DOCKETED	
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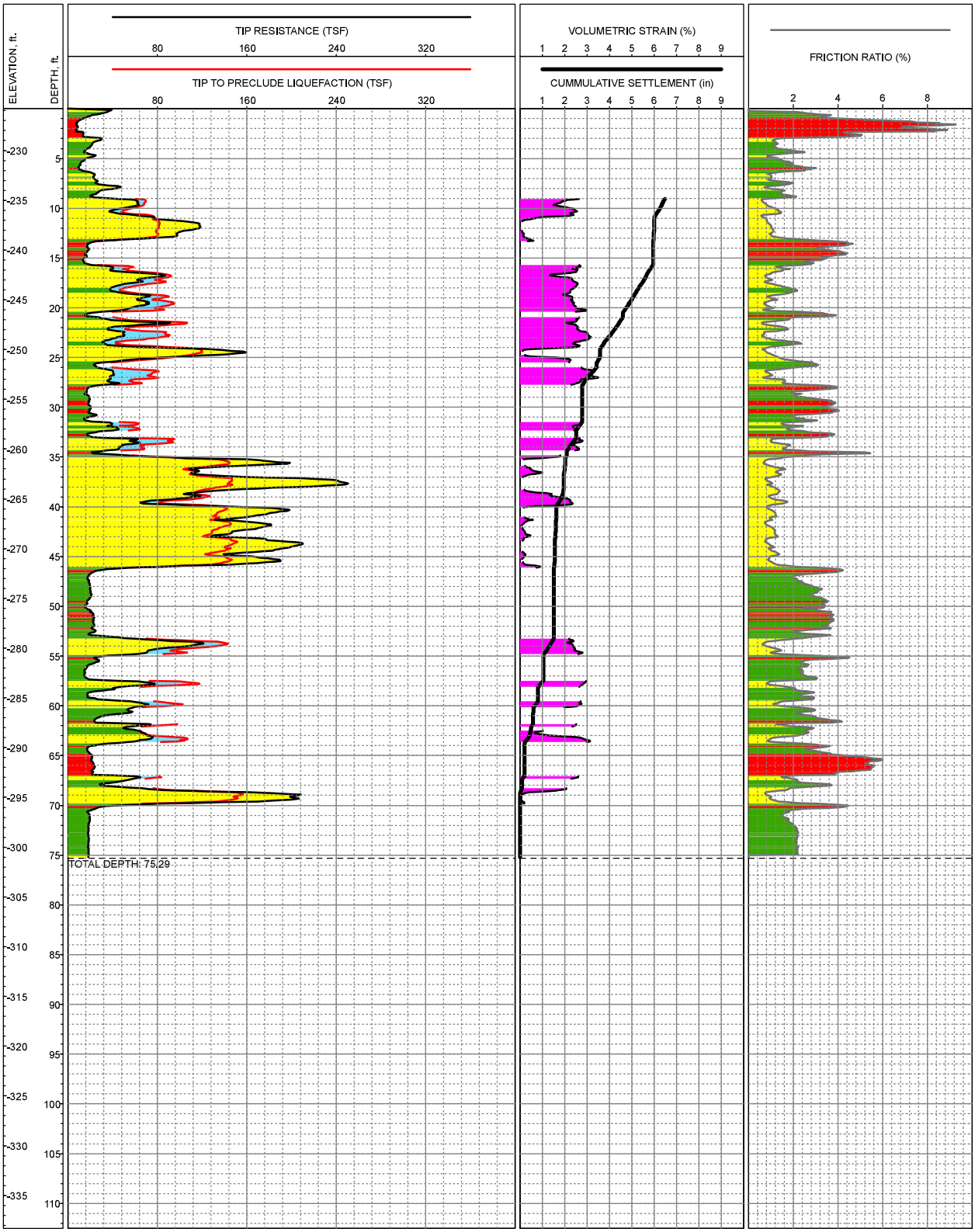
Docketed Date:	10/2/2023



LOCATION: E6,751,918, N2,004,171, CA State Plane, Zone 6, NAD83, Feet
SURFACE EL: -225.8ft +/- (NAVD88)
COMPLETION DEPTH: 75.29ft
TESTDATE: 10/8/2008

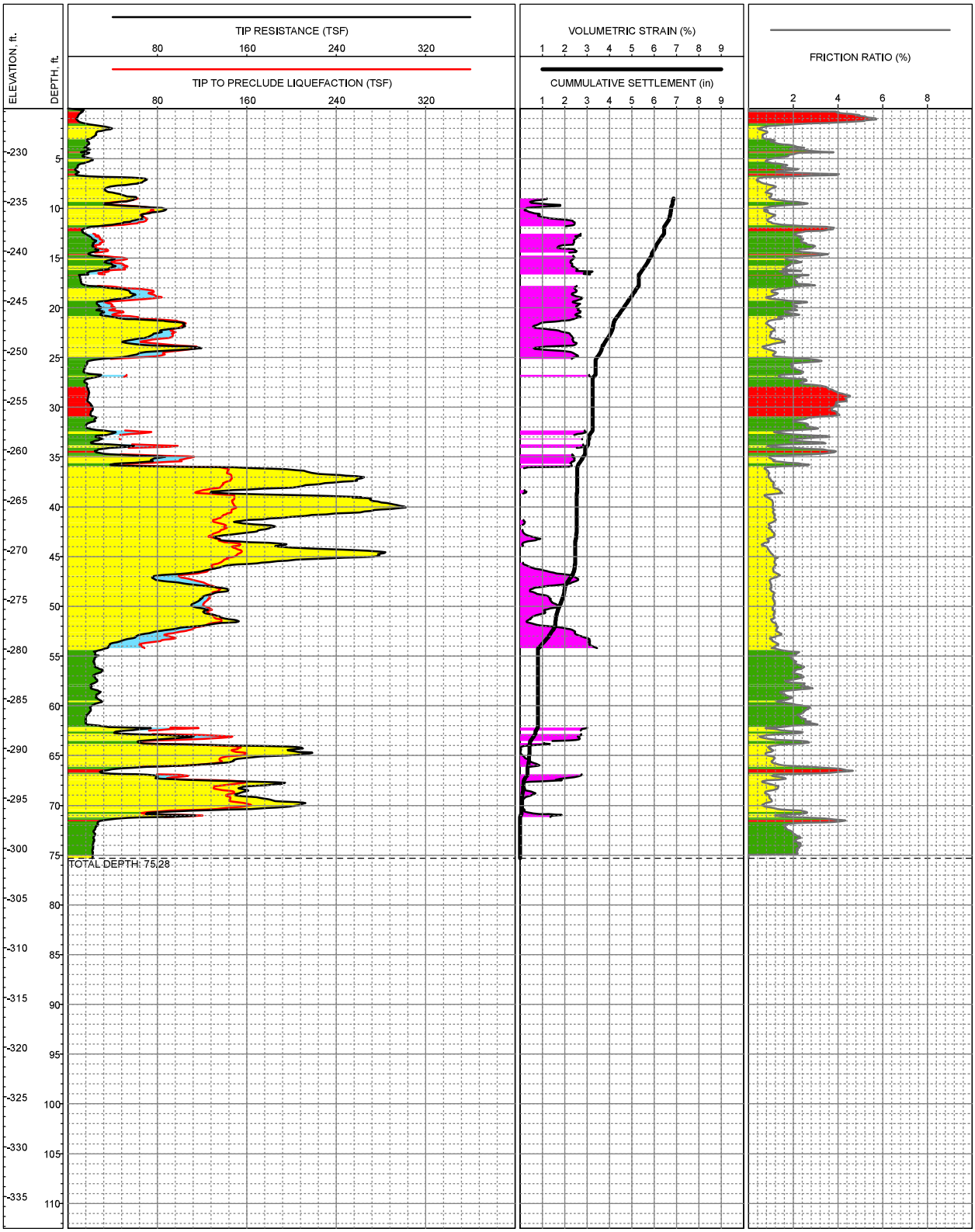
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Kehoe Testing & Engineering
REVIEWED BY: Jon Everett

LIQUEFACTION LOG OF CPT NO: C-113

P.G.A. = 0.40g and Mw = 6.5
Black Rock Units 1, 2 & 3
Calipatria, California

FIGURE C-14

N:\Projects\3652_CalEnergy\3652-001_Black_Rock\Explorations\CPT\2008\Logs\Logs_BlackRock123_Liqu_2008_12_18\MXD\Logs_BlackRock123_Liqu_2008_12_18.mxd 01/16/2009 CDean



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COMPLETION DEPTH: 75.28ft
TESTDATE: 10/8/2008

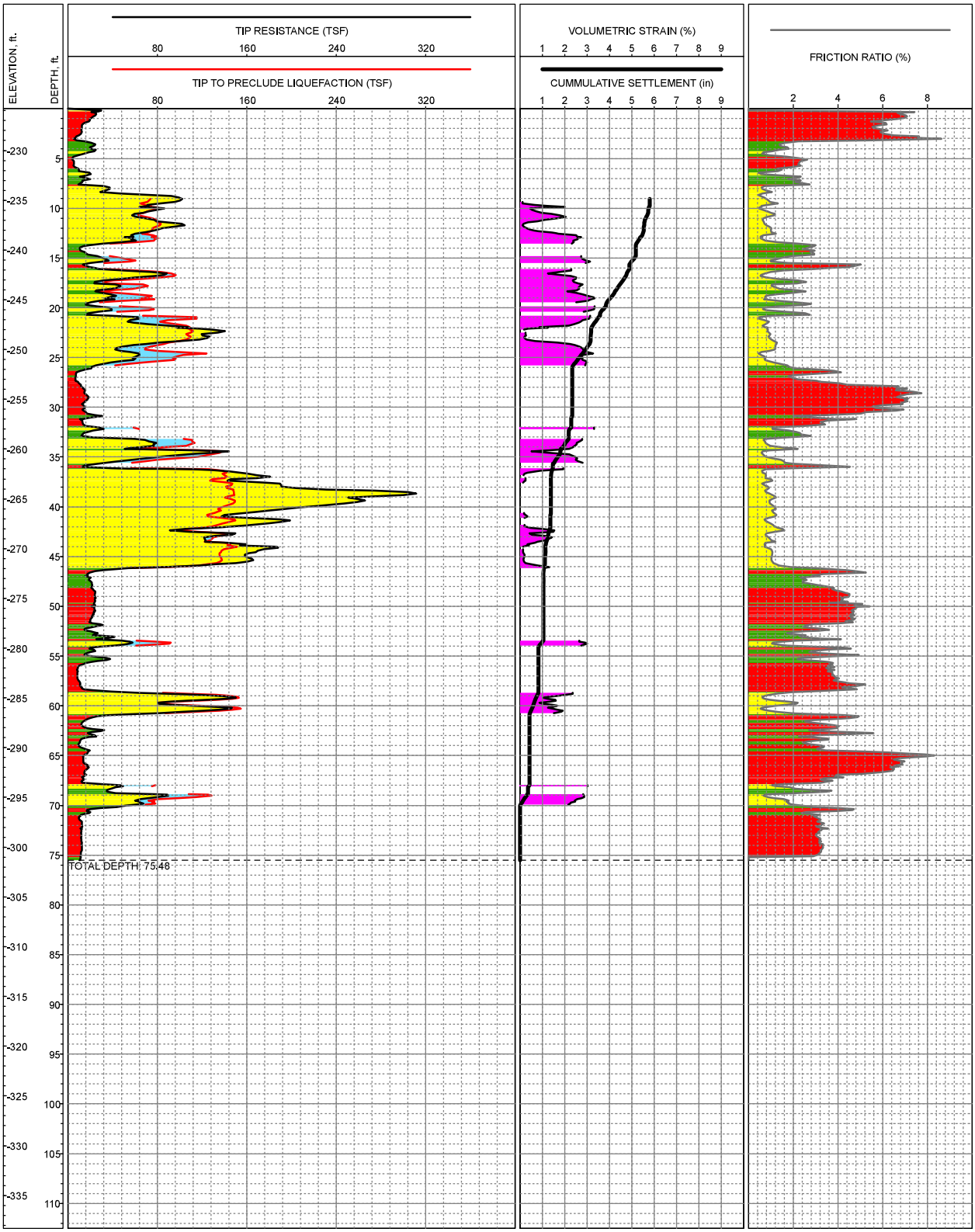
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Kehoe Testing & Engineering
REVIEWED BY: Jon Everett

LIQUEFACTION LOG OF CPT NO: C-114

P.G.A. = 0.40g and Mw = 6.5
Black Rock Units 1, 2 & 3
Calipatria, California

FIGURE C-15

N:\Projects\3652_CalEnergy\3652-001_Black_Rock\Explorations\CPT\2008\Logs\Logs_BlackRock123_Liqu_2008_12_18\MXD\Logs_BlackRock123_Liqu_2008_12_18.mxd.01/16/2009.CDean



