated, R-8.4.1	164-165
2	401+00 lt	Gap located in guard rail run for fire hydrant. No trailing end or leading end terminals.	See Note 2.	166-167
3	407+50 lt	Gap located in guard rail run for fire hydrant. No trailing end or leading end terminals.	See Note 2.	172-173
4	407+50 - 412+00 lt	Guard rail does not have leading end terminal. Also, guard rail does not extend enough to protect the steep foreslope located behind the shoulder. The rail should be extended approximately 900' to cover the slope, or the slope behind should be flattened.	See Note 3. Reference notes for Site 3 in roadside slopes for steep slope details.	175-177
5	410+00 rt	Guard rail does not have proper trailing end terminal treatment.	See Note 4.	180
6	428+00, 433+00 lt	Boulders present in clear-zone offset 10' from stripe.	Remove boulders from clear-zone.	
7	453+00 - 457+00 lt	Boulders present in clear-zone offset 10' from stripe on 3:1 foreslope.	Remove boulders from clear-zone.	196
8	474+00 - 479+00 lt	Guard rail does not have proper trailing end terminal treatment. The last 200' of this rail is not needed as the slope behind the rail is 4:1 extending for 25'. Rail only needed at culvert crossing.	See Note 4. Remove excess rail if it is not needed. Could save for reuse else ware.	200-202
9	480+00 lt	Guard rail does not have proper end terminal treatments or flare rates. Could bury leading end into hill side.	See Note 5. Because of change of flare rate, length needed to bury rail may exceed length needed for leading terminal. Cost analysis required to determine best solution.	208
10	480+00 rt	Guard rail does not have proper end terminal treatments on either end. Rail is offset 1-1.5' from EOP. Also, rail at this location does not extend to fully protect the hazard behind. Leading end should be extended to protect ditch following length of need analysis for the end treatment.	See Notes 1 and 5.	204-207
11	499+00 - 500+00 rt	Rocks located on slopes with in clear-zone. Fore slope in this location is 1.9:1.	Remove rocks from clear-zone. See slope compliance site	212
12	502+00 rt	Guard rail does not have proper end terminal treatments or flare rates. Rail is offset 1-1.5' from EOP.	See Note 5.	213-215
13	502+00 lt	Guard rail does not have proper end terminal treatments or flare rate. Rail is offset 1-1.5' from EOP. Could bury leading end into hill side. Possible maintenance access problem because of steep slopes leading to inlet.	See Note 5. Because of change of flare rate, length needed to bury rail may exceed length needed for leading end terminal. Cost analysis required to determine best solution. Also, the sides not protected by guardrail have steep rocky slopes sloping steeper than 1:1. Due to these slopes and the depth of the inlet, access by person or machine could be challenging.	216-218
14	510+50 lt	Guard rail does not have proper end terminal treatments or flare rate. Rail is offset 1-1.5' from EOP. Could bury leading end into hill side. Possible maintenance access problem because of steep slopes leading to inlet.	See Note 5. Because of change of flare rate, length needed to bury rail may exceed length needed for leading end terminal. Cost analysis required to determine best solution. The steep nature of the slopes leading to the inlet make access a challenge.	227-229, 231
15	511+00 rt	Guard rail does not have proper end terminal treatments or flare rate. Rail is offset 1-1.5' from EOP. Also, rail at this location does not extend to fully protect the hazard behind. Leading end should be extended.	See Notes 1 and 5.	223-225

16	515+00 rt	Boulder located 11' from stripe.	Remove boulder from clear-zone.	234
17	518+00 rt	Guard rail does not have proper end terminal treatments or flare rate. Rail is offset 1-1.5' from EOP.	See Note 5.	238-240
18	518+00 lt	Guard rail does not have proper end terminal treatments or flare rate. Rail is offset 1-1.5' from EOP.	See Note 5.	241-244
19	521+00 lt	Trailing end of guard rail does not have any end terminal.	See Note 4. This guardrail location falls on an approach meaning detail R-8.2.4 may apply. However, there is insufficient clear area behind the rail as it is protecting a culvert inlet.	247
20	521+00 rt	Guard rail does not have proper end terminal treatments or flare rate. Rail is offset 1-1.5' from EOP.	See Note 5.	251
21	524+00 rt	Guard rail does not have proper end terminal treatments or flare rate. Rail is offset 1-1.5' from EOP.	See Note 5.	252-254
22	524+00 lt	Guard rail does not have proper end terminal treatments or flare rate. Rail is offset 1-1.5' from EOP.	See Note 5.	259-261
23	537+00	"Comstock Meadows" sign rock features located 19.5' from stripe on the right and 17.5' from the stripe on the left.	See Note 1. Moving of one or two boulders would solve the issue. The signs themselves are outside the clear-zone.	268-271
24	539+00 rt	Boulders located 5' off EOP.	Remove boulders from clear-zone.	56
25	546+00 rt	Guard rail terminal does not protect roadside slope to culverts; however, the slope begins 21.6' from the stripe. This falls at the limit of accepted clear-zone. Likely guard rail at this location not intended to protect ditch but instead for the development to the north. Guard rail face for this run is even with EOP.	Refer to discussion provided for Site 18 of the Roadside Slopes section. Guardrail in this stretch should have shy distance sufficient to meet NDOT requirements.	59
26	545+00 lt	Damaged to guard rail at Sydney. This run of rail does not have a leading end terminal. This run of rail does not protect vehicles from entering the drainage channel located behind the rail. It begins too late to prevent an errant vehicle from crashing.	See Notes 1 and 3. Guardrail requires repair.	63-66
27	547+50 rt	Gap located in guard rail run for fire hydrant. No trailing end or leading end terminals.	See Note 2.	67-68
28	562+00 - 567+00	Several large boulders located in median 4' to 5' from stripe. Median with = 20.5' stripe to stripe.	Remove boulders from clear-zone.	74
29	563+00 rt	Incorrect guard rail end anchor. This is installed per detail 8.2.4.1 but should be per detail 8.2.2.	Could be accepted by NDOT as it meets the standard plans.	72-73
30	569+00 rt	Parallel culvert under approach located 8' offset from stripe, 24" concrete pipe with blunt end. Ditch is 3' below surface of pavement. No flared end section. Channel lined with rock round pipe inlet and outlet.	See Notes 1 and 7.	75, 79
31	569+50 rt	Pole guide wires located 19' from stripe.	Wires are located on the edge of the clear-zone. Instead of moving the pole, a solution may be to place an object marker to warn oncoming vehicles.	78
32	569+50 rt	Boulders located near edge of pavement around approach.	Remove boulders from clear-zone.	78
33	577+00 rt	Parallel culvert under approach located 8' offset from stripe, 24" concrete pipe with blunt end. Ditch is 2.5' below surface of pavement. No flared end section. Channel lined with rock round pipe inlet and outlet.	See Notes 1 and 7.	80-82
34	577+00 rt	Boulders located near edge of pavement around approach and in median.	Remove boulders from clear-zone.	80, 82-83

35	576+00 - 580+00 lt	Large boulders of 1' diameter and greater located along roadside slope.	Remove boulder from clear-zone.	88
36	581+50 lt	Bollards located around fire hydrant offset 9.4' from stripe	Bollards fall in clear-zone and should be removed. Refer to Site 15 of the Utilities section. The chain gate should be moved away from the road.	84
37	580+00 lt	Misc wooded post, 8" tall located in shoulder, offset 10' from stripe.	Minor object, but post should be removed.	89
38	579+00 - 582+00 rt	Rip-rap of varying size along roadside slope beginning 18'-22' from stripe. Gravel shoulder extends for about 5 ft at flatter than 10:1 slope prior to rip-rap area.	Boulders should be removed and shoulder are re-graded.	90
39	587+00 rt	Two parallel HDPE 36" culverts under Italy Drive. The inlet elevation is about 4' below the roadway. The channel side slope varies to about a 2:1. The distance from the stripe to the hinge is 7.5'. Culver inlet is heavily silted.	See Notes 1 and 7.	91-94
40	587+00 lt	Parallel 24" RCP culvert running under Italy Drive with flared end section. Ditch hinge offset 4' from stripe. Ditch is 3' deep. Cover on culvert is less than 1' and less than 6" for much of the run. Large 6" rip-rap surrounds the inlet and outlet.	See Notes 1 and 7. Culvert has insufficient cover. The Roadside Design Guide indicates that for culverts 24" or less, inlet protection may not be required.	96-99
41	593+00 rt	Large culvert inlet with headwall located at truck entrance to Wal-Mart truck driveway. Two 18" x 24" concrete boxes with inlet 5.5' below road surface. Hinge of the side slope to inlet begins 3' from the stripe., and the headwall begins 23' from the stripe. Rip-rap of varying sizes present protecting slopes from erosion. Unclear where water comes from to yield such a significant structure.	See Notes 1 and 7. Headwall located in clear-zone and protection is likely required. Pending a review by Hydraulics, large rip-rap in this ditch should be removed.	101-105
42	595+00 - 600+00 rt	Rock mound located 14 ft from stripe. Ground slope in this area is flatter than 6:1.	Remove rock mound.	108
43	607+00 rt	Three 18" x 24" box culverts with headwall under Wal-Mart car entrance. Inlet 4.75' below roadway. Headwall of the inlet side is offset 16.5' from the stripe and the outlet headwall is offset 10.5'. Very large boulders present sounding the slopes to the inlet and outlet.	See Notes 1 and 7. Headwall located in clear-zone and protection is likely required. Pending a review by Hydraulics, the rip-rap in this ditch should be removed.	111-113
44	613+00 rt	Two 42" CMP with inlet headwall running under an approach driveway. Inlet elevation is 4.5' below the roadway. Headwall is offset 4' from stripe with large 1' diameter rip-rap closer than that. 2' of gravel shoulder from EOP. Side slopes vary, but reach 1:1 at headwall. On outlet end, no headwall present, pipes end with metal flared end sections. Pipe outlets are at different elevations. There is approx 1' of cover on the higher pipe. Outlet invert elevations are lower than channel resulting in ponding at outlet end.	See Notes 1 and 7. Headwall located in clear-zone and protection is likely required. Pending a review by Hydraulics, the rip-rap in this ditch should be removed. Unclear why outlets are at different elevations as the inlets begin at the same elevation.	115, 120
45	614+00 rt	At outlet end of previous 42" CMP, the rip-rap slope ends right at the pavement edge, 1' from the stripe. Significant pavement erosion beginning.	Almost appears as if rip-rap is supporting pavement. Gravel shoulder has eroded.	121
46	617+00 rt	Two 36" cmp culverts running under Denmark Drive, no headwall. The inlet elevation sits 9' below the road surface. The side slopes are covered with large 1' plus sized rip-rap and slope at 1:1 or more. The hinge of this slope is 21' from the stripe falling outside the clear-zone requirements; however, the depth and severity of this inlet may warrant treatment.	See Note 1. Slope begins within the of clear-zone range and could be considered outside of the area, however, because of the slope steepness and rip-rap size coupled with the roadway being on a downhill section may warrant protection of some kind.	123-125
47	618+00 rt	On the outlet end of the previous 36" CMP, there is additional rip-rap of similar size however, the rip-rap sloping, sloping at 2:1 at this location, is closer to the shoulder beginning 14' from the stripe. The gravel shoulder has a slope of 6:1.	Regrading of ditch may be possible however, outlets and channel slope currently falls within clear-zone. See Note 1.	126

48	622+00 LT	At driveway to Joy Engineering, there are large boulders used to delineate the edges of the entrance. These boulders fall 14' and 19' from the stripe meaning they are in the clear-zone. Also this driveway is not paved and each time trucks pull onto USA Parkway gravel spreads across the road.	See Note 1. Boulders should be removed and markers placed to delineate the approach. Also per NDOT Road Design Guide, the approach should be paved to prevent dirt and mud from entering the travel lanes and support the shoulder.	128
49	626+00 to 641+00 lt	Several rocks of varying distances from stripe located in clear zone.	Remove rocks from clear-zone.	137
50	664+00 rt	Large boulders located 13.5' from stripe in clear-zone. Appear to protect pump station.	Remove boulders from clear-zone.	144-145
51	666+50 lt	Utility power pole 12' from stripe. Gravel shoulder sloping at 7.7:1	Pole falls within clear-zone. If pole cannot be moved, it would require protection.	148
52	675+00 lt	Guide wire for power pole are located 2.5' behind curb. Minimum at approaches is 3.0'	The Roadside Design Guide indicates that at approaches and at intersections the minimum offset for objects behind curbs is 3.0'.	277
53	675+00, 676+00, 682+00	Rocks as part of the landscaping located in median islands are positioned directly behind curb with little or no distance from the back of curb to the rocks.	See Note 6.	272-275
54	695+00 rt, 696+00	Rocks in median are near median nose as well as back of curb at this location. Also the rocks for the sign on the right side are 1' from the back of curb.		281-282
55	717+00 rt	Non standard barrier rail terminal and flare rate, and improper curb transition. Barrier rail should have tangential guard rail end prior to concrete section. Possible removal of small section for installation on proper end terminal.	The barrier does not have the proper end treatment. A guardrail end terminal should be placed prior to the barrier rail and flush with curb face to prevent vehicles from directly impacting the blunt end. Refer to detail R-8.4.3	286-289

Note 1: Chapter 3 of the Roadside Design Guide outlines the concept of the clear-zone. In general, a clear, unobstructed and traversable area should be provided beyond the edge of the through traveled roadway for the recovery of errant vehicles. If this distance cannot be met and the object cannot be removed, protection is required. From table 3-1 of the roadside design guide, the minimum clear-zone distance for a 50 mph road with 6000 ADT is 20-22' at a 6:1 foreslope and 24-28' at a 5:1 or 4:1 foreslope.

Note 2: Gaps in guardrail without proper end treatments are not accepted. Solution could be to end the first rail at the hydrant and begin the second rail behind the hydrant utilizing the proper end terminals. This maintains access to the hydrant. End terminals would still be required per drawing R-8.2.2. Should the rail remain under the same configuration, trailing and leading terminals are needed. Refer to details R-8.1.1 and R-8.2.2 of the NDOT Standard Plans.

Note 3: Refer to detail R-8.1.1 of the NDOT Standard Plans

Note 4: Refer to detail R-8.2.2 of the NDOT Standard Plans

Note 5: Refer to details R-8.1.1 and R-8.2.2 of the NDOT Standard Plans

Note 6: The Roadside Design Guide recommends that in areas of curb and gutter, the minimum offset for objects behind curbs is 1.5'. While it is desirable to have objects outside the clear-zone regardless of the curb placement, the Design Guide acknowledges that it may not be possible in existing urban areas. The rocks may need to be adjusted to achieve this requirement.

Note 7: Protection of culvert inlet is required if it is located in the clear-zone. Chapter 3 of the Roadside Design Guide provides detailed discussions for inlet and outlet designs at approach culverts.

ROADWAY CLEAR-ZONE AREA – PHOTO LOG

Site 1 – Station 400+00 LT, photo 164

Site 2 – Station 401+00 LT, photo 167

Site 3 – Station 407+50 LT, photo 172

Site 4 – Station 407+50 – 412+00 LT, photo 176

Site 4 cont. - photo 177

Site 5 – Station 410+00 RT, photo 180

Site 7 - Station 453+00 – 457+00 LT, photo 196 looking north

Site 8 – Station 474+00 – 479+00 LT, photo 200

Site 9 – Station 480+00 LT, photo 208

Photo 207

Site 10 – Station 480+00 RT, photo 204

Site 11 – Stations 499+00 - 500+00 RT, photo 212 looking north

Site 12 – Station 502+00 RT, photo 213

Photo 215

Site 13 – Station 503+00 LT, photo 216

Photo 217

Site14 – Station 510+50 LT, photo 228

Photo 225

Site 15 – Station 511+00 RT, photo 223

Site 16 – Station 515+00 RT, photo 234 looking north

Site 17 – Station 518+00 RT, photo 238

Site 18 – Station 518+00 LT, photo 243

Photo 240

Site 19 – Station 521+00 LT, photo 247

Site 20 – Station 521+00 RT, photo 251

Site 21 – Station 524+00 RT, photo 252

Site 22 – Station 524+00 LT, photo 261

Site 23 – Station 537+00, photo 269

Site 23 cont. - photo 270

Site 24 – Station 539+00 RT, photo 56

Site 25 – Station 546+00 RT, photo 59

Site 26 – Station 545+00 LT, photo 63

Site 26 cont. - photo 65

Photo 66

Site 27 – Station 547+50 RT, photo 68

Site 28 – Station 562+00 – 567+00, photo 74

Site 29 – Station 563+00 RT, photo 73

Site 30 – Station 569+00 RT, photo 75

Photo 79

Site 31, 32 – Station 569+50 RT, photo 78

Site 33 – Station 577+00 LT, photo 81

Site 34 – Station 577+00 LT, photo 83

Site 35 – Station 576+00 – 580+00 LT, photo 88 looking south

Site 36 – Station 581+50 LT, photo 84

Site 37 – Station 580+00 LT, photo 89

Site 38 – Station 579+00 – 582+00 RT, photo 90 looking north

Site 39 – Station 587+00 RT, photo 91 looking south

Site 40 – Station 587+00 LT, photo 97 looking south

Site 40 cont. - photo 98

Photo 104

Site 41 – Station 590+00 RT, photo 102

Site 42 – Station 596+00 – 600+00 RT, photo 108 looking south

Site 43 – Station 607+00 RT, photo 111 looking north

Photo 113

Site -44 Station 613+00 RT, photo 115 looking north

Photo 120

Site 45 – Station 614+00 RT, photo 121 looking south

Site 46 – Station 617+00 RT, photo 123 looking north

Site 47 – Station 618+00 RT, photo 126 looking south

Site 48 – Station 622+00 LT, photo 128 looking north

Site 49 – Station 626+00 – 641+00 LT, photo 137 looking south

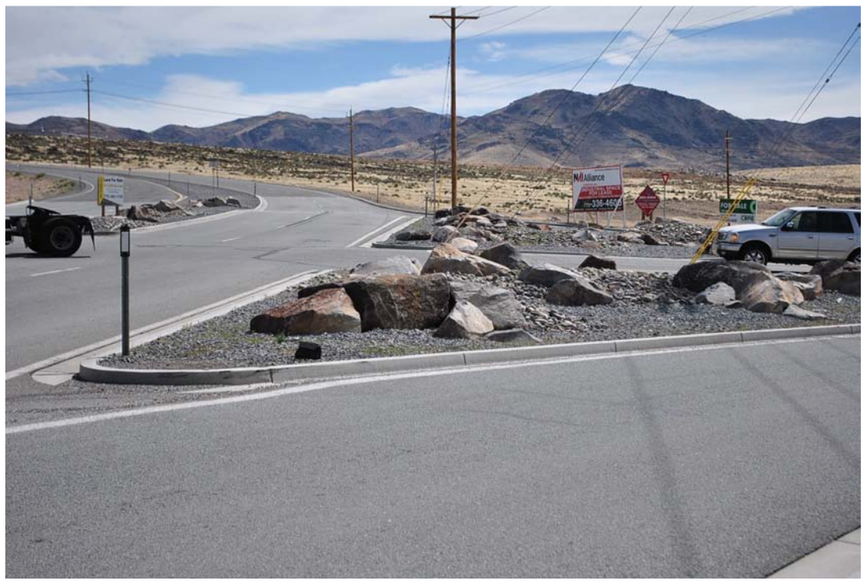
Site 50 – Station 664+00 LT, photo 144

Site 51 – Station 666+50 LT, photo 148

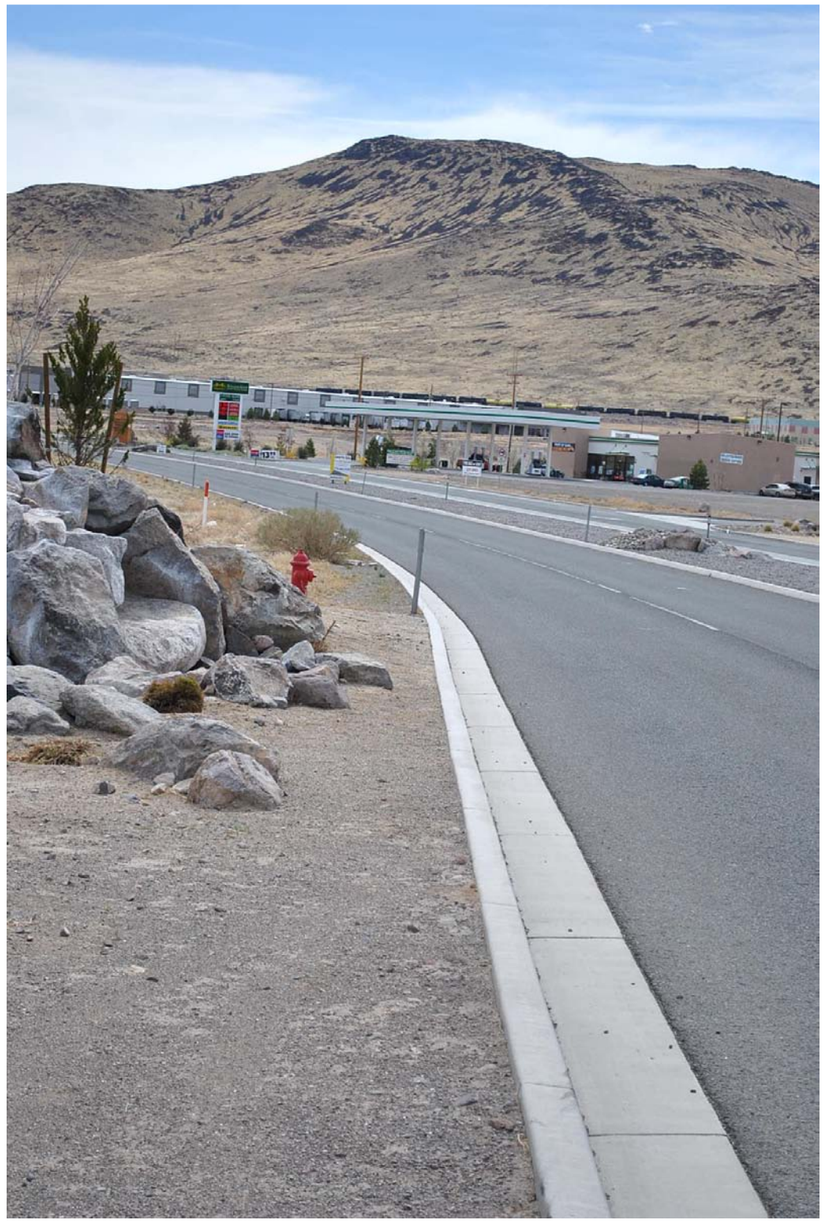
Site 52 – Station 675+00 LT, photo 277

Site 53 – Station 675+00, 676+00, 682+00, photo 272

Photo 273



Site 54 – Station 695+00 RT 696+00, photo 281 looking south



Site 54 cont. - photo 282

Photo 289

Site 55 – Station 717+00 RT, photo 286 looking north

APPENDIX C: ROADSIDE SLOPES

USA Parkway Design Compliance Appendix C - Roadside Slopes Compliance Summary

Site #	Station	Details of Non-Compliance	Additional Discussion	Photo Reference
1	400+00 - 402+00 rt	Foreslope of 1.75:1 after a 5.5' gravel shoulder of slope 7:1 from EOP to hinge. Height of fill is about 13'.	See Note 1. Because the distance from the traveled way to the hinge of the slope is only 13', the slope falls within the clear-zone. Guardrail is warranted.	162-163
2	410+00 - 420+00 rt	Roadside ditch foreslope of 1.5:1 after a 7' gravel shoulder from stripe to hinge sloping at 3%. Depth of ditch is 11' with many boulders present. Backslope of 2:1 begins 10' from stripe. Previous guard rail sections end just prior to this ditch and should be extended an additional 1000' past the limits of the ditch foreslope.	See Note 1. Foreslope falls within clear-zone. Extension of the guardrail is the best solution.	181,183
3	412+00 - 416+00 lt	Roadside ditch foreslope of 2:1 beginning after a 7' gravel shoulder from stripe sloping at 20:1. Depth of ditch is 10' with boulders present at bottom. Backslope of 1.5:1 begins 27' from stripe. Guard rail should be extended additional 900' to cover ditch.	See Note 1. Foreslope falls within clear-zone. Extension of the guardrail is the best solution.	182,184
4	447+00 - 450+00 lt	Roadside ditch foreslope of 2.5:1 after a 6' gravel shoulder from stripe to hinge sloping at 10:1. Ditch depth is 2'. Back slope of 2:1 begins 10' from stripe.	See Note 1. Foreslope falls within clear-zone. Although ditch is shallow and unlikely for a vehicle to roll, both the foreslope and the backslope are steeper than 3:1.	194
5	462+00 - 473+00 lt	Roadside ditch filled with 6" rip-rap. Ditch width is 11' sloping at 6:1. Begins after a 7' gravel shoulder from stripe to rip-rap sloping at 20:1. Clean backslope of 2:1 beginning 18' from stripe.	See Note 2. Steep backslope falls within clear-zone, however due to the clean nature of the slope, it may be acceptable.	197
6	477+00 - 479+00 rt	Foreslope of 2:1 after 9' of gravel shoulder from stripe to hinge sloping at 10:1. Depth of fill is 4' with some boulder present along slope.	See Note 1. Foreslope of 2:1 falls within clear-zone.	199
7	480+00 - 495+00 lt	Roadside ditch along this stretch is filled with 6"-8" rip-rap. Some larger boulders present. Ditch slopes at 4:1 and has a width of 13' Begins 20' from the stripe. Gravel shoulder present.	See Note 2. Steep backslope falls within clear-zone, however due to the clean nature of the slope, it may be acceptable.	209-210
8	486+00 - 495+00 rt	Foreslope of 1.9:1 after a 15' shoulder from stripe to hinge sloping at 10:1. Fill height is 4'. Relatively flat ground at base of fill extending some distance. Boulders present.	See Note 1. Foreslope of 1.9:1 falls within clear-zone. Slope flattening in this area may be possible. Boulders on slope should be removed.	212
9	496+00 - 502+00 lt	Ditch, offset 6'-7' from stripe in this stretch, is filled with 4"-6" rip-rap. Backslope located 17' from stripe. Ditch slopes at 10:1 along this section.	See Note 2.	
10	507+00 - 510+00 rt	Gravel shoulder width of 12' from stripe to hinge sloping at 10:1. After hinge 1.6:1 foreslope with boulders. Height of fill is 12'.	See Note 1. Foreslope falls within clear-zone. Boulders should be removed.	221-222
11	502+00 - 511+00 lt	Ditch, offset 6'-7' from stripe in this stretch, is filled with 4"-6" rip-rap.	See Note 2. Steep backslope falls within clear-zone, however due to the clean nature of the slope, it may be acceptable. Foreslope not an issue.	230
12	512+00 - 515+00 rt	Gravel shoulder width of 9' from stripe to hinge sloping at 15:1. After hinge 1.5:1 foreslope with boulders. Height of fill is 7'.	See Note 1. Foreslope falls within clear-zone. Slope flattening in this area may be possible. Remove boulders.	232-233
13	511+00 - 518+00 lt	Ditch, offset 6'-7' from stripe in this stretch, is filled with 4"-6" rip-rap.	See Note 2. Steep backslope falls within clear-zone, however due to the clean nature of the slope, it may be acceptable. Foreslope not an issue.	
14	521+00 lt	Erosion on slopes leading down to culvert inlet. The shoulder behind the guard rail has begun to erode and fall into the culvert inlet. Unclear as to why the pipe is so deep. Cover of pipe is 5' or more on this end.	Because this culvert inlet is behind guardrail, the placement of a headwall would reduce the risk of erosion.	249-250
15	518+00 - 520+00 lt	Ditch, offset 6'-7' from stripe in this stretch, is filled with 4"-6" rip-rap.	See Note 2. Slopes in this area are acceptable.	248
16	522+00 - 523+00 lt	Ditch, offset 6' from stripe in this stretch, is filled with 4"-6" rip-rap. Backslope after ditch is 3:1.	See Note 2. Backslope is acceptable.	258
17	524+00 - 536+00 lt	Shoulder width of 17' from stripe to hinge, sloping at 10:1. After hinge, backslope of 1.9:1. Gravel shoulder of 6'. Ditch in this location filled with 4"-6" rip-rap.	See Note 1. Backslope is in the clear-zone. However, the backslope in this location is clean and free of snags. Because it is located 17' from the stripe on a tangent roadway, it may be considered acceptable however the rip-rap in the ditch should be removed as it decrease the likelihood of an errant vehicles ability to recover.	264-265

18	545+50 rt	Eroding slope at culvert outlet location north of Sydney Drive. Erosion begins 20.6 ft from EOP. Slope down to culvert outlets is approx. 1.5:1. Slope of shoulder is about 6:1.	See Note 1. At the present time, the erosion falls outside the clear-zone distance however overtime the slope will move toward the road and ultimately into the clear-zone. Since the outlets of the culverts are out side the clear-zone, the placement of a headwall may stop the erosion.	57-58
19	563+00 rt	Insufficient shouldering material behind guard rail. Pavement is beginning to be undermined.	A minimum of 2' of gravel shoulder should be present behind all guardrails per NDOT Standard Plan 8-R-8.1.1 unless posts are lengthened.	73
20	587+50 - 589+50 rt	Roadside ditch with 2:1 slope 3' deep located 10.5'-15' from stripe to hinge. Ditch width approx 10 ft wide with a 2:1 backslope on other side	See Note 1. Foreslope falls in clear-zone.	94-95
21	606+00 rt	Shoulder eroded and pavement under mining beginning. Drop off at edge of pavement of 1'.	Insufficient shoulder. Ditch should be re-graded away from the roadway. Maintenance item primarily.	110
22	608+00 - 610+00 rt	Backslope of 2:1 slope beginning 16' from the stripe and getting closer as it continuous north. Gravel shoulder in this area is generally 7:1.	See Note 1. Backslope falls within clear-zone.	114
23	611+00 lt	Foreslope of 2.5:1 beginning 4' from stripe. Drops about 21" from the road surface. The backslope is 6:1 beginning 8 ft from the stripe.	See Note 1. Foreslope is in clear-zone.	118
24	Denmark Dr - 622+00 lt	Foreslope varies from 3:1 to 6:1 in this section; however, beginning 15.5' from the stripe there is a rocky slope of increased steepness. The width is about 30 ft. After this rock area, the slope flattens out to less than 6:1. gravel shoulder needs re-grading.	See Note 1. Foreslope is in clear-zone. Boulders should be removed. Possible slope flattening in this area.	127-128
25	624+00 rt	Short section of steep foreslope sloping at 2:1 to allow for power pole guide wires to remain in place. Distance from stripe to hinge is 14' sloping at 3.8:1. Gravel shoulder included.	See Note 1. Foreslope around guide wires is in clear-zone. Guide wires should be removed, slope re-graded and guide wires replaced as wires themselves fall outside of clear-zone.	334-335
26	624+00 lt	Four culverts located 12' below the roadway surface cross USA Parkway. The hinge point of the 1.5:1 slope leading down to these pipes is offset 3' from the stripe. Large bounders also present. Very unsafe situation	See Note 1. Because of the proximity to the road, steepness of the slope and depth of the inlet and outlets, these locations are of extreme concern. There is no marking of any kind and the weeds along the shoulder prevent a driver from seeing the slope. Should a vehicle pull of the road at these locations, they will almost certainly roll. Guardrail is needed. Headwall may also be needed to prevent erosion and undermining of the pavement.	131-133
27	625+00 rt	At outlet end of the above culverts, a foreslope of 1.1:1 begins 6' from the stripe. The gravel shoulder at this location is about 4:1. The slope down the outlets is hidden as there are numerous weeds growing around the slope. The culvert outlets are surrounded by large boulders that act as slope support.		331-333
28	650+00 to 660+00	This section along both sides of the road has a foreslope shoulder width of 6' sloping at 10:1, then a backslope of slope 1.45:1 immediately following. This backslope does not meet clear-zone.	See Note 1. Backslope falls within clear-zone.	142
29	657+00 - 665+00 lt	Rip-rap in channel section. Size varies from 3" to 6". Channel foreslopes are generally 7:1 and back slopes of 6:1. Width of channel is 16 ft	The rip-rap in the ditch may decrease the likelihood of an errant vehicles ability to recover.	146
30	665+00 - 671+00 lt	Barnroof shoulder design, however it meets clear-zone requirements. All slopes within clear-zone are 4:1 or flatter.	Meets all Roadside Design Guide Standards just wanted to point out the barnroof design.	150-151
31	671+00 lt	Shoulder width of 17' from stripe to hinge, sloping at 10:1. After hinge, foreslope increases to 3:1 and extends down a long slope of 50 or more feet before ending in rip-rap ditch.	See Note 1. Because of the length of the 3:1 slope and presence of rip-rap at base, roadside protection may be required.	153

Note 1: Chapter 3 of the Roadside Design Guide outlines the requirements for roadside slopes falling within the clear-zone. In general, slopes of 4:1 or flatter are considered acceptable provided they are free of obstacles. Slopes steeper than 4:1 but not more than 3:1 are not considered acceptable provided there is sufficient runout beyond the toe of a foreslope. Foreslopes and backslopes steeper than 3:1 are not allowed and require removal or protection. From table 3-1 of the roadside design guide, the minimum clear-zone distance for a 50 mph road with 6000 ADT is 20-22' at a 6:1 foreslope and 24-28' at a 5:1 or 4:1 foreslope.

Note 2: Pending a review by Hydraulics, the rip-rap in this ditch should be removed. The size and uneven nature of the rip-rap may decrease the likelihood of an errant vehicles ability to recover.

ROADSIDE SLOPES – PHOTO LOG

Site 1 – Station 400+00 – 402+00 RT, photo 163 looking south

Site 2 – Station 410+00 – 416+00 LT, photo 183 looking north

Site 3 – Station 412+00 – 416+00 LT, photo 182 looking north

Photo 184 looking south

Site 4 – Station 447+00 – 450+00 LT, photo 194 looking north

Site 5 – Station 462+00 – 473+00 LT, photo 197 looking south

Site 6 – Station 477+00 – 479+00 RT, photo 199 looking south

Site 7 – Station 480+00 – 495+00 RT, photo 209 looking south

Site 8 – Station 486+00 – 495+00 LT, photo 212 looking north

Photo 210 looking north

Site 10 – Stations 507+00 – 510+00 RT, photo 221 looking south

Site 11 – Stations 502+00 – 511+00 LT, photo 230 looking south

Site 12 – Stations 512+00 - 512+00 RT, photo 232 looking south

Site 12 cont. photo 233 looking south

Photo 250

Site 14 – Station 521+00 LT, photo 249

Site 15 – Stations 518+00 – 520+00 LT, photo 248 looking south

Site 16 – Stations 522+00 – 523+00 LT, photo 258 looking south

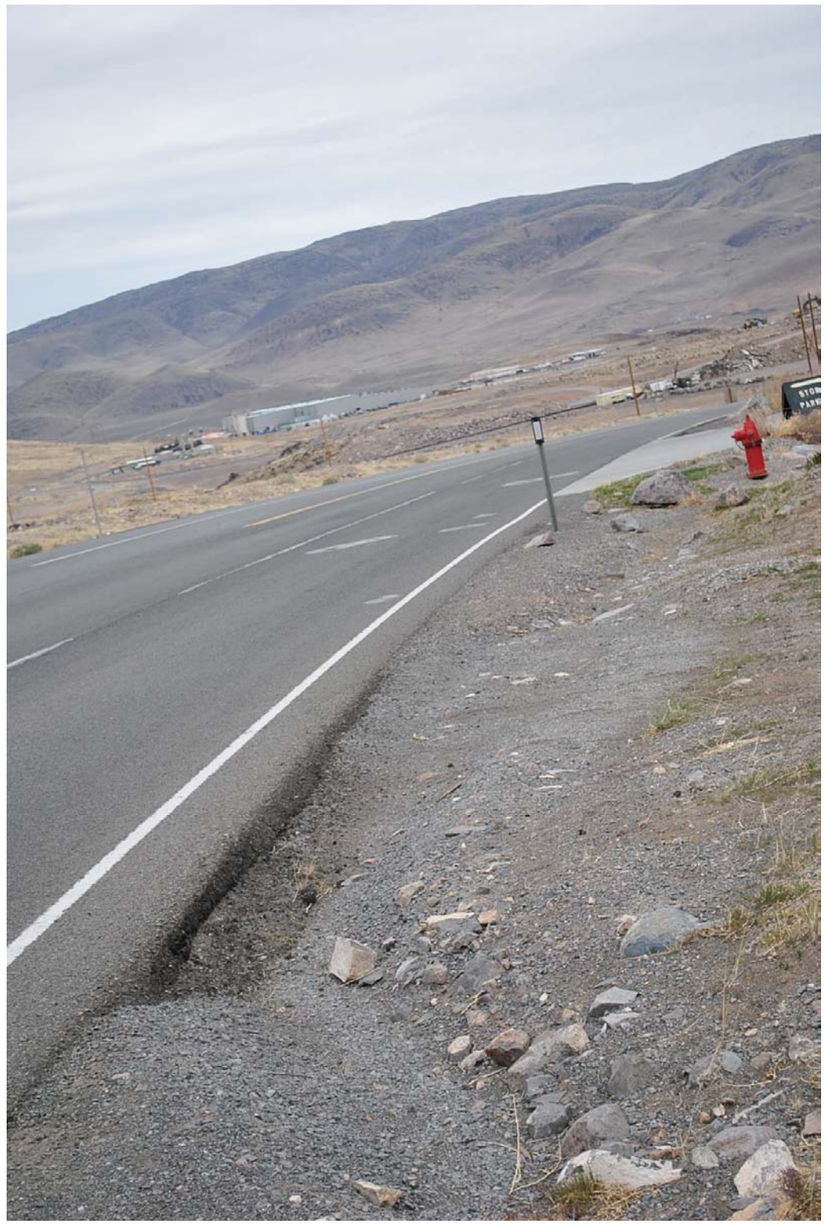
Site 17 – Stations 524+00 – 536+00 LT, photo 265

Site 18 – Station 545+50 RT, photo 57

Site 19 – Station 563+00 RT, photo 73

Site 20 – Stations 587+50 – 589+50 RT, photo 94 looking north

Site 21 – Station 606+00 RT, photo 110 looking north



Site 22 – Stations 608+00 – 610+00 RT, photo 114 looking north

Site 23 – Station 611+00 LT, photo 118 looking south

Site 24 – Stations Denmark Drive – 622+00 LT, photo 127 looking south

Photo 128 looking north

Site 25 – Station 624+00 RT, photo 334 looking north

Photo 335

Site 26 – Station 624+00 LT, photo 131

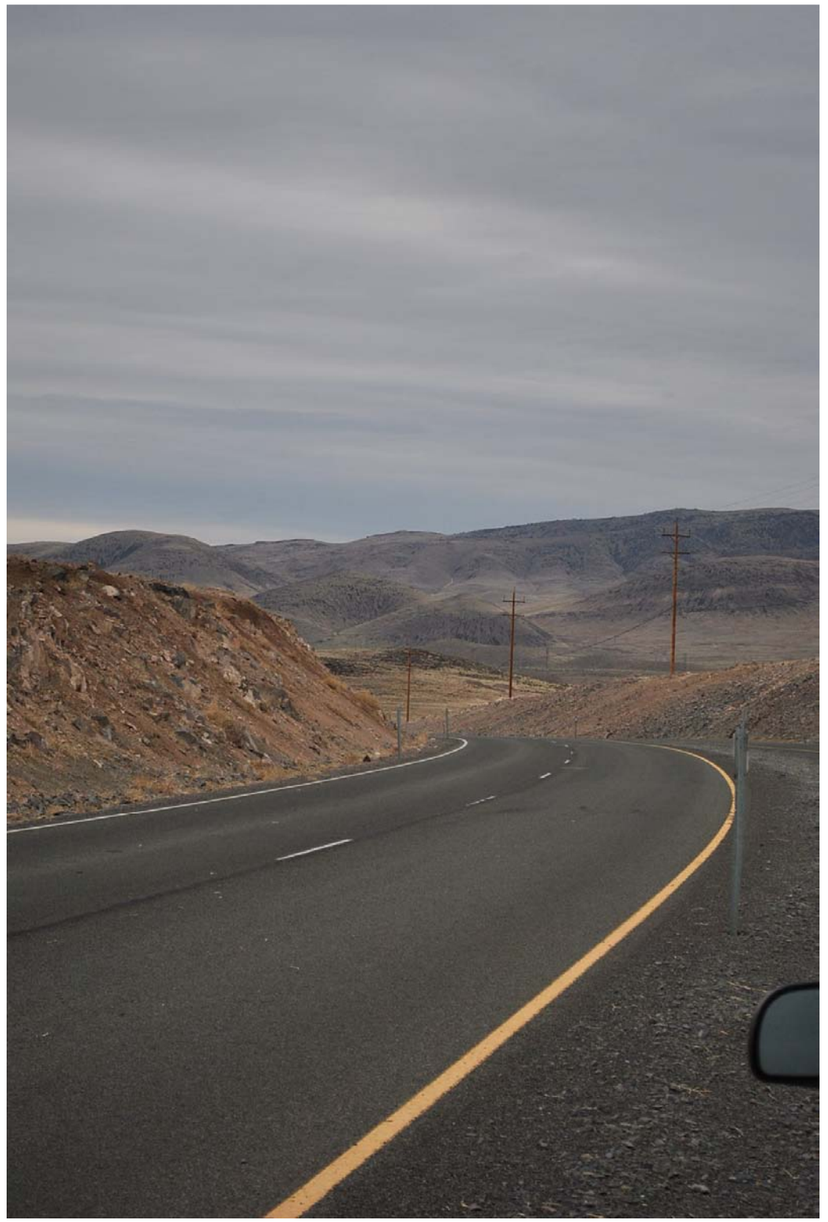
Photo 133

Site 26 cont. - photo 132 looking north

Site 27 – Station 625+00 RT, photo 331 looking north

Site 27 cont. - photo 333

Site 28 – Stations 650+00 - 660+00, photo 142 looking north



Site 29 – Stations 657+00 – 665+00 LT, photo 146 looking south

Site 30 – Stations 665+00 – 671+00 LT, photo 150 looking north

Site 31 – Station 671+00 LT, photo 153 looking south

APPENDIX D: UTILITIES

USA Parkway Design Compliance Appendix D - Utility Compliance Summary

Site #	Station	Description of Non-Compliance	Additional Discussion	Photo Reference
1	401+00	Fire Hydrant in clear-zone. Offset: lt = behind rail (6' from stripe), rt = 5' from stripe	See Notes 1 and 2.	166-169
2	407+50	Fire Hydrant in clear-zone. Offset: lt = 5', rt = behind rail (7')	See Notes 1 and 2.	172-174
3	471+50	Fire Hydrant in clear-zone. Offset: lt = 5' from EOP, rt = 4.5'	See Note 1.	185-186
4	427+50	Fire Hydrant in clear-zone. Offset: lt = 4' from EOP, rt = 7'	See Note 1.	188-189
5	437+50	Fire Hydrant in clear-zone. Offset: lt = 4.5' from EOP, rt = 6.'	See Note 1.	190-191
6	447+50	Fire Hydrant in clear-zone. Offset: lt = 4' from EOP, rt = 6'	See Note 1.	192-193
7	518+50	Fire Hydrant in clear-zone. Offset: lt = 9', rt = 8'	See Note 1.	245-246
8	527+00	Fire Hydrant in clear-zone, offset: lt = 9', rt = 8'	See Note 1.	262-263
9	537+50	Fire Hydrant in clear-zone. Offset: lt = 9.75', rt = 7.5'	See Note 1.	266-267
10	520+00 to 717+00	SSMHs located in travel lanes. Majority in SB direction of travel and in right lane. MHs prior to station 520+00 are on SB right shoulders out of travel lane.	The location of manholes and valve boxes in the travel lanes presents a maintenance issue as if access to these facilities is required, travel lanes must be closed. In addition, during reconstruction or during overlays, all utilities located in the pavement require adjustment. Also, improperly positioned utilities present problems for snow plows as the blade may damage lids or rims if they are raised above the finished surface of the pavement.	54
11	547+50	Fire Hydrant in clear-zone. Offset: lt = 8.99', rt = behind rail (6')	See Notes 1 and 2.	69
12	557+50	Fire hydrant in clear-zone. The one on the right is behind guard rail and may not be needed. Because of building improvements located behind its location.	See Notes 1 and 2. There is a hydrant located across the street and removing this one and repairing the guardrail gap is a possible solution.	
13	567+50	Fire hydrant in clear-zone	See Note 1.	
14	570+50 lt	Fire hydrant in clear-zone	See Note 1.	
15	581+50 lt	Fire hydrant in clear-zone	See Note 1. Because of the proximity of the hydrant to the approach, the placement of rail may be possible. Solution is to move the hydrant out of the clear-zone.	84
16	587+50	Fire hydrant in clear-zone	See Note 1.	
17	597+50	Fire hydrant in clear-zone	See Note 1.	108

18	607+50	Fire hydrant in clear-zone	See Note 1.	119
19	627+50	Fire hydrant in clear-zone	See Note 1.	135
20	637+50	Fire hydrant in clear-zone	See Note 1.	
21	667+00	Fire hydrant in clear-zone	See Note 1.	148
22	677+00, 682+00	Unfinished valves in median. Valve riser sticks above finished grade of road and are broken. Valve lids do not fit.	Valves should be checked for proper operation and adjusted per Method C flush with the finished ground. Having the valve covers rise above the finished ground in the median is a potential hazard for errant vehicles.	276, 279
23	682+00 lt	Valve located behind fire hydrant has broken lid and riser if full of dirt. Unclear is valve functions.		280
24	703+00, 709+00	Unfinished valves in median. Valve riser sticks above finished grade of road and are broken.		336
25	716+00	Irrigation located behind curb meaning it would be located in NDOT right-of-way limits.		290

Note 1: Chapter 3 of the Roadside Design Guide outlines the concept of the clear-zone. In general, a clear, unobstructed area should be provided beyond the edge of the through traveled roadway for the recovery of errant vehicles. If this distance cannot be met and the object cannot be removed, protection is required. From table 3-1 of the roadside design guide, the minimum clear-zone distance for a 50 mph road with 6000 ADT is 20-22' at a 6:1 foreslope and 24-28' at a 5:1 or 4:1 foreslope. Fire Hydrants set at improper heights where the riser pipe extends above the finished grade are objects requiring relocation or protection.

Note 2: Due to improperly designed gaps in the guardrail with non-compliant end terminals, the rail may not fully protect a vehicle from the Hydrant. It may be possible to rotate the hydrant such that the hose connections could still be made and the guardrail gaps filled. Additional discussion with Storey County required.

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UTILITIES – PHOTO LOG

Site 1 – Station 401+00, photo 166 and 169

Site 2 – Station 407+50, photos 173 and 174

Site 3 – Station 471+50, photos 185 and 186

Site 4 – Station 427+50, photos 188 and189

Site 5 – Station 437+50, photos 190 and 191

Site 6 – Station 447+50, photos 192 and 193

Site 7 – Station 518+50, photos 245 and 246

Site 8 – Station 527+00, photos 262 and 263

Site 9 – Station 537+50, photos 266 and 267

Site 10 – Station 520+00 to I-80, photo 54

Site 11 – Station 547+50, photo 69

Site 15 – Station 581+50 LT, photo 84

Site 17 – Station 597+50, photo 108

Site 18 – Station 607+50, photo 119

Site 19 – Station 627+50, photo 135

Site 21 – Station 667+00, photo 148

Site 22 – Station 677+00, 682+00, photos 276 and 279

Site 23 – Station 682+00 LT, photo 280

Site 24 – Station 703+00 and 709+00, photo 336

Site 25 – Station 715+00, photo 290

APPENDIX E: DRAINAGE

USA Parkway Design Compliance Appendix E - Drainage Specific Compliance Summary

Site #	Station	Description of Non-Compliance	Additional Discussion	Photo Reference
1	502+00 rt	Unique headwall located at outlet end of CMP culverts. Unclear why pipe was not extended. Headwall may become unstable is erosion occurs.	Headwall does not appear extend fully around pipes. If headwall is does not fully surround pipes, erosion may undermine the headwalls and ultimately the guardrail and pavement section. Headwall appears to be buried barrier rail. Pipe extension may solve issues at this location. See Notes 1 and 2.	215
2	502+00 lt	Two 72" CMP inlets located several feet below roadway with grouted rip-rap headwall. Inlets to culvert has steep rocky slopes on three sides sloping steeper that 1:1. While it is protected by guard rail, access for maintenance would be difficult. Future erosion is likely if any water were to traverse the slope.	Mainly an access and maintenance issue. See Note 2.	219
3	544+00 lt	Drop inlet located in approach. Unique location as there is not channeling directing flow to inlet.	Drop inlet similar to NDOT Type 2.	62
4	643+50	Non-standard drop inlet located 3' from stripe. Ditch appears to travel up hill.	Non-standard drop inlet type. Cross culvert may better serve this location.	138-139
5	716+50 lt	Curb drainage passes under barrier rail into rip-rap channel. Then channel drops into a basin with a 36" outlet pipe with headwall. Access to this basin is difficult meaning maintenance would be difficult. Basin seems to be a gathering point for weeds and debris. Unclear where other inlet originates.	No access road to the basin has been provided. As basin is located several feet from the road beyond a landscaped area, access is a challenge even by foot. Unclear how much water actually reaches the basin.	292-294
6	717+00 rt	Insufficient channeling to collect flows. Drop inlet may be too small. Resulting excess flows travel down the embankment onto the Union Pacific Railroad tracks.	Channeling should be provided and analysis completed to determine the capacity of inlet. Non-standard drop inlet type.	325-327

Note 1: Most culvert inlets and outlets do not have end sections of any kind. Inlets should be protected from large deposits of debris such that water continue to pass through the pipes without overtopping the roadway. In addition, at the outlet end of a pipe, rip-rap is typically needed to slow the water for discharge into a drainage channel. Many outlet ends of the culverts on USA Parkway do not have this rip-rap.

Note 2: Corrugated metal piping is adequate pipe material however overtime it tends to rust and corrode. It is more desirable to install pipe made of material such as concrete or HDPE with longer life spans requiring less maintenance.

DRAINAGE - PHOTO LOG

Site 1 – Station 502+00 RT, photo 215

Site 2 – Station 502+00 LT, photo 219

Site 3 – Station 544+00 LT, photo 62

Site 4 – Station 643+50 LT, photos 138

Site 4 cont. photo 139

Photo 293

Site 5 – Station 716+50 LT, photo 292

Photo 294

Site 6 – Station 717+00 RT, photo 325 looking south

Photo 236

Photo 327, looking north

APPENDIX F: SIGNING AND STRIPING

USA Parkway Design Compliance Appendix F - Signing Compliance Summary

Site #	Station	Details of Non-Compliance	Additional Discussion	Photo Reference
1	419+00 lt	Speed limit sign located 10' from stripe.	See Note 1.	301
2	427+00 rt	Speed limit sign located 10' from stripe.	See Note 1.	302
3	465+00	Speed limit signs: RT = 11' from stripe, LT = 11' from stripe	See Note 1.	303-304
4	491+00	Speed limit signs: RT = 10.5' from stripe, LT = 9' from stripe	See Note 1.	305-306
5	515+00 lt	Speed limit sign located 10' from stripe.	See Note 1.	307
6	523+00 rt	Speed limit sign located 10' from stripe.	See Note 1.	308
7	547+00	Sydney Drive street sign located 5' from SB yellow stripe in median. Pole embedded in concrete.	See Notes 1 and 2.	309
8	580+00, 581+00	Speed limit signs: RT = 5' from stripe, LT = 7.5' from stripe Pole embedded in concrete. Sign size is 24" x 30".	See Notes 1 and 3.	310
9	549+00	Large rock street sign in median clear-zone, 2.6' from stripe	See Note 4.	70-71
10	583+00	Italy Drive street sign located 4' from NB yellow stripe in median. Pole is embedded in concrete.	See Notes 1 and 2.	311
11	590+00	Large rock street sign in median clear-zone, 2.1' from stripe	See Note 4.	100
12	611+00 rt	Fire truck sign located 5' from stripe.	See Note 1.	312
13	622+00	Large rock street sign in median clear-zone, 2.5' from stripe	See Note 4.	130
14	622+00	Denmark Drive street sign located in median about 5' from SB yellow stripe. Pole embedded in concrete.	See Notes 1 and 2.	313
15	646+00 rt	Speed limit sign located 6' from stripe. Pole embedded in concrete. Size is 24" x 30".	See Notes 1, 2 and 3.	315
16	659+00 lt	Speed limit sign located 4' from stripe. Sign size is 24" x 30".	See Note 1 and 3.	314
17	671+00	Waltham Way street sign located in median. Sign is technically behind curb, but curb face only begins 2' prior to sign location. Post is offset 7; from yellow stripe.	See Note 1.	316
18	716+00 lt	Non-standard overhead sign. Reflectivity appears to be low and text on right panel appears small and difficult to read. Font of text appears non-standard.	MUTCD section 2D.07 Amount of Legend, recommends that the amount of text on the sign should be limited to no more than three lines of destinations. Also, the lettering fonts on both the signs do not seem to be consistent with the class of highway. MUTCD table 2D-2 details the requirements. If the sign is older than 5 years, it probably does not meet the current retroreflectivity standards, however the sign is lit and reflectivity is not an issue.	322

19	716+00 rt	Lane merges sign and "RIGHT LANE ENDS" sign are not needed as right lane does not end. It becomes a right turn lane to enter the freeway after it crosses the river.	An additional white advisory sign located nearer to the freeway indicating that the right lane is a turn only lane. Merge signs prior to this are not needed. An advance intersection lane control sign may be used instead (R3-8).	318
20	720+00 rt	Yellow warning sign "LANE ENDS MERGE LEFT" blocked by fencing on railroad bridge. Visible only after you cross the bridge. Unclear why sign is needed because lane ends in a right turn pocket, not a merge.		320-321
21	Entire Project	Incorrect guide post color. Guide posts in median are white and should be yellow.	NDOT Standard plans R-9.1.1 and R-9.2.1 indicate spacing and placement of guide posts and object markers.	55
22	Entire Project	There are no object markers.		
23	Entire Project	None of the approaches or medians are marked with the proper approach markers.		
24	Entire Project	Several Private signs located in median and near pavement edges. Most are on wooden posts however NDOT does not allow private advertizing signs within right-of-way.	Private signs do not conform to the MUTCD and do not have proper assemblies complying with NDOT and NCHRP Report 350 standards.	

Note 1: The MUTCD indicates that on rural roads, roadside signs shall be offset a minimum of 12' from the edge of pavement. Additionally, the NDOT standard plans indicate that for areas with no shoulder, the offset shall be 12'. I areas with a paved shoulder the offset should be 6'. Because USA Parkway does not have required shoulders, the 12' offset was used as the evaluation criteria.

Note 2: Round sign posts embedded in concrete are not compliant with NDOT and the Roadside Design Guide. Signs posts shall conform to detail T-31.1.2 and subsequent details of the NDOT standard plans. Any round sign posts shall have multidirectional slip bases.

Note 3: Per the MUTCD, for multi lane conventional roads, the minimum speed limit sign size is 30" x 36". The current size conforms to conventional single lane roads only. All speed limit signs prior to 547+00 are of correct size.

Note 4: In areas of no median curb or median barrier, the clear-zone must be maintained or objects within that clear-zone protected from impact by errant vehicles. Based on the design speed of the road of 50 mph, the clear-zone distance for anticipated traffic volumes is 20-22 ft for slopes 6:1 or flatter. These signs and rock features located in a relatively flat median fall within that clear-zone distance and are not protected.

SIGNING – PHOTO LOG

Site 1 – Station 419+00 LT, photo 301 looking south

Site 2 – Station 427+00 RT, photo 302 looking north

Site 3 – Station 465+00, photos 303 and 304

Site 4 – Station 491+00, photos 305 and 306

Site 5 – Station 515+00 LT, photo 307 looking south

Site 6 – Station 523+00 RT, photo 308 looking north

Site 7 – Station 547+00, photo 309 looking south

Site 8 – Station 580+00 and 581+00, photo 310

Site 9 – Station 549+00, photo 70

Site 10 – Station 583+00, photo 311 looking north

Site 11 – Station 590+00, photo 100

Site 12 – Station 611+00 RT, photo 312 looking north

Site 13 – Station 622+00, photo 130

Site 14 – Station 622+00, photo 313 looking south

Site 15 – Station 646+00 RT, photo 315 looking north

Site 16 – Station 659+00 LT, photo 314 looking south

Site 17 – Station 671+00, photo 316 looking north

Site 18 – Station 716+00 LT, photo 322 looking south

Site 19 – Station 716+00 RT, photo 318 looking north

Site 20 – Station 720+00 RT, photos 320 and 321

Site 21 – Entire Project, photo 55

APPENDIX G: DRAINAGE REPORT by WOOD RODGERS

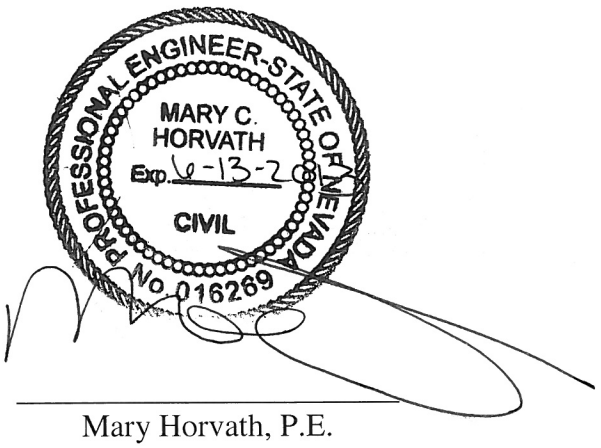
Revised (PASS/FAIL) DRAINAGE ANALYSIS

USA Parkway
Existing Roadway
Project # 8480.001
Storey County,
Nevada

Prepared for:
Nevada Department of Transportation
1263 S. Stewart St.
Carson City, NV 89712

September 2012

Prepared by:



Mary Horvath, P.E.

WOOD RODGERS
DEVELOPING INNOVATIVE DESIGN SOLUTIONS
5440 Reno Corporate Drive Tel: 775.823.4068
Reno, NV 89511 Fax: 775.823.4066

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FIGURES

APPENDICES

1.0 INTRODUCTION

This report represents the preliminary hydrologic and hydraulic analysis of the facilities along the existing portion of USA Parkway. It is meant to provide guidance for future, more detailed design-level analysis at locations where issues may potentially exist. Analysis was performed in accordance with the Nevada Department of Transportation Drainage Manual (2006). Hydrologic and hydraulic analyses data and results are presented in Appendix A. Additional supporting data is presented in Appendix B.

2.0 HYDROLOGIC & HYDRAULIC ANALYSES

The hydrologic analysis consists of peak runoff flow computations for existing conditions. Hydraulic analysis was based on facilities presented in the roadway design plans produced by Reno Engineering Corporation in 2003 and field review completed by Jacobs Engineering and Wood Rodgers in 2012. Based on the NDOT Drainage Manual and a roadway functional classification of "Minor Arterial", the 10-year and 25-year storm events were calculated to analyze roadway drainage facilities including culverts, channels, drop inlets, and curb & gutter. The following assumptions and methodology were applied to the hydrologic and hydraulic analyses:

- The watershed exhibit (SD1 and SD2), prepared in 2003, from Reno Engineering Corporation was reviewed. The information on this exhibit regarding the sizes and locations of crossing does not correlate with what was on the As-Build design plans for the roadway.
-
- The Rational Method was utilized for the hydrologic analysis of watersheds under 100 acres.

- SCS methodology with a balanced frequency storm rainfall distribution was utilized for the hydrologic analysis of watersheds greater than 100 acres.

- USGS Regression Equations (Region 5) were also applied to the two largest watersheds (see Appendix A, Table 6 for notes regarding equation applicability). It is noted that peak flows were substantially higher for these watersheds using the SCS methodology. Refer to HEC-HMS results in Appendix B and Regression Equation results in Appendix A for a comparison.

- For the Rational Method, offsite areas were categorized as "unimproved areas" for runoff coefficient development (see Appendix A for C-value development).

- For SCS methodology, offsite areas were categorized as "sagebrush with grass understory – poor" for curve number development (see Appendix A for CN development).

- HEC-HMS was applied for SCS analysis.
- NOAA Atlas 14 point precipitation was used (see Appendix B).
- Representative precipitation points were used to provide precipitation values for multiple watersheds where applicable (see Figure 1 for precipitation points).
- Drop inlets were analyzed for capacity: stormdrain networks were not analyzed.
- A bypass analysis was not conducted: bypass flows were not added to downstream features.
- Culverts were analyzed using HY-8.
- Drop inlets, channels, and curb & gutter were analyzed using Flowmaster.
- The 25-year storm event peak flow was used to assess culvert and channel hydraulic capacity.
- The 10-year storm event was applied for drop inlet and curb & gutter analysis.
- Typical roadside channels were assigned a manning's coefficient of 0.035. Actual conditions vary based on field observation but 0.035 was found to be representative for most cases. A manning's coefficient of 0.045 was applied to a few larger roadside channels based on observed conditions as indicated in Appendix A, Table 10.
- Channel, drop inlet, and curb & gutter characteristics such as longitudinal slopes, side slopes, cross slopes, etc. were based on digital topography developed from aerial mapping in combination with field survey. Capacities were based on bank-full depth.

Please see the footnotes on the tables in Appendix A for further assumptions specific to analysis represented on each table.

3.0 RESULTS

The hydrologic and hydraulic results are presented in Appendix A. Preliminary analysis indicates that the following locations need further assessment (see Tables in Appendix A for detailed results and at the conclusion of this section for summary of deficient facilities):

- Culvert 8 – the 25-year peak flow exceeds the calculated 12" culvert capacity by 125%. Pipe elevation and size information was estimated due to an inability to remove the inlet grate and an outlet pipe was not found. A more detailed hydrologic analysis will be necessary to determine the additional improvements necessary to meet NDOT conveyance standards. Regardless of the capacity of the pipe, if the pipe size is verified to be 12", it falls below the NDOT minimum size of 18".

- Culvert 10 – the 25-year peak flow exceeds the calculated culvert capacity by 38%. Two hydrologic methods were used to calculate peaks for this set of culverts: SCS and Regression (see Appendix A). The SCS peaks were significantly higher (25-year peaks of 2,869 cfs using SCS and 750 cfs using Regression). However, even the calculated Regression peak exceeds capacity. In order to meet the minimum capacity to pass the 25-year event based on the Regression equations, it is estimated that an additional 2x54" CMPs are necessary. If the higher flows calculated based on SCS methodology are utilized, 8 times the existing capacity is necessary.

  Two input variables for the Regression analysis are outside of the applicable ranges: latitude of 39.52 degrees (range 36.44-39.50) and mean basin elevation of 5040 feet (range 5,770-10,500). Because the latitude is just outside of the applicable range and the mean basin elevation is below the range, and thus conservative, Regression peak flows were deemed appropriate. A more detailed analysis is necessary to determine the degree of additional improvements needed to meet NDOT standards

- Culvert 29 – the 25-year peak flow significantly exceeds the calculated culvert capacity. This culvert runs along USA Parkway under an unpaved access road. It is unlikely that it was designed to pass the 25-year event due to the severe degree of deficiency. Note that in very large flows, this culvert may not pose an impediment to flows as the dirt road may at some point wash out. However, prior to potential road wash out, flows will likely encroach into the travel-way.

- Channels as indicated in Appendix A, Table 10. A total of 10 channels were calculated to be undersized for the 25-year event. Because there is large variation in channel characteristics (varying slopes, depths, roughness, etc.), a more detailed analysis on a channel-by-channel basis is recommended to determine the degree of further action necessary. However, channels were found to be undersized by a range of 30% to 1400%.

- Drop inlets as indicated in Appendix A, Table 9. Existing spread exceeds the allowable spread of ½ travel lane width in 4 locations. Table 9 also summarizes inlet interception and bypass. Bypass flows at each inlet were calculated to be less than 1 cfs except at DI09, DI21, and DI24. A review is necessary to determine acceptable interception and bypass flows.

- Curb & gutter and barrier rail spread as indicated in Appendix A, Table 11. Existing spread exceeds the allowable spread of ½ travel lane width in 3 locations. A more detailed analysis is necessary to determine if action is needed at these locations.

Additional areas of interest include:

- Culvert 11 consists of four 36" CMP. Based on offsite contour topography and current field evidence of erosion, it appears that this culvert crossing receives much less flow than expected for four 36" CMPs. Historic aerial photos taken prior to current developed land improvements show some evidence of flow near this location. However, due to improvements in the area, flow paths have likely been altered. Extended coverage of onsite 1-foot topography (see extents of detailed topography in the area of Watersheds 33 and 34) would be useful in verifying offsite areas contributing to Culvert 11 flows.

Culvert Deficiency Summary

Existing Label	Culvert Description	Capacity (cfs)	Peak Flow (cfs)		% Deficient	Comment
			10-Year	25-Year		
C08	12" PVC	3.4	5.2	7.7	125	More detailed hydrologic analysis and verification of minimum required NDOT pipe size necessary.
C10a	52" CMP	526.9	301.1	750.3	42	Review applicable hydrologic methodology and verify estimate of an additional 2x52" CMPs necessary. See Appendix A, Table 7 notes regarding methodology.
C10b	52" CMP					
C10c	52" CMP					
C29	13.5" PVC	5.9	93.1	142.9	2339	Conduct more detailed analysis to verify potential travel-way encroachment of flow during large events.

Note: Highlighting indicates capacity deficiency

Channel Deficiency Summary

Existing Label	Channel Capacity (cfs)	25-Year Peak Flow (cfs)	% Deficient
CH03	1.4	21.6	1400
CH05	29.7	46.7	57
CH06	5.6	44.3	694
CH06a	11.2	34.1	204
CH06b	8.8	26.4	201
CH09	9.3	16.9	82
CH15	3.0	3.9	30
CH16	2.9	5.3	80
CH22	6.5	63.9	877
CH25	115.5	142.9	24

Note: Highlighting indicates capacity deficiency

Minimum Pipe Size Requirement Deficiency Summary

Existing Label	Culvert Description	Capacity (cfs)	Peak Flow (cfs)	
			10-Year	25-Year
C02	12" PVC	4.6	0.7	0.9
C03	12" PVC	6.3	1.4	1.9
C04	12" PVC	4.7	2.7	3.6
C05	12" PVC	6.5	4.0	5.4
C06	12" PVC	3.5	1.1	1.6
C07	12" PVC	6.7	1.2	1.5
C08*	12" PVC	3.4	5.2	7.7
C29	13.5" PVC	5.9	93.1	142.9

Notes: *pipe information estimated, unable to remove inlet grate, no outlet found
Highlighting indicates capacity deficiency

Curb and Gutter Deficiency Summary

Label	Length (ft)	10-Year			% Deficient
		Peak Flow (cfs)	Spread (ft)	Allowable Spread (ft)	
CG04	498	1.9	8.4	7.5	12
CG18	858	5.2	10.2	8.0	28

Notes: Highlighting indicates capacity deficiency

4.0 CONCLUSIONS

In order to meet NDOT minimum pipe size standards, eight culverts would need to be upsized at culvert locations C02, C03, C04, C05, C06, C07, C08, and C29. Additionally, culverts C08, C10, and C29 are significantly undersized from a capacity standpoint. See Appendix A for the Culvert Inlet/Outlet deficiencies table. Channels are undersized in ten locations as indicated in the Channel Deficiency Summary. Supplementary or replacement culvert and channel design (with supporting design-level hydraulic analysis) should be prepared and implemented in order to meet NDOT standards at these locations as noted. Additionally, curb and gutter, and barrier rail spread is exceeded in three locations (refer to Table 11).

Wood Rodgers analysis has been limited to an after-the-fact assessment without benefit of accurate design drawings and thus our evaluation has been limited to that field data which could readily be collected. Identification of construction defects are not within the Scope of Work. Thus, deficiencies other than inadequate sizing may exist due to improper materials or installation.