LOCATION: E6,752,273, N2,004,188, CA State Plane, Zone 6, NAD83, Feet
SURFACE EL: -225.8ft +/- (NAVD88)
COMPLETION DEPTH: 75.48ft
TESTDATE: 10/9/2008

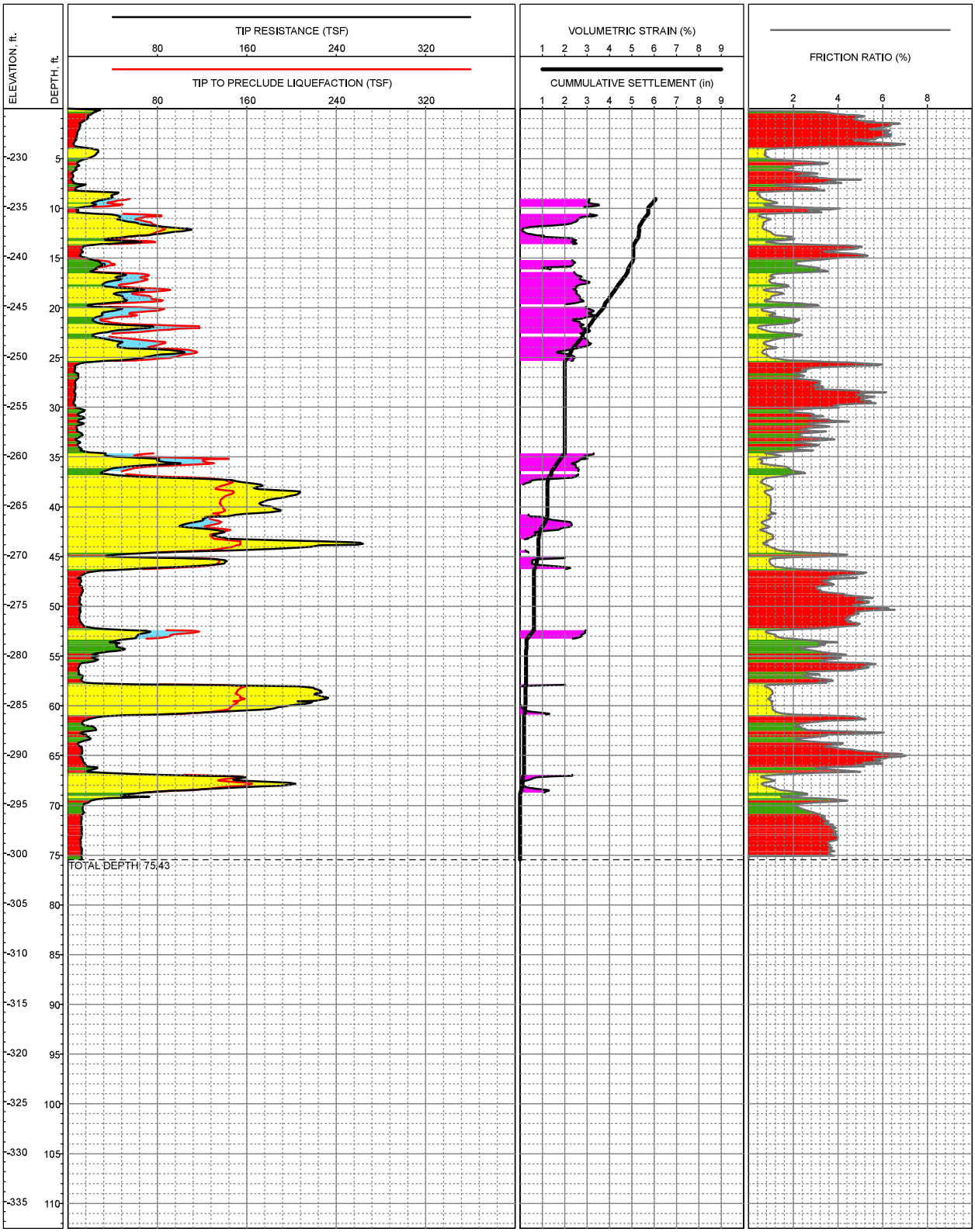
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Kehoe Testing & Engineering
REVIEWED BY: Jon Everett

LIQUEFACTION LOG OF CPT NO: C-115

P.G.A. = 0.40g and Mw = 6.5
Black Rock Units 1, 2 & 3
Calipatria, California

FIGURE C-16

N:\Projects\3652_CalEnergy\3652-001_Black_Rock\Explorations\CPT\2008\Logs\Logs_BlackRock123_Liqu_2008_12_18\MXD\Logs_BlackRock123_Liqu_2008_12_18.mxd.01/16/2009.CDean



LOCATION: E6,752,408, N2,004,134, CA State Plane, Zone 6, NAD83, Feet
SURFACE EL: -225.2ft +/- (NAVD88)
COMPLETION DEPTH: 75.43ft
TESTDATE: 10/8/2008

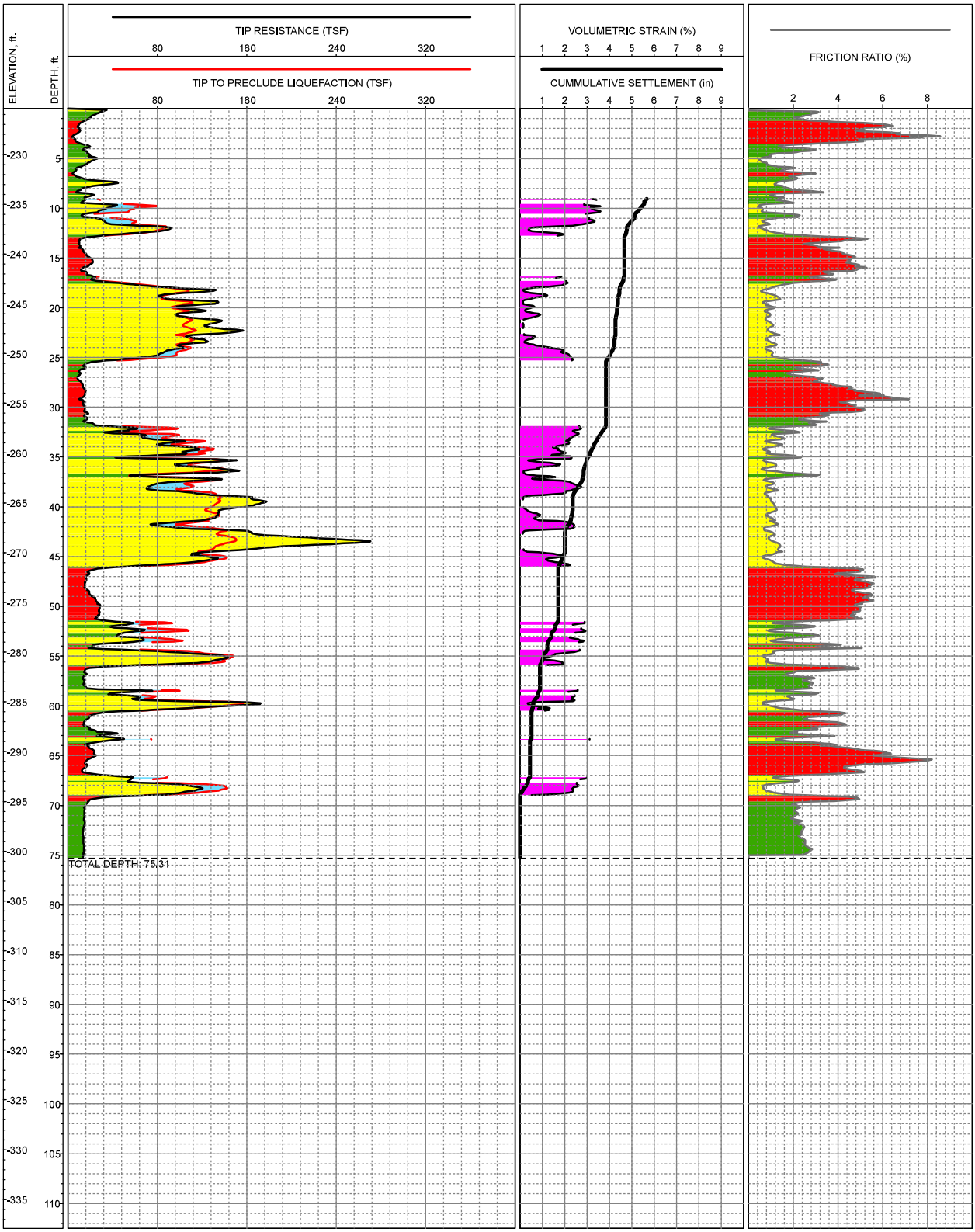
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Kehoe Testing & Engineering
REVIEWED BY: Jon Everett

LIQUEFACTION LOG OF CPT NO: C-116

P.G.A. = 0.40g and Mw = 6.5
Black Rock Units 1, 2 & 3
Calipatria, California

FIGURE C-17

N:\Projects\3652_CalEnergy\3652-001_Black_Rock\Explorations\CPT\2008\Logs\Logs_BlackRock123_Liqu_2008_12_18\MXD\Logs_BlackRock123_Liqu_2008_12_18.mxd 01/16/2009 CDean



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SURFACE EL: -225.4ft +/- (NAVD88)
COMPLETION DEPTH: 75.31ft
TESTDATE: 10/9/2008

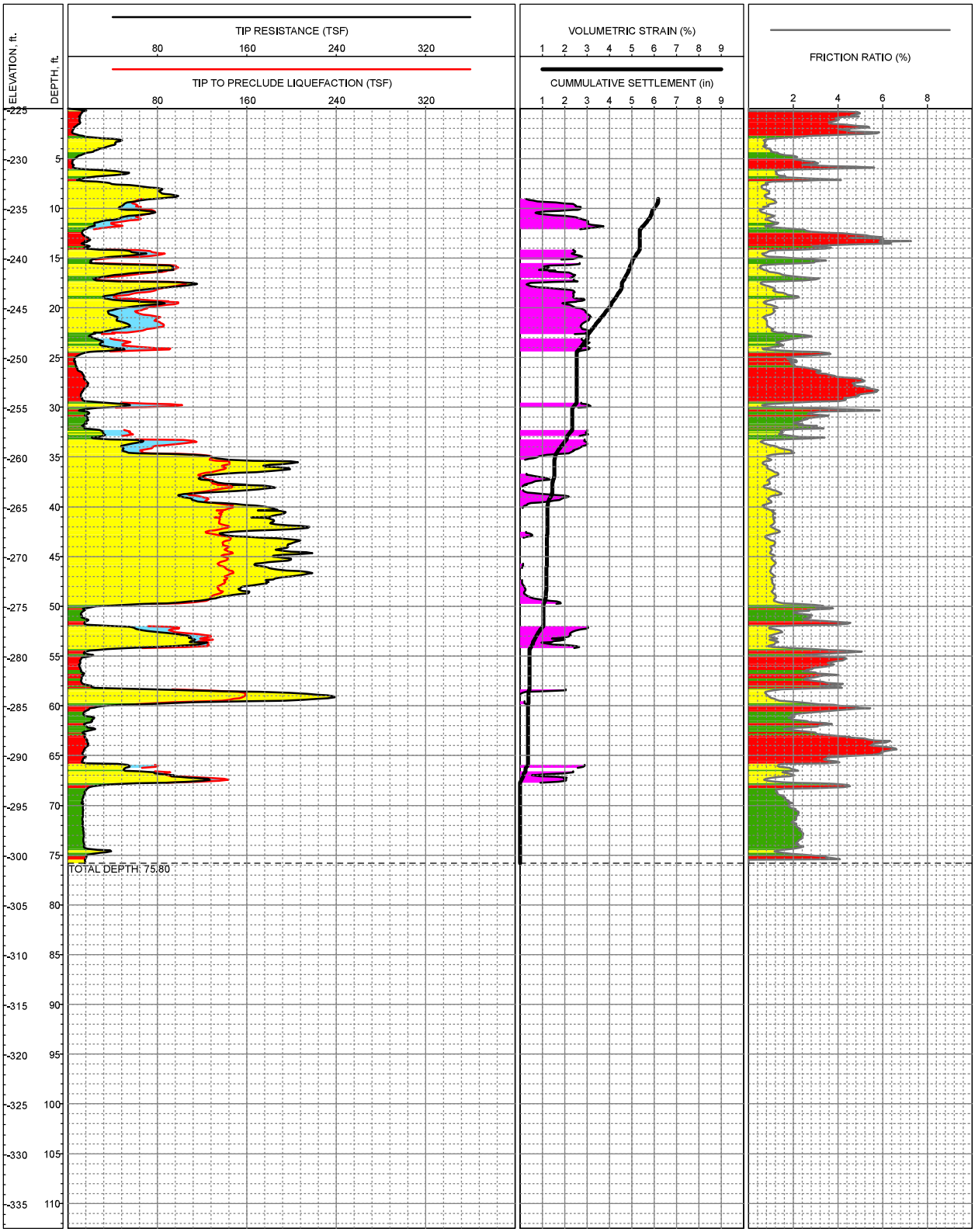
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Kehoe Testing & Engineering
REVIEWED BY: Jon Everett

LIQUEFACTION LOG OF CPT NO: C-117

P.G.A. = 0.40g and Mw = 6.5
Black Rock Units 1, 2 & 3
Calipatria, California

FIGURE C-18

N:\Projects\3652_CalEnergy\3652-001_Black_Rock\Explorations\CPT\2008\Logs\Logs_BlackRock123_Liqu_2008_12_18\MXD\Logs_BlackRock123_Liqu_2008_12_18.mxd 01/16/2009 CDean



LOCATION: E6,752,706, N2,004,045, CA State Plane, Zone 6, NAD83, Feet
SURFACE EL: -224.9ft +/- (NAVD88)
COMPLETION DEPTH: 75.80ft
TESTDATE: 10/9/2008

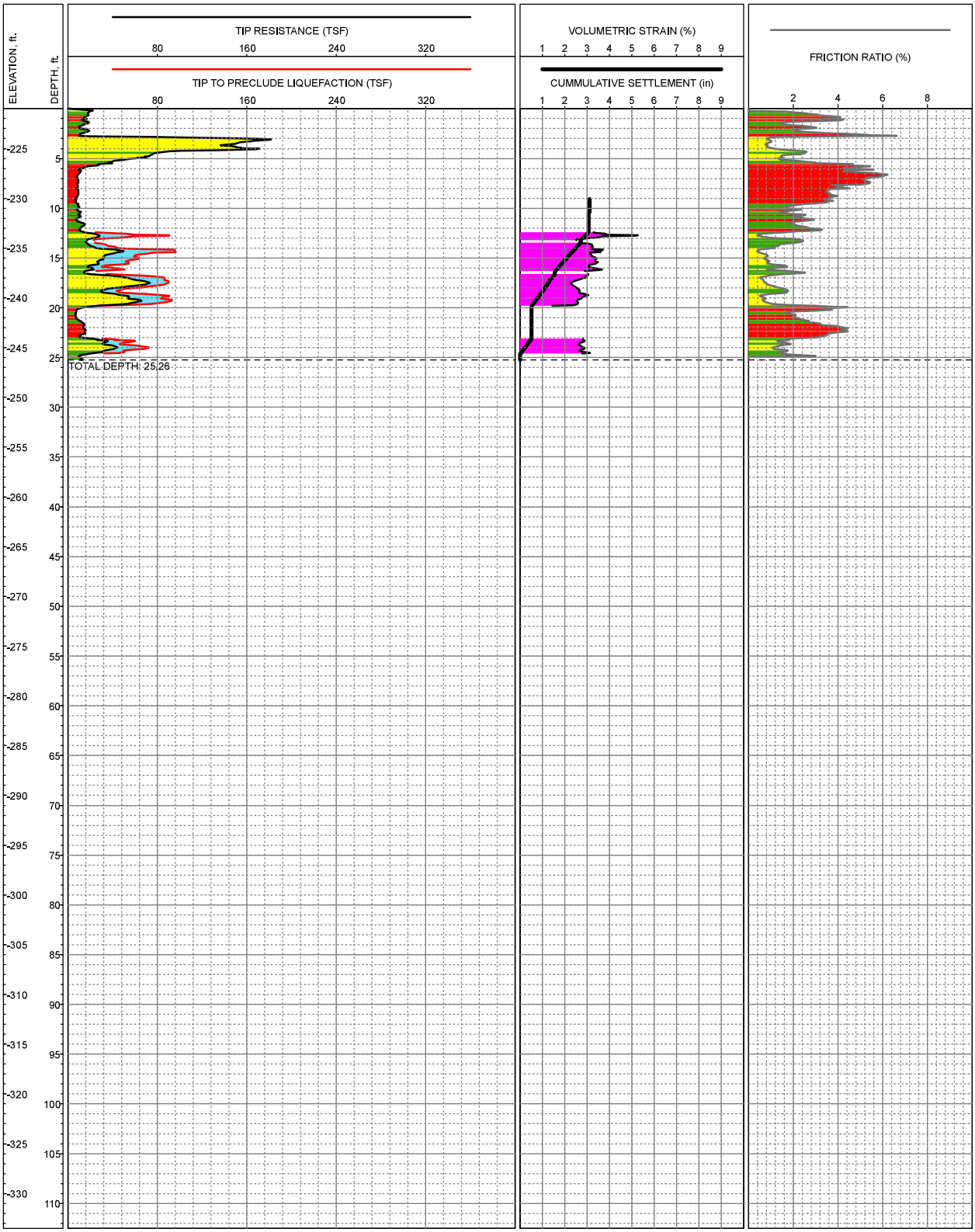
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Kehoe Testing & Engineering
REVIEWED BY: Jon Everett

LIQUEFACTION LOG OF CPT NO: C-118

P.G.A. = 0.40g and Mw = 6.5
Black Rock Units 1, 2 & 3
Calipatria, California

FIGURE C-19

N:\Projects\3652_CalEnergy\3652-001_Black_Rock\Explorations\CPT\2008\Logs\Logs_BlackRock123_Liqu_2008_12_18\MXD\Logs_BlackRock123_Liqu_2008_12_18.mxd.01/16/2009.CDean



LOCATION: E6,750,965, N2,003,867, CA State Plane, Zone 6, NAD83, Feet
SURFACE EL: -221.0ft +/- (NAVD88)
COMPLETION DEPTH: 25.26ft
TESTDATE: 10/8/2008

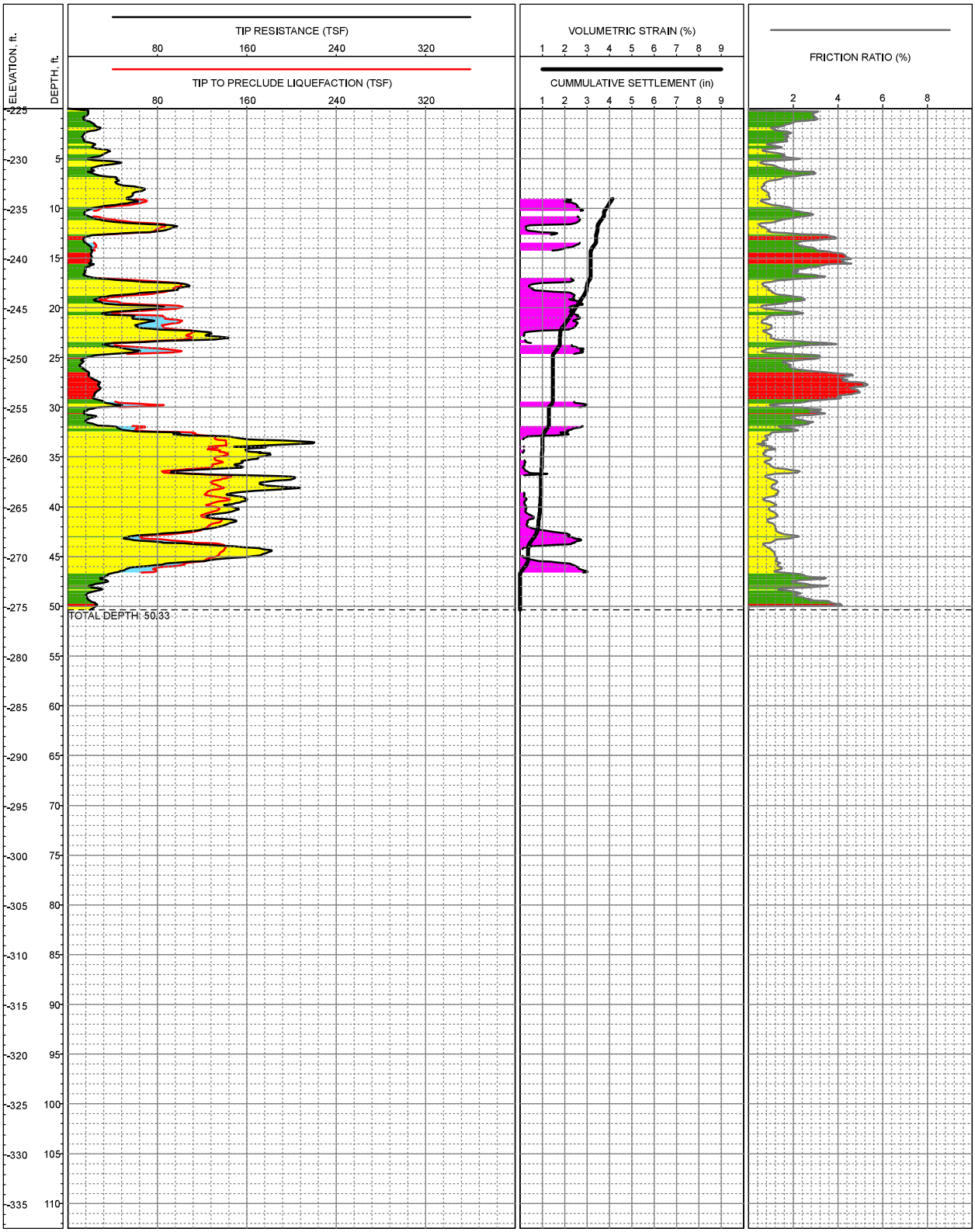
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Kehoe Testing & Engineering
REVIEWED BY: Jon Everett

LIQUEFACTION LOG OF CPT NO: C-119

P.G.A. = 0.40g and Mw = 6.5
Black Rock Units 1, 2 & 3
Calipatria, California

FIGURE C-20

N:\Projects\3652_CalEnergy\3652-001_Black_Rock\Explorations\CPT\2008\Logs\Logs_BlackRock123_Liqu_2008_12_18\MXD\Logs_BlackRock123_Liqu_2008_12_18.mxd.01/16/2009.CDean



LOCATION: E6,752,247, N2,003,460, CA State Plane, Zone 6, NAD83, Feet
SURFACE EL: -224.9ft +/- (NAVD88)
COMPLETION DEPTH: 50.33ft
TESTDATE: 10/8/2008

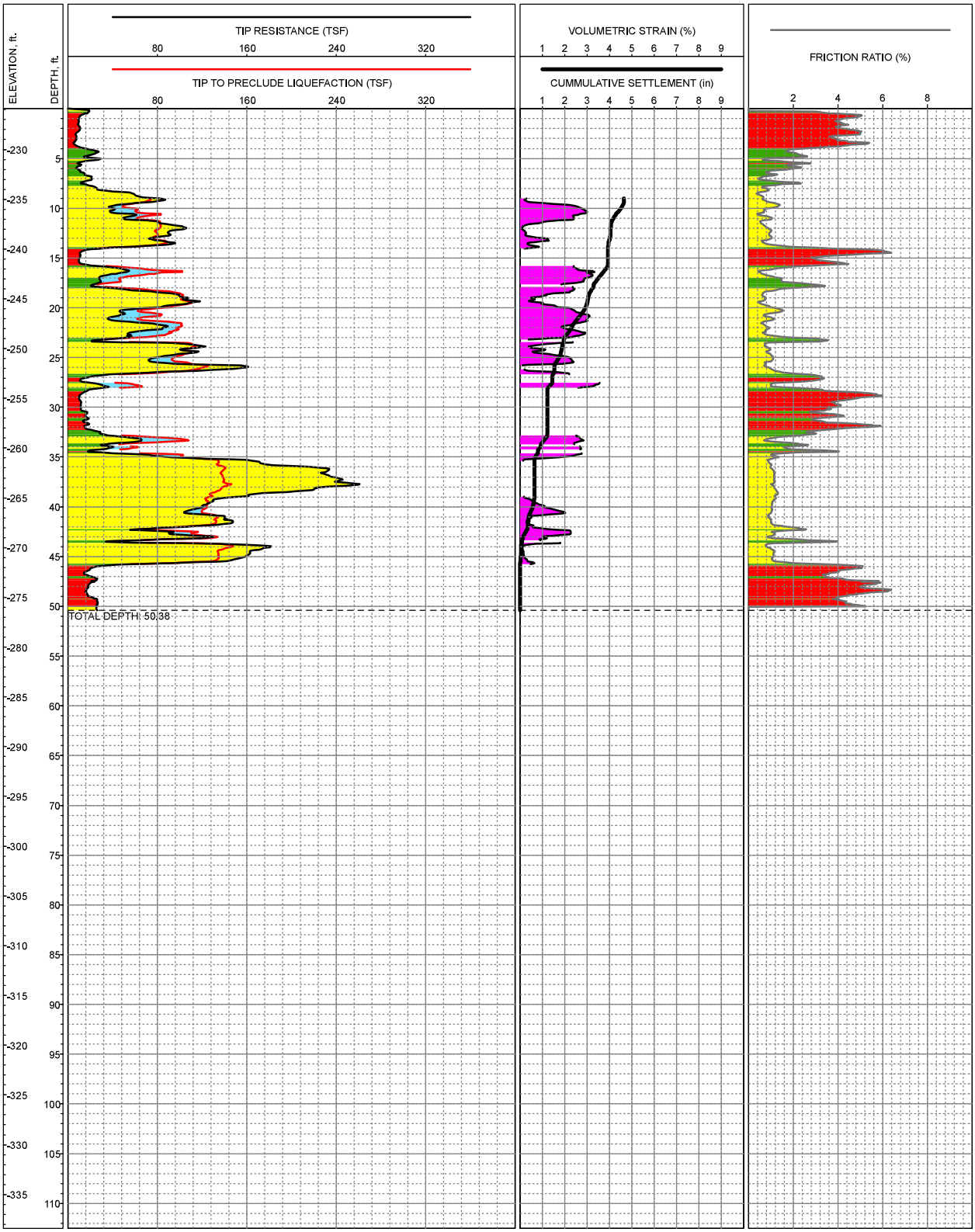
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Kehoe Testing & Engineering
REVIEWED BY: Jon Everett