FIGURES

Figure 1a - Watershed Map (Scale: 1" = 6000')
Figure 1b - Watershed Map (Scale: 1" = 3000')
Figures 2.1 - 2.13 - Existing Roadway Features (Scale: 1" = 200')

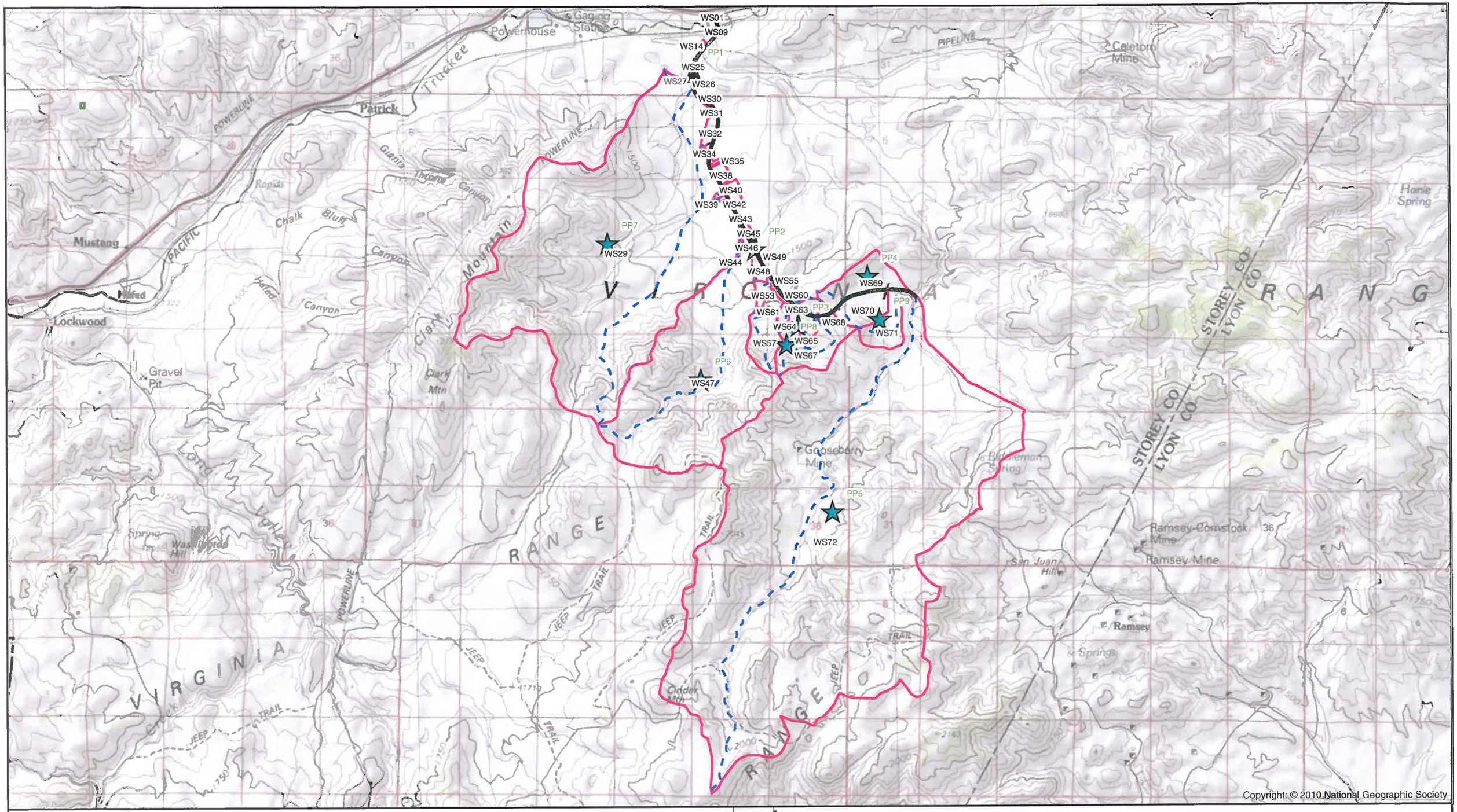

Figure 1a - Watershed Map
USA Parkway - Pass/Fail
Drainage Analysis
Storey County, Nevada
September 2012

NOTES:
BACKGROUND: USGS

USA Parkway
Flowpath
Watersheds
Precipitation Points

NORTH

0 3,000 6,000
FEET

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DEVELOPING INNOVATIVE DESIGN SOLUTIONS
5440 Reno Corporate Drive Tel: 775.823.4068
Reno, NV 89511 Fax: 775.823.4066

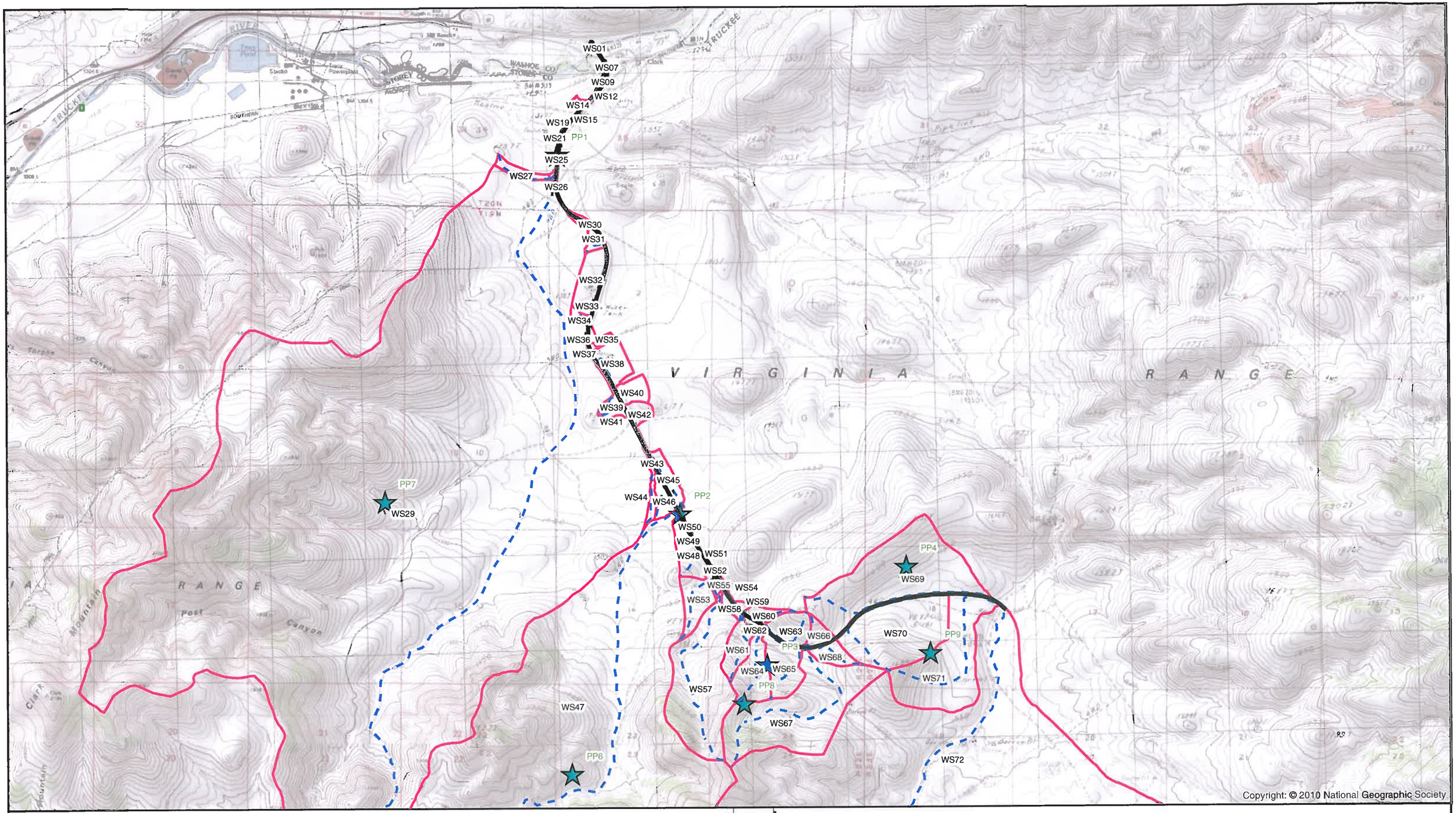

Figure 1b - Watershed Map
USA Parkway - Pass/Fail
Drainage Analysis
Storey County, Nevada
September 2012

NOTES:
BACKGROUND: USGS

USA Parkway
Flowpath
Watersheds
Precipitation Points

NORTH

0 1,500 3,000
FEET

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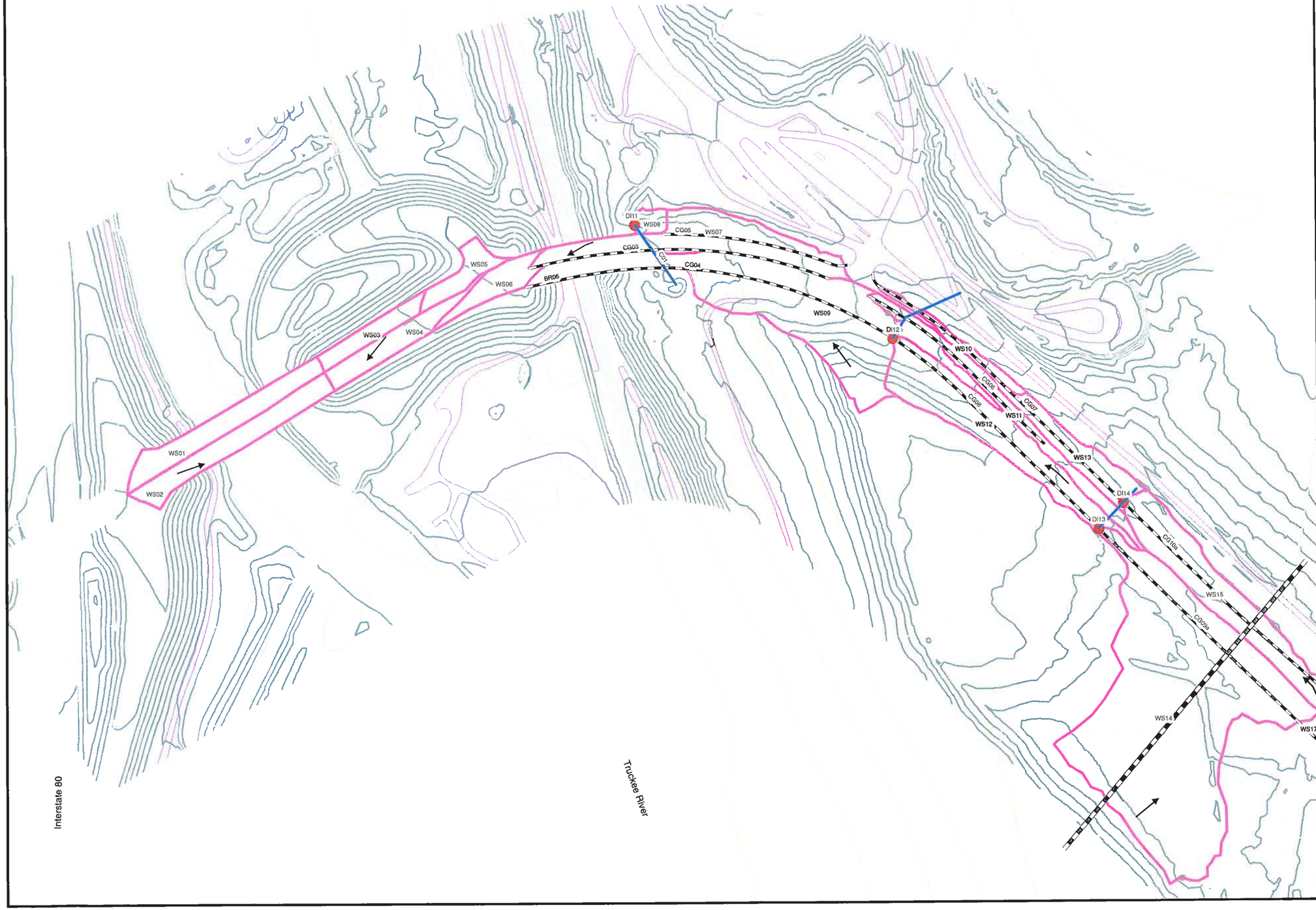
Reno, NV 89511 Fax: 775.823.4066

Figure 2.1 - Existing Features

USA Parkway-Pass/Fail Drainage Analysis

Storey County, Nevada

September 2012



NORTH

0 100 200

FEET

Legend

- Flow Direction
- Match Line
- Culverts
- Channels
- DIs
- Curb & Gutter
- Watersheds
- 20-foot contours

NOTES:
Aerial topography by AeroTech Mapping:
1-foot contour intervals
Background by USA Imagery

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5440 Reno Corporate Drive
Reno, NV 89511

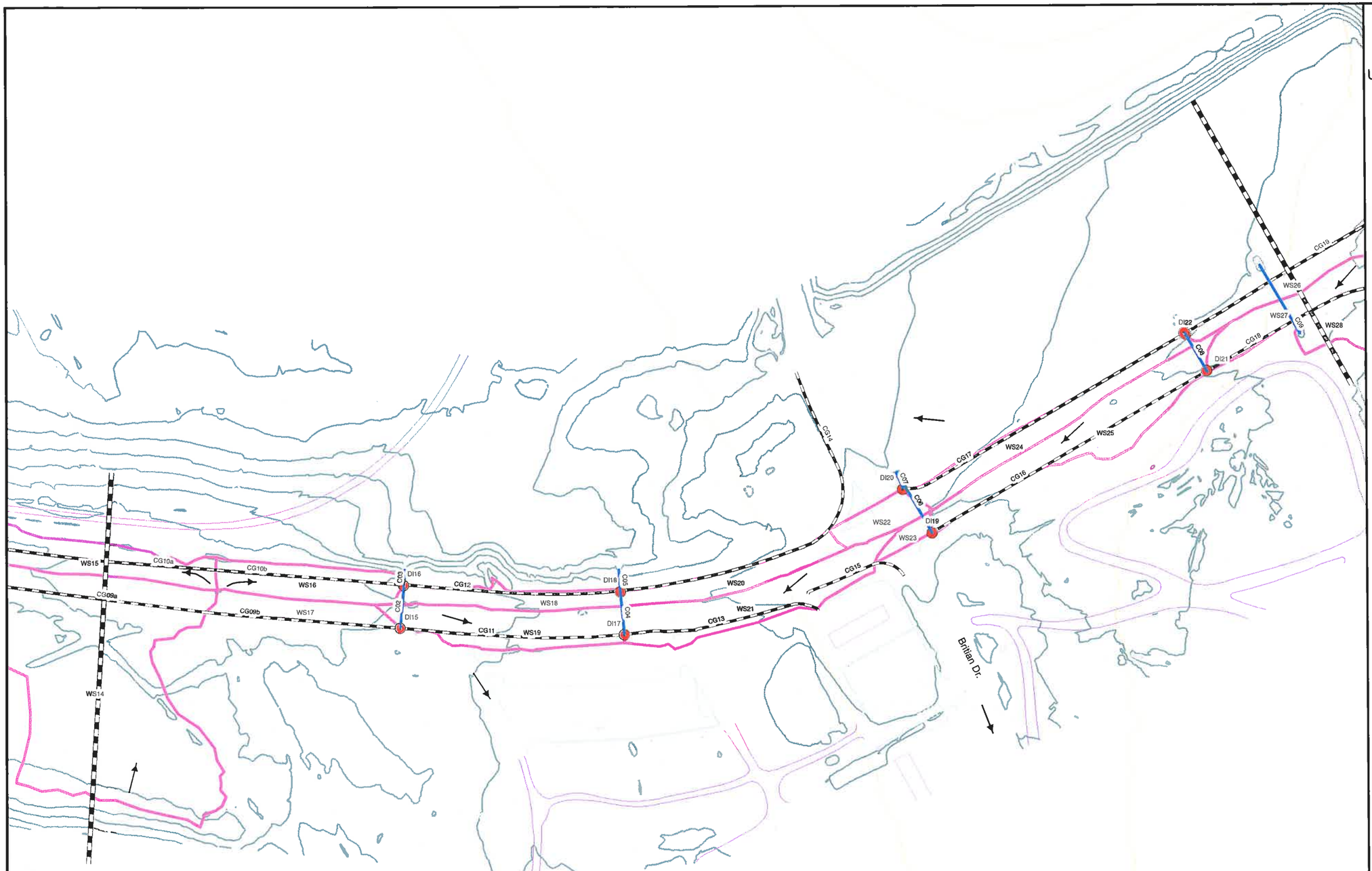
Tel: 775.823.4068
Fax: 775.823.4066

Figure 2.2 - Existing Features

USA Parkway-Pass/Fail Drainage Analysis

Storey County, Nevada

September 2012



NORTH

0 100 200

FEET

Legend

- Flow Direction
- Match Line
- Culverts
- Channels
- DIs
- Curb & Gutter
- Watersheds
- 20-foot contours

NOTES:
Aerial topography by AeroTech Mapping:
1-foot contour intervals
Background by USA Imagery

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Fax: 775.823.4066

Figure 2.3 - Existing Features

USA Parkway-Pass/Fail Drainage Analysis

Storey County, Nevada

September 2012

NORTH

0 100 200

FEET

Legend

- Flow Direction
- Match Line
- Culverts
- Channels
- DIs
- Curb & Gutter
- Watersheds
- 20-foot contours

NOTES:
Aerial topography by AeroTech Mapping:
1-foot contour intervals
Background by USA Imagery

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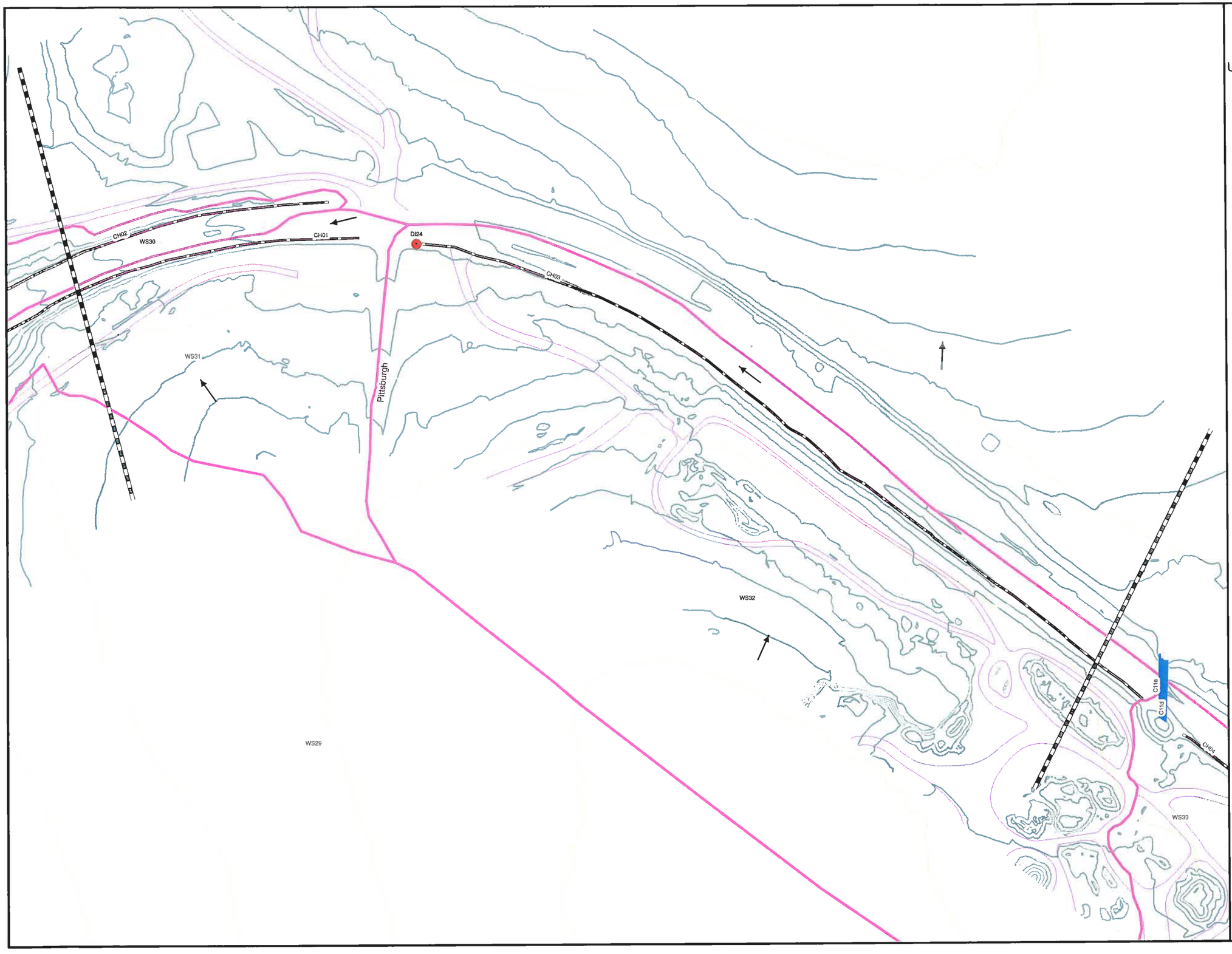
Figure 2.4 - Existing Features

USA Parkway-Pass/Fail Drainage Analysis

Storey County, Nevada

September 2012



NORTH

0 100 200

FEET

Legend

- Flow Direction
- Match Line
- Culverts
- Channels
- DIs
- Curb & Gutter
- Watersheds
- 20-foot contours

NOTES:
Aerial topography by AeroTech Mapping:
1-foot contour intervals
Background by USA Imagery

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Figure 2.5 - Existing Features

USA Parkway-Pass/Fail Drainage Analysis

Storey County, Nevada

September 2012

NORTH

0 100 200

FEET

Legend

- Flow Direction
- Match Line
- Culverts
- Channels
- DIs
- Curb & Gutter
- Watersheds
- 20-foot contours

NOTES:
Aerial topography by AeroTech Mapping:
1-foot contour intervals
Background by USA Imagery

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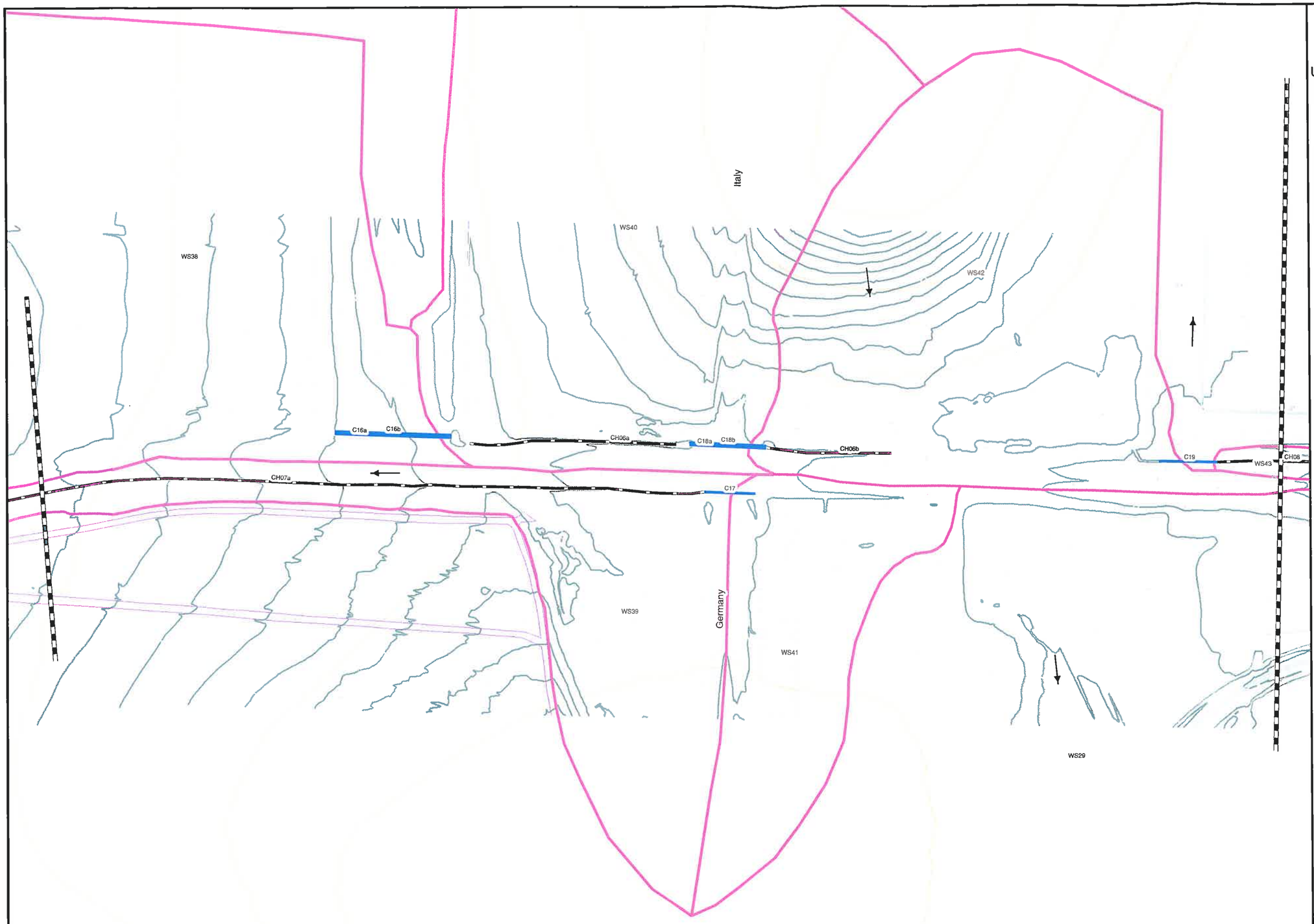
Figure 2.6 - Existing Features

USA Parkway-Pass/Fail Drainage Analysis

Storey County, Nevada

September 2012



NORTH

0 100 200

FEET

Legend

- Flow Direction
- Match Line
- Culverts
- Channels
- DIs
- Curb & Gutter
- Watersheds
- 20-foot contours

NOTES:
Aerial topography by AeroTech Mapping:
1-foot contour intervals
Background by USA Imagery

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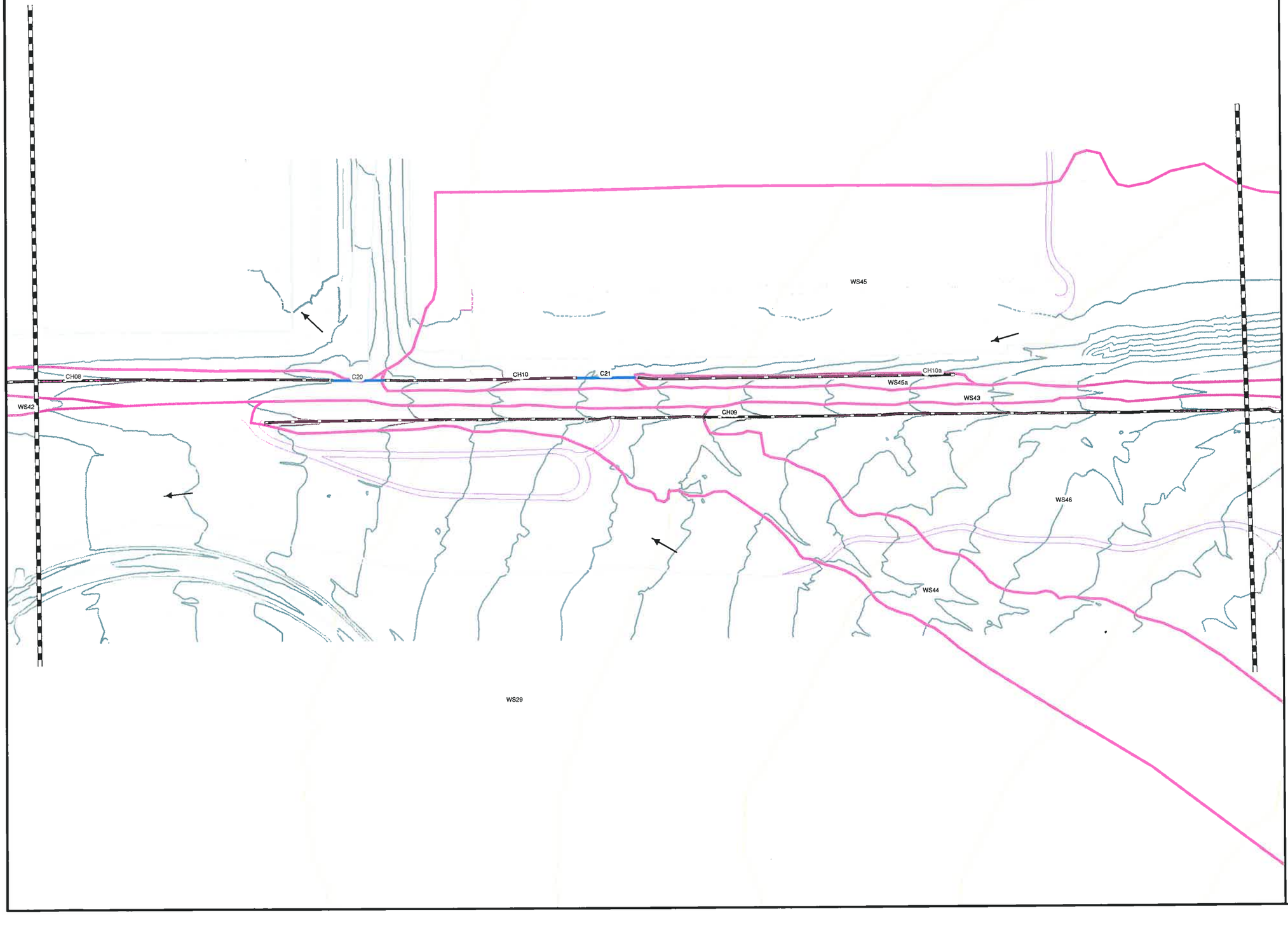
Figure 2.7 - Existing Features

USA Parkway-Pass/Fail Drainage Analysis

Storey County, Nevada

September 2012



NORTH

0 100 200

FEET

Legend

- Flow Direction
- Match Line
- Culverts
- Channels
- DIs
- Curb & Gutter
- Watersheds
- 20-foot contours

NOTES:
Aerial topography by AeroTech Mapping:
1-foot contour intervals
Background by USA Imagery

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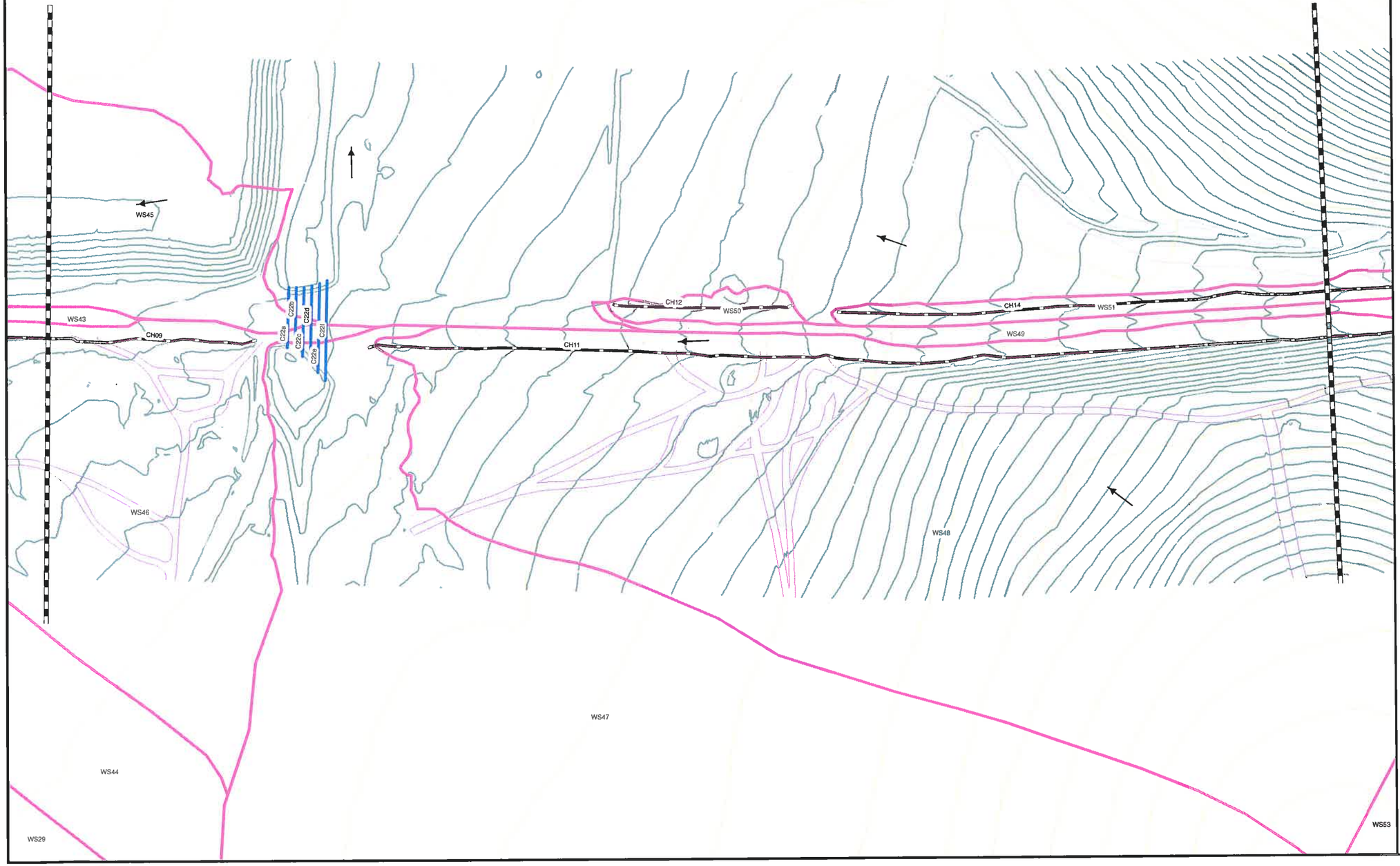
Figure 2.8 - Existing Features

USA Parkway-Pass/Fail Drainage Analysis

Storey County, Nevada

September 2012



NORTH

0 100 200

FEET

Legend

- Flow Direction
- Match Line
- Culverts
- Channels
- DIs
- Curb & Gutter
- Watersheds
- 20-foot contours

NOTES:
Aerial topography by AeroTech Mapping:
1-foot contour intervals
Background by USA Imagery

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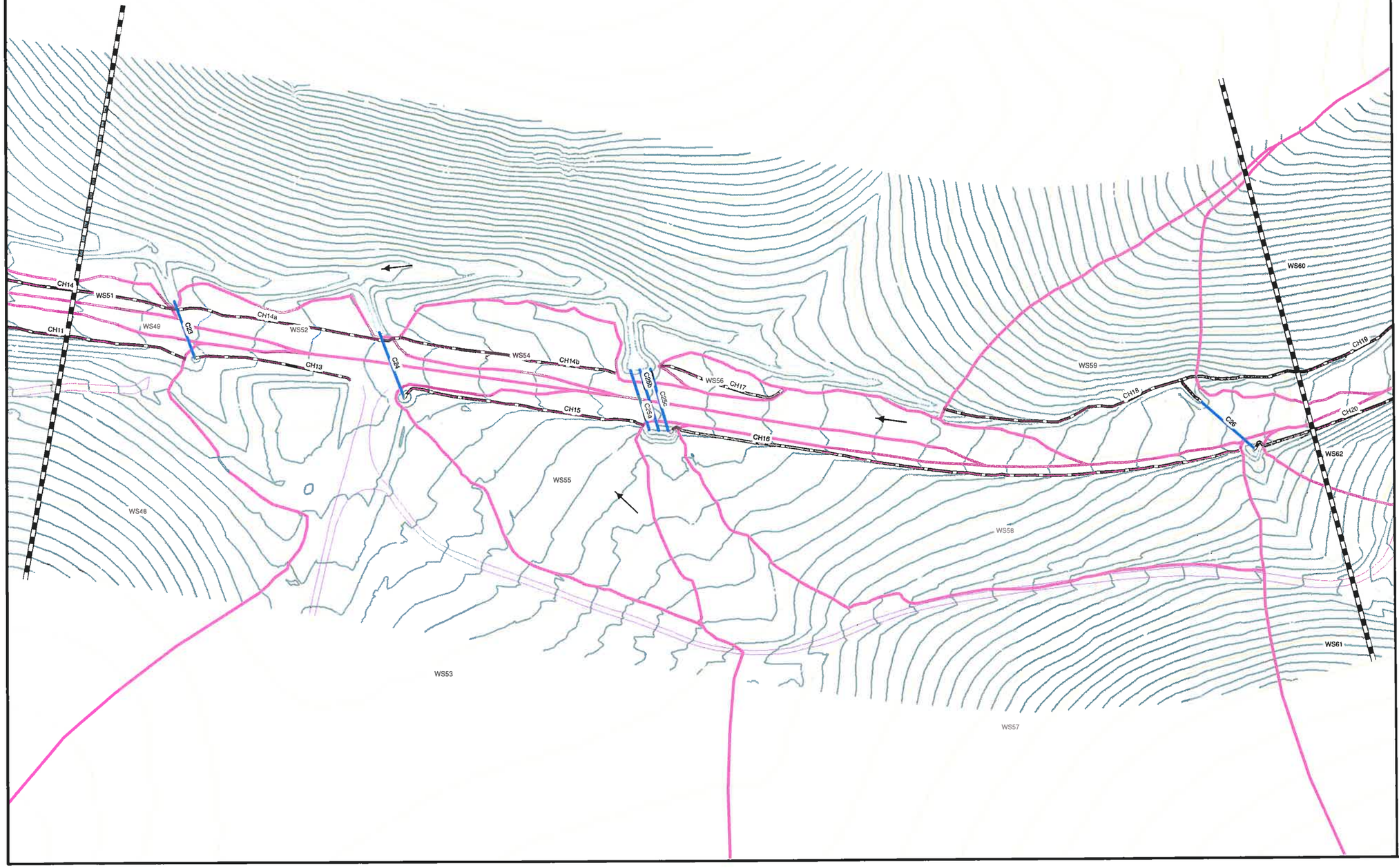
Figure 2.9 - Existing Features

USA Parkway-Pass/Fail Drainage Analysis

Storey County, Nevada

September 2012



NORTH

0 100 200

FEET

Legend

- Flow Direction
- Match Line
- Culverts
- Channels
- DIs
- Curb & Gutter
- Watersheds
- 20-foot contours

NOTES:
Aerial topography by AeroTech Mapping:
1-foot contour intervals
Background by USA Imagery

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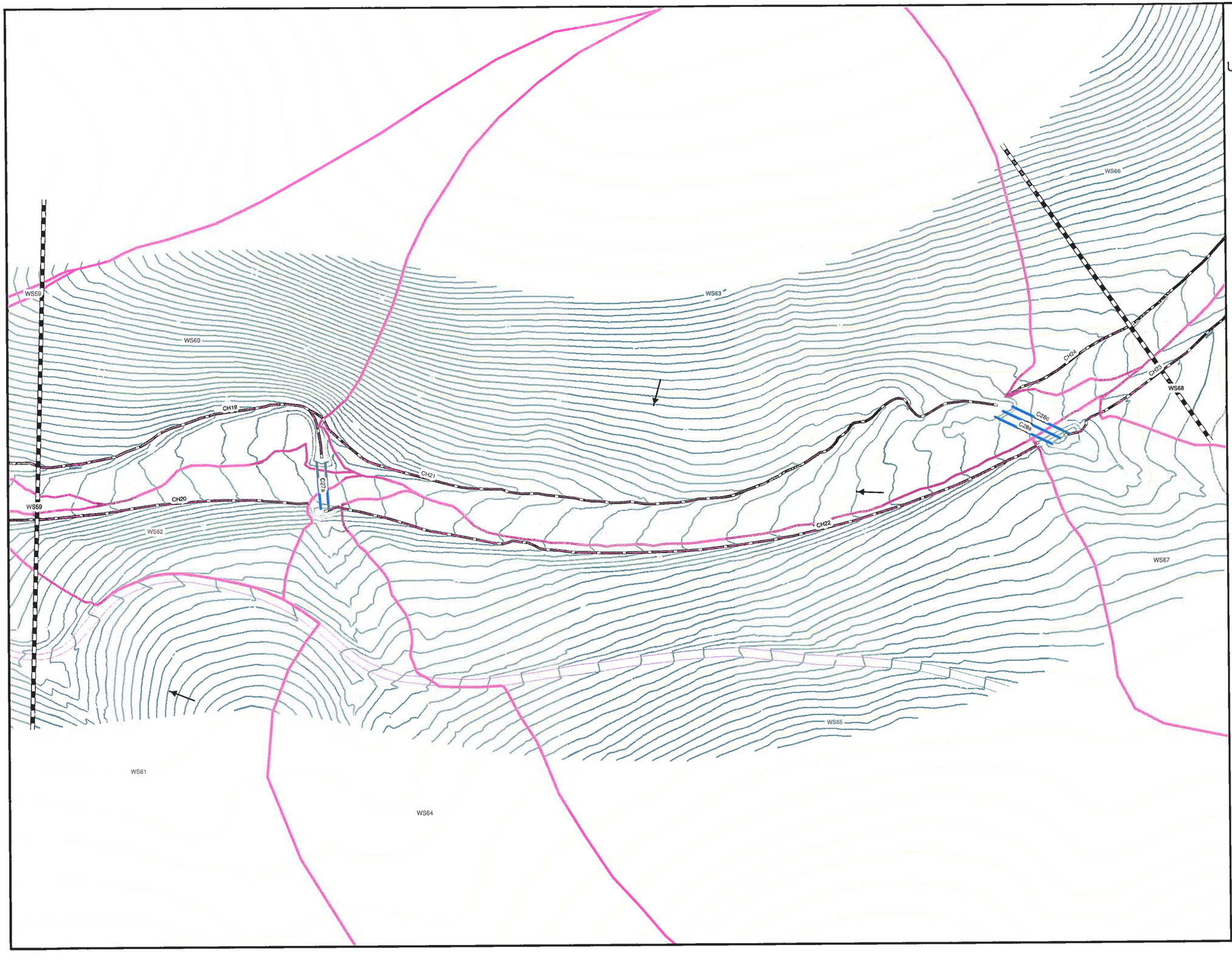
Figure 2.10- Existing Features

USA Parkway-Pass/Fail Drainage Analysis

Storey County, Nevada

September 2012



NORTH

0 100 200

FEET

Legend

- Flow Direction
- Match Line
- Culverts
- Channels
- DIs
- Curb & Gutter
- Watersheds
- 20-foot contours

NOTES:
Aerial topography by AeroTech Mapping:
1-foot contour intervals
Background by USA Imagery

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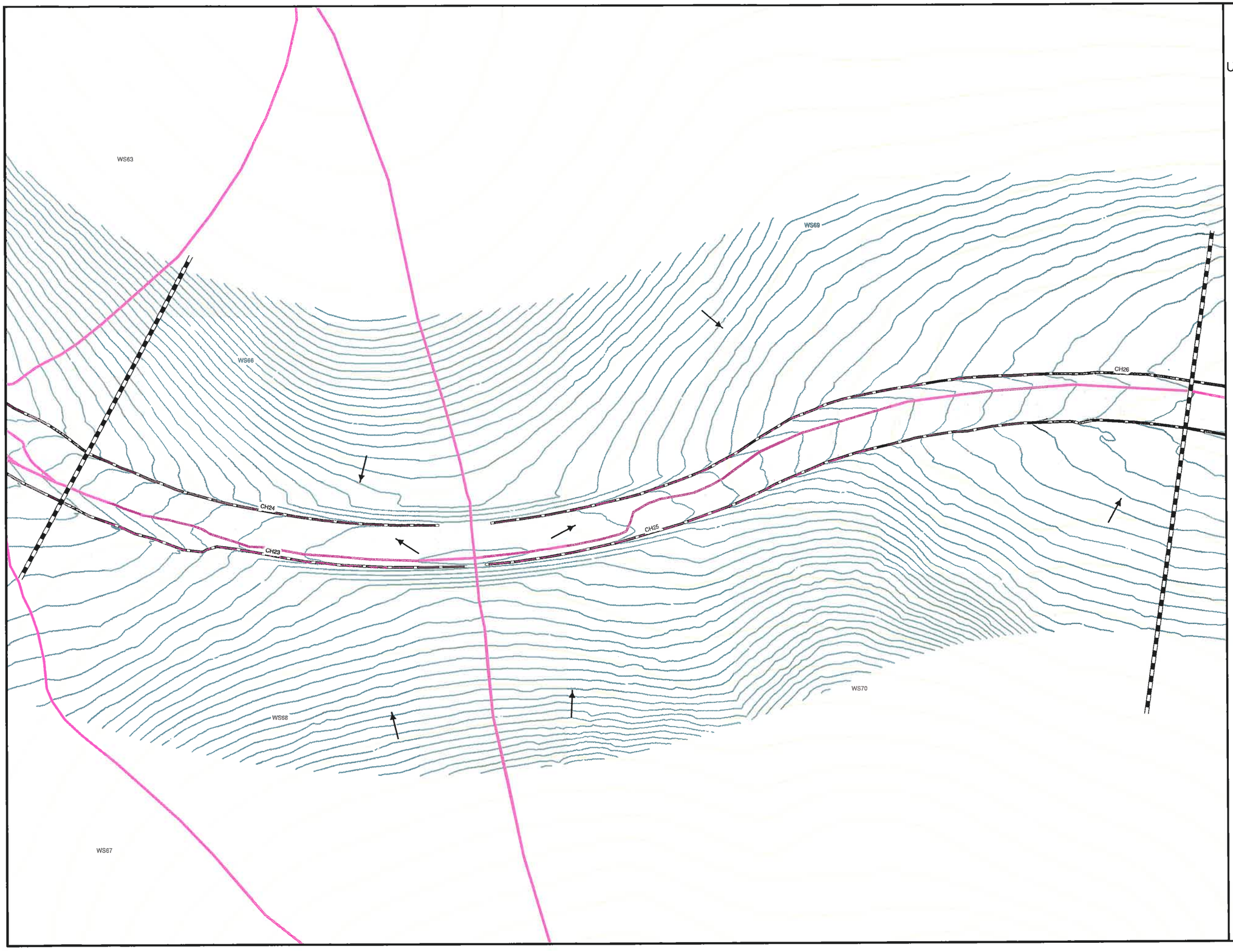
Figure 2.11 - Existing Features

USA Parkway-Pass/Fail Drainage Analysis

Storey County, Nevada

September 2012



NORTH

0 100 200

FEET

Legend

- Flow Direction
- Match Line
- Culverts
- Channels
- DIs
- Curb & Gutter
- Watersheds
- 20-foot contours

NOTES:
Aerial topography by AeroTech Mapping:
1-foot contour intervals
Background by USA Imagery

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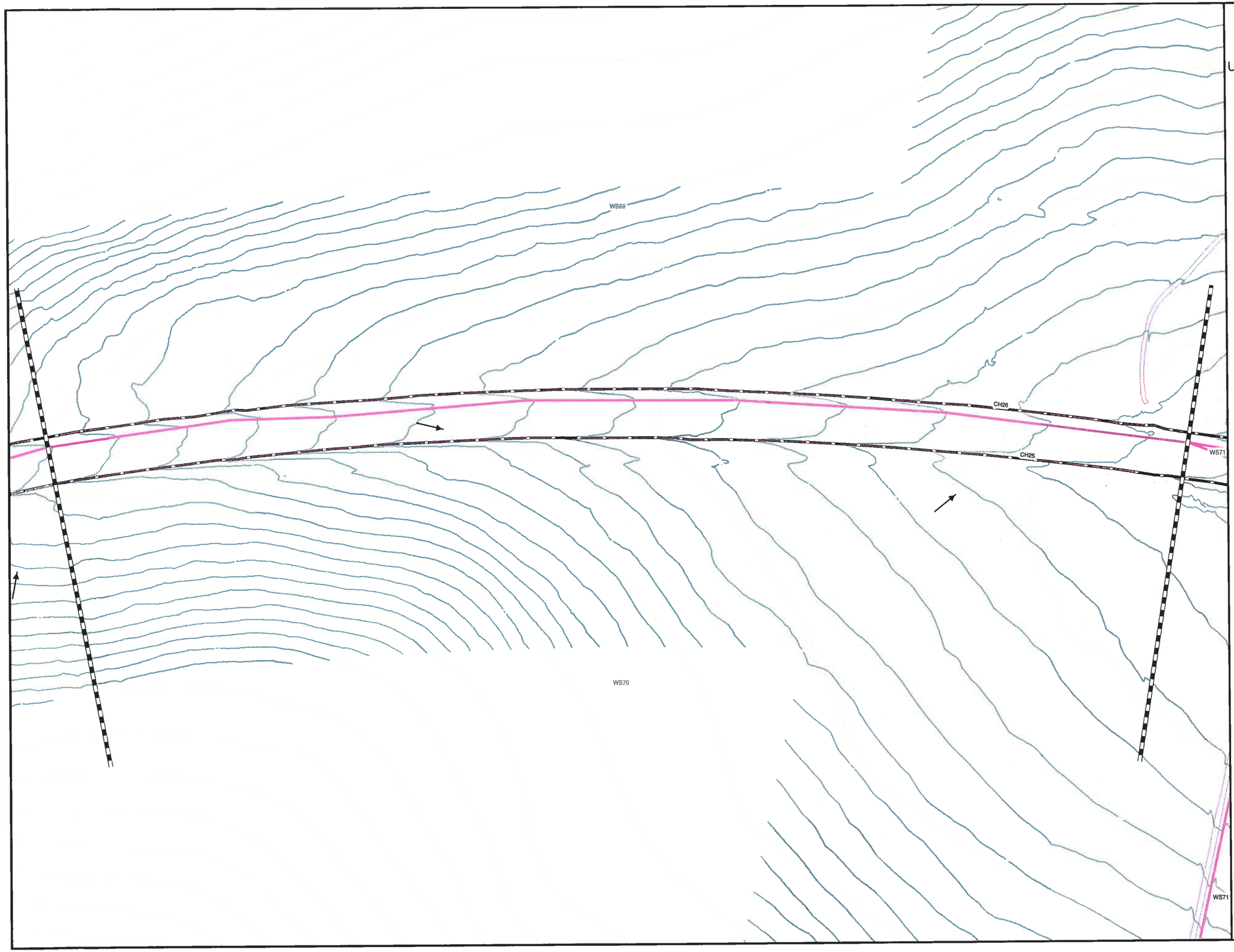

Figure 2.12- Existing Features

USA Parkway-Pass/Fail Drainage Analysis

Storey County, Nevada

September 2012

NORTH

0 100 200

FEET

Legend

- Flow Direction
- Match Line
- Culverts
- Channels
- DIs
- Curb & Gutter
- Watersheds
- 20-foot contours

NOTES:
Aerial topography by AeroTech Mapping:
1-foot contour intervals
Background by USA Imagery

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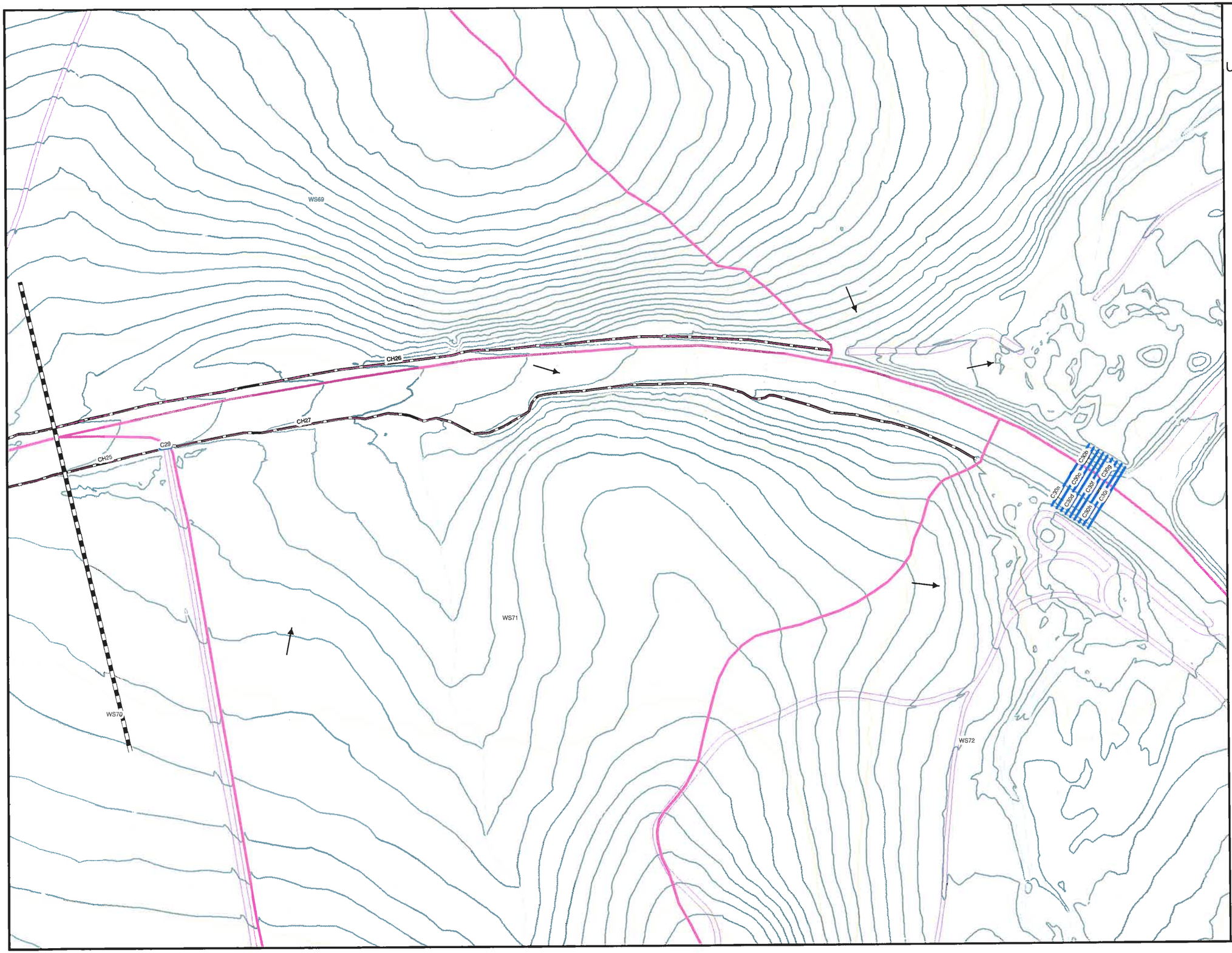
Figure 2.13- Existing Features

USA Parkway-Pass/Fail Drainage Analysis

Storey County, Nevada

September 2012



NORTH

0 100 200

FEET

Legend

- Flow Direction
- Match Line
- Culverts
- Channels
- DIs
- Curb & Gutter
- Watersheds
- 20-foot contours

NOTES:
Aerial topography by AeroTech Mapping:
1-foot contour intervals
Background by USA Imagery

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APPENDIX A

Hydrologic and Hydraulic Analysis

Table/Supporting Documentation No.	Table/Supporting Documentation Name
1	Hydrologic Soil Groups
2	Rational Method C Calculations
3	Combined Watersheds Rational Method C Calculations
4	SCS Curve Number Calculations
5	SCS Lag Time Calculations
6	USGS Regression Equations Calculations
7	Peak Flow Calculations
8	Culvert Analysis
9	Drop Inlet Analysis
10	Channel Analysis
11	Curb & Gutter/Barrier Rail Analysis
12	Culvert Inlet/Outlet Treatment Deficiencies

Table 1
Hydrologic Soil Groups

	Not Rated		Total	B		B Total	C	C Total	D								D Total	Grand Total
LABEL	Pits	Water		Patna	Perazzo		Sagouape		Cleaver	Devada	Doorkiss	Fulstone	Lapon	Manogue	Olac	Old Camp	Xman	
WS01		0.13	0.13				0.04	0.04										0.17
WS02		0.15	0.15				0.03	0.03										0.18
WS03							0.19	0.19										0.19
WS04							0.30	0.30										0.30
WS05							0.19	0.19										0.19
WS06				0.05		0.05	0.17	0.17										0.22
WS07				0.78		0.78												0.78
WS08				0.07		0.07												0.07
WS09				1.83	0.00	1.83												1.83
WS10				0.10	0.03	0.13												0.13
WS11				0.36	0.02	0.38												0.38
WS12				0.92		0.92												0.92
WS13				0.37		0.37												0.37
WS14				3.73		3.73												3.73
WS15				0.85		0.85												0.85
WS16	0.05		0.05	0.48		0.48												0.53
WS17				0.33		0.33												0.33
WS18	0.36		0.36	0.01		0.01												0.37
WS19	0.52		0.52	0.22		0.22												0.74
WS20	0.39		0.39															0.39
WS21	0.88		0.88		0.00	0.00												0.88
WS22	0.13		0.13		0.10	0.10												0.24
WS23	0.03		0.03		0.06	0.06												0.09
WS24					0.28	0.28						0.27					0.27	0.55
WS25					0.27	0.27						0.68					0.68	0.95
WS26									0.68			0.89					1.57	1.57
WS27					0.92	0.92						8.38		4.60			12.97	13.89
WS28												0.82					0.82	0.82
WS29									101.46	1.07	428.03	499.88	1407.88	6.66	1843.84	1094.77	5383.58	5383.58
WS30									4.56								4.56	4.56
WS31									10.61								10.61	10.61
WS32									36.01								36.01	36.01
WS33									4.27								4.27	4.27
WS34									6.70								6.70	6.70
WS35									6.25								6.25	6.25
WS36									1.00								1.00	1.00
WS37									2.81								2.81	2.81
WS38									29.81								29.81	29.81
WS39									7.32				1.74				9.06	9.06
WS40									18.20				0.88				19.08	19.08
WS41												0.40	4.95				5.35	5.35
WS42									2.45			10.50	1.28				14.23	14.23
WS43												2.75					2.75	2.75
WS44												10.78					10.78	10.78
WS45												19.92	0.16				20.08	20.08
WS46												15.24	0.31				15.55	15.55
WS47											1922.50	6.34	360.05		0.13		2289.02	2289.02
WS48											24.88		8.60				33.47	33.47
WS49											0.93		0.16				1.10	1.10
WS50											0.01		0.41				0.42	0.42
WS51											1.10						1.10	1.10
WS52											0.92						0.92	0.92
WS53											39.76		0.00				39.76	39.76
WS54											2.24						2.24	2.24
WS55											3.56						3.56	3.56
WS56											0.26						0.26	0.26

Table 1
Hydrologic Soil Groups

	Not Rated		Total	B		B Total	C	C Total	D								D Total	Grand Total
LABEL	Pits	Water		Patna	Perazzo		Sagouspe		Cleaver	Devada	Doorkiss	Fulstone	Lapon	Manogue	Olac	Old Camp	Xman	
WS57											202.92							202.92	202.92
WS58											5.76							5.76	5.76
WS59											3.97							3.97	3.97
WS60											12.30							12.30	12.30
WS61											30.71							30.71	30.71
WS62											3.24							3.24	3.24
WS63											33.15							33.15	33.15
WS64											49.37							49.37	49.37
WS65											49.56							49.56	49.56
WS66											14.81							14.81	14.81
WS67											235.13							235.13	235.13
WS68											19.69							19.69	19.69
WS69											241.60							241.60	241.60
WS70											164.21							164.21	164.21
WS71											173.99							173.99	173.99
WS72											8753.25	847.43			167.77		168.57	9937.03	9937.03
Grand Total	2.36	0.28	2.64	10.10	1.68	11.78	0.92	0.92	232.13	1.07	12417.82	1424.28	1786.42	11.26	2011.74	1094.77	168.57	19148.07	19163.40

Note:
Values above are in acres

Table 2
Rational Method C Calculations

Watershed	Total Area (ac)	$C_{unimproved}$			$C_{impervious}$		$C_{combined}$	
		$C_{10\text{-yr}}$	$C_{25\text{-yr}}$	Unimproved Area (ac)	$C_{10,25\text{-yr}}$	Impervious Area (ac)	10-yr	25-yr
WS01	0.45	0.30	0.35	0.00	0.90	0.45	0.90	0.90
WS02	0.44	0.30	0.35	0.00	0.90	0.44	0.90	0.90
WS03	0.19	0.30	0.35	0.00	0.90	0.19	0.90	0.90
WS04	0.30	0.30	0.35	0.00	0.90	0.30	0.90	0.90
WS05	0.19	0.30	0.35	0.00	0.90	0.19	0.90	0.90
WS06	0.22	0.30	0.35	0.00	0.90	0.22	0.90	0.90
WS07	0.78	0.30	0.35	0.31	0.90	0.47	0.66	0.68
WS08	0.07	0.30	0.35	0.07	0.90	0.00	0.30	0.35
WS09	1.83	0.30	0.35	1.08	0.90	0.75	0.55	0.58
WS10	0.13	0.30	0.35	0.09	0.90	0.04	0.50	0.53
WS11	0.38	0.30	0.35	0.16	0.90	0.22	0.64	0.67
WS12	0.92	0.30	0.35	0.60	0.90	0.32	0.51	0.54
WS13	0.37	0.30	0.35	0.25	0.90	0.12	0.49	0.52
WS14	3.73	0.30	0.35	3.40	0.90	0.33	0.35	0.40
WS15	0.85	0.30	0.35	0.53	0.90	0.32	0.53	0.56
WS16	0.53	0.30	0.35	0.31	0.90	0.22	0.54	0.57
WS17	0.33	0.30	0.35	0.03	0.90	0.30	0.84	0.84
WS18	0.37	0.30	0.35	0.08	0.90	0.29	0.78	0.79
WS19	0.74	0.30	0.35	0.29	0.90	0.45	0.66	0.68
WS20	0.39	0.30	0.35	0.11	0.90	0.28	0.73	0.75
WS21	0.88	0.30	0.35	0.26	0.90	0.62	0.72	0.74
WS22	0.24	0.30	0.35	0.01	0.90	0.23	0.88	0.88
WS23	0.09	0.30	0.35	0.01	0.90	0.08	0.86	0.86
WS24	0.55	0.30	0.35	0.04	0.90	0.51	0.86	0.86
WS25	0.95	0.30	0.35	0.56	0.90	0.39	0.54	0.57
WS26	1.57	0.30	0.35	0.38	0.90	1.19	0.75	0.77
WS27	13.89	0.30	0.35	12.42	0.90	1.47	0.36	0.41
WS28	0.82	0.30	0.35	0.81	0.90	0.00	0.30	0.35
WS29	5383.58	NA	NA	NA	NA	NA	NA	NA
WS30	4.56	0.30	0.35	3.17	0.90	1.40	0.48	0.52
WS31	10.61	0.30	0.35	9.52	0.90	1.10	0.36	0.41
WS32	36.01	0.30	0.35	32.48	0.90	3.53	0.36	0.40
WS33	4.27	0.30	0.35	3.88	0.90	0.39	0.35	0.40
WS34	6.70	0.30	0.35	6.28	0.90	0.42	0.34	0.38

Table 2
Rational Method C Calculations

Watershed	Total Area (ac)	$C_{unimproved}$			$C_{impervious}$		$C_{combined}$	
		C_{10-yr}	C_{25-yr}	Unimproved Area (ac)	$C_{10,25-yr}$	Impervious Area (ac)	10-yr	25-yr
WS35	6.25	0.30	0.35	5.78	0.90	0.48	0.35	0.39
WS36	1.00	0.30	0.35	0.48	0.90	0.52	0.61	0.63
WS37	2.81	0.30	0.35	2.52	0.90	0.29	0.36	0.41
WS38	29.81	0.30	0.35	28.19	0.90	1.62	0.33	0.38
WS39	9.06	0.30	0.35	7.79	0.90	1.27	0.38	0.43
WS40	19.08	0.30	0.35	18.45	0.90	0.63	0.32	0.37
WS41	5.35	0.30	0.35	5.12	0.90	0.23	0.33	0.37
WS42	14.23	0.30	0.35	13.27	0.90	0.95	0.34	0.39
WS43	2.75	0.30	0.35	1.43	0.90	1.32	0.59	0.61
WS44	10.78	0.30	0.35	10.26	0.90	0.52	0.33	0.38
WS45	19.68	0.30	0.35	8.55	0.90	11.12	0.64	0.66
WS45a	0.41	0.30	0.35	0.12	0.90	0.29	0.73	0.74
WS46	15.55	0.30	0.35	14.70	0.90	0.85	0.33	0.38
WS47	2289.02	NA	NA	NA	NA	NA	NA	NA
WS48	33.47	0.30	0.35	32.39	0.90	1.08	0.32	0.37
WS49	1.10	0.30	0.35	0.50	0.90	0.60	0.63	0.65
WS50	0.42	0.30	0.35	0.29	0.90	0.13	0.49	0.52
WS51	1.10	0.30	0.35	0.75	0.90	0.34	0.49	0.52
WS52	0.92	0.30	0.35	0.48	0.90	0.44	0.59	0.61
WS53	39.76	0.30	0.35	39.35	0.90	0.41	0.31	0.36
WS54	2.24	0.30	0.35	1.43	0.90	0.80	0.52	0.55
WS55	3.56	0.30	0.35	3.02	0.90	0.54	0.39	0.43
WS56	0.26	0.30	0.35	0.26	0.90	0.00	0.30	0.35
WS57	202.92	NA	NA	NA	NA	NA	NA	NA
WS58	5.76	0.30	0.35	5.75	0.90	0.00	0.30	0.35
WS59	3.97	NA	NA	NA	NA	NA	NA	NA
WS60	12.30	NA	NA	NA	NA	NA	NA	NA
WS61	30.71	NA	NA	NA	NA	NA	NA	NA
WS62	3.24	NA	NA	NA	NA	NA	NA	NA
WS63	33.15	NA	NA	NA	NA	NA	NA	NA
WS64	49.37	NA	NA	NA	NA	NA	NA	NA
WS65	49.56	NA	NA	NA	NA	NA	NA	NA
WS66	14.81	NA	NA	NA	NA	NA	NA	NA
WS67	235.13	NA	NA	NA	NA	NA	NA	NA

Table 2
Rational Method C Calculations

Watershed	Total Area (ac)	$C_{unimproved}$			$C_{impervious}$		$C_{combined}$	
		$C_{10\text{-yr}}$	$C_{25\text{-yr}}$	Unimproved Area (ac)	$C_{10,25\text{-yr}}$	Impervious Area (ac)	10-yr	25-yr
WS68	19.69	NA	NA	NA	NA	NA	NA	NA
WS69	241.60	NA	NA	NA	NA	NA	NA	NA
WS70	164.21	NA	NA	NA	NA	NA	NA	NA
WS71	173.99	NA	NA	NA	NA	NA	NA	NA
WS72	9937.03	NA	NA	NA	NA	NA	NA	NA

Notes:
A runoff coefficient of 0.90 was applied for impervious areas.
A runoff coefficient of 0.30 was applied for unimproved areas in the 10-year event.
A runoff coefficient of 0.35 was applied for unimproved areas in the 25-year event.
Runoff coefficient development is not applicable for watersheds greater than 100 acres or watersheds that combine to greater than 100
See the Curve Number table for all watersheds labeled "NA" above.

Table 3
Combined Watersheds
Rational Method C Calculations

Feature	Contributing Watersheds	Combined Watersheds		
		Area (ac)	Weighted C 10-yr	Weighted C 25-yr
DI09, BR06, CG04	9, 11	2.21	0.56	0.59
CG07	10, 13	0.50	0.49	0.52
C03	16, 17	0.86	0.66	0.68
DI17, C04	19, 21	1.62	0.69	0.71
DI18	18, 20	0.76	0.75	0.77
C05	18, 19, 20, 21	2.37	0.71	0.73
C11, CH04	33, 34	10.97	0.34	0.39
C13, CH05	35, 37, 38, 40, 42, 43, 45, 45a	95.01	0.41	0.45
C14, CH06	37, 38, 40, 42, 43, 45, 45a	88.76	0.41	0.45
CH07a	39, 41	14.41	0.36	0.41
C15	38, 40, 42, 43, 45, 45a	85.95	0.41	0.45
C16, CH06a	40, 42, 43, 45, 45a	56.14	0.45	0.49
C18, CH06b	42, 43, 45, 45a	37.06	0.52	0.55
C19, CH08	43, 45, 45a	22.83	0.63	0.66
CH09	44, 46	26.34	0.33	0.38
C20, CH10	45, 45a	20.08	0.64	0.66
CH14	51, 52	2.02	0.53	0.56

Notes:
Example Calculation: C10yr(WS9+WS11) = ((0.55*1.83)+(0.64*0.38))/(1.83+0.38) = 0.56

Table 4
SCS Curve Number
Calculations

Watershed	Total Area (ac)	Total Area (sq. mi.)	$CN_{unimproved}$						$CN_{impervious}$			$CN_{combined}$
			Hydro Soil Group B	Hydro Soil Group B Area (ac)	Hydro Soil Group C	Hydro Soil Group C Area (ac)	Hydro Soil Group D	Hydro Soil Group D Area (ac)	Impervious	Impervious Area (ac)	Impervious Area (%)	
WS29+	5435.94	8.494	67	0.00	80	0.00	85	5384.51	98	51.43	0.9	85.0
WS47+	2322.50	3.629	67	0.00	80	0.00	85	2322.00	98	0.49	0.0	85.0
WS57+	208.68	0.326	67	0.00	80	0.00	85	208.68	98	0.00	0.0	85.0
WS59	3.97	0.006	67	0.00	80	0.00	85	3.33	98	0.63	16.0	85.0
WS60	12.30	0.019	67	0.00	80	0.00	85	12.05	98	0.25	2.0	85.0
WS61	30.71	0.048	67	0.00	80	0.00	85	30.71	98	0.01	0.0	85.0
WS62	3.24	0.005	67	0.00	80	0.00	85	2.79	98	0.44	13.7	85.0
WS63	33.15	0.052	67	0.00	80	0.00	85	31.51	98	1.64	4.9	85.0
WS64	49.37	0.077	67	0.00	80	0.00	85	49.24	98	0.13	0.3	85.0
WS65	49.56	0.077	67	0.00	80	0.00	85	49.35	98	0.22	0.4	85.0
WS66	14.81	0.023	67	0.00	80	0.00	85	13.63	98	1.17	7.9	85.0
WS67	235.13	0.367	67	0.00	80	0.00	85	235.13	98	0.00	0.0	85.0
WS68	19.69	0.031	67	0.00	80	0.00	85	19.66	98	0.03	0.1	85.0
WS69	241.60	0.377	67	0.00	80	0.00	85	240.94	98	0.65	0.3	85.0
WS70	164.21	0.257	67	0.00	80	0.00	85	159.74	98	4.47	2.7	85.0
WS71	173.99	0.272	67	0.00	80	0.00	85	171.54	98	2.44	1.4	85.0
WS72	9937.03	15.527	67	0.00	80	0.00	85	9936.12	98	0.91	0.0	85.0

Notes:
CN values based on Technical Release 55 Urban Hydrology for Small Watersheds manual.
Cover type of "Sagebrush with grass understory" was applied.
A Hydrologic Condition of "Poor - <30% ground cover" was applied.
See HMS Time of Concentration Table for all contributing watersheds for watersheds denoted above with a "+".

Table 5
Existing Conditions
SCS Lag Time Calculations

Concentration Point	Contributing Watersheds	Total Area (ac)	TLAG (Basins < 2000 acres)						TLAG (Basins >2000 acres)					
			L (ft)	CN	S	Slope (%)	Tlag (hr)	Tlag (min)	L (mi)	Lc (mi)	Kn	S (ft/mi)	Tlag (hr)	Tlag (min)
C10	29, 31, 36, 39, 41, 44, 46	5435.94	-	-	-	-	-	-	5.34	3.15	0.10	367.03	2.12	127.03
C22	47, 48	2322.50	-	-	-	-	-	-	3.92	2.16	0.10	408.07	1.66	99.47
C25	57, 58	208.68	7181	85.0	1.76	17.6	0.31	18.64	-	-	-	-	-	-
WS59	59	3.97	1005	87.08	1.48	16.0	0.06	3.76	-	-	-	-	-	-
WS60	60	12.30	1987	85.27	1.73	19.8	0.10	6.24	-	-	-	-	-	-
WS61	61	30.71	2578	85.00	1.76	23.5	0.12	7.12	-	-	-	-	-	-
WS62	62	3.24	874	86.77	1.52	68.0	0.03	1.65	-	-	-	-	-	-
WS63	63	33.15	2362	85.64	1.68	14.9	0.14	8.13	-	-	-	-	-	-
WS64	64	49.37	3085	85.03	1.76	24.0	0.14	8.12	-	-	-	-	-	-
WS65	65	49.56	3677	85.06	1.76	23.5	0.16	9.42	-	-	-	-	-	-
WS66	66	14.81	1405	86.03	1.62	18.6	0.08	4.74	-	-	-	-	-	-
WS67	67	235.13	7632	85.00	1.76	14.3	0.36	21.69	-	-	-	-	-	-
WS68	68	19.69	2230	85.02	1.76	16.2	0.13	7.63	-	-	-	-	-	-
WS69	69	241.60	6690	85.04	1.76	5.5	0.52	31.36	-	-	-	-	-	-
WS70	70	164.21	5764	85.35	1.72	10.6	0.33	19.88	-	-	-	-	-	-
WS71	71	173.99	6787	85.18	1.74	9.5	0.40	24.06	-	-	-	-	-	-
WS72	72	9937.03	-	-	-	-	-	-	7.94	3.52	0.10	249.33	2.67	160.16

Notes:
Peak flows to concentration points are a combination of offsite and onsite flows.
For basins < 2000 acres:
$S = (1000/CN)-10$
$Tlag = (L^{0.8}(S+1)^{0.7})/(1900*Slope^{0.5})$
For basins > 2000 acres:
$Tlag = 22.1*Kn*(L*L_c/S^{0.5})^{0.33}$
Kn = 0.1 for shrub and brush

Table 6
USGS Regression Calculations

WS29

Area (sq. mi.)	8.5
Mean Basin Elevation (ft.)	5040
Latitude (Dec. Degrees)	39.52

Q2 =	28.14	cfs
Q5 =	128.74	cfs
Q10=	301.08	cfs
Q25=	750.33	cfs
Q50=	1312.20	cfs
Q100=	2103.23	cfs

WS70 thru 72

Area (sq. mi.)	16.1
Mean Basin Elevation (ft.)	5680
Latitude (Dec. Degrees)	39.47

Q2 =	65.59	cfs
Q5 =	241.13	cfs
Q10=	500.30	cfs
Q25=	1083.46	cfs
Q50=	1745.12	cfs
Q100=	2615.19	cfs

Notes:
Analysis based on USGS Fact Sheet 123-98, September, 1999
Region 5 Equations were applied.
The mean basin elevation for both watersheds 29 and 70-72 are located below the minimum limit of 5770' (see applicable ranges in USGS Fact Sheet).
However, a physically lower mean elevation was considered to yield conservative peak flows.
The latitude for WS29 was just outside of the applicable range of 36.44-39.50 degrees.

Table 7
Existing Conditions
Peak Flow Calculations

Concentration Point	Feature	Contributing Watersheds	Total Area (ac)	Time of Concentration														Precipitation		Runoff				Methodology
				Initial Sheet Flow					Shallow Conc. Flow				Channel Flow				Total	Intensity (in/hr)		C		Q (cfs)		
				L_i (ft)	n	P_2 (in)	S (ft/ft)	T_i (min)	L_s(ft)	S (ft/ft)	V(ft/s)	T_{t1} (min)	L_t (ft)	S (ft/ft)	V (ft/s)	T_{t2} (min)	T_c(min)	10-yr	25-yr	10yr	25-yr	10-yr	25-yr	
DI01	DI01, BR01	1	0.45	57	0.011	1.25	0.025	1.13	0	0.000	0.0	0.00	394	0.017	2.6	2.50	5.00	2.52	3.31	0.90	0.90	1.0	1.3	Rational
DI02	DI02	Bypass 1, 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Rational
DI03	DI03, BR04	3	0.19	57	0.011	1.25	0.034	1.00	0	0.000	0.0	0.00	187	0.017	2.7	1.17	5.00	2.52	3.31	0.90	0.90	0.4	0.6	Rational
DI04	DI04, BR02	2	0.44	35	0.011	1.25	0.029	0.73	0	0.000	0.0	0.00	424	0.017	2.6	2.70	5.00	2.52	3.31	0.90	0.90	1.0	1.3	Rational
DI05	DI05	Bypass 2, 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Rational
DI06	DI06, BR03	4	0.30	99	0.011	1.25	0.032	1.59	74	0.034	3.7	0.33	188	0.014	2.4	1.28	5.00	2.52	3.31	0.90	0.90	0.7	0.9	Rational
DI07	DI07, CG02	5	0.19	99	0.011	1.25	0.019	1.97	20	0.030	3.5	0.10	98	0.031	3.6	0.46	5.00	2.52	3.31	0.90	0.90	0.4	0.6	Rational
DI08	DI08, BR05	6	0.22	99	0.011	1.25	0.035	1.53	22	0.027	3.3	0.11	168	0.029	3.5	0.81	5.00	2.52	3.31	0.90	0.90	0.5	0.7	Rational
DI09	DI09, BR06, CG04	9, 11	2.21	99	0.130	1.25	0.041	10.36	122	0.200	4.5	0.46	690	0.034	3.8	3.05	13.87	1.65	2.18	0.56	0.59	2.1	2.9	Rational
DI10	DI10, CG03	7	0.78	23	0.050	1.25	0.085	1.14	0	0.000	0.0	0.00	624	0.033	3.7	2.80	10.00	1.91	2.52	0.66	0.68	1.0	1.3	Rational
DI11	DI11, C01	8	0.07	36	0.130	1.25	0.318	2.04	0	0.000	0.0	0.00	58	0.058	2.4	0.40	10.00	1.91	2.52	0.30	0.35	0.0	0.1	Rational
DI12	DI12, CG08	12	0.92	12	0.011	1.25	0.099	0.19	0	0.000	0.0	0.00	565	0.044	4.2	2.22	10.00	1.91	2.52	0.51	0.54	0.9	1.2	Rational
CG06	CG06	11	0.38	47	0.011	1.25	0.042	0.79	0	0.000	0.0	0.00	723	0.041	4.1	2.91	5.00	2.52	3.31	0.64	0.67	0.6	0.8	Rational
CG07	CG07	10, 13	0.50	99	0.050	1.25	0.061	4.15	22	0.114	3.4	0.11	583	0.041	4.1	2.35	10.00	1.91	2.52	0.49	0.52	0.5	0.7	Rational
DI13	DI13, CG09a	14	3.73	99	0.130	1.25	0.050	9.59	556	0.005	0.7	13.73	198	0.026	3.2	1.02	24.34	1.26	1.66	0.35	0.40	1.7	2.5	Rational
DI14	DI14, CG10a	15	0.85	27	0.050	1.25	0.074	1.36	0	0.000	0.0	0.00	558	0.016	2.6	3.60	5.00	2.52	3.31	0.53	0.56	1.1	1.6	Rational
DI15	DI15, CG09b, C02	17	0.33	50	0.011	1.25	0.045	0.81	0	0.000	0.0	0.00	339	0.012	2.2	2.57	5.00	2.52	3.31	0.84	0.84	0.7	0.9	Rational
DI16	DI16, CG10b	16	0.53	26	0.050	1.25	0.076	1.30	0	0.000	0.0	0.00	366	0.011	2.2	2.82	5.00	2.52	3.31	0.54	0.57	0.7	1.0	Rational
C03	C03	16, 17	0.86	26	0.050	1.25	0.076	1.30	0	0.000	0.0	0.00	366	0.011	2.2	2.82	5.00	2.52	3.31	0.66	0.68	1.4	1.9	Rational
CG11	CG11	19	0.74	99	0.011	1.25	0.015	2.15	0	0.000	0.0	0.00	401	0.017	2.6	2.53	5.00	2.52	3.31	0.66	0.68	1.2	1.7	Rational
CG13	CG13	21	0.88	96	0.011	1.25	0.018	1.97	0	0.000	0.0	0.00	509	0.009	2.0	4.31	6.27	2.36	3.11	0.72	0.74	1.5	2.0	Rational
DI17	DI17, C04	19, 21	1.62	96	0.011	1.25	0.018	1.97	0	0.000	0.0	0.00	509	0.009	2.0	4.31	6.27	2.36	3.11	0.69	0.71	2.7	3.6	Rational
CG14	CG14	20	0.39	52	0.011	1.25	0.019	1.16	0	0.000	0.0	0.00	417	0.011	2.1	3.24	5.00	2.52	3.31	0.73	0.75	0.7	1.0	Rational
CG12	CG12	18	0.37	12	0.011	1.25	0.052	0.24	0	0.000	0.0	0.00	445	0.017	2.7	2.79	5.00	2.52	3.31	0.78	0.79	0.7	1.0	Rational
DI18	DI18	18, 20	0.76	52	0.011	1.25	0.019	1.16	0	0.000	0.0	0.00	417	0.011	2.1	3.24	5.00	2.52	3.31	0.75	0.77	1.4	1.9	Rational
C05	C05	18, 19, 20, 21	2.37	96	0.011	1.25	0.018	1.97	0	0.000	0.0	0.00	593	0.013	2.3	4.30	6.26	2.37	3.11	0.71	0.73	4.0	5.4	Rational
DI19	DI19, CG16, C06	25	0.95	99	0.011	1.25	0.010	2.53	186	0.013	1.9	1.65	421	0.012	2.2	3.21	7.40	2.23	2.93	0.54	0.57	1.1	1.6	Rational
DI20	DI20, CG17, C07	24	0.55	35	0.011	1.25	0.029	0.73	0	0.000	0.0	0.00	631	0.013	2.3	4.57	5.30	2.48	3.26	0.86	0.86	1.2	1.5	Rational
DI21	DI21, CG18, C08	27	13.89	99	0.130	1.25	0.051	9.57	2063	0.036	1.9	18.17	594	0.011	2.1	4.66	32.41	1.03	1.36	0.36	0.41	5.2	7.7	Rational
DI22	DI22, CG19	26	1.57	43	0.011	1.25	0.056	0.66	0	0.000	0.0	0.00	1991	0.047	4.4	7.52	8.18	2.13	2.81	0.75	0.77	2.5	3.4	Rational
C09	C09	28	0.82	99	0.130	1.25	0.030	11.78	61	0.181	4.2	0.24	361	0.020	1.8	3.40	15.41	1.57	2.06	0.30	0.35	0.4	0.6	Rational
C10	C10	29, 31, 36, 39, 41, 44, 46	5435.94	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	301.1	750.3 *	Regression
CH01	CH01	31	10.61	99	0.050	1.25	0.040	4.88	621	0.036	1.9	5.45	1790	0.038	3.7	8.15	18.49	1.46	1.92	0.36	0.41	5.6	8.3	Rational

Table 7
Existing Conditions
Peak Flow Calculations

Concentration Point	Feature	Contributing Watersheds	Total Area (ac)	Time of Concentration														Precipitation		Runoff				Methodology
				Initial Sheet Flow					Shallow Conc. Flow				Channel Flow				Total	Intensity (in/hr)		C		Q (cfs)		
				L_i (ft)	n	P_2 (in)	S (ft/ft)	T_i (min)	L_s(ft)	S (ft/ft)	V(ft/s)	T_{t1} (min)	L_i (ft)	S (ft/ft)	V (ft/s)	T_{t2} (min)	T_c(min)	10-yr	25-yr	10yr	25-yr	10-yr	25-yr	
CH02	CH02	30	4.56	22	0.050	1.25	0.053	1.31	0	0.000	0.0	0.00	1726	0.042	3.3	8.64	10.00	1.91	2.52	0.48	0.52	4.2	6.0	Rational
DI24	DI24, CH03	32	36.01	99	0.050	1.34	0.020	6.22	810	0.033	1.8	7.42	1820	0.006	2.0	15.17	28.81	1.13	1.48	0.36	0.40	14.6	21.6	Rational
C11	C11, CH04	33, 34	10.97	99	0.050	1.34	0.020	6.21	614	0.015	2.0	5.24	416	0.012	2.3	2.99	14.45	1.66	2.17	0.34	0.39	6.3	9.3	Rational
C12	C12	34	6.70	99	0.050	1.34	0.020	6.21	614	0.015	2.0	5.24	0	0.000	0.0	0.00	11.46	1.86	2.43	0.34	0.38	4.2	6.3	Rational
C13	C13, CH05	35, 37, 38, 40, 42, 43, 45, 45a	95.01	99	0.050	1.34	0.349	1.99	2029	0.006	1.2	28.08	5101	0.025	4.8	17.90	47.97	0.84	1.10	0.41	0.45	32.3	46.7	Rational
C14	C14, CH06	37, 38, 40, 42, 43, 45, 45a	88.76	99	0.050	1.34	0.349	1.99	2029	0.006	1.2	28.08	4533	0.021	4.3	17.45	47.52	0.84	1.11	0.41	0.45	30.7	44.3	Rational
CH07	CH07	36	1.00	85	0.011	1.34	0.041	1.24	0	0.000	0.0	0.00	756	0.053	2.8	4.51	5.75	2.48	3.25	0.61	0.63	1.5	2.1	Rational
CH07a	CH07a	39, 41	14.41	99	0.050	1.34	0.020	6.24	399	0.020	2.3	2.91	2409	0.020	3.7	11.00	20.16	1.44	1.88	0.36	0.41	7.5	11.0	Rational
C15	C15	38, 40, 42, 43, 45, 45a	85.95	99	0.050	1.34	0.349	1.99	2029	0.006	1.2	28.08	4228	0.019	5.1	13.95	44.02	0.89	1.17	0.41	0.45	31.6	45.6	Rational
C16	C16, CH06a	40, 42, 43, 45, 45a	56.14	99	0.050	1.34	0.349	1.99	2029	0.006	1.2	28.08	2644	0.014	4.2	10.54	40.61	0.94	1.24	0.45	0.49	23.9	34.0	Rational
C17	C17	41	5.35	99	0.050	1.34	0.020	6.24	399	0.020	2.3	2.91	406	0.005	1.8	3.87	13.02	1.75	2.29	0.33	0.37	3.1	4.6	Rational
C18	C18, CH06b	42, 43, 45, 45a	37.06	99	0.050	1.34	0.349	1.99	2029	0.006	1.2	28.08	2008	0.014	3.9	8.58	38.65	0.97	1.27	0.52	0.55	18.7	26.1	Rational
C19	C19, CH08	43, 45, 45a	22.83	99	0.050	1.34	0.349	1.99	2029	0.006	1.2	28.08	1036	0.019	4.1	4.24	34.31	1.03	1.35	0.63	0.66	14.9	20.3	Rational
CH09	CH09	44, 46	26.34	99	0.130	1.34	0.040	10.15	741	0.038	1.9	6.35		#VALUE!	4.3	#VALUE!	#VALUE!	1.29	1.69	0.33	0.38	11.3	16.9	Rational
C20	C20, CH10	45, 45a	20.08	99	0.050	1.34	0.349	1.99	2029	0.006	1.2	28.08	186	0.041	4.3	0.72	30.79	1.08	1.42	0.64	0.66	13.9	18.8	Rational
C21	C21, CH10a	45a	0.41	36	0.011	1.34	0.065	0.51	0	0.000	0.0	0.00	676	0.033	2.4	4.66	5.17	2.55	3.34	0.73	0.74	0.8	1.0	Rational
C22	C22	47, 48	2322.50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	444.2	645.6	SCS
CH11	CH11	48	33.47	99	0.130	1.34	0.121	6.52	1182	0.166	4.1	4.85	1188	0.043	4.6	4.30	15.66	1.60	2.09	0.32	0.37	17.1	25.7	Rational
CH12	CH12	50	0.42	45	0.050	1.34	0.034	2.71	0	0.000	0.0	0.00	288	0.045	2.3	2.13	5.00	2.57	3.37	0.49	0.52	0.5	0.7	Rational
CH14	CH14	51, 52	2.02	99	0.011	1.34	0.069	1.13	416	0.048	4.5	1.56	1497	0.041	2.7	9.10	11.79	1.84	2.40	0.53	0.56	2.0	2.7	Rational
CH14a	CH14a	52	0.92	99	0.011	1.34	0.069	1.13	416	0.048	4.5	1.56	364	0.044	2.4	2.49	10.00	1.96	2.56	0.59	0.61	1.1	1.4	Rational
CH14b	CH14b	54	2.24	99	0.011	1.47	0.067	1.09	957	0.050	4.5	3.51	309	0.045	2.9	1.79	10.00	2.01	2.63	0.52	0.55	2.3	3.2	Rational
C23	C23, CH13	53	39.76	99	0.130	1.47	0.071	7.71	2059	0.123	3.5	9.83	961	0.087	4.7	3.44	20.97	1.45	1.89	0.31	0.36	17.6	26.8	Rational
C24	C24, CH15	55	3.56	99	0.130	1.47	0.089	7.04	632	0.066	2.6	4.12	60	0.166	3.2	0.32	11.48	1.91	2.50	0.39	0.43	2.7	3.9	Rational
C25	C25	57, 58	208.68	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	121.8	186.2	SCS
CH16	CH16	58	5.76	99	0.050	1.47	0.232	2.23	169	0.169	4.1	0.69	967	0.054	3.4	4.77	10.00	2.01	2.63	0.30	0.35	3.5	5.3	Rational
CH17	CH17	56	0.26	37	0.050	1.47	0.054	1.81	0	0.000	0.0	0.00	220	0.045	1.8	2.09	10.00	2.01	2.63	0.30	0.35	0.2	0.2	Rational
CH18	CH18	59, 60, 61, 62, 63, 64, 65, 66, 67, 68	451.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	246.2	378.1	SCS
C26	C26	61, 62	33.95	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31.5	48.2	SCS
CH19	CH19	60, 63, 64, 65, 66, 67, 68	414.02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	217.7	334.7	SCS
CH20	CH20	62	3.24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.9	7.3	SCS
C27	C27	64, 65	98.93	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	85.7	131.5	SCS
CH21	CH21	63, 66, 67, 68	302.78	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	146.7	223.6	SCS

Table 7
Existing Conditions
Peak Flow Calculations

Concentration Point	Feature	Contributing Watersheds	Total Area (ac)	Time of Concentration														Precipitation		Runoff				Methodology
				Initial Sheet Flow					Shallow Conc. Flow				Channel Flow				Total	Intensity (in/hr)		C		Q (cfs)		
				L_i (ft)	n	P_2 (in)	S (ft/ft)	T_i (min)	L_s(ft)	S (ft/ft)	V(ft/s)	T_{t1} (min)	L_i (ft)	S (ft/ft)	V (ft/s)	T_{t2} (min)	T_c(min)	10-yr	25-yr	10yr	25-yr	10-yr	25-yr	
CH22	CH22	65	49.56	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	41.7	63.9	SCS
C28	C28	67, 68	254.82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	132.0	201.4	SCS
CH23	CH23	68	19.69	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	18.4	28.2	SCS
CH24	CH24	66	14.81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17.5	26.4	SCS
C29	C29, CH25	70	164.21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	93.1	142.9	SCS
CH26	CH26	69	241.60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	94.8	147.0	SCS
CH27	CH27	71, 70	338.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	179.6	275.8	SCS
C30	C30	70, 71, 72	10275.22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	500.3	1083.5 **	Regression

Notes:
* Peak flow also analyzed with SCS methodology: Q_{25} = 2869 cfs
** Peak flow also analyzed with SCS methodology: Q_{25} = 4405 cfs
SCS methodology was applied for watersheds greater than 100 acres or watersheds that combine to greater than 100 acres. See SCS methodology tables for SCS data and results.
Rational Method was applied for watersheds under 100 acres.
USGS Regression Region 5 equations were applied where indicated.
P_2 equals the 2-yr, 24 hr rainfall depth.
Channel velocities were calculated using Manning's Formula in FlowMaster, under the following assumptions: Small Roadside channels - n=0.035, 3:1 side slopes, 1' depth;
Moderate Roadside/Offsite channels - n=0.045, 3' bottom width, 3:1 side slopes, 2' depth; Large Offsite channels - n=0.050, 5' bottom width, 3:1 side slopes, 3' depth.
$V_{shallowconc.\ nearly\ bare} = 9.965*S^{0.5}$
$V_{shallowconc.\ disturbed\ unpaved} = 16.135*S^{0.5}$
$V_{shallowconc.\ paved} = 20.328*S^{0.5}$
$T_i = (0.42*L_i*n)^{0.8}/P_2^{0.5}/S^{0.4}$
$T_{t1} = L_s/V/60$
$T_{t2} = L_f/(60*V)$
Manning's values for sheet flow: 0.011 for paved/smooth surfaces; 0.05 for disturbed surfaces (fallow); 0.13 for natural range surfaces.

Table 8
Culvert Analysis

Existing Label	Culvert Description	Invert Elevations		Slope (ft/ft)	Length (ft)	Maximum Allowable Headwater (ft)	Entrance Type	Capacity (cfs)	Peak Flow (cfs)	
		Upstream (ft)	Downstream (ft)						10-Year	25-Year
C01	36" CMP	4289.24	4286.11	0.021	148	4293.2	DI11	49.0	0.0	0.1
C02	12" PVC	4341.80	4341.02	0.009	83	4343.8	DI15	4.6	0.7	0.9
C03	12" PVC	4340.71	4340.04	0.023	29	4343.9	C02, DI16	6.3	1.4	1.9
C04	12" PVC	4334.97	4334.41	0.007	84	4337.2	DI17	4.7	2.7	3.6
C05	12" PVC	4334.04	4332.17	0.045	42	4337.4	C04, DI18	6.5	4.0	5.4
C06	12" PVC	4341.64	4338.27	0.025	136	4343.1	DI19	3.5	1.1	1.6
C07	12" PVC	4338.34	4337.37	0.031	32	4341.9	DI20	6.7	1.2	1.5
C08*	12" PVC	4347.64	4347.21	0.005	86	4349.1	DI21	3.4	5.2	7.7
C09	18" CMP	4347.62	4339.95	0.050	155	4351.3	Headwall	13.5	0.4	0.6
C10a	52" CMP	4339.97	4338.00	0.008	261	4355.0	Projected	526.9	301.1	750.3 **
C10b	52" CMP	4340.16	4338.00	0.008	261	4355.0	Projected			
C10c	52" CMP	4340.28	4338.00	0.009	261	4355.0	Projected			
C11a	36" CMP	4492.30	4492.00	0.002	135	4503.0	Projected	286.8	6.6	9.8
C11b	36" CMP	4492.40	4492.00	0.003	128	4503.0	Projected			
C11c	36" CMP	4492.24	4492.00	0.002	127	4503.0	Projected			
C11d	36" CMP	4492.28	4492.00	0.002	130	4503.0	Projected			
C12	18" RCP	4507.25	4505.90	0.016	83	4516.5	Projected	26.0	4.2	6.3
C13a	42" CMP	4524.00	4518.00	0.055	110	4529.0	Projected	139.7	34.1	49.3
C13b	42" CMP	4524.00	4518.00	0.055	109	4529.0	Projected			
C14a	42" CMP	4561.83	4553.79	0.059	135	4566.3	Headwall	144.7	32.3	46.6
C14b	42" CMP	4561.82	4555.38	0.048	135	4566.3	Headwall			
C15a	3X4 RCP	4577.67	4576.52	0.020	59	4581.0	Headwall	185.1	31.5	45.5
C15b	3X4 RCP	4577.70	4576.46	0.021	59	4581.0	Headwall			
C15c	3X4 RCP	4577.72	4576.48	0.021	59	4581.0	Headwall			
C16a	3X4 RCP	4620.10	4617.26	0.012	234	4622.7	Headwall	86.0	24.0	34.1
C16b	3X4 RCP	4620.16	4617.23	0.012	234	4622.7	Headwall			
C17	24" RCP	4630.72	4629.57	0.011	102	4633.5	Projected	21.0	3.1	4.6
C18a	36" Corr. Plastic	4629.03	4628.18	0.006	154	4633.5	Projected	81.1	18.9	26.4
C18b	36" Corr. Plastic	4628.90	4628.04	0.006	155	4633.5	Projected			
C19	24" RCP	4639.02	4638.23	0.007	121	4642.5	Projected	23.7	15.1	20.5
C20	24" RCP	4650.40	4647.96	0.022	109	4653.0	Projected	19.7	13.9	18.9
C21	24" CMP	4664.42	4661.11	0.027	122	4667.0	Projected	15.5	0.8	1.0
C22a	72" CMP	4700.53	4700.05	0.004	116	4711.0	Projected	1761.4	444.2	645.6
C22b	72" CMP	4700.85	4699.78	0.009	116	4711.0	Projected			
C22c	72" CMP	4700.72	4699.85	0.007	131	4711.0	Projected			
C22d	72" CMP	4700.60	4699.69	0.006	151	4711.0	Projected			
C22e	72" CMP	4701.23	4699.92	0.008	171	4711.0	Projected			
C22f	72" CMP	4702.87	4700.19	0.014	191	4711.0	Projected			

Table 8
Culvert Analysis

Existing Label	Culvert Description	Invert Elevations		Slope (ft/ft)	Length (ft)	Maximum Allowable Headwater (ft)	Entrance Type	Capacity (cfs)	Peak Flow (cfs)	
		Upstream (ft)	Downstream (ft)						10-Year	25-Year
C23	48" CMP	4796.29	4794.40	0.016	115	4803.5	Projected	117.6	18.2	27.7
C24	48" CMP	4813.65	4811.94	0.013	130	4821.0	Projected	116.6	2.7	3.9
C25a	72" CMP	4837.10	4835.18	0.016	119	4844.0	Projected	625.9	121.8	186.2
C25b	72" CMP	4837.24	4835.25	0.016	123	4844.0	Projected			
C25c	72" CMP	4837.14	4835.41	0.014	123	4844.0	Projected			
C26	72" CMP	4895.32	4892.00	0.025	132	4907.0	Projected	335.2	31.5	48.2
C27a	72" CMP	4941.39	4940.22	0.012	102	4949.0	Projected	471.5	85.7	131.5
C27b	72" CMP	4941.34	4940.62	0.007	100	4949.0	Projected			
C28a	72" CMP	5032.00	5022.00	0.072	139	5040.0	Projected	890.0	132.0	201.4
C28b	72" CMP	5029.00	5022.00	0.050	139	5040.0	Projected			
C28c	72" CMP	5030.00	5024.00	0.043	139	5040.0	Projected			
C29	13.5" PVC	4949.50	4949.25	0.009	27	4951.5	Projected	5.9	93.1	142.9
C30a	90" CMP	4909.00	4907.00	0.013	155	4925.5	Projected	5167.0	500.3	1083.5 **
C30b	90" CMP	4910.35	4907.25	0.020	155	4925.5	Projected			
C30c	90" CMP	4910.00	4908.00	0.013	155	4925.5	Projected			
C30d	90" CMP	4909.75	4908.00	0.011	156	4925.5	Projected			
C30e	90" CMP	4910.40	4907.90	0.016	156	4925.5	Projected			
C30f	90" CMP	4909.75	4908.10	0.011	156	4925.5	Projected			
C30g	90" CMP	4908.90	4908.05	0.005	156	4925.5	Projected			
C30h	90" CMP	4909.00	4908.15	0.005	156	4925.5	Projected			
C30i	90" CMP	4911.00	4907.80	0.021	155	4925.5	Projected			

Notes:
Calculated IE by giving pipe 1.5' of cover
Calculated IE to have 0.5% slope in specified direction
Based on topo
Yellow highlighting indicates locations where culvert capacity is exceeded by 25-year event.
*Pipe information estimated, unable to remove inlet grate, no outlet found.
See Table 7 for Peak Flow calculations.
Culverts with drop inlet entrances were modeled as headwall entrances.
Culverts were analyzed as un-clogged and with free outfall at outlet.
Culverts analyzed with HY-8 software.
** 25-yr peak flow reflects Regression Equation methodology. See Table 7 for notes regarding peaks using SCS methodology.

Table 9
Drop Inlet Calculations

Existing Label	Existing Type	Location	Gutter/ Roadway Longitudinal Slope (ft/ft)	Gutter Cross-Slope (ft/ft)	Gutter Width (ft)	Pavement Cross-Slope (ft/ft) or Channel Side Slope (H:V)	Manning's n	# of Grates	Grate Width (ft)	Grate Length (ft)	Slotted Drain Length (ft)	10-Year					
												Peak Flow (cfs)	Slotted Drain Interception (cfs)	Drop Inlet Interception (cfs)	Bypass (cfs)	Existing Spread (ft)	Allowable Spread (ft)
DI01	P 1-7/8 x 4	Barrier Rail	0.015	-	-	0.015	0.015	1	2.0	2.5	-	1.0	-	0.6	0.4	7.8	8.0
DI02	P 1-7/8 x 4	Barrier Rail	sag	-	-	0.015	0.015	1	2.0	2.5	-	0.5	-	0.5	0.0	9.0	8.0
DI03	P 1-7/8 x 4	Barrier Rail	0.010	-	-	0.015	0.015	1	2.0	2.5	-	0.4	-	0.3	0.1	6.0	8.0
DI04	P 1-7/8 x 4	Barrier Rail	0.015	-	-	0.015	0.015	1	2.0	2.5	-	1.0	-	0.6	0.4	7.8	8.0
DI05	P 1-7/8 x 4	Barrier Rail	sag	-	-	0.015	0.015	1	2.0	2.5	-	0.7	-	0.7	0.0	10.8	8.0
DI06	P 1-7/8 x 4	Barrier Rail	0.010	-	-	0.015	0.015	1	2.0	2.5	-	0.7	-	0.4	0.3	7.4	8.0
DI07	P 1-7/8 x 4	Median	0.023	-	-	0.024	0.015	1	2.0	2.5	6.5	0.4	0.3	0.1	0.0	3.8	8.0
DI08	P 1-7/8 x 4	Barrier Rail	0.034	-	-	0.015	0.015	1	2.0	2.5	13.0	0.5	0.4	0.1	0.0	5.2	8.0
DI09	45 Tilt	Barrier Rail	0.024	-	-	0.019	0.015	1	1.5	3.0	-	2.1	-	1.0	1.1	8.1	8.0
DI10	45 Tilt Combo	Median	0.025	-	-	0.021	0.015	1	1.5	3.0	-	1.0	-	0.6	0.4	5.8	8.0
DI11	24" diam.	Shoulder	0.033	-	-	10.0	0.025	1	1.8	1.8	-	0.0	-	0.0	0.0	2.3	8.0
DI12	45 Tilt Combo	Curb & Gutter	0.036	0.083	1.5	0.051	0.015	1	1.5	3.0	-	0.9	-	0.9	0.0	2.6	7.5
DI13	45 Tilt Combo	Curb & Gutter	0.034	0.083	1.5	0.064	0.015	1	1.5	3.0	-	1.7	-	1.5	0.2	3.2	7.5
DI14	45 Tilt Combo	Curb & Gutter	0.027	0.083	1.5	0.048	0.015	1	1.5	3.0	-	1.1	-	1.0	0.1	3.1	7.5
DI15	45 Tilt Combo	Curb & Gutter	0.018	0.083	1.5	0.016	0.015	1	1.5	3.0	-	0.7	-	0.6	0.1	4.8	7.5
DI16	45 Tilt Combo	Curb & Gutter	0.022	0.083	1.5	0.033	0.015	1	1.5	3.0	-	0.7	-	0.7	0.0	3.1	7.5
DI17	45 Tilt Combo	Curb & Gutter	sag	0.083	1.5	0.030	0.015	1	1.5	3.0	-	2.7	-	2.7	0.0	6.5	8.0
DI18	45 Tilt Combo	Curb & Gutter	sag	0.083	1.5	0.036	0.015	1	1.5	3.0	-	1.4	-	1.4	0.0	2.5	8.0
DI19	45 Tilt Combo	Curb & Gutter	0.011	0.083	1.5	0.046	0.015	1	1.5	3.0	-	1.1	-	1.0	0.1	3.9	7.5
DI20	45 Tilt Combo	Curb & Gutter	0.034	0.083	1.5	0.023	0.015	1	1.5	3.0	-	1.2	-	1.0	0.2	4.5	8.0
DI21	45 Tilt Combo	Curb & Gutter	0.011	0.083	1.5	0.032	0.015	1	1.5	3.0	-	5.2	-	2.8	2.5	9.3	8.0
DI22	45 Tilt Combo	Curb & Gutter	0.010	0.083	1.5	0.036	0.015	1	1.5	3.0	-	2.5	-	1.7	0.8	6.5	7.5
DI23	24" diam.	Shoulder	0.010	-	-	20.0	0.025	1	1.8	1.8	-	0.0	-	0.0	0.0	0.0	8.0

Table 9
Drop Inlet Calculations

Existing Label	Existing Type	Location	Gutter/ Roadway Longitudinal Slope (ft/ft)	Gutter Cross-Slope (ft/ft)	Gutter Width (ft)	Pavement Cross-Slope (ft/ft) or Channel Side Slope (H:V)	Manning's n	# of Grates	Grate Width (ft)	Grate Length (ft)	Slotted Drain Length (ft)	10-Year					
												Peak Flow (cfs)	Slotted Drain Interception (cfs)	Drop Inlet Interception (cfs)	Bypass (cfs)	Existing Spread (ft)	Allowable Spread (ft)
DI24	24" diam.	Shoulder	0.010	-	-	6.0	0.035	1	1.8	1.8	-	14.6	-	4.1	10.6	11.8	12.0

Notes:
Topography unavailable on roadway over the Truckee River. Feature data approximated.
25% clogging factor applied for inlets on grade. Multiple grates were observed to have debris during site visits.
50% clogging factor applied for inlets in sag.
1" depth and 3' length were applied for local depressions in combination grates.
Curb opening length of 2.83' was applied for combination grates.
DI23 observed to be inoperable: plugged with soil.
Highlighting indicates locations where allowable spread is exceeded.
See Table 7 for Peak Flow calculations.
Drop Inlets analyzed with FlowMaster software.

Table 10
Channel Calculations

Existing Label	Channel Length (ft)	Channel Slope (ft/ft)	Existing Bottom Width (ft)	Existing Left Side Slope (H:V)	Existing Right Side Slope (H:V)	Existing Manning's n	Channel Depth (ft)	Channel Capacity (cfs)	25-Year Peak Flow (cfs)	Hydraulic Radius* (ft)	Applied Shear Stress (lb/ft^3)
CH01	1714	0.059	0.00	6	15	0.035	0.50	10.7	8.7	0.2	0.8
CH02	1714	0.062	0.00	3	6	0.035	1.00	29.4	6.0	0.6	2.1
CH03	1885	0.006	0.00	3	6	0.035	0.50	1.4	21.6	0.2	0.1
CH04	316	0.012	0.00	3	3	0.035	3.00	158.9	9.8	0.5	0.4
CH05	433	0.063	0.00	6	3	0.035	1.00	29.7	49.3	0.5	1.9
CH06	245	0.050	0.00	9	3	0.035	0.50	5.6	46.6	0.3	0.8
CH06a	422	0.009	0.00	6	3	0.035	1.00	11.2	34.1	0.5	0.3
CH06b	256	0.007	0.00	4	4	0.035	1.00	8.8	26.4	0.5	0.2
CH07	774	0.059	0.00	4	4	0.035	1.00	25.5	2.1	0.2	0.7
CH07a	1898	0.028	0.00	9	6	0.035	0.75	15.5	11.0	0.3	0.6
CH08	746	0.014	0.00	6	4	0.035	1.50	46.0	20.5	0.5	0.5
CH09	2453	0.023	0.00	4	6	0.035	0.75	9.3	16.9	0.4	0.5
CH10	401	0.027	0.00	6	6	0.035	1.00	26.1	18.9	0.4	0.7
CH10a	661	0.028	0.00	3	3	0.035	0.50	2.0	1.0	0.2	0.3
CH11	2085	0.047	0.00	6	6	0.035	1.25	62.5	26.1	0.4	1.3
CH12	345	0.038	0.00	6	6	0.035	0.75	14.4	0.7	0.1	0.3
CH13	304	0.051	0.00	9	15	0.035	1.00	72.3	27.7	0.4	1.1
CH14	1147	0.042	0.00	6	9	0.035	1.00	40.9	2.9	0.2	0.5
CH14a	422	0.043	0.00	9	9	0.035	0.50	7.8	1.4	0.1	0.3
CH14b	430	0.048	0.00	6	4	0.035	0.50	4.6	3.2	0.2	0.6
CH15	473	0.044	0.00	3	4	0.035	0.50	3.0	3.9	0.2	0.7
CH16	1113	0.042	0.00	3	4	0.035	0.50	2.9	5.3	0.2	0.6
CH17	250	0.046	0.00	6	6	0.035	0.50	5.4	0.2	0.3	0.7
CH18	531	0.061	3.00	3	3	0.045	6.00	2173.9	378.1	1.6	6.1
CH19	957	0.058	2.00	3	3	0.045	7.00	2939.9	334.7	1.5	5.6
CH20	724	0.061	0.00	2	4	0.035	1.25	34.6	7.3	0.3	1.3
CH21	1651	0.050	1.00	3	3	0.045	4.50	818.6	223.6	1.4	4.2
CH22	1619	0.069	0.00	2	10	0.035	0.50	6.5	63.9	0.2	1.0
CH23	1173	0.044	0.00	4	4	0.035	3.00	411.7	28.2	0.5	1.5
CH24	1101	0.062	0.00	4	6	0.045	3.50	721.5	26.4	0.5	1.9
CH25	4261	0.019	0.00	4	6	0.035	2.00	115.5	142.9	1.0	1.2
CH26	5813	0.018	0.00	4	3	0.035	3.00	228.9	147.0	1.2	1.4
CH27	1839	0.010	0.00	3	4	0.035	5.00	666.3	275.8	1.7	1.1

Notes:
Channel features approximated based on digital topography.
Highlighting indicates locations where full-flow channel capacity is exceeded.
Highlighting indicates locations where channels require riprap protection
See Table 7 for Peak Flow calculations.
Channels analyzed with FlowMaster software.
*When 25-year Peak Flow exceeds the channel capacity the hydraulic radius is based on full flow capacity

Table 11
Curb and Gutter/Barrier Rail Calculations

Label	Length (ft)	Longitudinal Slope (ft/ft)	Gutter Width (ft)	Gutter Cross Slope (ft/ft)	Road Cross Slope (ft/ft)	Manning's n	10-Year		
							Peak Flow (cfs)	Spread (ft)	Allowable Spread (ft)
BR01	358	0.015	-	-	0.015	0.015	1.0	7.8	8.0
BR02	376	0.015	-	-	0.015	0.015	1.0	7.8	8.0
BR03	228	0.010	-	-	0.015	0.015	0.7	7.4	8.0
BR04	352	0.010	-	-	0.015	0.015	0.4	6.0	8.0
BR05	206	0.034	-	-	0.015	0.015	0.5	5.2	8.0
BR06	284	0.024	-	-	0.019	0.015	2.1	8.1	8.0
CG01	671	0.017	1.5	0.083	high side	0.015	0.0	0.0	7.0
CG02	102	0.023	1.5	0.083	0.024	0.015	0.4	2.4	8.0
CG03	619	0.025	1.5	0.083	0.021	0.015	1.0	4.7	8.0
CG04	498	0.029	1.5	0.083	0.013	0.015	1.9	8.4	7.5
CG05	381	0.033	1.5	0.083	high side	0.015	0.0	0.0	7.5
CG06	468	0.047	1.5	0.083	0.034	0.015	0.6	2.2	7.5
CG07	696	0.039	1.5	0.083	0.008	0.015	0.5	3.7	7.5
CG08	569	0.036	1.5	0.083	0.051	0.015	0.9	2.6	7.5
CG09a	565	0.034	1.5	0.083	0.064	0.015	1.7	3.2	7.5
CG09b	379	0.018	1.5	0.083	0.016	0.015	0.7	4.8	7.5
CG10a	575	0.024	1.5	0.083	0.026	0.015	1.1	4.4	7.5
CG10b	366	0.022	1.5	0.083	0.033	0.015	0.7	3.1	7.5
CG11	439	0.011	1.5	0.083	0.030	0.015	1.2	5.1	8.0
CG12	425	0.014	1.5	0.083	0.055	0.015	0.7	2.8	8.0
CG13	391	0.011	1.5	0.083	0.030	0.015	1.5	5.7	8.0
CG14	763	0.012	1.5	0.083	0.060	0.015	0.7	2.8	8.0
CG15	210	0.009	1.5	0.083	0.051	0.015	0.5	2.7	8.0
CG16	625	0.009	1.5	0.083	0.046	0.015	1.1	4.1	7.5
CG17	634	0.010	1.5	0.083	0.034	0.015	1.2	4.9	7.5
CG18	858	0.009	1.5	0.083	0.029	0.015	5.2	10.2	8.0
CG19	755	0.010	1.5	0.083	0.036	0.015	2.5	6.5	7.5
CG20	384	0.064	1.5	0.083	0.018	0.015	0.4	1.5	10.0
CG21	289	0.034	1.5	0.083	high side	0.015	0.0	0.0	7.5

Notes:
Topography unavailable on roadway over the Truckee River. Feature data approximated.
Highlighting indicates locations where allowable spread is exceeded.
See Table 7 for Peak Flow calculations.
Curb & Gutter and Barrier Rail analyzed with FlowMaster software.

Table 12
Culvert Inlet/Outlet Treatment Deficiencies

Culvert #	Inlet Treatment (Y/N)	Outlet Treatment (Y/N)	Culvert End Treatments (Y/N)	Photos (Y/N)	Low Point (Y/N)	Note
C01	N/A	N	N	N	N	DI at Invert, no protection needed
C02	N/A	N/A	N	N	N	DI at Inlet and Outlet, no protection needed
C03	N/A	N	N	N	N	DI at Invert, no protection needed
C04	N/A	N/A	N	N	Y	Flankers are needed (Per NDOT Standards), DI at Inlet and Outlet, no protection needed
C05	N/A	N	N	N	N	DI at Invert, no protection needed
C06	N/A	N	N	N	N	DI at Invert, no protection needed
C07	N/A	N	N	N	N	DI at Invert, no protection needed
C08	N/A	N/A	N	N	N	DI at Inlet and Outlet, no protection needed
C09	N	N	N	N	N	
C10	N	N	N	N	N	
C11	Y	Y	N	Y	N	
C12	Buried	Y	N	Y	N	Culvert Inlet is Buried
C13	N	N	N	Y	N	
C14	Y	Y	N	Y	N	
C15	Y	Y	Y	Y	N	
C16	Y	N	Y	Y	N	
C17	N	Y	N	Y	N	
C18	N	N	N	Y	N	
C19	Y	Y	N	Y	N	
C20	Y	Y	N	Y	N	
C21	N	N	N	N	N	
C22	N	Y	N	Y	N	
C23	N	N	N	Y	N	
C24	N	N	N	Y	N	
C25	N	N	N	Y	N	
C26	N	Y	N	Y	N	
C27	N	N	N	Y	N	
C28	N	Y	N	Y	N	
C29	N	N	N	Y	N	
C30	N	N	N	Y	N	

APPENDIX B

Supporting Hydrologic Data

Table/Supporting Documentation No.	Table/Supporting Documentation Name
-	HEC-HMS Results
-	SCS, Rational, and Regression Methodology Support
-	NOAA Atlas 14 Precipitation
-	Watershed Exhibits

Project: USA_Pkwy_P_F_20120828 Simulation Run: 29 25yr

Start of Run: 16Feb2012, 12:01 Basin Model: 29
End of Run: 17Feb2012, 12:02 Meteorologic Model: 29 25yr
Compute Time: 30Aug2012, 08:02:27 Control Specifications: 24hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
29	8.494	1103.6	17Feb2012, 02:19	1.15

Project: USA_Pkwy_P_F_20120828 Simulation Run: 47 10yr

Start of Run: 16Feb2012, 12:01 Basin Model: 47
End of Run: 17Feb2012, 12:02 Meteorologic Model: 47 10yr
Compute Time: 30Aug2012, 08:02:49 Control Specifications: 24hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
47	3.629	444.2	17Feb2012, 01:50	0.99

Project: USA_Pkwy_P_F_20120828 Simulation Run: 47 25yr

Start of Run: 16Feb2012, 12:01
End of Run: 17Feb2012, 12:02
Compute Time: 30Aug2012, 08:03:05

Basin Model: 47
Meteorologic Model: 47 25yr
Control Specifications: 24hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
47	3.629	645.6	17Feb2012, 01:47	1.39

Project: USA_Pkwy_P_F_20120828 Simulation Run: 57 10yr

Start of Run: 16Feb2012, 12:01 Basin Model: 57
End of Run: 17Feb2012, 12:02 Meteorologic Model: 57 10yr
Compute Time: 30Aug2012, 08:03:30 Control Specifications: 24hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
57	0.326	121.8	17Feb2012, 00:22	1.01

Project: USA_Pkwy_P_F_20120828 Simulation Run: 57 25yr

Start of Run: 16Feb2012, 12:01
End of Run: 17Feb2012, 12:02
Compute Time: 30Aug2012, 08:03:47

Basin Model: 57
Meteorologic Model: 57 25yr
Control Specifications: 24hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
57	0.326	186.2	17Feb2012, 00:22	1.42

Global Summary Results for Run "59 thru 68 10yr"

Project: USA_Pkwy_P_F_20120828 Simulation Run: 59 thru 68 10yr

Start of Run: 16Feb2012, 12:01
End of Run: 17Feb2012, 12:02
Compute Time: 30Aug2012, 08:04:18

Basin Model: 59 thru 68
Meteorologic Model: 59 thru 68 10yr
Control Specifications: 24hr

Show Elements: All Elements Volume Units: (•) IN ( ) AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
67	0.367	125.5	17Feb2012, 00:25	1.01
68	0.031	18.4	17Feb2012, 00:10	1.02
C-28	0.398	132.0	17Feb2012, 00:24	1.01
R-4	0.398	131.9	17Feb2012, 00:24	1.01
66	0.023	17.5	17Feb2012, 00:07	1.12
J-2	0.421	135.6	17Feb2012, 00:24	1.01
R-5	0.421	135.5	17Feb2012, 00:26	1.01
63	0.052	31.2	17Feb2012, 00:11	1.08
CH21	0.473	146.7	17Feb2012, 00:25	1.02
R-10	0.473	146.7	17Feb2012, 00:26	1.02
65	0.077	41.7	17Feb2012, 00:12	1.02
64	0.077	44.4	17Feb2012, 00:11	1.02
C-27	0.154	85.7	17Feb2012, 00:11	1.02
R-9	0.154	85.5	17Feb2012, 00:13	1.02
60	0.019	12.4	17Feb2012, 00:09	1.04
CH19	0.646	217.7	17Feb2012, 00:14	1.02
R-15	0.646	217.8	17Feb2012, 00:15	1.02
61	0.048	29.2	17Feb2012, 00:10	1.01
62	0.005	4.9	17Feb2012, 00:04	1.19
C-26	0.053	31.5	17Feb2012, 00:09	1.03
R-14	0.053	31.3	17Feb2012, 00:11	1.03
59	0.006	5.2	17Feb2012, 00:06	1.22
CH18	0.705	246.2	17Feb2012, 00:14	1.02

Global Summary Results for Run "59 thru 68 25yr"

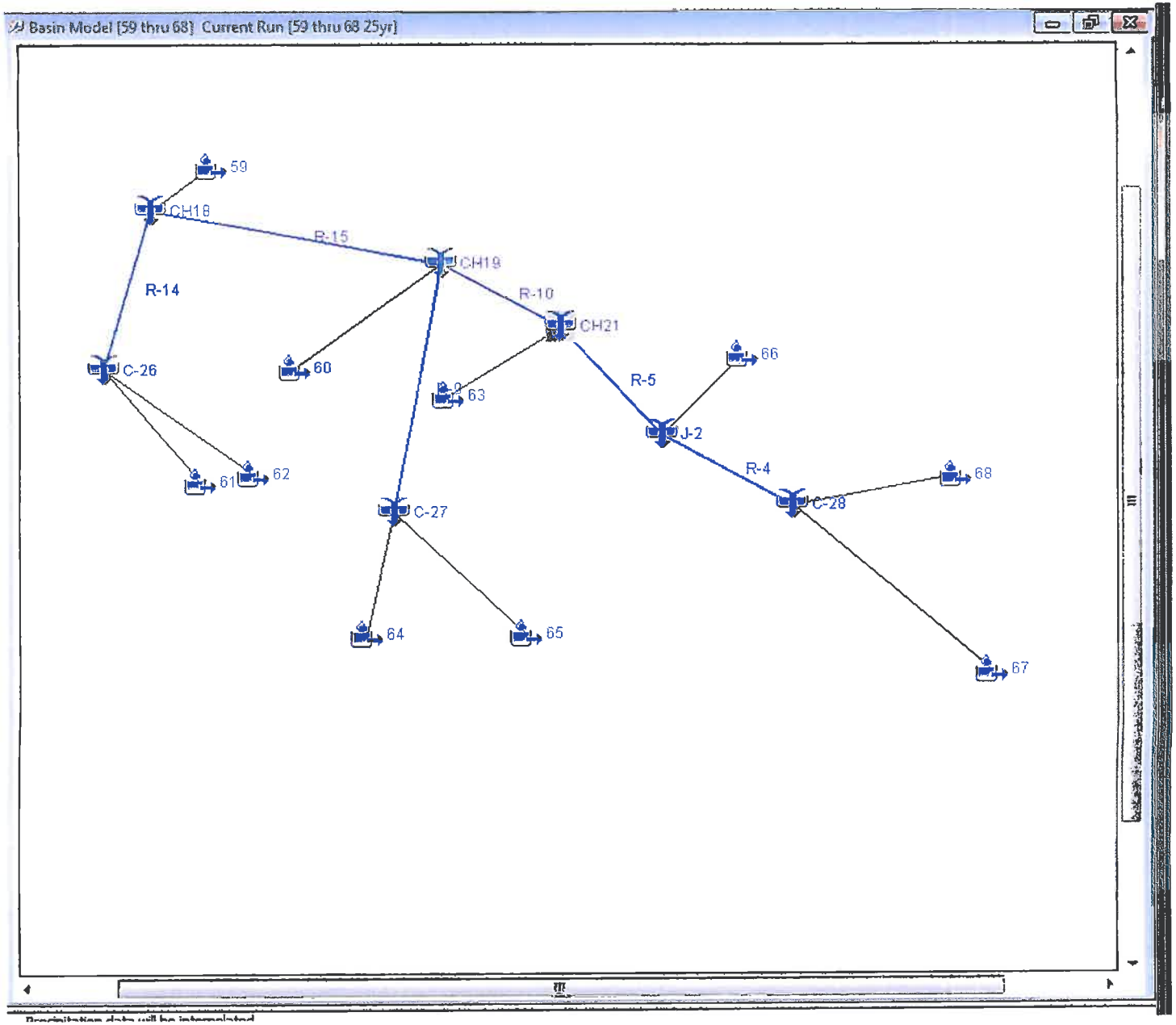
Project: USA_Pkwy_P_F_20120828 Simulation Run: 59 thru 68 25yr

Start of Run: 16Feb2012, 12:01
End of Run: 17Feb2012, 12:02
Compute Time: 30Aug2012, 08:06:15

Basin Model: 59 thru 68
Meteorologic Model: 59 thru 68 25yr
Control Specifications: 24hr

Show Elements: All Elements Volume Units: IN AC-FT Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
67	0.367	191.7	17Feb2012, 00:25	1.42
68	0.031	28.2	17Feb2012, 00:10	1.43
C-28	0.398	201.4	17Feb2012, 00:24	1.42
R-4	0.398	201.4	17Feb2012, 00:24	1.42
66	0.023	26.4	17Feb2012, 00:07	1.54
J-2	0.421	206.8	17Feb2012, 00:24	1.43
R-5	0.421	206.7	17Feb2012, 00:26	1.43
63	0.052	47.3	17Feb2012, 00:11	1.50
CH21	0.473	223.6	17Feb2012, 00:24	1.43
R-10	0.473	223.6	17Feb2012, 00:25	1.43
65	0.077	63.9	17Feb2012, 00:12	1.44
64	0.077	68.1	17Feb2012, 00:11	1.44
C-27	0.154	131.5	17Feb2012, 00:11	1.44
R-9	0.154	131.1	17Feb2012, 00:13	1.43
60	0.019	19.0	17Feb2012, 00:09	1.46
CH19	0.646	334.7	17Feb2012, 00:14	1.43
R-15	0.646	334.2	17Feb2012, 00:15	1.43
61	0.048	44.8	17Feb2012, 00:10	1.43
62	0.005	7.3	17Feb2012, 00:04	1.63
C-26	0.053	48.2	17Feb2012, 00:09	1.45
R-14	0.053	48.0	17Feb2012, 00:10	1.45
59	0.006	7.7	17Feb2012, 00:06	1.66
CH18	0.705	378.1	17Feb2012, 00:14	1.44


Basin Model [59 thru 68] Current Run [59 thru 68 25yr]
59
CH18
R-15
CH19
R-14
R-10
CH21
C-26
60
63
66
R-5
J-2
61
62
R-4
68
C-28
C-27
64
65
67

Project: USA_Pkwy_P_F_20120828 Simulation Run: 69 10yr

Start of Run: 16Feb2012, 12:01
End of Run: 17Feb2012, 12:02
Compute Time: 30Aug2012, 08:09:07

Basin Model: 69
Meteorologic Model: 69 10yr
Control Specifications: 24hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
69	0.377	94.8	17Feb2012, 00:36	0.89

Project: USA_Pkwy_P_F_20120828 Simulation Run: 69 25yr

Start of Run: 16Feb2012, 12:01 Basin Model: 69
End of Run: 17Feb2012, 12:02 Meteorologic Model: 69 25yr
Compute Time: 30Aug2012, 08:09:24 Control Specifications: 24hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
69	0.377	147.0	17Feb2012, 00:36	1.26

Project: USA_Pkwy_P_F_20120828 Simulation Run: 71_70 10yr

Start of Run: 16Feb2012, 12:01
End of Run: 17Feb2012, 12:02
Compute Time: 28Aug2012, 15:35:43

Basin Model: 70 thru 71
Meteorologic Model: 70 + 71 10yr
Control Specifications: 24hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
71	0.272	86.7	17Feb2012, 00:28	0.98
70	0.257	93.1	17Feb2012, 00:23	1.00
Reach-1	0.257	93.0	17Feb2012, 00:27	1.00
70_71	0.529	179.6	17Feb2012, 00:27	0.99

Project: USA_Pkwy_P_F_20120828 Simulation Run: 71_70 25yr

Start of Run: 16Feb2012, 12:01
End of Run: 17Feb2012, 12:02
Compute Time: 28Aug2012, 15:36:38

Basin Model: 70 thru 71
Meteorologic Model: 70 + 71 25yr
Control Specifications: 24hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
71	0.272	133.3	17Feb2012, 00:28	1.40
70	0.257	142.9	17Feb2012, 00:23	1.42
Reach-1	0.257	142.6	17Feb2012, 00:26	1.41
70_71	0.529	275.8	17Feb2012, 00:27	1.40

Project: USA_Pkwy_P_F_20120828 Simulation Run: 72 10yr

Start of Run: 16Feb2012, 12:01
End of Run: 17Feb2012, 12:02
Compute Time: 30Aug2012, 08:10:44

Basin Model: 72+70_71
Meteorologic Model: 72 10yr
Control Specifications: 24hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
72	16.055	1527.3	17Feb2012, 03:01	1.05

Project: USA_Pkwy_P_F_20120828 Simulation Run: 72 25yr

Start of Run: 16Feb2012, 12:01
End of Run: 17Feb2012, 12:02
Compute Time: 30Aug2012, 08:11:01

Basin Model: 72+70_71
Meteorologic Model: 72 25yr
Control Specifications: 24hr

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (IN)
72	16.055	2147.8	17Feb2012, 02:57	1.47

Thick mulches in forests are associated with low retardance factors and reflect high degrees of retardance, as well as high infiltration rates. Hay meadows have relatively low retardance factors. Like thick mulches in forests, stem densities in meadows provide a high degree of retardance to overland flow in small watersheds. Conversely, bare surfaces with little retardance to overland flows are represented by high retardance factors.

The retardance factor is approximately the same as the curve number (CN) as defined in NEH630.09, Hydrologic Soil-Cover Complexes. In practical usage, CN is used as a surrogate for cn´, and the CN tables in NEH 630.09 may be used to approximate cn´ in equations 15–4a and 15–4b. A CN of less than 50, or greater than 95 should not be used in the solution of equations 15–4a and 15–4b (Mockus 1961).

Applications and limitations—The watershed lag equation was developed using data from 24 watersheds ranging in size from 1.3 acres to 9.2 square miles, with the majority of the watersheds being less than 2,000 acres in size (Mockus 1961). Folmar and Miller (2000) revisited the development of this equation using additional watershed data and found that a reasonable upper limit may be as much as 19 square miles.

(b) Velocity method

Another method for determining time of concentration normally used within the NRCS is called the velocity method. The velocity method assumes that time of concentration is the sum of travel times for segments along the hydraulically most distant flow path.

$$T_c = T_{t1} + T_{t2} + T_{t3} + \ldots T_{tn} \qquad \text{(eq. 15–7)}$$

where:
T_c = time of concentration, h
T_{tn} = travel time of a segment n, h
n = number of segments comprising the total hydraulic length

The segments used in the velocity method may be of three types: sheet flow, shallow concentrated flow, and open channel flow.

Sheet flow—Sheet flow is defined as flow over plane surfaces. Sheet flow usually occurs in the headwaters of a stream near the ridgeline that defines the watershed boundary. Typically, sheet flow occurs for no more than 100 feet before transitioning to shallow concentrated flow (Merkel 2001).

A simplified version of the Manning's kinematic solution may be used to compute travel time for sheet flow. This simplified form of the kinematic equation was developed by Welle and Woodward (1986) after studying the impact of various parameters on the estimates.

$$T_t = \frac{0.007(n\ell)^{0.8}}{(P_2)^{0.5} S^{0.4}} \qquad \text{(eq. 15–8)}$$

where:
T_t = travel time, h
n = Manning's roughness coefficient (table 15–1)
ℓ = sheet flow length, ft
P_2 = 2-year, 24-hour rainfall, in
S = slope of land surface, ft/ft

Table 15–1 Manning's roughness coefficients for sheet flow (flow depth generally ≤ 0.1 ft)

Surface description	n [1]
Smooth surface (concrete, asphalt, gravel, or bare soil)	0.011
Fallow (no residue)	0.05
Cultivated soils:	
Residue cover ≤ 20%	0.06
Residue cover > 20%	0.17
Grass:	
Short-grass prairie	0.15
Dense grasses [2]	0.24
Bermudagrass	0.41
Range (natural)	0.13
Woods: [3]	
Light underbrush	0.40
Dense underbrush	0.80

1 The Manning's n values are a composite of information compiled by Engman (1986).
2 Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
3 When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.

This simplification is based on the following assumptions:

- shallow steady uniform flow
- constant rainfall excess intensity (that part of a rain available for runoff) both temporally and spatially
- 2-year, 24-hour rainfall assuming standard NRCS rainfall intensity-duration relations apply (Types I, II, and III)
- minor effect of infiltration on travel time

For sheet flow, the roughness coefficient includes the effects of roughness and the effects of raindrop impact including drag over the surface; obstacles such as litter, crop ridges, and rocks; and erosion and transport of sediment. These n values are only applicable for flow depths of approximately 0.1 foot or less, where sheet flow occurs. Table 15–1 gives roughness coefficient values for sheet flow for various surface conditions.

Kibler and Aron (1982) and others indicated the maximum sheet flow length is less than 100 feet. To support the sheet flow limit of 100 feet, Merkel (2001) reviewed a number of technical papers on sheet flow. McCuen and Spiess (1995) indicated that use of flow length as the limiting variable in the equation 15–8 could lead to less accurate designs, and proposed that the limitation should instead be based on:

$$\ell = \frac{100\sqrt{S}}{n} \qquad \text{(eq. 15–9)}$$

Table 15–2 Maximum sheet flow lengths using the McCuen-Spiess limitation criterion

Cover type	n values	Slope (ft/ft)	Length (ft)
Range	0.13	0.01	77
Grass	0.41	0.01	24
Woods	0.80	0.01	12.5
Range	0.13	0.05	172
Grass	0.41	0.05	55
Woods	0.80	0.05	28

where:
n = Manning's roughness coefficient
ℓ = limiting length of flow, ft
S = slope, ft/ft

Table 15–2 provides maximum sheet flow lengths based on the McCuen-Spiess limiting criteria for various cover type—n value—slope combinations.

Shallow concentrated flow—After approximately 100 feet, sheet flow usually becomes shallow concentrated flow collecting in swales, small rills, and gullies. Shallow concentrated flow is assumed not to have a well-defined channel and has flow depths of 0.1 to 0.5 feet. It is assumed that shallow concentrated flow can be represented by one of seven flow types. The curves in figure 15–4 were used to develop the information in table 15–3.

To estimate shallow concentrated flow travel time, velocities are developed using figure 15–4, in which average velocity is a function of watercourse slope and type of channel (Kent 1964). For slopes less than 0.005 foot per foot, the equations in table 15–3 may be used.

After estimating average velocity using figure 15–4, use equation 15–1 to estimate travel time for the shallow concentrated flow segment.

Open channel flow— Shallow concentrated flow is assumed to occur after sheet flow ends at shallow depths of 0.1 to 0.5 feet. Beyond that channel flow is assumed to occur. Open channels are assumed to begin where surveyed cross-sectional information has been obtained, where channels are visible on aerial photographs, or where bluelines (indicating streams) appear on U.S. Geological Survey (USGS) quadrangle sheets.

Manning's equation or water surface profile information can be used to estimate average flow velocity. Average flow velocity is usually determined for the bankfull elevation.

Manning's equation is:

$$V = \frac{1.49 r^{\frac{2}{3}} s^{\frac{1}{2}}}{n} \qquad \text{(eq. 15–10)}$$

Figure 15–4 Velocity versus slope for shallow concentrated flow

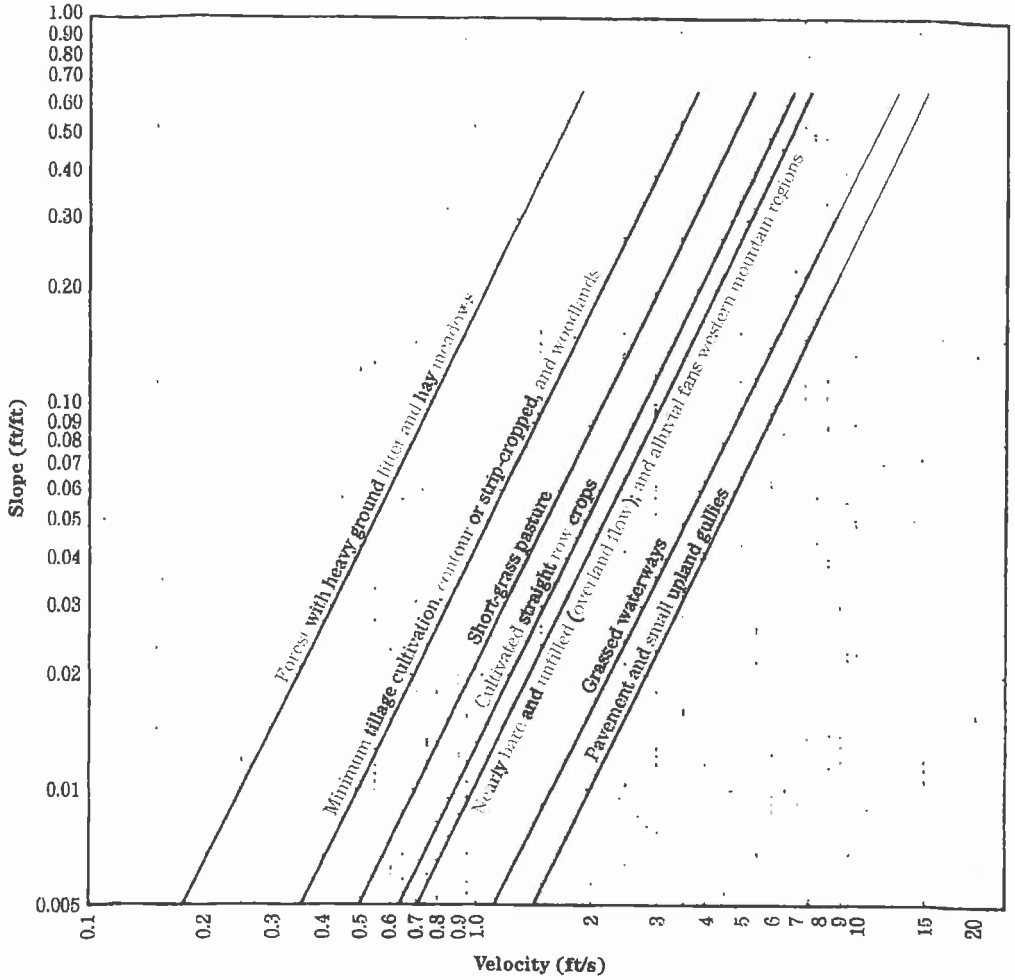


Table 15–3 Equations and assumptions developed from figure 15–4

Flow type	Depth (ft)	Manning's *n*	Velocity equation (ft/s)
Pavement and small upland gullies	0.2	0.025	$V = 20.328(s)^{0.5}$
Grassed waterways	0.4	0.050	$V = 16.135(s)^{0.5}$
Nearly bare and untilled (overland flow); and alluvial fans in western mountain regions	0.2	0.051	$V = 9.965(s)^{0.5}$
Cultivated straight row crops	0.2	0.058	$V = 8.762(s)^{0.5}$
Short-grass pasture	0.2	0.073	$V = 6.962(s)^{0.5}$
Minimum tillage cultivation, contour or strip-cropped, and woodlands	0.2	0.101	$V = 5.032(s)^{0.5}$
Forest with heavy ground litter and hay meadows	0.2	0.202	$V = 2.516(s)^{0.5}$

where:

V = average velocity, ft/s

r = hydraulic radius, ft

$$= \frac{a}{P_w}$$

a = cross-sectional flow area, ft^2

P_w = wetted perimeter, ft

s = slope of the hydraulic grade line (channel slope), ft/ft

n = Manning's n value for open channel flow

Manning's n values for open channel flow can be obtained from standard hydraulics textbooks, such as Chow (1959), and Linsley, Kohler, and Paulhus (1982). Publications dealing specifically with Manning's n values are Barnes (1967); Arcement and Schneider (1989); Phillips and Ingersoll (1998); and Cowen (1956). For guidance on calculating Manning's n values, see NEH630.14, Stage Discharge Relations.

Applications and limitations—The velocity method of computing time of concentration is hydraulically sound and provides the opportunity to incorporate changes in individual flow segments if needed. The velocity method is the best method for calculating time of concentration for an urbanizing watershed or if hydraulic changes to the watercourse are being considered.

Often, the average velocity and valley length of a reach are used to compute travel time through the reach using equation 15–1. If the stream is quite sinuous, the channel length and valley length may be significantly different and it is up to the modeler to determine which is the appropriate length to use for the depth of flow of the event under consideration.

The role of channel and valley storage is important in the development and translation of a flood wave and the estimation of lag. Both the hydraulics and storage may change from storm to storm and the velocity distribution may vary considerably both horizontally and vertically. As a result, actual lag for a watershed may have a large variation. In practice, calculations are typically based on the 2-year frequency discharge event since it is normally assumed that the time of concentration computed using these characteristics is representative of travel time conditions for a wide range of storm events. Welle and Woodward's simplification of Manning's kinematic equation was developed assuming the 2-year, 24-hour precipitation value.

630.1503 Other considerations

(a) Field observations

At the time field surveys to obtain channel data are made, there is a need to observe the channel system and note items that may affect channel efficiency. Observations such as the type of soil materials in the banks and bottoms of the channel; an estimate of Manning's roughness coefficients; the apparent stability or lack of stability of channel; indications of debris flows as evidenced by deposition of coarse sediments adjacent to channels, size of deposited materials, etc., may be significant.

(b) Multiple subarea watersheds

For multiple subarea watersheds, the time of concentration must be computed for each subarea individually, and consideration must be given to the travel time through downstream subareas from upstream subareas. Travel time and attenuation of hydrographs in valley reaches and reservoirs are accounted for using channel and reservoir routing procedures addressed in NEH630.17.

(c) Surface flow

Both of the standard methods for estimating time of concentration, as well as most other methods, assume that flow reaching the channel as surface flow or quick return flow adds directly to the peak of the subarea hydrograph. Locally derived procedures might be developed from data where a major portion of the contributing flow is other than surface flow. This is normally determined by making a site visit to the watershed.

(d) Travel time through bodies of water

The potential for detention is the factor that most strongly influences travel time through a body of water. It is best to divide the watershed such that any potential storage area is modeled as storage.

Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2]	A [3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and I_a = 0.2S. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

RATIONAL FORMULA METHOD
RUNOFF COEFFICIENTS

Land Use or Surface Characteristics	Aver. % Impervious Area	Runoff Coefficients 5-Year (C_5)	Runoff Coefficients 100-Year (C_{100})
Business/Commercial:			
Downtown Areas	85	.82	.85
Neighborhood Areas	70	.65	.80
Residential:			
(Average Lot Size)			
⅛ Acre or Less (Multi-Unit)	65	.60	.78
¼ Acre	38	.50	.65
⅓ Acre	30	.45	.60
½ Acre	25	.40	.55
1 Acre	20	.35	.50
Industrial:	72	.68	.82
Open Space:			
(Lawns, Parks, Golf Courses)	5	.05	.30
Undeveloped Areas:			
Range	0	.20	.50
Forest	0	.05	.30
Streets/Roads:			
Paved	100	.88	.93
Gravel	20	.25	.50
Drives/Walks:	95	.87	.90
Roof:	90	.85	.87

Notes:

1. Composite runoff coefficients shown for Residential, Industrial, and Business/Commercial Areas assume irrigated grass landscaping for all pervious areas. For development with landscaping other than irrigated grass, the designer must develop project specific composite runoff coefficients from the surface characteristics presented in this table.

The regression equations, the average standard errors of prediction, and the equivalent years of record for regions 1, 2, 3, and 5 are given in table 1. The average standard errors of prediction are an average measure of the accuracy of the regression equations when estimating peak-discharge values for ungaged watersheds similar to those that were used to derive the regression equations. The equivalent years of record is the number of years of streamflow record needed to achieve the same accuracy as the regression equation.

Table 1. Flood-peak discharge regression equations and associated statistics for regions 1, 2, 3, and 5 in Nevada (modified from Thomas and others, 1997)

[QT, peak discharge for recurrence interval T, 2 to 100 years, in cubic feet per second; AREA, drainage area, in square miles; PREC, mean annual precipitation, in inches; ELEV, mean basin elevation, in feet above sea level (NGVD of 1929); LAT, latitude in decimal degrees]

Regression equation	Average standard error of prediction, in percent	Equivalent years of record
Region 1 - 165 stations		
(For sites located at elevations greater than elevation threshold from figure 2)		
$Q_2 = 0.124AREA^{0.845}PREC^{1.44}$	59	0.16
$Q_5 = 0.629AREA^{0.807}PREC^{1.12}$	52	.62
$Q_{10} = 1.43AREA^{0.786}PREC^{0.958}$	48	1.34
$Q_{25} = 3.08AREA^{0.768}PREC^{0.811}$	46	2.50
$Q_{50} = 4.75AREA^{0.758}PREC^{0.732}$	46	3.37
$Q_{100} = 6.78AREA^{0.750}PREC^{0.668}$	46	4.19
Region 2 - 108 stations		
$Q_2 = 13.1AREA^{0.713}$	72	0.96
$Q_5 = 22.4AREA^{0.723}$	66	1.80
$Q_{10} = 55.7AREA^{0.727}(ELEV/1,000)^{-0.353}$	61	3.07
$Q_{25} = 84.7AREA^{0.737}(ELEV/1,000)^{-0.438}$	61	4.64
$Q_{50} = 113AREA^{0.746}(ELEV/1,000)^{-0.511}$	64	5.47
$Q_{100} = 148AREA^{0.752}(ELEV/1,000)^{-0.584}$	68	6.05
Region 3 - 35 stations		
$Q_2 = 0.444AREA^{0.649}PREC^{1.15}$	86	0.29
$Q_5 = 1.21AREA^{0.639}PREC^{0.995}$	83	.49
$Q_{10} = 1.99AREA^{0.633}PREC^{0.924}$	80	.77
$Q_{25} = 3.37AREA^{0.627}PREC^{0.849}$	78	1.23
$Q_{50} = 4.70AREA^{0.625}PREC^{0.802}$	77	1.57
$Q_{100} = 6.42AREA^{0.621}PREC^{0.757}$	78	1.92
Region 5 - 37 stations		

$Q_2 = 0.0333AREA^{0.853}(ELEV/1,000)^{2.68}[(LAT - 28)/10]^{4.1}$	135	0.21
$Q_5 = 2.42AREA^{0.823}(ELEV/1,000)^{1.01}[(LAT - 28)/10]^{4.1}$	101	.73
$Q_{10} = 28.0AREA^{0.826}[(LAT - 28)/10]^{4.3}$	84	1.69
$Q_{25} = 426AREA^{0.812}(ELEV/1,000)^{-1.10}[(LAT - 28)/10]^{4.3}$	87	2.62
$Q_{50} = 2,030AREA^{0.798}(ELEV/1,000)^{-1.71}[(LAT - 28)/10]^{4.4}$	91	3.26
$Q_{100} = 7,000AREA^{0.782}(ELEV/1,000)^{-2.18}[(LAT - 28)/10]^{4.6}$	95	3.80

The regression equations for regions 6 and 10 were developed using an iterative regression method (Hjalmarson and Thomas, 1992) and a modified form of the station year statistical analysis method (Fuller, 1914). The regression equations, the estimated average standard errors of regression, and the equivalent years of record for regions 6 and 10 are given in table 2. The average standard error of regression is an estimate of the predictive accuracy of these regression equations and is determined by a direct sampling method.

Table 2. Flood-peak discharge equations and associated statistics for regions 6 and 10 in Nevada (modified from Thomas and others, 1994)

[Q, peak discharge for recurrence interval T, 2 to 100 years, in cubic feet per second; AREA, drainage area, in square miles; ELEV, mean basin elevation, in feet above sea level (NGVD of 1929)]

Estimated average standard error of regression for these equations includes much of the within-station residual variance and therefore is not comparable to standard error of estimate from an ordinary-least-squares regression.

Regression equation	Estimated average standard error of regression, in log units	Equivalent years of record
Region 6 - 80 stations		
$Q_2 = 0$	--	--
$Q_5 = 32AREA^{0.80}(ELEV/1,000)^{-0.66}$	1.47	0.233
$Q_{10} = 590AREA^{0.62}(ELEV/1,000)^{-1.6}$	1.12	.748
$Q_{25} = 3,200AREA^{0.62}(ELEV/1,000)^{-2.1}$	.796	2.52
$Q_{50} = 5,300AREA^{0.64}(ELEV/1,000)^{-2.1}$	1.10	1.75
$Q_{100} = 20,000AREA^{0.51}(ELEV/1,000)^{-2.3}$	1.84	.794
Region 10 - 104 stations		
$Q_2 = 12\ AREA^{0.58}$	1.14	0.618
$Q_5 = 85\ AREA^{0.59}$	.602	3.13
$Q_{10} = 200\ AREA^{0.62}$	.675	3.45
$Q_{25} = 400\ AREA^{0.65}$	.949	2.49
$Q_{50} = 590\ AREA^{0.67}$	.928	3.22
$Q_{100} = 850\ AREA^{0.69}$	1.23	2.22

The approximate ranges of the explanatory watershed variables over which the equations are applicable are shown in table 3. Thomas and others (1997) presented the actual ranges of applicability as two-dimensional clusters of

explanatory variables plotted against one another. The ranges shown in table 3 define a rectangular space that brackets the clusters and, therefore, include pairs of values of the explanatory variables near the corners of the rectangle that are outside of the clusters. Application of the equations for values of the variables near the extremes of a range should be done cautiously. The standard errors increase appreciably when any explanatory watershed variable is near or outside the quoted range.

Table 3. Range of explanatory variables for which regression equations are applicable

[–, not applicable.]

Hydrologic study region	Drainage area, in square miles[1]	Mean basin elevation, in feet above sea level[2]	Mean annual precipitation, in inches	Latitude in decimal degrees
Region 1	0.6-1,060	--	11-43	--
Region 2	0.8–1,680	3,540-7,950	--	--
Region 3	2.2-1,450	--	10-41	--
Region 5	4.1-360	5,770-10,500	--	36.44-39.50
Region 6	0.2-210	4,770–9,960	--	--
Region 10	0.1-1,000	--	--	--

[1]For best results, applications should be limited to basins of less than 200 square miles.

[2]NGVD of 1929.

Improving Estimates With Gaged Data

The U.S. Water Resources Council (1981, appendix 8) described weighting techniques to improve estimates of peak discharge at gaged locations by combining the estimates derived from analysis of gage records with estimates derived by other means, including regression equations.

The weights for these two estimates are based on the length of the stream gage record (in years) and the equivalent years of record of the applicable regression equation. The weighted estimate of peak discharge is computed as:

$$\log Q_T(W) = \frac{N \cdot \log Q_T(G) + EQ \cdot \log Q_T(R)}{N + EQ}$$

where

$Q_T(W)$ is the weighted estimate for recurrence interval T at the gaged site,

$Q_T(G)$ is the estimate of Q_T derived from analysis of the gage records,

$Q_T(R)$ is the estimate of Q_T derived from application of the regression equation,

WS 1 - 31
Point precipitation frequency estimates (inches)
NOAA Atla Volume 1 Version 5
Data type: Precipitation depth
Time series type: Partial duration
Project area: Southwest
Latitude (decimal degrees): 39.5550
Longitude (decimal degrees): -119.4900

PRECIPITATION FREQUENCY ESTIMATES

by duration	1	2	5	10	25	50	100	200	500	1000 years
5-min:	0.1	0.13	0.17	0.21	0.28	0.34	0.41	0.49	0.64	0.76
10-min:	0.15	0.19	0.26	0.32	0.42	0.51	0.62	0.75	0.97	1.16
15-min:	0.19	0.24	0.32	0.4	0.52	0.64	0.77	0.93	1.2	1.44
30-min:	0.26	0.32	0.43	0.53	0.7	0.85	1.04	1.26	1.61	1.94
60-min:	0.32	0.4	0.53	0.66	0.87	1.06	1.28	1.56	2	2.4
2-hr:	0.41	0.51	0.66	0.79	0.98	1.15	1.36	1.61	2.06	2.47
3-hr:	0.48	0.6	0.76	0.89	1.07	1.23	1.42	1.68	2.1	2.5
6-hr:	0.64	0.8	1.01	1.17	1.38	1.53	1.7	1.92	2.29	2.63
12-hr:	0.82	1.03	1.31	1.53	1.82	2.05	2.28	2.51	2.82	3.12
24-hr:	0.99	1.25	1.6	1.88	2.27	2.59	2.92	3.26	3.73	4.11
2-day:	1.15	1.46	1.88	2.22	2.7	3.08	3.49	3.92	4.51	4.99
3-day:	1.26	1.6	2.08	2.47	3.02	3.46	3.93	4.43	5.13	5.7
4-day:	1.37	1.74	2.28	2.71	3.33	3.83	4.38	4.94	5.76	6.42
7-day:	1.6	2.04	2.68	3.2	3.94	4.53	5.17	5.84	6.79	7.57
10-day:	1.8	2.3	3.03	3.61	4.41	5.05	5.72	6.43	7.41	8.19
20-day:	2.21	2.83	3.7	4.37	5.28	5.99	6.72	7.47	8.49	9.29
30-day:	2.52	3.22	4.21	4.97	6	6.8	7.62	8.46	9.59	10.47
45-day:	3	3.85	5.02	5.91	7.09	8	8.92	9.84	11.09	12.05
60-day:	3.44	4.43	5.78	6.76	8.01	8.94	9.85	10.74	11.9	12.76

Date/time (GMT): Wed Feb 8 19:02:42 2012
pyRunTime: 0.0778210163116

WS 1 - 31
Point precipitation frequency estimates (inches/hour)
NOAA Atla Volume 1 Version 5
Data type: Precipitation intensity
Time series type: Partial duration
Project area: Southwest
Latitude (decimal degrees): 39.5550
Longitude (decimal degrees): -119.4900

PRECIPITATION FREQUENCY ESTIMATES

by duration	1	2	5	10	25	50	100	200	500	1000 years
5-min:	1.21	1.51	2.03	2.52	3.31	4.03	4.9	5.94	7.62	9.17
10-min:	0.92	1.15	1.54	1.91	2.52	3.07	3.73	4.52	5.8	6.98
15-min:	0.76	0.95	1.28	1.58	2.08	2.54	3.08	3.74	4.79	5.76
30-min:	0.51	0.64	0.86	1.06	1.4	1.71	2.07	2.52	3.23	3.88
60-min:	0.32	0.4	0.53	0.66	0.87	1.06	1.28	1.56	2	2.4
2-hr:	0.2	0.25	0.33	0.39	0.49	0.57	0.68	0.81	1.03	1.23
3-hr:	0.16	0.2	0.25	0.3	0.36	0.41	0.47	0.56	0.7	0.83
6-hr:	0.11	0.13	0.17	0.19	0.23	0.26	0.28	0.32	0.38	0.44
12-hr:	0.07	0.09	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.26
24-hr:	0.04	0.05	0.07	0.08	0.09	0.11	0.12	0.14	0.16	0.17
2-day:	0.02	0.03	0.04	0.05	0.06	0.06	0.07	0.08	0.09	0.1
3-day:	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07	0.08
4-day:	0.01	0.02	0.02	0.03	0.03	0.04	0.05	0.05	0.06	0.07
7-day:	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.05
10-day:	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03	0.03
20-day:	0	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02
30-day:	0	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
45-day:	0	0	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01
60-day:	0	0	0	0	0.01	0.01	0.01	0.01	0.01	0.01

Date/time (GMT): Wed Feb 8 19:02:11 2012
pyRunTime: 0.0735769271851

WS 29
Point precipitation frequency estimates (inches)
NOAA Atla Volume 1 Version 5
Data type: Precipitation depth
Time series type: Partial duration
Project area: Southwest
Latitude (decimal degrees): 39.5230
Longitude (decimal degrees): -119.5110

PRECIPITATION FREQUENCY ESTIMATES

by duration	1	2	5	10	25	50	100	200	500	1000 years
5-min:	0.1	0.13	0.17	0.21	0.28	0.34	0.41	0.5	0.64	0.77
10-min:	0.16	0.2	0.26	0.33	0.43	0.52	0.63	0.76	0.98	1.18
15-min:	0.19	0.24	0.33	0.4	0.53	0.64	0.78	0.94	1.21	1.46
30-min:	0.26	0.33	0.44	0.54	0.71	0.87	1.05	1.27	1.63	1.96
60-min:	0.32	0.4	0.54	0.67	0.88	1.07	1.3	1.57	2.02	2.43
2-hr:	0.42	0.52	0.68	0.81	1	1.18	1.39	1.65	2.1	2.51
3-hr:	0.5	0.62	0.79	0.92	1.1	1.27	1.47	1.72	2.16	2.56
6-hr:	0.68	0.86	1.07	1.24	1.46	1.62	1.8	2.02	2.39	2.74
12-hr:	0.9	1.13	1.44	1.67	1.99	2.24	2.49	2.74	3.08	3.38
24-hr:	1.12	1.42	1.82	2.14	2.6	2.96	3.35	3.74	4.3	4.75
2-day:	1.33	1.69	2.19	2.6	3.18	3.65	4.14	4.67	5.41	6.01
3-day:	1.46	1.86	2.43	2.9	3.57	4.11	4.69	5.3	6.18	6.89
4-day:	1.59	2.03	2.67	3.2	3.96	4.57	5.24	5.94	6.95	7.78
7-day:	1.87	2.4	3.18	3.81	4.72	5.46	6.26	7.1	8.31	9.3
10-day:	2.11	2.72	3.61	4.32	5.31	6.1	6.95	7.83	9.07	10.08
20-day:	2.68	3.44	4.53	5.38	6.54	7.44	8.38	9.35	10.69	11.75
30-day:	3.12	4.02	5.3	6.29	7.64	8.7	9.79	10.93	12.47	13.69
45-day:	3.75	4.83	6.34	7.51	9.09	10.31	11.58	12.88	14.66	16.07
60-day:	4.31	5.58	7.34	8.62	10.28	11.53	12.78	14.02	15.67	16.94

Date/time (GMT): Wed Feb 8 21:51:49 2012
pyRunTime: 0.0826070308685

WS 32 - 52
Point precipitation frequency estimates (inches)
NOAA Atla Volume 1 Version 5
Data type: Precipitation depth
Time series type: Partial duration
Project area: Southwest
Latitude (decimal degrees): 39.5220
Longitude (decimal degrees): -119.4750

PRECIPITATION FREQUENCY ESTIMATES

by duration	1	2	5	10	25	50	100	200	500	1000 years
5-min:	0.1	0.13	0.17	0.21	0.28	0.34	0.41	0.5	0.64	0.77
10-min:	0.16	0.2	0.26	0.33	0.43	0.52	0.63	0.76	0.98	1.18
15-min:	0.2	0.24	0.33	0.4	0.53	0.65	0.78	0.95	1.21	1.46
30-min:	0.26	0.33	0.44	0.54	0.71	0.87	1.05	1.27	1.63	1.96
60-min:	0.32	0.41	0.55	0.67	0.88	1.07	1.3	1.58	2.02	2.43
2-hr:	0.42	0.52	0.67	0.8	1	1.18	1.38	1.64	2.09	2.51
3-hr:	0.49	0.62	0.78	0.91	1.1	1.26	1.46	1.71	2.15	2.54
6-hr:	0.67	0.84	1.04	1.21	1.43	1.59	1.76	1.99	2.35	2.7
12-hr:	0.86	1.09	1.38	1.61	1.92	2.16	2.4	2.65	2.98	3.28
24-hr:	1.06	1.34	1.72	2.02	2.45	2.79	3.15	3.52	4.04	4.46
2-day:	1.25	1.58	2.05	2.43	2.97	3.4	3.85	4.33	5.01	5.56
3-day:	1.37	1.74	2.27	2.7	3.32	3.81	4.35	4.91	5.71	6.35
4-day:	1.49	1.9	2.49	2.98	3.67	4.23	4.84	5.48	6.4	7.15
7-day:	1.75	2.24	2.95	3.54	4.37	5.04	5.76	6.53	7.62	8.51
10-day:	1.98	2.54	3.35	4.01	4.92	5.64	6.41	7.21	8.34	9.24
20-day:	2.49	3.19	4.19	4.96	6.01	6.83	7.69	8.56	9.76	10.71
30-day:	2.87	3.68	4.84	5.73	6.94	7.89	8.86	9.87	11.23	12.3
45-day:	3.43	4.42	5.79	6.84	8.25	9.35	10.46	11.61	13.18	14.4
60-day:	3.95	5.11	6.7	7.85	9.34	10.45	11.55	12.66	14.1	15.21

Date/time (GMT): Wed Feb 8 19:03:23 2012
pyRunTime: 0.0781569480896

WS 32 - 52
Point precipitation frequency estimates (inches/hour)
NOAA Atla Volume 1 Version 5
Data type: Precipitation intensity
Time series type: Partial duration
Project area: Southwest
Latitude (decimal degrees): 39.5220
Longitude (decimal degrees): -119.4750

PRECIPITATION FREQUENCY ESTIMATES

by duration	1	2	5	10	25	50	100	200	500	1000 years
5-min:	1.24	1.55	2.08	2.57	3.37	4.1	4.97	6.02	7.72	9.28
10-min:	0.94	1.18	1.58	1.96	2.56	3.12	3.78	4.58	5.87	7.06
15-min:	0.78	0.97	1.31	1.62	2.12	2.58	3.12	3.78	4.85	5.83
30-min:	0.52	0.65	0.88	1.09	1.43	1.74	2.1	2.55	3.26	3.93
60-min:	0.32	0.41	0.55	0.67	0.88	1.07	1.3	1.58	2.02	2.43
2-hr:	0.21	0.26	0.34	0.4	0.5	0.59	0.69	0.82	1.05	1.25
3-hr:	0.16	0.21	0.26	0.3	0.37	0.42	0.49	0.57	0.71	0.85
6-hr:	0.11	0.14	0.17	0.2	0.24	0.27	0.29	0.33	0.39	0.45
12-hr:	0.07	0.09	0.11	0.13	0.16	0.18	0.2	0.22	0.25	0.27
24-hr:	0.04	0.06	0.07	0.08	0.1	0.12	0.13	0.15	0.17	0.19
2-day:	0.03	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.1	0.12
3-day:	0.02	0.02	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.09
4-day:	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.07	0.07
7-day:	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.04	0.05	0.05
10-day:	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.04
20-day:	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
30-day:	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
45-day:	0	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
60-day:	0	0	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Date/time (GMT): Wed Feb 8 19:03:55 2012
pyRunTime: 0.0847890377045

WS 47
Point precipitation frequency estimates (inches)
NOAA Atla Volume 1 Version 5
Data type: Precipitation depth
Time series type: Partial duration
Project area: Southwest
Latitude (decimal degrees): 39.4970
Longitude (decimal degrees): -119.4880

PRECIPITATION FREQUENCY ESTIMATES

by duration	1	2	5	10	25	50	100	200	500	1000 years
5-min:	0.11	0.13	0.18	0.22	0.29	0.35	0.42	0.51	0.66	0.79
10-min:	0.16	0.2	0.27	0.34	0.44	0.54	0.65	0.78	1	1.2
15-min:	0.2	0.25	0.34	0.42	0.55	0.66	0.8	0.97	1.24	1.49
30-min:	0.27	0.34	0.46	0.56	0.74	0.89	1.08	1.3	1.67	2
60-min:	0.34	0.42	0.56	0.7	0.91	1.1	1.33	1.61	2.06	2.48
2-hr:	0.44	0.55	0.7	0.84	1.04	1.22	1.43	1.69	2.15	2.58
3-hr:	0.52	0.65	0.82	0.96	1.15	1.32	1.52	1.79	2.23	2.64
6-hr:	0.73	0.92	1.14	1.31	1.55	1.72	1.9	2.14	2.51	2.87
12-hr:	0.98	1.23	1.56	1.82	2.17	2.44	2.71	2.98	3.35	3.67
24-hr:	1.24	1.57	2.02	2.38	2.89	3.3	3.73	4.18	4.8	5.3
2-day:	1.5	1.9	2.48	2.95	3.62	4.17	4.75	5.37	6.24	6.95
3-day:	1.65	2.1	2.77	3.31	4.08	4.71	5.39	6.11	7.14	7.98
4-day:	1.8	2.3	3.05	3.66	4.54	5.25	6.03	6.85	8.04	9.01
7-day:	2.13	2.73	3.64	4.39	5.45	6.31	7.25	8.24	9.67	10.85
10-day:	2.42	3.12	4.16	4.99	6.15	7.08	8.07	9.11	10.58	11.77
20-day:	3.15	4.05	5.34	6.35	7.72	8.8	9.93	11.09	12.69	13.97
30-day:	3.73	4.81	6.36	7.57	9.21	10.5	11.85	13.24	15.15	16.65
45-day:	4.49	5.8	7.66	9.09	11.02	12.55	14.13	15.78	18.07	19.9
60-day:	5.19	6.74	8.89	10.46	12.5	14.05	15.61	17.18	19.3	20.95

Date/time (GMT): Wed Feb 8 19:07:53 2012
pyRunTime: 0.0823230743408

WS 53 - 68
Point precipitation frequency estimates (inches)
NOAA Atla Volume 1 Version 5
Data type: Precipitation depth
Time series type: Partial duration
Project area: Southwest
Latitude (decimal degrees): 39.5070
Longitude (decimal degrees): -119.4650

PRECIPITATION FREQUENCY ESTIMATES

by duration	1	2	5	10	25	50	100	200	500	1000 years
5-min:	0.11	0.13	0.18	0.22	0.29	0.35	0.42	0.51	0.65	0.79
10-min:	0.16	0.2	0.27	0.34	0.44	0.53	0.64	0.78	0.99	1.2
15-min:	0.2	0.25	0.34	0.41	0.54	0.66	0.8	0.96	1.23	1.48
30-min:	0.27	0.34	0.45	0.56	0.73	0.89	1.07	1.3	1.66	2
60-min:	0.34	0.42	0.56	0.69	0.91	1.1	1.33	1.61	2.06	2.47
2-hr:	0.43	0.54	0.69	0.83	1.03	1.21	1.42	1.68	2.13	2.56
3-hr:	0.51	0.64	0.81	0.94	1.14	1.3	1.5	1.76	2.2	2.61
6-hr:	0.71	0.89	1.1	1.27	1.5	1.67	1.85	2.08	2.46	2.81
12-hr:	0.93	1.17	1.49	1.74	2.07	2.32	2.58	2.85	3.2	3.52
24-hr:	1.16	1.47	1.89	2.23	2.7	3.08	3.48	3.9	4.48	4.95
2-day:	1.38	1.75	2.29	2.71	3.33	3.83	4.35	4.91	5.7	6.34
3-day:	1.52	1.94	2.54	3.03	3.74	4.31	4.92	5.57	6.5	7.25
4-day:	1.65	2.12	2.8	3.35	4.15	4.79	5.49	6.23	7.29	8.16
7-day:	1.96	2.51	3.33	4	4.96	5.73	6.57	7.46	8.73	9.78
10-day:	2.22	2.86	3.79	4.54	5.58	6.42	7.31	8.24	9.55	10.61
20-day:	2.85	3.67	4.82	5.73	6.95	7.91	8.91	9.94	11.36	12.48
30-day:	3.35	4.31	5.69	6.75	8.2	9.34	10.52	11.73	13.4	14.71
45-day:	4.02	5.19	6.83	8.1	9.8	11.13	12.52	13.94	15.91	17.48
60-day:	4.65	6.03	7.93	9.32	11.12	12.47	13.84	15.21	17.04	18.45

Date/time (GMT): Wed Feb 8 18:57:48 2012
pyRunTime: 0.0789940357208

WS 53 - 68
Point precipitation frequency estimates (inches/hour)
NOAA Atla Volume 1 Version 5
Data type: Precipitation intensity
Time series type: Partial duration
Project area: Southwest
Latitude (decimal degrees): 39.5070
Longitude (decimal degrees): -119.4650

PRECIPITATION FREQUENCY ESTIMATES

by duration	1	2	5	10	25	50	100	200	500	1000 years
5-min:	1.28	1.6	2.15	2.64	3.46	4.2	5.08	6.13	7.84	9.42
10-min:	0.97	1.22	1.63	2.01	2.63	3.19	3.86	4.67	5.97	7.17
15-min:	0.8	1	1.35	1.66	2.18	2.64	3.19	3.86	4.93	5.93
30-min:	0.54	0.68	0.91	1.12	1.46	1.78	2.15	2.6	3.32	3.99
60-min:	0.34	0.42	0.56	0.69	0.91	1.1	1.33	1.61	2.06	2.47
2-hr:	0.22	0.27	0.35	0.41	0.51	0.6	0.71	0.84	1.07	1.28
3-hr:	0.17	0.21	0.27	0.31	0.38	0.43	0.5	0.59	0.73	0.87
6-hr:	0.12	0.15	0.18	0.21	0.25	0.28	0.31	0.35	0.41	0.47
12-hr:	0.08	0.1	0.12	0.14	0.17	0.19	0.21	0.24	0.27	0.29
24-hr:	0.05	0.06	0.08	0.09	0.11	0.13	0.15	0.16	0.19	0.21
2-day:	0.03	0.04	0.05	0.06	0.07	0.08	0.09	0.1	0.12	0.13
3-day:	0.02	0.03	0.04	0.04	0.05	0.06	0.07	0.08	0.09	0.1
4-day:	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.06	0.08	0.08
7-day:	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06
10-day:	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.04	0.04
20-day:	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.03
30-day:	0	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02
45-day:	0	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
60-day:	0	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Date/time (GMT): Wed Feb 8 19:00:30 2012
pyRunTime: 0.0697660446167

WS 57 and 67
Point precipitation frequency estimates (inches)
NOAA Atla Volume 1 Version 5
Data type: Precipitation depth
Time series type: Partial duration
Project area: Southwest
Latitude (decimal degrees): 39.5040
Longitude (decimal degrees): -119.4670

PRECIPITATION FREQUENCY ESTIMATES

by duration	1	2	5	10	25	50	100	200	500	1000 years
5-min:	0.11	0.14	0.18	0.22	0.29	0.35	0.42	0.51	0.66	0.79
10-min:	0.16	0.2	0.28	0.34	0.44	0.54	0.65	0.78	1	1.2
15-min:	0.2	0.25	0.34	0.42	0.55	0.66	0.8	0.97	1.24	1.49
30-min:	0.27	0.34	0.46	0.56	0.74	0.89	1.08	1.3	1.67	2
60-min:	0.34	0.42	0.57	0.7	0.91	1.11	1.34	1.61	2.06	2.48
2-hr:	0.44	0.55	0.7	0.84	1.04	1.22	1.43	1.7	2.15	2.58
3-hr:	0.52	0.65	0.82	0.96	1.15	1.32	1.53	1.79	2.23	2.64
6-hr:	0.73	0.91	1.13	1.3	1.53	1.71	1.89	2.13	2.5	2.87
12-hr:	0.96	1.21	1.54	1.79	2.13	2.4	2.67	2.94	3.3	3.63
24-hr:	1.21	1.53	1.97	2.32	2.82	3.22	3.64	4.08	4.69	5.18
2-day:	1.45	1.84	2.4	2.85	3.51	4.03	4.59	5.19	6.04	6.72
3-day:	1.59	2.03	2.67	3.19	3.94	4.55	5.2	5.89	6.88	7.69
4-day:	1.74	2.22	2.94	3.53	4.38	5.07	5.81	6.6	7.73	8.66
7-day:	2.06	2.64	3.51	4.23	5.25	6.07	6.97	7.92	9.29	10.41
10-day:	2.34	3.01	4.01	4.8	5.91	6.8	7.75	8.75	10.15	11.29
20-day:	3.02	3.89	5.13	6.09	7.4	8.43	9.5	10.61	12.13	13.35
30-day:	3.58	4.61	6.09	7.24	8.81	10.04	11.32	12.64	14.45	15.88
45-day:	4.3	5.55	7.32	8.69	10.53	11.98	13.49	15.05	17.22	18.96
60-day:	4.98	6.46	8.52	10.02	11.97	13.44	14.93	16.43	18.44	20.02