LIQUEFACTION LOG OF CPT NO: C-120

P.G.A. = 0.40g and Mw = 6.5
Black Rock Units 1, 2 & 3
Calipatria, California

FIGURE C-21

N:\Projects\3652_CalEnergy\3652-001_Black_Rock\Explorations\CPT\2008\Logs\Logs_BlackRock123_Liqu_2008_12_18\MXD\Logs_BlackRock123_Liqu_2008_12_18.mxd 01/16/2009 CDean



LOCATION: E6,752,168, N2,004,311, CA State Plane, Zone 6, NAD83, Feet
SURFACE EL: -225.9ft +/- (NAVD88)
COMPLETION DEPTH: 50.38ft
TESTDATE: 10/8/2008

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Kehoe Testing & Engineering
REVIEWED BY: Jon Everett

LIQUEFACTION LOG OF CPT NO: C-121

P.G.A. = 0.40g and Mw = 6.5
Black Rock Units 1, 2 & 3
Calipatria, California

FIGURE C-22

N:\Projects\3652_CalEnergy\3652-001_Black_Rock\Explorations\CPT\2008\Logs\Logs_BlackRock123_Liqu_2008_12_18\MXD\Logs_BlackRock123_Liqu_2008_12_18.mxd 01/16/2009 CDean

BRGP Attachment DRR 52 Episodic Holocene eruption of the Salton Buttes rhyolites, California from paleomagnetic, U-Th, and Ar/Ar Dating

AGU PUBLICATIONS

Geochemistry, Geophysics, Geosystems

RESEARCH ARTICLE
10.1002/2015GC005714

Episodic Holocene eruption of the Salton Buttes rhyolites, California, from paleomagnetic, U-Th, and Ar/Ar dating

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Key Points:
- Five rhyolite obsidian domes form the Salton Buttes, CA
- We use Ar/Ar, U-Th, and paleomagnetism to date all five domes
- All domes are mid-late Holocene in age, erupted in three separate episodes

Supporting Information:
- Supporting Information S1
- Table S1
- Table S2
- Table S3

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hwright@usgs.gov

Citation:
Wright, H. M., J. A. Vazquez, D. E. Champion, A. T. Calvert, M. T. Mangan, M. Stelten, K. M. Cooper, C. Herzig, and A. Schriener Jr. (2015), Episodic Holocene eruption of the Salton Buttes rhyolites, California, from paleomagnetic, U-Th, and Ar/Ar dating, *Geochem. Geophys. Geosyst.*, *16*, 1198–1210, doi:10.1002/2015GC005714.

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Abstract In the Salton Trough, CA, five rhyolite domes form the Salton Buttes: Mullet Island, Obsidian Butte, Rock Hill, North and South Red Hill, from oldest to youngest. Results presented here include $^{40}Ar/^{39}Ar$ anorthoclase ages, ^{238}U-^{230}Th zircon crystallization ages, and comparison of remanent paleomagnetic directions with the secular variation curve, which indicate that all domes are Holocene. ^{238}U-^{230}Th zircon crystallization ages are more precise than but within uncertainty of $^{40}Ar/^{39}Ar$ anorthoclase ages, suggesting that zircon crystallization proceeded until shortly before eruption in all cases except one. Remanent paleomagnetic directions require three eruption periods: (1) Mullet Island, (2) Obsidian Butte, and (3) Rock Hill, North Red Hill, and South Red Hill. Borehole cuttings logs document up to two shallow tephra layers. North and South Red Hills likely erupted within 100 years of each other, with a combined ^{238}U-^{230}Th zircon isochron age of: 2.83 ± 0.60 ka (2 sigma); paleomagnetic evidence suggests this age predates eruption by hundreds of years (1800 cal BP). Rock Hill erupted closely in time to these eruptions. The Obsidian Butte ^{238}U-^{230}Th isochron age (2.86 ± 0.96 ka) is nearly identical to the combined Red Hill age, but its Virtual Geomagnetic Pole position suggests a slightly older age. The age of aphyric Mullet Island dome is the least well constrained: zircon crystals are resorbed and the paleomagnetic direction is most distinct; possible Mullet Island ages include ca. 2300, 5900, 6900, and 7700 cal BP. Our results constrain the duration of Salton Buttes volcanism to between ca. 5900 and 500 years.

1. Introduction

Age determination of Holocene volcanic rocks is inherently difficult, especially where carbon that could be used for ^{14}C dating is not present or the relation of the organic material to the eruption is difficult to establish [e.g., *Schmitt et al*., 2010a; cf. *Capra et al*., 2007]. At monogenetic volcanic fields, where there is only one phase of eruptive activity at each center, eruptive deposits from all centers likely do not form a single stratigraphic section. Thus, detailed mapping is required in order to resolve relative age relationships, if at all possible. Indeed, the use of a variety of dating techniques in combination with geologic mapping may be required in order to resolve the eruptive chronology at monogenetic volcanic fields in general [*Connor and Conway*, 2000]. Apart from ^{14}C dating, radioisotope dating of Holocene rocks is challenging due to small accumulated quantities of radioactive decay daughters, but analytical advances and high-resolution sampling techniques yield meaningful dates for late Pleistocene-Holocene eruptions [e.g., *Lanphere et al*., 2007; *Vazquez and Lidzbarski*, 2012]. In cases where uncertainties are large, paleomagnetic directions of primary volcanic deposits can be used to refine age determinations [*Hagstrum and Champion*, 2002]. Here we use the results from multiple dating techniques to resolve the timing and episodicity of rhyolitic volcanism that generated the five obsidian domes that compose the Salton Buttes, southern California, and scrutinize the advantages and shortfalls of each geochronologic technique.

2. Salton Trough Magmatism

The Salton Buttes consist of five rhyolitic obsidian domes located at the southern margin of the Salton Sea, California, USA. The domes are aligned subparallel to the axis of spreading along the boundary between the

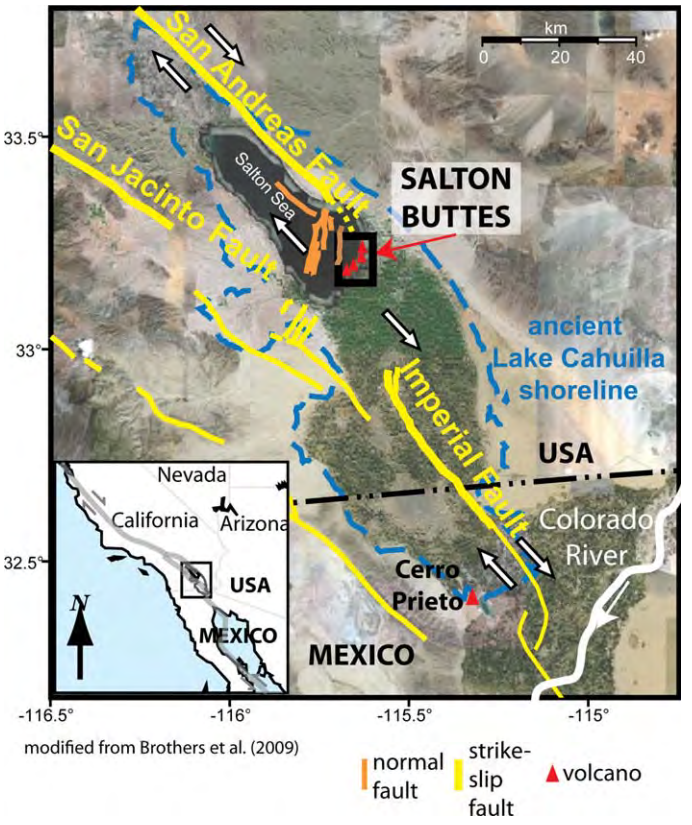

Figure 1. Location of Salton Buttes domes in a pull-apart basin between right-lateral strike slip faults along the Pacific-North American plate boundary. The location of ancient Lake Cahuilla shoreline (precursor to current Salton Sea) is shown for reference, as is the current path of the Colorado River in the southeastern corner of the figure.

North American and Pacific plates [*Brothers et al*., 2009] (Figure 1). Heat flow in the Salton Trough is high [*Lachenbruch et al*., 1985] and the locations of the Salton Buttes are coincident with positive magnetic and gravity anomalies [*Griscom and Muffler*, 1971; *Mariano et al*., 1986; *Langenheim et al*., 2012]. The five domes, from northeast to southwest, include Mullet Island (now a peninsula: *Lynch et al*. [2014]), North Red Hill, South Red Hill, Rock Hill, and Obsidian Butte (Figure 2). They range in vertical relief from 13 to 31 m above the adjacent Salton Sea, which itself lies 69 m below sea level (as of 2010 USGS lidar survey; Figure 2). The Salton Trough has repeatedly been submerged beneath the ancient Lake Cahuilla (predecessor to Salton Sea) and exposed over thousands of years, where at least five lake highstands have occurred since 800 CE [*Philibosian et al*., 2011]. The total volume of all five domes has been estimated at <5 km^3 [*Robinson et al*., 1976]. A young age (Holocene or late Pleistocene) for the small volume buttes is required by their subaerial exposure in an area of rapid sedimentation largely derived from the Colorado River (average 2.2–3.8 mm/yr over the past 420 ka) [*Schmitt and Hulen*, 2008]. However, the exact age of the buttes and the timespan required to produce all five dome-forming eruptions is more difficult to determine.

Previous eruption age determinations have largely focused on South Red Hill and Obsidian Butte. *Muffler and White* [1969] cite a whole-rock K-Ar age of Obsidian Butte of ca. 16 ka by R. W. Kistler and J. Obravodich (unpublished data), whereas obsidian hydration rind ages (fraught with errors) [e.g., *Anovitz et al*., 1999] placed Obsidian Butte at ca. 6.7–8.4 ka and Red Island (Red Hill) at ca. 2.4 ka [*Friedman and Obradovich*, 1981]. U-Th crystallization ages of zircon crystals in Obsidian Butte and South Red Hill span a range of ages, depending upon the component analyzed: granophyre xenoliths at South Red Hill contain ca. 26.2–20.5 ka and one 3 ka zircon (zircon isochron and zircon-whole rock model ages: *Schmitt and Vazquez* [2006] and *Schmitt et al*. [2012]), a fine-grained altered felsite xenolith at South Red Hill contains 18.3 ka zircon (zircon isochron age: *Schmitt and Vazquez* [2006]), rhyolitic partial melt pockets in basalt contain ca. 30.1 and 9.2 ka zircon (zircon isochron ages: *Schmitt and Vazquez* [2006]), and lava from Obsidian Butte and South Red Hill contains zircon cores *and* rims with age peaks at ca. 12.1 and 5.5 ka with minor inherited pre-Quaternary zircons (unmixed zircon model ages: *Schmitt et al*. [2012]). *Schmitt et al*. [2012] determined a 2.48 $\pm$ 0.47 ka (U-Th)/He eruption age (95% confidence interval) from analysis of zircon in a granophyre xenolith at South Red Hill. Consistent with the young age found for South Red Hill, *Schmitt et al*. [2012] compiled a list of dated artifacts sourced at Obsidian Butte and found that the oldest Obsidian Butte artifact was excavated above 1497 and 2259 cal BP age hearths [*Kyle*, 1996] (recalibrated here using OxCal v.4.2.3 *Bronk Ramsey* [2009] using the IntCal13 calibration curve of *Reimer et al*. [2013]), under about 1 m of sediment. Finally, *Perrine et al*. [2013] report a combined infrared stimulated luminescence age of sediment underlying Obsidian