Date/time (GMT): Wed Feb 8 19:10:23 2012
pyRunTime: 0.0927259922028

WS 69
Point precipitation frequency estimates (inches)
NOAA Atla Volume 1 Version 5
Data type: Precipitation depth
Time series type: Partial duration
Project area: Southwest
Latitude (decimal degrees): 39.5170
Longitude (decimal degrees): -119.4480

PRECIPITATION FREQUENCY ESTIMATES

by duration	1	2	5	10	25	50	100	200	500	1000 years
5-min:	0.11	0.13	0.18	0.22	0.29	0.35	0.42	0.51	0.65	0.78
10-min:	0.16	0.2	0.27	0.34	0.44	0.53	0.64	0.78	0.99	1.19
15-min:	0.2	0.25	0.34	0.41	0.54	0.66	0.8	0.96	1.23	1.48
30-min:	0.27	0.34	0.45	0.56	0.73	0.89	1.07	1.3	1.66	1.99
60-min:	0.33	0.42	0.56	0.69	0.91	1.1	1.33	1.6	2.05	2.47
2-hr:	0.43	0.54	0.69	0.83	1.03	1.21	1.42	1.68	2.13	2.56
3-hr:	0.51	0.64	0.8	0.94	1.13	1.3	1.5	1.76	2.2	2.6
6-hr:	0.7	0.87	1.09	1.26	1.48	1.65	1.83	2.06	2.44	2.79
12-hr:	0.91	1.15	1.46	1.7	2.03	2.28	2.53	2.79	3.13	3.45
24-hr:	1.13	1.43	1.84	2.17	2.63	3	3.39	3.79	4.36	4.81
2-day:	1.34	1.7	2.21	2.63	3.23	3.7	4.21	4.75	5.51	6.13
3-day:	1.47	1.87	2.46	2.94	3.62	4.17	4.77	5.4	6.29	7.02
4-day:	1.6	2.05	2.71	3.25	4.02	4.65	5.32	6.04	7.07	7.91
7-day:	1.9	2.43	3.23	3.88	4.81	5.57	6.38	7.25	8.48	9.5
10-day:	2.15	2.77	3.68	4.4	5.42	6.23	7.09	8	9.27	10.3
20-day:	2.74	3.53	4.64	5.51	6.69	7.62	8.58	9.57	10.94	12.02
30-day:	3.2	4.12	5.44	6.46	7.85	8.94	10.07	11.23	12.83	14.09
45-day:	3.84	4.96	6.53	7.74	9.38	10.66	11.99	13.36	15.27	16.79
60-day:	4.43	5.75	7.58	8.91	10.64	11.94	13.25	14.58	16.35	17.73

Date/time (GMT): Wed Feb 8 19:06:08 2012
pyRunTime: 0.0771069526672

WS 70 and 71
Point precipitation frequency estimates (inches)
NOAA Atla Volume 1 Version 5
Data type: Precipitation depth
Time series type: Partial duration
Project area: Southwest
Latitude (decimal degrees): 39.5090
Longitude (decimal degrees): -119.4450

PRECIPITATION FREQUENCY ESTIMATES

by duration	1	2	5	10	25	50	100	200	500	1000 years
5-min:	0.11	0.14	0.18	0.22	0.29	0.35	0.43	0.51	0.66	0.79
10-min:	0.16	0.21	0.28	0.34	0.44	0.54	0.65	0.78	1	1.2
15-min:	0.2	0.26	0.34	0.42	0.55	0.67	0.8	0.97	1.24	1.49
30-min:	0.27	0.34	0.46	0.57	0.74	0.9	1.08	1.31	1.67	2
60-min:	0.34	0.42	0.57	0.7	0.92	1.11	1.34	1.62	2.06	2.48
2-hr:	0.44	0.55	0.71	0.84	1.05	1.23	1.44	1.71	2.16	2.59
3-hr:	0.52	0.65	0.82	0.96	1.15	1.32	1.53	1.79	2.23	2.64
6-hr:	0.72	0.9	1.12	1.29	1.52	1.7	1.88	2.11	2.49	2.85
12-hr:	0.94	1.19	1.51	1.77	2.1	2.36	2.63	2.9	3.25	3.58
24-hr:	1.18	1.49	1.93	2.27	2.77	3.16	3.57	4	4.6	5.08
2-day:	1.41	1.79	2.34	2.79	3.43	3.94	4.49	5.08	5.91	6.58
3-day:	1.55	1.98	2.61	3.13	3.87	4.47	5.11	5.79	6.77	7.57
4-day:	1.69	2.17	2.88	3.47	4.31	4.99	5.73	6.51	7.63	8.55
7-day:	2.01	2.58	3.44	4.16	5.17	6	6.89	7.85	9.21	10.34
10-day:	2.28	2.94	3.93	4.72	5.82	6.71	7.66	8.66	10.07	11.21
20-day:	2.93	3.78	4.99	5.93	7.22	8.23	9.29	10.39	11.9	13.12
30-day:	3.44	4.45	5.9	7.02	8.56	9.77	11.03	12.34	14.13	15.55
45-day:	4.14	5.36	7.08	8.43	10.25	11.69	13.2	14.77	16.97	18.75
60-day:	4.78	6.22	8.24	9.71	11.64	13.11	14.59	16.11	18.17	19.8

Date/time (GMT): Wed Feb 8 19:11:20 2012
pyRunTime: 0.0849831104279

WS 72
Point precipitation frequency estimates (inches)
NOAA Atla Volume 1 Version 5
Data type: Precipitation depth
Time series type: Partial duration
Project area: Southwest
Latitude (decimal degrees): 39.4720
Longitude (decimal degrees): -119.4560

PRECIPITATION FREQUENCY ESTIMATES

by duration	1	2	5	10	25	50	100	200	500	1000 years
5-min:	0.11	0.14	0.18	0.23	0.29	0.36	0.43	0.52	0.66	0.79
10-min:	0.17	0.21	0.28	0.35	0.45	0.54	0.66	0.79	1	1.2
15-min:	0.21	0.26	0.35	0.43	0.56	0.68	0.81	0.98	1.24	1.49
30-min:	0.28	0.35	0.47	0.58	0.75	0.91	1.09	1.31	1.67	2
60-min:	0.35	0.44	0.58	0.72	0.93	1.12	1.35	1.63	2.07	2.48
2-hr:	0.45	0.57	0.73	0.87	1.08	1.26	1.47	1.74	2.19	2.61
3-hr:	0.55	0.68	0.86	1	1.2	1.38	1.58	1.85	2.29	2.69
6-hr:	0.78	0.97	1.2	1.39	1.63	1.82	2.01	2.26	2.64	3
12-hr:	1.05	1.32	1.67	1.95	2.32	2.6	2.9	3.19	3.58	3.92
24-hr:	1.34	1.7	2.19	2.58	3.14	3.59	4.05	4.54	5.23	5.78
2-day:	1.63	2.07	2.72	3.24	4	4.61	5.26	5.96	6.95	7.76
3-day:	1.79	2.29	3.04	3.64	4.52	5.23	5.99	6.81	7.98	8.94
4-day:	1.95	2.51	3.35	4.04	5.04	5.84	6.72	7.66	9.01	10.11
7-day:	2.32	2.99	4.02	4.86	6.06	7.05	8.11	9.26	10.9	12.25
10-day:	2.64	3.41	4.58	5.51	6.81	7.87	8.99	10.18	11.86	13.23
20-day:	3.45	4.46	5.91	7.04	8.59	9.8	11.08	12.4	14.24	15.71
30-day:	4.15	5.37	7.15	8.53	10.42	11.91	13.47	15.09	17.32	19.09
45-day:	4.99	6.47	8.59	10.23	12.47	14.25	16.12	18.07	20.81	23.03
60-day:	5.81	7.58	10.06	11.88	14.26	16.09	17.94	19.83	22.41	24.47

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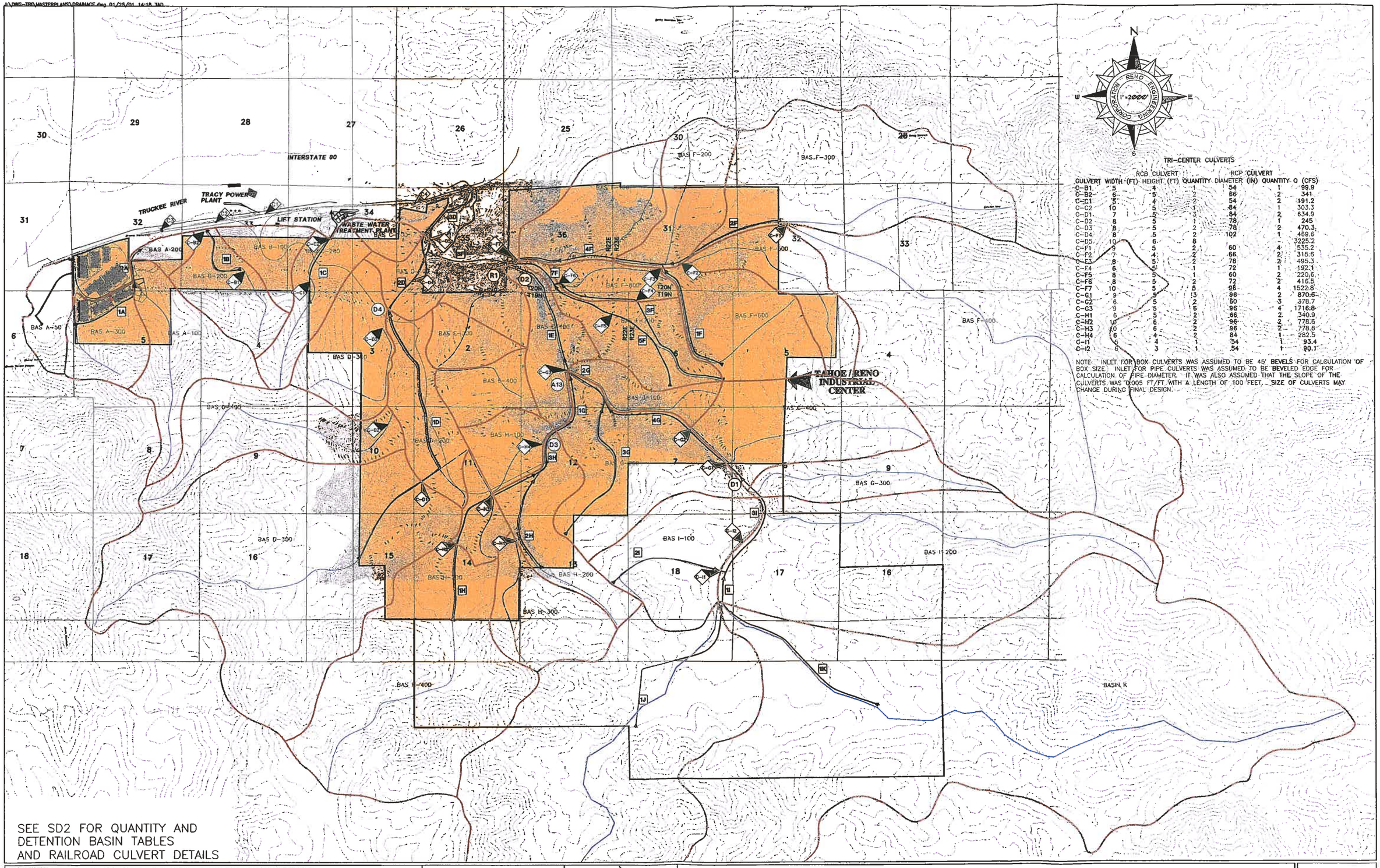

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1"=2000'
RENO ENGINEERING CORPORATION

TRI-CENTER CULVERTS

	RCB CULVERT			RCP CULVERT		
CULVERT	WIDTH (FT)	HEIGHT (FT)	QUANTITY	DIAMETER (IN)	QUANTITY	Q (CFS)
C-B1	5	4	1	54	1	99.9
C-B2	6	5	2	86	2	341
C-C1	5	4	2	54	2	191.2
C-C2	10	5	1	84	1	303.3
C-D1	7	6	3	84	2	634.9
C-D2	8	5	1	78	1	245
C-D3	8	5	2	78	2	470.3
C-D4	8	5	2	102	1	489.6
C-D5	10	6	8			3225.2
C-F1	9	5	2	60	4	535.2
C-F2	7	4	2	66	2	315.6
C-F3	8	5	2	78	2	495.3
C-F4	6	5	1	72	1	192.1
C-F5	8	5	1	60	2	220.6
C-F6	8	5	2	72	2	416.5
C-F7	10	5	5	96	4	1522.8
C-G1	9	5	3	96	2	870.6
C-G2	6	5	2	60	3	378.7
C-G3	9	5	6	96	4	1716.8
C-H1	6	5	2	66	2	340.9
C-H2	10	6	2	96	2	778.6
C-H3	10	6	2	96	2	778.6
C-H4	6	4	2	84	1	282.5
C-I1	5	4	1	54	1	93.4
C-I2	6	3	1	54	1	90.1

NOTE: INLET FOR BOX CULVERTS WAS ASSUMED TO BE 45° BEVELS FOR CALCULATION OF BOX SIZE. INLET FOR PIPE CULVERTS WAS ASSUMED TO BE BEVELED EDGE FOR CALCULATION OF PIPE DIAMETER. IT WAS ALSO ASSUMED THAT THE SLOPE OF THE CULVERTS WAS 0.005 FT/FT WITH A LENGTH OF 100 FEET. SIZE OF CULVERTS MAY CHANGE DURING FINAL DESIGN.

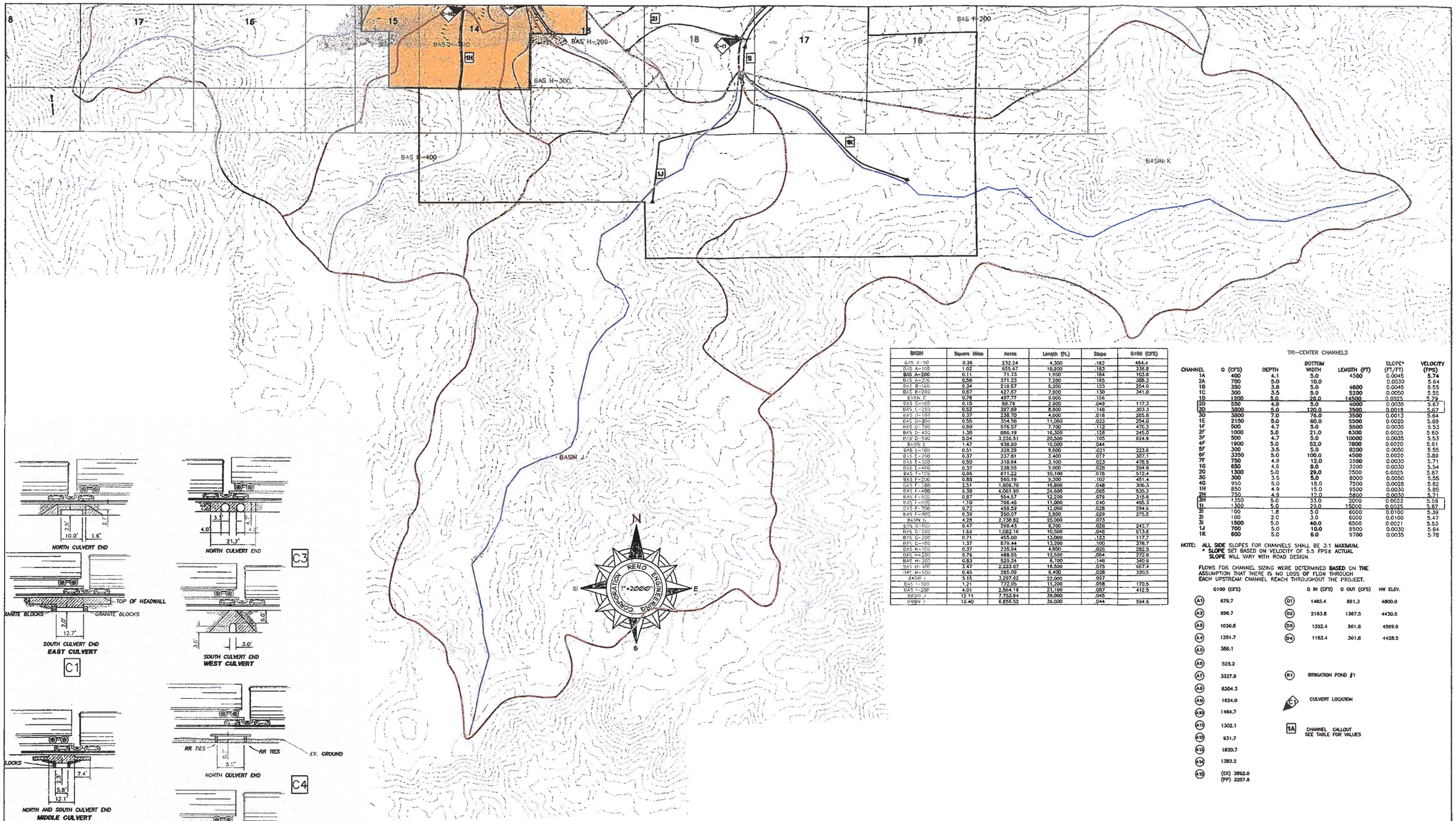
SEE SD2 FOR QUANTITY AND DETENTION BASIN TABLES AND RAILROAD CULVERT DETAILS

RENO ENGINEERING CORPORATION
CIVIL ENGINEERING • DESIGN • LAND PLANNING
3983 S. McCARRAN BLVD #332 RENO, NV 89502
PHONE: (702) 852-5700 FAX: (702) 852-2104

TAHOE RENO INDUSTRIAL CENTER

MASTER DRAINAGE PLAN

SD1



BASIN	Square Miles	Acres	Length (ft.)	Slope	Q100 (CFS)
BAS A-50	0.36	232.24	4,300	.182	464.4
BAS A-100	1.02	655.67	10,900	.183	338.8
BAS A-200	0.11	71.73	1,900	.184	163.8
BAS A-300	0.58	371.23	7,200	.165	388.3
BAS B-100	0.34	219.57	5,200	.123	254.0
BAS B-200	0.67	427.67	7,900	.130	341.0
BASIN C	0.78	497.77	9,000	.156	-
BAS C-100	0.15	98.76	2,900	.049	117.3
BAS C-200	0.52	397.69	8,500	.148	303.3
BAS D-100	0.37	238.70	4,000	.016	265.8
BAS D-200	0.55	354.56	11,000	.033	254.0
BAS D-300	0.90	576.57	7,700	.112	470.3
BAS D-400	1.38	886.19	16,300	.126	245.0
BAS D-500	5.04	3,226.51	20,500	.105	824.9
BASIN E	1.47	938.90	16,000	.044	-
BAS E-100	0.51	328.29	9,500	.021	223.6
BAS E-200	0.37	237.81	3,400	.017	307.1
BAS E-300	0.50	318.64	3,100	.023	478.5
BAS E-400	0.37	238.55	5,000	.026	264.6
BAS F-100	0.96	611.22	10,100	.078	512.4
BAS F-200	0.88	560.19	9,200	.102	451.4
BAS F-300	2.51	1,606.70	16,800	.048	306.3
BAS F-400	6.38	4,081.90	24,600	.065	535.2
BAS F-500	0.87	554.57	12,200	.078	315.6
BAS F-600	1.10	706.46	11,000	.040	468.3
BAS F-700	0.72	459.59	12,000	.028	294.6
BAS F-800	0.39	250.07	5,800	.029	275.5
BASIN G	4.28	2,738.82	22,000	.073	-
BAS G-100	0.47	298.43	8,700	.028	242.7
BAS G-200	1.69	1,082.16	10,500	.048	613.6
BAS G-300	0.71	455.50	13,000	.123	117.7
BAS G-400	1.37	879.44	13,200	.100	378.7
BAS H-100	0.37	235.94	4,800	.026	282.5
BAS H-200	0.76	488.55	12,500	.054	272.8
BAS H-300	0.83	529.24	6,700	.148	340.9
BAS H-400	3.47	2,223.07	16,500	.078	667.4
BAS H-500	0.45	285.09	6,400	.038	320.5
BASIN I	5.15	3,297.62	22,000	.097	-
BAS I-100	1.21	772.05	11,200	.058	170.5
BAS I-200	4.01	2,564.16	21,100	.087	412.5
BASIN J	12.11	7,753.94	39,000	.045	-
BASIN K	10.40	6,656.52	36,000	.044	594.6

TRI-CENTER CHANNELS

CHANNEL	Q (CFS)	DEPTH	BOTTOM WIDTH	LENGTH (FT)	SLOPE* (FT/FT)	VELOCITY (FPS)
1A	400	4.1	5.0	4500	0.0045	5.74
2A	700	5.0	10.0		0.0030	5.64
1B	350	3.8	5.0	4800	0.0045	5.55
1C	300	3.5	5.0	5200	0.0050	5.55
1D	1200	5.0	26.0	14500	0.0025	5.79
2D	550	4.9	5.0	4000	0.0035	5.67
3D	3800	5.0	120.0	3500	0.0018	5.67
3D	3800	7.0	76.0	3500	0.0013	5.64
1E	2150	5.0	60.0	5500	0.0020	5.69
1F	500	4.7	5.0	5500	0.0035	5.53
2F	1000	5.0	21.0	6300	0.0025	5.60
3F	500	4.7	5.0	10000	0.0035	5.53
4F	1900	5.0	52.0	7800	0.0020	5.61
5F	300	3.5	5.0	8200	0.0050	5.55
6F	3350	5.0	100.0	4500	0.0020	5.68
7F	750	4.9	12.0	2500	0.0030	5.71
1G	650	4.9	9.0	3200	0.0030	5.54
2G	1300	5.0	29.0	2500	0.0025	5.67
3G	300	3.5	5.0	8000	0.0050	5.55
4G	950	5.0	18.0	7500	0.0028	5.82
1H	850	4.9	15.0	9500	0.0030	5.85
2H	750	4.9	12.0	5800	0.0030	5.71
3H	1350	5.0	33.0	2000	0.0022	5.59
1I	1300	5.0	29.0	15000	0.0025	5.67
2I	100	1.8	5.0	6000	0.0100	5.39
2I	100	2.0	3.0	6000	0.0100	5.47
3I	1500	5.0	40.0	6500	0.0021	5.53
1J	700	5.0	10.0	8500	0.0030	5.64
1K	600	5.0	6.0	9700	0.0035	5.78

NOTE: **ALL SIDE** SLOPES FOR CHANNELS SHALL BE 3:1 **MAXIMUM.**
* **SLOPE** SET BASED ON VELOCITY OF 5.5 FPS± ACTUAL **SLOPE** WILL VARY WITH ROAD DESIGN.

FLOWS FOR CHANNEL SIZING WERE DETERMINED **BASED** ON THE ASSUMPTION THAT THERE IS NO LOSS OF FLOW THROUGH EACH UPSTREAM CHANNEL REACH THROUGHOUT THE PROJECT.

	Q100 (CFS)		Q IN (CFS)	Q OUT (CFS)	HW ELEV.
A1	679.7	D1	1485.4	881.3	4800.0
A2	896.7	D2	2163.8	1367.5	4430.5
A3	1036.8	D3	1352.4	561.6	4599.0
A4	1251.7	D4	1163.4	301.8	4428.5
A5	366.1				
A6	525.2				
A7	3327.9	R1	IRRIGATION POND #1		
A8	8304.3				
A9	1824.0	C1	CULVERT LOCATION		
A10	1464.7				
A11	1302.1	1A	CHANNEL CALLOUT SEE TABLE FOR VALUES		
A12	931.7				
A13	1920.7				
A14	1383.2				
A15	(EX) 3892.0 (PP) 3257.8				

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TAHOE RENO

MASTER DRAINAGE PLAN

SD2

APPENDIX C

Comments and Responses

REVIEW COMMENTS

Project Name:	USA Parkway (Pass/Fail) Drainage Analysis	Date:	September 2012
Project No./EA:	73708E1P	Submittal Level:	Revised
Reviewer:	NDOT		
Consultant:	Wood Rodgers		

COMMENT #	SHEET #	REVIEW COMMENTS	RESPONSE
Drainage Report Comments			
1	App A Table 7	Some of the Channel Flow velocity appears to be supercritical. Typically a majority of steep sloped natural channels adjust themselves to be critical velocity either on a macro (pool and drop) or micro scale (boulders act as weir). This would result in longer Lag Times and thus reduced flows. Please verify velocities and corresponding Lag Times.	The Velocities for each channel with supercritical flow has been adjusted so flow is subcritical.
2	App A Table 7	Regarding the note on Channel Velocity, is the assumption of constant channel geometry and depth reasonable for all large offsite channels no matter what the overall drainage basin area is? After determining preliminary flows, initial assumptions should be verified to be reasonable or not.	For the flows determined by HMS the TLAG was recalculated using the SCS methodology and the methodology presented in the Truckee Meadows Regional Drainage Manual.
3	App A Table 10	Please evaluate channel velocity to identify unstable channels requiring rip-rap protection and note as an additional deficiency. Those channels requiring rip-rap protection would have a smaller cross sectional area, higher roughness coefficient and thus lower capacity than shown.	The shear stresses have been calculated for the channels and areas where riprap lining is needed have been highlighted in the Table 10 in Appendix A.
4	Figures	Are there original construction plans available that show the drainage facilities and storm drain connectivity. We have been told that plans are available. Many DI's shown in the existing features figure don't have any connecting pipes shown. This connectivity will be important for us to know and including the plans would help fill in the gaps.	Per the Plan set given to Wood Rodgers on 5/22/12, culverts and connectivity were added to the Pass/Fail drainage report.
5	3.0 Results	It is current NDOT standard practice and policy to always provide culvert end treatments (end-sections or headwalls) as well as outlet protection (riprap if needed) on all culverts. Please note any deficiencies here and in a summary table.	A table showing the deficiencies has been added to the drainage report.
6	3.0 Results	Please note any deficiencies in culvert or storm drain system geometry or minimum slopes.	The Culvert and storm drain geometry deficiencies are listed in the report. There appear to be no culvert and storm drain slope deficiencies.

NEVADA DOT

REVIEW COMMENTS

Project Name:	USA Parkway (Pass/Fail) Drainage Analysis	Date:	September 2012
Project No./EA:	73708E1P	Submittal Level:	Revised
Reviewer:	NDOT		
Consultant:	Wood Rodgers		

COMMENT #	SHEET #	REVIEW COMMENTS	RESPONSE
7	3.0 Results	Please note any deficiencies of hydraulic facilities acting as roadside obstructions unless this will be covered elsewhere.	This will be noted in the report from Jacobs.
8	3.0 Results	Please verify that drop inlets have been placed in all critical areas such as Flankers at low points, super reversals, etc., and note non-standard drop inlets.	There is one low point in the project area and there are DI's on the left and right side of the road, however, there are no flankers. This area is noted in the appendices.
9	3.0 Results	Additional Areas of Interest – We have been told; although, no one knows where the drainage report is for the constructed portion of USA Parkway, a watershed map does exist and is available. Can the issues discussed in the additional areas of interest be compared to this water shed map to verify the hydrology and your assumptions for the post development condition?	Per the REC Engineering master drainage plan sheets Wood Rodgers was provided it is still unclear as to the reasoning for the existing C11design. The culvert C11 appears to be C-H3 in the REC plan and is shown as 2-96" RCP's which are not what was constructed. The REC master drainage plan shows that the flow for watersheds 57, 61, 64, 65, and 67 (Basin H-300 in REC plan) drains over the parallel road and therefore the "Additional Area Of Interest" comment regarding Watersheds 57, 61, 64, 65, and 67 has been removed.
10	3.0 Results	The roadway and drainage improvements located between I-80 and the Railroad Bridge were constructed as part of the USA Parkway Interchange Project which was overseen by NDOT unlike the rest of the USA Parkway alignment. Additional information and analysis of these facilities can be found in the plans and report for the interchange project (Contract 3320) prepared by Carter Burgess.	Features from Contract 3320 have been removed from the drainage report since they are downstream of the project area and therefore do not affect the design.
11	3.0 Results	A Summary table of Spread violations would be helpful here so as to highlight all deficiencies quickly, in one place, and in the same format.	A table for spread violations was added to the Drainage Report.

NEVADA DOT

REVIEW COMMENTS

Project Name:	USA Parkway (Pass/Fail) Drainage Analysis	Date:	September 2012
Project No./EA:	73708E1P	Submittal Level:	Revised
Reviewer:	NDOT		
Consultant:	Wood Rodgers		

COMMENT #	SHEET #	REVIEW COMMENTS	RESPONSE
12	3.0 Results	Please note damage or poorly installed facilities that have been noted. One Item that we are aware of are damaged (deformed and perforated) CMP's at C30.	A table specifying the Culvert Inlet and Outlet deficiencies has been added to Appendix A
13	3.0 Results	C15 and C16 – Are these 3' x 4' culverts RCP's (pipes) or RCB's (box culverts).	Culverts C15 and C16 were modeled as RCBs but were labeled wrong in the appendices. The appendices have been updated.
14	3.0 Results	Remove the opinions from the text and just stick to the facts.	The opinions have been removed from the drainage report.

APPENDIX H: EXISTING USA PARKWAY PLAN SETS

JURISDICTION

GRADING — STOREY COUNTY
SEWER — TRI WATER AND SEWER
WATER — TRI WATER AND SEWER
RECLAIM WATER — TRI WATER AND SEWER
POWER/GAS — SIERRA PACIFIC POWER

APPROVALS

STOREY COUNTY BUILDING PERMIT ______________________

TRI UTILITY COMPANY ______________________
STATE DUST CONTROL# AP-1629-1221

NOTE TO ALL OF THOSE USING THESE PLANS:
IF THE NECESSARY APPROVAL DATES ARE NOT SHOWN ABOVE, THESE PLANS SHALL BE CONSIDERED PRELIMINARY AND NOT FOR CONSTRUCTION. PRIOR TO CONSTRUCTION OR THE ORDERING OF ANY MATERIALS OBTAIN A SET OF DRAWINGS WHICH HAVE ALL OF THE NECESSARY APPROVALS FROM THE ENGINEER.

OWNER

TAHOE - RENO INDUSTRIAL CENTER, L.L.C.,
A NEVADA LIMITED LIABILITY COMPANY
P.O. BOX 838, POWAY, CA 92074-0838

ENGINEER

RENO ENGINEERING CORPORATION
9476 DOUBLE R BLVD., SUITE A
RENO, NEVADA 89521
FOR QUESTIONS OR COMMENTS CONTACT
VINCENT GRIFFITH P.E. 852-5700

TOPOGRAPHY

CONTOURS AND SPOT GRADES SHOWN ON THESE PLANS WERE TAKEN FROM AERIAL MAPPING AND CONFORM TO THE FOLLOWING STANDARDS.

XY ACCURACY: 1/50" AT MAP SCALE
Z ACCURACY: ;1/2 CONTOUR INTERVAL
SPOTS: ;1/4 CONTOUR INTERVAL
MAPS MUST BE FIELD CHECKED BEFORE USE-ALTERATIONS SERVICED PROMPTLY
DASHED LINES MAY NOT MEET MAP ACCURACY STANDARDS
BUILDING OUTLINES INDICATE DRIP LINE BUT MAY ALSO INCLUDE STAIRS AND ATTACHEMENTS

FEATURES IN SHADOW AND VEGETATION AREAS OR NEAR TALL OBJECTS MAY BE OBSCURED DUE TO PHOTOGRAPHIC ANGLE
MAPPING OUTSIDE OF CONTROL PERIMETER MAY NOT MEET MAP ACCURACY STANDARDS
SMALL SHADOW AREAS ARE NOT SHOWN FOR CLARITY

GENERAL RECLAIMED WATER NOTES

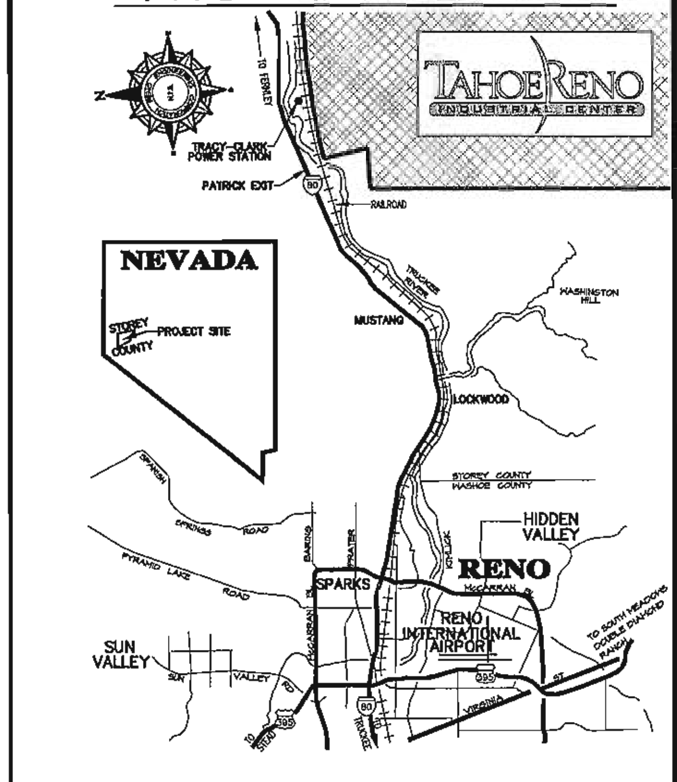
1. All construction shall conform to the Standard Specification for Public Works Construction (1996) and Washoe County Standards.
2. All reclaimed water lines constructed out of PVC shall be purple plastic or be encased in purple polyethylene bags labeled "CAUTION: RECLAIMED WATER LINE" at intervals no greater than 5 feet. If purple pipe or bags are not available, purple vinyl adhesive tape shall be attached to the pipe continuously, in a longitudinal direction. The tape shall have the wording "CAUTION: RECLAIMED WATER LINE" at intervals of no more than 5 feet, have a minimum width of 6", and be installed along the top of the pipe. Reclaimed water lines constructed out of ductile iron pipe shall be encased in purple polyethylene bags labeled "CAUTION: RECLAIMED WATER LINE" at intervals no greater than 5 feet.
3. Tracer wire shall be placed on top of bedding material prior to pipe installation. At 500' intervals, wire shall be extended into separate test stations consisting of risers and valve boxes. A minimum of 18 inches of wire shall be left at the top of the riser and connected with the appropriately sized wire nut. The tracer wire shall be placed under laterals, extended into the meter box and up to the meter cover. Wire shall be #12 AWG, insulated, stranded copper. Prior to acceptance of the reclaimed waterline, the contractor shall perform a continuity test after backfilling the trench to the satisfaction of the Utility Services Division Inspector.
4. Purple warning tape, at least 3" in width, with wording "CAUTION: RECLAIMED WATER LINE BELOW," shall be installed 12 inches above all pipe.
5. All covers for valve boxes, flush valves, pressure reducing stations, air/vac stations, and all other appurtenances requiring vaults or boxes shall be purple in color (Pantone Color #512) and labeled "RECLAIMED WATER" or "R.C.W.". Purple coloration shall be obtained from the manufacturer or applied by powder coating or epoxy paint. All appurtenances shall have a purple tag attached with the wording "WARNING: RECLAIMED WATER—DO NOT DRINK" in English and Spanish (T. Christy Enterprises, Valve Identification Tag, ID-STD-P2-RC1P2 or approved equal). A debris cap with purple coloration shall be installed inside of all round valve boxes.
6. All aboveground piping shall be painted purple (Pantone Color # 512) and a purple tag, with the wording "WARNING: RECLAIMED WATER — DO NOT DRINK" in English and Spanish, attached to the assembly (T. Christy Enterprises, Valve Identification Tag, ID-STD-P2-RC1P2 or approved equal).
7. All meter box covers shall be purple in color (see above) and a purple tag, with the wording "WARNING: RECLAIMED WATER — DO NOT DRINK" in English and Spanish, attached to the meter (T. Christy Enterprises, Valve Identification Tag, ID-STD-P2-RC1P2 or approved equal).
8. The minimum horizontal separation between parallel reclaimed waterlines and potable waterlines shall be 10 feet. When reclaimed waterlines cross potable waterlines, the reclaimed line shall be installed below the potable line. A minimum of 18 inches vertical separation shall be maintained from the bottom of a potable waterline to the top of a crossing reclaimed waterline. Reclaimed waterline pipe joints shall be kept as far away as possible from crossing potable waterlines.
9. Direct connections between potable water piping and reclaimed water piping shall not exist under any condition with or without backflow protection per UPC (1994 edition) Section 603.2.4.
10. Hose bibs on the reclaimed system are PROHIBITED.

UTILITIES

1. THE LOCATION OF UNDERGROUND UTILITIES SHOWN HEREON HAS BEEN DETERMINED FROM SURFACE EVIDENCE OF THEIR EXISTENCE OR FROM INFORMATION OBTAINED FROM THE UTILITY COMPANIES. THE ENGINEER ACCEPTS NO LIABILITY FOR THE EXISTENCE OR NON-EXISTENCE OF UTILITY LINES. CONTRACTORS AND OTHERS USING THIS MAP MUST CONFIRM THE LOCATION OF UNDERGROUND LINES OR STRUCTURES FROM THE UTILITY COMPANIES PRIOR TO COMMENCING ANY EXCAVATION OR ORDERING OF MATERIALS.
2. THE CONTRACTOR SHALL VERIFY IN FIELD, ALL ELEVATIONS, DIMENSIONS, FLOW LINES EXISTING CONDITIONS, AND POINTS OF CONNECTIONS WITH AD-JOINING PROPERTY (PUBLIC OR PRIVATE). ANY DISCREPANCIES SHALL BE CALLED TO THE ATTENTION OF THE ENGINEER BEFOR PROCEEDING WITH THE WORK.

CALL 1-800-227-2600 BEFORE EXCAVATION TAKES PLACE

VICINITY MAP



INDEX

R1	COVER SHEET
R2	MASTER SHEET INDEX
[redacted]	
RS3	ROAD SECTION
RD1	ROAD DETAIL SHEET
RD2	ROAD DETAIL SHEET
RD3	ROAD DETAIL SHEET
USA PP5	PLAN AND PROFILE - USA PKWY
USA PP6	PLAN AND PROFILE - USA PKWY
USA PP7	PLAN AND PROFILE - USA PKWY
USA PP8	PLAN AND PROFILE - USA PKWY
USA PP9	PLAN AND PROFILE - USA PKWY
USA PP10	PLAN AND PROFILE - USA PKWY
USA PP11	PLAN AND PROFILE - USA PKWY
USA T1	USA PWKY TRAFFIC PLAN
USA T2	USA PWKY TRAFFIC PLAN

REVISIONS

BENCHMARKS (REV 7-27-00)

NGVD 29 DATUM - BENCHMARK A

THE SECTION CORNER OF SECTIONS 31, 32, 6, AND 5. TOP OF THE 2 1/2 G.L.O. BRASS CAP IN ROCK MOUND. AS SHOWN ON THE SECOND PARCEL MAP FOR ASAMERA MINERALS (US) INC., FILE NO. 83402. RECORDED WITH STOREY COUNTY ON SEPTEMBER 25TH 1998.
(SUBTRACT 3.38' FROM ELEVATIONS SHOWN ON PLANS USING NAVD 88 DATUM)

ELEVATION= 4349.18

NGVD 29 DATUM - BENCHMARK B

EAST OF THE NORTH EAST CORNER OF PARCEL 2-A, AS SHOWN ON THE PARCEL MAP FOR SIERRA PACIFIC POWER FILE NO. 76995. RECORDED WITH STOREY COUNTY ON DECEMBER 22, 1995. USC & GS "K339 1953"
(SUBTRACT 3.38' FROM ELEVATIONS SHOWN ON PLANS USING NAVD 88 DATUM)

ELEVATION= 4283.13

NAVD 88 DATUM - BENCHMARK C

USC & GS BRASS CAP STAMPED "N 339 1953" IN CONCRETE HEADWALL NORTH OF THE EAGLE PITCHER PLANT AT CLARKS STATION 16KM EAST OF VISTA INTERCHANGE IN SPARKS
(ADD 3.38' TO ELEVATIONS SHOWN ON PLANS USING NGVD 29 DATUM)

ELEVATION= 4256.42

** INFORMATION SUPPLIED TO RENO ENGINEERING CORPORATION BY WESTERN NEVADA SURVEYING & MAPPING 1998

BASIS OF BEARING

THE BASIS OF BEARING IS THE NEVADA COORDINATE SYSTEM 1983/84 AS DETERMINED FROM STATION N339 AND STATION X146, HARN EXTENSION 1983/84. A COMBINED FACTOR OF 1.000254928 WAS USED FOR GRID TO GROUND CONVERSION.

GENERAL NOTES

1. ALL CONSTRUCTION SHALL CONFORM TO STOREY COUNTY CODES AND REGULATIONS.
2. ALL CONSTRUCTION SHALL CONFORM TO THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 1996 EDITION AND THE STANDARD DETAILS FOR PUBLIC WORKS.
3. THE CONTRACTOR SHALL MAINTAIN A DUST CONTROL PROGRAM TO INCLUDE WATERING OF OPEN AREAS AND MAINTAIN CONFORMITY WITH STATE OF NEVADA AIR POLLUTION PROVISIONS.
4. ALL DIMENSIONS ARE FROM FACE OF CURB UNLESS OTHERWISE NOTED.
5. HANDICAPPED RAMPS ARE TO BE CONSTRUCTED AT ALL NEW AND RECONSTRUCTED CURB RETURNS AS SHOWN ON STANDARD DETAILS.
6. REFER TO UTILITY NOTE THIS PAGE.
7. THE CONTRACTOR SHALL MAINTAIN ALL EXISTING DRAINAGE FACILITIES WITHIN THE CONSTRUCTION AREA UNTIL NEW DRAINAGE IMPROVEMENTS ARE IN PLACE AND FUNCTIONING.
8. ALL EXCAVATION AND EMBANKMENT SHALL BE IN ACCORDANCE WITH THE ORANGE BOOK STANDARDS AND THE PROJECT SPECIFIC SOILS REPORT.
9. IT IS THE INTENT OF THESE SPECIFICATIONS AND IMPROVEMENT PLANS THAT THE WORK PERFORMED UNDER THE CONTRACT SHALL RESULT IN A COMPLETE OPERATING SYSTEM IN SATISFACTORY WORKING CONDITION WITH RESPECT TO THE FUNCTIONAL PURPOSES OF THE INSTALLATION. IF THERE ARE ANY QUESTIONS REGARDING THE STATED OR IMPLIED MEANING OF THESE PLANS, THE CONTRACTOR IS DIRECTED TO CONTACT RENO ENGINEERING CORPORATION IMMEDIATELY AT 852-5700.
10. ALL SANITARY SEWER AND WATER LINE CROSSINGS SHALL HAVE A MINIMUM OF 18" CLEARANCE. IF 18" CLEARANCE CANNOT BE MAINTAINED, THE SEWER PIPE SHALL BE CAST IRON, CLASS 50, OR WATER CLASS PIPE. SEPARATION OF PIPES SHALL CONFORM TO NAC 445A.67155, AND SHALL BE INCASE WITH RED CONCRETE.

HORIZONTAL AND VERTICAL SEPARATION
SEWERS SHALL BE LAID AT LEAST 10 FEET (3 M) HORIZONTALLY FROM ANY EXISTING OR PROPOSED WATER MAIN. THE DISTANCE SHALL BE MEASURED FROM EDGE TO EDGE. IN CASES WHERE IT IS NOT PRACTICAL TO MAINTAIN A 10 FOOT (3 M) SEPARATION, THE APPROPRIATE REVIEWING AGENCY MAY ALLOW DEVIATION ON A CASE-BY CASE BASIS, IF SUPPORTED BY DATA FROM THE DESIGN ENGINEER. SUCH DEVIATION MAY ALLOW INSTALLATION OF THE SEWER CLOSER TO THE WATER MAIN, PROVIDED THAT THE WATER MAIN IS IN A SEPARATE TRENCH OR ON AN UNDISTURBED EARTH SHELF LOCATED ON ONE SIDE OF THE SEWER AND AT AN ELEVATION SO THAT THE BOTTOM OF THE WATER MAIN IS AT LEAST 18 INCHES (457 MM) ABOVE THE TOP OF THE SEWER.
IF IT IS IMPOSSIBLE TO OBTAIN PROPER HORIZONTAL AND VERTICAL SEPARATION AS DESCRIBED ABOVE, BOTH THE WATER MAIN AND THE SEWER MUST BE CONSTRUCTED OF SLIP-ON OR MECHANICAL JOINT PIPE COMPLYING WITH THE PUBLIC WATER SUPPLY DESIGN STANDARDS OF THE AGENCY AND BE PRESSURE TESTED TO 150 psi (1034 kPa) TO ASSURE WATERTIGHTNESS BEFORE BACKFILLING.

CROSSINGS
SEWER CROSSING WATER MAINS SHALL BE LAID TO PROVIDE A MINIMUM VERTICAL DISTANCE OF 18 INCHES (457 MM) BETWEEN OUTSIDE OF THE WATER MAIN AND THE OUTSIDE OF THE SEWER. THIS SHALL BE THE CASE WHERE THE WATER MAIN IS EITHER ABOVE OR BELOW THE SEWER. THE CROSSING SHALL BE ARRANGED SO THAT THE SEWER JOINTS WILL BE EQUIDISTANT AND AS FAR AS POSSIBLE FROM THE WATER MAIN JOINTS. WHERE A WATER MAIN CROSSES UNDER A SEWER, ADAQUATE STRUCTURAL SUPPORT SHALL BE PROVIDED FOR THE SEWER TO MAINTAIN LINE AND GRADE.

WHERE IT IS IMPOSSIBLE TO OBTAIN PROPER HORIZONTAL AND VERTICAL SEPARATION AS STIPULATED ABOVE, ONE OF THE FOLLOWING METHODS MUST BE SPECIFIED:
A. THE SEWER SHALL BE DESIGNED AND CONSTRUCTED EQUAL TO THE WATER PIPE, AND SHALL BE PRESSURE TESTED TO 150 psi (1034 kPa) TO ASSURE WATER TIGHTNESS PRIOR TO BACKFILLING.
B. EITHER THE WATER MAIN OR THE SEWER LINE MAY BE ENCASED IN A WATERTIGHT CARRIER PIPE WHICH EXTENDS 10 FEET (3 M) ON BOTH SIDES OF THE CROSSING, MEASURED PERPENDICULAR TO THE WATER MAIN. THE CARRIER PIPE SHALL BE OF MATERIALS APPROVED BY THE REGULATORY AGENCY FOR USE IN WATER MAIN CONSTRUCTION.

11. CONSTRUCTION EXPANSION JOINTS IN ALL CURBS AND GUTTERS SHALL BE AT THIRTY FEET (30') ON CENTER AND AT ALL RETURNS WITH WEAKENED PLANE JOINTS AT INTERVALS OF TEN FEET (10')
12. ALL SANITARY SEWER LINES SHALL BE S.D.R. CLASS 35. IN ADDITION, ALL SANITARY SEWER LATERALS SHALL BE 8 INCH MIN. DIAMETER S.O.R. 35., UNLESS SHOWN OTHERWISE, AND SHALL BE PLUGGED AND MARKED AS SHOWN ON PLANS.
13. THE LETTER "S" SHALL BE STAMPED ON THE TOP OF CURB AT ALL LOCATIONS WHERE A SEWER SERVICE LATERAL CROSSES THE CURB LINE. THE LETTER "W" SHALL BE STAMPED IN THE CURB AT ALL LOCATIONS WHERE A WATER LATERAL CROSSES A CURB LINE.
14. ALL STORM DRAIN LINES (R.C.P.) SHALL BE CLASS III UNLESS OTHERWISE NOTED.
15. ALL AREAS DISTURBED AND LEFT UNDEVELOPED FOR A PERIOD OF MORE THAN THIRTY (30) DAYS SHALL BE STABILIZED BY THE APPLICATION OF DUST PALLIATIVE AND IF LEFT MORE THAN NINETY (90) DAYS PLANTED AS FOLLOWS:
FERTILIZER – (16-20-0) 300# ACRE
GRASS, THE BROADCAST SEEDING RATE SHALL BE 12#/AC. OF SODAR WHEATGRASS AND 8#/AC. OF FAIRWAY CREATED WHEATGRASS. IF DRILLED, THE RATE SHOULD BE 6#/AC. OF SODAR WHEATGRASS AND 5#/AC. OF FAIRWAY CREATED WHEATGRASS
STRAW MULCH 3000#/AC., ANCHORED BY A STRAW PUNCHING TOOL OR COVERED WITH NETTING AND STAPLED.
16. PARALLEL WATER AND SANITARY SEWER/RECLAIMED WATER SEPARATION SHALL BE 10' MINIMUM.
17. ALL ASPHALT SHALL BE SAWCUT WHERE NEW CONSTRUCTION MEETS EXISTING.
18. ALL SIGN LOCATIONS SHALL BE IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (M.U.T.C.D.).
19. SLOPE STABILIZATION – NO SLOPE TO BE STEEPER THAN 3:1 ON THIS PROJECT WITHOUT NOTIFACTION OF ENGINEER, AND CONFORMANCE TO THE ORANGE BOOK.
    A. SLOPE STABALIZATION – FOR > 3:1 – RIPRAP PER THE ORANGE BOOK.
    B. SLOPE STABALIZATION – FOR 3:1 TO 5:1 – REVEGITATE WITH NATIVE SEED MIX PRIOR TO ACCEPTANCE OF THE IMPROVEMENT.
    C. NO SLOPE TREATMENT REQUIRED – FOR SLOPE < 5:1
    I. PLANTING:
        A. THE SEED MIXTURE AND APPLICATION RATE FOR THE SLOPE STABILIZATION SHALL BE TO THE APPROVAL OF THE ENGINEER. SEED SHALL BE DRILLED INTO THE SOIL TO A DEPTH RECOMMENDED BY THE SEED SUPPLIER.
        B. A FLEXIBLE SOIL REINFORCEMENT MATTING MADE OF THREE DIMENSIONAL NYLON OR VINYL MONOFILIMENTS, FUSED AT THE INTERSECTIONS, WITH A MINIMUM THICKNESS OF 9MM (OR APPROVED EQUAL), SHALL PROVIDE COVERAGE ON ALL SLOPES. THE MATERIAL SHALL HAVE 95% OPENING AND PROVIDE ULTRAVIOLET PROTECTION. IT SHALL RETAIN A MINIMUM OF 90% OF IT'S STRENGTH AFTER TWO YEARS. THE FABRIC SHALL BE INSTALLED STRICTLY ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
    II. ALL SLOPES SHALL BE IRRIGATED UNTIL ESTABLISHED AS APPROVED BY THE ENGINEER.
    III. WHEN ROCK RIP-RAP IS USED FOR SLOPE STABILIZATION, IT SHALL CONFORM TO THE ORANGE BOOK.
20. ALL WATERLINES SHALL BE CONSTRUCTED PER AWWA STANDARDS.
THE WATER SYSTEM SHALL CONFORM TO THE STANDARD SPECS FOR PWC, 1996 EDITION. THE STANDARD DETAILS FOR PUBLIC WORKS ADOPTED BY STOREY COUNTY EXCEPT AS MODIFIED BY THESE PLANS ON SPECIAL PROVISIONS.
    A. WATER LINES SHALL BE DISINFECTED IN THE PRESENCE OF A U.D. INSPECTOR IN ACCORDANCE WITH AWWA C651 STANDARDS TO THE SATISFACTION OF THE USD INSPECTOR.
    B. WATER LINES SHALL BE FLUSHED AND PRESSURE TESTED IN THE PRESENCE OF A U.D. INSPECTOR.
    C. NEW WATER LINES SHALL BE ISOLATED FROM EXISTING UNTIL APPROVED BY A U.D. INSPECTOR. IN CONFORMANCE WITH AWWA C600 FOR DUCTILE IRON, AND AWWA C605 FOR PVC PIPE.
    D. NEW WATER LINES SHALL BE BACTI'D BY A U.D. INSPECTOR.
    E. ALL PIPE LATERALS TO EXTEND 20' BEYOND EDGE OF PAVEMENT MIN. OR TO THE EDGE OF THE LANDSCAPE EASEMENT, OR B.O., WHICHEVER IS FARTHER. INCLUDE FLUSH VALVE ASSEMBLY.
    F. ALL TIES TO EXISTING WATER LINES SHALL BE APPROVED BY A UD INSPECTOR
    G. SUBMITTALS FOR ALL WATER AND RECLAIM WATER PIPES & APPURTENANCES SHALL BE SUBMITTED AND AND APPROVED BY THE ENGINEER.
    H. ALL WATER LINES TO HAVE A MINIMUM OF 3' OF COVER.
    J. ALL TEEs, BENDS, CAPS, AND HYDRANTS REQUIRE THRUST BLOCKS PER DETAIL ON SHEET CD1.
    K. LOCATOR TAPE SHALL BE PLACED ABOVE ALL WATER PIPE PER TRENCH DETAIL ON SHEET CD2.
    L. NO OPENINGS IN WATER PIPE UNDER CONSTRUCTION SHALL BE LEFT OPEN OVERNIGHT TO KEEP WILDLIFE AND POLLUTION OUT OF THE PIPE.
21. STREETLIGHTS TO BE CONSTRUCTED PER SIERRA PACIFIC POWER COMPANY CONTRACT DRAWINGS
22. DETAILS ARE SHOWN FOR INFORMATION ONLY AND ARE NOT MEANT TO SUPERSEDE THE ACTUAL STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION.
23. DUCTILE IRON PIPE SHALL CONFORM TO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 1992, 203.06 UNLESS OTHERWISE SPECIFIED. PIPE TO BE PUSH-ON JOINTED, CEMENT LINED DUCTILE IRON PIPE CLASS 50.
24. 3"-12" WATER PIPE SHOWN ON THESE PLANS SHALL BE PVC AND CONFORM TO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 1992 203.15.03 UNLESS OTHERWISE SPECIFIED. PVC PIPE TO BE CLASS 150, DR18, CONFORMING TO AWWA C900.
25. WATER PIPE LARGER THAN 12" SHALL BE PVC AND CONFORM TO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 1992 203.15.03 UNLESS OTHERWISE SPECIFIED. PVC PIPE TO BE CLASS 165, DR25, CONFORMING TO AWWA C905.
26. POLYETHELENE PRESSURE TUBING (1"-3" SHOWN ON THESE PLANS) SHALL CONFORM TO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 1992 203.16.02.01 UNLESS OTHERWISE SPECIFIED. POLYETHELENE TUBES SHALL BE CLASS 200 (DR9) CONFORMING TO AWWA C901.
27. ALL MANHOLES TO BE WATER TIGHT. STEPS ("MA" MANHOLE STEP BY MA INDUSTRIES OR EQUAL) WILL BE REQUIRED IN ALL MANHOLES 5 FEET OR MORE IN DEPTH.
28. EROSION CONTROL PERMIT # APPROVED BY NDEP, SHALL BE USED FOR THIS PROJECT. CONTACT ENGINEER FOR COPY OF PERMIT PRIOR TO COMMENCEMENT OF WORK.
29. CONTRACTOR TO SCHEDULE A PRE-CON MEETING PRIOR TO COMMENCEMENT OF CONSTRUCTION WITH ENGINEER AND STOREY COUNTY OFFICIALS.
30. REPRODUCIBLE AS-BUILTS SHOWING ELEVATIONS, LOCATIONS & TYPES OF FITTINGS MUST BE PROVIDED TO THE COUNTY AND ENGINEER BEFORE PROJECT WILL BE ACCEPTED.
31. ALL THE NOTES LISTED ABOVE MAY NOT PERTAIN TO THE SPECIFIC WORK SHOWN ON THESE PLANS HOWEVER ALL THOSE USING THESE PLANS ARE STRONGLEY ADVISED TO READ AND UNDERSTAND THESE NOTES AS THEY PERTAIN TO THE WORK SHOWN HEREIN. FOR ASSISTANCE INTERPRETING THESE NOTES CONTACT THE ENGINEER.

CONSTRUCTION NOTES

NOT ALL NOTES LISTED BELOW ARE USED ON THESE PLANS

POTABLE/RECLAIM WATER

WATER NOTES

(1) INSTALL 12" x 12" x 10" TEE WITH 12" PO x FLG GATE VALVES & 10" PO x FLG GATE VALVE WHERE SHOWN. INCLUDE THRUST BLOCKS PER DETAIL ON SHEET RD1. CAP & MARK FOR FUTURE EXTENSION WHERE REQ'D.
(2) INSTALL THRUST BLOCKS AND CAP & MARK AT END OF WATER LINE OR RECLAIM LINE PER DETAIL ON SHEET RD2. INSTALL B.O. ASSY. AS SHOWN ON SHEET RD2, UNLESS FVA IS PRESENT.
(3) ~~REMOVE CAP FROM EXISTING LINE AND EXTEND. INSTALL 12" GATE VALVE PER DETAIL ON SHT. RD1, UNLESS EXISTING VALVE IS PRESENT.~~
(4) INSTALL STANDARD 2" FLUSHING HYDRANT ASSEMBLY AT LOW POINT IN WATER/RECLAIM LINE. NO VALVES IN STREET (SEE SHT. RD2)
(5) INSTALL AIR RELIEF VALVE AT HIGH POINT IN WATER/RECLAIM LINE PER DETAIL ON SHEET RD2. NO VALVES IN STREET.
(6) INSTALL INLINE VALVE IN NEW WATER OR RECLAIM LINE. SIZE PER MAIN DIAMETER. (USE BUTTERFLY VALVES FOR 14" AND GREATER MAINS.) REFER TO SHEET RD1 FOR DETAIL.
(7) WARP PIPE INTO ALIGNMENT. MINIMUM RADIUS TO BE PER PIPE MANUFACTURERS SPECIFICATION.
(8) INSTALL 14" x 14" x 14" TEE W/ 14" PO x FLG BUTTERFLY VALVES WHERE SHOWN. CAP FOR FUTURE EXTENSION WHERE REQUIRED. INCLUDE THRUST BLOCKS PER SHEET RD1.
(9) INSTALL 12" x 12" x 6" TEE WITH 6" FLG x PO GATE VALVE AND FIRE HYDRANT (SHT. RD1). LOCATION AS SHOWN ON PLANS.
(10) INSTALL 90° ELBOW AS SHOWN. INCLUDE STANDARD THRUST BLOCKS, SIZE PER MAIN DIAMETER (SHT. RD1).
(11) INSTALL 10" x 10" x 6" TEE WITH 10" PO x FLG GATE VALVES & 6" PO x FLG GATE VALVE WHERE SHOWN. INCLUDE THRUST BLOCKS PER DETAIL ON SHEET RD1. CAP FOR FUTURE EXTENSION WHERE REQ'D. IN LOCATIONS WITH TWO LATERALS A 10x6x10x6 CROSS IS ACCEPTABLE. CAP AND MARK ENDS AT R.O.W.
(12) INSTALL 12" x 10" REDUCER
(13) ~~INSTALL 10" x 10" x 6" TEE WITH 6" FLG x PO GATE VALVE AND FIRE HYDRANT (SHT. RD1). LOCATION AS SHOWN ON PLANS.~~
(14) ~~INSTALL 6" x 6" x 6" TEE W/ 6" PO x FLG GATE VALVES WHERE SHOWN. CAP FOR FUTURE EXTENSION WHERE REQUIRED. INCLUDE THRUST BLOCKS PER SHEET RD1.~~
(15) ~~INSTALL 12" x 12" x 8" TEE WITH 12" PO x FLG GATE VALVES & 8" FLG x PO GATE VALVE WHERE SHOWN. CAP FOR FUTURE EXTENSION WHERE REQ'D.~~
(16) ~~INSTALL 8" x 8" x 6" TEE WITH 6" FLG x PO GATE VALVE AND FIRE HYDRANT (SHT. RD1). LOCATION AS SHOWN ON PLANS.~~
(17) ~~INSTALL 10" x 10" x 8" TEE WITH 10" PO x FLG GATE VALVES & 8" FLG x PO GATE VALVE WHERE SHOWN. CAP FOR FUTURE EXTENSION WHERE REQ'D.~~
(18) INSTALL 10" x 10" x 10" TEE WITH 10" PO x FLG GATE VALVES WHERE SHOWN. INCLUDE THRUST BLOCKS PER DETAIL ON SHEET RD1. IN LOCATIONS WITH TWO LATERALS A 10x10x10x10 CROSS IS ACCEPTABLE. CAP AND MARK ENDS AT R.O.W.
(19) INSTALL 22.5° OR 11.25° ELBOW W/ STANDARD THRUST BLOCKS. SIZE PER MAIN DIAMETER.
(20) ~~INSTALL 45° ELBOW W/ STANDARD THRUST BLOCKS. SIZE PER MAIN DIAMETER.~~
(21) INSTALL BLOW OFF ASSEMBLY PER DETAIL ON SHEET RD2. INCLUDE THRUST BLOCKS PER SHEET RD1.
(22) ~~REMOVE EX. CAP & THRUST BLOCK. INSTALL ELBOW PER NOTE SHOWN.~~
(23) ~~INSTALL 10" x 8" REDUCER~~
(24) INSTALL 14" x 12" REDUCER
(25) ~~INSTALL 16" x 14" REDUCER~~
(26) INSTALL 14" x 14" x 6" TEE WITH 6" FLG x PO GATE VALVE AND FIRE HYDRANT (SHT. RD1). LOCATION AS SHOWN ON PLANS.
(27) INSTALL 12"x12"x12" TEE WITH 12" PO x FLG GATE VALVES WHERE SHOWN. CAP & MARK FOR FUTURE EXTENSION WHERE REQ'D.
(28) ~~CAP AND MARK~~
(29) INST 10"x10"x4" TEE W/ 10" PO x FLG GV & 4" PO x FLG GV's WHERE SHOWN IN LOCATIONS WITH TWO LATERALS, A 10x4x10x4 CROSS IS ACCEPTABLE. CAP AND MARK ENDS AT R.O.W.
(47) INSTALL 12" x 6" REDUCER
(48) INSTALL FIRE HYDRANT AND 6x12 REDUCER AS SHOWN PER RD1 5' BEHIND BACK OF CURB. TEMPORARY INSTALLATION UNTIL ADJACENT SITE IS DEVELOPED AND LATERAL IS EXTENDED.
(49) 12" CROSS W/ 12" PO x FLG GATE VALVES WHERE SHOWN. INCLUDE THRUST BLOCKS AS REQUIRED. OPTION – INSTALL (2) 12"X12"X12" TEES SIDE BY SIDE.
(50) INSTALL 14"X14"X12" TEE W/ (1) 14" PO x FLG BUTTERFLY VALVE & (2) 12" PO x FLG GATE VALVES WHERE SHOWN. IN LOCATIONS WITH TWO HYDRANTS A 14x12x14x12 CROSS IS ACCEPTABLE.
(60) INSTALL 14"x12"x14"x12" CROSS WITH (2) – 12" POX FLG GATE VALUES AND (2) – 14" PO x FLG BUTTER FLY VALUES.
(61) ~~INSTALL 10"x6"x10"x6" CROSS WITH (2) – 10" PO x FLG GATE VALUES AND (2) – 6" PO x FLG GATE VALUE~~
(62) INSTALL 14"x16"x14"x14" CROSS WITH (3) – 14" PO x FLG BUTTER FLY VALUES AND (1) – 16" PO x FLG BUTTER FLY VALUE.
(63) INSTALL 10"x10"x10"x6" CROSS WITH (3) – 10" PO x FLG , GV AND (1) – 6" PO x FLG, GV.

SANITARY SEWER

(51) INSTALL NEW 8" SANITARY SEWER LATERAL TO SEWER MAIN, MATCH CROWN AS SHOWN IN PROFILE. USE STANDARD TAPPING COLLAR OR WYE CONNECTION ON NEW MAINS IF NOT AT MH. REFER TO PLAN. EXTEND LINE TO LANDSCAPE LIMITS OR 20' BEHIND CURB, WHICHEVER IS GREATER.
(52) ~~EXPOSE EXISTING SANITARY SEWER LINE AND EXTEND AS SHOWN.~~
(53) CONSTRUCT NEW 48" TYPE I SANITARY SEWER MANHOLE (UNLESS OTHERWISE NOTED) INVERTS AS SHOWN. SEE SHEET RD1 FOR DETAILS.
(54) ~~WHEN THE SEWER MAIN CROSSES THE WATER MAIN, THE SEWER MAIN MUST BE LOCATED AT LEAST 18" LOWER THAN THE WATER MAIN. WHEN THE SEWER MAIN CROSSES A WATER SERVICE LATERAL, THE SEWER MAIN MUST BE LOCATED AT LEAST 18" LOWER THAN THE WATER SERVICE LATERAL. WHEN THE SEWER SERVICE LATERAL CROSSES A WATER MAIN OR WATER SERVICE LATERAL, THE SEWER SERVICE LATERAL MUST BE LOCATED AT LEAST 12" LOWER THAN THE WATER MAIN OR WATER SERVICE LATERAL. WHEN A SEWER MAIN PARALLELS A WATER MAIN OR WATER SERVICE LATERAL, THE SEWER MAIN MUST BE IN A SEPARATE TRENCH AND MUST HAVE A 10' HORIZONTAL SEPARATION. WHEN A SEWER SERVICE LATERAL PARALLELS A WATER MAIN OR WATER SERVICE LATERAL, THE SEWER SERVICE LATERAL MUST BE IN A SEPARATE TRENCH, BE LOCATED 12" LOWER, AND MUST HAVE A 10' HORIZONTAL SEPARATION.~~
(55) CONSTRUCT NEW 60" TYPE I OR IV SANITARY SEWER MANHOLE (UNLESS OTHERWISE NOTED) INVERTS AS SHOWN. SEE SHEET RD1 FOR DETAILS.
(56) ~~CONSTRUCT NEW 48" TYPE III SPECIAL DROP MANHOLE (INVERTS AS SHOWN) REFER TO ORANGE BOOK DETAIL 2-3.~~
(57) PROVIDE STUB FOR FUTURE EXTENSION 10' PAST EDGE OF AC. CAP & MARK FOR FUTURE CONNECTION.

STORM DRAIN

(31) ~~REMOVE EXISTING END SECTION OR HEADWALL AND CONTINUE STORM DRAIN AS SHOWN ON PLANS.~~
(32) ~~INSTALL NEW STORM DRAIN LATERAL TO NEW SD MAIN OR CROSSING, SIZE AS 12" RCP CLASS V (UNLESS NOTED OTHERWISE). CONNECT TO MAIN OR CROSSING USING STANDARD "CUT-IN" CONNECTION. GROUT EDGES TO FORM WATERTIGHT SEAL. MATCH CENTERLINES OF LATERAL AND MAIN. REFER TO DETAIL SHEET RD2 FOR DETAILS.~~
(33) INSTALL STANDARD TYPE 4R CATCH BASIN WITH 12" RCP CLASS V LATERAL AS SHOWN. INSTALL W/ "SUR-TRAP" GREASE TRAP. REFER TO SHEETS RD1 AND RD2 FOR DETAILS. SLOPE LATERAL AT 1.0%, UNLESS INVERTS ARE INDICATED ON PLANS. REFER TO STORM DRAIN NOTE #34 FOR RIP-RAP REQUIREMENTS AT OUTLET.
(34) INSTALL RIP-RAP OUTLET, 6" MINIMUM DIAMETER STONES. LOCATE AS SHOWN ON PLANS. BEVEL END OF PIPE TO MATCH CHANNEL SIDE SLOPE FOR 12" DIA. PIPES AND SMALLER. LARGER PIPES REQUIRE STANDARD HEADWALL PER ORANGE BOOK SPECIFICATIONS. RIP-RAP TO COVER TOP OF PIPE TO FLOW LINE OF CHANNEL OR TOE OF SLOPE.
(35) ~~INSTALL 12" STORM LATERAL. LEAVE INLET EXPOSED WITH RIPRAP WHEN LATERAL IS USED TO DRAIN HIGHSIDE OF ROADWAY. SEE SD NOTE #34 FOR RIP-RAP REQUIREMENTS.~~
(36) ~~INSTALL CONCRETE HEADWALL PER ORANGE BOOK DRAWING 2-45/1.~~
(37) INSTALL RIP-RAP AT PIPE OUTLET/INLET, 10' DOWNSTREAM, TWICE THE WIDTH OF THE PIPE. STONES TO BE 8" MINIMUM. MINIMUM DEPTH OF 18". UNLESS NOTED OTHERWISE.
(38) INSTALL NEW 48" TYPE I SD MANHOLE (UNLESS OTHERWISE NOTED) INVERTS AS SHOWN. SEE SHEET RD1 FOR SDMH DETAIL.
(39) INSTALL RIP-RAP AT PIPE INLET/OUTLET PER UNION PACIFIC RAILROAD STANDARDS. REFER TO DETAIL, EXHIBIT "K" OF UPRR TECHNICAL SPECS.
(40) DIVERT EXISTING FLOW LINES OF DITCH TO NEW CULVERT CROSSING AS SHOWN TO PREVENT PONDING IN CHANNEL AFTER COMPLETION OF ROADWAY. FUTURE DEVELOPMENT WILL FILL CHANNEL AND RE-CONTOUR SLOPES TO DRAIN NEW IMPROVEMENTS.
(41) INSTALL NEW 12" RCP LATERAL TO EXISTING CATCH BASIN, CONNECT TO PROPOSED ROADSIDE DITCH ALONG ROADWAY. RCP TO BE CLASS V.
(42) INSTALL PRECAST DROP INLET WITH TRAFFIC RATED FRAME AND GRATE SIMILAR TO JENSEN 48" X 48" DROP INLET, OR AS DESIGNATED ON PLAN.
(43) INST STANDARD TYPE 3R CATCH BASIN IN LANDSCAPE MEDIAN. GRADE AREA TO DRAIN. INCLUDE CONCRETE COLLAR. REFER TO DWG. NO. R-11 (311) OF THE STANDARD DETAILS.
(44) ~~INST RISER TYPE DROP INLET ABOVE SD MAIN. GRADE AREA TO DRAIN. INCLUDE CONCRETE COLLAR. REFER TO DWG. NO. 2-41 (306) OF THE STANDARD DETAILS.~~
(45) ~~ALL CULVERTS SHALL BE CABRERED PER UPRR STANDARDS. REFER TO DETAIL, EXHIBIT "K" OF UPRR TECHNICAL SPECIFICATIONS.~~

GAS/POWER

(70) ~~REFER TO SPPCO GAS DRAWINGS FOR INFORMATION~~
(71) PLACE STREET LIGHT PER SPPC. SPECIFICATIONS.

ROAD

(81) SAWCUT AND MATCH NEW ASPHALT TO CUT LINE.
(82) ~~VERIFY LOCATION OF POWER POLE GUY WIRES PRIOR TO CONSTRUCTION. REPORT CONFLICTS TO ENGINEER IMMEDIATELY.~~
(83) ALL SLOPES 3:1 MAX, UNLESS OTHERWISE SPECIFIED, AND SHALL CONFORM TO GENERAL NOTES PER THIS PLAN. ALL SLOPES TO BEGIN ONE FOOT BEHIND FLATWORK.
(84) ~~SLOPES MAY BE INCREASED WITH PERMISSION OF SOILS ENGINEER OF SITE~~
(85) DOUBLE 4" IRRIGATION SLEEVE UNLESS NOTED OTHERWISE. MARK ENDS WITH PURPLE 2 X 4 POST 3' ABOVE GRADE.
(86) ~~3/8 SLURRY SEAL~~
(87) INSTALL A SURVEY MONUMENT PER STANDARD AT ALL PT's, PC's, AND MAJOR INTERSECTIONS.
(88) REMOVE EXISTING CURB, GUTTER AND SIDEWALK IN THIS AREA. REPLACE WITH NEW AS SHOWN
(89) ~~CONTRACTOR TO CONSTRUCT L-CURB AND SIDEWALK STRAIGHT THROUGH FUTURE DRIVEWAY UNLESS PROJECT IS UNDER CONSTRUCTION DURING CONSTRUCTION OF ROAD. IF PROJECT IS UNDER CONSTRUCTION, CONTRACTOR TO "BOX OUT" DRIVEWAY AREA TO RELIEVE ONSITE DEVELOPMENT FROM COST OF SIDEWALK AND CURB.~~
(90) ~~BORING HOLE PER SOILS REPORT~~
(91) ~~ASPHALT UTILITY CUT WITH PERMANENT PAVEMENT PATCH PER STANDARD DRAWING #R-23 PAGE 23 OF ORANGE BOOK.~~
(92) ~~SIDE SLOPES SHALL BE 1:1 MAX. VERIFY AND CONFIRM WITH SOILS REPORT AND GEOTECHNICAL ENGINEER.~~
(93) LIMIT OF CONSTRUCTION LINE FOR THIS SHEET (BIDDING LIMITS). SEE NOTE 95.
(94) ~~THIS IMPROVEMENT TO BE CONSTRUCTED WITH FUTURE PHASE~~
(95) ~~CONTRACTOR TO PLACE SIX (6) 18"x18" END OF PAVEMENT MARKERS AT THE END OF ANY PAVED IMPROVEMENTS BETWEEN PHASES. USE TYPE N-3 RED W/ REFLECTORS. IF GRADES ARE GREATER THAN 10 FEET, INCLUDE CONCRETE K-RAIL WITH FLASHING WARNING LIGHTS.~~
(96) CONSTRUCT 10' WIDE PCC VALLEY GUTTER AT INTERSECTION. REFER TO SHEET RD2.
(97) ~~CONSTRUCT PEDESTRIAN RAMP IN SIDEWALK OR MEDIAN ISLAND. REFER TO SHEET RD2 FOR CONSTRUCTION DETAILS.~~
(98) BASIS OF BEARING AND BENCHMARK ELEVATIONS ARE SHOWN ON COVER SHEET ONLY. REFER TO "BENCHMARK" SECTION ON COVER SHEET FOR INFORMATION.
(99) SOME UNDERGROUND UTILITIES MAY NOT BE CONSTRUCTED AT THIS TIME. REFER TO SHEET R1 FOR CONSTRUCTION SCHEDULE.
(100) ~~ALL SLOPES 2:1 MAX, UNLESS SOIL CONDITIONS WARRANT FLATTER SLOPES. ALL SLOPES TO BEGIN WHERE SHOWN ON SECTION SHEETS.~~
(101) INSTALL 2-3" CONDUITS FOR FUTURE TRAFFIC SIGNAL AS SHOWN. TERMINATE CONDUIT IN STANDARD NDOT #5 TRAFFIC BOXES.
(102) ~~INSTALL ROAD CROSSING WITH PRECAST CONCRETE PANELS. INSTALL PER UPRR STANDARDS. REFER TO DETAIL, EXHIBIT "Z-4" OF UPRR TECHNICAL SPECIFICATIONS.~~
(103) REMOVE ABANDONED STEEL PIPE IN CONSTRUCTION ZONE. STOCK PILE ADJACENT TO REMOVAL SITE.

USA PARKWAY

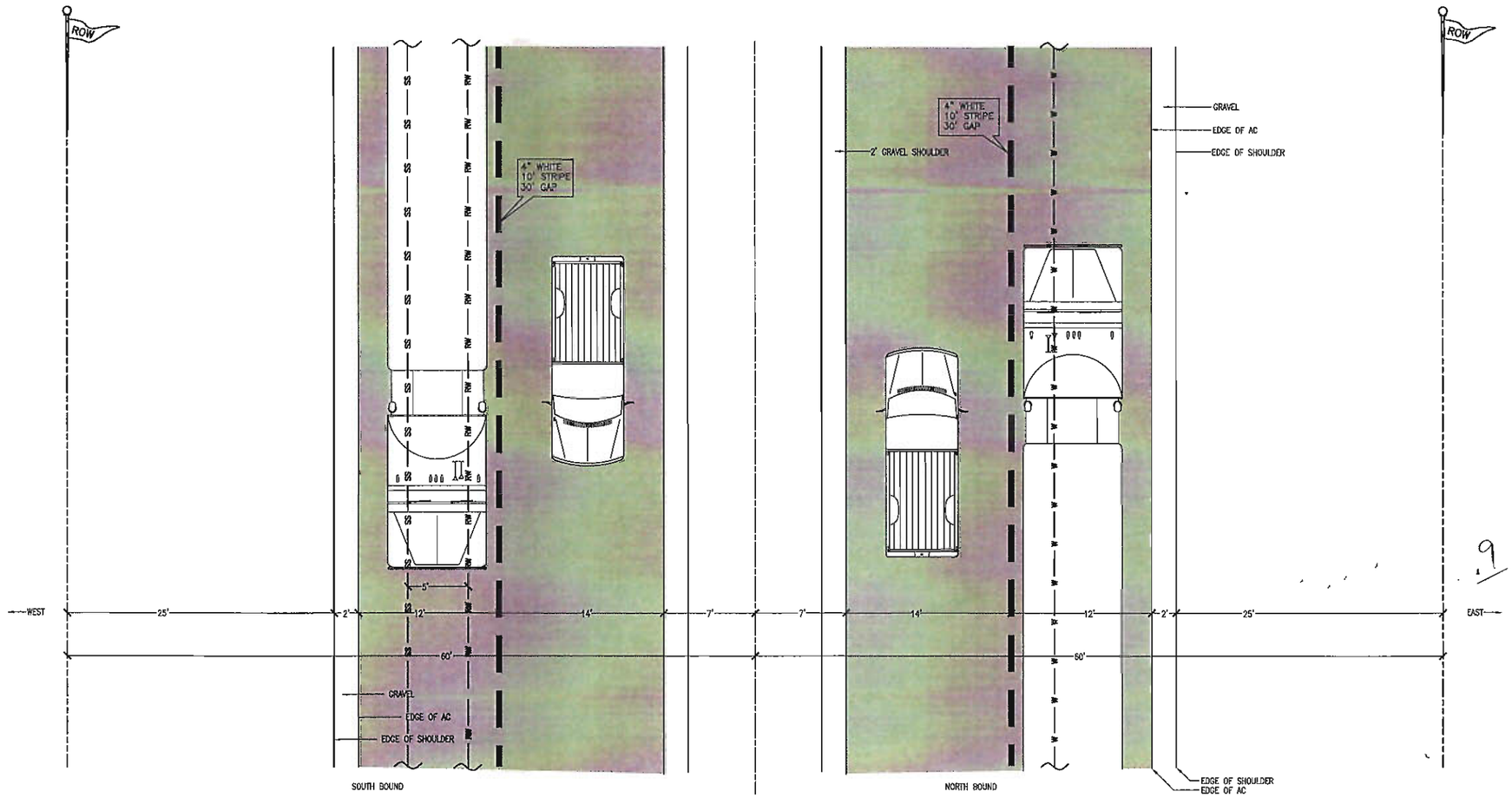
(USA)

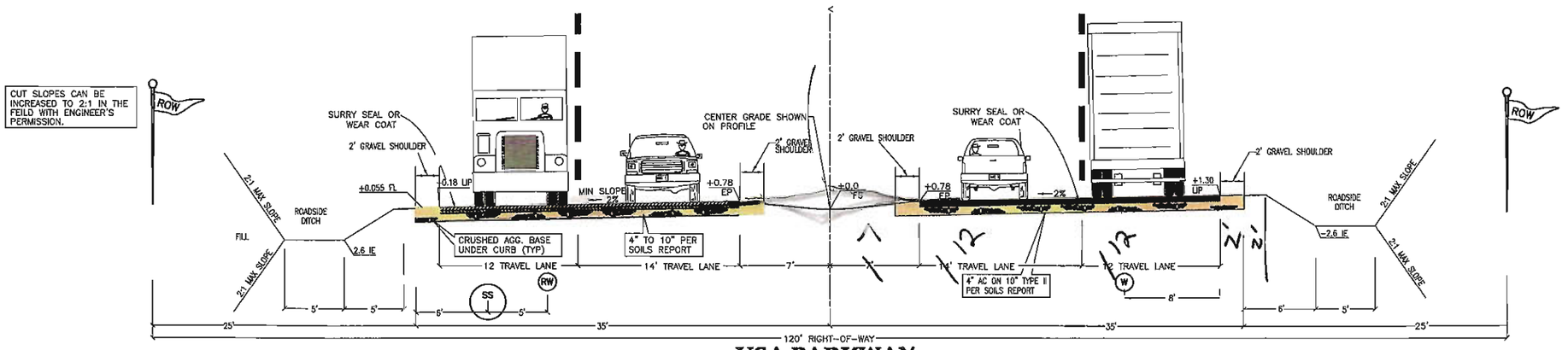
REC
RENO ENGINEERING CORPORATION
CIVIL ENGINEERING · DESIGN · LAND PLANNING
5600 SOUTH MEADOWS PARKWAY RENO, NEVADA
PHONE: (702) 852-5700 FAX: (702) 852-2104

TAHOE RENO INDUSTRIAL CENTER

TRI-CENTER ROADWAYS COVER SHEET

ROAD R1
AKA RCV





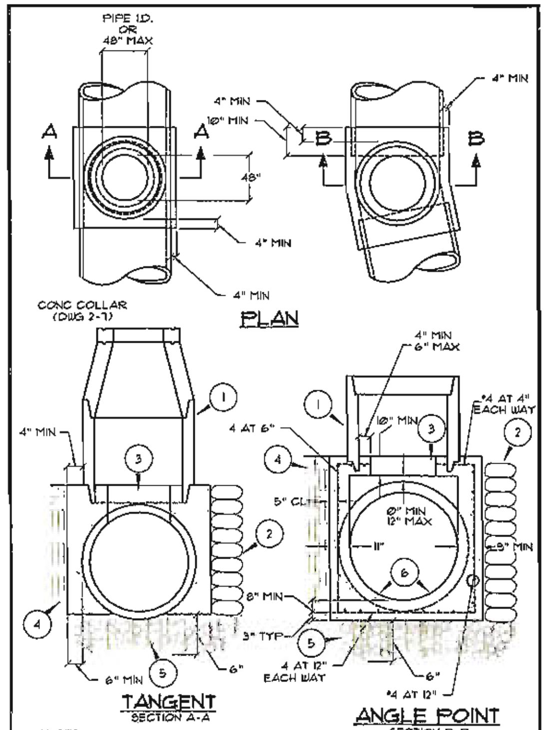
USA PARKWAY
SUPER-ELEVATED ROADWAY SECTION
(WALTHAM WAY TO ITALY)

REC
RENO ENGINEERING CORPORATION
CIVIL ENGINEERING • DESIGN • LAND PLANNING
3983 S. McCARRAN BLVD #332 RENO, NV 89502
PHONE: (702) 852-5700 FAX: (702) 852-2104
TAHOE RENO INDUSTRIAL CENTER

MASTER ROADWAY PLAN
USA PARKWAY - WALTHAM TO ITALY

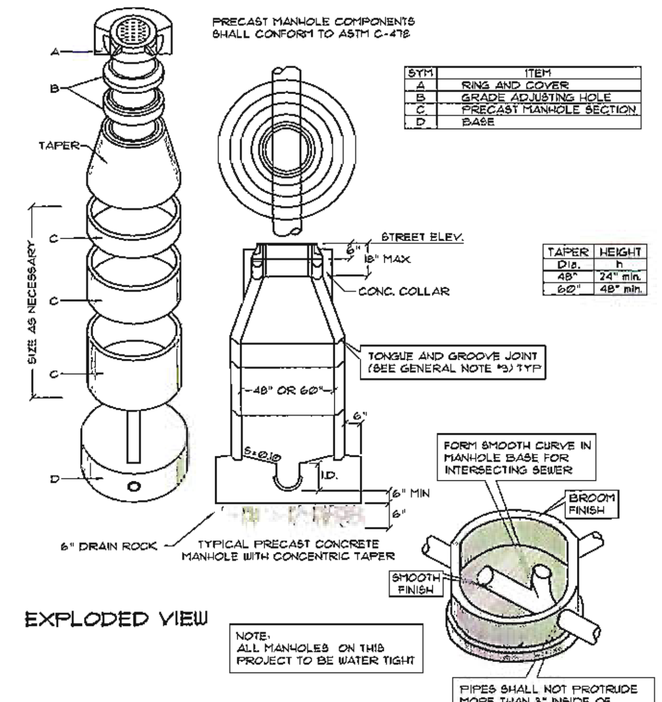
REVISION 7/8/04
REVISION 11/19/04

ROAD SECTION
RS3



NOTES
1. CONCENTRIC MANHOLE (SEE TYPE I MANHOLE)
2. SANDBAGS MAY BE USED AS FORM
3. FORM CIRCULAR OR ELLIPTICAL HOLE
4. EARTH IN PLACE CAN BE USED AS FORM
5. 6" DRAIN ROCK
6. SLOPE TO CONFORM W/PIPE BELOW SPRING LINE PROVIDE SMOOTH FINISH

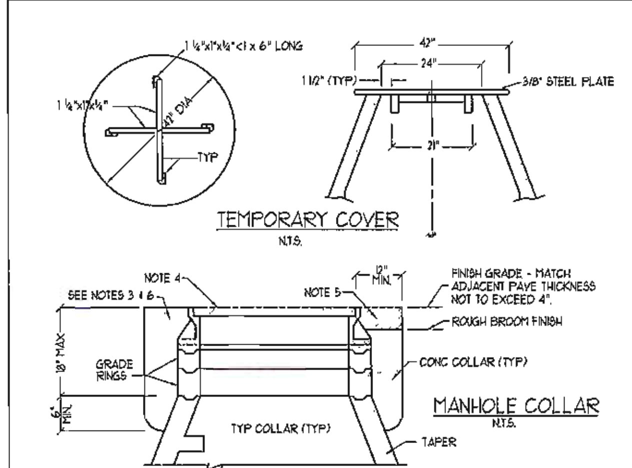
NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTION 2
1	Drain rock	5-95	MANHOLE TYPE IV	DRAWING NO. 2-6 (306)
				DATE 7-81 / PAGE 9



TAPER Dia.	HEIGHT h
48"	24" min.
60"	48" min.

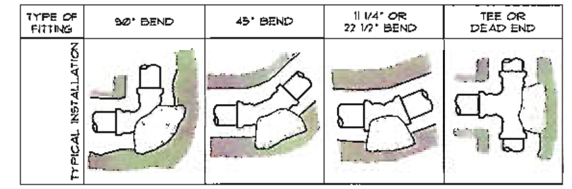
1. MANHOLE SECTION LENGTHS ARRANGED TO FIT DEPTH
2. PRECAST BASE MAY BE USED IF APPROVED BY GOVERNING AGENCY
3. LANDER CO. ONLY - MANHOLES CONSTRUCTED IN NON-PAVED AREA SHALL HAVE MIN. WALL THICKNESS OF 5" ON CONE AND BARREL SECTIONS

NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTION 2
1	SEE NOTE	3-83	MANHOLE TYPE I	DRAWING NO. 2-3 (306)
2	ITEM C,D	8-85		
3	Collar,dr.rock	5-95		DATE 7-81 / PAGE 4



NOTES
1. CONC COLLAR TO BE PORTLAND CEMENT CONC (P.C.C.) W/THE FOLLOWING CHARACTERISTICS: 4000psi MIN COMP STRENGTH @ 28 DAYS MIN 6 SACKS OF CEMENT PER CU. YD. W/MAX WATER-CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6%±1.5%, SLUMP @ 1 TO 4 INCHES. IN WASHOE CO. MIN CEMENT CONTENT TO BE 16.25sack. ALL MATERIAL SHALL CONFORM TO SSPWC SEC.202
2. HEIGHT OF COLLAR SHALL BE CONSISTANT ALL AROUND MANHOLE.
3. RENO - CONC COLLAR SHALL BE FLUSH W/ADJACENT PAVEMENT
4. WASHOE CO. - MANHOLE RING SHALL BE SET 3/8" - 5/8" BELOW FINISH ROADWAY SURFACE. MANHOLES IN ALL OTHER AREAS SHALL BE SET FLUSH W/FINISH GRADE UNLESS OTHERWISE NOTED
5. WASHOE CO. - CONC COLLAR SHALL BE LEFT 2" BELOW FINISH ASPH SURFACE. PLACE 2" THICH TYPE 3 A.C. PAVING AROUND MANHOLES & APPLY SS-1 TACK COAT BEFORE PAVING, SEAL A.C. SURFACE W/SS-1 & SAND CHIP SEAL, SLURRY SEAL, SAND SEAL OR FOG SEAL PAVED SURFACE AS REQ'D BY PLANS OR SPECS. EXCEPTION - EXTEND CONC COLLAR TO FIN. GRADE WHEN NOT LOCATED IN ASPH PAVE OR IN AN UNPAVED AREA
6. SPARKS-CONC COLLAR SHALL BE FLUSH W/ADJACENT PAVEMENT. PLACE ONE #3 REBAR RING IN COLLAR IN UNIMPROVED AREAS.
7. WASHOE CO.-STEPS ARE REQ'D FOR SANITARY SEWER/STORM DRAIN MANHOLES OF 5 FEET OR GREATER DEPTH
8. CARSON CITY-REFER TO DETAIL C-6A

NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTIONS 2
1	REDRAWN	11/94 VP	MANHOLE COLLAR & TEMPORARY COVER	DRAWING NO. 2-7 (306)
2	NOTE 2,5	11/94 VP		
3	NOTE 4,7	11/94 VP		
4	CORR NOTE 1	4/95 VP		DATE 11/92 VP / PAGE 10

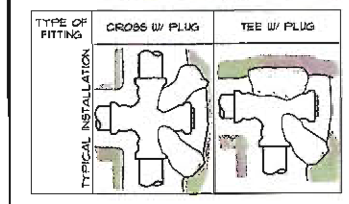


THRUST BLOCK BEARING AREA (SQ FT.)

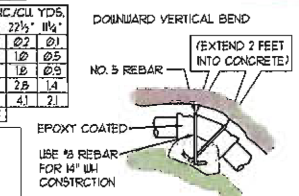
SIZE OF PIPE	90° BEND	45° BEND	11 1/4° OR 22 1/2° BEND	TEE OR DEAD END	TEE W/PLUG	CROSS W/PLUG
4"	2	1	1	2	2	2
6"	4	4	2	4	4	4
8"	7	4	2	5	7	7
10"	12	6	3	8	12	12
12"	16	10	5	12	16	16
14"	20	12	6	14	20	20
16"	27	15	8	18	27	27
18"	45	25	13	32	45	45
24"	65	35	18	46	65	65

THRUST BLOCK BEARING AREA (SQFT) FROM STA: 57+62.36 TO STA: 664+09.87 AND FROM STA: 0+00 TO STA: 52+00

90° BEND	45° BEND	TEE OR DEAD END
48	26	34
27	15	18



PIPE I.D.	CONC./CU. YDS. 45°	22 1/2°	11 1/4°
4"	0.8	0.2	0.1
6"	1.9	1.0	0.5
8"	3.3	1.8	0.9
10"	5.2	2.8	1.4
12"	7.5	4.1	2.1
14"	10.4		

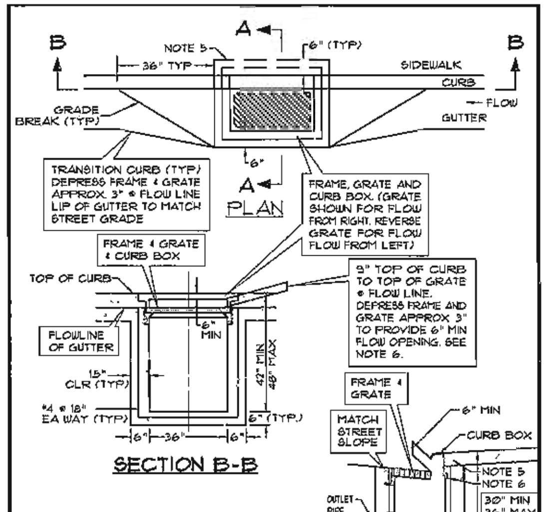


NOTES:
1.) THRUST BLOCKS TO BE CONSTRUCTED OF CLASS "C" CONCRETE.
2.) AREAS GIVEN AREA FOR CLASS 150 PIPE AT TEST PRESSURE OF 150 PSI, WITH 2000 PSF BEARING CAPACITY. INSTALLATIONS USING DIFFERENT PIPE, TEST PRESSURES, AND/OR SOIL TYPES SHOULD ADJUST AREAS ACCORDINGLY. SUBJECT TO APPROVAL OF THE ENGINEER.
3.) BLOCKS TO BE POURED AGAINST UNDISTURBED SOIL
4.) JOINTS AND FACE OF PLUGS TO BE KEPT CLEAR OF CONCRETE
5.) REVERSE THRUST BLOCK CONCRETE CALCS UPDATED PER WASHOE COUNTY UTILITY SERVICES DIVISION (3/2/98)

GENERAL NOTES:
ALL CONCRETE SHALL BE 2000 PSI MINIMUM 28 DAYS COMPRESSIVE STRENGTH CONCRETE IS TO BE PLACED AGAINST UNDISTURBED EARTH TABLE ABOVE DENOTES MINIMUM BEARING AREA OR VOLUME OF THRUST BLOCK. SPECIAL DESIGN FOR EACH INSTALLATION IS REQUIRED IF ALLOWABLE SOIL BEARING CAPACITY IS LESS THAN 3000 P.S.F. ALL VERTICAL SURFACES NOT BEARING AGAINST UNDISTURBED EARTH SHALL BE FORMED.

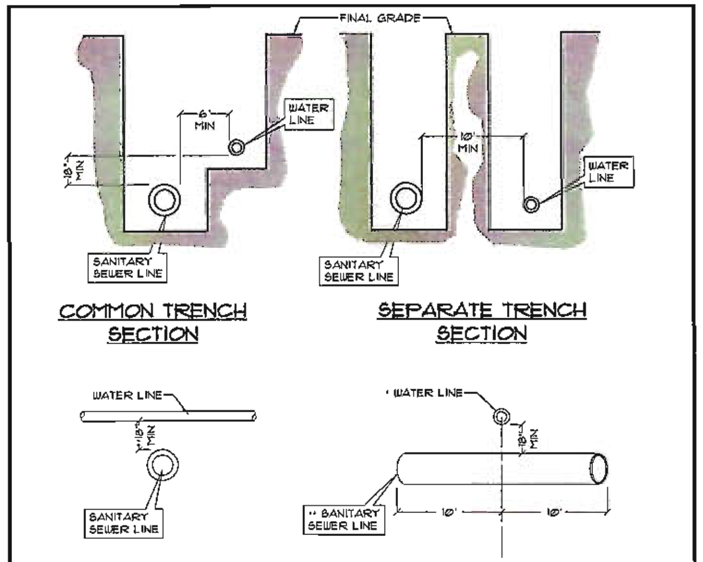
TYPE IV
GRAVITY THRUST BLOCK

NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTION 3
1	NOTE 2	3/83	THRUST BLOCK BEARING AREAS	DRAWING NO. 3-7 (307)
				DATE 7-81 / PAGE 9



NOTE:
1. PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000psi MIN COMPRESSIVE STRENGTH @ 28 DAYS, (FOR CURB AND GUTTER TRANSITION ONLY, ALL UNEXPOSED CONCRETE MAY BE 3000 PSI) MIN 6 SACKS OF CEMENT PER CUBIC YARD WITH A MAX WATER/CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6% ± 1.5% SLUMP AT 1-4 INCHES. ALL MATERIALS SHALL CONFORM TO SSPWC SECTION 202.
2. REINFORCING STEEL SHALL BE GRADE 40 AND HAVE 1.5" CLEAR COVER.
3. CONC. STRUCTURE MAY BE A PRECAST CONC. UNIT UPON APPROVAL OF THE CITY ENGINEER BASE OF PRECAST CONRETE UNIT SHALL BE PLACED ON 6" COMPACTED DRAIN ROCK.
4. FRAME, GRATE, AND CURB BOX SHALL BE NEENAH R-3067 OR APPROVED EQUAL (W/EQUAL FLOW CAPACITY AND WEIGHT)
5. CONC. SHALL BE PLACED AS SHOWN WHEN NOT LOCATED IN A SIDEWALK.
6. TILT FRAME AND GRATE AS REQUIRED TO ATTAIN 6" MIN FLOW OPENING AND SHIM BETWEEN CURB BOX & FRAME AS REQUIRED TO MATCH CURB BOX TO TOP OF CURB AND FACE OF CURB. (SEE SECTION B-B)
7. INSTALL GREASE TRAP PER STANDARD DETAIL R-11

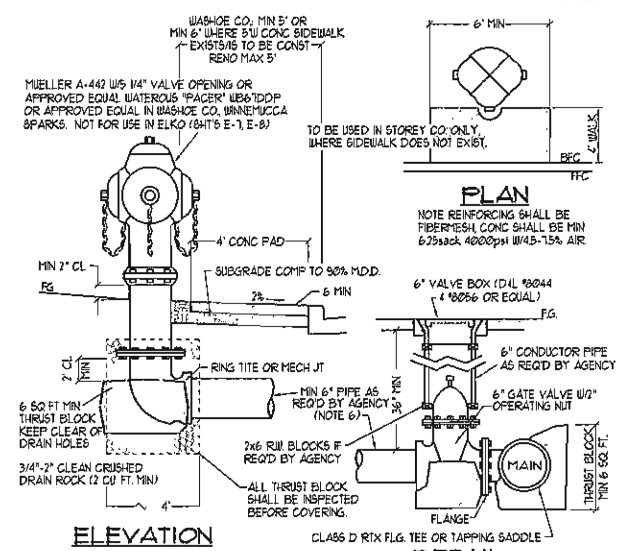
NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTION RENO
1	REDRAWN	2-92	TYPE 4-R CATCH BASIN	DRAWING NO. R-12 (311)
2	6% AIR	12-93		
3	REVISED	3-95		
APPR. BY: S.V.		3-95		DATE 5-80 / PAGE 12



* IF WATER LINE IS LOCATED 18" OR MORE ABOVE THE SANITARY SEWER, THE DISTANCE BETWEEN LINES CAN BE REDUCED TO A MIN. OF 6 FEET.

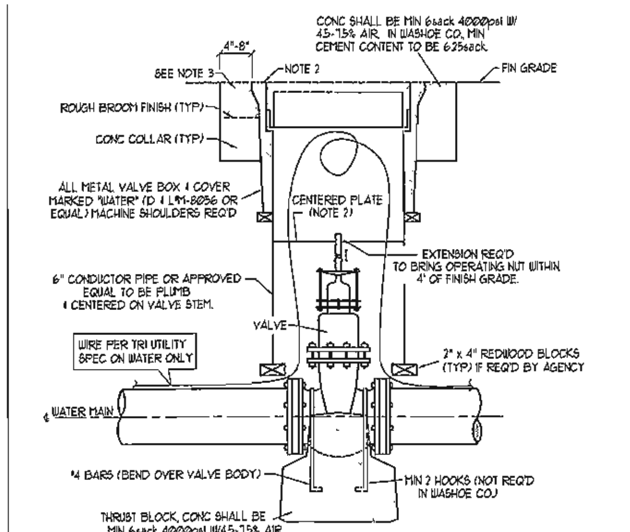
** LESS THAN 18" CLEARANCE REQUIRES THE SANITARY SEWER TO BE DUCTILE IRON OR REINFORCED CONCRETE ENCASED TO A LENGTH OF 10 FEET IN EITHER DIRECTION FROM THE WATER MAIN.

NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTION RENO
1	REDRAWN	8-92	TYPICAL SANITARY SEWER UTILITY TRENCH	DRAWING NO. R-4
APPR. BY: S.V.		12-92		DATE 8-85 / PAGE 4



NOTES
1. HYDRANT SHALL BE ENAMELED RED EXCEPT IN SPARKS, WASHOE CO., WINNEMUCCA, YERINGTON & DOUGLAS CO. WHERE IT SHALL BE YELLOW
2. ALL HYDRANTS SHALL HAVE (2) 2 1/2" HOSE NOZZLES & (1) 4 1/2" STEAMER NOZZLE. ALL THREADS SHALL BE AS SPECIFIC FOR AMERICAN NATIONAL HOSE COUPLING EXCEPT RENO, SPARKS & WASHOE CO (DET."A")
3. OPERATING NUT SHALL BE 1 1/2" PENTAGON EXCEPT: RENO, SPARKS AND WASHOE CO (DET."B")
4. INSPECTION BY APPROPRIATE AGENCY SHALL BE REQUIRED PRIOR TO BACKFILLING.
5. YERINGTON MIN DEPTH OF MAIN SHALL BE 42".
6. LANDER CO - BUTTERFLY VALVE SHALL BE USED IN LIEU OF GATE VALVE IN STREET. WATER PIPE SHALL BE PVC CLASS 150. NO A.C. IN WASHOE CO.
7. NO FENCES SHALL BE ALLOWED WITHIN 3' OF ANY PORTION OF A FIRE HYDRANT.
8. IN CARSON CITY, SEE DET. "C-103"

NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTIONS 3
	REDRAWN	11/94 VP	FIRE HYDRANT	DRAWING NO. 3 - 11 (307)
				DATE 11/94 VP / PAGE 1



NOTES
1. SEE DWG 3-7 FOR THRUST BLOCK SIZE
2. IN WASHOE CO., VALVE BOXES OR BOTH GAS & WATER TO BE SET 3/8"-5/8" BELOW FINISH ROADWAY SURFACE INSTALL OPERATING EXTENSION W/OPERATING NUT RESTRAINING BOLT & TOP CENTERING PLATE. ANCHOR BARS & REDWOOD BLOCKS NOT REQ'D WHEN OPERATING NUT IS AT GREATER DEPTH THAN 4' FROM FIN GRADE.
3. IN WASHOE CO. CONC COLLAR TO BE LEFT 2" BELOW FINISH ASPH SURFACE. PLACE 2' OF TYPE 3 ASPH PAVING AROUND VALVE BOX APPLY SS-1 TACK COAT BEFORE PAVING. SEAL A.C. SURFACE W/SS-1 SAND. CHIP SEAL FOG SEAL, SAND SEAL OR SLURRY SEAL PAVED SURFACE AS REQ'D BY PLANS OR SPECS. EXTEND CONC COLLAR TO GRADE WHEN NOT LOCATED IN ASPH PAVE OR IN UNPAVED AREA.
4. IN CARSON CITY REFER TO DETAIL C-101
5. RENO ONLY PLACE VALVE BOX & CONC COLLAR FLUSH W/ASPHALT.

NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTIONS 3
1	REDRAWN	3/94 VP	VALVE, BOX & COVER	DRAWING NO. 3-9 (307)
2	NOTE 2,3,4	1/95 VP		
3	NOTE 5	4/95 VP		DATE 1/80 / PAGE 11

THESE DETAILS ARE FOR INFORMATION ONLY AND ARE NOT MEANT TO SUPERSEDE THE ACTUAL STANDARD DETAILS FOR PUBLIC WORKS

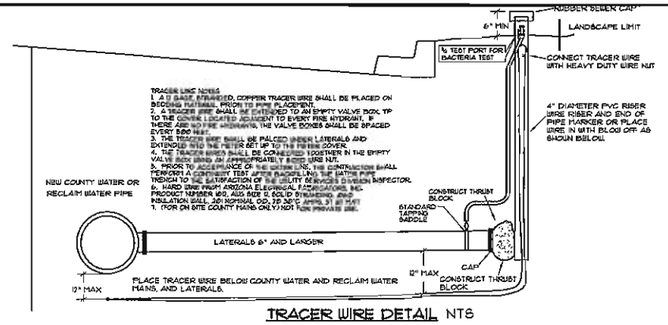
REC

RENO ENGINEERING CORPORATION
CIVIL ENGINEERING · DESIGN · LAND PLANNING
3983 S. McCARRAN BLVD #332 RENO, NV 89502
PHONE: (702) 852-5700 FAX: (702) 852-2104

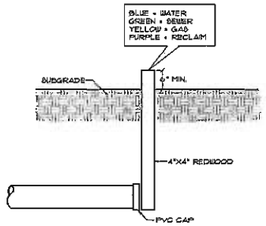
REVISIONS	BY	DATE
REVISE FIRE HYDRANT DETAIL NOTES	ESD	12/04

TAHOE / RENO INDUSTRIAL CENTER
DETAIL SHEET

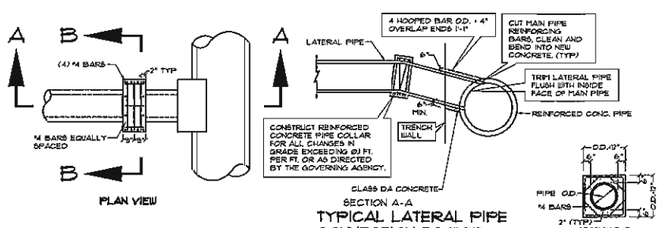
ROAD DETAIL
RD1
AKA RD1



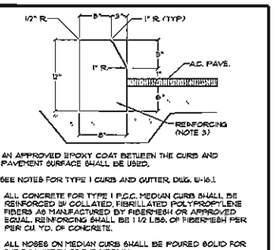
TRACER WIRE DETAIL NTS



CAP & MARK DETAIL



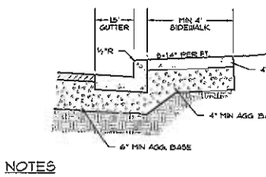
STORM DRAIN LATERAL



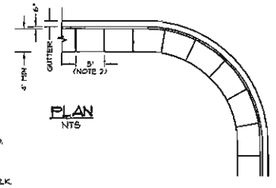
1. AN APPROVED SPOOKY COAT BETWEEN THE CURB AND PAVEMENT SURFACE SHALL BE USED.
2. SEE NOTES FOR TYPE I CURB AND GUTTER, DWG. R-16.1
3. ALL CONCRETE FOR TYPE I P.C.C. MEDIAN CURB SHALL BE REINFORCED BY COLLATED, FIBRILLATED POLYPROPYLENE FIBERS AS MANUFACTURED BY FIBERMESH OR APPROVED EQUAL. REINFORCING SHALL BE 1 1/2 LBS. OF FIBERMESH PER PER CU. YD. OF CONCRETE.
4. ALL NOSES ON MEDIAN CURBS SHALL BE POURED SOLID FOR THE FULL WIDTH OF THE MEDIAN.

TYPE I P.C.C. CURB

NTS DWG NO. 312 (3-83)



DETAIL "A"
NTS



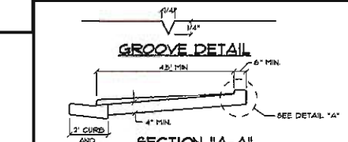
PLAN
NTS

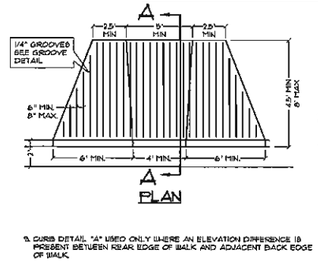
NOTES

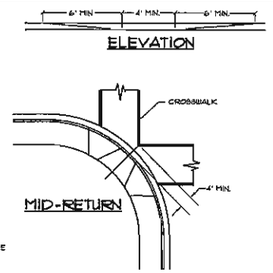
1. MIN CURB RETURN SHALL BE 20 FEET UNLESS OTHERWISE SPECIFIED ('B' IN FALLON & RENO)
2. (a) WEAKENED PLANE JOINTS SHALL BE CONSTRUCTED IN ACCORDANCE W/DETAIL "A". IN WASHOE COUNTY, REFER TO DWG. W-16.4. (b) TRANSVERSE EXPANSION JOINTS ½" WIDE SHALL BE CONSTRUCTED AT ALL SIDEWALK RETURNS, OPPOSITE EXPANSION JOINTS IN ADJACENT CURB, & REGULAR INTERVALS NOT EXCEEDING 30'. ISOLATION JOINTS SHALL BE INSTALLED AROUND ALL STRUCTURES. EXPANSION & ISOLATION JOINTS SHALL BE FILLED W/JOINT FILLER STRIPS ½" THICK. JOINT MATERIAL SHALL CONFORM TO SEC.202.10.
3. ALL AGG. BASE SHALL BE TYPE 2 CLASS B.
4. RENO: COLORED CONC NOT ALLOWED.
5. ON SIDEWALKS WIDER THAN 5', JOINTING PATTERN SHALL BE 5 - 12 TIMES THE WIDTH OF THE SIDEWALK.
6. PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000 psi MIN COMPRESSIVE STRENGTH @ 28 DAYS, MIN 6 SACKS OF CEMENT PER CUBIC YARD WITH A MAX WATER/CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6% ± 1.5%, SLUMP AT 1 TO 4 INCHES. ALL MATERIALS SHALL CONFORM TO SECTION 202.

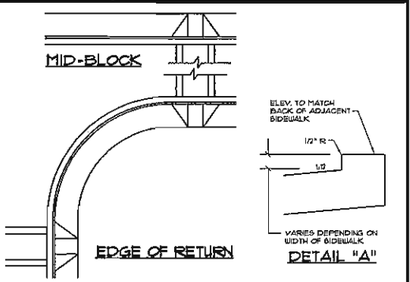
TYPICAL SIDEWALK

DWG NO. I-1 (312) 4-95







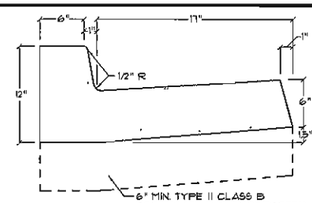


NOTES

1. P CONSTRUCTIONS SUCH AS INLETS, UTILITY POLES, FIRE HYDRANTS, ETC. ARE ENCOUNTERED, THE LOCATION AND DIMENSIONS MAY BE ADJUSTED UPON APPROVAL OF THE ENGINEER.
2. TEXTURE TO BE HEAVY BROOM FINISH TRAVERSE TO AXIS OF RAMP.
3. THE MID-BLOCK RAMP SHOWN IN DETAIL SHALL BE CENTERED IN THE CROSSWALK, AND HAVE A MINIMUM CURB OPENING OF 6 FEET.
4. SLOPE TO MEET EXISTING CONDITIONS.
5. ALL RAMPS TO BE LOCATED WITHIN CROSSWALK AREAS.
6. ALL CONCRETE TO BE REMOVED TO SAWCUT OR EXPANSION JOINTS.
7. THE GUTTER PAN - SIDEWALK TRANSITION (SECTION A-A) WILL BE SMOOTH WITH NO LIP AT THE GUTTER FLOWLINE. THE TRANSITION SECTION MAY BE A MONOLITHIC POUR.
8. SLOPES ON WINGS AT 1/2, SLOPE ON RAMP FROM FLOWLINE TO BACK OF WALK 1/2 WITH CURB ON BACKSIDE, IF NEEDED.
9. CURB DETAIL "A" USED ONLY WHERE AN ELEVATION DIFFERENCE IS PRESENT BETWEEN REAR EDGE OF WALK AND ADJACENT BACK EDGE OF WALK.
10. PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000 psi MIN COMPRESSIVE STRENGTH @ 28 DAYS, MIN 6 SACKS OF CEMENT PER CUBIC YARD WITH A MAX WATER/CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6% ± 1.5%, SLUMP AT 1 TO 4 INCHES. ALL MATERIALS SHALL CONFORM TO SECTION 202.

PEDESTRIAN RAMP FOR THE DISABLED

NTS DWG NO. I-8 (312) 3-95



NOTES

1. PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000 PSI MIN. COMPRESSIVE STRENGTH @ 28 DAYS, MIN. 6 SACKS OF CEMENT PER CUBIC YARD WITH A MAX. WATER/CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6±2% & 1 1/2" SLUMP AT 1 TO 4 INCHES. ALL MATERIALS SHALL CONFORM TO SECTION 202.
2. EXPANSION JOINTS 1/2-INCH WIDE SHALL BE LOCATED IN CURBS AND GUTTERS AT EACH SIDE OF STRUCTURES, AT THE ENDS OF ALL CURB RETURNS, AND ABUTTING HARDENED IN-PLACE CURB AND GUTTER, EXCEPT THAT EXPANSION JOINTS SHALL NOT BE INSTALLED WITHIN 20' FEET OF AN 18-INCH WIDE EXPANSION JOINTS SHALL BE 1/2-INCH THICK, SHAPED TO THE CROSS SECTION OF THE CURB AND GUTTER, AND CONSTRUCTED AT RIGHT ANGLES TO THE CURB AND GUTTER. JOINT FILLER MATERIAL SHALL CONFORM TO SECTION 202.10. WEAKENED PLANE JOINTS SHALL BE EVERY 10 FEET.
3. CURB AND GUTTER SECTIONS SHALL BE PLACED SEPARATELY FROM SIDEWALK SECTIONS

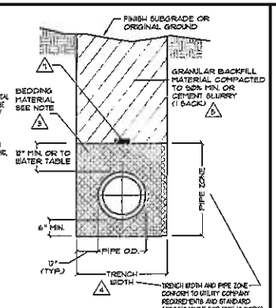
TYPE I P.C.C. CURB (PER DWG. #R-7A(312)

NTS REV(3-85) CHECKED

NOTES:

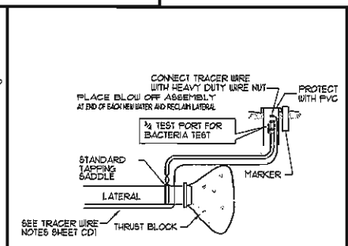
1. A PERMIT MUST BE OBTAINED FROM THE CITY ENGINEER PRIOR TO CUTTING ANY STREET. SEE RELATED DETAIL DRAWINGS NO. R-3, R-4, AND R-23.
2. ALL MATERIALS AND INSTALLATION PROCEDURES SHALL BE IN ACCORDANCE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, LATEST REVISION.
3. BEDDING MATERIAL SHALL CONFORM TO OWNING UTILITY COMPANY REQUIREMENTS AS APPROVED BY THE CITY OF RENO. FOR CITY OWNED UTILITIES, BEDDING MATERIAL SHALL BE CLASS "A", "B", OR "C" AND SHALL BE COMPACTED TO 95% MINIMUM FOR TRAFFIC/ELECTRICAL CONDUIT TRENCHES LESS THAN 10' IN WIDTH, INCLUDING UTILITY TRENCHES. BEDDING SHALL BE CLASS "A" MATERIAL. BACKFILL SHALL BE CEMENT SLURRY (1 SACK). CEMENT SLURRY BEDDING/BACKFILL MAY BE USED AS AN ALTERNATE TO CLASS "A", "B", OR "C" MATERIAL WITH WRITTEN APPROVAL FROM THE CITY ENGINEER FOR EACH SPECIFIC APPLICATION.
4. ALL EXCAVATIONS SHALL CONFORM TO THE LATEST O.S.H.A. REQUIREMENTS. SHORING OR SLOPED CUT MAY BE NECESSARY, BUT THERE WILL BE NO PAYMENT FOR ADDITIONAL EXCAVATION, BEDDING, BACKFILL OR SHORING.
5. SEE PAGES 24.1 THRU 24.4 FOR CEMENT SLURRY SPECIFICATIONS.
6. 4" WEEPER TRENCHES FOR CONDUIT SHALL BE LOCATED A MINIMUM OF 5' FROM GUTTER LIP.
7. PIPE TAPE IDENTIFICATION OF UTILITY SHALL BE INSTALLED.

CLASS A BEDDING SHALL CONFORM TO 306.03.02 OF THE STANDARD SPECIFICATIONS
CLASS B BEDDING SHALL CONFORM TO 306.03.03 OF THE STANDARD SPECIFICATIONS
CLASS C BEDDING SHALL CONFORM TO 210.03.04 OF THE STANDARD SPECIFICATIONS
INSPECTION OF THE BEDDING SHALL BE PER STANDARD SPECIFICATIONS 336.03.01.

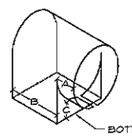


TRENCH EXCAVATION AND BACKFILL

REV (3-85)



BLOW OFF DETAIL



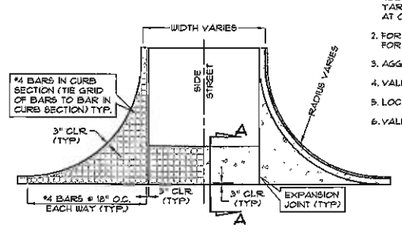
DIMENSIONS			
SIZE	A	B	C
4"	3"	3"	3"
6"	4"	5"	4"
8"	4"	6.5"	4"
10"	4"	8"	4"
12"	5"	10"	4"
15"	6"	10.5"	6.5"

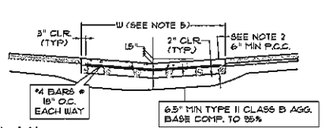
NOTES:

1. ALL CATCH BASINS SHALL BE PROVIDED WITH A "SUR-TRAP" GREASE TRAP OR APPROVED EQUAL.
2. INSTALL GREASE TRAP WITH THE BOTTOM EDGE PARALLEL TO THE WATER SURFACE AND THE RECTANGULAR OPENING FACING DOWNWARD AND THE CIRCULAR END PLACED INSIDE THE OUTLET PIPE.

"SUR-TRAP" GREASE TRAP

REV (3-95) CHECKED



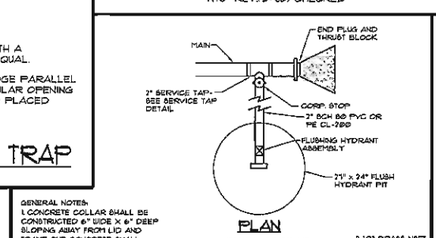


VALLEY GUTTER DETAIL

NTS

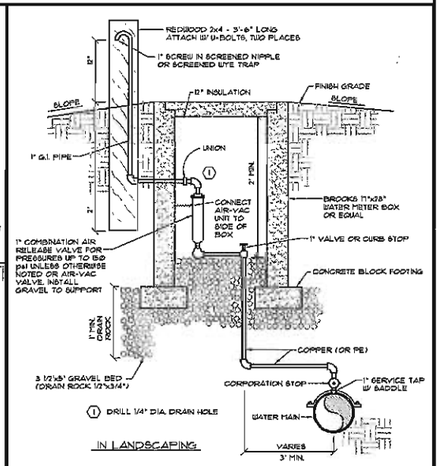
NOTES:

1. PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000 PSI MIN COMPRESSIVE STRENGTH @ 28 DAYS, 6-8 SACKS OF CEMENT PER CUBIC YARD WITH A MAX WATER / CEMENT RATION OF 0.45, AIR ENTRAINMENT OF 6% ±1.5%, SLUMP AT ONE TO FOUR INCHES. ALL MATERIALS SHALL CONFORM TO SSPWC SECTION 202.
2. FOR INDUSTRIAL AREAS, AN ENGINEERED DESIGN IS REQUIRED. USE 6.5 INCHES OF CONCRETE FOR 40 TRUCKS (TRUCK TRAFFIC). SEE CALC SHEETS SUPPLIED WITH PERMIT SET.
3. AGGREGATE BASE SHALL BE ENGINEERED TYPE 2, CLASS B WITH 95% COMPECTION.
4. VALLEY GUTTER SHALL HAVE WEAKENED PLANE JOINTS EVERY 10 FEET.
5. LOCAL AND COLLECTOR STREETS W=6'. ARTERIAL STREETS (DRIVEWAYS ONLY) W=10 FEET.
6. VALLEY GUTTER SECTIONS ALONG CURB AND GUTTER MAY BE MONOLITHIC POUR AS SHOWN.



GENERAL NOTES:
1. CONCRETE COLLAR SHALL BE CONSTRUCTED 6" WIDE X 6" DEEP SLOPING AWAY FROM LID AND FRAME. USE CONCRETE SHALL BE 3000 PSI MIN. COMPRESSIVE STRENGTH
2. FLUSH HYDRANT SHALL BE LOCATED 6"-18" BELOW LID

FLUSHING HYDRANT ASSEMBLY



COMBINATION AIR-RELEASE VALVE OR AIR-VAC VALVE

N.T.S

THESE DETAILS ARE FOR INFORMATION ONLY AND ARE NOT MEANT TO SUPERSEDE THE ACTUAL STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION

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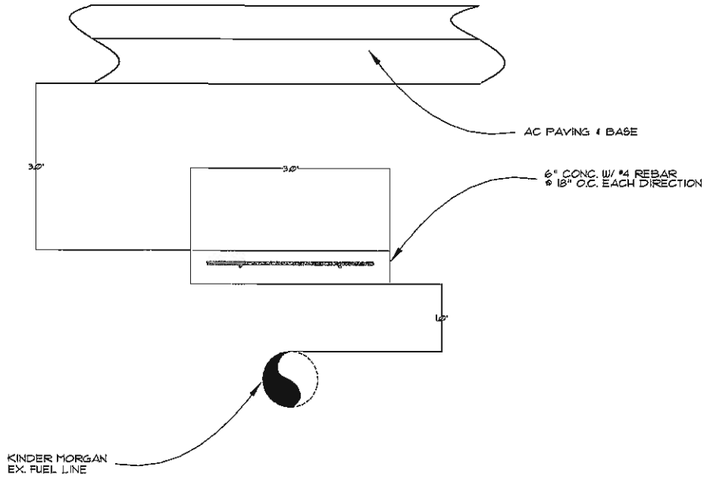
TAHOE RENO INDUSTRIAL CENTER

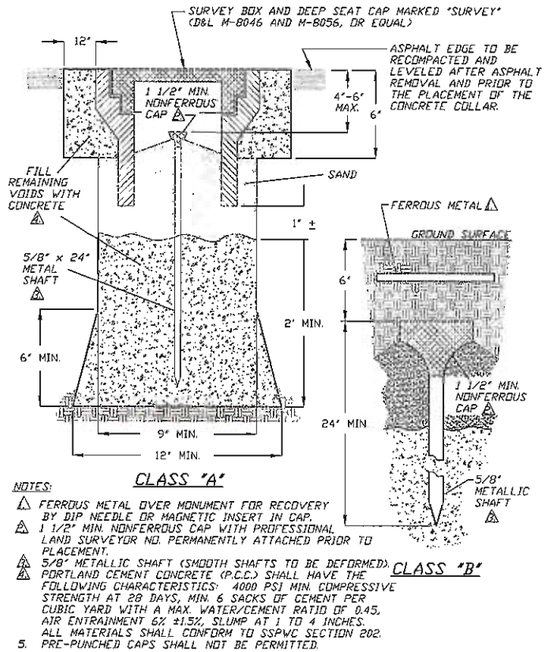
TRI CENTER ROADS DETAIL SHEET

ROAD DETAIL
RD2
AKA RD2



NEW 16" DI SLEEVE FOR WATER AND RECLAIM

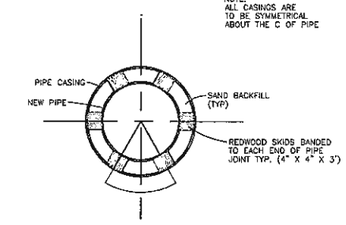
SECTION DETAIL 1 N.T.S. CSG



NOTES:

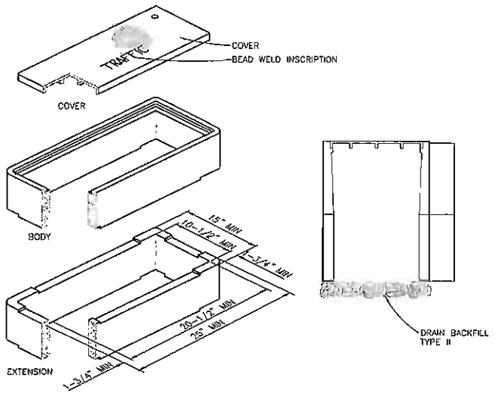
1. FERROUS METAL OVER MONUMENT FOR RECOVERY BY DIP NEEDLE OR MAGNETIC INSERT IN CAP.
2. 1 1/2" MIN. NONFERROUS CAP WITH PROFESSIONAL LAND SURVEYOR NO. PERMANENTLY ATTACHED PRIOR TO PLACEMENT.
3. 5/8" METALLIC SHAFT (SMOOTH SHAFTS TO BE DEFORMED).
4. PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000 PSI MIN. COMPRESSIVE STRENGTH AT 28 DAYS, MIN. 6 SACKS OF CEMENT PER CUBIC YARD WITH A MAX. WATER/CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6% ±1.5%, SLUMP AT 1 TO 4 INCHES. ALL MATERIALS SHALL CONFORM TO SSPWC SECTION 202.
5. PRE-PUNCHED CAPS SHALL NOT BE PERMITTED.

SURVEY MONUMENTS

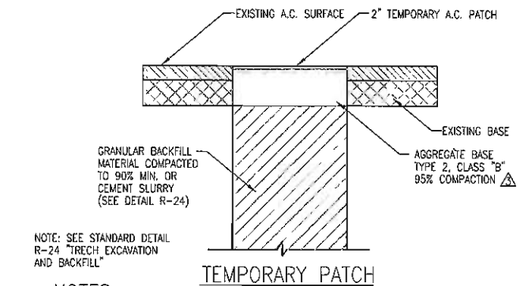


1. STEEL PIPE CASING SHALL BE FABRICATED FROM A MINIMUM OF 1/4" THICK STEEL PLATES, CONFORMING TO THE REQUIREMENTS OF ASTM A283, GRADE B, C, OR D. ALL JOINTS SHALL BE WELDED. INTERIOR JOINTS SHALL BE A SMOOTH FINISH. ALL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH AWWA C201, "AWWA STANDARD FOR FABRICATED ELECTRICALLY WELDED STEEL WATER PIPE". COATINGS FOR STEEL CASING ARE NOT REQUIRED.
2. PIPE CASING SHALL BE LAID TRUE TO LINE AND GRADE WITH NO BENDS OR CHANGES IN GRADE FOR THE FULL LENGTH OF THE CASING.
3. THE PIPE SHALL BE SUPPORTED AT EACH END OF JOINT WITH SKIDS. THE ANNULAR SPACE BETWEEN THE PIPE AND CASING SHALL BE BACKFILLED WITH SAND. AFTER INSTALLATION OF THE PIPE, THE CASING SHALL BE AT BOTH ENDS WITH MOTARED BRICK OR CEMENT BRICK.

TYPICAL SLEEVE DETAIL



NO. 5 PULL BOX

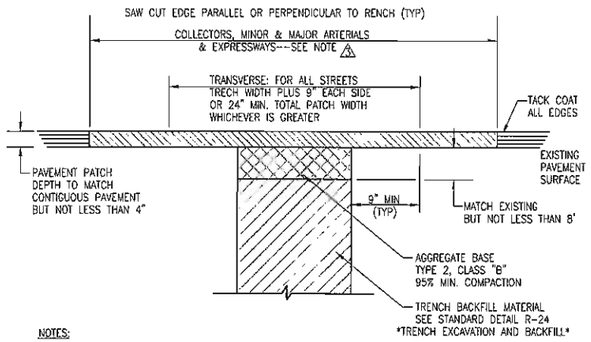


TEMPORARY PATCH
(TO BE PERFORMED BY PERMITTEE)

NOTES:

1. PRIOR TO EXCAVATION, THE OUTLINE OF THE TRENCH SHALL BE VERTICALLY CUT FULL DEPTH THRU THE EXISTING ASPHALT WITH A SAW, OR AN ASPHALT SPADE OR EQUIPMENT APPROVED BY THE ENGINEER.
2. CARE SHALL BE EXERCISED TO PREVENT SLOUGHING AND OVERBREAK. IF THE TRENCH SLOUGHS, THE SURFACE SHALL BE WIDENED TO ELIMINATE THE UNDERMINED SECTION OF ASPHALT.
3. TYPE 2 CLASS "B" AGGREGATE BASE SHALL BE COMPACTED TO A THICKNESS OF AT LEAST 10"-12" OR A DEPTH OF 8" BELOW THE BOTTOM OF THE EXISTING PAVEMENT, WHICHEVER IS GREATER.
4. A TEMPORARY PATCH OF COLD MIX ASPHALT CONCRETE SHALL BE PLACED AND COMPACTED. THE COMPACTED PATCH SHALL BE APPROXIMATELY 1/8" TO 1/4" ABOVE THE LEVEL OF THE ADJACENT PAVEMENT. IF NOT PATCHED WITHIN 24 HOURS AFTER BACKFILLING, A.R.C. MAY PATCH AND AND BACK-CHARGE THE PERMITTEE FOR ALL COSTS.
5. COMPACTION OF BACKFILL BASE AND A.C. TEMPORARY PATCH SHALL BE PERFORMED WITH APPROVED MECHANICAL TAMPERS. EQUIPMENT WHEEL ROLLING NOT PERMITTED.
6. ENTIRE AREA SHALL BE CLEANED OF ALL DIRT, DUST, DEBRIS, ETC PRIOR TO LEAVING SITE. ANY SITE LEFT UNCLEANED WILL BE CLEANED BY A.R.C. AND ALL COSTS WILL BE BACK-CHARGED TO THE PERMITTEE.
7. TUNNELING UNDER CURB AND GUTTER OR SIDEWALK IS NOT PERMITTED. COMPLETE REMOVAL REQUIRED TO THE NEAREST CONSTRUCTION OR EXPANSION JOINT OUTSIDE THE TRENCH WIDTH.
8. ALL EXCAVATIONS SHALL BE COMPLETE OR BACKFILLED AT THE END OF THE DAY.

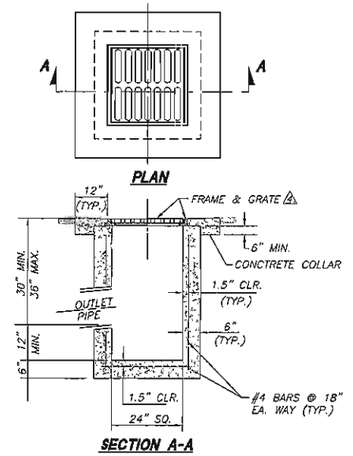
TAHOE RENO INDUSTRIAL CENTER TEMPORARY TRENCH PATCH



NOTES:

1. A PERMIT MUST BE OBTAINED PRIOR TO CUTTING ANY STREET.
2. IF SAWCUT IS WITHIN TWO (2) FEET OF AN EXISTING PAVEMENT EDGE OR EXISTING PAVEMENT PATCH, REMOVE EXISTING PAVEMENT TO THAT EDGE AND REPLACE ENTIRE SECTION.
3. LONGITUDINAL TRENCH PATCH WIDTH.
   A. FOR COLLECTORS, MINOR AND MAJOR ARTERIALS AND EXPRESSWAYS: IF SAWCUT EDGES FOR LONGITUDINAL OR TRANSVERSE EXCAVATIONS FALL WITHIN A TRAVEL LANE, SAWCUT SHALL BE EXTENDED TO, AND REMOVAL MADE TO EDGE OF THE TRAVEL LANE± OR THE FULL DEPTH PATCH SHALL BE MADE PER THE SPECIFICATIONS FOR TRANSVERSE PATCHES AND THE ENTIRE TRAVEL LANE ROTOMILLED TO A DEPTH OF TWO (2) INCHES AND OVERLAYED WITH (2) INCHES OF BITUMINOUS PLANTMIX AS DIRECTED BY THE ENGINEER.
4. 4" VERMIER TRENCHES FOR CONDUIT SHALL BE LOCATED A MINIMUM OF 9" FROM GUTTER LIP AND SHALL BE PATCHED AS PER THE ABOVE DETAIL.
5. AGGREGATE BASE AND BITUMINOUS PAVEMENT SHALL BE IN ACCORDANCE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, LATEST REVISION.
6. CONTRACTOR SHALL BE RESPONSIBLE FOR REPLACEMENT OF LOOP DETECTORS, ADJUSTMENT OF UTILITIES AND SURVEY MONUMENTS TO GRADE AND INSTALLATION OF TEMPORARY PAVEMENT MARKINGS.
7. FOR P.C.C. CURB REPLACEMENT SAWCUT EXISTING PAVEMENT 18 INCHES MIN. FROM GUTTER LIP LINE, REMOVE AND REPLACE PAVEMENT TO SAWCUT EDGES. CONCRETE MAY BE POURED NEAT AGAINST EXISTING EDGE OF ASPHALT IF APPROVED BY THE CITY ENGINEER.

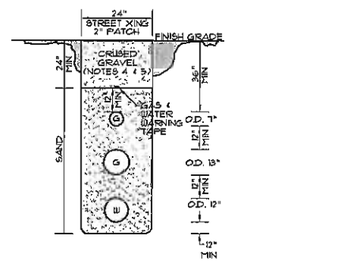
TAHOE RENO INDUSTRIAL CENTER PERMANENT BITUMINOUS PAVEMENT PATCH



NOTES:

1. PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000 PSI MIN. COMPRESSIVE STRENGTH @ 28 DAYS, (FOR COLLAR ONLY, ALL UNEXPOSED CONCRETE MAY BE 3000 PSI) MIN. 6 SACKS OF CEMENT PER CUBIC YARD WITH A MAX. WATER/CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6% ±1.5%, SLUMP AT 1 TO 4 INCHES. ALL MATERIALS SHALL CONFORM TO SSPWC SECTION 202.
2. REINFORCING STEEL SHALL BE GRADE 40 AND HAVE 1.5" CLEAR COVER.
3. CONCRETE STRUCTURE MAY BE A PRE-CAST CONCRETE UNIT. BASE OF PRE-CAST CONCRETE UNIT SHALL BE PLACED ON 6" COMPACTED DRAIN ROCK.
2. FRAME & GRATE SHALL BE D&L I-9226 OR APPROVED EQUAL.
5. CATCH BASIN SHALL BE TRAFFIC-RATED AND USED ONLY AT LOW POINTS IN ALLEYS OR PARKING AREAS.
6. INSTALL GREASE TRAP PER STANDARD DETAIL DRAWING NO. R-213 (311).

CATCH BASIN TYPE 3-R



TYPICAL GAS AND WATER MAIN TRENCH

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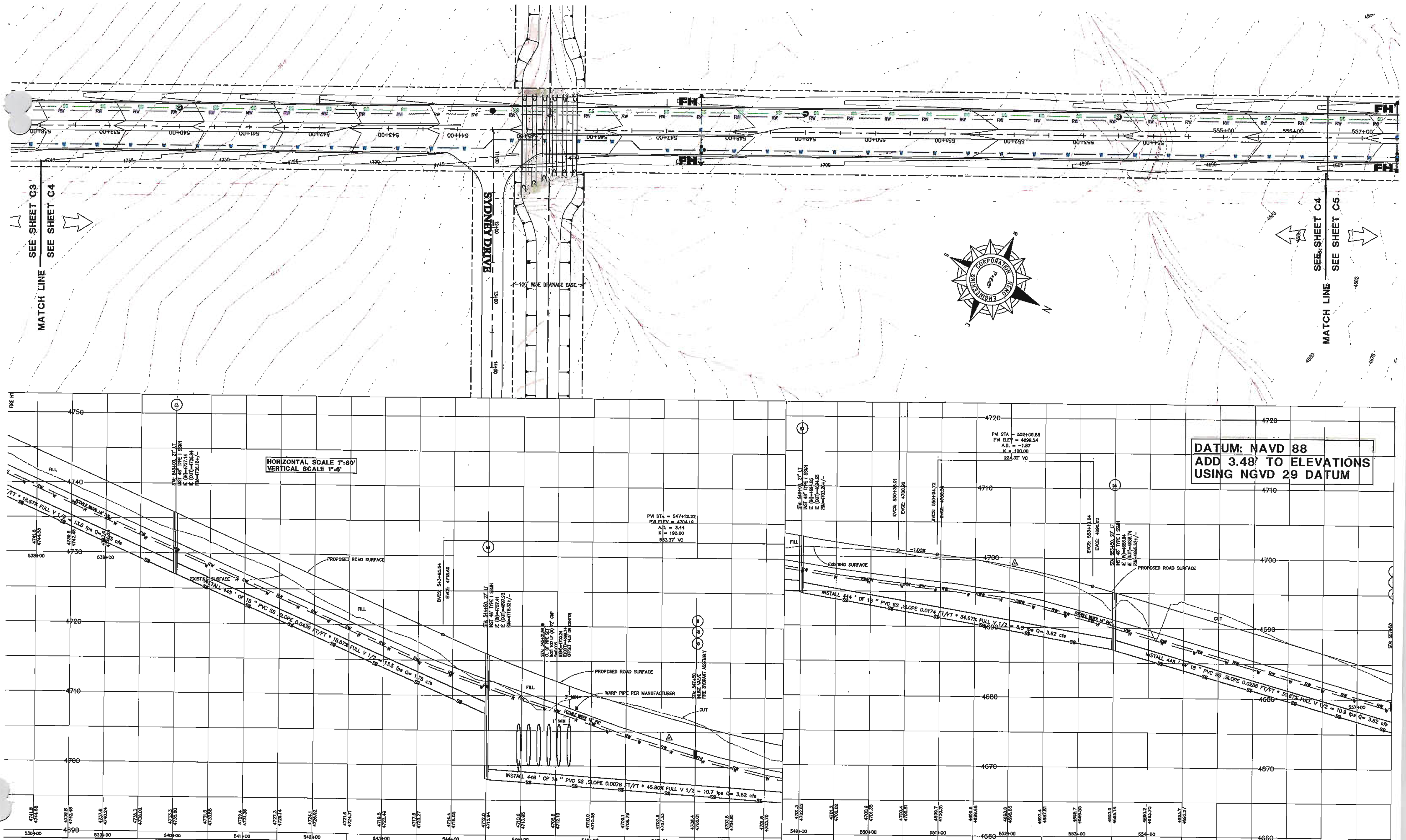
TRI CENTER ROADS DETAIL SHEET

ROAD DETAIL RD3
AKA RD3



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TAHOE RENO INDUSTRIAL CENTER

REVISIONS | BY | DATE

TAHOE/RENO INDUSTRIAL CENTER
USA PARKWAY PLAN AND PROFILE

USA
PP4
AKA US C4

USA PARKWAY

MATCH LINE — SEE SHEET C4 / SEE SHEET C5

MATCH LINE — SEE SHEET C5 / SEE SHEET C6

EXISTING DIRT ROAD (HAUL ROAD) OLD USA

HORIZONTAL SCALE 1"=80'
VERTICAL SCALE 1"=8'

EXISTING GL GRADE
PROPOSED GL GRADE

5' WIDE TRAPEZOIDAL ROUSSIDE CHANNEL FL IS 2.6' BELOW CL REFER TO SECTION SHEET AND CHANNEL NOTES ABOVE

INSTALL 445 ' OF 18 " PVC SS SLOPE 0.0288 FT/FT * 30.67% FULL V 1/2 = 10.9 fps Q= 3.82 cfs

INSTALL 445 ' OF 18 " PVC SS SLOPE 0.0370 FT/FT * 28.67% FULL V 1/2 = 12

INSTALL 462 ' OF 18 " PVC SS SLOPE 0.0097 FT/FT * 40.67% FULL V 1/2 = 6.3 fps Q= 3.82 cfs

INSTALL 378 ' OF 18 " PVC SS SLOPE 0.0096 FT/FT * 40.67% FULL V 1/2 = 6.3 fps Q= 3.82 cfs

WL TO BE 14" CLASS 165 DR 25 C905 PVC

WL TO BE 14" CLASS 200 DR 21 C905 PVC

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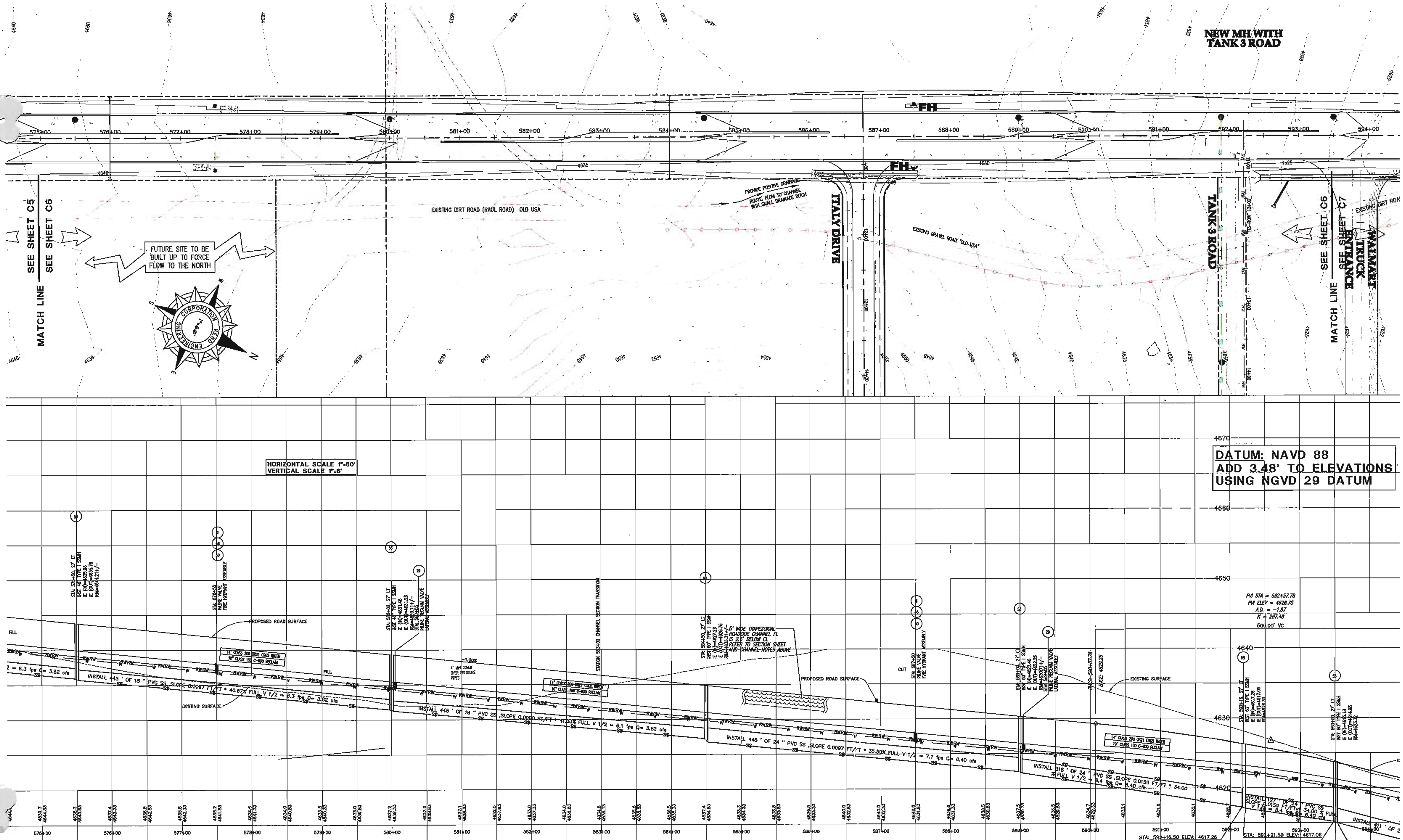
TAHOE RENO INDUSTRIAL CENTER

REVISIONS	BY	DATE
1 MOVED FIRE HYDRANTS	VJG	08/04
2 REMOVED CATCH BASINS	VJG	08/04
3 FROM STA: 571+62 TO STA: 564+10	VJG	08/04
4 SEE THRUST BLOCK DETAIL SHEET		
5 GENERAL REVISIONS	JDM	6/05

TAHOE/RENO INDUSTRIAL CENTER
USA PARKWAY PLAN AND PROFILE

USA
PP5
AKA US C5



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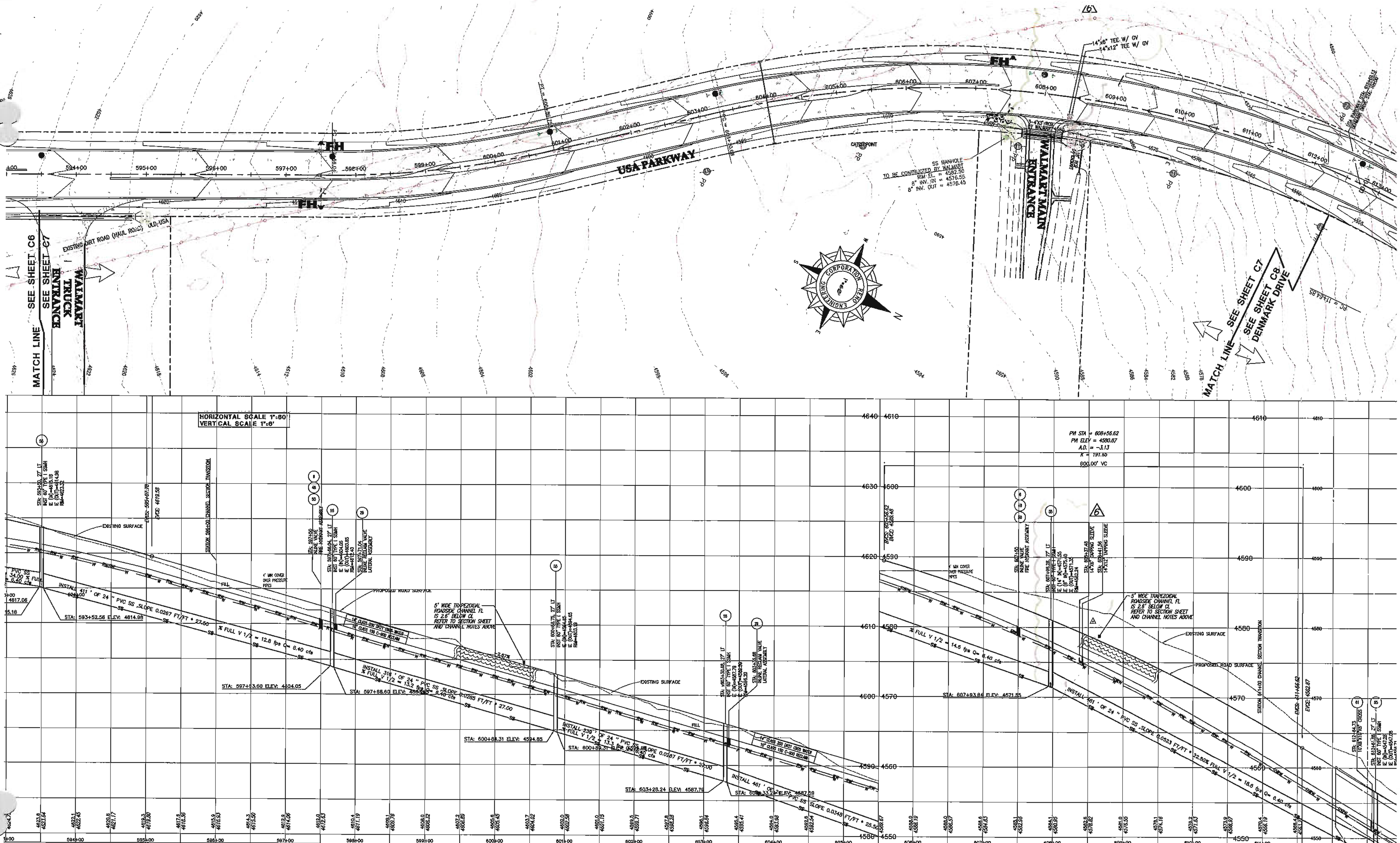
TAHOE RENO INDUSTRIAL CENTER

REVISIONS	BY	DATE
REMOVED CATCH BASINS	VJG	08/04
FROM STA: 571+62 TO STA: 664+10	VJG	09/04
SEE THRUST BLOCK DETAIL SHEET		
MANHOLE RIM ELEV'S ADDED	LRT	10/20
PROPOSED GRADE AND SSMH'S LOWERED 2'	LRT	11/04
FROM STA: 593+50 TO STA: 608+00		
GENERAL REVISIONS	JDM	6/05

TAHOE/RENO INDUSTRIAL CENTER
USA PARKWAY PLAN AND PROFILE

USA
PP6
AKA US C6



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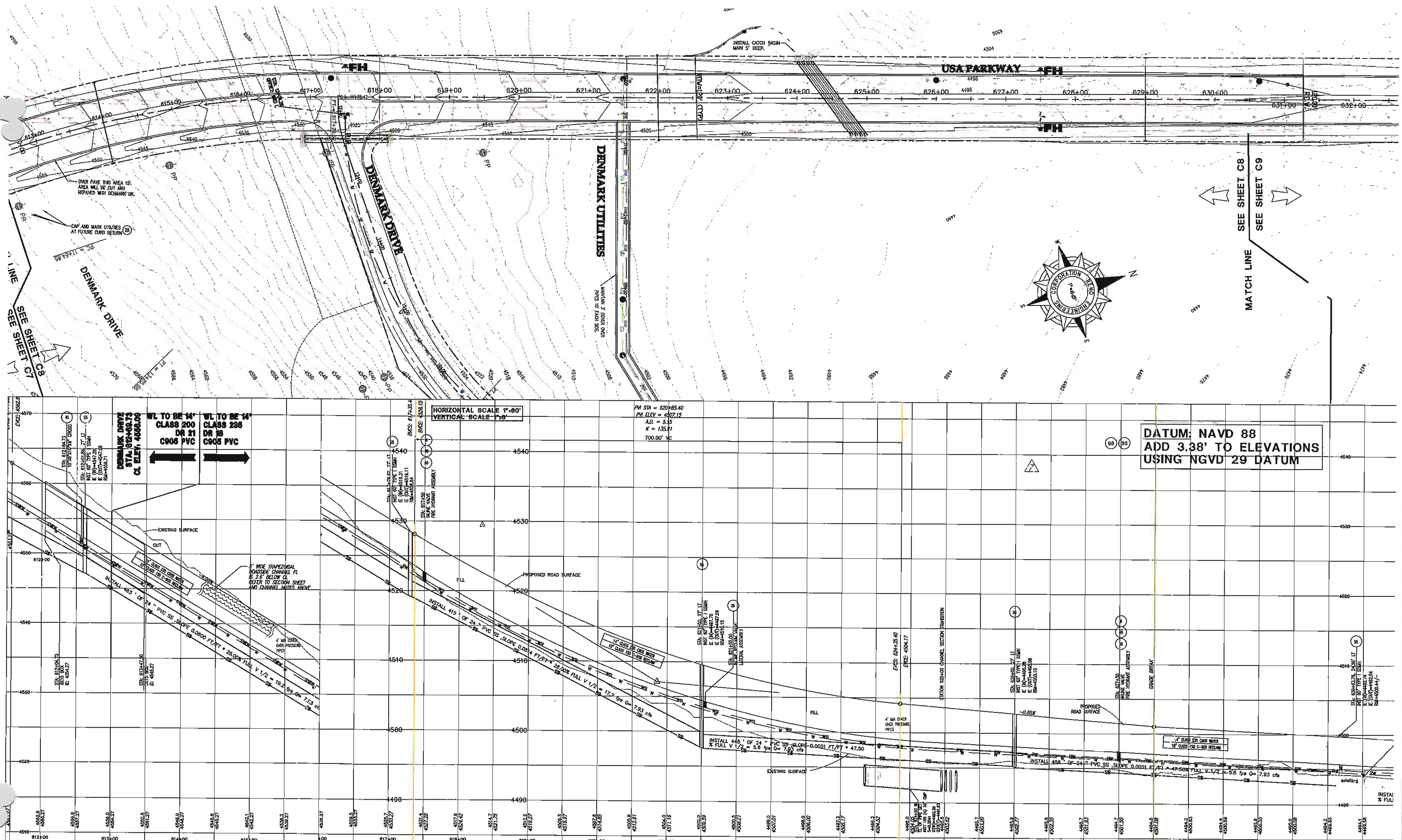
TAHOE RENO INDUSTRIAL CENTER

REVISIONS	BY	DATE
FROM STA: 571+62 TO STA: 654+10	VJG	09/04
SEE THRUST BLOCK DETAIL SHEET		
MANHOLE RIM ELEV'S ADDED	LRT	10/04
PROPOSED GRADE AND SSMH'S LOWERED 2'	LRT	11/04
FROM STA: 593+50 TO STA: 608+00		
WALMART UTILITY REVISIONS	JDM	12/04
GENERAL REVISIONS	JDM	6/05

TAHOE/RENO INDUSTRIAL CENTER
USA PARKWAY PLAN AND PROFILE

USA
PP7
AKA US C7


USA PARKWAY
DENMARK DRIVE
DENMARK UTILITIES
INSTALL CATCH BASIN MAIN 5' DEEP.
OVER PAVE THIS AREA 15' AREA WILL BE CUT AND REPAVED WITH DENMARK DR.
CAP AND MARK UTILITIES AT FUTURE CURB RETURN
MAINTAIN 3' COVER OVER PIPES 10' EACH SIDE.
MATCH LINE
SEE SHEET C8
SEE SHEET C9
SEE SHEET C8
SEE SHEET C7
HORIZONTAL SCALE 1"=80'
VERTICAL SCALE 1"=8'
DATUM: NAVD 88
ADD 3.38' TO ELEVATIONS
USING NGVD 29 DATUM
DENMARK DRIVE STA. 612+69.73 CL ELEV. 4556.09
WL TO BE 14" CLASS 200 DR 21 C905 PVC
WL TO BE 14" CLASS 235 DR 18 C905 PVC
PVI STA = 620+85.40
PVI ELEV = 4507.15
A.D. = 5.15
K = 135.91
700.00' VC
EXISTING SURFACE
CUT
FILL
PROPOSED ROAD SURFACE
5' WIDE TRAPEZOIDAL ROADSIDE CHANNEL FL IS 2.6' BELOW CL REFER TO SECTION SHEET AND CHANNEL NOTES ABOVE
INSTALL 463 ' OF 24 " PVC SS, SLOPE 0.0600 FT/FT
INSTALL 415 ' OF 24 " PVC SS, SLOPE 0.0514 FT/FT
INSTALL 445 ' OF 24 " PVC SS, SLOPE 0.0051 FT/FT
INSTALL 458 ' OF 24 " PVC SS, SLOPE 0.0051 FT/FT
GRADE BREAK
STATION 625+00 CHANNEL SECTION TRANSITION

REVISIONS	BY	DATE
REMOVED CATCH BASINS	WJG	08/04
FROM STA: 664+10 TO STA: 671+62	WJG	09/04
SEE THRUST BLOCK DETAIL SHEET		
MANHOLE RIM ELEV'S ADDED	LRT	10/04
REVISED GRADES OVER CULVERT FOR GAS	WJG	03/05
REVISED PROFILE BETWEEN STATIONS 616+00 – 628+00	WJG	04/20

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TAHOE RENO INDUSTRIAL CENTER

TAHOE/RENO INDUSTRIAL CENTER
USA PARKWAY PLAN AND PROFILE

USA
PP8
AKA US C8

HORIZONTAL SCALE 1"=60'
VERTICAL SCALE 1"=6'

DATUM: NAVD 88
ADD 3.38' TO ELEVATIONS SHOWN ON PLANS USING NGVD 29 DATUM

SEE SHEET C8

SEE SHEET C9

MATCH LINE

SEE SHEET C9

SEE SHEET C10

USA PARKWAY

VENICE DR

FENCE

REGUAL BOOSTER PUMP STATION

EXISTING OSBERRY MINE WATER PIPE - (UNUSED)

STA: 643+50.00
OFFSET: 137.90 R
CONST STANDARD END SECTION TO 24" CMP
IE(24"CMP)=81.44
DITCH TO DAYLIGHT

STA: 643+50.00
OFFSET: 17.50 L
CONST 1 w/ GRATE
INST 60" SDMH
IE(IN)=4457.5
IE(OUT)=4457.5
TOP OF CONE=4471

ADD 90° ELBOW ON EXISTING 12"

STA: 644+72.52
INST (1)-12" GATE VALVE
(1) - 12"x10" REDUCER AS SHOWN

STA: 644+69
TIE IN TO BE CONNECTED TO RW SOUTH

STA: 645+00.03
INST (1)-12" GATE VALVE

STA: 645+00.00 FIRE MAIN
INST (1)-12" GATE VALVE

STA: 644+50.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4458.61
RIM=4469.03

STA: 644+50.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 644+72.52
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 645+11.10
INST 60" TYPE I SSMH
IE (IN)=4465.81
IE (OUT)=4465.41
RIM=4469.11+/-

STA: 645+69.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 645+69.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 646+00.74
INST 60" TYPE I SSMH
IE (IN)=4462.30
IE (OUT)=4462.10
RIM=4469.04+/-

STA: 643+50.00 EXIST. RIM=4469.33
GRADE BREAK

STA: 643+69
TIE IN TO BE CONNECTED TO RW SOUTH

STA: 644+72.52
INST (1)-12" GATE VALVE AS SHOWN
(1) - 12"x10" REDUCER

STA: 644+72.52
INST (1)-12" GATE VALVE AS SHOWN
(1) - 12"x10" REDUCER

STA: 645+00.03
INST (1)-12" GATE VALVE

STA: 645+00.00 FIRE MAIN
INST (1)-12" GATE VALVE

STA: 646+00.74
INST 60" TYPE I SSMH
IE (IN)=4462.30
IE (OUT)=4462.10
RIM=4469.04+/-

STA: 646+50.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 646+50.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 646+72.52
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 647+11.10
INST 60" TYPE I SSMH
IE (IN)=4465.81
IE (OUT)=4465.41
RIM=4469.11+/-

STA: 647+69.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 647+69.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 648+00.74
INST 60" TYPE I SSMH
IE (IN)=4462.30
IE (OUT)=4462.10
RIM=4469.04+/-

STA: 648+50.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 648+50.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 648+72.52
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 649+11.10
INST 60" TYPE I SSMH
IE (IN)=4465.81
IE (OUT)=4465.41
RIM=4469.11+/-

STA: 649+69.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 649+69.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 650+00.74
INST 60" TYPE I SSMH
IE (IN)=4462.30
IE (OUT)=4462.10
RIM=4469.04+/-

STA: 650+50.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 650+50.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 650+72.52
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 651+11.10
INST 60" TYPE I SSMH
IE (IN)=4465.81
IE (OUT)=4465.41
RIM=4469.11+/-

STA: 651+69.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 651+69.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 652+00.74
INST 60" TYPE I SSMH
IE (IN)=4462.30
IE (OUT)=4462.10
RIM=4469.04+/-

STA: 652+50.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 652+50.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 652+72.52
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 653+11.10
INST 60" TYPE I SSMH
IE (IN)=4465.81
IE (OUT)=4465.41
RIM=4469.11+/-

STA: 653+69.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 653+69.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 654+00.74
INST 60" TYPE I SSMH
IE (IN)=4462.30
IE (OUT)=4462.10
RIM=4469.04+/-