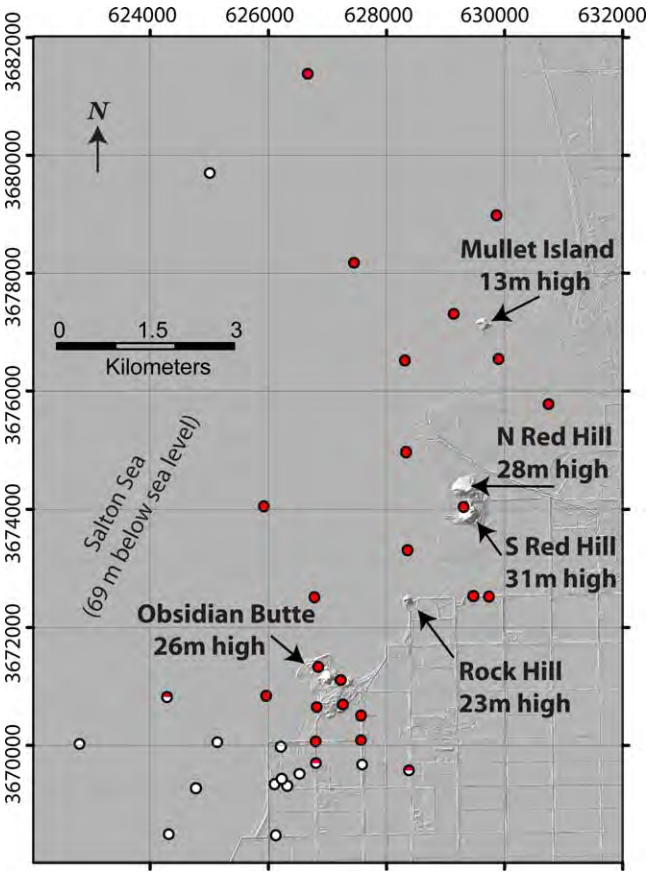

Figure 2. Shaded relief image of the southern margin of the Salton Sea and Salton Buttes from 2010 USGS LIDAR survey. Dispersal of tephra around buttes as recorded in shallow drill holes, where white dots indicate absence of tephra and red dots indicate that tephra is present. Two dots are half red, indicating the presence of tephra that is likely contamination in the hole. UTM coordinate system, see supporting information for complete well log data.

Butte at 3.3 ± 0.5 ka (2 sigma uncertainty), placing a maximum limit on the age of the Obsidian Butte eruption.

2.1. Geologic Context of Salton Buttes Volcanism

Eruptions at all five Salton Buttes consisted of an effusive eruptive phase, but at least two of these volcanoes also experienced explosive eruptions. Pyroclastic deposits from Obsidian Butte and South Red Hill are found in boreholes drilled through or in close proximity to the Salton Buttes. Six of these holes (including continuous core hole and rotary-drilled cuttings holes) intersect rhyolite flows at Obsidian Butte (five holes: 86-1, 86-2, 86-3, 84-3, and IID-8; California Department of Conservation well records: Figure 2) and South Red Hill (one hole: IID-14) in the shallow parts of the holes. There, effusive dome deposits are underlain by pumice fall deposits that are more laterally extensive than the effusive counterparts. Pumice fall deposits in these holes are found at 20–87 m depth and are thickest closest to the volcanic vent. These pumice deposits were quarried from the vicinity of Obsidian Butte as early as 1918, where quarried pumice bed thickness exceeded 3 m [*Chesterman*, 1956]. At South Red Hill, a pumice fall deposit is found at 24–85 m depth. Shallow rotary-drilled temperature gradient holes around Obsidian Butte (Figure 2) intersect pumice deposits at 20–40 m depth and are thickest on the E side of the dome (cuttings were logged at ~1.5 m intervals). Shallow temperature-gradient boreholes drilled by the Shallow Salton Thermal Gradient Project (Lawrence Livermore National Lab and Sandia National Lab) [*Newmark et al.*, 1988] in the southeastern portion of the Salton Sea intersected tephra deposits as well (cuttings were logged at 3 m intervals). Pumiceous clasts, obsidian fragments, and ash shards were found at depths up to 80 m below the lake-bed. Depths and textural classifications of intersected tephra are recorded in supporting information Table S1. The maximum thickness of primary volcanic material (i.e., not contaminated slough from higher in the hole) is 43 m, and is located north of Obsidian Butte (Well 7F). No tephra is found in holes >1 km southeast of Obsidian Butte (white circles, Figure 2), but is found in holes up to 10 km northward of Obsidian Butte (Hole 6E, ~5 km north-northwest of Mullet Island); based on these and shallow observation wells near Obsidian Butte, tephra dispersal was likely to the northeast (Figure 2). Clear evidence is lacking in these core holes for multiple tephra layers separated by at least several meters of sediments (as would be expected from multiple explosive eruptions separated in time by a period of sedimentation in the lake), except in one hole, 6T (Figure 2 and supporting information Table S1), where tephra is found at 6–25 m and 60–70 m.

In addition to well-sorted fall deposits that underlie effusive deposits (lava and flow margin breccia), volcaniclastic sediments overlie the domes at North and South Red Hills (Figure 3). These deposits are matrix-supported, where the matrix consists of fine clay and quartz sediment and clasts consist of variably vesicular juvenile material. Accretionary lapilli are found in some outcrops on the southwest side of North Red Hill,

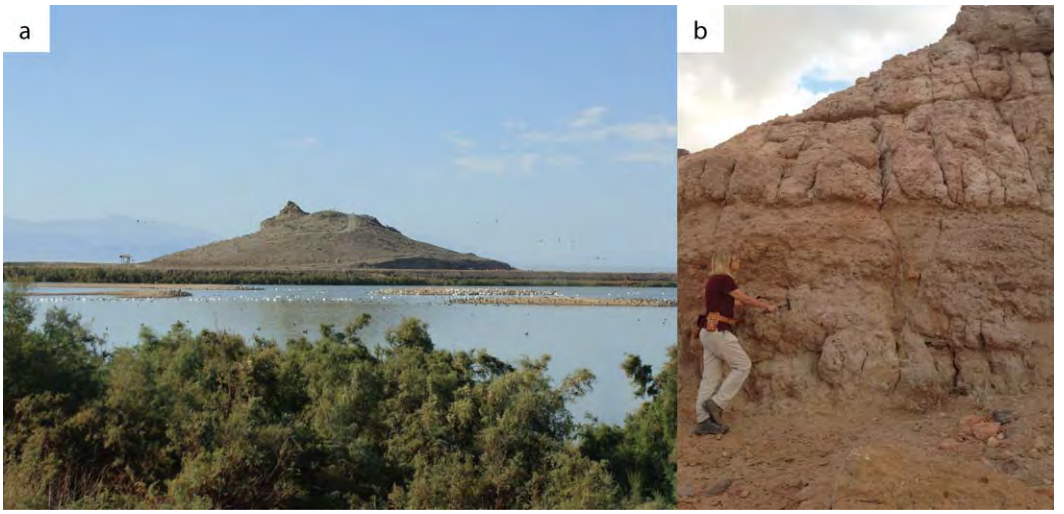

Figure 3. (a) Rock Hill viewed from South Red Hill. Total vertical relief is 23 m above water level as measured from 2010 lidar data. (b) Weakly vertically columnar jointed pyroclastic deposits at South Red Hill. Thermal demagnetization of these sediment laden pyroclastic deposits indicates emplacement temperatures in excess of 500°C, where remanent magnetization is identical to the volcanic dome rock itself.

indicating moist aggregation of ash in the atmosphere. At South Red Hill, these deposits are red-colored, coherent, and weakly columnar to vertically jointed in places.

Eruptive products are high-K rhyolites (73.2–76.4 wt. % SiO_2; unpublished analyses). All five domes are phenocryst-poor, containing <1–2% of anorthoclase and clinopyroxene, accessory magnetite, ilmenite, orthopyroxene, quartz, amphibole, zircon, and apatite. Several xenolith lithologies have been identified in rhyolitic lavas, including low-K tholeiitic, amphibole-bearing basalt, partially melted granophyre, altered rhyolite, and hornfelsic metasediments [*Robinson et al.*, 1976; *Schmitt and Vazquez*, 2006].

3. Geochronologic Techniques

In order to better constrain the timing of eruptive activity three independent geochronologic dating techniques were applied to each of the five Salton Buttes domes.

3.1. ^{238}U-^{230}Th Geochronology

Zircon crystals were extracted from cleaned, crushed obsidian samples using standard magnetic and heavy liquid separation techniques. After separation, zircon crystals were placed in a cold, dilute hydrofluoric acid bath for 5 min to remove adhering glass. Individual grains were then hand-picked and embedded into soft indium metal in order to analyze unpolished zircon rim compositions [*Vazquez and Lidzbarski*, 2012]. Grains were mounted on the same mounts as reference standards. ^{238}U-^{230}Th-^{232}Th compositions of 109 zircon crystals (>17 crystals for each of the five domes) were determined by secondary ion mass spectrometry (SIMS) using the Stanford-USGS SHRIMP-RG ion microprobe following analytical techniques described in *Vazquez and Lidzbarski* [2012]. Measurements were made in 2013, which is the reference year for zircon crystallization age determinations here. All zircon grains were imaged after analysis with a cathodoluminescence (CL) detector to document grain shape and analysis spot position on the crystal face. U and Th isotope compositions of host obsidian glass were determined by multicollector Inductively Coupled Plasma Mass Spectrometer (ICP-MS) for hand-picked glass separates from each dome using standard dissolution techniques and ion-exchange chromatography as described in *Cooper and Donnelly* [2008] and modified in *Stelten and Cooper* [2012]. For each dome, isochron ^{238}U-^{230}Th ages were calculated using respective rim compositions and the measured ^{238}U-^{230}Th composition of host obsidian glass. Model ^{238}U-^{230}Th crystallization ages were calculated as two-point isochrons through individual rim analyses and host obsidian glass [*Reid et al.*, 1997]. Isochron and weighted mean model ages are reported with uncertainty at the 95% confidence level. During the analytical sessions, sectioned zircon from Puy de Dome trachyte, France (PdD), and from a syenite lithic clast erupted at Laacher See, Germany (268 sanidinite), were analyzed for comparison

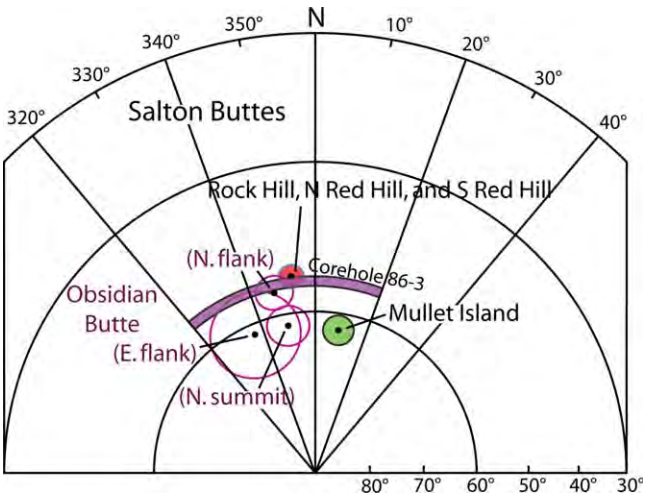

Figure 4. Lower hemisphere equal area plots of mean magnetization directions of Salton Buttes domes with 95% confidence ovals. Data represent two sites on Mullet Island, six sites on Rock Hill, North Red Hill, and South Red Hill, and three sites from Obsidian Butte (purple labels). Purple inclination band centered at 54° inclination is derived from 19 of 22 azimuthally unoriented vertical drill core samples in Obsidian Butte rhyolite from core hole 86-3. The overlap between this band and the orientation of one Obsidian Butte site supports the inference that this site was the least deformed of the three Obsidian Butte sites and thereby most closely represents the original magnetization direction.

to the results from independent studies. Together with U-Th data delimiting the initial $^{230}Th/^{232}Th$ of their host magma [*Condomines*, 1997], Puy de Dome zircon yield an isochron age of 10.1 ± 2.1 ka (n = 9, 95% confidence), which is indistinguishable from the thermal ionization mass spectrometry U-Th age of 12.1 ± 1.0 ka reported for bulk zircon separate [*Condomines*, 1997], and a SIMS age of 14.8 ± 2.4 [*Schmitt et al*., 2010b]. Laacher See zircon yields an isochron age of 17.2 ± 3.1 ka (n = 14, 95% confidence), which is indistinguishable from the SIMS isochron age of 17.1 ± 2.6 ka reported by *Schmitt* [2006].