STA: 654+50.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 654+50.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 654+72.52
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 655+11.10
INST 60" TYPE I SSMH
IE (IN)=4465.81
IE (OUT)=4465.41
RIM=4469.11+/-

STA: 655+69.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 655+69.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 656+00.74
INST 60" TYPE I SSMH
IE (IN)=4462.30
IE (OUT)=4462.10
RIM=4469.04+/-

STA: 656+50.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 656+50.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 656+72.52
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 657+11.10
INST 60" TYPE I SSMH
IE (IN)=4465.81
IE (OUT)=4465.41
RIM=4469.11+/-

STA: 657+69.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 657+69.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 658+00.74
INST 60" TYPE I SSMH
IE (IN)=4462.30
IE (OUT)=4462.10
RIM=4469.04+/-

STA: 658+50.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 658+50.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 658+72.52
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 659+11.10
INST 60" TYPE I SSMH
IE (IN)=4465.81
IE (OUT)=4465.41
RIM=4469.11+/-

STA: 659+69.53
INST 60" TYPE I SSMH
IE (IN)=4458.61
IE (OUT)=4465.81
RIM=4469.24+/-

STA: 659+69.53
INST 60" TYPE I SSMH
IE(24"OUT)=4458.61
IE (VIA 90°)=4458.77

STA: 660+00.74
INST 60" TYPE I SSMH
IE (IN)=4462.30
IE (OUT)=4462.10
RIM=4469.04+/-

STA: 630+43.75 2.45' LT
INST 60" TYPE I SSMH
IE (IN)=4467.3
IE (OUT)=4467.1
RIM=4500.44+/-

TIE IN TO NEW 12" GATE VALVE INTO EXISTING 12" FM
INST (1)-12" GATE VALVE
(REUSE EXISTING IF POSSIBLE)
& 90 DEG ELL W/ 12"x10" REDUCER

88, FH, EXISTING TO THIS POINT

STA: 633+97.76
END TYPICAL ROADWAY SECTION (SHT. C57)
BEGIN TRANSITION TO "SUPERELEVATED" SECTION

300.00' SUPERELEVATION TRANSITION

STA: 634+97.76 24.45' LT
INST 60" TYPE I SSMH
IE (IN)=4468.53
IE (OUT)=4468.68
RIM=4480.04+/-

STA: 635+00.57 24.29' LT
INST 60" TYPE I SSMH
IE (IN)=4468.61
IE (OUT)=4468.61
RIM=4480.7+/-

STA: 637+50
INLINE VALVE
FIRE HYDRANT ASSEMBLY

STA: 640+28.53 24.45' LT
INST 60" TYPE I SSMH
IE (IN)=4468.29
IE (OUT)=4468.09
RIM=4480.84+/-

PROPOSED ROAD SURFACE

PROPOSED WEST EDGE OF PAVEMENT GRADE

PROPOSED WEST EDGE OF PAVEMENT GRADE

PROPOSED EAST EDGE OF PAVEMENT GRADE

PROPOSED ROAD SURFACE

PROPOSED EAST EDGE OF PAVED

PROPOSED WEST EDGE OF PAVEMENT GRADE

EXISTING SURFACE

EXISTING SURFACE

FILL

CUT

existing

4' MIN COVER
HIGH PRESSURE PIPES

4" CLASS 235 DIPS WATER
18" CLASS 150 D-900 RECLAIM
12" CLASS 150 CIOD EFFLUENT LINE

14" CLASS 235 DIPS WATER
10" CLASS 150 D-900 RECLAIM
12" CLASS 150 CIOD EFFLUENT LINE

5' WIDE TRAPEZOIDAL ROADSIDE CHANNEL FL IS 2.6' BELOW CL REFER TO SECTION SHEET AND CHANNEL NOTES ABOVE

INSTALL 337 ' OF 24 " PVC SS ,SLOPE 0.0051 FT/FT * 47.50
% FULL V 1/2 = 5.6 fps Q= 7.93 cfs

INSTALL 338 ' OF 24 " PVC SS ,SLOPE 0.0051 FT/FT * 47.50
% FULL V 1/2 = 5.6 fps Q= 7.93 cfs

INSTALL 272 ' OF 24 " PVC SS ,SLOPE 0.0051 FT/FT * 47.50
% FULL V 1/2 = 5.6 fps Q= 7.93 cfs

INSTALL 274 ' OF 24 " PVC SS ,SLOPE 0.0051 FT/FT * 47.50
% FULL V 1/2 = 5.6 fps Q= 7.93 cfs

INSTALL 274 ' OF 24 " PVC SS ,SLOPE 0.0051 FT/FT * 47.50
% FULL V 1/2 = 5.6 fps Q= 7.93 cfs

INSTALL 255 ' OF 24 " PVC SS ,SLOPE 0.0051 FT/FT * 47.50
% FULL V 1/2 = 5.6 fps Q= 7.93 cfs

INSTALL 264 ' OF 24 " PVC SS ,SLOPE
% FULL V 1/2 = 11.3 fps

4494.2 4466.83
4493.9 4466.63
4493.7 4466.33
4493.4 4466.03
4493.2 4465.83
4493.0 4465.63
4492.8 4465.43
4492.6 4465.23
4492.4 4465.03
4492.2 4464.83
4492.0 4464.63
4491.8 4464.43
4491.6 4464.23
4491.4 4464.03
4491.2 4463.83
4491.0 4463.63
4490.8 4463.43
4490.6 4463.23
4490.4 4463.03
4490.2 4462.83
4490.0 4462.63
4489.8 4462.43
4489.6 4462.23
4489.4 4462.03
4489.2 4461.83
4489.0 4461.63
4488.8 4461.43
4488.6 4461.23
4488.4 4461.03
4488.2 4460.83
4488.0 4460.63
4487.8 4460.43
4487.6 4460.23
4487.4 4460.03
4487.2 4459.83
4487.0 4459.63
4486.8 4459.43
4486.6 4459.23
4486.4 4459.03
4486.2 4458.83
4486.0 4458.63
4485.8 4458.43
4485.6 4458.23
4485.4 4458.03
4485.2 4457.83
4485.0 4457.63
4484.8 4457.43
4484.6 4457.23
4484.4 4457.03
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4484.0 4456.63
4483.8 4456.43
4483.6 4456.23
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4483.2 4455.83
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4482.6 4455.23
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4482.0 4454.63
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4481.6 4454.23
4481.4 4454.03
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4481.0 4453.63
4480.8 4453.43
4480.6 4453.23
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4479.6 4452.23
4479.4 4452.03
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4478.6 4451.23
4478.4 4451.03
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4478.0 4450.63
4477.8 4450.43
4477.6 4450.23
4477.4 4450.03
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4477.0 4449.63
4476.8 4449.43
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4475.0 4447.63
4474.8 4447.43
4474.6 4447.23
4474.4 4447.03
4474.2 4446.83
4474.0 4446.63
4473.8 4446.43
4473.6 4446.23
4473.4 4446.03
4473.2 4445.83
4473.0 4445.63
4472.8 4445.43
4472.6 4445.23
4472.4 4445.03
4472.2 4444.83
4472.0 4444.63
4471.8 4444.43
4471.6 4444.23
4471.4 4444.03
4471.2 4443.83
4471.0 4443.63
4470.8 4443.43
4470.6 4443.23
4470.4 4443.03
4470.2 4442.83
4470.0 4442.63

631+00 632+00 633+00 634+00 635+00 636+00 637+00 638+00 639+00 640+00 641+00 642+00 643+00 644+00 645+00 646+00 647+00 648+00 649+00

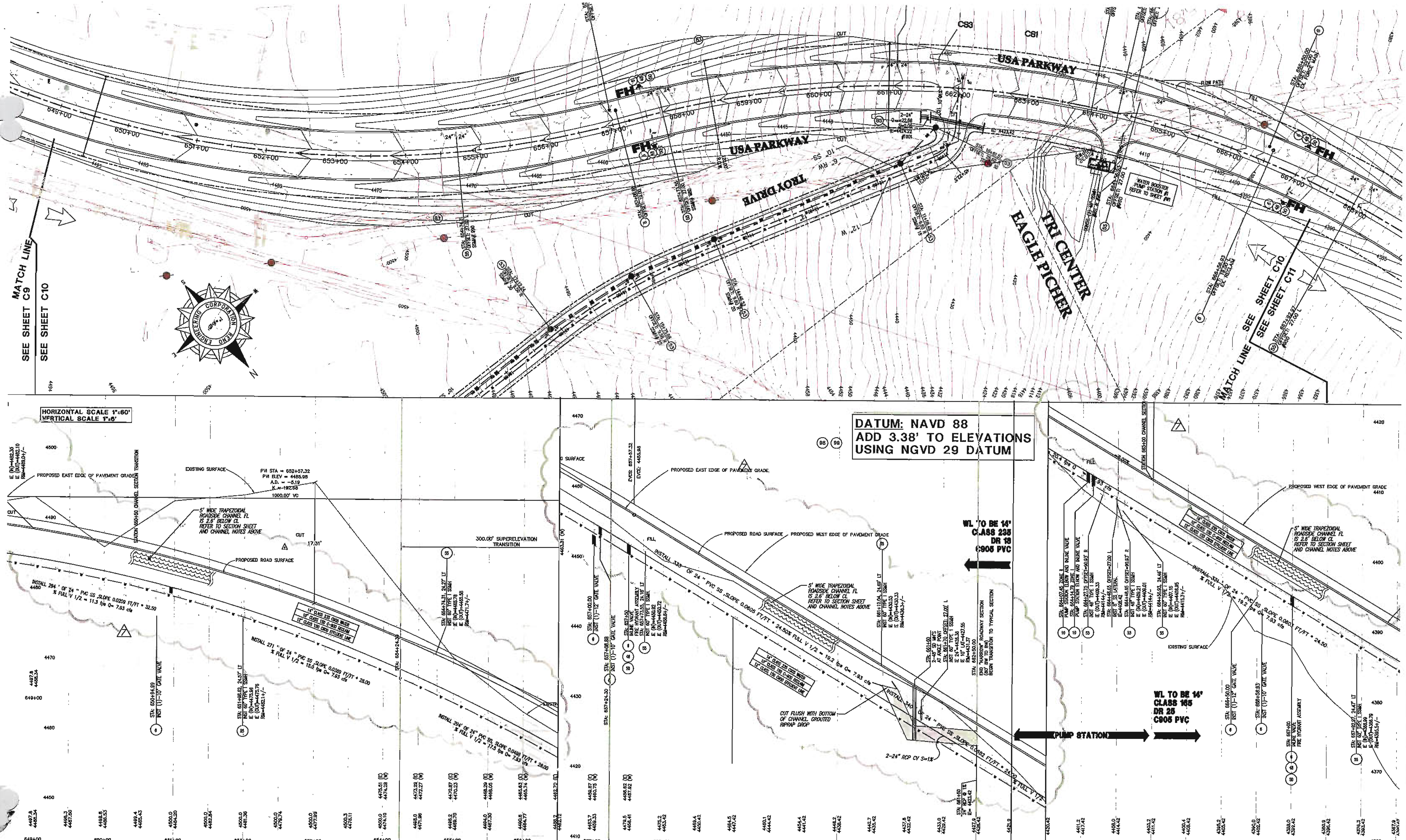
REVISIONS	BY	DATE
1 REMOVED CATCH BASINS	VJC	08/04
2 FROM STA: 664+10 TO STA: 571+62	VJC	09/04
3 MANHOLE RIM ELEV'S ADDED	LRT	10/04
4 REMOVED RW LATERAL	VJC	01/05
5 NORTHBOUND SECTION SUPER-ELEVATED	LRT	05/05
6 60" SDMH & 24" CMP SD ADDED		
7 REMOVED SD PIPE & PUMPHOUSE	JDM	06/05

RENO ENGINEERING CORPORATION
CIVIL ENGINEERING • DESIGN • LAND PLANNING
3883 S. McCARRAN BLVD #332 RENO, NV 89502
PHONE: (702) 852-5700 FAX: (702) 852-2104

TAHOE RENO INDUSTRIAL CENTER

TAHOE/RENO INDUSTRIAL CENTER
USA PARKWAY PLAN AND PROFILE

USA
PP9
AKA US 09



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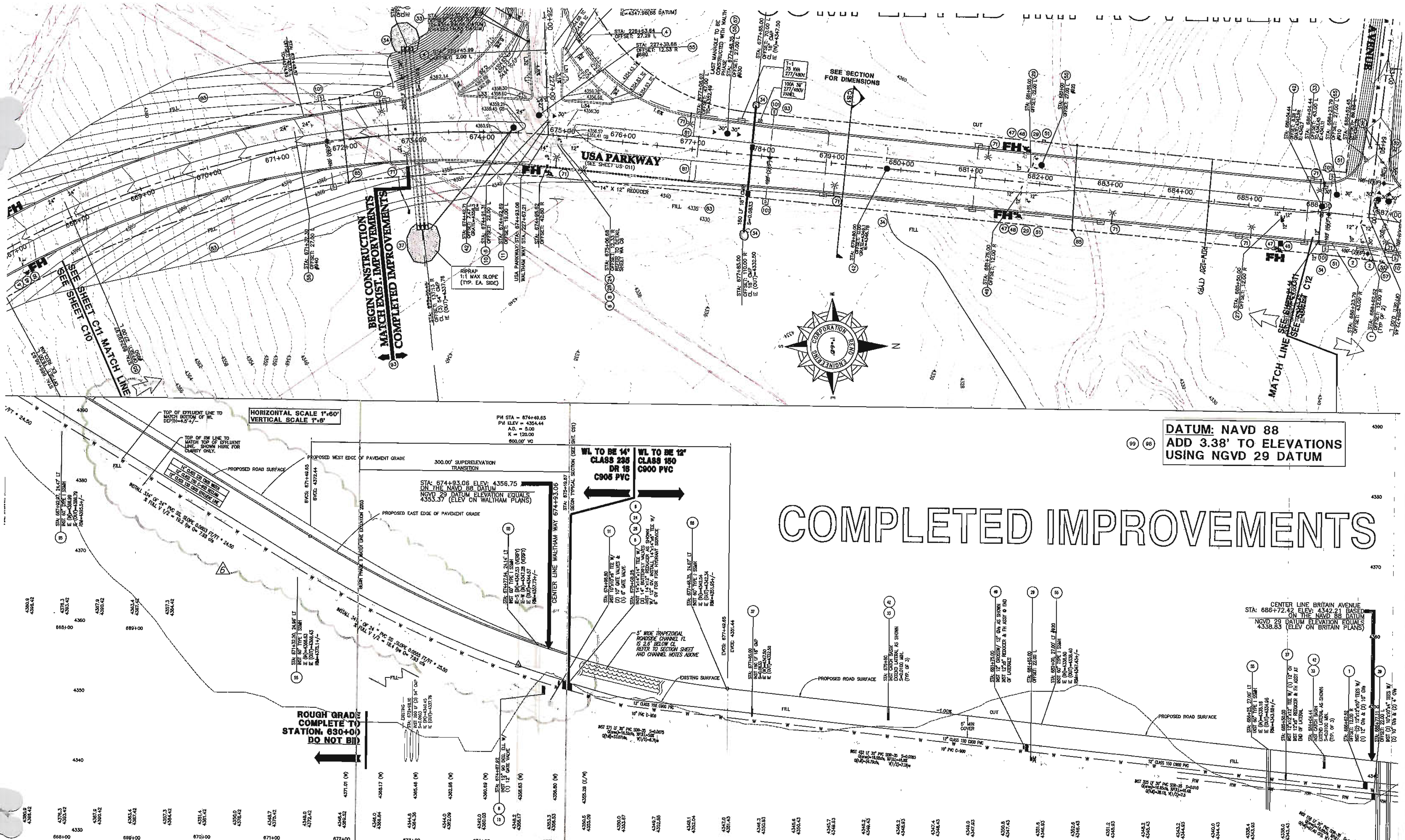
	REVISIONS	BY	DATE
1	REVISE VERTICAL ALIGNMENT	KDK	11/00
2	MOVED FIRE HYDRANTS	VJG	08/05
3	REMOVED CATCH BASINS	VJG	09/05
4	FROM STA: 664+10 TO STA: 571+62	VJG	09/04
5	MANHOLE RIM ELEV'S ADDED	LRT	10/04
6	REMOVED RW LATERALS	ESD	01/05
7	BOTH LANES SUPER-ELEVATED	LRT	05/10

TAHOE/RENO INDUSTRIAL CENTER
USA PARKWAY PLAN AND PROFILE

USA
PP10
AKA US C10


USA PARKWAY
(SEE SHEET US-C11)
SEE SECTION FOR DIMENSIONS
BEGIN CONSTRUCTION MATCH EXIST. IMPROVEMENTS COMPLETED IMPROVEMENTS
SEE SHEET C11 MATCH LINE SEE SHEET C10
SEE SHEET C12 MATCH LINE
RIPRAP 1:1 MAX SLOPE (TYP. EA. SIDE)
14" X 12" REDUCER
CORPORATION RENO ENGINEERING
HORIZONTAL SCALE 1"=60'
VERTICAL SCALE 1"=6'
DATUM: NAVD 88
ADD 3.38' TO ELEVATIONS USING NGVD 29 DATUM
COMPLETED IMPROVEMENTS
WL TO BE 14' CLASS 235 DR 18 C905 PVC
WL TO BE 12' CLASS 150 C900 PVC
CENTER LINE WALTHAM WAY 674+93.06
STA: 674+93.06 ELEV: 4356.75 ON THE NAVD 88 DATUM
NGVD 29 DATUM ELEVATION EQUALS 4353.37 (ELEV ON WALTHAM PLANS)
CENTER LINE BRITAIN AVENUE
STA: 686+72.42 ELEV: 4342.21 BASED ON THE NAVD 88 DATUM
NGVD 29 DATUM ELEVATION EQUALS 4338.83 (ELEV ON BRITAIN PLANS)
300.00' SUPERELEVATION TRANSITION
PROPOSED WEST EDGE OF PAVEMENT GRADE
PROPOSED EAST EDGE OF PAVEMENT GRADE
PROPOSED ROAD SURFACE
EXISTING SURFACE
5' WIDE TRAPEZOIDAL ROADSIDE CHANNEL FL @ 2.6' BELOW CL REFER TO SECTION SHEET AND CHANNEL NOTES ABOVE
ROUGH GRADE COMPLETE TO STATION 630+00 DO NOT BID
TOP OF EFFLUENT LINE TO MATCH BOTTOM OF WL DEPTH=4.5'+/-
TOP OF RW LINE TO MATCH TOP OF EFFLUENT LINE. SHOWN HERE FOR CLARITY ONLY.
PVI STA = 674+49.65
PVI ELEV = 4354.44
A.D. = 5.00
K = 120.00
600.00' VC
FILL
CUT
-1.00%
5' MIN COVER

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REVISIONS	BY	DATE
REVISE VERTICAL ALIGNMENT	KDK	11/00
GENERAL REVISIONS	KDK	01/03
UPDATED SS	VJG	06/03
REMOVED CATCH BASINS	VJG	08/04
REMOVED RW LATERAL	VJG	01/05
SUPER-ELEVATION STARTS AT STA: 675+19.67	LRT	05/10

TAHOE/RENO INDUSTRIAL CENTER
USA PARKWAY PLAN AND PROFILE

USA
PP11

\\renoeng01\ZDRIVE\DWG-TRI\ROADS\USA-AVENUE\USA-ppC12A.dwg Tue Jul 08 11:51:04 2003 jmaATTACK

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TAHOE RENO INDUSTRIAL CENTER

	REVISIONS	BY	DATE
1	REVISE ALIGNMENT & UTILITIES	KDK	11/02
2	GENERAL REVISIONS	KDK	01/03
	MOVED SS TO NEW BRITTIAN	VJG	06/03
	UPDATED W/ BRITAIN INTERSECTION	JM	7/5/03

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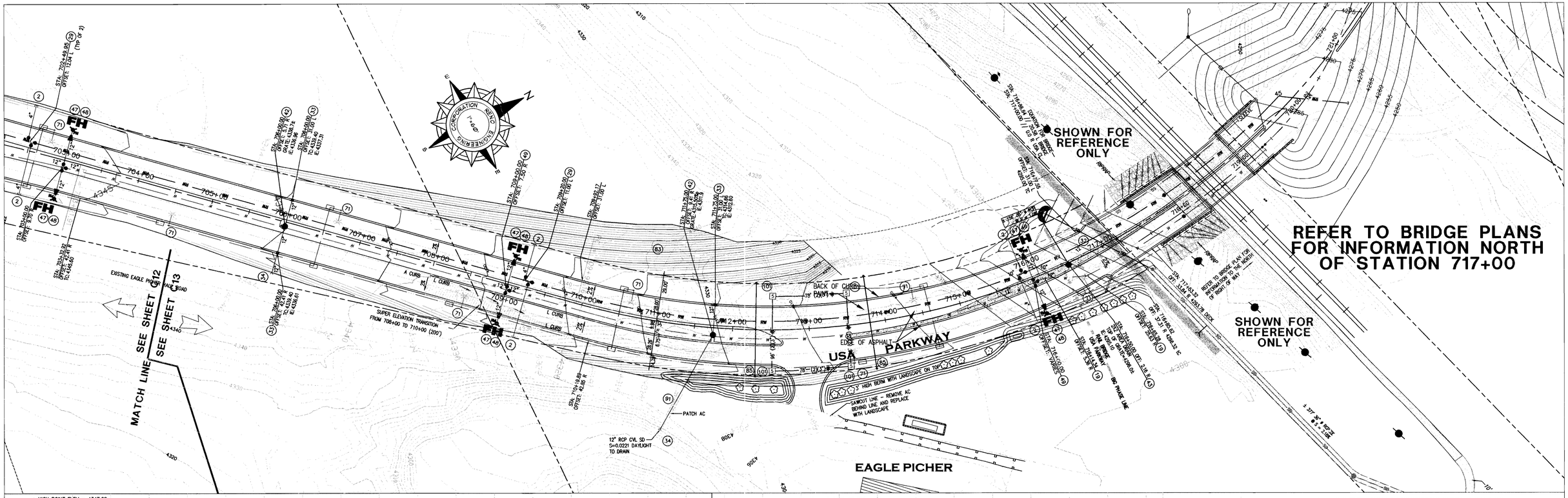
USA PARKWAY PLAN AND PROFILE

US C12



HIGH POINT ELEV = 4347.28
HIGH POINT STA = 700+28.08
PVI STA = 703+00
PVI ELEV = 4358.02
A.D. = 7.22
K = 193.83
1400.00' VC

HORIZONTAL SCALE 1"=60'
VERTICAL SCALE 1"=6'

EXISTING SURFACE
CUT
-3.52%
-5.01%
TC EAST EDGE OF NORTH BOUND LANE
SUPER ELEVATION TRANSITION SECTION EAST SIDE ONLY (NORTH BOUND LANE)
STA: 708+00 BEGIN SUPERELEVATION
STA: 710+00 FULL SUPERELEVATION
EXIST GRADE AT CL CONTROL GRADE (NORTH BOUND)
EXIST GRADE AT CL CONTROL GRADE (SOUTH BOUND)

PVI STA = 713+00 CONTROL LINE
PVI ELEV = 4307.87
A.D. = 2.01
K = 148.93
300.00' VC

PVI STA = 714+02.97 TC WEST EDGE OF SOUTH BOUND
PVI ELEV = 4303.33
A.D. = 1.97
K = 151.95
300.00' VC

BVCS: 712+52.97
BVCE: 4310.85
EVCS: 714+52.97
EVCE: 4303.37
EVCS: 715+52.97
EVCE: 4298.77
TC WEST EDGE OF SOUTH BOUND LANE
CONTROL LINE ELEVATION REFER TO SECTION DRAWING FOR INFORMATION
TC EAST EDGE OF NORTH BOUND LANE
SAME POINT
NON-TYPICAL SECTION
CONTACT ENGINEER FOR CLARIFICATION OF TC ELEVATIONS. PLAN DOES NOT MATCH TYPICAL SECTION IN THIS AREA.
MATCH TO BRIDGE PROFILE

DATUM: NAVD 88
ADD 3.38' TO ELEVATIONS USING NGVD 29 DATUM

RAILROAD RIGHT OF WAY
WEST EDGE OF NORTH BOUND LANE
STREET LIGHT
PROPOSED GRADE @ BRIDGE CONTROL LINE=CENTER OF NORTH BOUND LANE
EAST EDGE OF NORTH BOUND LANE
WEST EDGE OF SOUTH BOUND LANE
STRUCTURE
SPAN
BRIDGE PROF SHOWN FOR REF ONLY
REFER TO BRIDGE PLANS FOR MOST RECENT INFO

PVI STA = 720+04.48
PVI ELEV = 4285.46
A.D. = -4.41
K = 33.99
150.00' VC

BVCS: 719+29.48
BVCE: 4287.71
EVCS: 720+79.48
EVCE: 4279.90
STA: 719+68.53 ELEV: 4286.68
TOP OF ASPHALT CL OFF EAST DOUBLE LANE "TC"
RIGHT SUPER EOP = +0.337' (2% @ 17.84)

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TAHOE RENO INDUSTRIAL CENTER

REVISIONS	BY	DATE
1. REVISE ALIGNMENT & UTILITIES	KDK	11/00
2. GENERAL REVISIONS	KDK	01/03
3. TC GRADE REVISIONS	JM	07/03
4. NEW CURB LAYOUT	VG	8/18/03

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USA PARKWAY PLAN AND PROFILE

US C13

TRI CENTER
INDUSTRIAL CENTER

BENCHMARK
NAVD 88 DATUM

USC & GS BRASS CAP STAMPED "N 339 1953" IN CONCRETE HEADWALL NORTH OF THE EAGLE PITCHER PLANT AT CLARKS STATION 16KM EAST OF VISTA INTERCHANGE IN SPARKS
(ADD 3.38' TO ELEVATIONS SHOWN ON PLANS USING NGVD 29 DATUM)

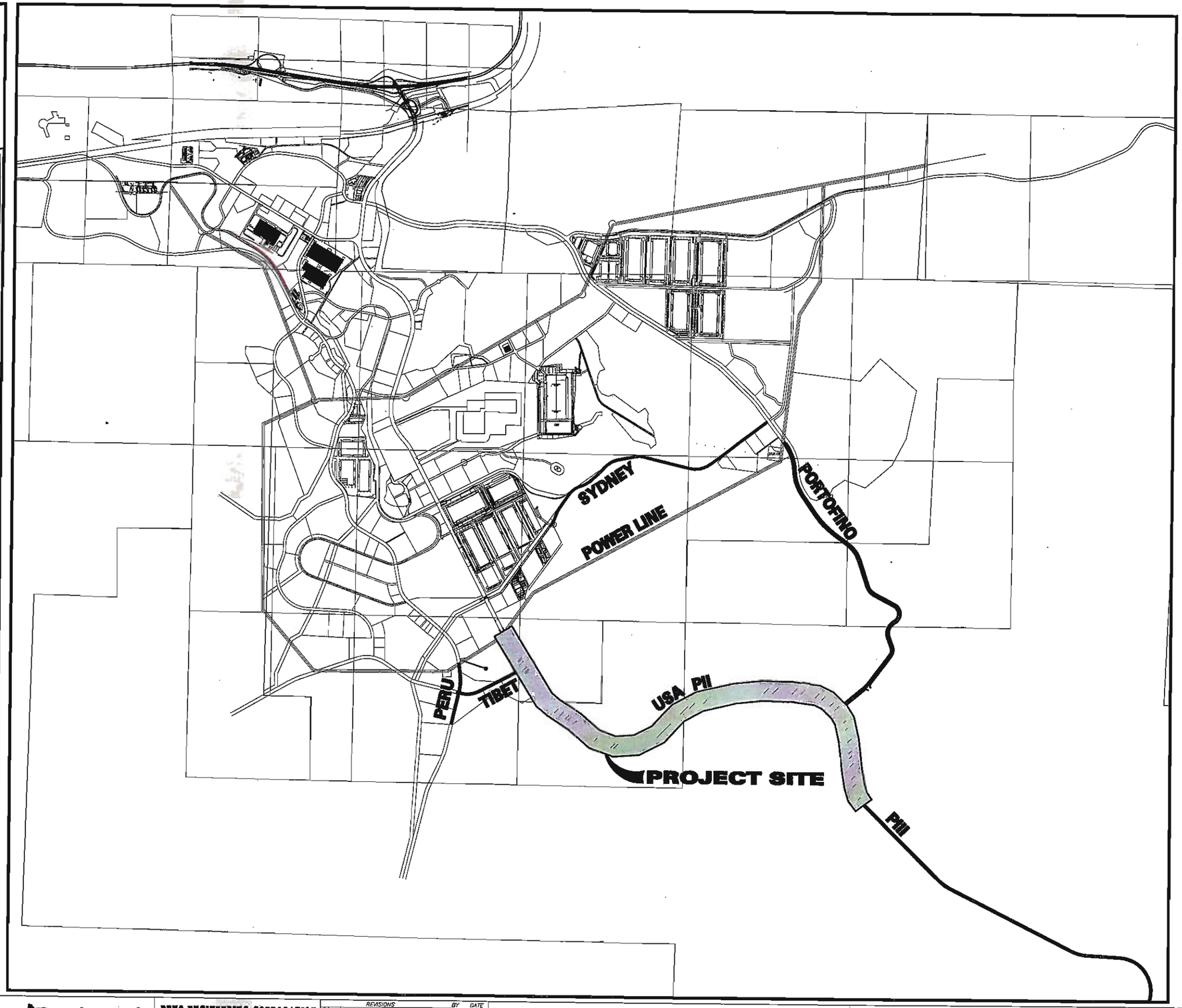
ELEVATION = 4256.42

** INFORMATION SUPPLIED TO RENO ENGINEERING CORPORATION BY WESTERN NEVADA SURVEYING & MAPPING 1998

BASIS OF BEARING

THE BASIS OF BEARING IS THE NEVADA COORDINATE SYSTEM 1983/84 AS DETERMINED FROM STATION N339 AND STATION X148, HARN EXTENSION 1983/84. A COMBINED FACTOR OF 1.000254928 WAS USED FOR GRID TO GROUND CONVERSION.

INDEX



TRI CENTER ROADS (2009)
USA THROUGH COMMSTOCK MEADOWS

RENO ENGINEERING CORPORATION
CIVIL ENGINEERING · DESIGN · LAND PLANNING
6205 TECHNOLOGY WAY, SUITE B RENO, NV 89521
PHONE: (775) 852-5700 FAX: (775) 852-5707

REVISIONS	BY	DATE

TRI ROADS 2009
COVER SHEET

CV1

JURISDICTION

GRADING	STOREY COUNTY
SEWER	TRI WATER AND SEWER
WATER	TRI WATER AND SEWER
RECLAIM WATER	TRI WATER AND SEWER
POWER/GAS	SIERRA PACIFIC POWER

APPROVALS

STOREY COUNTY BUILDING PERMIT ______

TRI UTILITY COMPANY ______

STATE DUST CONTROL# AP-1629-1221

NOTE TO ALL OF THOSE USING THESE PLANS:
IF THE NECESSARY APPROVAL DATES ARE NOT SHOWN ABOVE, THESE PLANS SHALL BE CONSIDERED PRELIMINARY AND NOT FOR CONSTRUCTION. PRIOR TO CONSTRUCTION OR THE ORDERING OF ANY MATERIALS OBTAIN A SET OF DRAWINGS WHICH HAVE ALL OF THE NECESSARY APPROVALS FROM THE ENGINEER.

OWNER

TAHOE-RENO INDUSTRIAL CENTER, L.L.C.
A NEVADA LIMITED LIABILITY COMPANY
P.O. BOX 838, POWAY, CA 92074-0838

ENGINEER

RENO ENGINEERING CORPORATION
8725 TECHNOLOGY WAY, SUITE B
RENO, NEVADA 89521
FOR QUESTIONS OR COMMENTS CONTACT
VINCENT GRIFFITH P.E. 852-5700

TOPOGRAPHY

CONTOURS AND SPOT GRADES SHOWN ON THESE PLANS WERE TAKEN FROM AERIAL MAPPING AND CONFORM TO THE FOLLOWING STANDARDS.

XY ACCURACY: 1/50" AT MAP SCALE
Z ACCURACY: ;1/2 CONTOUR INTERVAL
SPOTS: ;1/4 CONTOUR INTERVAL
MAPS MUST BE FIELD CHECKED BEFORE USE-ALTERATIONS SERVICED PROMPTLY
DASHED LINES MAY NOT MEET MAP ACCURACY STANDARDS
BUILDING OUTLINES INDICATE DRIP LINE BUT MAY ALSO INCLUDE STAIRS AND ATTACHEMENTS
FEATURES IN SHADOW AND VEGETATION AREAS OR NEAR TALL OBJECTS MAY BE OBSCURED DUE TO PHOTOGRAPHIC ANGLE
MAPPING OUTSIDE OF CONTROL PERIMETER MAY NOT MEET MAP ACCURACY STANDARDS
SMALL SHADOW AREAS ARE NOT SHOWN FOR CLARITY

GENERAL RECLAIMED WATER NOTES

1. All construction shall conform to the Standard Specification for Public Works Construction (1996) and Washoe County Standards.
2. All reclaimed water lines constructed out of PVC shall be purple plastic or be encased in purple polyethylene bags labeled "CAUTION: RECLAIMED WATER LINE" at intervals no greater than 5 feet. If purple pipe or bags are not available, purple vinyl adhesive tape shall be attached to the pipe continuously, in a longitudinal direction. The tape shall have the wording "CAUTION: RECLAIMED WATER LINE" at intervals of no more than 5 feet, have a minimum width of 6", and be installed along the top of the pipe. Reclaimed water lines constructed out of ductile iron pipe shall be encased in purple polyethylene bags labeled "CAUTION: RECLAIMED WATER LINE" at intervals no greater than 5 feet.
3. Tracer wire shall be placed on top of bedding material prior to pipe installation. At 500' intervals, wire shall be extended into separate test stations consisting of risers and valve boxes. A minimum of 18 inches of wire shall be left at the top of the riser and connected with the appropriately sized wire nut. The tracer wire shall be placed under laterals, extended into the meter box and up to the meter cover. Wire shall be #12 AWG, insulated, stranded copper. Prior to acceptance of the reclaimed waterline, the contractor shall perform a continuity test after backfilling the trench to the satisfaction of the Utility Services Division Inspector.
4. Purple warning tape, at least 3" in width, with wording "CAUTION: RECLAIMED WATER LINE BELOW." shall be installed 12 inches above all pipe.
5. All covers for valve boxes, flush valves, pressure reducing stations, air/vac stations, and all other appurtenances requiring vaults or boxes shall be purple in color (Pantone Color #512) and labeled "RECLAIMED WATER" or "R.C.W.". Purple coloration shall be obtained from the manufacturer or applied by powder coating or epoxy paint. All appurtenances shall have a purple tag attached with the wording "WARNING: RECLAIMED WATER–DO NOT DRINK" in English and Spanish (T. Christy Enterprises, Valve Identification Tag, ID-STD-P2-RC1P2 or approved equal). A debris cap with purple coloration shall be installed inside of all round valve boxes.
6. All aboveground piping shall be painted purple (Pantone Color # 512) and a purple tag, with the wording "WARNING: RECLAIMED WATER – DO NOT DRINK" in English and Spanish, attached to the assembly (T. Christy Enterprises, Valve Identification Tag, ID-STD-P2-RC1P2 or approved equal).
7. All meter box covers shall be purple in color (see above) and a purple tag, with the wording "WARNING: RECLAIMED WATER – DO NOT DRINK" in English and Spanish, attached to the meter (T. Christy Enterprises, Valve Identification Tag, ID-STD-P2-RC1P2 or approved equal).
8. The minimum horizontal separation between parallel reclaimed waterlines and potable waterlines shall be 10 feet. When reclaimed waterlines cross potable waterlines, the reclaimed line shall be installed below the potable line. A minimum of 18 inches vertical separation shall be maintained from the bottom of a potable waterline to the top of a crossing reclaimed waterline. Reclaimed waterline pipe joints shall be kept as far away as possible from crossing potable waterlines.
9. Direct connections between potable water piping and reclaimed water piping shall not exist under any condition with or without backflow protection per UPC (1994 edition) Section 603.2.4.
10. Hose bibs on the reclaime system are PROHIBITED.

UTILITIES

1. THE LOCATION OF UNDERGROUND UTILITIES SHOWN HEREON HAS BEEN DETERMINED FROM SURFACE EVIDENCE OF THEIR EXISTENCE OR FROM INFORMATION OBTAINED FROM THE UTILITY COMPANIES. THE ENGINEER ACCEPTS NO LIABILITY FOR THE EXISTENCE OR NON-EXISTENCE OF UTILITY LINES. CONTRACTORS AND OTHERS USING THIS MAP MUST CONFIRM THE LOCATION OF UNDERGROUND LINES OR STRUCTURES FROM THE UTILITY COMPANIES PRIOR TO COMMENCING ANY EXCAVATION OR ORDERING OF MATERIALS.
2. THE CONTRACTOR SHALL VERIFY IN FIELD, ALL ELEVATIONS, DIMENSIONS, FLOW LINES EXISTING CONDITIONS, AND POINTS OF CONNECTIONS WITH AD-JOINING PROPERTY (PUBLIC OR PRIVATE). ANY DISCREPANCIES SHALL BE CALLED TO THE ATTENTION OF THE ENGINEER BEFOR PROCEEDING WITH THE WORK.

CALL 1-800-227-2600 BEFORE EXCAVATION TAKES PLACE

GENERAL NOTES

1. ALL CONSTRUCTION SHALL CONFORM TO STOREY COUNTY CODES AND REGULATIONS.
2. ALL CONSTRUCTION SHALL CONFORM TO THE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 1996 EDITION AND THE STANDARD DETAILS FOR PUBLIC WORKS.
3. THE CONTRACTOR SHALL MAINTAIN A DUST CONTROL PROGRAM TO INCLUDE WATERING OF OPEN AREAS AND MAINTAIN CONFORMITY WITH STATE OF NEVADA AIR POLLUTION PROVISIONS.
4. ALL DIMENSIONS ARE FROM FACE OF CURB UNLESS OTHERWISE NOTED.
5. HANDICAPPED RAMPS ARE TO BE CONSTRUCTED AT ALL NEW AND RECONSTRUCTED CURB RETURNS AS SHOWN ON STANDARD DETAILS.
6. REFER TO UTILITY NOTE THIS PAGE.
7. THE CONTRACTOR SHALL MAINTAIN ALL EXISTING DRAINAGE FACILITIES WITHIN THE CONSTRUCTION AREA UNTIL NEW DRAINAGE IMPROVEMENTS ARE IN PLACE AND FUNCTIONING.
8. ALL EXCAVATION AND EMBANKMENT SHALL BE IN ACCORDANCE WITH THE ORANGE BOOK STANDARDS AND THE PROJECT SPECIFIC SOILS REPORT.
9. IT IS THE INTENT OF THESE SPECIFICATIONS AND IMPROVEMENT PLANS THAT THE WORK PERFORMED UNDER THE CONTRACT SHALL RESULT IN A COMPLETE OPERATING SYSTEM IN SATISFACTORY WORKING CONDITION WITH RESPECT TO THE FUNCTIONAL PURPOSES OF THE INSTALLATION. IF THERE ARE ANY QUESTIONS REGARDING THE STATED OR IMPLIED MEANING OF THESE PLANS, THE CONTRACTOR IS DIRECTED TO CONTACT RENO ENGINEERING CORPORATION IMMEDIATELY AT 852-5700.
10. ALL SANITARY SEWER AND WATER LINE CROSSINGS SHALL HAVE A MINIMUM OF 18" CLEARANCE. IF 18" CLEARANCE CANNOT BE MAINTAINED, THE SEWER PIPE SHALL BE CAST IRON, CLASS 50, OR WATER CLASS PIPE. SEPARATION OF PIPES SHALL CONFORM TO NAC 445A.67155.

HORIZONTAL AND VERTICAL SEPARATION
SEWERS SHALL BE LAID AT LEAST 10 FEET (3 M) HORIZONTALLY FROM ANY EXISTING OR PROPOSED WATER MAIN. THE DISTANCE SHALL BE MEASURED FROM EDGE TO EDGE. IN CASES WHERE IT IS NOT PRACTICAL TO MAINTAIN A 10 FOOT (3 M) SEPARATION, THE APPROPRIATE REVIEWING AGENCY MAY ALLOW DEVIATION ON A CASE-BY CASE BASIS, IF SUPPORTED BY DATA FROM THE DESIGN ENGINEER. SUCH DEVIATION MAY ALLOW INSTALLATION OF THE SEWER CLOSER TO THE WATER MAIN, PROVIDED THAT THE WATER MAIN IS IN A SEPARATE TRENCH OR ON AN UNDISTURBED EARTH SHELF LOCATED ON ONE SIDE OF THE SEWER AND AT AN ELEVATION SO THAT THE BOTTOM OF THE WATER MAIN IS AT LEAST 18 INCHES (457 MM) ABOVE THE TOP OF THE SEWER.
IF IT IS IMPOSSIBLE TO OBTAIN PROPER HORIZONTAL AND VERTICAL SEPARATION AS DESCRIBED ABOVE, BOTH THE WATER MAIN AND THE SEWER MUST BE CONSTRUCTED OF SLIP-ON OR MECHANICAL JOINT PIPE COMPLYING WITH THE PUBLIC WATER SUPPLY DESIGN STANDARDS OF THE AGENCY AND BE PRESSURE TESTED TO 150 psi (1034 kPa) TO ASSURE WATERTIGHTNESS BEFORE BACKFILLING.

CROSSINGS
SEWER CROSSING WATER MAINS SHALL BE LAID TO PROVIDE A MINIMUM VERTICAL DISTANCE OF 18 INCHES (457 MM) BETWEEN OUTSIDE OF THE WATER MAIN AND THE OUTSIDE OF THE SEWER. THIS SHALL BE THE CASE WHERE THE WATER MAIN IS EITHER ABOVE OR BELOW THE SEWER. THE CROSSING SHALL BE ARRANGED SO THAT THE SEWER JOINTS WILL BE EQUIDISTANT AND AS FAR AS POSSIBLE FROM THE WATER MAIN JOINTS. WHERE A WATER MAIN CROSSES UNDER A SEWER, ADEQUATE STRUCTURAL SUPPORT SHALL BE PROVIDED FOR THE SEWER TO MAINTAIN LINE AND GRADE.

WHERE IT IS IMPOSSIBLE TO OBTAIN PROPER HORIZONTAL AND VERTICAL SEPARATION AS STIPULATED ABOVE, ONE OF THE FOLLOWING METHODS MUST BE SPECIFIED:
- A. THE SEWER SHALL BE DESIGNED AND CONSTRUCTED EQUAL TO THE WATER PIPE, AND SHALL BE PRESSURE TESTED TO 150 psi (1034 kPa) TO ASSURE WATER TIGHTNESS PRIOR TO BACKFILLING.
- B. EITHER THE WATER MAIN OR THE SEWER LINE MAY BE ENCASED IN A WATERTIGHT CARRIER PIPE WHICH EXTENDS 10 FEET (3 M) ON BOTH SIDES OF THE CROSSING, MEASURED PERPENDICULAR TO THE WATER MAIN. THE CARRIER PIPE SHALL BE OF MATERIALS APPROVED BY THE REGULATORY AGENCY FOR USE IN WATER MAIN CONSTRUCTION.

11. CONSTRUCTION EXPANSION JOINTS IN ALL CURBS AND GUTTERS SHALL BE AT THIRTY FEET (30') ON CENTER AND AT ALL RETURNS WITH WEAKENED PLANE JOINTS AT INTERVALS OF TEN FEET (10')
12. ALL SANITARY SEWER LINES SHALL BE S.D.R. CLASS 35. IN ADDITION, ALL SANITARY SEWER LATERALS SHALL BE 8 INCH MIN. DIAMETER S.D.R. 35., UNLESS SHOWN OTHERWISE, AND SHALL BE PLUGGED AND MARKED AS SHOWN ON PLANS.
13. THE LETTER "S" SHALL BE STAMPED ON THE TOP OF CURB AT ALL LOCATIONS WHERE A SEWER SERVICE LATERAL CROSSES THE CURB LINE. THE LETTER "W" SHALL BE STAMPED IN THE CURB AT ALL LOCATIONS WHERE A WATER LATERAL CROSSES A CURB LINE.
14. ALL STORM DRAIN LINES (R.C.P.) SHALL BE CLASS III UNLESS OTHERWISE NOTED.
15. ALL AREAS DISTURBED AND LEFT UNDEVELOPED FOR A PERIOD OF MORE THAN THIRTY (30) DAYS SHALL BE STABILIZED BY THE APPLICATION OF DUST PALLIATIVE AND IF LEFT MORE THAN NINETY (90) DAYS PLANTED AS FOLLOWS:
    FERTILIZER – (16-20-0) 300# ACRE
    GRASS, THE BROADCAST SEEDING RATE SHALL BE 12#/AC. OF SODAR WHEATGRASS AND 8#/AC. OF FAIRWAY CREATED WHEATGRASS. IF DRILLED, THE RATE SHOULD BE 6#/AC. OF SODAR WHEATGRASS AND 5#/AC. OF FAIRWAY CREATED WHEATGRASS
    STRAW MULCH 3000#/AC., ANCHORED BY A STRAW PUNCHING TOOL OR COVERED WITH NETTING AND STAPLED.
16. PARALLEL WATER AND SANITARY SEWER/RECLAIMED WATER SEPARATION SHALL BE 10' MINIMUM.
17. ALL ASPHALT SHALL BE SAWCUT WHERE NEW CONSTRUCTION MEETS EXISTING.
18. ALL SIGN LOCATIONS SHALL BE IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (M.U.T.C.D.).
19. SLOPE STABILIZATION – NO SLOPE TO BE STEEPER THAN 3:1 ON THIS PROJECT WITHOUT NOTIFACTION OF ENGINEER, AND CONFORMANCE TO THE ORANGE BOOK.
    - A. SLOPE STABALIZATION – FOR > 3:1 – RIPRAP PER THE ORANGE BOOK.
    - B. SLOPE STABALIZATION – FOR 3:1 TO 5:1 – REVEGITATE WITH NATIVE SEED MIX PRIOR TO ACCEPTANCE OF THE IMPROVEMENT.
    - C. NO SLOPE TREATMENT REQUIRED – FOR SLOPE < 5:1
    - I. PLANTING:
        - A. THE SEED MIXTURE AND APPLICATION RATE FOR THE SLOPE STABILIZATION SHALL BE TO THE APPROVAL OF THE ENGINEER. SEED SHALL BE DRILLED INTO THE SOIL TO A DEPTH RECOMMENDED BY THE SEED SUPPLIER.
        - B. A FLEXIBLE SOIL REINFORCEMENT MATTING MADE OF THREE DIMENSIONAL NYLON OR VINYL MONOFILIMENTS, FUSED AT THE INTERSECTIONS, WITH A MINIMUM THICKNESS OF 9MM (OR APPROVED EQUAL), SHALL PROVIDE COVERAGE ON ALL SLOPES. THE MATERIAL SHALL HAVE 95% OPENING AND PROVIDE ULTRAVIOLET PROTECTION. IT SHALL RETAIN A MINIMUM OF 90% OF IT'S STRENGTH AFTER TWO YEARS. THE FABRIC SHALL BE INSTALLED STRICTLY ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
    - II. ALL SLOPES SHALL BE IRRIGATED UNTIL ESTABLISHED AS APPROVED BY THE ENGINEER.
    - III. WHEN ROCK RIP-RAP IS USED FOR SLOPE STABILIZATION, IT SHALL CONFORM TO THE ORANGE BOOK.
20. ALL WATERLINES SHALL BE CONSTRUCTED PER AWWA STANDARDS. THE WATER SYSTEM SHALL CONFORM TO THE STANDARD SPECS FOR PWC, 1996 EDITION. THE STANDARD DETAILS FOR PUBLIC WORKS ADOPTED BY STOREY COUNTY EXCEPT AS MODIFIED BY THESE PLANS ON SPECIAL PROVISIONS.
    - A. WATER LINES SHALL BE DISINFECTED IN THE PRESENCE OF A U.D. INSPECTOR IN ACCORDANCE WITH AWWA C651 STANDARDS TO THE SATISFACTION OF THE USD INSPECTOR.
    - B. WATER LINES SHALL BE FLUSHED AND PRESSURE TESTED IN THE PRESENCE OF A U.D. INSPECTOR.
    - C. NEW WATER LINES SHALL BE ISOLATED FROM EXISTING UNTIL APPROVED BY A U.D. INSPECTOR. IN CONFORMANCE WITH AWWA C600 FOR DUCTILE IRON, AND AWWA C605 FOR PVC PIPE.
    - D. NEW WATER LINES SHALL BE BACTI'D BY A U.D. INSPECTOR.
    - E. ALL PIPE LATERALS TO EXTEND 20' BEYOND EDGE OF PAVEMENT MIN. OR TO THE EDGE OF THE LANDSCAPE EASEMENT, OR B.O., WHICHEVER IS FARTHER. INCLUDE FLUSH VALVE ASSEMBLY.
    - F. ALL TIES TO EXISTING WATER LINES SHALL BE APPROVED BY A UD INSPECTOR
    - G. SUBMITTALS FOR ALL WATER AND RECLAIM WATER PIPES & APPURTENANCES SHALL BE SUBMITTED AND AND APPROVED BY THE ENGINEER.
    - H. ALL WATER LINES TO HAVE A MINIMUM OF 3' OF COVER.
    - J. ALL TEEs, BENDS, CAPS, AND HYDRANTS REQUIRE THRUST BLOCKS PER DETAIL ON SHEET CD1.
    - K. LOCATOR TAPE SHALL BE PLACED ABOVE ALL WATER PIPE PER TRENCH DETAIL ON SHEET CD2.
    - L. NO OPENINGS IN WATER PIPE UNDER CONSTRUCTION SHALL BE LEFT OPEN OVERNIGHT TO KEEP WILDLIFE AND POLLUTION OUT OF THE PIPE.
21. STREETLIGHTS TO BE CONSTRUCTED PER SIERRA PACIFIC POWER COMPANY CONTRACT DRAWINGS
22. DETAILS ARE SHOWN FOR INFORMATION ONLY AND ARE NOT MEANT TO SUPERSEDE THE ACTUAL STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION.
23. DUCTILE IRON PIPE SHALL CONFORM TO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 1992, 203.06 UNLESS OTHERWISE SPECIFIED. PIPE TO BE PUSH-ON JOINTED, CEMENT LINED DUCTILE IRON PIPE CLASS 50.
24. 3"-12" WATER PIPE SHOWN ON THESE PLANS SHALL BE PVC AND CONFORM TO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 1992 203.15.03 UNLESS OTHERWISE SPECIFIED. PVC PIPE TO BE CLASS 150, DR18, CONFORMING TO AWWA C900.
25. WATER PIPE LARGER THAN 12" SHALL BE PVC AND CONFORM TO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 1992 203.15.03 UNLESS OTHERWISE SPECIFIED. PVC PIPE TO BE CLASS 165, DR25, CONFORMING TO AWWA C905.
26. POLYETHELENE PRESSURE TUBING (1"-3" SHOWN ON THESE PLANS) SHALL CONFORM TO STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION 1992 203.18.02.01 UNLESS OTHERWISE SPECIFIED. POLYETHELENE TUBES SHALL BE CLASS 200 (DR9) CONFORMING TO AWWA C901.
27. ALL MANHOLES TO BE WATER TIGHT. STEPS ("MA" MANHOLE STEP BY MA INDUSTRIES OR EQUAL) WILL BE REQUIRED IN ALL MANHOLES 5 FEET OR MORE IN DEPTH.
28. EROSION CONTROL PERMIT # ______ APPROVED BY NDEP, SHALL BE USED FOR THIS PROJECT. CONTACT ENGINEER FOR COPY OF PERMIT PRIOR TO COMMENCEMENT OF WORK.
29. CONTRACTOR TO SCHEDULE A PRE-CON MEETING PRIOR TO COMMENCEMENT OF CONSTRUCTION WITH ENGINEER AND STOREY COUNTY OFFICIALS.
30. REPRODUCIBLE AS-BUILTS SHOWING ELEVATIONS, LOCATIONS & TYPES OF FITTINGS MUST BE PROVIDED TO THE COUNTY AND ENGINEER BEFORE PROJECT WILL BE ACCEPTED.
31. ALL THE NOTES LISTED ABOVE MAY NOT PERTAIN TO THE SPECIFIC WORK SHOWN ON THESE PLANS HOWEVER ALL THOSE USING THESE PLANS ARE STRONGLEY ADVISED TO READ AND UNDERSTAND THESE NOTES AS THEY PERTAIN TO THE WORK SHOWN HEREIN. FOR ASSISTANCE INTERPRETING THESE NOTES CONTACT THE ENGINEER.

CONSTRUCTION NOTES

NOT ALL NOTES LISTED BELOW ARE USED ON THESE PLANS

POTABLE/RECLAIM WATER

WATER NOTES

(1) INSTALL 18" x 18" x 12" TEE WITH 12" PO x FLG GATE VALVES & 12" PO x FLG GATE VALVE WHERE SHOWN. INCLUDE THRUST BLOCKS PER DETAIL ON SHEET RD1. CAP & MARK FOR FUTURE EXTENSION WHERE REQ'D.

(2) INSTALL THRUST BLOCKS AND CAP & MARK AT END OF WATER LINE OR RECLAIM LINE PER DETAIL ON SHEET RD2. INSTALL B.O. ASSY. AS SHOWN ON SHEET RD2, UNLESS FVA IS PRESENT.

(3) REMOVE CAP FROM EXISTING LINE AND EXTEND. INSTALL 12" GATE VALVE PER DETAIL ON SHT. RD1, UNLESS EXISTING VALVE IS PRESENT.

(4) INSTALL STANDARD 2" FLUSHING HYDRANT ASSEMBLY AT LOW POINT IN WATER/RECLAIM LINE. NO VALVES IN STREET (SEE SHT. RD2)

(5) INSTALL AIR RELIEF VALVE AT HIGH POINT IN WATER/RECLAIM LINE PER DETAIL ON SHEET RD2. NO VALVES IN STREET.

(6) INSTALL INLINE VALVE IN NEW WATER OR RECLAIM LINE. SIZE PER MAIN DIAMETER. (USE BUTTERFLY VALVES FOR 14" AND GREATER MAINS.) REFER TO SHEET RD1 FOR DETAIL.

(7) WARP PIPE INTO ALIGNMENT. MINIMUM RADIUS TO BE PER PIPE MANUFACTURERS SPECIFICATION.

(8) CONSTRUCT 12" HOT TAP ON EX. 14" WL. INCLUDE 12" FLG X PO GV AT TAP LOCATION. THRUST BLOCK INCLUDED.

(9) INSTALL 18" x 18" x 6" TEE WITH 6" FLG x PO GATE VALVE AND FIRE HYDRANT (SHT. RD1). LOCATION AS SHOWN ON PLANS.

(10) INSTALL 22.5' ELBOW AS SHOWN. INCLUDE STANDARD THRUST BLOCKS, SIZE PER MAIN DIAMETER (SHT. RD1).

(11) INSTALL 10" x 10" x 6" TEE WITH 10" PO x FLG GATE VALVES & 6" PO x FLG GATE VALVE WHERE SHOWN. INCLUDE THRUST BLOCKS PER DETAIL ON SHEET RD1. CAP FOR FUTURE EXTENSION WHERE REQ'D. IN LOCATIONS WITH TWO LATERALS A 10x6x10x6 CROSS IS ACCEPTABLE. CAP AND MARK ENDS AT RO.W.

(12) INSTALL 12" x 10" REDUCER

(13) INSTALL 10" x 10" x 6" TEE WITH 6" FLG x PO GATE VALVE AND FIRE HYDRANT (SHT. RD1). LOCATION AS SHOWN ON PLANS.

(14) INSTALL 6" x 6" x 6" TEE W/ 6" PO x FLG GATE VALVES WHERE SHOWN. CAP FOR FUTURE EXTENSION WHERE REQUIRED. INCLUDE THRUST BLOCKS PER SHEET RD1.

(15) INSTALL 12" x 12" x 8" TEE WITH 12" PO x FLG GATE VALVES & 8" FLG x PO GATE VALVE WHERE SHOWN. CAP FOR FUTURE EXTENSION WHERE REQ'D.

(16) INSTALL 8" x 8" x 6" TEE WITH 6" FLG x PO GATE VALVE AND FIRE HYDRANT (SHT. RD1). LOCATION AS SHOWN ON PLANS.

(17) INSTALL 14" x 14" x 14" TEE WITH (3) 14" PO x FLG GATE VALVES WHERE SHOWN. CAP FOR FUTURE EXTENSION WHERE REQ'D.

(18) INSTALL 10" x 10" x 10" TEE WITH 10" PO x FLG GATE VALVES WHERE SHOWN. INCLUDE THRUST BLOCKS PER DETAIL ON SHEET RD1. IN LOCATIONS WITH TWO LATERALS A 10x10x10x10 CROSS IS ACCEPTABLE. CAP AND MARK ENDS AT R.O.W.

(19) INSTALL 22.5' AND 11.25' ELBOW W/ STANDARD THRUST BLOCKS. SIZE PER MAIN DIAMETER.

(20) INSTALL 45' ELBOW W/ STANDARD THRUST BLOCKS. SIZE PER MAIN DIAMETER.

(21) INSTALL BLOW OFF ASSEMBLY PER DETAIL ON SHEET RD2. INCLUDE THRUST BLOCKS PER SHEET RD1.

(22) REMOVE EX. CAP & THRUST BLOCK. INSTALL ELBOW PER NOTE SHOWN.

(23) INSTALL 10" IN-LINE FLUSH VALVE ASSEMBLY.

(24) INSTALL 14" x 12" REDUCER

(25) INSTALL 14" IN-LINE FLUSH VALVE ASSEMBLY.

(26) REMOVE EX. 90' ELBOW AND INSTALL 6" FLG TEE W/ (2) 6" FLG BY PO GATE VALVES

(27) INSTALL 12"x12"x12" TEE WITH 12" PO x FLG GATE VALVES WHERE SHOWN. CAP & MARK FOR FUTURE EXTENSION WHERE REQ'D.

(28) CAP AND MARK

(29) INST 14"X14"6" TEE W/ (1) 14" POxFLG BUTTERFLY VALVE & (2) 6" POxFLG GVs WHERE SHOWN. IN LOCATIONS WITH TWO LATERALS, A 14x6x14x6 CROSS IS ACCEPTABLE. CAP AND MARK ENDS AT R.O.W.

(30) INSTALL 12"x10"x12"x10" CROSS WITH (2) – 10" PO X FLG GATE VALVES AND (1) – 12" PO x FLG GATE VALVES.

(47) INSTALL 12" x 6" REDUCER

(48) INSTALL FIRE HYDRANT AND 6x12 REDUCER AS SHOWN PER RD1 5' BEHIND BACK OF CURB. TEMPORARY INSTALLATION UNTIL ADJACENT SITE IS DEVELOPED AND LATERAL IS EXTENDED.

(49) 12" CROSS W/ 12" PO x FLG GATE VALVES WHERE SHOWN. INCLUDE THRUST BLOCKS AS REQUIRED. OPTION – INSTALL (2) 12"X12"X12" TEES SIDE BY SIDE.

(50) INSTALL 14"X14"X12" TEE W/ (1) 14" PO x FLG BUTTERFLY VALVE & (2) 12" PO x FLG GATE VALVES WHERE SHOWN. IN LOCATIONS WITH TWO HYDRANTS A 14x12x14x12 CROSS IS ACCEPTABLE.

(60) REMOVE EX. 12" X 10" AND INSTALL 12" FLG CROSS W/ (3) 12" FLG X PO GATE VALVES AND 12"X10" FLG REDUCER W/10" FLG X PO GV(NORTH)

(61) INSTALL 10"x6"x10"x6" CROSS WITH (2) – 10" PO x FLG GATE VALUES AND (2) – 6" PO x FLG GATE VALUE.

(62) INSTALL 14"x14"x14"x14" CROSS WITH (4) – 14" PO x FLG BUTTER FLY VALUES

(63) INSTALL 10"x10"x10"x6" CROSS WITH (3) – 10" PO x FLG , GV AND (1) – 6" PO x FLG, GV.

(64) INSTALL FIRE HYDRANT AND 6x10 REDUCER AS SHOWN PER RD1 5' BEHIND BACK OF CURB. TEMPORARY INSTALLATION UNTIL ADJACENT SITE IS DEVELOPED AND LATERAL IS EXTENDED.

WATER NOTE

(65) INSTALL 6" IN-LINE FLUSH VALVE ASSEMBLY.

(66) INSTALL FIRE HYDRANT AS SHOWN PER RD1 5' BEHIND BACK OF CURB. TEMPORARY INSTALLATION UNTIL ADJACENT SITE IS DEVELOPED AND LATERAL IS EXTENDED.

(67) INSTALL 12"X12"X6" TEE W/ (1) 12" PO x FLG BUTTERFLY VALVE & (2) 6" PO x FLG GATE VALVES WHERE SHOWN. IN LOCATIONS WITH TWO HYDRANTS A 12x6x12x6 CROSS IS ACCEPTABLE.

SANITARY SEWER

(51) INSTALL NEW 8" SANITARY SEWER LATERAL TO SEWER MAIN, MATCH CROWN AS SHOWN IN PROFILE. USE STANDARD TAPPING COLLAR OR WYE CONNECTION ON NEW MAINS IF NOT AT MH.. REFER TO PLAN. EXTEND LINE TO LANDSCAPE LIMITS OR 20' BEHIND CURB, WHICHEVER IS GREATER.

(52) EXPOSE EXISITING SANITARY SEWER LINE AND EXTEND AS SHOWN.

(53) CONSTRUCT NEW 48" TYPE I SANITARY SEWER MANHOLE (UNLESS OTHERWISE NOTED) INVERTS AS SHOWN. SEE SHEET RD1 FOR DETAILS.

(54) WHEN THE SEWER MAIN CROSSES THE WATER MAIN, THE SEWER MAIN MUST BE LOCATED AT LEAST 18" LOWER THAN THE WATER MAIN. WHEN THE SEWER MAIN CROSSES A WATER SERVICE LATERAL, THE SEWER MAIN MUST BE LOCATED AT LEAST 18" LOWER THAN THE WATER SERVICE LATERAL. WHEN THE SEWER SERVICE LATERAL CROSSES A WATER MAIN OR WATER SERVICE LATERAL, THE SEWER SERVICE LATERAL MUST BE LOCATED AT LEAST 12" LOWER THAN THE WATER MAIN OR WATER SERVICE LATERAL. WHEN A SEWER MAIN PARALLELS A WATER MAIN OR WATER SERVICE LATERAL, THE SEWER MAIN MUST BE IN A SEPARATE TRENCH AND MUST HAVE A 10' HORIZONTAL SEPARATION. WHEN A SEWER SERVICE LATERAL PARALLELS A WATER MAIN OR WATER SERVICE LATERAL, THE SEWER SERVICE LATERAL MUST BE IN A SEPARATE TRENCH, BE LOCATED 12" LOWER, AND MUST HAVE A 48" HORIZONTAL SEPARATION.

(55) CONSTRUCT NEW 60" TYPE I OR IV SANITARY SEWER MANHOLE (UNLESS OTHERWISE NOTED) INVERTS AS SHOWN. SEE SHEET RD1 FOR DETAILS.

(56) CONSTRUCT NEW 48" TYPE III SPECIAL DROP MANHOLE (INVERTS AS SHOWN) REFER TO "ORANGE BOOK" DETAIL 2-5.

(57) PROVIDE STUB FOR FUTURE EXTENSION 10' PAST EDGE OF AC. CAP & MARK FOR FUTURE CONNECTION.

(58) CORE DRILL INTO EX. SSMH GROUT ALL EDGES TO FORM WATER TIGHT SEAL

STORM DRAIN

(31) [illegible]

(32) [illegible]

(33) [illegible]

(34) INSTALL RIP-RAP OUTLET, 6" MINIMUM DIAMETER STONES. LOCATE AS SHOWN ON PLANS. BEVEL END OF PIPE TO MATCH CHANNEL SIDE SLOPE FOR 12" DIA. PIPES AND SMALLER. LARGER PIPES REQUIRE STANDARD HEADWALL PER ORANGE BOOK SPECIFICATIONS. RIP-RAP TO COVER TOP OF PIPE TO FLOW LINE OF CHANNEL OR TOE OF SLOPE.

(35) INSTALL 12" STORM LATERAL. LEAVE INLET EXPOSED WITH RIPRAP WHEN LATERAL IS USED TO DRAIN HIGHSIDE OF ROADWAY. SEE SD NOTE #34 FOR RIP-RAP REQUIREMENTS.

(36) INSTALL CONCRETE HEADWALL PER ORANGE BOOK DRAWING 2-13/1.

(37) INSTALL RIP-RAP AT PIPE OUTLET/INLET, 10' DOWNSTREAM, TWICE THE WIDTH OF THE PIPE. STONES TO BE 8" MINIMUM. MINIMUM DEPTH OF 18". UNLESS NOTED OTHERWISE.

(38) INSTALL NEW 48" TYPE I SD MANHOLE (UNLESS OTHERWISE NOTED) INVERTS AS SHOWN. SEE SHEET RD1 FOR SDMH DETAIL.

(39) INSTALL RIP-RAP AT PIPE INLET/OUTLET PER UNION PACIFIC RAILROAD STANDARDS. REFER TO DETAIL, EXHIBIT "K" OF UPRR TECHNICAL SPECS.

(40) DIVERT EXISTING FLOW LINES OF DITCH TO NEW CULVERT CROSSING AS SHOWN TO PREVENT PONDING IN CHANNEL AFTER COMPLETION OF ROADWAY. FUTURE DEVELOPMENT WILL FILL CHANNEL AND RE-CONTOUR SLOPES TO DRAIN NEW IMPROVEMENTS.

(41) INSTALL NEW 12" RCP LATERAL TO EXISTING CATCH BASIN, CONNECT TO PROPOSED ROADSIDE DITCH ALONG ROADWAY. RCP TO BE CLASS V.

(42) INSTALL PRECAST DROP INLET WITH TRAFFIC RATED FRAME AND GRATE SIMILAR TO JENSEN 48" X 48" DROP INLET, OR AS DESIGNATED ON PLAN.

(43) INST STANDARD TYPE 3R CATCH BASIN IN LANDSCAPE MEDIAN. GRADE AREA TO DRAIN. INCLUDE CONCRETE COLLAR. REFER TO DWG. NO. R-11 (311) OF THE STANDARD DETAILS.

(44) INST RISER TYPE DROP INLET ABOVE SD MAIN. GRADE AREA TO DRAIN. INCLUDE CONCRETE COLLAR. REFER TO DRWG. NO. 2-11 (306) OF THE STANDARD DETAILS.

(45) ALL CULVERTS SHALL BE CAMBERED PER UPRR STANDARDS. REFER TO DETAIL, EXHIBIT "K" OF UPRR TECHNICAL SPECIFICATIONS.

GAS/POWER

(70) REFER TO SPPCo GAS DRAWINGS FOR INFORMATION

(71) PLACE STREET LIGHT PER SPPC. SPECIFICATIONS.

ROAD

(81) SAWCUT AND MATCH NEW ASPHALT TO CUT LINE. 1' MIN. SAWCUT.

(82) VERIFY LOCATION OF POWER POLE GUY WIRES PRIOR TO CONSTRUCTION. REPORT CONFLICTS TO ENGINEER IMMEDIATELY.

(83) ALL SLOPES 3:1 MAX, UNLESS OTHERWISE SPECIFIED, AND SHALL CONFORM TO GENERAL NOTES PER THIS PLAN. ALL SLOPES TO BEGIN ONE FOOT BEHIND FLATWORK.

(84) SLOPES MAY BE INCREASED WITH PERMISSION OF SOILS ENGINEER ON SITE

(85) DOUBLE 4" IRRIGATION SLEEVE UNLESS NOTED OTHERWISE. MARK ENDS WITH PURPLE 2 X 4 POST 3' ABOVE GRADE.

(86) 3/8 SLURRY SEAL

(87) INSTALL A SURVEY MONUMENT PER STANDARD AT ALL PT's, PC's, AND MAJOR INTERSECTIONS.

(88) REMOVE EXISTING CURB, GUTTER AND SIDEWALK IN THIS AREA. REPLACE WITH NEW AS SHOWN

(89) CONTRACTOR TO CONSTRUCT L-CURB AND SIDEWALK STRAIGHT THROUGH FUTURE DRIVEWAY UNLESS PROJECT IS UNDER CONSTRUCTION DURING CONSTRUCTION OF ROAD. IF PROJECT IS UNDER CONSTRUCTION, CONTRACTOR TO "BOX OUT" DRIVEWAY AREA TO RELIEVE ONSITE DEVELOPEMENT FROM COST OF SIDEWALK AND CURB.

(90) BORING HOLE PER SOILS REPORT

(91) ASPHALT UTILITY CUT WITH PERMANENT PAVEMENT PATCH PER STANDARD DRAWING #R-23 PAGE 23 OF ORANGE BOOK.

(92) SIDE SLOPES SHALL BE 1:1 MAX. VERIFY AND CONFIRM WITH SOILS REPORT AND GEOTECHNICAL ENGINEER.

(93) LIMIT OF CONSTRUCTION LINE FOR THIS SHEET (BIDDING LIMITS). SEE NOTE 95.

(94) THIS IMPROVEMENT TO BE CONSTRUCTED WITH FUTURE PHASE.

(95) CONTRACTOR TO PLACE SIX (6) 18"x18" END OF PAVEMENT MARKERS AT THE END OF ANY PAVED IMPROVEMENTS BETWEEN PHASES. USE TYPE N-5 RED W/ REFLECTORS. IF GRADES ARE GREATER THAN 10 FEET, INCLUDE CONCRETE K RAIL WITH FLASHING WARNING LIGHTS.

(96) CONSTRUCT 10' WIDE PCC VALLEY GUTTER AT INTERSECTION. REFER TO SHEET RD2.

(97) EDGE OF NEW PAVING. INSTALL 2" X 6" REDWOOD HEADER OR OVERPAVE 1' FOR FUTURE SAWCUT.

(98) BASIS OF BEARING AND BENCHMARK ELEVATIONS ARE SHOWN ON COVER SHEET ONLY. REFER TO "BENCHMARK" SECTION ON COVER SHEET FOR INFORMATION.

(99) SOME UNDERGROUND UTILITIES MAY NOT BE CONSTRUCTED AT THIS TIME. REFER TO SHEET R1 FOR CONSTRUCTION SCHEDULE.

(100) ALL SLOPES 2:1 MAX, UNLESS SOIL CONDITIONS WARRANT FLATTER SLOPES. ALL SLOPES TO BEGIN WHERE SHOWN ON SECTION SHEETS.

(101) INSTALL 2-3" CONDUITS FOR FUTURE TRAFFIC SIGNAL AS SHOWN. TERMINATE CONDUIT IN STANDARD NDOT #5 TRAFFIC BOXES.

(102) INSTALL ROAD CROSSING WITH PRECAST CONCRETE PANELS. INSTALL PER UPRR STANDARDS. REFER TO DETAIL, EXHIBIT "L-1" OF UPRR TECHNICAL SPECIFICATIONS.

(103) REMOVE ABANDONED STEEL PIPE IN CONSTRUCTION ZONE. STOCK PILE ABANDONMENT TO REMOVAL SITE.

TRI CENTER ROADS (2008) NOTES

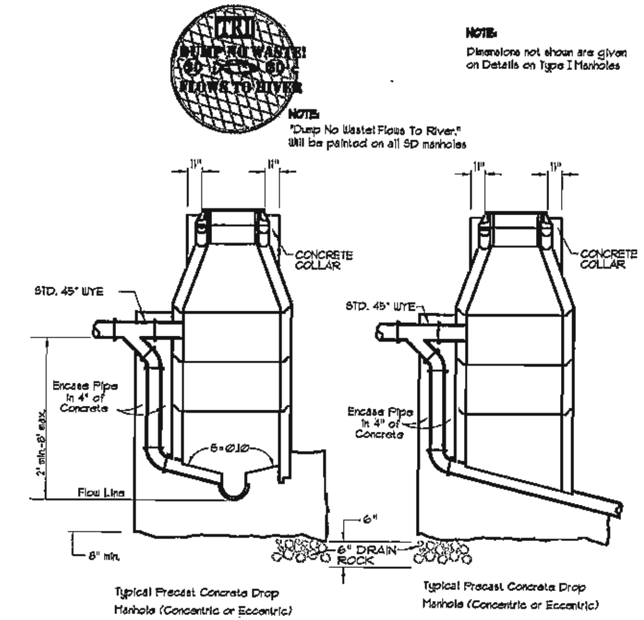
REC

RENO ENGINEERING CORPORATION
CIVIL ENGINEERING · DESIGN · LAND PLANNING
8725 TECHNOLOGY WAY, SUITE B RENO, NV 89521
PHONE: (775) 852-5700 FAX: (775) 852-5707

REVISIONS	BY	DATE

TRI ROADS 2008 NOTES

CV2



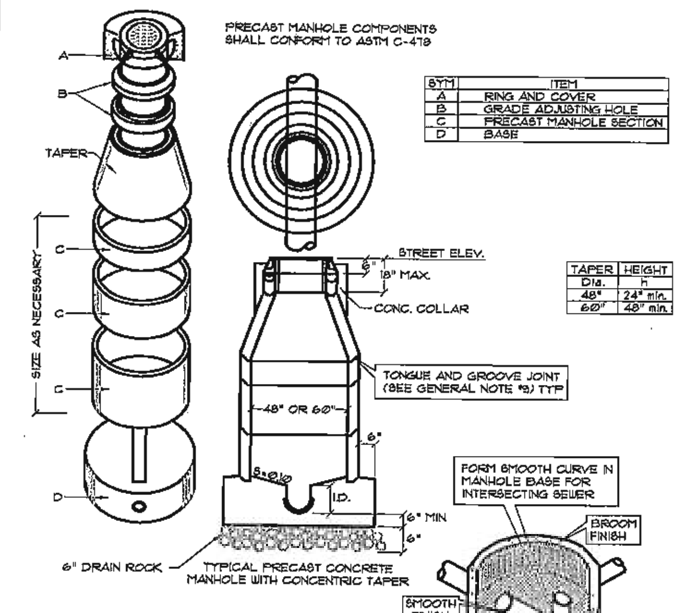
LATERAL TO MAIN

MAIN TO MAIN

NOTES:

1. DROP MANHOLES ARE TO BE USED ON ALL SANITARY SEWERS WITH MORE THAN 2 FEET VERTICAL DROP AT MANHOLE, NOT TO EXCEED 8 FEET.
2. ECCENTRIC CONES MAY BE USED AT THE DIRECTION OF THE GOVERNING AUTHORITY.
3. MAINS SHALL BE SLOPED TO FALL AT LEAST 0.1 FEET ACROSS MANHOLE SECTION.
4. PIPE SECTION WITHIN MANHOLE MAY BE P.V.C.
5. NOT FOR USE IN CARSON CITY, SEE AGENCY SECTION.
6. 8 FOOT VERTICAL DROP MAY ONLY BE EXCEEDED IN WASHOE COUNTY & THE CITY OF RENO UPON APPROVAL OF THE SANITARY ENGINEERS.

NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTION 2
1	ADD NOTE 6	7-83	MANHOLE TYPE III	DRAWING NO. 2-5 (306)
2	collar,dele,dr.rk.	9-95		DATE 7-81 / PAGE 8



EXPLODED VIEW

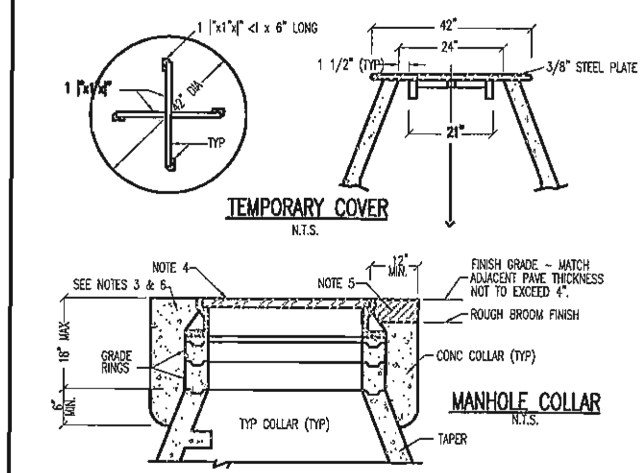
NOTE:
ALL MANHOLES ON THIS PROJECT TO BE WATER TIGHT

PIPES SHALL NOT PROTRUDE MORE THAN 3" INSIDE OF MANHOLE SECTION, CONSTRUCT WATER TIGHT CONNECTIONS TO MANHOLE.

1. MANHOLE SECTION LENGTHS ARRANGED TO FIT DEPTH
2. PRECAST BASE MAY BE USED IF APPROVED BY GOVERNING AGENCY
3. LANDER CO. ONLY - MANHOLES CONSTRUCTED IN NON-PAVED AREA SHALL HAVE MIN. WALL THICKNESS OF 5" ON CONE AND BARREL SECTIONS

ISOMETRIC VIEW

NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTION 2
1	SEE NOTE	3-83	MANHOLE TYPE I	DRAWING NO. 2-3.1 (306)
2	ITEM C,D	8-85		DATE 7-81 / PAGE 4
3	Collar,dr.rock	5-95		



MANHOLE COLLAR

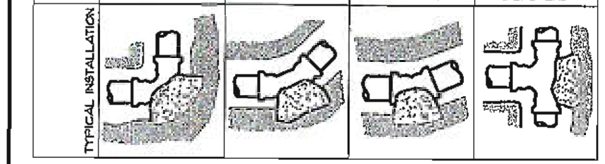
N.T.S.

NOTES

1. CONC COLLAR TO BE PORTLAND CEMENT CONC (P.C.C.) W/THE FOLLOWING CHARACTERISTICS: 4000psi MIN COMP STRENGTH @ 28 DAYS MIN 6 SACKS OF CEMENT PER CU. YD. W/MAX WATER-CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6%;1.5%, SLUMP @ 1 TO 4 INCHES. IN WASHOE CO. MIN CEMENT CONTENT TO BE 16.25sack. ALL MATERIAL SHALL CONFORM TO SSPWC SEC.202.
2. HEIGHT OF COLLAR SHALL BE CONSISTANT ALL AROUND MANHOLE.
3. RENO - CONC COLLAR SHALL BE FLUSH W/ADJACENT PAVEMENT.
4. WASHOE CO. - MANHOLE RING SHALL BE SET ¦" - ¦" BELOW FINISH ROADWAY SURFACE. MANHOLES IN ALL OTHER AREAS SHALL BE SET FLUSH W/FINISH GRADE UNLESS OTHERWISE NOTED.
5. WASHOE CO. - CONC COLLAR SHALL BE LEFT 2" BELOW FINISH ASPH SURFACE. PLACE 2" THICH TYPE 3 A.C. PAVING AROUND MANHOLES & APPLY SS-1 TACK COAT BEFORE PAVING, SEAL A.C. SURFACE W/SS-1 & SAND CHIP SEAL, SLURRY SEAL, SAND SEAL OR FOG SEAL PAVED SURFACE AS REQ'D BY PLANS OR SPECS. EXCEPTION - EXTEND CONC COLLAR TO FIN. GRADE WHEN NOT LOCATED IN ASPH PAVE OR IN AN UNPAVED AREA.
6. SPARKS-CONC COLLAR SHALL BE FLUSH W/ADJACENT PAVEMENT. PLACE ONE #3 REBAR RING IN COLLAR IN UNIMPROVED AREAS.
7. WASHOE CO.-STEPS ARE REQ'D FOR SANITARY SEWER/STORM DRAIN MANHOLES OF 5 FEET OR GREATER DEPTH.
8. CARSON CITY-REFER TO DETAIL C-6.4

NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTIONS 2
1	REDRAWN	11/94 VP	MANHOLE COLLAR & TEMPORARY COVER	DRAWING NO. 2-7 (306)
2	NOTE 2,9	11/94 VP		DATE 11/92 VP / PAGE 10
3	NOTE 4,7	11/94 VP		
4	CORR NOTE 1	4/95 VP		

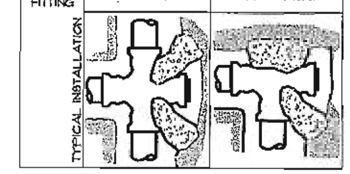
TYPE OF FITTING	90° BEND	45° BEND	11 1/4" OR 22 1/2" BEND	TEE OR DEAD END



THRUST BLOCK BEARING AREA (SQ FT.)

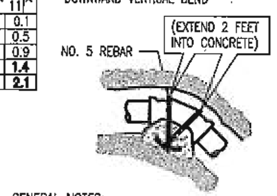
SIZE OF PIPE / TYPE OF FITTING	90° BEND	45° BEND	11 1/4" OR 22 1/2" BEND	TEE OR DEAD END	TEE W/PLUG	CROSS W/PLUG
4"	2	1	1	2	2	2
6"	4	4	2	4	.4	4
8"	7	4	2	5	7	7
10"	12	6	3	8	12	12
12"	16	10	5	12	16	16
14"	20	12	6	14	20	20
16"	27	15	8	18	27	27
18"	45	25	13	32	45	45
24"	65	35	18	46	65	65

TYPE OF FITTING	CROSS W/ PLUG	TEE W/ PLUG



PIPE I.D.	CONC./CU. YDS. 45^	22\^	11|^
4"	0.8	0.2	0.1
6"	1.9	1.0	0.5
8"	3.3	1.8	0.9
10"	5.2	2.8	1.4
12"	7.5	4.1	2.1
14"	10.4		

DOWNWARD VERTICAL BEND



NOTES:
1.) THRUST BLOCKS TO BE CONSTRUCTED OF CLASS "C" CONCRETE.
2.) AREAS GIVEN AREA FOR CLASS 150 PIPE AT TEST PRESSURE OF 150 PSI, WITH 2000 PSF BEARING CAPACITY. INSTALLATIONS USING DIFFERENT PIPE, TEST PRESSURES, AND/OR SOIL TYPES SHOULD ADJUST AREAS ACCORDINGLY. SUBJECT TO APPROVAL OF THE ENGINEER.
3.) BLOCKS TO BE POURED AGAINST UNDISTURBED SOIL.
4.) JOINTS AND FACE OF PLUGS TO BE KEPT CLEAR OF CONCRETE.
5.) REVERSE THRUST BLOCK CONCRETE CALCS UPDATED PER WASHOE COUNTY UTILITY SERVICES DIVISION (3/2/98)

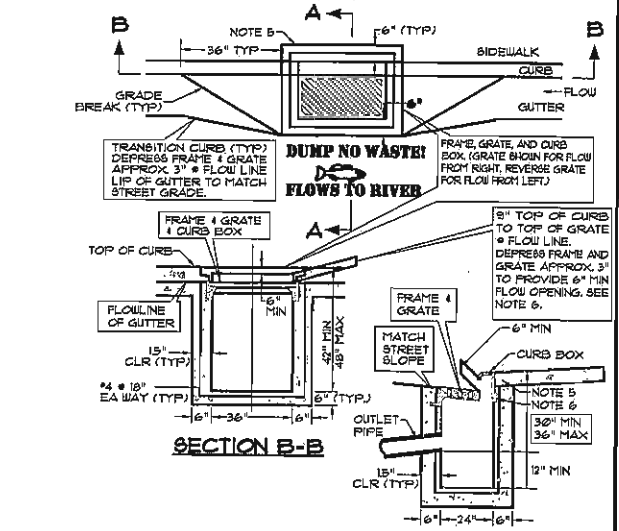
GENERAL NOTES:
ALL CONCRETE SHALL BE 2000 PSI MINIMUM 28 DAYS COMPRESSIVE STRENGTH. CONCRETE IS TO BE PLACED AGAINST UNDISTURBED EARTH. TABLE ABOVE DENOTES MINUMUM BEARING AREA OR VOLUME OF THRUST BLOCK. SPECIAL DESIGN FOR EACH INSTALLATION IS REQUIRED IS ALLOWABLE SOIL BEARING CAPACITY IS LESS THAN 3000 P.S.F. ALL VERTICAL SURFACES NOT BEARING AGAINST UNDISTURBED EARTH SHALL BE FORMED.

TYPE IV REVERSE THRUST BLOCK

NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTION 3
1	NOTE 2	3/83	THRUST BLOCK BEARING AREAS	DRAWING NO. 3-7 (307)
				DATE 7-81 / PAGE 9

THESE DETAILS ARE FOR INFORMATION ONLY AND ARE NOT MEANT TO SUPERSEDE THE ACTUAL STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION

PLAN



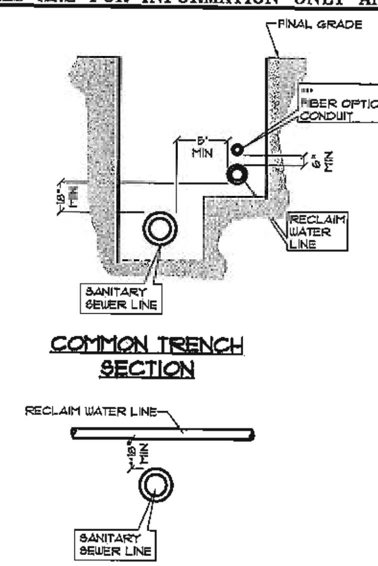
SECTION B-B

SECTION A-A

NOTE:

1. PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000psi MIN COMPRESSIVE STRENGTH @ 28 DAYS, (FOR CURB AND GUTTER TRANSITION ONLY, ALL UNEXPOSED CONCRETE MAY BE 3000 PSI) MIN 6 SACKS OF CEMENT PER CUBIC YARD WITH A MAX. WATER/CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6% ± 1.5% SLUMP AT 1-4 INCHES. ALL MATERIALS SHALL CONFORM TO SSPWC SECTION 202.
2. REINFORCING STEEL SHALL BE GRADE 40 AND HAVE 1.5" CLEAR COVER.
3. CONC. STRUCTURE MAY BE A PRECAST CONC. UNIT UPON APPROVAL OF THE CITY ENGINEER. BASE OF PRECAST CONRETE UNIT SHALL BE PLACED ON 6" COMPACTED DRAIN ROCK.
4. FRAME, GRATE, AND CURB BOX SHALL BE NEENAH R-3067 OR APPROVED EQUAL. (W/EQUAL FLOW CAPACITY AND WEIGHT)
5. CONC. SHALL BE PLACED AS SHOWN WHEN NOT LOCATED IN A SIDEWALK.
6. TILT FRAME AND GRATE AS REQUIRED TO ATTAIN 6" MIN FLOW OPENING AND SHIM BETWEEN CURB BOX & FRAME AS REQUIRED TO MATCH CURB BOX TO TOP OF CURB AND FACE OF CURB. (SEE SECTION B-B)
7. INSTALL GREASE TRAP PER STANDARD DETAIL R-17

NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTION RENO
1	REDRAWN	2-92	TYPE 4-R CATCH BASIN	DRAWING NO. R-12 (311)
2	6% AIR	12-93		DATE 8-90 / PAGE 12
3	REVISED	3-95		
APPR. BY: S.V.		3-95		



COMMON TRENCH SECTION

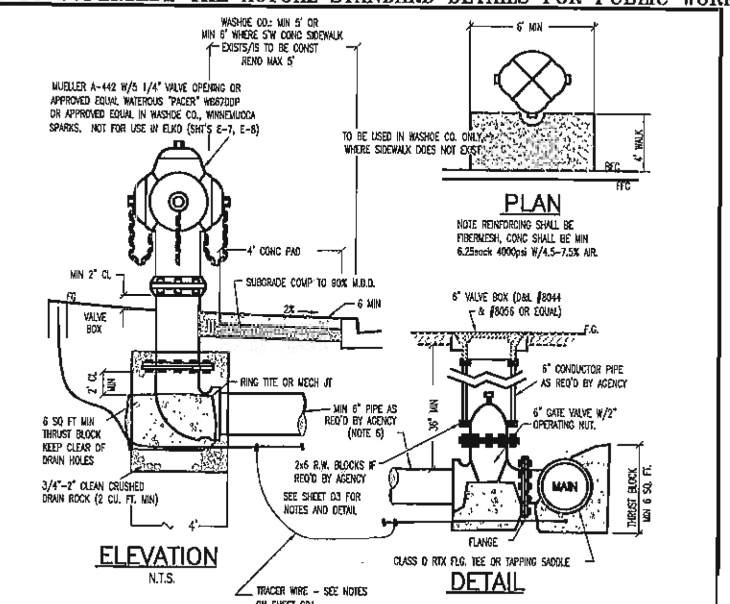
CROSSING DETAILS

* IF WATER LINE IS LOCATED 18" OR MORE ABOVE THE SANITARY SEWER, THE DISTANCE BETWEEN LINES CAN BE REDUCED TO A MIN. OF 6 FEET.

** LESS THAN 18" CLEARANCE REQUIRES THE SANITARY SEWER TO BE DUCTILE IRON OR REINFORCED CONCRETE ENCASED TO A LENGTH OF 10 FEET IN EITHER DIRECTION FROM THE WATER MAIN.

*** CONTACT AL LACHNER 303-4708 FOR PAYMENT

NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTION RENO
1	REDRAWN	8-92	TYPICAL SANITARY SEWER UTILITY TRENCH	DRAWING NO. R-4
APPR. BY: S.V.		12-92		DATE 8-85 / PAGE 4

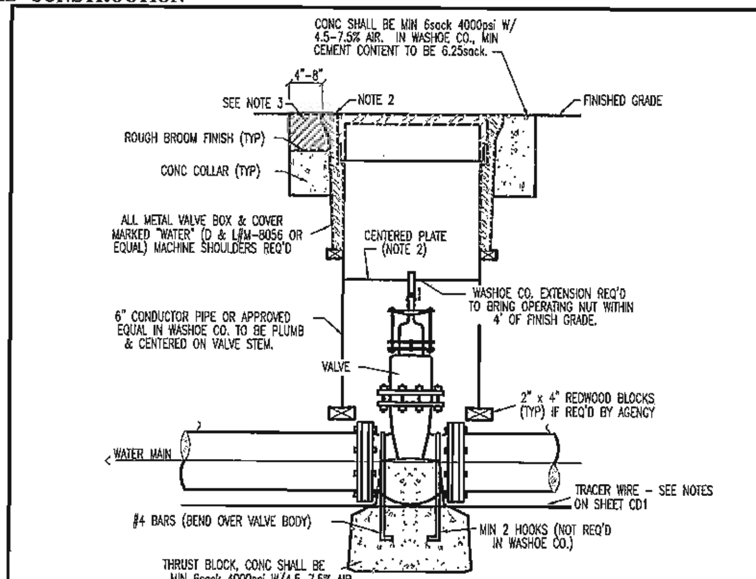


NOTES

1. HYDRANT SHALL BE ENAMELED RED EXCEPT IN SPARKS, WASHOE CO., WINNEMUCCA, YERINGTON & DOUGLAS CO. WHERE IT SHALL BE YELLOW.
2. ALL HYDRANTS SHALL HAVE (2) 2 1/2" HOSE NOZZLES & (1) 4 1/2" STEAMER NOZZLE. ALL THREADS SHALL BE AS SPECIFIC FOR AMERICAN NATIONAL HOSE COUPLING EXCEPT RENO, SPARKS & WASHOE CO. (DET."A")
3. OPERATING NUT SHALL BE 1 1/2" PENTAGON EXCEPT: RENO, SPARKS AND WASHOE CO. (DET."B")
4. INSPECTION BY APPROPRIATE AGENCY SHALL BE REQUIRED PRIOR TO BACKFILLING.
5. YERINGTON MIN DEPTH OF MAIN SHALL BE 42".
6. LANDER CO - BUTTERFLY VALVE SHALL BE USED IN LIEU OF GATE VALVE IN STREET. WATER PIPE SHALL BE PVC CLASS 150. NO A.C. IN WASHOE CO.
7. NO FENCES SHALL BE ALLOWED WITHIN 3' OF ANY PORTION OF A FIRE HYDRANT.
8. IN CARSON CITY, SEE DET. "C-10.3"

REFER TO TRACER WIRE DETAIL ON SHEET D3

NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTION 3
	REDRAWN	11/94	FIRE HYDRANT	DRAWING NO. 3 - 11 (307)
				DATE 11/94 VP / PAGE 1



SECTION

N.T.S.

NOTES

1. SEE DWG 3-7 FOR THRUST BLOCK SIZE
2. IN WASHOE CO., VALVE BOXES OR BOTH GAS & WATER TO BE SET ¦"-¦" BELOW FINISH ROADWAY SURFACE. INSTALL OPERATING EXTENSION W/OPERATING NUT RESTRAINING BOLT & TOP CENTERING PLATE. ANCHOR BARS & REDWOOD BLOCKS NOT REQ'D WHEN OPERATING NUT IS AT GREATER DEPTH THAN 4' FROM FIN GRADE.
3. IN WASHOE CO. CONC COLLAR TO BE LEFT 2" BELOW FINISH ASPH SURFACE. PLACE 2' OF TYPE 3 ASPH PAVING AROUND VALVE BOX APPLY SS-1 TACK COAT BEFORE PAVING. SEAL A.C. SURFACE W/SS-1 SAND. CHIP SEAL FOG SEAL, SAND SEAL OR SLURRY SEAL PAVED SURFACE AS REQ'D BY PLANS OR SPECS. EXTEND CONC COLLAR TO GRADE WHEN NOT LOCATED IN ASPH PAVE OR IN UNPAVED AREA.
4. IN CARSON CITY REFER TO DETAIL C-10.1
5. RENO ONLY PLACE VALVE BOX & CONC COLLAR FLUSH W/ASPHALT.

REFER TO TRACER WIRE DETAIL ON SHEET D3

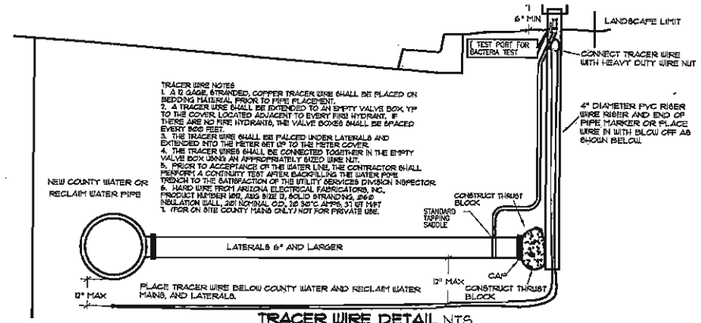
NO.	REVISION	DATE	STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION	SECTION 3
1	REDRAWN	3/94 VP	VALVE, BOX, AND COVER	DRAWING NO. 3 - 9 (307)
2	NOTE 2,3,4	1/95 VP		DATE 1/90 / PAGE 11
3	NOTE 5	4/95 VP		

REC
RENO ENGINEERING CORPORATION
CIVIL ENGINEERING · DESIGN · LAND PLANNING
9725 TECHNOLOGY WAY, SUITE 8 RENO, NV 89521
PHONE: (775) 852-5700 FAX: (775) 852-5707

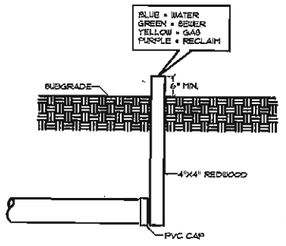
REVISIONS | BY | DATE

TAHOE / RENO INDUSTRIAL CENTER STANDARD DETAILS

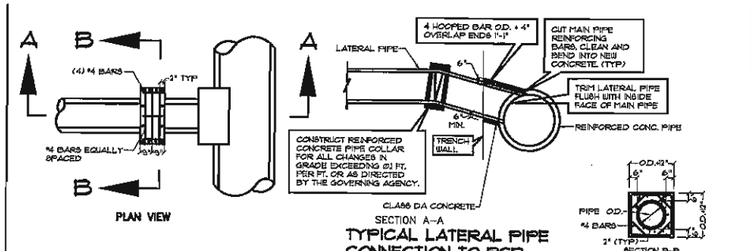
RD1



TRACER WIRE DETAIL NTS



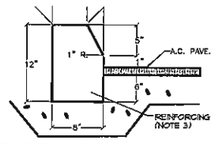
CAP & MARK DETAIL



STORM DRAIN LATERAL

TYPICAL LATERAL PIPE CONNECTION TO RCP

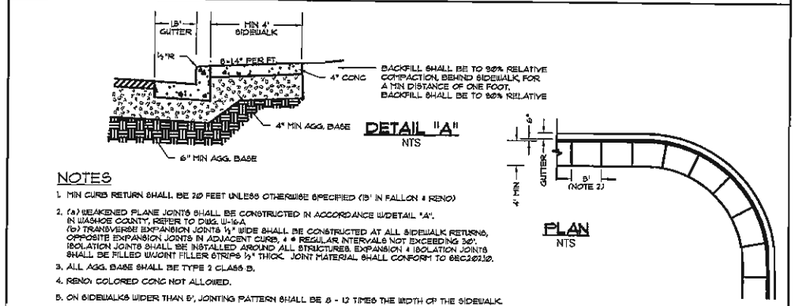
TYPICAL REINFORCED CONC. PIPE COLLAR



1. AN APPROVED EPOXY COAT BETWEEN THE CURB AND PAVEMENT SURFACE SHALL BE USED.
2. SEE NOTES FOR TYPE I CURB AND GUTTER, DWG. W-16.).
3. ALL CONCRETE FOR TYPE I P.C.C. MEDIAN CURB SHALL BE REINFORCED W/ COLLATED, FIBRILLATED POLYPROPYLENE FIBERS AS MANUFACTURED BY FIBERMESH OR APPROVED EQUAL. REINFORCING SHALL BE 1 1/2 LBS. OF FIBERMESH PER PER CU. YD. OF CONCRETE.
4. ALL NOSES ON MEDIAN CURBS SHALL BE MOUNED SOLID FOR THE FULL WIDTH OF THE MEDIAN.

TYPE I P.C.C. CURB

NTS DWG NO. 312 (3-83)

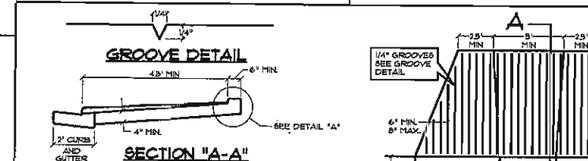


NOTES

1. MIN CURB RETURN SHALL BE 20 FEET UNLESS OTHERWISE SPECIFIED (15' IN FALLON & RENO)
2. (a) WEAKENED PLANE JOINTS SHALL BE CONSTRUCTED IN ACCORDANCE W/DETAIL "A". IN WASHOE COUNTY, REFER TO DWG. W-16.A. (b) TRANSVERSE EXPANSION JOINTS 1/2" WIDE SHALL BE CONSTRUCTED AT ALL SIDEWALK RETURNS, OPPOSITE EXPANSION JOINTS IN ADJACENT CURB, & @ REGULAR INTERVALS NOT EXCEEDING 36'. ISOLATION JOINTS SHALL BE INSTALLED AROUND ALL STRUCTURES. EXPANSION & ISOLATION JOINTS SHALL BE FILLED W/JOINT FILLER STRIPS 1/2" THICK. JOINT MATERIAL SHALL CONFORM TO 88CSS10.10.
3. ALL AGG. BASE SHALL BE TYPE 2 CLASS B.
4. RENO COLORED CONC NOT ALLOWED.
5. ON SIDEWALKS WIDER THAN 5', JOINTING PATTERN SHALL BE 3 - 12 TIMES THE WIDTH OF THE SIDEWALK.
6. PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000 psi MIN COMPRESSIVE STRENGTH @ 28 DAYS, MIN 6 SACKS OF CEMENT PER CUBIC YARD WITH A MAX WATER/CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6% ± 1.5% SLUMP AT 1 TO 4 INCHES. ALL MATERIALS SHALL CONFORM TO SSPWC SECTION 202.

TYPICAL SIDEWALK

DWG NO. 1-7 (312) 4-95

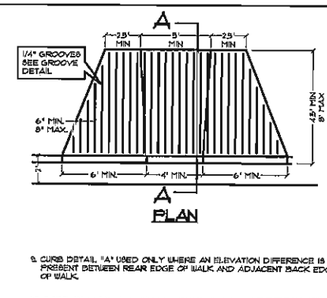


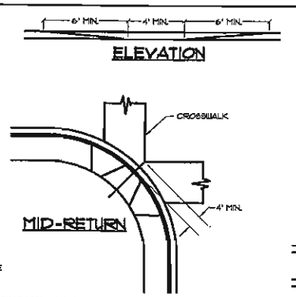
NOTES

1. IF OBSTRUCTIONS SUCH AS INLETS, UTILITY POLES, FIRE HYDRANTS, ETC. ARE ENCOUNTERED, THE LOCATION AND DIMENSIONS MAY BE ADJUSTED UPON APPROVAL OF THE ENGINEER.
2. TEXTURE TO BE HEAVY BROOM FINISH TRAVERSE TO AXIS OF RAMP.
3. THE MID-BLOCK RAMP SHOWN IN DETAIL SHALL BE CENTERED IN THE CROSSWALK AND HAVE A MINIMUM CURB OPENING OF 6 FEET.
4. SLOPE TO MEET EXISTING CONDITIONS.
5. ALL RAMPS TO BE LOCATED WITHIN CROSSWALK AREAS.
6. ALL CONCRETE TO BE REMOVED TO NEAREST OR EXPANSION JOINTS.
7. THE GUTTER PAN - SIDEWALK TRANSITION (SECTION A-A) WILL BE SMOOTH WITH NO LIP AT THE GUTTER FLOWLINE, THE TRANSITION SECTION MAY BE A MONOLITHIC POUR.
8. SLOPE ON WINGS AT 1:12, SLOPE ON RAMP FROM FLOWLINE TO BACK OF WALK 1:12 WITH CURB ON BACKSIDE, IF NEEDED.

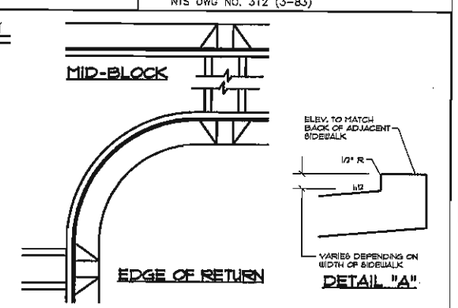
PEDESTRIAN RAMP FOR THE DISABLED

NTS DWG NO. 1-8 (312) 3-95





9. CURB DETAIL "A" USED ONLY WHERE AN ELEVATION DIFFERENCE IS PRESENT BETWEEN REAR EDGE OF WALK AND ADJACENT BACK EDGE OF WALK.
10. PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000 psi MIN COMPRESSIVE STRENGTH @ 28 DAYS, MIN 6 SACKS OF CEMENT PER CUBIC YARD WITH A MAX WATER/CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6% ± 1.5% SLUMP AT 1 TO 4 INCHES. ALL MATERIALS SHALL CONFORM TO 88PW SECTION 202.



NOTES:

1. A PERMIT MUST BE OBTAINED FROM THE CITY ENGINEER PRIOR TO CUTTING ANY STREET. SEE RELATED DETAIL DRAWINGS NO. R-3, R-4, AND R-23.
2. ALL MATERIALS AND INSTALLATION PROCEDURES SHALL BE IN ACCORDANCE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, LATEST REVISION.

⚠1 BEDDING MATERIAL SHALL CONFORM TO OWNING UTILITY COMPANY REQUIREMENTS AS APPROVED BY THE CITY OF RENO. FOR CITY OWNED UTILITIES, BEDDING MATERIAL SHALL BE CLASS "A", "B", OR "C" AND SHALL BE COMPACTED TO 95% MINIMUM FOR TRAFFIC/ELECTRICAL CONDUIT TRENCHES LESS THAN 12' IN WIDTH, INCLUDING WIDNER TRENCHES. BEDDING SHALL BE CLASS "A" MATERIAL. BACKFILL SHALL BE CEMENT SLURRY (1 SACK). CEMENT SLURRY BEDDING/BACKFILL MAY BE USED AS AN ALTERNATE TO CLASS "A", "B", OR "C" MATERIAL WITH WRITTEN APPROVAL FROM THE CITY ENGINEER FOR EACH SPECIFIC APPLICATION.

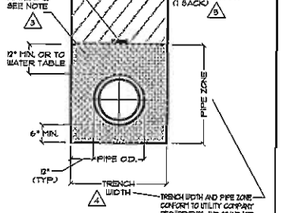
4. ALL EXCAVATIONS SHALL CONFORM TO THE LATEST O.S.H.A. REQUIREMENTS. SHORING OR SLOPED CUT MAY BE NECESSARY, BUT THERE WILL BE NO PAYMENT FOR ADDITIONAL EXCAVATION, BEDDING, BACKFILL, OR SHORING.

⚠3 SEE PAGES 24.1 THRU 24.4 FOR CEMENT SLURRY SPECIFICATIONS.

6. 4" WARNER TRENCHES FOR CONDUIT SHALL BE LOCATED A MINIMUM OF 5' FROM CUTTER LIP.

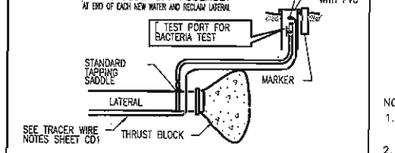
⚠4 PIPE TAPE IDENTIFICATION OF UTILITY SHALL BE INSTALLED.

CLASS A BEDDING SHALL CONFORM TO 200.03.02 OF THE STANDARD SPECIFICATIONS
CLASS B BEDDING SHALL CONFORM TO 200.03.03 OF THE STANDARD SPECIFICATIONS
CLASS C BEDDING SHALL CONFORM TO 200.03.04 OF THE STANDARD SPECIFICATIONS
INSPECTOR OF THE BEDDING SHALL BE PER STANDARD SPECIFICATIONS 338.03.01.

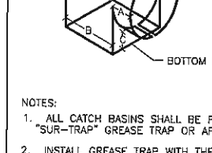


TRENCH EXCAVATION AND BACKFILL

REV (3-95)



BLOW OFF DETAIL

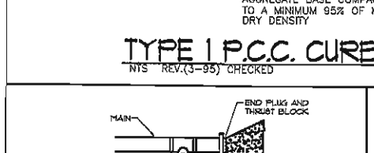


NOTES:

1. ALL CATCH BASINS SHALL BE PROVIDED WITH A "SUR-TRAP" GREASE TRAP OR APPROVED EQUAL.
2. INSTALL GREASE TRAP WITH THE BOTTOM EDGE PARALLEL TO THE WATER SURFACE AND THE RECTANGULAR OPENING FACING DOWNWARD AND THE CIRCULAR END PLACED INSIDE THE OUTLET PIPE.

"SUR-TRAP" GREASE TRAP

REV (3-95) CHECKED

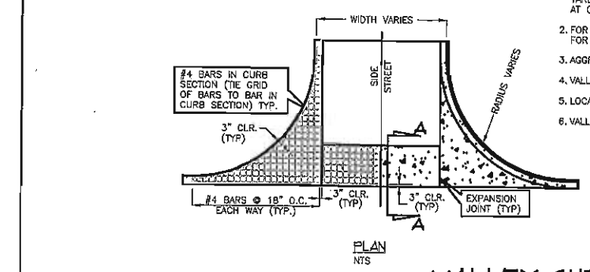


NOTES

1. PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000 P.S.I MIN. COMPRESSIVE STRENGTH @ 28 DAYS, MIN. 6 SACKS OF CEMENT PER CUBIC YARD WITH A MAX WATER/CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6.5% ± 1.5% SLUMP AT 1 TO 4 INCHES, ALL MATERIALS SHALL CONFORM TO 88PWC SECTION 202.
2. EXPANSION JOINTS 1/2-INCH WIDE SHALL BE LOCATED IN CURBS AND GUTTERS AT EACH SIDE OF STRUCTURES, AT THE ENDS OF ALL CURB RETURNS, AND ABUTTING HARDENED IN-PLACE CURBS AND GUTTER, EXCEPT THAT EXPANSION JOINTS SHALL NOT BE INSTALLED WITHIN 20 FEET OF AN ISLAND NOSE. EXPANSION JOINTS SHALL BE 1/2-INCH THICK, SHAPED TO THE CROSS SECTION OF THE CURB AND GUTTER, AND CONSTRUCTED AT RIGHT ANGLES TO THE CURB AND GUTTER. JOINT FILLER MATERIAL SHALL CONFORM TO SECTION 202.10. WEAKENED PLANE JOINTS SHALL BE EVERY 10 FEET.
3. CURB AND GUTTER SECTIONS SHALL BE PLACED SEPARATELY FROM SIDEWALK SECTIONS.

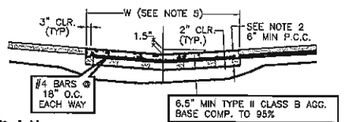
TYPE I P.C.C. CURB (PER DWG. #R-7A(312)

NTS REV.(3-95) CHECKED



NOTES:

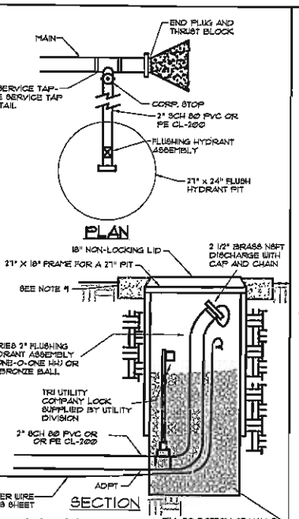
1. PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000 PSI MIN COMPRESSIVE STRENGTH @ 28 DAYS, 6-8 SACKS OF CEMENT PER CUBIC YARD WITH A MAX. WATER / CEMENT RATION OF 0.45, AIR ENTRAINMENT OF 6% ;1.5%, SLUMP AT ONE TO FOUR INCHES. ALL MATERIALS SHALL CONFORM TO SSPWC SECTION 202.
2. FOR INDUSTRIAL AREAS, AN ENGINEERED DESIGN IS REQUIRED. USE 6.5 INCHES OF CONCRETE FOR 40 TRUCKS (TRUCK TRAFFIC). SEE CALC SHEETS SUPPLIED WITH PERMIT SET.
3. AGGREGATE BASE SHALL BE ENGINEERED TYPE 2, CLASS B WITH 95% COMPECTION.
4. VALLEY GUTTER SHALL HAVE WEAKENED PLANE JOINTS EVERY 10 FEET.
5. LOCAL AND COLLECTOR STREETS W=5'. ARTERIAL STREETS (DRIVEWAYS ONLY) W=10 FEET.
6. VALLEY GUTTER SECTIONS ALONG CURB AND GUTTER MAY BE MONOLITHIC POUR AS SHOWN.



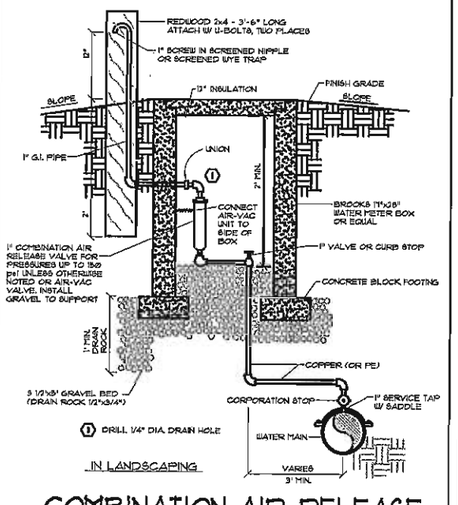
VALLEY GUTTER DETAIL

NTS

GENERAL NOTES:
1. CONCRETE COLLAR SHALL BE CONSTRUCTED 6" WIDE X 6" DEEP SLOPING AWAY FROM LID AND PRAYER. THE CONCRETE SHALL BE 3000 PSI MIN. COMPRESSIVE STRENGTH
2. FLUSH HYDRANT SHALL BE LOCATED 6"-18" BELOW LID



FLUSHING HYDRANT ASSEMBLY



COMBINATION AIR-RELEASE VALVE OR AIR-VAC VALVE

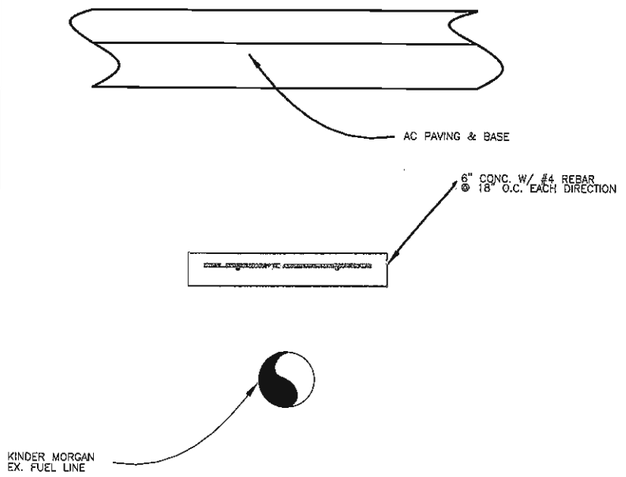
N.T.S

RENO ENGINEERING CORPORATION
CIVIL ENGINEERING · DESIGN · LAND PLANNING
8725 TECHNOLOGY WAY, SUITE B RENO, NV 89521
PHONE: (775) 853-5700 FAX: (775) 853-5707

REVISIONS	BY	DATE

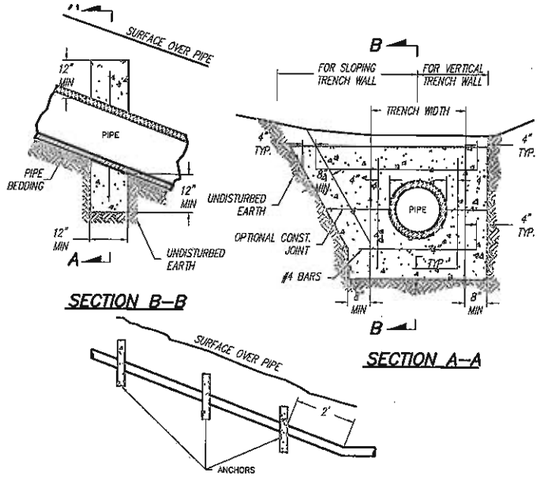
TAHOE / RENO INDUSTRIAL CENTER STANDARD DETAILS

RD2



NEW 16" DI SLEEVE FOR WATER AND RECLAIM

SECTION DETAIL 1 CSG
N.T.S.

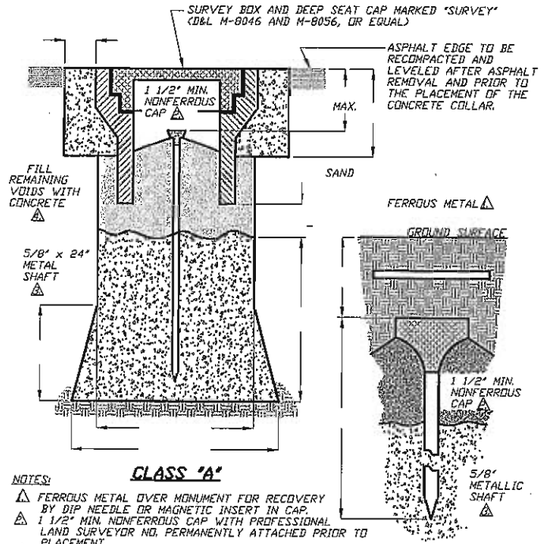


ELEVATION PIPE ANCHORS

NOTES:

1. ANCHORS SHALL BE CONSTRUCTED AT 7' VERTICAL INTERVAL.
2. ANCHOR SHALL BE 4000 PSI CONCRETE
3. FOR CLAY PIPE, ANCHORS SHALL NOT BE PLACED WITHIN 6 INCHES OF PIPE JOINT.
4. TRENCH SHALL BE BACKFILLED PER CITY OF RENO STANDARDS.
5. SEWERS ON 20 PERCENT SLOPES OR GREATER SHALL BE ANCHORED SECURELY WITH CONCRETE ANCHORS, SPACED AS FOLLOWS:
   A. NOT OVER 36 FEET CENTER TO CENTER ON GRADES 20 PERCENT AND UP TO 35 PERCENT.
   B. NOT OVER 24 FEET CENTER TO CENTER ON GRADES 35 PERCENT AND UP TO 50 PERCENT.
   C. NOT OVER 16 FEET CENTER TO CENTER ON GRADES 50 PERCENT AND OVER.

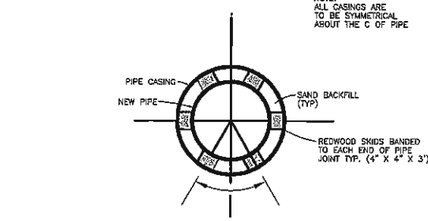
PIPE ANCHORS AND BACKFILL STABILIZERS



NOTES:

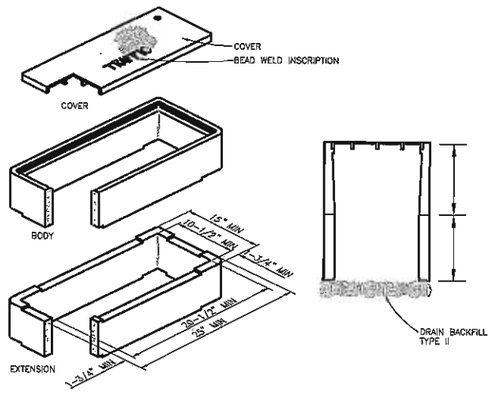
△ FERROUS METAL OVER MONUMENT FOR RECOVERY BY DIP NEEDLE OR MAGNETIC INSERT IN CAP.
△ 1 1/2" MIN. NONFERROUS CAP WITH PROFESSIONAL LAND SURVEYOR NO. PERMANENTLY ATTACHED PRIOR TO PLACEMENT.
△ 5/8" METALLIC SHAFT (SMOOTH SHAFTS TO BE DEFORMED).
△ PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000 PSI MIN. COMPRESSIVE STRENGTH AT 28 DAYS, MIN. 6 SACKS OF CEMENT PER CUBIC YARD WITH A MAX. WATER/CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6% ±1.5%, SLUMP AT 1 TO 4 INCHES. ALL MATERIALS SHALL CONFORM TO SSPWC SECTION 202.
5. PRE-PUNCHED CAPS SHALL NOT BE PERMITTED.

SURVEY MONUMENTS

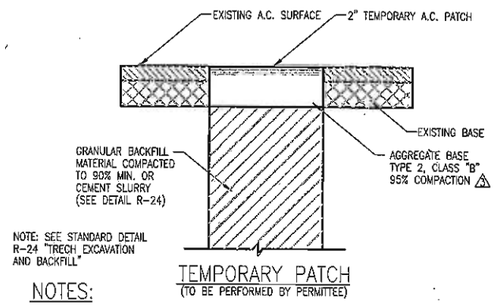


1. STEEL PIPE CASING SHALL BE FABRICATED FROM A MINIMUM OF 1/4" THICK STEEL PLATES, CONFORMING TO THE REQUIREMENTS OF ASTM A283, GRADE B, C, OR D. ALL JOINTS SHALL BE WELDED. INTERIOR JOINTS SHALL BE A SMOOTH FINISH. ALL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH AWWA C201, "AWWA STANDARD FOR FABRICATED ELECTRICALLY WELDED STEEL WATER PIPE". COATINGS FOR STEEL CASING ARE NOT REQUIRED.
2. PIPE CASING SHALL BE LAID TRUE TO LINE AND GRADE WITH NO BENDS OR CHANGES IN GRADE FOR THE FULL LENGTH OF THE CASING.
3. THE PIPE SHALL BE SUPPORTED AT EACH END OF JOINT WITH SKIDS. THE ANNULAR SPACE BETWEEN THE PIPE AND CASING SHALL BE BACKFILLED WITH SAND. AFTER INSTALLATION OF THE PIPE, THE CASING SHALL BE AT BOTH ENDS WITH MOTARED BRICK OR CEMENT BRICK.

TYPICAL SLEEVE DETAIL



NO. 5 PULL BOX

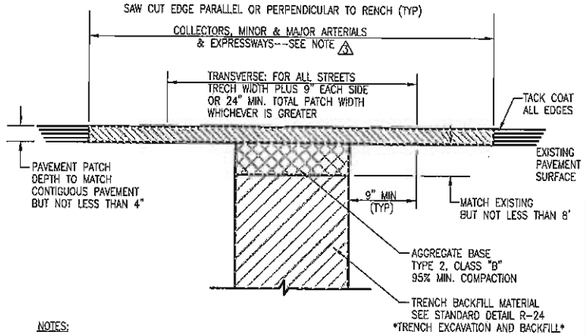


TEMPORARY PATCH
(TO BE PERFORMED BY PERMITTEE)

NOTES:

1. PRIOR TO EXCAVATION, THE OUTLINE OF THE TRENCH SHALL BE VERTICALLY CUT FULL DEPTH THRU THE EXISTING ASPHALT WITH A SAW, OR AN ASPHALT SPADE OR EQUIPMENT APPROVED BY THE ENGINEER.
2. CARE SHALL BE EXERCISED TO PREVENT SLOUGHING AND OVERBREAK. IF THE TRENCH SLOUGHS, THE SURFACE SHALL BE WIDENED TO ELIMINATE THE UNDERMINED SECTION OF ASPHALT.
3. TYPE 2 CLASS "B" AGGREGATE BASE SHALL BE COMPACTED TO A THICKNESS OF AT LEAST 10"–12" OR A DEPTH OF 8" BELOW THE BOTTOM OF THE EXISTING PAVEMENT, WHICHEVER IS GREATER.
4. A TEMPORARY PATCH OF COLD MIX ASPHALT CONCRETE SHALL BE PLACED AND COMPACTED. THE COMPACTED PATCH SHALL BE APPROXIMATELY 1/8" TO 1/4" ABOVE THE LEVEL OF THE ADJACENT PAVEMENT. IF NOT PATCHED WITHIN 24 HOURS AFTER BACKFILLING, A.R.C. MAY PATCH AND AND BACK-CHARGE THE PERMITTEE FOR ALL COSTS.
5. COMPACTION OF BACKFILL BASE AND A.C. TEMPORARY PATCH SHALL BE PERFORMED WITH APPROVED MECHANICAL TAMPERS. EQUIPMENT WHEEL ROLLING NOT PERMITTED.
6. ENTIRE AREA SHALL BE CLEANED OF ALL DIRT, DUST, DEBRIS, ETC PRIOR TO LEAVING SITE. ANY SITE LEFT UNCLEANED WILL BE CLEANED BY A.R.C. AND ALL COSTS WILL BE BACK-CHARGED TO THE PERMITTEE.
7. TUNNELING UNDER CURB AND GUTTER OR SIDEWALK IS NOT PERMITTED. COMPLETE REMOVAL REQUIRED TO THE NEAREST CONSTRUCTION OR EXPANSION JOINT OUTSIDE THE TRENCH WIDTH.
8. ALL EXCAVATIONS SHALL BE COMPLETE OR BACKFILLED AT THE END OF THE DAY.

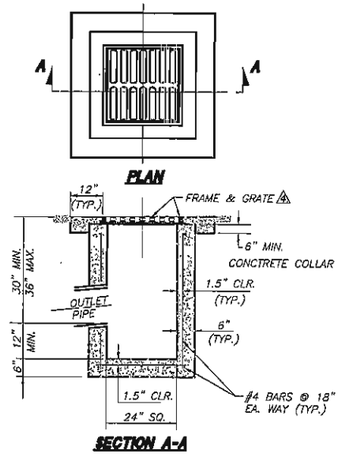
TAHOE RENO INDUSTRIAL CENTER TEMPORARY TRENCH PATCH



NOTES:

1. A PERMIT MUST BE OBTAINED PRIOR TO CUTTING ANY STREET.
2. IF SAWCUT IS WITHIN TWO (2) FEET OF AN EXISTING PAVEMENT EDGE OR EXISTING PAVEMENT PATCH, REMOVE EXISTING PAVEMENT TO THAT EDGE AND REPLACE ENTIRE SECTION.
3. △ LONGITUDINAL TRENCH PATCH WIDTH.
   A. FOR COLLECTORS, MINOR AND MAJOR ARTERIALS AND EXPRESSWAYS: IF SAWCUT EDGES FOR LONGITUDINAL OR TRANSVERSE EXCAVATIONS FALL WITHIN A TRAVEL LANE, SAWCUT SHALL BE EXTENDED TO, AND REMOVAL MADE TO EDGE OF THE TRAVEL LANE± OR THE FULL DEPTH PATCH SHALL BE MADE PER THE SPECIFICATIONS FOR TRANSVERSE PATCHES AND THE ENTIRE TRAVEL LANE ROTOMILLED TO A DEPTH OF TWO (2) INCHES AND OVERLAYED WITH (2) INCHES OF BITUMINOUS PLANTMIX AS DIRECTED BY THE ENGINEER.
4. 4" VERMIER TRENCHES FOR CONDUIT SHALL BE LOCATED A MINIMUM OF 9" FROM GUTTER LIP AND SHALL BE PATCHED AS PER THE ABOVE DETAIL.
5. AGGREGATE BASE AND BITUMINOUS PAVEMENT SHALL BE IN ACCORDANCE WITH STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, LATEST REVISION.
6. CONTRACTOR SHALL BE RESPONSIBLE FOR REPLACEMENT OF LOOP DETECTORS, ADJUSTMENT OF UTILITIES AND SURVEY MONUMENTS TO GRADE AND INSTALLATION OF TEMPORARY PAVEMENT MARKINGS.
7. FOR P.C.C. CURB REPLACEMENT SAWCUT EXISTING PAVEMENT 18 INCHES MIN. FROM GUTTER LIP LINE, REMOVE AND REPLACE PAVEMENT TO SAWCUT EDGES. CONCRETE MAY BE POURED NEAT AGAINST EXISTING EDGE OF ASPHALT IF APPROVED BY THE CITY ENGINEER.

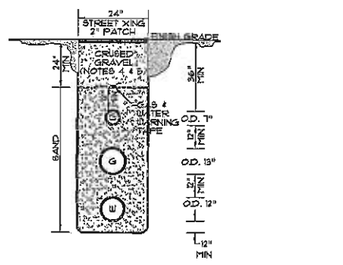
TAHOE RENO INDUSTRIAL CENTER PERMANENT BITUMINOUS PAVEMENT PATCH



NOTES:

1. PORTLAND CEMENT CONCRETE (P.C.C.) SHALL HAVE THE FOLLOWING CHARACTERISTICS: 4000 PSI MIN. COMPRESSIVE STRENGTH @ 28 DAYS, (FOR COLLAR ONLY, ALL UNEXPOSED CONCRETE MAY BE 3000 PSI) MIN. 6 SACKS OF CEMENT PER CUBIC YARD WITH A MAX. WATER/CEMENT RATIO OF 0.45, AIR ENTRAINMENT 6% ±1.5%, SLUMP AT 1 TO 4 INCHES. ALL MATERIALS SHALL CONFORM TO SSPWC SECTION 202.
2. REINFORCING STEEL SHALL BE GRADE 40 AND HAVE 1.5" CLEAR COVER.
3. CONCRETE STRUCTURE MAY BE A PRE-CAST CONCRETE UNIT. BASE OF PRE-CAST CONCRETE UNIT SHALL BE PLACED ON 6" COMPACTED DRAIN ROCK.
4. △ FRAME & GRATE SHALL BE D&L I-9226 OR APPROVED EQUAL.
5. CATCH BASIN SHALL BE TRAFFIC-RATED AND USED ONLY AT LOW POINTS IN ALLEYS OR PARKING AREAS.
6. INSTALL GREASE TRAP PER STANDARD DETAIL DRAWING NO. R-213 (311).

CATCH BASIN TYPE 3-R



TYPICAL GAS AND WATER MAIN TRENCH

REC
RENO ENGINEERING CORPORATION
CIVIL ENGINEERING · DESIGN · LAND PLANNING
6795 TECHNOLOGY WAY, SUITE B RENO, NV 89511
PHONE: (775) 852-5700 FAX: (775) 852-5707

REVISIONS	BY	DATE
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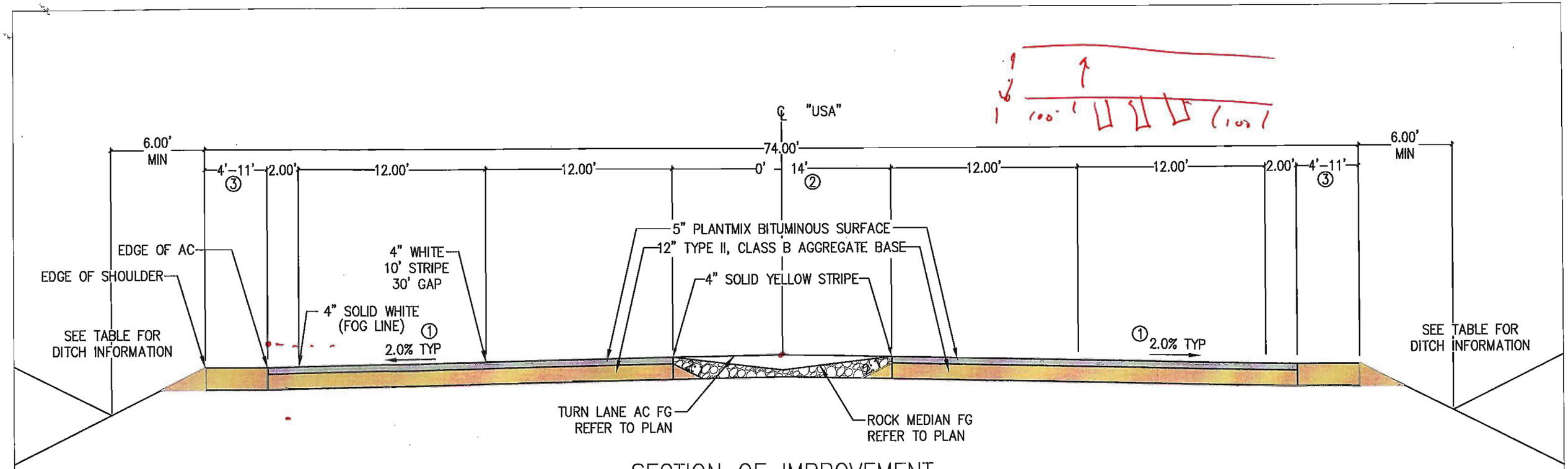
TAHOE / RENO INDUSTRIAL CENTER STANDARD DETAILS

RD3



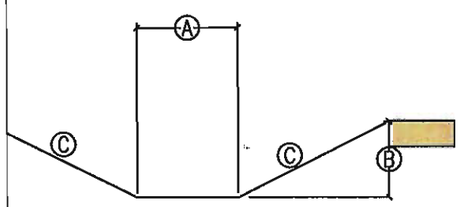
SECTION OF IMPROVEMENT

"USA" 514+00.00 TO "USA" 535+00.00

① UNLESS OTHERWISE NOTED FOR SUPERELEVATION, SEE PROFILE SHEETS.

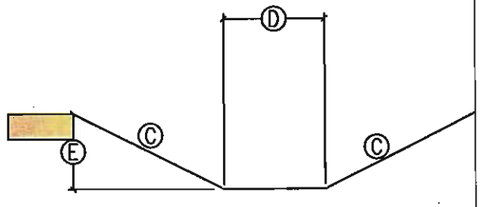
② 0' CENTER MEDIAN FROM STA: 456+30.00 TO STA: 510+00.00. REFER TO PLAN SHEETS FOR TRANSITIONS.

③ 4' SHOULDER FROM STA: 514+00.00 TO STA: 535+00.00. REFER TO PLAN SHEETS FOR TRANSITIONS.



USA PARKWAY DITCH TABLE

FROM	TO	Ⓐ LEFT BOTTOM WIDTH	Ⓑ LEFT SIDE DEPTH	Ⓒ LEFT SIDE SLOPE	Ⓓ RIGHT BOTTOM WIDTH	Ⓔ RIGHT SIDE DEPTH	Ⓒ RIGHT SIDE SLOPE
401+24.04	410+00.00	0'	3'	2:1	0'	3'	2:1
410+00.00	422+50.00	10'	5'	2:1	3.5'	5'	2:1
422+50.00	480+00.00	0'	3'	2:1	0'	3'	2:1
480+00.00	496+00.00	0'	3'	2:1	4.5'	5'	2:1
496+00.00	509+00.00	0'	3'	2:1	7'	5'	2:1
509+00.00	514+00.00	0'	3'	2:1	10'	5.5'	2:1
514+00.00	528+50.00	0'	3'	2:1	15'	6'	2:1
528+50.00	535+00.00	0'	3'	2:1	0'	3'	2:1



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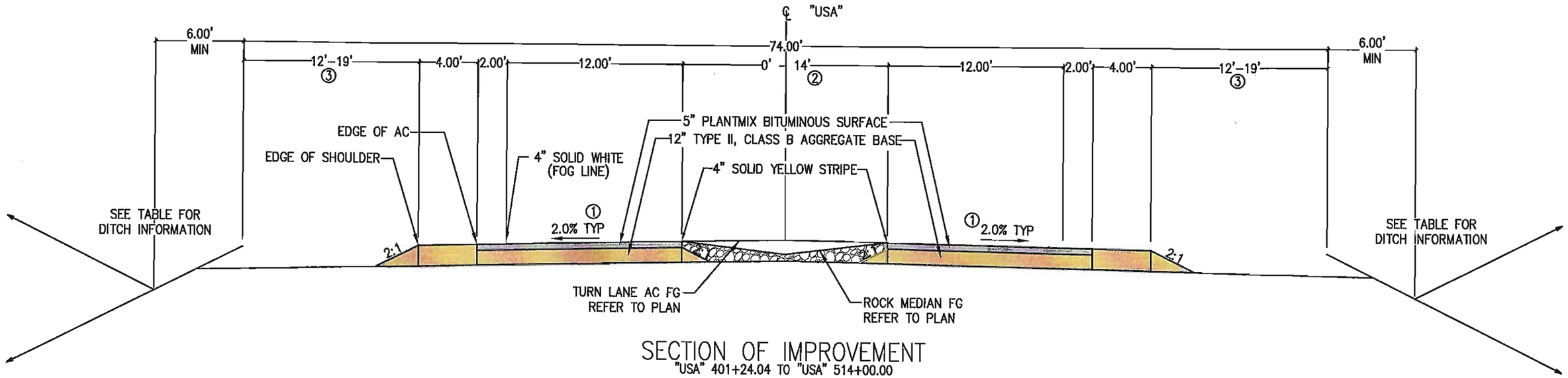
REVISIONS	BY	DATE

USA PARKWAY EXTENSION
ROAD SECTION

XS1



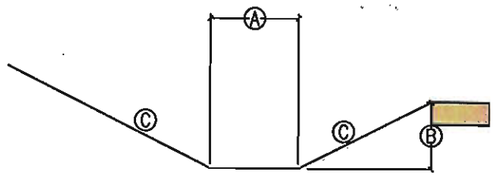
SECTION OF IMPROVEMENT

"USA" 401+24.04 TO "USA" 514+00.00

① UNLESS OTHERWISE NOTED FOR SUPERELEVATION, SEE PROFILE SHEETS.

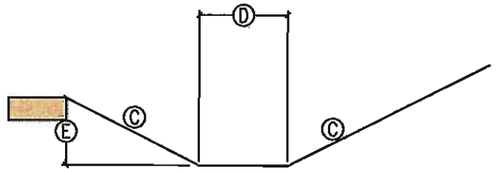
② 0' CENTER MEDIAN FROM STA: 456+30.00 TO STA: 510+00.00. REFER TO PLAN SHEETS FOR TRANSITIONS.

③ 12' SHOULDER FROM STA: 401+24.04 TO STA: 452+50.00
19' SHOULDER FROM STA: 456+30.00 TO STA: 510+15.00. REFER TO PLAN SHEETS FOR TRANSITIONS.



USA PARKWAY DITCH TABLE

FROM	TO	Ⓐ LEFT BOTTOM WIDTH	Ⓑ LEFT SIDE DEPTH	Ⓒ LEFT SIDE SLOPE	Ⓓ RIGHT BOTTOM WIDTH	Ⓔ RIGHT SIDE DEPTH	Ⓒ RIGHT SIDE SLOPE
401+24.04	410+00.00	0'	3'	2:1	0'	3'	2:1
410+00.00	422+50.00	10'	5'	2:1	3.5'	5'	2:1
422+50.00	480+00.00	0'	3'	2:1	0'	3'	2:1
480+00.00	496+00.00	0'	3'	2:1	4.5'	5'	2:1
496+00.00	509+00.00	0'	3'	2:1	7'	5'	2:1
509+00.00	514+00.00	0'	3'	2:1	10'	5.5'	2:1
514+00.00	528+50.00	0'	3'	2:1	15'	6'	2:1
528+50.00	535+00.00	0'	3'	2:1	0'	3'	2:1



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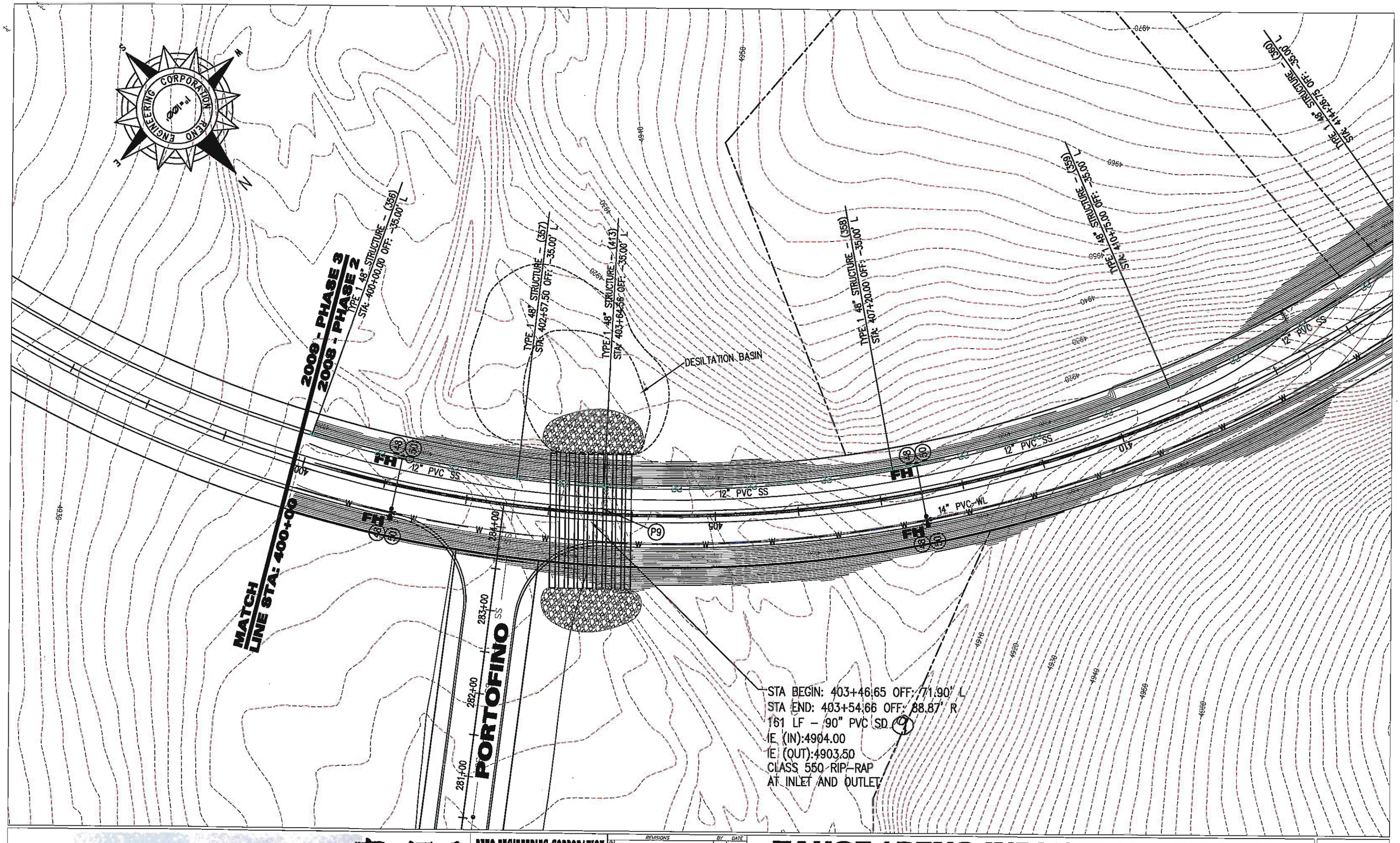
REVISIONS	BY	DATE

USA PARKWAY EXTENSION
ROAD SECTION

XS2



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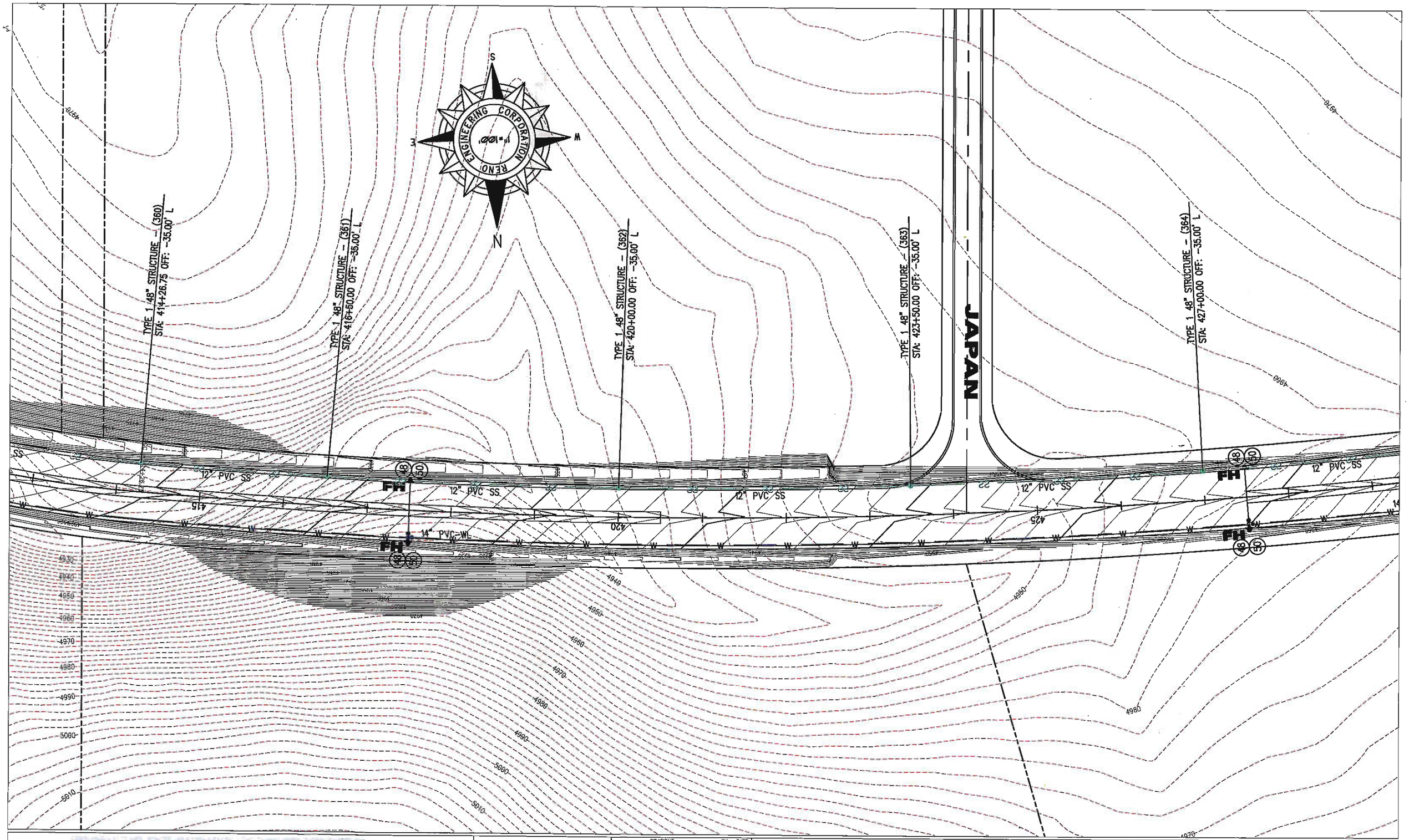
REVISIONS	BY	DATE

TAHOE / RENO INDUSTRIAL CENTER
USA PARKWAY EXTENSION

COMSTOCK DEVELOPMENTS

C5



REC

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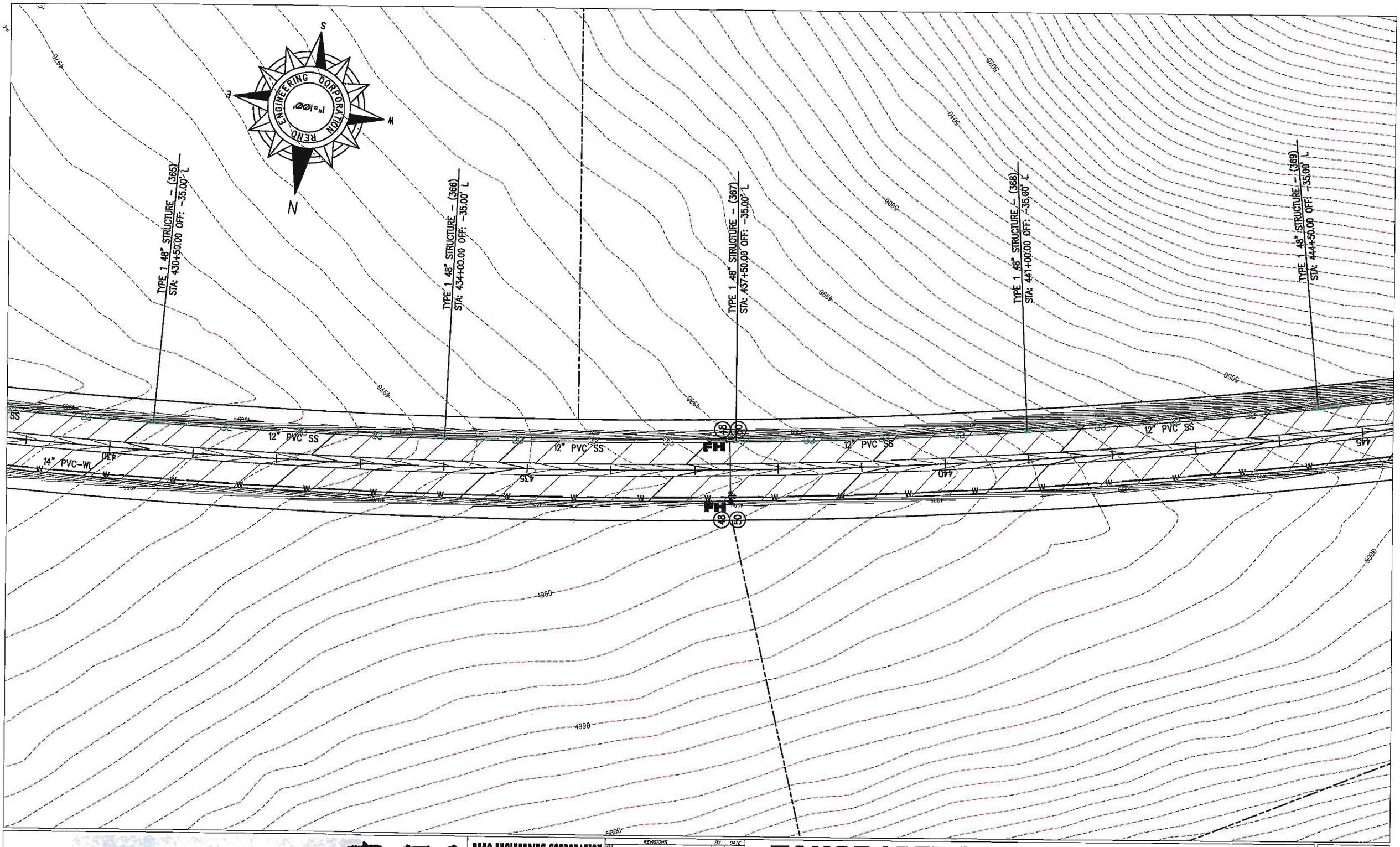
REVISIONS	BY	DATE

TAHOE / RENO INDUSTRIAL CENTER
USA PARKWAY EXTENSION

COMSTOCK MEADOWS

C6



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REVISIONS	BY	DATE

TAHOE / RENO INDUSTRIAL CENTER
USA PARKWAY EXTENSION

COMSTOCK MINING

C7

TYPE 1 48" STRUCTURE - (369)
STA: 444+50.00 OFF: -35.00' L

TYPE 1 48" STRUCTURE - (370)
STA: 448+00.00 OFF: -35.00' L

12" PVC SS

14" PVC WL

FH

END WATER LINE. ADD AIR RELEASE AT HIGH POINT

BID ALT. A EXTEND WATER LINE.

STA = 452+49.68
14" MEDIAN STOP

14" PVC WL (OPTION A)

STA = 455+29.52
0" MEDIAN START

(OPTIONAL)

FH

(OPTIONAL)

FH

14" PVC

WATER-BID ALT A

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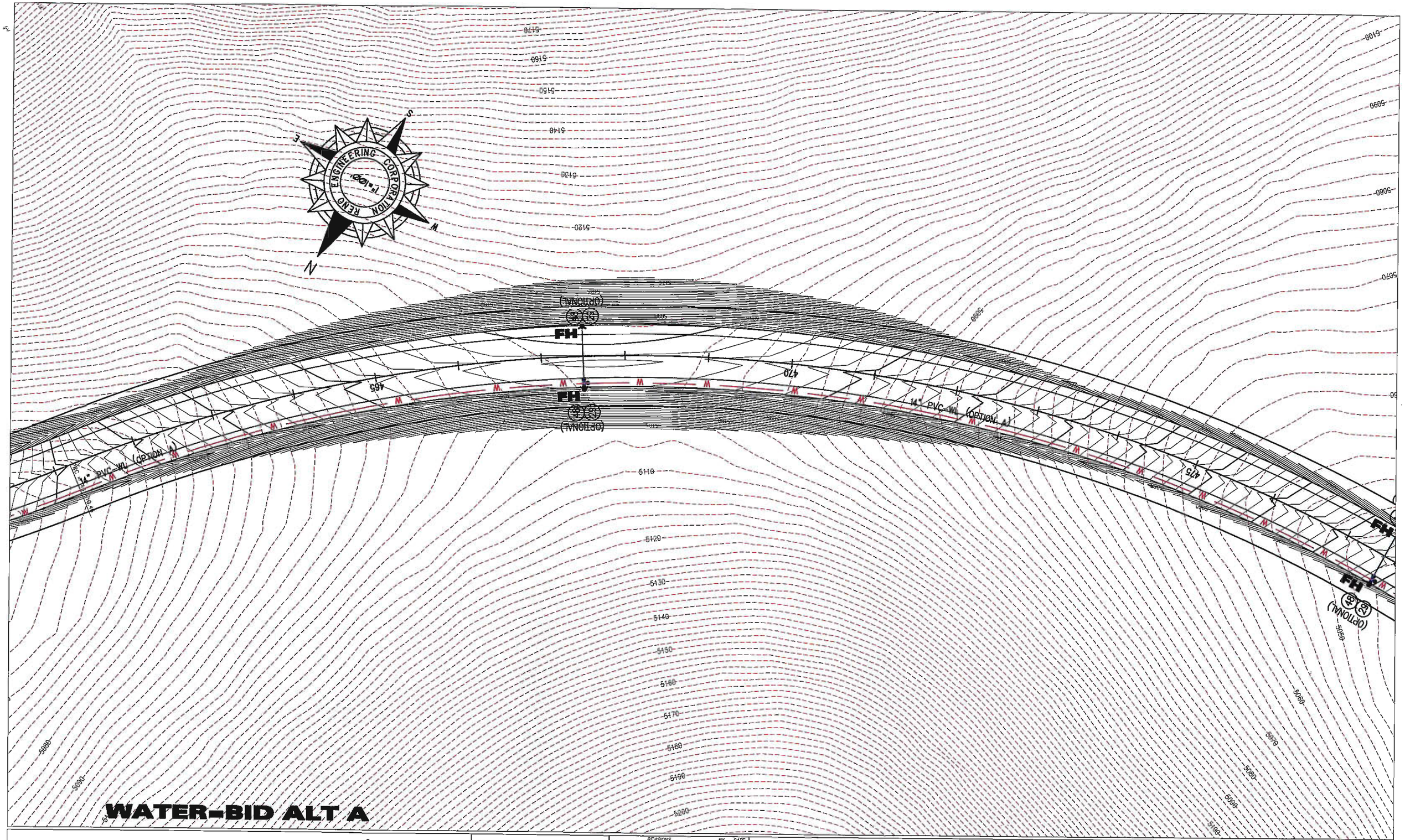
USA PARKWAY EXTENSION

COMSTOCK MEXICO

C8



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REVISIONS	BY	DATE

TAHOE / RENO INDUSTRIAL CENTER
USA PARKWAY EXTENSION
COMSTOCK REGIONS

C9

STA BEGIN: 479+36.77 OFF: 53.89' L
STA END: 480+14.16 OFF: 47.10' R
127 LF – 72" PVC SD
IE (IN):5028.00
IE (OUT):5026.00
CLASS 550 RIP-RAP
AT INLET AND OUTLET

14" PVC W/ OPTION A

WATER-BID ALT A

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TAHOE / RENO INDUSTRIAL CENTER
USA PARKWAY EXTENSION

COMSTOCK RESIDENTIAL

C10

STA BEGIN: 495+29.80 OFF: 42.88' L
STA END: 495+50.57 OFF: 46.99' R
92 LF - 72" PVC SD
IE (IN):4941.00
IE (OUT):4940.00
CLASS 550 RIP-RAP
AT INLET AND OUTLET

STA BEGIN: 502+92.38 OFF: 42.93' L
STA END: 503+62.51 OFF: 50.20' R
116 LF - 72" PVC SD
IE (IN):4895.50
IE (OUT):4892.00
CLASS 550 RIP-RAP
AT INLET AND OUTLET

12" PVC W/ (OPTION A)

(OPTIONAL)

(OPTIONAL)

(OPTIONAL)

WATER-BID ALT A

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TAHOE / RENO INDUSTRIAL CENTER
USA PARKWAY EXTENSION
COMSTOCK MEADOWS

C11

STA BEGIN: 514+20.15 OFF: 51.87' L
STA END: 514+83.66 OFF: 58.13' R
127 LF – 72" PVC SD
IE (IN):4837.00
IE (OUT):4835.00
CLASS 550 RIP-RAP
AT INLET AND OUTLET

STA BEGIN: 519+14.15 OFF: 62.09' L
STA END: 519+81.75 OFF: 55.00' R
135 LF – 60" PVC SD
IE (IN):4812.50
IE (OUT):4809.50
CLASS 550 RIP-RAP
AT INLET AND OUTLET

STA BEGIN: 523+21.13 OFF: 50.00' L
STA END: 523+78.87 OFF: 50.00' R
115 LF – 48" PVC SD
IE (IN):4796.00
IE (OUT):4794.00
CLASS 550 RIP-RAP
AT INLET AND OUTLET

STA = 509+58.67
STA = 510+15.16
0' MEDIAN STOP

STA = 514+00
14' MEDIAN START

STA = 515+50
OFF = -22.00' L

STA = 520+74.47
BEGIN 14' ROCK MEDIAN

14" PVC-WL (OPTION A)

6" PVC

10" PVC

FUTURE SPEC REC SITE

TYPE 1 48" STRUCTURE L (313)
STA: 514+75.00 OFF: -27.00' L

TYPE 1 48" STRUCTURE L (289)
STA: 518+05.60 OFF: -27.00' L

TYPE 1 48" STRUCTURE L (411)
STA: 519+53.65 OFF: -27.00' L

TYPE 1 48" STRUCTURE L (288)
STA: 521+55.60 OFF: -27.00' L

TYPE 1 48" STRUCTURE L (287)
STA: 525+05.60 OFF: -27.00' L

BID ALT. A-
EXTEND WATER LINE. END ALL UTILITIES. ADD AIR RELEASE AT HIGH POINTS.