3.2. $^{40}Ar/^{39}Ar$ Geochronology

Both anorthoclase and glass separates were extracted from obsidian samples for $^{40}Ar/^{39}Ar$ geochronology. Anorthoclase crystals were separated from four of the Salton Buttes domes: Obsidian Butte, North Red Hill, South Red Hill, and Rock Hill. 250–500 μm size whole anorthoclase crystals were extracted from the same cleaned, crushed obsidian samples used for zircon extraction, using standard magnetic and hand separation techniques. After separation, crystals were placed in a cold, dilute hydrofluoric acid bath to remove adhering glass. In addition, 500–1000 μm size anorthoclase crystals were extracted from Obsidian Butte obsidian and 250–355 μm size fresh glass chips were separated from Obsidian Butte and Mullet Island obsidians. Aliquants of anorthoclase weighing 121–161 mg and of glass weighing 104–115 mg were encapsulated in Cu foil and placed in quartz vials along with fluence monitor mineral Bodie Hills sanidine (t = 9.6345 Ma), an internal USGS standard calibrated to Taylor Creek sanidine (TCR-2 = 27.87 Ma). TCR-2 is calibrated to the first principles standard SB-3 (162.9 Ma) [*Lanphere and Dalrymple*, 2000]. Using these standard ages, the commonly employed monitor Fish Canyon sanidine yields an age of 27.63 Ma. The quartz vials were then wrapped with Cd foil and were irradiated for 60 min in the U.S. Geological Survey TRIGA reactor in Denver, Colorado. Samples were irradiated in two sets, IRR314 and IRR315, and were rotated continuously and the package was oscillated through the reactor centerline to minimize the flux gradient. Full details of the irradiation and experimental technique, with special

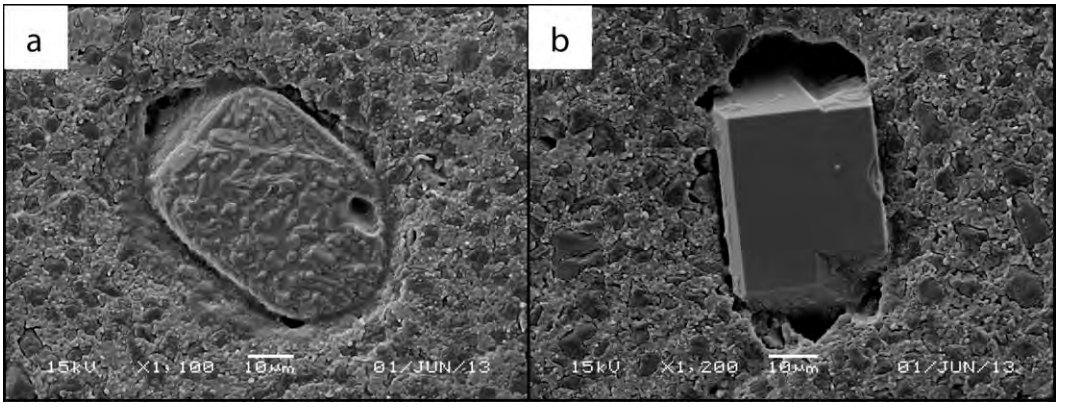

Figure 5. Secondary electron images of unpolished zircon grains mounted in indium metal, (a) Mullet Island zircon: note irregular surface, and (b) Rock Hill zircon. Zircons from Obsidian Butte, North and South Red Hills, and Rock Hill look like Rock Hill zircon shown here.

Table 1. $^{40}Ar/^{39}Ar$ ages for Saltern Buttas with 2 sigma uncertatinties

			$^{40}Ar/^{39}Ar$ Weighted mean plateau age				$^{40}Ar/^{39}$ isotope correlation (isochom) age				$^{40}Ar/^{39}$total gas	
Sample	Matenal	Experiment	Age (ka)	%^{39}Ar[steps, °C]	MSWD	Age (ka)	%^{39}Ar[steps, °C]	MSWD	$^{40}Ar/^{36}Ar_I$	Age (ka)	Comments
1 2HW-SB08 South Red Hill (250-500μm)	Anorthoclase	13Z0134	*0.9 ± 2.8*	74[700-1250]	1.98	1.7±4.0	74[700-1250]	2.11	293.3 ±6.2	5.8 ± 2.0	Climbing spectrum, acceptable plateau or isochron
12HW-SB09 Rock Hill (250-500μm)	Anorthoclase	13Z0131	6.5±7.6	100[600-1450]	10.88	9.8±7.0	73[600-1250]	1.68	289.1 ±4.0	2.7 ± 2.6	Acceptable isochron
12HW-SB11 North Red Hill (250-500μm)	Anorthoclase	13Z0135	*1.7 ± 1.6*	68[900-1250)	0.78	2.1 ±3.0	68[900-1250]	0.89	293.7 ±9.6	4.4 ± 1.6	Good plateau, isochron
13HW-SB18 Obsidian Butte (250-500μm)	Anorthoclase	13Z0132	*4.9±2.0*	59[900-1200]	0.52	4.9±3.6	59[900-1200]	0.62	295.2±5.6	7.8 ± 2.0	Good plateau, isochron
13HW-SB18 Obsidian Butte (500-1000μm)	Anorthoclase	13Z0137	*4.7±2.4*	66[600-1250]	0.57	3.6±3.8	66[600-1250]	0.59	298.0±8.5	6.9 ± 2.2	Good plateau, isochron
13HW-SBI8 Obsidian Butte	Obsidian	13Z0133	*5.8±1.8*	67[800-1050)	0.29	1.8±15.0	67[800-1050)	0.29	319.4 ± 99.6	9.4 ± 1.8	Good plateau, isochron
1 2HW-SB04 Mullet Island	Obsidian	13Z0136	−119.4 ± 7.6	47[600-850]	1.13	*5.7±335.4*	47[600-850]	1.13	282.2 ±26.9	−93.1 ± 5.2	Low precision isochron ok

[a]Samples irradiated at USGS TRIGA reactor using 9.6345 Ma Bodie Hills sanidine as a neutron flux monitor
Preferred ages in italics

consideration for young volcanic samples with low radiogenic yields, are found in *Calvert and Lanphere* [2006]. The results are presented as age spectrum diagrams and as normal isochron (isotope correlation) plots. All analyses are shown with 2 sigma uncertainties (Table 1).

3.3. Paleomagnetics

Paleomagnetic samples were collected, processed, and interpreted using the methods described by *McElhinny* [1973]. Sites were occupied at 1–3 locations in each of the five obsidian domes. An additional site was taken in syn-eruptive volcaniclastic deposits plastered against the dome at South Red Hill. These volcaniclastic deposits are red-colored, matrix-supported, poorly sorted deposits with a sedimentary matrix (fine clay and quartz silt) surrounding abundant volcanic (pumice and obsidian) clasts. Samples were taken in the field using a handheld, gasoline-powered, 2.5 cm coring drill and were oriented using a sun compass. Eight, 10 cm long samples were taken at each site. 2.5 cm long specimens were measured using an automated cryogenic magnetometer and variously subjected to alternating-field (AF) or thermal demagnetization to remove secondary components of, and reveal the characteristic direction of remanent magnetization. The mean direction of magnetization for each site was calculated using Fisher statistics on data from line fits on vector component diagrams. Site mean directions are presented in Table 2, and illustrated in Figure 4 for each dome as part of an equal-area projection (lower hemisphere) showing mean directions and ovals of 95% confidence (α95).

An additional 28 samples were subcored from vertical (6.4 cm diameter) drill cores taken through Obsidian Dome (Holes 86-1 and 86-3; Department of Conservation well log list: http://geosteam.conservation.ca.gov/WellSearch/GeoWellSearch.aspx), and generously made available to us by CalEnergy Operating Corporation. These samples were not oriented with regard to azimuth and thus can only provide remanent inclination data. They too were measured in an automated cryogenic magnetometer, AF demagnetized, fit with line solutions on vector component diagrams, and average inclination values calculated using an algorithm by *McFadden and Reid* [1982, Table 2.

4. Results

4.1. ^{238}U-^{230}Th Geochronology

All analyzed zircon crystals are euhedral, with the exception of most grains from Mullet Island, which have less distinct crystal edges and vermiform surfaces (Figure 5 and supporting information Figure S1). Isochron ages calculated from zircon populations and matrix glass compositions at North Red Hill, Obsidian Butte, and South Red Hill yield dates of 3.15 ± 0.40, 2.86 ± 0.48, and 2.43 ± 0.47 ka, respectively (±1 sigma, Figure 6, Table 3; supporting information Table S2).

Mean apparent zircon rim model ages for crystallization in order of decreasing age are 8.9 ± 0.5, 4.2 ± 0.4, 3.1 ± 0.4, 2.8 ± 0.5, and

Table 2. Salton Buttes Paleomagnetic Data

Dome	Site number	LAT	LON	N/No	Exp. type	I (°)	D (°)	A_{95}	k	R	λ_P	Φ_P
Rock Hill	0652B	33.182	244.377	8/8	AF	52.3	354.5	3.3	288	7.9757	85.4	152.4
South Red Hill	0732B	33.194	244.389	8/8	AF	52.7	354.8	2.1	692	7.9899	85.7	156.9
	1132B	33.195	244.389	8/8	AF	52.9	352.9	1.1	2343	7.997	84.1	159.3
	0013B	33.197	244.388	7/8	Th	53.2	351.8	2.2	744	6.99193	83.2	161.7
	average	33.195	244.389	3/3		52.9	353.2	1.4	7288	2.99973	84.3	159.4
North Red Hill	0812B	33.198	244.389	6/8	AF	55.7	347.2	1.7	1621	5.9969	79.1	174.1
	1212B	33.198	244.388	8/8	AF	49.6	355.5	3.2	294	7.97262	85.3	119.7
	average	33.198	244.389	2/2		52.7	351.6	17.3	211	1.99525	83	157.5
Average of Rock and Red Hills	average	33.190	244.380	3/3		52.8	352.9	2.2	925	5.9946	84.1	157.8
Obsidian Butte	1052B	33.170	244.363	7/8	AF	55.4	347.1	3.3	328	6.9817	79	172.6
	0972B	33.171	244.363	7/8	Th	62.1	349.5	3.8	260	6.97695	76.9	208.7
	6982B	33.172	244.364	4/8	Th	61.9	336.5	8.2	126	3.97613	69.1	189.6
Mullet Island	6732B	33.225	244.393	9/9	Th	63	10.5	3.6	206	8.96111	76.1	277.1
	6822B	33.226	244.392	8/8	Th	63.2	7.7	2.2	666	7.98949	77.1	269.6
	average	33.225	244.392	2/2		63.1	9.1	2.8	7982	1.99987	76.6	273.6

[a]Site number is a field and laboratory identification number, all sites were drilled in rhyolite lava except 0013B that was drilled in red fragmental deposits on top of South Red Hill dome; N/No is the number of samples used in calculation of the average divided by the number of samples collected; Exp. type: AF indicates line fits on alternating field demagnetization results, Th indicates line fits on thermal demagnetization results; I, D are in situ inclination and declination directions of mean paleomagnetic directions; R is the resultant vector sum of N unit vectors; k is the concentration parameter (Fisher 1953); A_{95} is the radius of 95% confidence, λP and ΦP are the latitude and longitude of the virtual geomagetic pole, respectively.

2.4 ± 0.5 ka for Mullet Island, Rock Hill, North Red Hill, Obsidian Butte, and South Red Hill, respectively (1 sigma uncertainty; supporting information Table S2). These model ages are well within uncertainty limits of isochron ages for North Red Hill, Obsidian Butte, and South Red Hill. A minority of zircon crystals from three domes (Obsidian Butte, North Red Hill, and Rock Hill) yield individual model ages from ca. 10 to 100 ka.

4.2. $^{40}Ar/^{39}Ar$ Geochronology

For each of the seven aliquants in Table 1, a weighted-mean plateau age, an isotope correlation age, and a total gas age has been calculated, where the preferred age is shown in bold. We define the criteria for selection of the most meaningful incremental heating age following *McDougall and Harrison* [1999] and *Calvert and Lanphere* [2006]. On this basis, weighted mean plateau ages are favored when four criteria are met: a well-defined horizontal plateau for more than 50% of the ^{39}Ar released; a well-defined isochron for the plateau gas fractions; concordant plateau and isochron ages; and a $^{40}Ar/^{39}Ar$ isochron intercept that does not significantly differ from the atmospheric value of 295.5. Where one or more of these criteria are not met, we favor the isochron age for that sample. Weighted mean plateau ages are favored for all samples, except the Rock Hill anorthoclase and the Mullet Island obsidian glass samples (Figure 7, supporting information Figure S2 and Table S3).

In order of decreasing age, our interpreted ages for incremental heating experiments are all Holocene. The Rock Hill anorthoclase yielded a climbing age spectrum with no plateau, but an isochron age for Rock Hill anorthoclase of 9.8 ± 7.0 ka (±2 sigma). Mullet Island contained no separable anorthoclase and obsidian produced all negative apparent ages and yielded a reasonable, but poorly determined isochron age of 5.7 ± 330 ka. Obsidian Butte anorthoclase analyses yielded well-determined weighted mean plateau ages of 4.9 ± 2.0 and 4.7 ± 2.4 ka, and obsidian analyses produced a weighted mean plateau age of 5.8 ± 1.8 ka; these three ages

Table 3. ^{238}U-^{230}Th Zircon-Glass Isochron Ages for Salton Buttes

Sample	Rhyolite	Isochron age (ka)	±1σ	N	MSWD	±95% conf.
SB08	South Red Hill	2.41	0.47	18/18	1.6	0.93
SB11	North Red Hill	3.14	0.40	20/23	1.5	0.79
SB18	Obsidian Butte	2.86	0.48	17/20	0.95	0.94
SB08+SB11	South Red Hill +North Red Hill	2.83	0.30	38/41	1.5	0.76

[a]Isochron and model ages are derived using a ^{230}Th decay constant of 9.1705 (±0.0138)x$10^{-6}a^{-1}$ [*Cheng et al.*, 2013] and reported as years before 2013 (ka) with uncertainty at the 1 sigma and 95% confidence interval. N = number of analyses included for isochron age relative to number analyzed. MSWD = mean square of weighted deviates [*Wendt and Carl*, 1991].

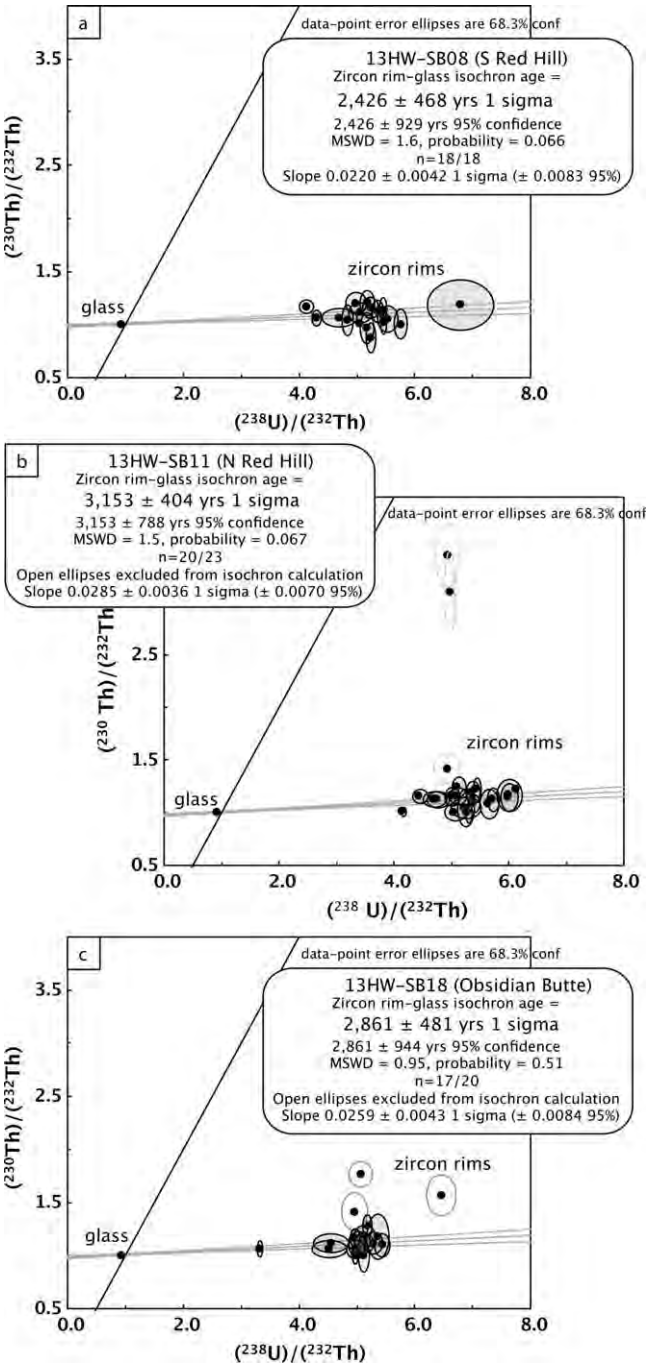

Figure 6. ^{238}U-^{230}Th isochron age diagrams for zircon rims (supporting information Table S2 contains all U-Th data).

are within 2 sigma analytical uncertainty of each other. North Red Hill anorthoclase analyses yielded a weighted mean plateau age of 1.7 ± 1.6 ka and South Red Hill anorthoclase analyses produced a weighted mean plateau age of 0.9 ± 2.8 ka.

4.3. Paleomagnetic Directions

Mean characteristic directions for all sampled sites are shown in Table 2. North Red Hill, South Red Hill, and Rock Hill obsidian domes have identical remanent directions within the calculated uncertainty, with I ~ 53° and D ~ 353°. Samples from red, clastic deposits that overlie South Red Hill also have identical directions, indicating that these deposits were emplaced at temperatures above the Curie point, and must be primary phreatomagmatic deposits (with clay and quartz sedimentary matrix supporting volcanic clasts; Figure 3). Samples from the two sites on Mullet Island are distinct from the above and cluster tightly at I ~ 63° and D ~ 9°.

The remanent directions recorded by samples from the three paleomagnetic sites on Obsidian Butte, however, exhibit significant internal variation (Figure 4). Two sources of variation are possible. The scatter may be a reflection of geomagnetic secular variation occurring over the course of the eruption, or, alternatively, may be an artifact of syn or posteruption dome deformation. Geomagnetic secular variation, which occurs at a rate of 2° to 8° per 100 years [*Merrill et al*., 1996], is dismissed because the time required to produce the observed variation is inconsistent with the characteristic days to tens of years durations of small dome-forming eruptions [*Newhall and Melson*, 1983]. Instead we attribute the variation to sub-Curie point deformation (e.g., at temperatures below 580°C), either by postemplacement fracture and rotation of cold dome rocks, or, by nonuniform, plastic deformation occurring during extrusion (e.g., scatter in single Unzen lava flow directions) [*Tanaka et al*., 2004].

Paleomagnetic inclinations of vertical drill core from Obsidian Butte (core hole 86-3 in Figure 2) can be used to determine which of the surface sample sites most faithfully represent the primary magnetic field direction at the time of eruption. The mean inclination derived from 19 of the 22 Obsidian Butte core samples analyzed is 54.0 ± 0.9°, which is shown in Figure 4 as the purple band reflecting the 95% confidence

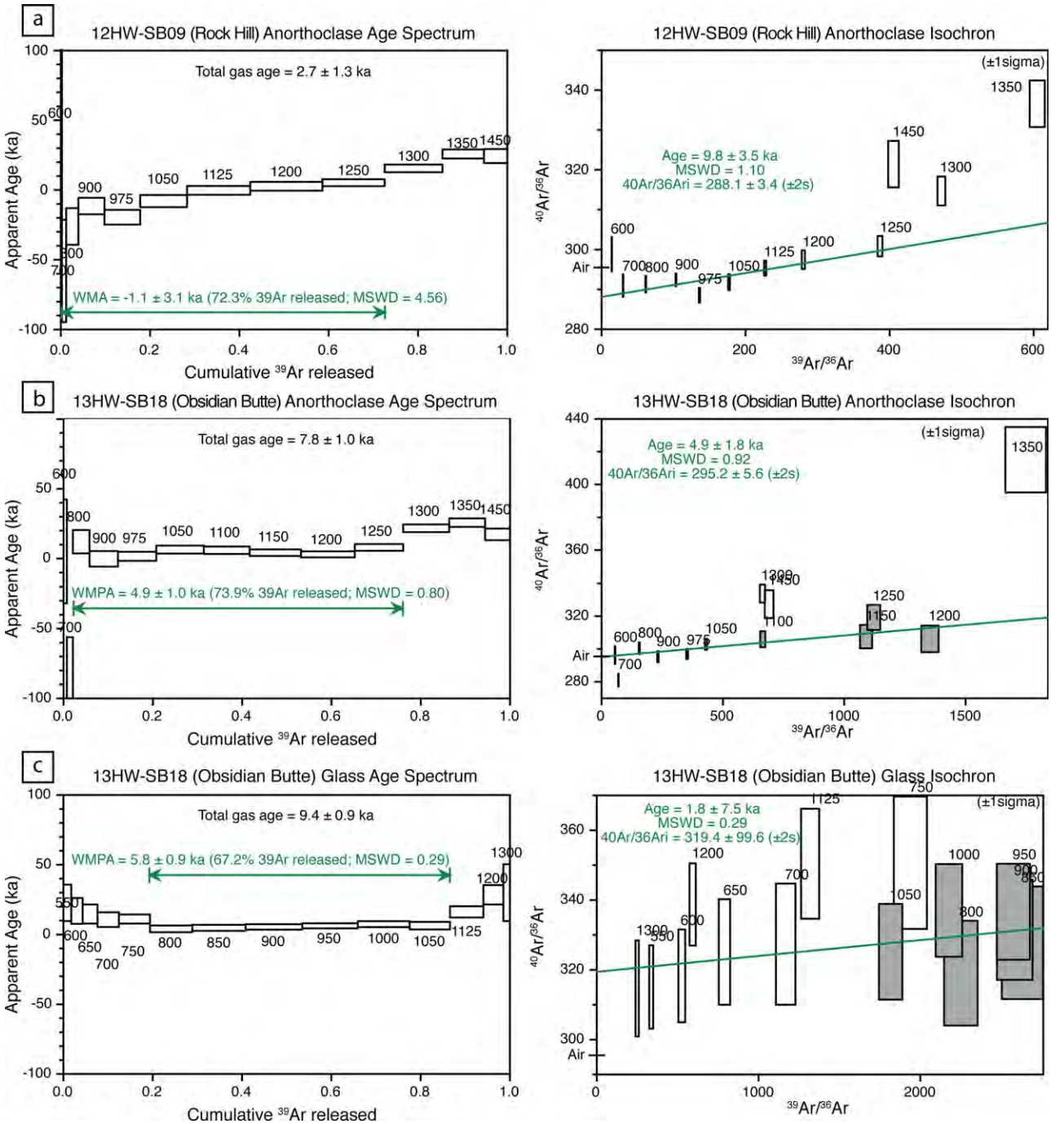

Figure 7. Sample $^{40}Ar/^{36}Ar$ age spectra diagrams and normal isochron plots for anorthoclase and glass separates from Salton Buttes (supporting information Figure S2 contains all plots). Uncertainties for apparent ages and isotopic ratio boxes are all 2 sigma. Interpreted ages, weighted mean plateau ages (WMPA), and $^{40}Ar/^{36}Ar$ ratios are 2 sigma. Horizontal lines with arrows on age spectra show which steps were used in plateau ages, filled symbols on isochron plots show steps used in isochron fit.

interval. The band only intersects the north flank magnetization direction. Data from the other two sites on Obsidian Butte are off by ~8°. The best estimate for the characteristic remanent magnetization of Obsidian Butte is therefore taken as I ~ 55° and D ~ 347°. The Obsidian Butte direction is slightly steeper and more westerly than the mean direction of Rock Hill, North Red Hill, and South Red Hill. The observed 4° angular separation between the two clusters suggests eruptions separated by no more than 200 years. The 13° separation of Mullet Island data from the other domes suggests the entire eruptive episode creating Salton Buttes could have lasted no more than approximately 500 years.

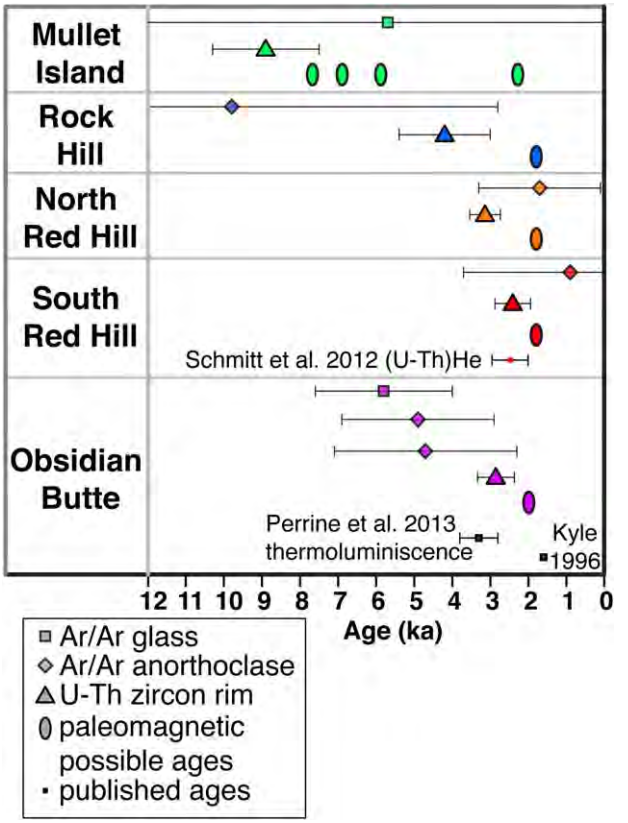

Figure 8. Compilation of $^{40}Ar/^{39}Ar$ and ^{238}U-^{230}Th age results (with 2 sigma uncertainties for Ar ages and 95% confidence intervals for U-Th ages) from this study, including permissible ages for paleomagnetic data within uncertainty limits of other age determinations and previously published age constraints for Salton Buttes surface domes.