REC

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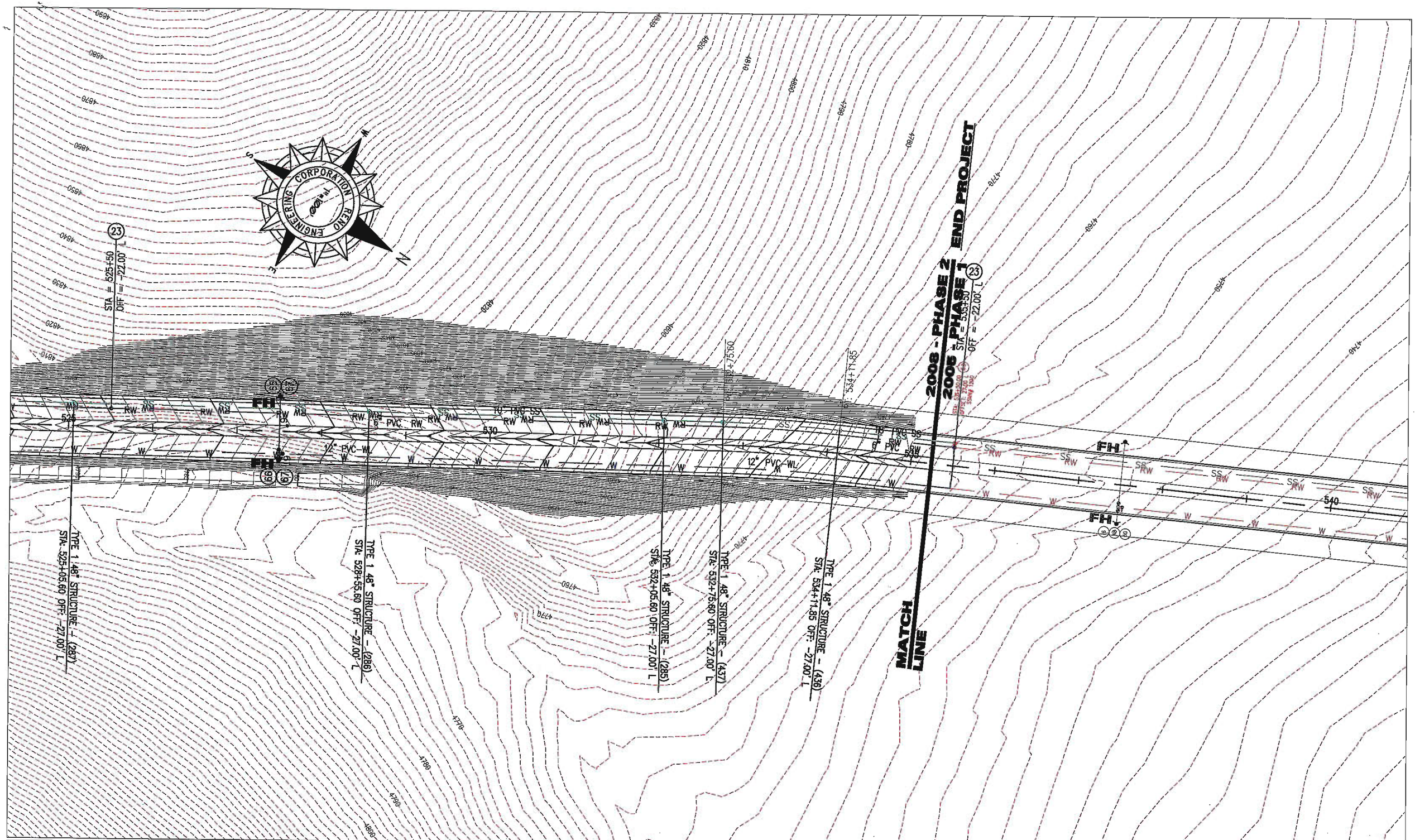
USA PARKWAY EXTENSION

COMSTOCK REGIONS

C12



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USA PARKWAY EXTENSION

COMSTOCK MEADOWS

C13

(P0) CONST (1) 115 LF 48" CMP
IE IN: 4796.00
IE OUT: 4794.00
Q_{100}: 71.92 cfs
SLOPE: 0.0173 FT/FT

(P9) CONST (9) 161 LF 90" CMP
IE IN: 4904.00
IE OUT: 4903.50
Q_{100}: 7332.78 cfs
SLOPE: 0.0031 FT/FT

(P1) CONST (1) 135 LF 60" CMP
IE IN: 4812.50
IE OUT: 4809.50
Q_{100}: 116.64 cfs
SLOPE: 0.0222 FT/FT

(P2) CONST (3) 127 LF 72" CMP
IE IN: 4837.00
IE OUT: 4835.00
Q_{100}: 550.32 cfs
SLOPE: 0.0157 FT/FT

(P3) CONST (1) 116 LF 72" CMP
IE IN: 4895.50
IE OUT: 4892.00
Q_{100}: 160.73 cfs
SLOPE: 0.0301 FT/FT

(P4) CONST (2) 92 LF 72" CMP
IE IN: 4941.00
IE OUT: 4940.00
Q_{100}: 394.65 cfs
SLOPE: 0.0108 FT/FT

(P5) CONST (3) 127 LF 72" CMP
IE IN: 5028.00
IE OUT: 5026.00
Q_{100}: 628.52 cfs
SLOPE: 0.0157 FT/FT

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REVISIONS	BY	DATE

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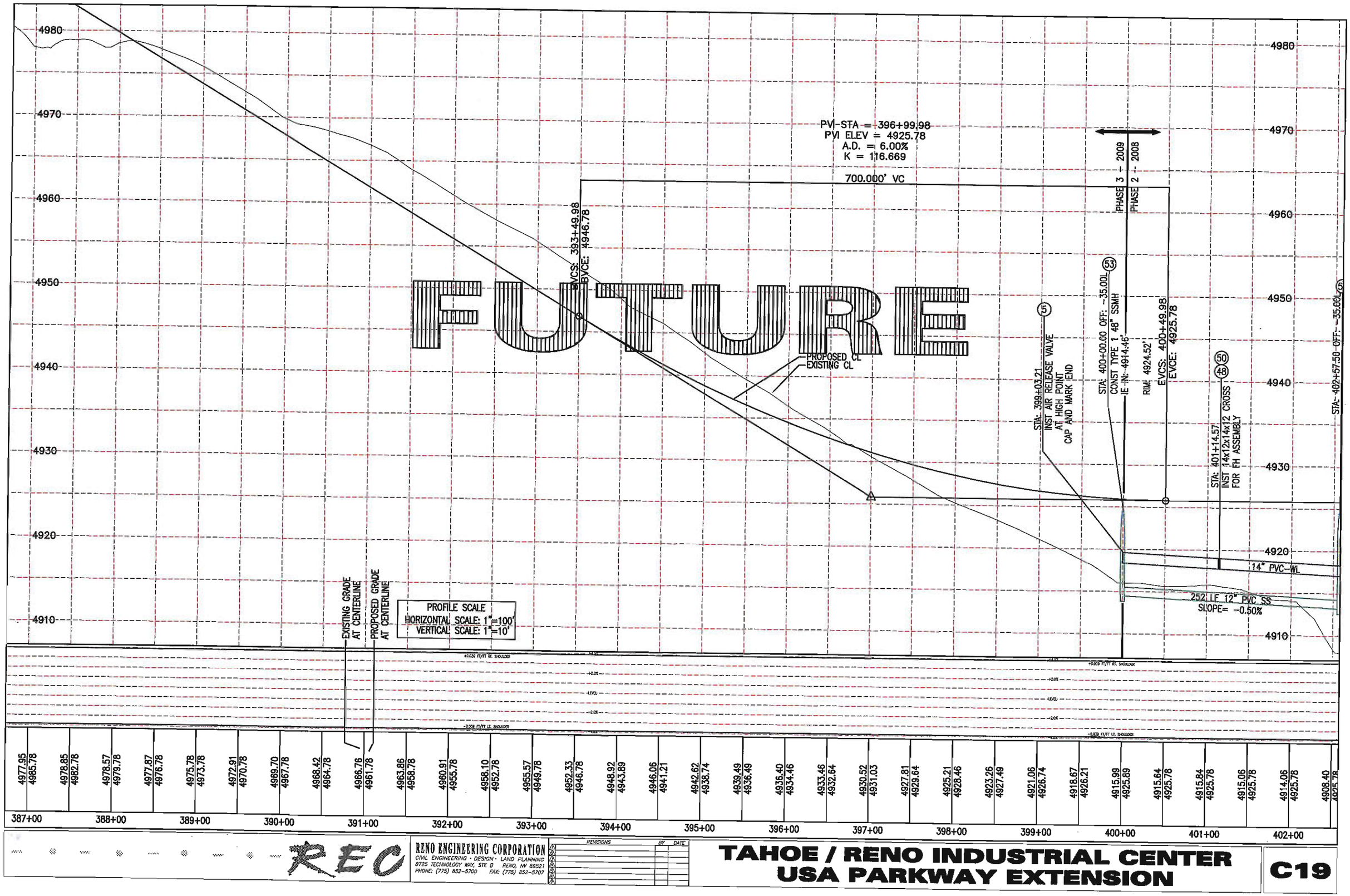
USA PARKWAY EXTENSION

COMSTOCK REGIONS

PX



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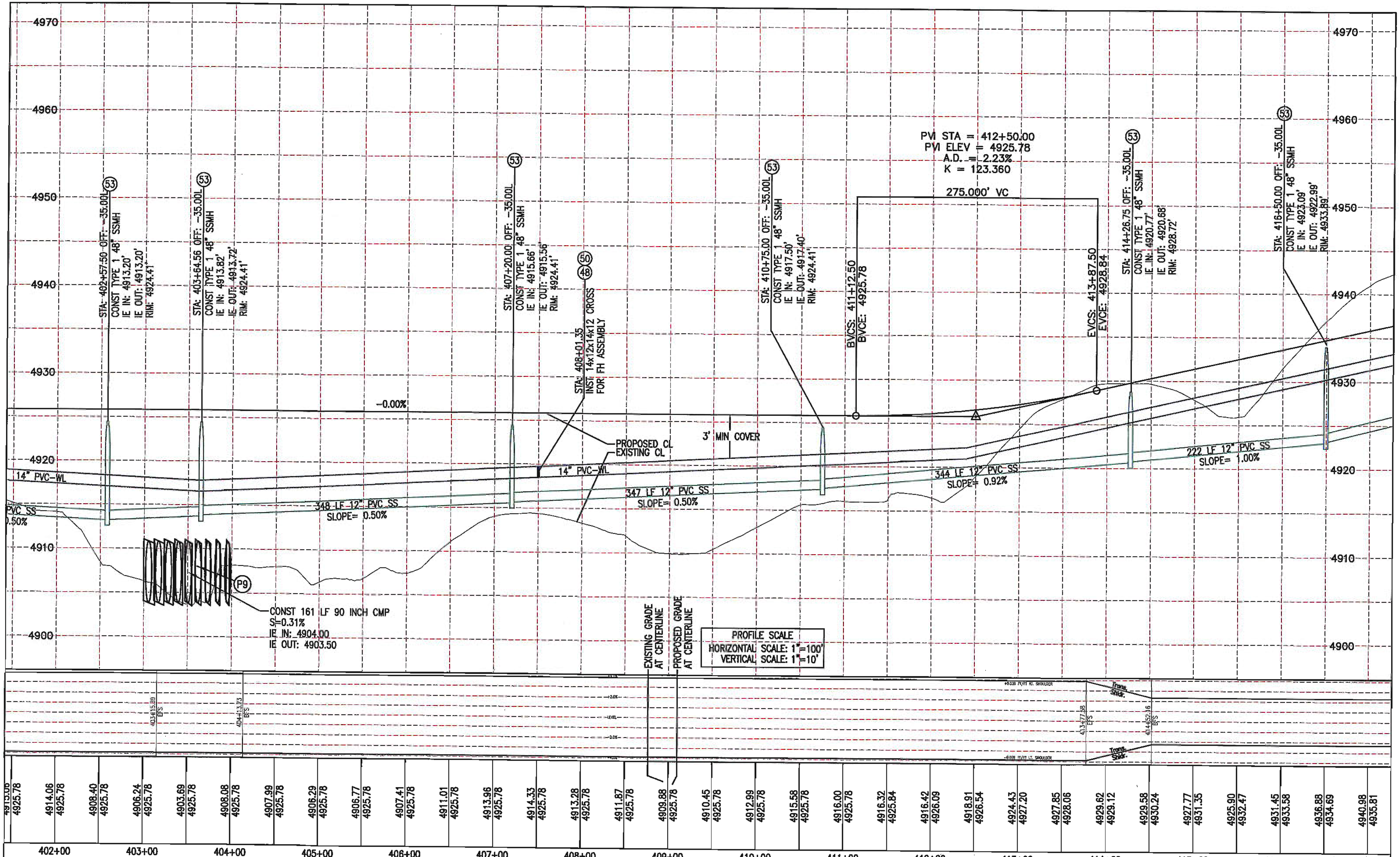
USA PARKWAY EXTENSION

C19



REC

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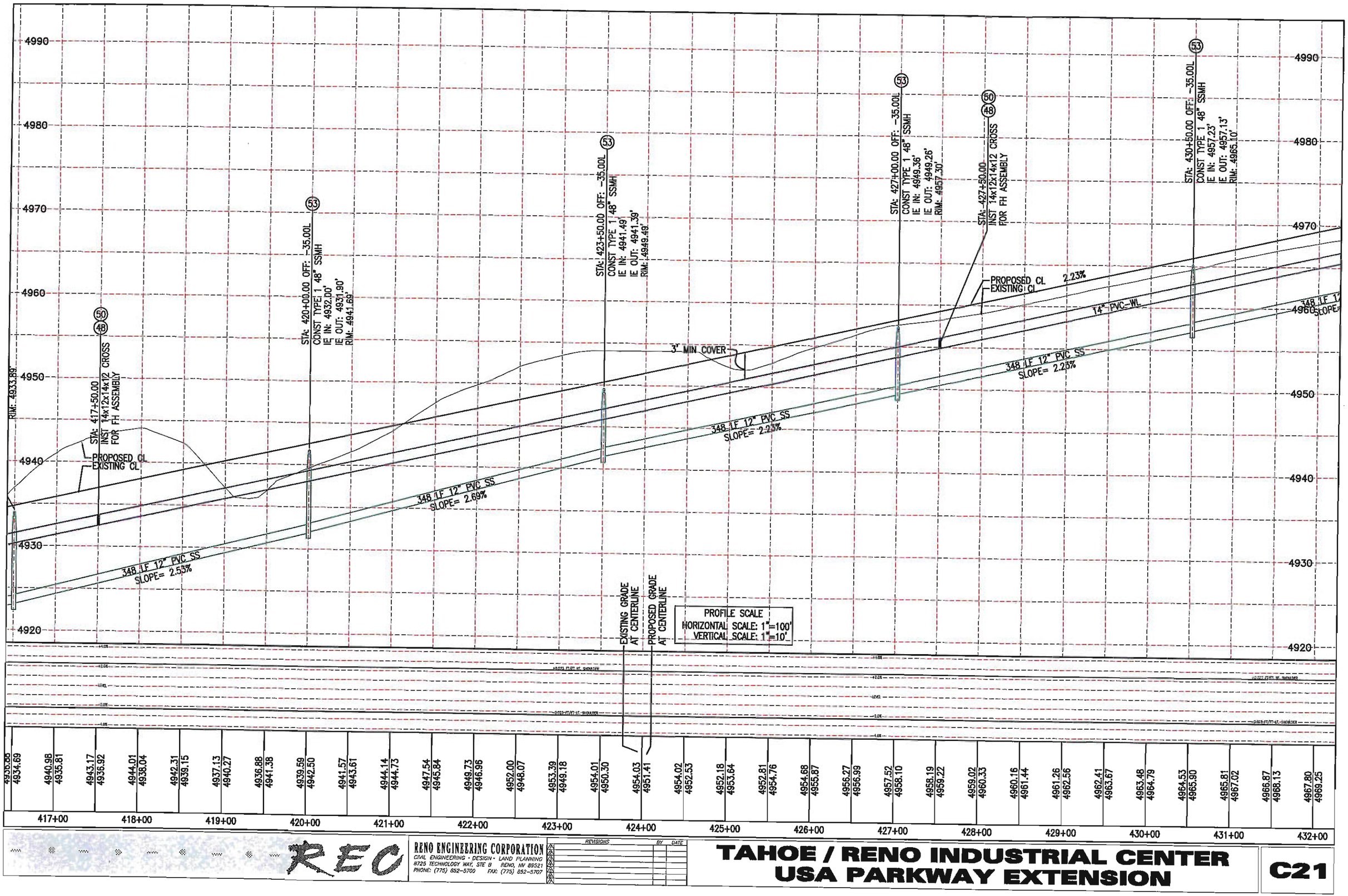
USA PARKWAY EXTENSION

C20



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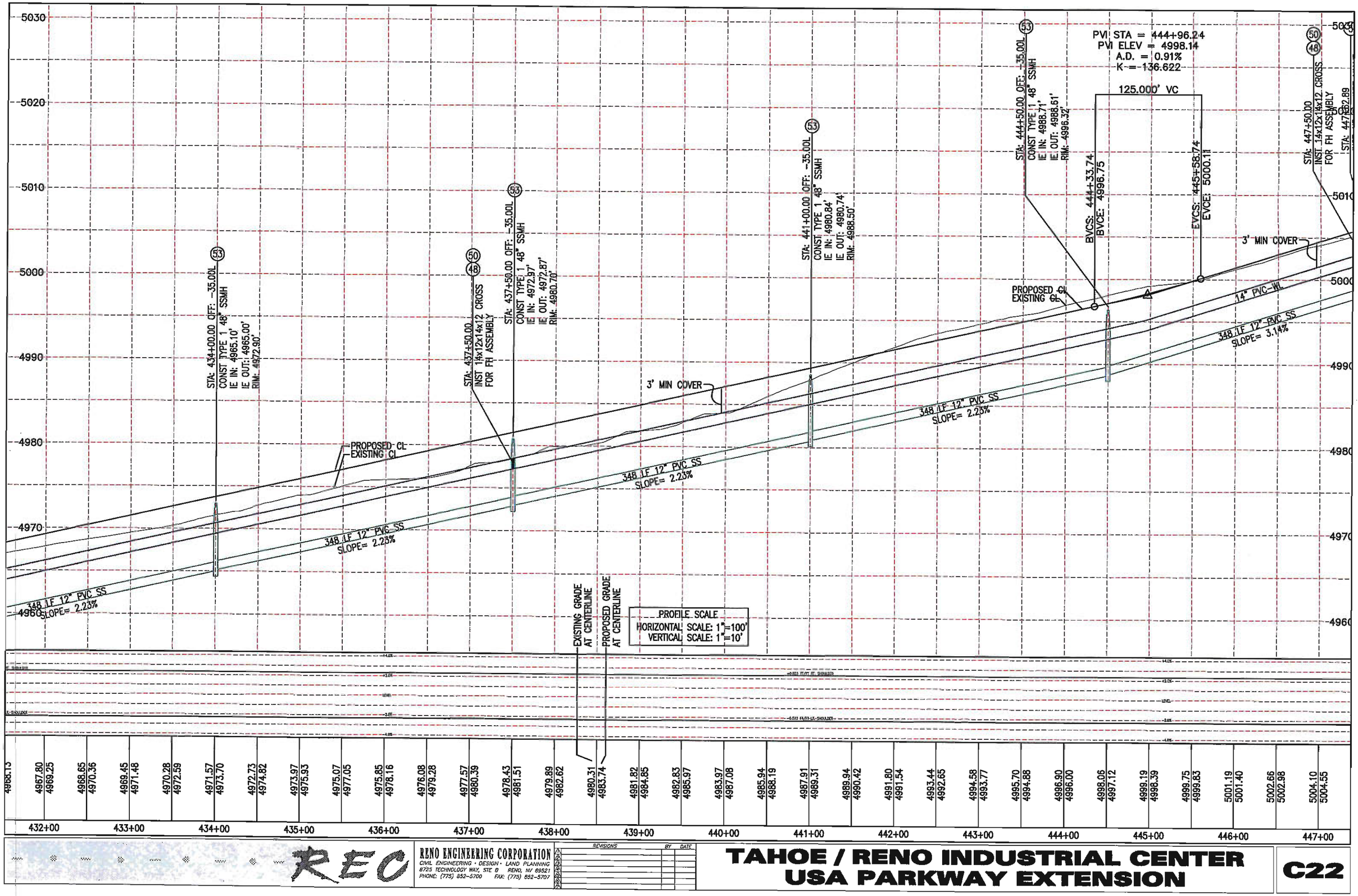
USA PARKWAY EXTENSION

C21



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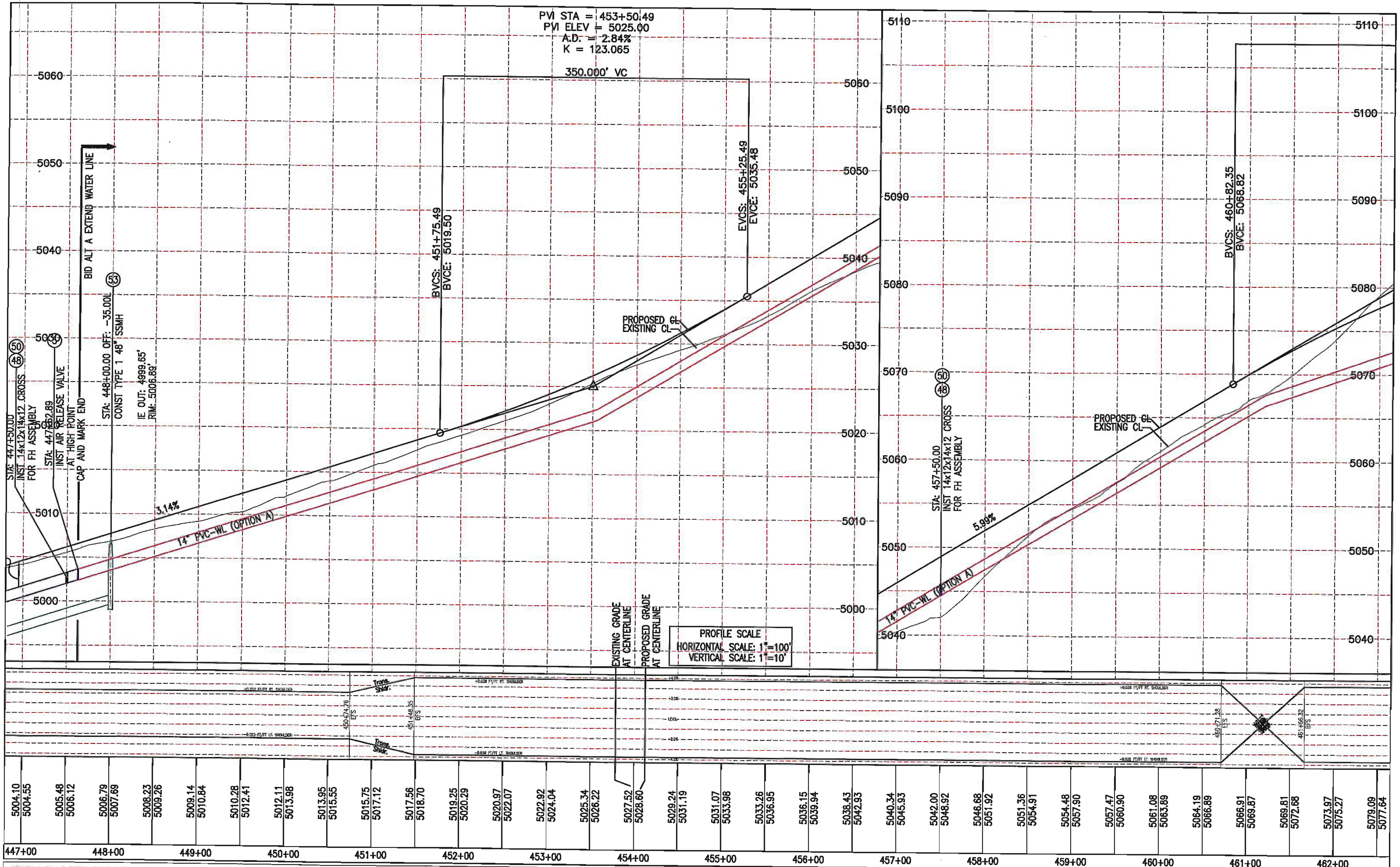
USA PARKWAY EXTENSION

C22



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USA PARKWAY EXTENSION

C23

PVI STA = 467+72.35
PVI ELEV = 5110.14
A.D. = -11.97%
K = 115.271
1380.000' VC

STA: 467+50.00
INST 14x12x14x12 CROSS
FOR FH ASSEMBLY

STA: 467+72.24
INST AIR RELEASE VALVE
AT HIGH POINT

3' MIN COVER

14" PVC-WL (OPTION A)

PROPOSED CL
EXISTING CL

EVCS: 474+62.35
EVCE: 5068.85

14" PVC-WL (OPTION A)

STA: 477+50.00
INST 14x12x14x12 CROSS
FOR FH ASSEMBLY

EXISTING GRADE AT CENTERLINE

PROPOSED GRADE AT CENTERLINE

PROFILE- SCALE
HORIZONTAL SCALE: 1"=100'
VERTICAL SCALE: 1"=10'

463+00	464+00	465+00	466+00	467+00	468+00	469+00	470+00	471+00	472+00	473+00	474+00	475+00	476+00	477+00	478+
5079.09	5083.62	5088.17	5092.17	5095.42	5098.69	5101.09	5103.11	5104.90	5105.97	5106.81	5107.26	5106.97	5105.72	5104.30	5102.32
5077.64	5079.80	5081.74	5083.47	5084.98	5086.27	5087.34	5088.20	5088.84	5089.26	5089.47	5089.46	5089.23	5088.79	5088.13	5087.25
5099.70	5096.26	5091.57	5086.31	5081.91	5077.56	5073.24	5069.03	5064.69	5060.95	5057.62	5054.27	5051.52	5048.61	5046.62	5044.23
5086.15	5084.84	5083.31	5081.57	5079.60	5077.43	5075.03	5072.42	5069.59	5066.60	5063.61	5060.62	5057.63	5054.63	5051.64	

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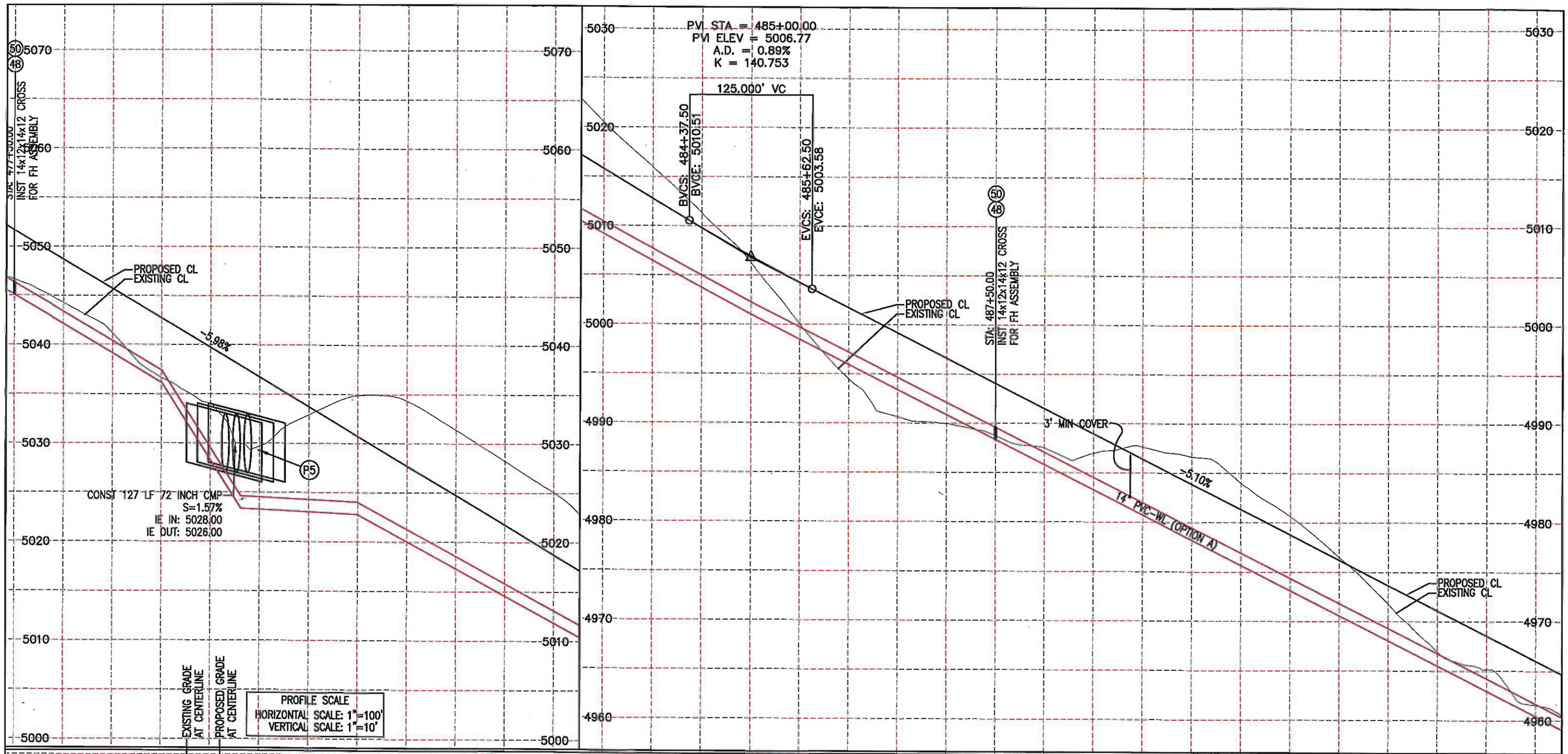
USA PARKWAY EXTENSION

C24



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1		
2		
3		
4		
5		
6		

TAHOE / RENO INDUSTRIAL CENTER
USA PARKWAY EXTENSION

C25

PVI STA = 494+00.00
PVI ELEV = 4960.91
A.D. = -0.96%
K = 129.561
125.000' VC
BVCS: 493+37.50
BVCE: 4964.09
EVCS: 494+62.50
EVCE: 4957.12
3' MIN COVER
18" MIN SEPERATION
P4
CONST 92 LF 72 INCH CMP
S=1.08%
IE IN: 4941.00
IE OUT: 4940.00
14" PVC-WL (OPTION A)
STA: 497+50.00
INST 14x12x14x12 CROSS
FOR FH ASSEMBLY
-6.06%
PROPOSED CL
EXISTING CL
P3
CONST 116 LF 72 INCH CMP
S=3.01%
IE IN: 4895.50
IE OUT: 4892.00
14" PVC-WL (OPTION A)
STA: 507+50.00
INST 14x12x14x12 CROSS
FOR FH ASSEMBLY
BVCS: 508+12.50
BVCE: 4875.30
PROFILE SCALE
HORIZONTAL SCALE: 1"=100'
VERTICAL SCALE: 1"=10'
EXISTING GRADE AT CENTERLINE
PROPOSED GRADE AT CENTERLINE
493+01.85 EFS
493+97.48 EFS
499+28.48 EFS
500+22.83 EFS
+0.035 FT/FT RT. SHOULDER
-0.035 FT/FT LT. SHOULDER

493+00	494+00	495+00	496+00	497+00	498+00	499+00	500+00	501+00	502+00	503+00	504+00	505+00	506+00	507+00	508+00
4961.53	4958.26	4955.82	4957.24	4959.16	4959.55	4963.93	4961.77	4957.10	4952.05	4945.04	4939.01	4935.23	4930.30	4925.26	4921.55	4917.94	4916.14	4912.55	4908.01	4905.16	4905.90	4903.17	4898.90	4894.63	4890.46	4885.84	4880.98	4876.90	4874.55	4867.76	4870.22
4966.00	4963.45	4960.75	4957.87	4954.84	4951.81	4948.78	4945.75	4942.72	4939.69	4936.66	4933.63	4930.60	4927.57	4924.54	4921.51	4918.48	4915.45	4912.42	4909.39	4906.36	4903.33	4900.30	4897.27	4894.24	4891.21	4888.18	4885.15	4882.12	4879.09	4876.06	

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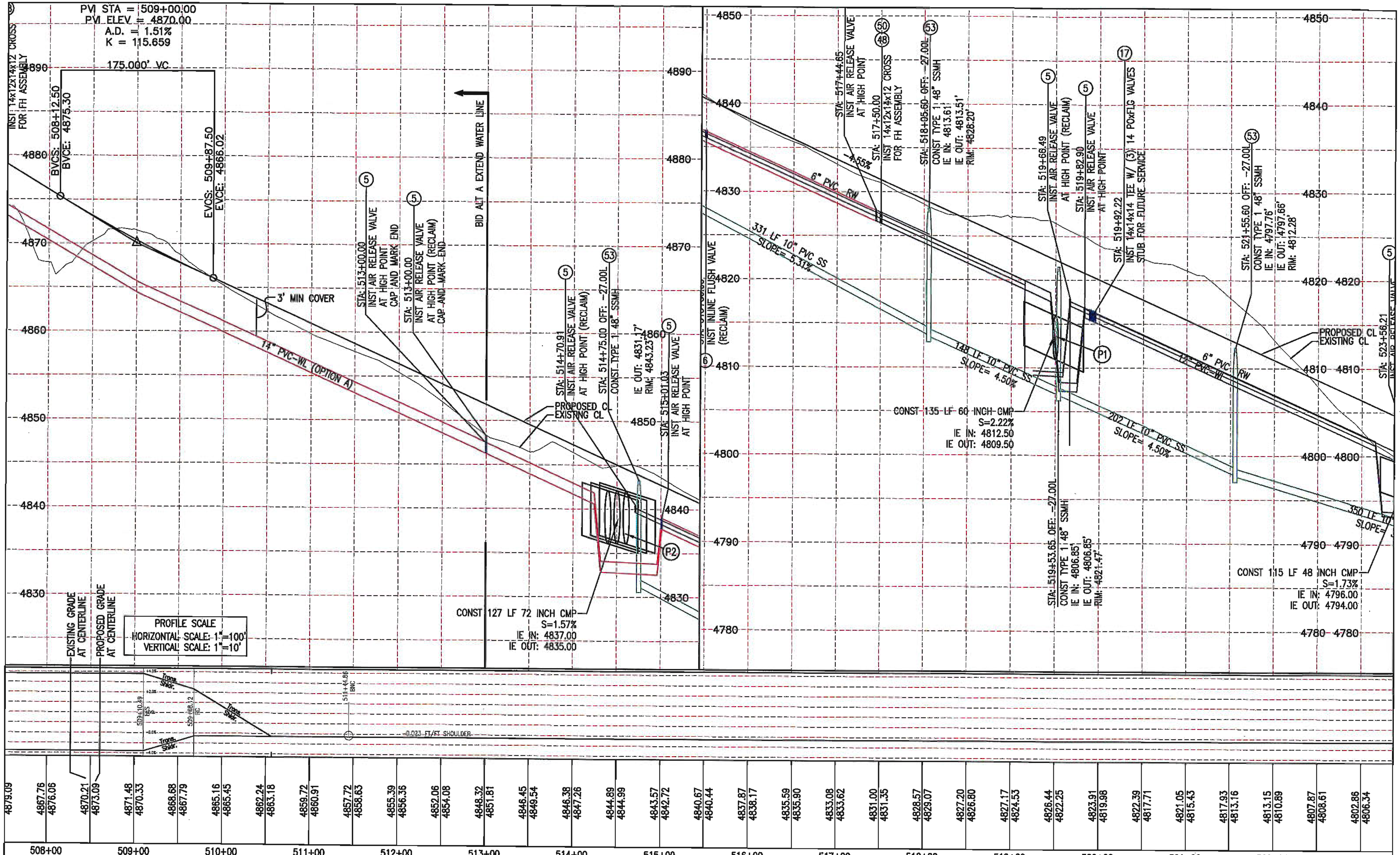
USA PARKWAY EXTENSION

C26



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CIVIL ENGINEERING · DESIGN · LAND PLANNING
8725 TECHNOLOGY WAY, STE B RENO, NV 89521
PHONE: (775) 852-5700 FAX: (775) 852-5707

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TAHOE / RENO INDUSTRIAL CENTER USA PARKWAY EXTENSION

C27

PVI STA = 525+00.00
PVI ELEV = 4797.24
A.D. = 0.71%
K = 140.189

100.000' VC

PROPOSED CL
EXISTING CL

STA: 523+56.21
INST AIR RELEASE VALVE
AT HIGH POINT (RECLAIM)

STA: 525+80.97
INST AIR RELEASE VALVE
AT HIGH POINT

BVCS: 524+50.00
BVCE: 4799.52

EVCS: 525+50.00
EVCE: 4795.33

STA: 525+50.00
INST INLINE FLUSH VALVE
(RECLAIM)

STA: 527+50.00
INST 14x8x14x12 CROSS
FOR FH ASSEMBLY

EXISTING CL
PROPOSED CL

STA: 528+55.60 OFF: -27.00L
CONST TYPE 1 48" SSMH
IE IN: 4776.46'
IE OUT: 4776.36'
RIM: 4782.99'

STA: 532+05.60 OFF: -27.00L
CONST TYPE 1 48" SSMH
IE IN: 4762.36'
IE IN: 4762.26'
RIM: 4769.98'

STA: 532+75.60 OFF: -27.00L
CONST TYPE 1 48" SSMH
IE IN: 4759.48'
IE OUT: 4759.38'
RIM: 4768.19'

PVI STA = 533+50.00
PVI ELEV = 4764.65
A.D. = -0.60%
K = 165.340

100.000' VC

BVCS: 533+00.00
BVCE: 4766.57

EVCS: 534+00.00
EVCE: 4762.44

STA: 534+11.85 OFF: -27.00L
CONST TYPE 1 48" SSMH
IE IN: 4753.24'
IE OUT: 4753.34'
RIM: 4762.60'

STA: 535+47.00
INST INLINE FLUSH VALVE
(RECLAIM)

PHASE 2 - 2008
PHASE 1 - 2005

STA: 525+05.60 OFF: -27.00L
CONST TYPE 1 48" SSMH
IE IN: 4787.16'
IE OUT: 4787.06'
RIM: 4796.48'

NCH CMP
S=1.73%
4796.00
4794.00

350 LF 10" PVC SS
SLOPE= 3.00%

350 LF 10" PVC SS
SLOPE= 3.03%

-3.83%

6" PVC RW

3' MIN COVER

350 LF 10" PVC SS
SLOPE= 4.00%

20 LF 18" PVC SS
SLOPE= -3.83%

12" PVC-W

138 LF 18" PVC SS
SLOPE= -4.43%

-4.44%

6" PVC RW

138 LF 18" PVC SS
SLOPE= -4.44%

STA: 536+58.58
INST 48" TYPE 1 SSMH
IE IN (IN)=4747.11
IE (OUT)=4746.91
RIM=4656.16+/-

STA: 537+50
INLINE VALVE
FIRE HYDRANT ASSEMBLY

PROPOSED ROAD SURFACE

FILL

RW

EXISTING GRADE
AT CENTERLINE

PROPOSED GRADE
AT CENTERLINE

PROFILE SCALE
HORIZONTAL SCALE: 1"=100'
VERTICAL SCALE: 1"=10'

530+89.40 EVC

532+65.78 BC

533+23.78 EVS

533+63.87 EVS

534+21.30 EC

536+08.94 EVC

-0.023-FT/FT-SHOULDER-

-0.023-FT/FT-SHOULDER-

Trans Slope

Trans Slope

Trans Slope

Trans Slope

4820
4810
4800
4790
4780
4770
4760
4750

4808.61

523+00	524+00	525+00	526+00	527+00	528+00	529+00	530+00	531+00	532+00	533+00	534+00	535+00	536+00	537+00	538+00
4802.66	4799.44	4796.08	4796.23	4796.38	4795.24	4792.58	4791.43	4793.39	4796.89	4796.92	4795.88	4797.89	4802.70	4806.66	4806.60
4806.34	4804.06	4801.79	4799.52	4797.33	4795.33	4793.41	4791.49	4789.58	4787.66	4785.74	4783.82	4781.91	4779.99	4778.07	4776.16
4804.47	4798.27	4791.64	4785.27	4779.05	4772.95	4767.40	4761.89	4756.85	4752.24	4749.74	4747.83	4746.14	4744.69	4741.78	
4774.24	4772.32	4770.41	4768.49	4766.57	4764.58	4762.44	4760.22	4758.00							

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8725 TECHNOLOGY WAY, STE B RENO, NV 89521
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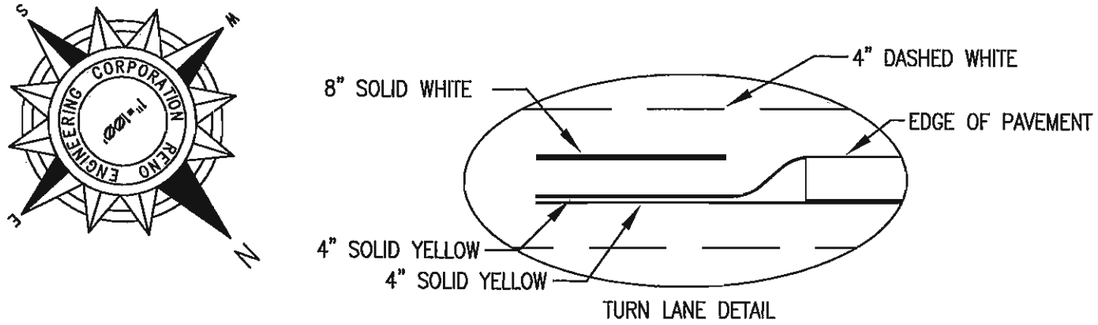
REVISIONS	BY	DATE

TAHOE / RENO INDUSTRIAL CENTER
USA PARKWAY EXTENSION

C28



TURN LANE DETAIL

"C1"
Δ=68°16'29"
R=1569.00 ft
L=1869.65 ft
T=1063.79 ft

"C2"
Δ=38°47'18"
R=1569.00 ft
L=1062.19 ft
T=552.35 ft

2008 - PHASE 3
2008 - PHASE 2

MATCH LINE STA: 400+00

MATCH LINE

PCC: 403+64.56

STA = 406+50
BEGIN 14" ROCK MEDIAN

8" SOLID WHITE

4" SOLID YELLOW STRIPE

4" WHITE, 10' STRIPE
W/ 30' GAP

4" SOLID WHITE
(FOG LINE)

12" STOP BAR

PORTOFINO

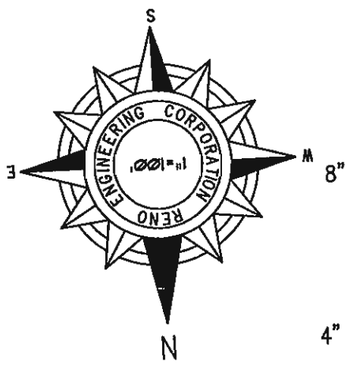
SPEED LIMIT 45 R2-1

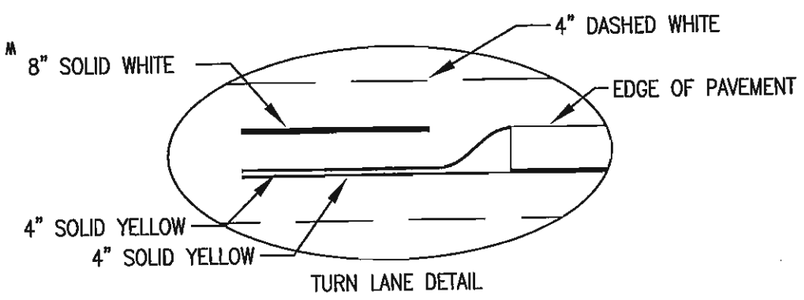
STOP R1-1

C55 C56 C57 C58 C59 C60 L28

400 405 410

284+00 283+00 282+00 281+00





TURN LANE DETAIL

MATCH LINE
C05
C06
PCC: 414+26.75
415
C54
STA = 420+50
END 14' ROCK MEDIAN
420
"C3"
Δ=26°18'30"
R=8000.18 ft
L=3673.43 ft
T=1869.68 ft
L26
STOP
R1-1
L25
12" STOP BAR
C53
C52
JAPAN
425
STA = 427+50
BEGIN 14' ROCK MEDIAN
MATCH LINE
C06
C07
C61
4" WHITE, 10' STRIPE
W/ 30' GAP
4" SOLID YELLOW STRIPE
C62
L29
C63
L30
4" SOLID WHITE
(FOG LINE)

REC

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CIVIL ENGINEERING · DESIGN · LAND PLANNING
6725 TECHNOLOGY WAY, SUITE B RENO, NV 89521
PHONE: (775) 852-5700 FAX: (775) 852-5707

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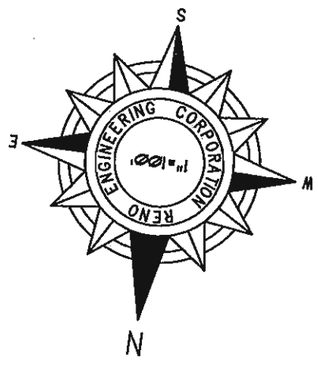
TAHOE / RENO INDUSTRIAL CENTER
USA PARKWAY EXTENSION
COMSTOCK MEADOWS

H2



MATCH LINE
C06
C07
C51
430
435
C64
440
445
4" SOLID WHITE
(FOG LINE)
4" WHITE, 10' STRIPE
W/ 30' GAP
4" SOLID YELLOW STRIPE
C07
C08
MATCH LINE

REC

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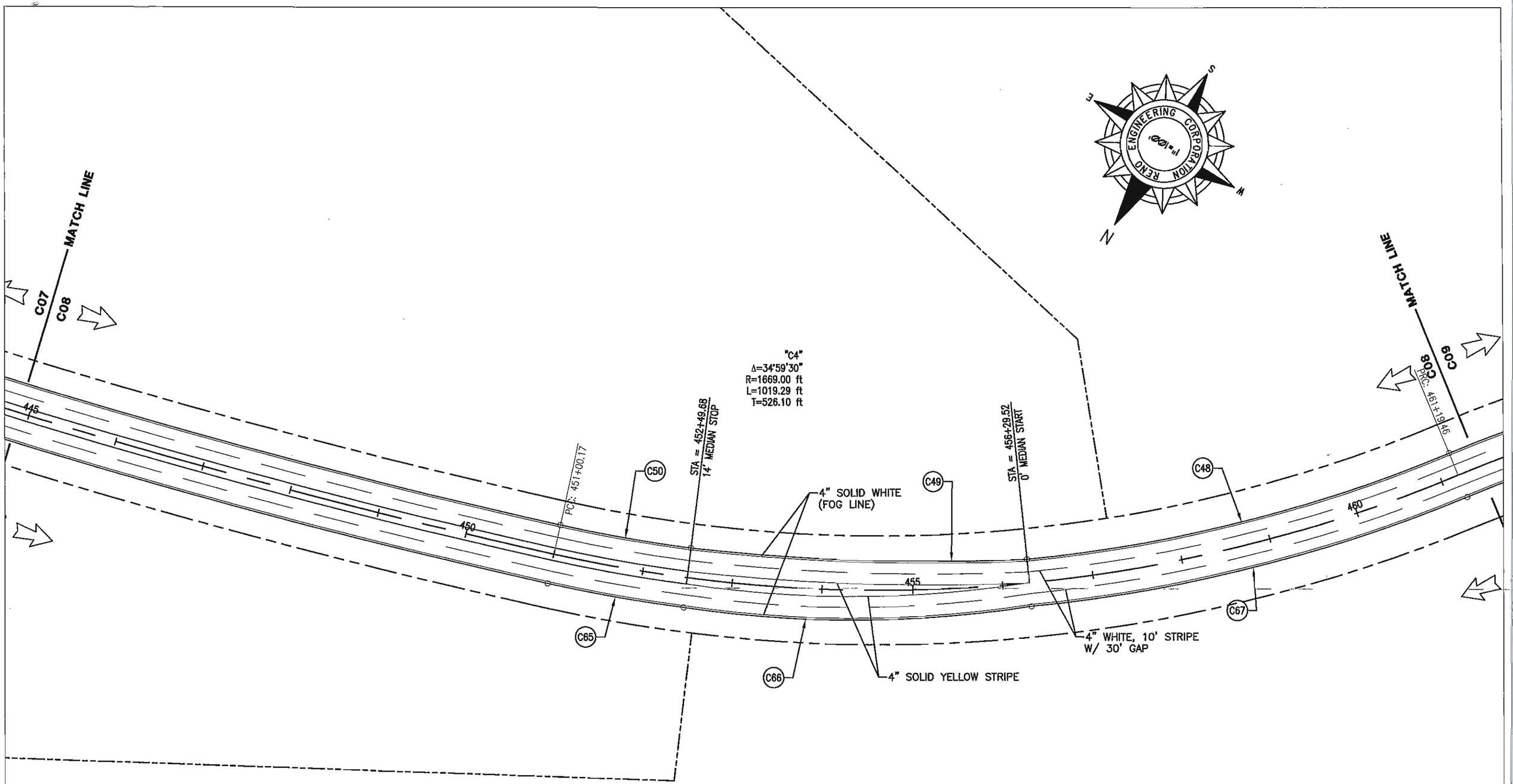
USA PARKWAY EXTENSION
COMSTOCK MEADOWS

H3



WATER-BID ALT A

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CIVIL ENGINEERING · DESIGN · LAND PLANNING
6725 TECHNOLOGY WAY, SUITE B RENO, NV 89521
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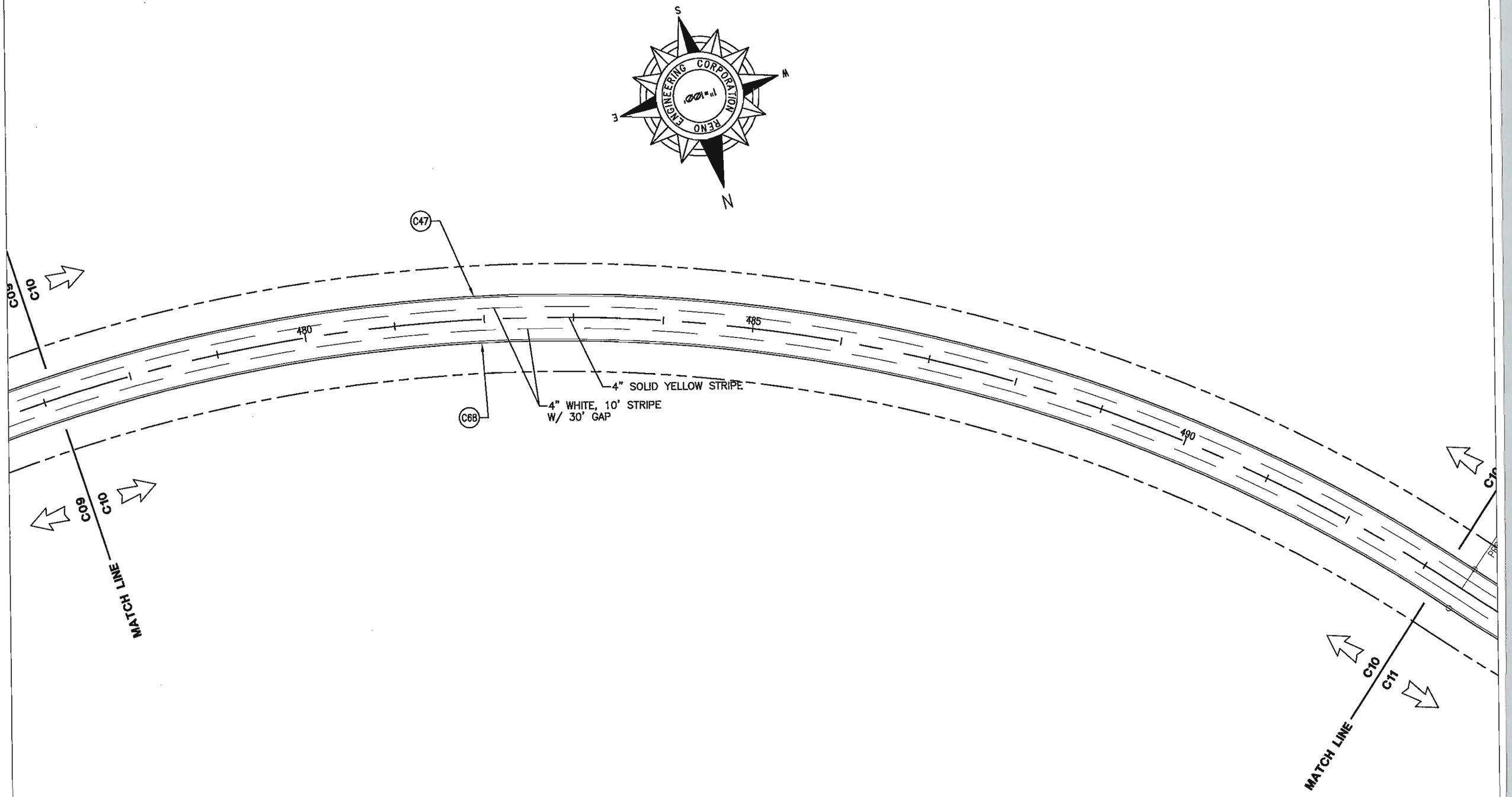
REVISIONS	BY	DATE

TAHOE / RENO INDUSTRIAL CENTER
USA PARKWAY EXTENSION

COMSTOCK MEADOWS

H4



WATER-BID ALT A

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REVISIONS	BY	DATE

TAHOE / RENO INDUSTRIAL CENTER
USA PARKWAY EXTENSION

COMSTOCK REVISIONS

H6

"C6"
Δ=24°02'21"
R=1500.00 ft
L=629.34 ft
T=319.37 ft

"C7"
Δ=33°40'40"
R=1669.00 ft
L=981.02 ft
T=505.14 ft

MATCH LINE

C10 C11

PRC: 493+48.15

C46

4" SOLID WHITE
(FOG LINE)

PRC: 499+77.65

C45

495

500

505

C70

C69

4" WHITE, 10' STRIPE
W/ 30' GAP

4" SOLID YELLOW STRIPE

C10 C11

MATCH LINE

C11 C12

L31

MATCH LINE

WATER-BID ALT A

REC

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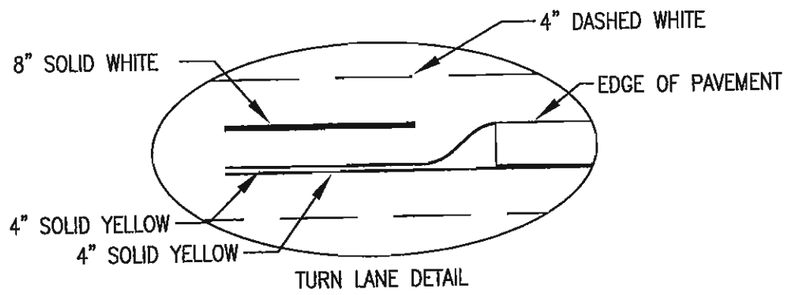
REVISIONS	BY	DATE

TAHOE / RENO INDUSTRIAL CENTER
USA PARKWAY EXTENSION

COMSTOCK MEADOWS

H7

MATCH LINE
C11
C12
STA = 510+15.16
0' MEDIAN STOP
PT: 508.67
L24
L23
STA = 514+00
14' MEDIAN START
L22
4" SOLID WHITE
(FOG LINE)
SPEED LIMIT 45
R2-1
STOP
R1-1
L21
C44
4" SOLID YELLOW
TIGER
L20
12' STOP BAR
STA = 520+74.47
BEGIN 14' ROCK MEDIAN
C43
C12
C13
MATCH LINE
510
515
520
525
L31
L32
L33
4" WHITE, 10' STRIPE
W/ 30' GAP
8" SOLID WHITE
SPEED LIMIT 45
R2-1
C11
C12
C12
C13
MATCH LINE
MATCH LINE



TURN LANE DETAIL

RENO ENGINEERING CORPORATION
CIVIL ENGINEERING · DESIGN · LAND PLANNING
6225 TECHNOLOGY WAY, SUITE B RENO, NV 89511
PHONE: (775) 852-5700 FAX: (775) 852-5707

REVISIONS | BY | DATE

TAHOE / RENO INDUSTRIAL CENTER
USA PARKWAY EXTENSION

COMMSTOCK

H8

MATCH LINE

C12 C13

L19

525

4" SOLID WHITE
(FOG LINE)

4" WHITE, 10' STRIPE
W/ 30' GAP

530 "T1" N32°03'23.90"W ~ 2316.93 ft

PC: 532+75.60

G42

"C8"
Δ=4°40'38"
R=1669.00 ft
L=136.25 ft
T=68.16 ft

PT: 534+11.85

L18

"T36" N27°22'45.43"W ~ 1088.1[illegible] ft

2008 - PHASE 2
2006 - PHASE 1
END PROJECT

EXIT STRIPE

FH

C71

L35

L34

540

FH

MATCH LINE

MATCH LINE

C12 C13

REC

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TAHOE / RENO INDUSTRIAL CENTER
USA PARKWAY EXTENSION

COMMSTOCK MEADOWS

H9

CURVE TABLE – ALIGNMENT				
NO.	Δ	R	L	T
"C1"	68°16'29"	1569.00'	1869.65'	1063.79'
"C2"	38°47'18"	1569.00'	1062.19'	552.35'
"C3"	26°18'30"	8000.18'	3673.43'	1869.68'
"C4"	34°59'30"	1669.00'	1019.29'	526.10'
"C5"	102°46'39"	1800.00'	3228.85'	2253.91'
"C6"	24°02'21"	1500.00'	629.34'	319.37'
"C7"	33°40'40"	1669.00'	981.02'	505.14'
"C8"	4°40'38"	1669.00'	136.25'	68.16'

LINE TABLE – ALIGNMENT						
LINE	LENGTH	BEARING	START NORTHING	START EASTING	END NORTHING	END EASTING
"T1"	2316.93'	N32°03'23.90"W	62258.72	75331.02	64222.38	74101.29
"T36"	1088.15'	N27°22'45.43"W	64340.67	74033.77	65306.93	73533.35

LINE TABLE – EDGE OF PAVEMENT						
LINE	LENGTH	BEARING	START NORTHING	START EASTING	END NORTHING	END EASTING
L18	112.64'	S27°22'45.43"E	64425.52	73952.66	64325.50	74004.46
L19	1223.66'	S32°03'23.90"E	64204.86	74073.32	63167.77	74722.79
L20	31.19'	S27°25'34.51"E	63079.84	74698.80	63052.16	74713.17
L21	7.22'	N62°34'25.49"E	63050.10	74719.66	63053.43	74726.07
L22	490.28'	S32°03'23.90"E	63030.94	74808.48	62615.42	75068.70
L23	384.98'	S33°05'53.76"E	62615.35	75068.75	62292.84	75278.97
L24	56.45'	S32°03'23.90"E	62292.76	75279.02	62244.92	75308.98
L25	34.70'	S87°51'05.94"E	62347.11	82783.02	62345.81	82817.69
L26	5.07'	N2°08'54.06"E	62348.99	82821.12	62354.06	82821.31
L27	66.00'	S66°06'33.99"E	60229.55	85010.81	60202.82	85071.15
L28	60.00'	N40°02'38.55"W	61921.67	84926.29	61967.60	84887.69
L29	34.79'	N87°51'05.94"W	62583.88	82829.93	62585.18	82795.16
L30	5.03'	S2°08'54.06"W	62582.10	82791.84	62577.07	82791.65
L31	56.46'	N32°03'23.90"W	62272.52	75353.05	62320.38	75323.09
L32	385.01'	N31°00'54.04"W	62320.43	75323.05	62650.39	75124.68
L33	1875.41'	N32°03'23.90"W	62650.44	75124.65	64239.89	74129.26
L34	109.43'	N27°22'45.43"W	64355.85	74063.07	64453.02	74012.74
L35	62.79'	S62°37'14.57"W	64454.40	74008.42	64425.52	73952.66

CURVE TABLE – EDGE OF PAVEMENT				
NO.	Δ	R	L	T
C42	4°40'39"	1702.00'	138.94'	69.51'
C43	94°37'49"	62.00'	102.40'	67.22'
C44	85°22'11"	63.00'	93.87'	58.10'
C45	33°40'40"	1695.00'	996.30'	513.00'
C46	24°02'21"	1474.00'	618.44'	313.83'
C47	102°46'39"	1826.00'	3275.49'	2286.47'
C48	16°49'10"	1643.00'	482.31'	242.90'
C49	8°45'11"	2440.81'	372.89'	186.81'
C50	5°07'39"	1636.00'	146.41'	73.25'
C51	18°27'28"	7967.18'	2566.62'	1294.52'
C52	93°01'01"	82.00'	133.12'	86.44'
C53	88°17'51"	82.00'	126.37'	79.60'
C54	6°22'53"	7967.18'	887.37'	444.14'
C55	38°47'18"	1536.00'	1039.85'	540.73'
C56	68°16'29"	1536.00'	1830.33'	1041.41'
C57	59°29'30"	1602.00'	1663.40'	915.46'
C58	85°33'26"	102.00'	152.31'	94.38'
C59	85°33'26"	102.00'	152.31'	94.38'
C60	38°41'08"	1602.00'	1081.66'	562.36'
C61	6°20'00"	8033.18'	887.95'	444.43'

CURVE TABLE – EDGE OF PAVEMENT				
NO.	Δ	R	L	T
C62	91°34'21"	82.00'	131.06'	84.28'
C63	86°55'06"	82.00'	124.40'	77.70'
C64	18°32'52"	8033.18'	2600.49'	1311.72'
C65	5°08'15"	1702.00'	152.61'	76.36'
C66	17°10'49"	1290.92'	387.08'	195.01'
C67	16°49'10"	1695.00'	497.58'	250.59'
C68	102°46'39"	1774.00'	3182.21'	2221.35'
C69	24°02'21"	1526.00'	640.25'	324.91'
C70	33°40'40"	1643.00'	965.73'	497.27'
C71	4°40'39"	1636.00'	133.56'	66.82'

REC

RENO ENGINEERING CORPORATION
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6725 TECHNOLOGY WAY, SUITE B RENO, NV 89521
PHONE: (775) 853-6700 FAX: (775) 853-6707

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TAHOE / RENO INDUSTRIAL CENTER
USA - GEOMETRIC PLAN

COMSTOCK MEADOWS

H10

APPENDIX I: CORING AND PAVEMENT REPORT

PAVEMENT ANALYSIS AND CORING SUMMARY

This document summarizes the findings following pavement analysis of the existing paved section of USA Parkway. The following information was provided to NDOT's Material Division in order to determine the needed structural section for the specified limits of the proposed USA Parkway Project:

- Use NDOT's typical pavement structural design criteria, guidelines, and codes; and
- Use traffic data provided by Traffic Division for years 2017 to 2037.

I addition, determination of a possible rehabilitation strategy has been provided if the existing pavement structural section is found to be not in accordance with what typically NDOT would design for this type of facility.

Due to existence of variable strength subgrade, the paved segment of USA Parkway was divided into three sections, called Zone A, Zone B, and Zone C, to better define the strength parameters of the subgrade, aggregate base, and pavement.

ZONE A: FROM I-80 TO 0.5 MILES SOUTH OF WALTHAM WAY

This zone is represented by test holes 20-25

Test Hole	PBS Depth	Base Depth	R-Value
20	4.75"	10"	~~64~~ **
21	5.38"	6"	33
22	4.50"	10"	30
23	5.38"	9"	38
24	4.75"	12"	25
25	~~8.63"~~ *	~~4.0"~~ *	28
Average	4.95"	9.4"	30.8

* Did not use these depths for the averages because the location of this test hole was in between the bridges, most likely built under an NDOT contract and is not a good representation of what the developer placed.
** This R-Value was an outlier and not used in the average.

The following is the DARWin output if NDOT were to have designed the structural section for this segment of USA Pkwy:

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Flexible Structural Design Module

2017 Initial Construction of SR 439
R-Value = 30
Based on 2017 projected traffic numbers

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	10,364,421
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	75 %
Overall Standard Deviation	0.45
Roadbed Soil Resilient Modulus	6,900 psi
Stage Construction	1
Calculated Design Structural Number	4.48 in

Simple ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	6,600
Number of Lanes in Design Direction	2
Percent of All Trucks in Design Lane	85 %
Percent Trucks in Design Direction	57 %
Percent Heavy Trucks (of ADT) FHWA Class 5 or Greater	24.79 %
Average Initial Truck Factor (ESALs/truck)	0.928
Annual Truck Factor Growth Rate	0 %
Annual Truck Volume Growth Rate	6.44 %
Growth	Compound
Total Calculated Cumulative ESALs	10,364,421

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	2017 Plantmix	0.35	1	8	12	2.80
2	Type 1 Class B Aggregate Base	0.1	1	12	12	1.20
3	Select Borrow	0.07	1	8	12	0.56
Total	-	-	-	28.00	-	4.56

In accordance with the above calculation, NDOT's roadbed structural design would have been as follows:

Plantmix Bituminous Open Graded Surface (PG 64-28NV) (⅜" Size)	¾"
Plantmix Bituminous Surface (PG 64-28NV) (Type 2C)	8"
Type 1 Class B Aggregate Base	12"
Nonwoven Geotextile	
Select Borrow	8"

If this segment were to be rehabilitated in 2016/2017 about the time USA Parkway is opened to full traffic it would be 10 years old. It is valid to say from past experience that at least a 1 ½" mill would be necessary to remove the future distresses. A plantmix overlay would then be needed to structurally make this section adequate for a design life of 20 years. The existing material reveals there is approximately 5" of plantmix on 9.4" of aggregate base.

Following is the DARWin output if NDOT were to rehabilitate the already existing pavement for a 20 year design:

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Flexible Structural Design Module

2017 Rehabilitation of SR 439
R-Value = 30
Based on 2017 projected traffic numbers

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	10,364,421
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	75 %
Overall Standard Deviation	0.45
Roadbed Soil Resilient Modulus	6,900 psi
Stage Construction	1
Calculated Design Structural Number	4.48 in

Simple ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	6,600
Number of Lanes in Design Direction	2
Percent of All Trucks in Design Lane	85 %
Percent Trucks in Design Direction	57 %
Percent Heavy Trucks (of ADT) FHWA Class 5 or Greater	24.79 %
Average Initial Truck Factor (ESALs/truck)	0.928
Annual Truck Factor Growth Rate	0 %
Annual Truck Volume Growth Rate	6.44 %
Growth	Compound
Total Calculated Cumulative ESALs	10,364,421

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	2017 Plantmix	0.35	1	7	12	2.45
2	Old Plantmix	0.32	1	3.5	12	1.12
3	Aggregate Base	0.1	1	9.4	12	0.94
Total	-	-	-	19.90	-	4.51

In accordance with the above DARWin calculation, NDOT would recommend the following rehabilitation strategy:

Plantmix Bituminous Open Graded Surface (PG 64-28NV) (⅜" Size)	¾"
Plantmix Bituminous Surface (PG 64-28NV) (Type 2C)	7"
Cold Mill	1 ½"

ZONE B: FROM 0.5 MILES SOUTH OF WALTHAM WAY TO 140' SOUTH OF DENMARK

This zone is represented by test holes 17-19.

Test Hole	PBS Depth	Base Depth	R-Value
17	4.50"	5"	14
18	5.00"	9"	14
19	4.50"	8"	13
Average	4.67"	7.33"	13.67

The following is the DARWin output if NDOT were to have designed the structural section for this segment of USA Pkwy:

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

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Flexible Structural Design Module

2017 Initial Construction of SR 439
R-Value = 14
Based on 2017 projected traffic numbers

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	10,364,421
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	75 %
Overall Standard Deviation	0.45
Roadbed Soil Resilient Modulus	4,000 psi
Stage Construction	1
Calculated Design Structural Number	5.34 in

Simple ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	6,600
Number of Lanes in Design Direction	2
Percent of All Trucks in Design Lane	85 %
Percent Trucks in Design Direction	57 %
Percent Heavy Trucks (of ADT) FHWA Class 5 or Greater	24.79 %
Average Initial Truck Factor (ESALs/truck)	0.928
Annual Truck Factor Growth Rate	0 %
Annual Truck Volume Growth Rate	6.44 %
Growth	Compound
Total Calculated Cumulative ESALs	10,364,421

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	2017 Plantmix	0.35	1	8	12	2.80
2	Type 1 Class B Aggregate Base	0.1	1	12	12	1.20
3	Select Borrow	0.07	1	20	12	1.40
Total	-	-	-	40.00	-	5.40

In accordance with the above calculation, NDOT's roadbed structural design would have been as follows:

Plantmix Bituminous Open Graded Surface (PG 64-28NV) (⅜" Size)	¾"
Plantmix Bituminous Surface (PG 64-28NV) (Type 2C)	8"
Type 1 Class B Aggregate Base	12"
Nonwoven Geotextile	
Select Borrow	20"

An overlay on this section is not recommended because of the substantial thickness increase of plantmix required to make this segment structurally adequate for a 20 year design. For rehabilitation in this section, NDOT would recommend full depth reconstruct as follows:

Plantmix Bituminous Open Graded Surface (PG 64-28NV) (⅜" Size)	¾"
Plantmix Bituminous Surface (PG 64-28NV) (Type 2C)	8"
Type 1 Class B Aggregate Base	12"
Nonwoven Geotextile	
Select Borrow	20"
Roadway Excavation	40 ¾"

ZONE B: FROM 140' SOUTH OF DENMARK TO 260' NORTH OF SOUTH PORTOFINO

This zone is represented by test holes 1-16.

Test Hole	PBS Depth	Base Depth	R-Value
1	5.13	10	46
2	5.25	11	75
3	5.13	6	54
4	5.13	11	40
5	5.13	9	32
6	4.75	9	47
7	5.50	12	65
8	5.13	13	16
9	5.50	9	53
10	5.38	12	53
11	4.75	8	36
12	5.00	12	73
13	4.75	9	51
14	5.00	9	34
15	5.63	6	72
16	5.38	9	57
Average	5.16	9.69	50.25*

*NDOT uses a maximum R-value of 45 because of the minimum requirement for placed borrow having an R-value 45.

The following is the DARWin output if NDOT were to have designed the structural section for this segment of USA Pkwy:

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Flexible Structural Design Module

2017 Initial Construction of SR 439
R-Value = 45
Based on 2017 projected traffic numbers

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	10,364,421
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	75 %
Overall Standard Deviation	0.45
Roadbed Soil Resilient Modulus	11,250 psi
Stage Construction	1
Calculated Design Structural Number	3.79 in

Simple ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	6,600
Number of Lanes in Design Direction	2
Percent of All Trucks in Design Lane	85 %
Percent Trucks in Design Direction	57 %
Percent Heavy Trucks (of ADT) FHWA Class 5 or Greater	24.79 %
Average Initial Truck Factor (ESALs/truck)	0.928
Annual Truck Factor Growth Rate	0 %
Annual Truck Volume Growth Rate	6.44 %
Growth	Compound
Total Calculated Cumulative ESALs	10,364,421

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	2017 Plantmix	0.35	1	8	12	2.80
2	Type 1 Class B Aggregate Base	0.1	1	12	12	1.20
Total	-	-	-	20.00	-	4.00

In accordance with the above calculation, NDOT's roadbed structural design would have been as follows:

Plantmix Bituminous Open Graded Surface (PG 64-28NV) (⅜" Size)	¾"
Plantmix Bituminous Surface (PG 64-28NV) (Type 2C)	8"
Type 1 Class B Aggregate Base	12"
Nonwoven Geotextile	

If this segment were to be rehabilitated in 2016/2017 about the time USA Parkway is opened to full traffic it would be 10 years old. It is valid to say from past experience that at least a 1 ½" mill would be necessary to remove the future distresses. A plantmix overlay would then be needed to structurally make this section adequate for a design life of 20 years. The existing material reveals there is approximately 5" of plantmix on 9.7" of aggregate base.

The following is the DARWin output if NDOT were to bring the already existing pavement up to a 20 year design following an 1 ½" cold mill:

1993 AASHTO Pavement Design

DARWin Pavement Design and Analysis System

A Proprietary AASHTOWare
Computer Software Product

Flexible Structural Design Module

2017 Rehabilitation of SR 439
R-Value = 45
Based on 2017 projected traffic numbers

Flexible Structural Design

18-kip ESALs Over Initial Performance Period	10,364,421
Initial Serviceability	4.5
Terminal Serviceability	2.5
Reliability Level	75 %
Overall Standard Deviation	0.45
Roadbed Soil Resilient Modulus	11,250 psi
Stage Construction	1
Calculated Design Structural Number	3.79 in

Simple ESAL Calculation

Performance Period (years)	20
Two-Way Traffic (ADT)	6,600
Number of Lanes in Design Direction	2
Percent of All Trucks in Design Lane	85 %
Percent Trucks in Design Direction	57 %
Percent Heavy Trucks (of ADT) FHWA Class 5 or Greater	24.79 %
Average Initial Truck Factor (ESALs/truck)	0.928
Annual Truck Factor Growth Rate	0 %
Annual Truck Volume Growth Rate	6.44 %
Growth	Compound
Total Calculated Cumulative ESALs	10,364,421

Specified Layer Design

Layer	Material Description	Struct Coef. (Ai)	Drain Coef. (Mi)	Thickness (Di)(in)	Width (ft)	Calculated SN (in)
1	2017 Plantmix	0.35	1	5	12	1.75
2	Old Plantmix	0.32	1	3.5	12	1.12
3	Type 1 Class B Aggregate Base	0.1	1	9.7	12	0.97
Total	-	-	-	18.20	-	3.84

In accordance with the above DARWin calculation, NDOT would recommend the following rehabilitation strategy:

Plantmix Bituminous Open Graded Surface (PG 64-28NV) (⅜" Size)	¾"
Plantmix Bituminous Surface (PG 64-28NV) (Type 2C)	5"
Cold Mill	1 ½"

Lane Abbreviations: Center Turn Lane = Cntr Trn Location Abbreviations: Gutter Pan = GP, Right/Left /Between Wheel Path = RWP/LWP/BWP, Centerline = CL, EastBound = EB, WestBound = WB, NorthBound = NB, SouthBound = SB Core Abbreviations: Stripped = STRP, Delaminated = DELM, Broke = BRK, Bottom = BTM, Roadmix = RM, Roadbed Modification = RBM, Plantmix Bituminous Surface = PBS, Cement Treated Base = CTB, Ligh t= LT, Medium = MED, Heavy = HVY, Stripped and Fell Apart = STRP&FA, Plantmix Bituminous Base = PBB

MATERIALS DIVISION CORE DATA SHEET

Limits listed are in County Cumulative Miles

OS999 WA 0.000 **To** 6.295 Date 5/15/2012 To 5/16/2012

Project Description: USA PARKWAY FROM THE BEGINNING OF PAVEMENT TO THE JUNCTION OF RAMPS 3&4

Test Hole No	County Cum Mile	Distance to CL (ft)	Side	Direction	Lane No	Location Remarks	Total Depth (in)	PBS Depth (in)	Core Size (in)	Core Condition
1	0.098	10.00	LT	NB	Lane 1	NEAR SHOULDER / 260' NW OF SOUTH PORTOFINO STREET / NE SIDE	5.13	5.13	4	
2	0.327	6.17	LT	SB	Lane 2	BWP / 2640' (1/2 MILE) EAST OF TEST HOLE #4 / SOUTH SIDE	5.25	5.25	4	
3	0.596	8.58	LT	NB	Lane 1	LWP / 2640' (1/2 MILE) WEST OF TEST HOLE #1 / NORTH SIDE	5.13	5.13	4	
4	0.822	6.00	LT	SB	Lane 2	BWP / 2640' (1/2 MILE) EAST OF TEST HOLE #6 / SOUTH SIDE	5.13	5.13	4	
5	1.096	7.08	LT	NB	Lane 1	LWP / 2640' (1/2 MILE) WEST OF TEST HOLE #3 / NW SIDE	5.13	5.13	4	
6	1.319	9.00	LT	SB	Lane 2	RWP / 2640' (1/2 MILE) EAST OF TEST HOLE #8 / SOUTH SIDE	4.75	4.75	4	
7	1.599	7.08	LT	NB	Lane 1	LWP / 2640' (1/2 MILE) WEST OF TEST HOLE #5 / NE SIDE	5.50	5.50	4	
8	1.830	8.00	LT	SB	Lane 2	RWP / 4670' SE OF SYDNEY DRIVE / SW SIDE	5.13	5.13	4	
9	2.097	7.25	LT	NB	Lane 1	LWP / 3350' SE OF SYDNEY DRIVE / EAST SIDE	5.50	5.50	4	
10	2.336	8.33	RT	SB	Lane 1	LWP / 2030' SOUTH OF SYDNEY DRIVE / WEST SIDE	5.38	5.38	4	
11	2.601	8.75	LT	NB	Lane 1	LWP / 710' SOUTH OF SYDNEY DRIVE / EAST SIDE	4.75	4.75	4	
12	2.831	8.17	RT	SB	Lane 1	LWP / 560' NORTH OF SYDNEY DRIVE / WEST SIDE	5.00	5.00	4	
13	3.089	7.83	LT	NB	Lane 1	LWP / 2340' SOUTH OF ITALY STREET / EAST SIDE	4.75	4.75	4	
14	3.335	8.58	RT	SB	Lane 1	LWP / 1020' SOUTH OF ITALY STREET / WEST SIDE	5.00	5.00	4	
15	3.592	7.50	LT	NB	Lane 1	LWP / 290' NORTH OF ITALY STREET / EAST SIDE	5.63	5.63	4	DELM @ 4.50"
16	3.830	8.00	RT	SB	Lane 1	LWP / 1460' SOUTH OF DENMARK STREET / WEST SIDE	5.38	5.38	4	
17	4.088	7.92	LT	NB	Lane 1	LWP / 140' SOUTH OF DENMARK STREET / EAST SIDE	4.50	4.50	4	
18	4.341	9.50	LT	SB	Lane 2	RWP / 1520' SOUTH OF PITTSBRUG STREET / WEST SIDE	5.00	5.00	4	
19	4.592	7.67	LT	NB	Lane 1	LWP / 200' SOUTH OF PITTSBURG STREET / EAST SIDE	4.50	4.50	4	
20	4.828	10.33	LT	SB	Lane 2	NEAR SHOULDER / 1910' SOUTH OF WALTHAM STREET / WEST SIDE	4.75	4.75	4	
21	5.088	7.92	LT	NB	Lane 1	LWP / 590' SOUTH OF WALTHAM STREET / EAST SIDE	5.38	5.38	4	
22	5.341	9.00	LT	SB	Lane 2	RWP / 420' SOUTH OF BRITAIN/PORTOFINO ROAD / WEST SIDE	4.50	4.50	4	
23	5.589	8.58	RT	NB	Lane 2	RWP / 900' NORTH OF BRITAIN/PORTOFINO ROAD / EAST SIDE	5.38	5.38	4	
24	5.846	9.00	LT	SB	Lane 2	RWP / 1320' SOUTH OF THE SOUTH END OF STRUCTURE B-2797 / WEST SIDE	4.75	4.75	4	
25	6.086	10.08	RT	NB	Lane 2	RWP / 300' SOUTH OF SOUTH END OF STRUCTURE B-2797 / EAST SIDE	8.63	8.63	4	

Comment Matrix and Responses

Comment No.	Comment	Response
1	ADA Ramps were not addressed. Was Jacobs asked to address such aspects as ADA compliance. The original plans show ADA ramps that do not meet Compliance, were they installed per plan originally?	An evaluation of ADA compliance was not conducted; however, it should be noted that there are no existing sidewalks or pedestrian ramps along the existing portion of USA Parkway. Text has been added to section 3.3.7.5 indicating this fact.
2	Flare rate on end terminals will be in Compliance when installed using NDOT's Standard Plans.	Yes, when guardrail end terminals are installed per NDOT's Standard Plans, the improper flare rates would be corrected.
3	Calculate the guardrail length-of-need for the given design speed.	The guardrail length of need is highly dependant on the location of the obstacle and type of guardrail installation. Generally for at 50 mph design speed using a flared terminal, the length of need falls between 70 ad 150 feet.
4	Were bike lanes and associated impacts evaluated (if this is will become part of NDOT's master plan)?	Bike lanes were not included as part of the evaluation process.
5	The drainage compliance report in the appendix is the same report we reviewed and provided comments on in March, so those comments still stand until revisions to the report are complete.	The report has been updated.
6	Was the roadway structural integrity evaluated?	NDOT Materials is performing a pavement analysis on the existing pavement and base. The report and supporting documentation is included in Appendix I of this evaluation.
7	Was maintenance access, etc evaluated?	Maintenance access was evaluated only at the request of District 2. At this time, District 2 has not requested evaluation of any additional maintenance access issues along USA Parkway. Some issues discusses during the field review included: where pipe inlets would require specialized equipment for maintenance due to the steepness of the inlet slopes, where guardrail positioning currently limits access to inlets, and at an inlet near the north end where access for maintenance would be difficult.
8	If we are to widen the roadway to accommodate new shoulders, what are the environmental impacts?	The current environmental process
9	Section 3.3.7.1: There is a typo in the first sentence "preformed cores" instead of "performed coring".	Changed text in Section 3.3.7.1.
10	Concern was expressed about the amount of embankment material needed to bring shoulder widths and roadside slope into compliance with NDOT Standards. Be reminded that a concern expressed during a scoping meeting was an excess of materials generated from straightening out a curve to bring it into compliance with the proposed design speed. The decision was made to use the lower design speed for the curve, but modifications could be made to that curve, increasing the design speed just to the point where sufficient material is made available for the project needs.	Our goal is to balance the earthwork as much as is practical and this curve represents just one component of the overall earthwork evaluation. As mentioned in the Section 4.0 of the document, additional analysis is need to determine final details of the possible solutions identified as well as their benefit to the overall project.