5. Discussion

The ^{238}U-^{230}Th isochron ages for the final increment of zircon crystallization provide the most precise radioisotopic ages in this study (Figure 8). Crystallization ages from zircon provide a maximum limit on eruption age because crystal growth necessarily precedes eruption and U and Th are effectively retained in zircon even at magmatic temperatures. Given potential growth rates from diffusion of Zr in a cooling rhyolitic melt [e.g., *Watson*, 1996] and the results from depth profiling of crystallization ages in single zircon [*Schmitt*, 2011; *Storm et al*., 2011], the typical depth of ~5 μm sampled during SHRIMP-RG U-Th analyses [*Vazquez and Lidzbarski*, 2012] may integrate several centuries to millennia of crystal stratigraphy if crystallization was continuous without hiatus or loss of the youngest zircon domains by resorption. Dating studies that directly or effectively sample the outermost rims on euhedral zircon can resolve crystallization ages that precede eruption by several millennia or less [e.g., *Crowley et al*., 2007; *Vazquez and Lidzbarski*, 2012]. Rim ages that precede eruption by tens of thousands of years indicate recycling of antecrysts [e.g., *Storm et al*., 2011].

Rims on zircon from Obsidian Dome, North Red Hill, South Red Hill, and Rock Hill are euhedral (Figure 5), consistent with thermochemical equilibrium with their host rhyolitic melt. The irregular overall morphology of zircon grains in the Mullet Island dome suggests limited dissolution and in turn that this rhyolite batch became undersaturated in zircon prior to eruption. Partial dissolution of outer growth zones is evident in the CL images of some, but not all Mullet Island zircon grains (supporting information Figure S3). Resorption of Mullet Island zircon was rapid, lasting no more than several centuries based on the dissolution kinetics of entire 50–100 μm zircon grains in undersaturated melt [*Harrison and Watson*, 1983] at the 770–790°C temperatures derived from Zr-in-melt geothermometry (H. Wright, unpublished data, 2013). The thin vermiform texture on the crystal faces of the Mullet Island zircon (Figure 5) suggests that this population of crystals may have undergone a final episode of rapid crystallization, likely near the time of eruption [e.g., *Roeder et al*., 2001; *Waters and Lange*, 2013]. The relatively old U-Th model ages for the resorbed Mullet Island zircon can be reconciled with the zircon ages for the other rhyolites if the apparent episode of dissolution removed a sequence of the crystal stratigraphy equivalent to several millennia of growth. Accordingly, the Mullet Island zircon U-Th ages are likely to predate eruption by a greater interval of time than for the other domes. The ages for the resorbed Mullet Island zircon are consistent with the isochron ages reported by *Schmitt and Vazquez* [2006] for zircon cores from Obsidian Butte and South Red Hill (ca. 12.1 ka) that reflect the onset of zircon saturation or recycling of antecrysts.

$^{40}Ar/^{39}Ar$ ages are less precise than ^{238}U-^{230}Th isochron ages; we find that $^{40}Ar/^{39}Ar$ ages agree with ^{238}U-^{230}Th crystallization ages within 2 sigma uncertainty levels. The overlap in the two age determinations validates the assumption that zircon crystallization proceeded to sometime shortly before eruption (i.e., zircon rim crystallization ages are not thousands of years older than the eruption). These results inform our ultimate interpretation that all five Salton Buttes erupted in the Holocene, and at least four of the five

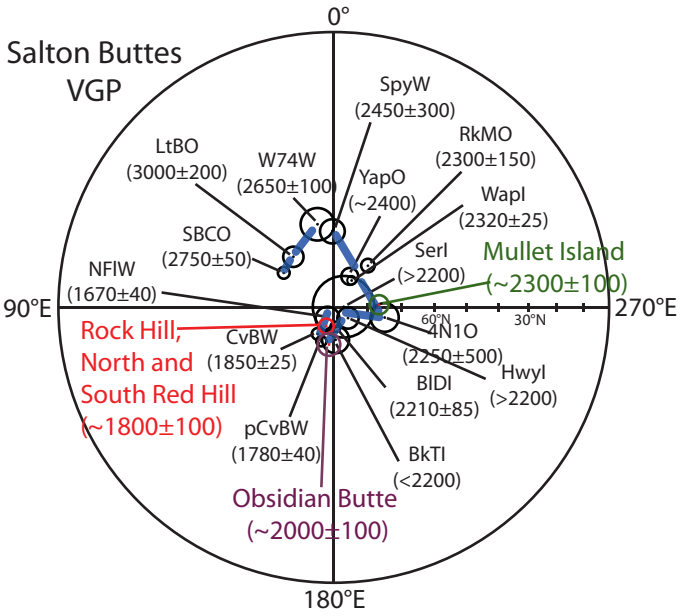

Figure 9. North polar equal area plot showing Virtual Geomagnetic Poles (VGP) from Salton Buttes units (in red, purple, and green), and calibrated ^{14}C dated reference VGP principally from *Hagstrum and Champion* [2002], but also unpublished Mount St. Helens area data from Clynne and Champion (written communication). Ages in parentheses are calibrated ^{14}C ages ±1 sigma uncertainty for the reference flow VGP. Thick dashed blue line shows generalized path of geomagnetic secular variation through about 1000 years. Abbreviations of reference VGP in decreasing age order are SBCO: South Belknap Cone flow; LtBO: Little Belknap flow; W74W: W74-type basaltic andesite, Castle Creek episode, Mount St. Helens; SpyW: South Puyallup pyroclastic flow; RkMO: Rock Mesa pyroclastic flow; YapO: Yapoah lava flow; WapI: Wapi and Kings Bowl lava fields; 4N1O: Four-in-One flow; SerI: Serrate flow; Hwyl: highway flow; BlDl: Blue Dragon flows; BkTl: Broken Top flows; pCvBW: pre-Cave basalt flows, Mount St. Helens; CvBW: Cave Basalt flows, Mount St. Helens; and NFlW: North flank basalts, Mount St. Helens.

erupted in the mid to late-Holocene. We can further refine these estimates, however, using paleomagnetic data. A comparison of paleomagnetic directions in the flows allows us to better understand the differences between eruption ages, where paleomagnetic results provide evidence for three different eruption intervals.

On their own, remanent paleomagnetic directions can discriminate between times of eruptions, but cannot provide eruption ages. However, eruption ages can be inferred through comparisons with the established Holocene paleomagnetic secular variation curve derived from ^{14}C-dated magnetic reference points for the western U.S. [*Hagstrum and Champion*, 2002]. This comparison is made on plots of virtual geomagnetic poles (VGP), calculated from the original site directional data, in order to remove gradients in direction inherent to the dipolar geomagnetic field, and allow regional comparisons to be made.

In Figure 9, two distinct eruption periods are evident (two clusters of VGP positions). Reference to the calibrated ^{14}C ages on this curve assigns ages of 2000 ± 100 cal BP for Obsidian Butte, and 1800 ± 100 cal BP for Rock Hill, and South and North Red Hills. Using approximate depths to tephra in shallow drill holes near Obsidian Butte of 15–18 m and an age of 2000 BP for the Obsidian Butte eruption, implies an average sedimentation rate of 8–9 mm/yr. Reference to calibrated ^{14}C ages gives an eruption age of 2300 ± 100 cal BP for Mullet Island. The inferred eruption ages are consistent with the approximately 500 year duration of Salton Butte volcanism indicated by the site mean directions in Figure 4.

Despite textural evidence for late-stage resorption of Mullet Island zircons, the 8.9 ± 1.4 ka ^{238}U-^{230}Th mean apparent model age of those crystals allows for the possibility that Mullet Island erupted much earlier than the other domes. By comparison to calibrated ^{14}C dated reference VGP available from the western US, and younger than ca. 9 ka, three older (than the 2300 ± 100 cal BP age listed above) possible paleomagnetic age assignments for Mullet Island (ca. 5900, 6900, and 7700 years cal BP) are suggested (Figure 10). A significantly older eruption age for the Mullet Island rhyolite may explain the apparent presence of two tephra layers separated by >20 m of sediment in shallow drill hole 6T west of Mullet Island (Figure 2).

The combination of paleomagnetism with ^{238}U-^{230}Th and ^{40}Ar/^{39}Ar dating reveals that episodic volcanism generated the rhyolites at Salton Buttes. Paleomagnetic characteristics require three distinct episodes of volcanism separated by several years to hundreds of years, despite similar compositions for the rhyolites. If Mullet Island is young (ca. 2 ka, Figure 8), then Salton Buttes volcanism extended over an interval of approximately 500 years, but could be as long as approximately 5000 years if older (i.e., if zircon crystallization ages are close in time to eruptions, despite resorbed surfaces, ca. 8 ka, Figure 8). Hence, the Holocene eruptive activity that produced the five obsidian domes and pyroclastic volcanic deposits was not constrained to a single episode of eruption.

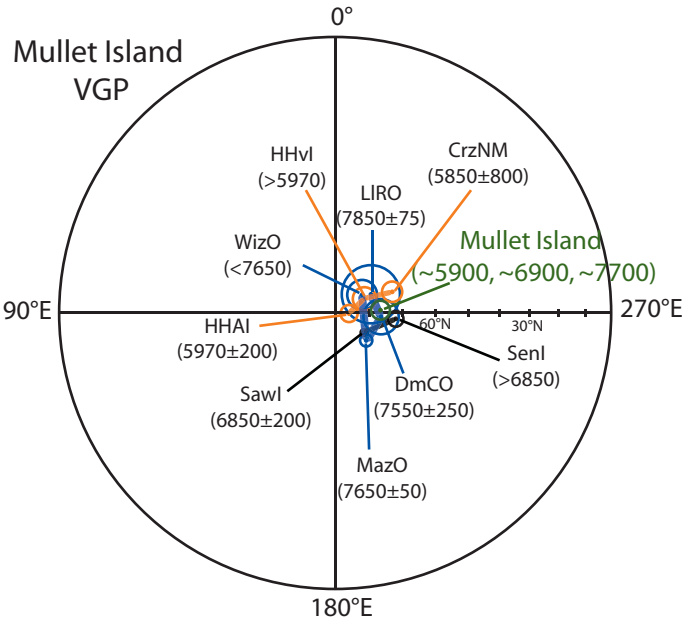

Figure 10. North polar equal area plot showing Virtual Geomagnetic Poles (VGP) from Mullet Island (in green), and calibrated ^{14}C dated reference VGP principally from *Hagstrum and Champion* [2002], but also from *Sherrod et al*. [2012]. Ages in parentheses are calibrated ^{14}C ages ±1 sigma uncertainty for the reference flow VGP. Thick tan (~5900 years), black (~6900 years), and blue (~7700 years) lines show generalized paths of geomagnetic secular variation through those three different time spans. Abbreviations of reference VGP in decreasing age order are: HHAI: Hells Half Acre lava field; HHvI: Hells Half Acre vent area; CrzNM: Carrizozo lava field; SawI: Sawtooth flow; SenI: Sentinel flow; LIRO: Llao flow; DmCO: Diamond Craters lava field; MazO: climactic pyroclastic flows of Mount Mazama; and WizO: Wizard Island.

6. Conclusions

All five Salton Buttes dome-forming eruptions occurred in Holocene time, likely mid to late-Holocene. Based on the overlap in paleomagnetic directions, the overlap in ^{238}U-^{230}Th ages, and the overlap in $^{40}Ar/^{39}Ar$ ages, North and South Red Hills likely erupted within a century of each other. Slightly younger South Red Hill appears to be the only butte (of the five) clearly erupted through water. A combined U-Th isochron age for these two domes is 2.83 ± 0.60 ka (2 sigma), but paleomagnetic evidence suggests that this age predates eruption by hundreds of years, where an age of 1800 ± 100 cal BP is found for other volcanics with identical paleomagnetic directions to South and North Red Hills. The similarity in paleomagnetic direction, the overlap in ^{238}U-^{230}Th age, and to a lesser degree the overlap in $^{40}Ar/^{39}Ar$ age suggests that Rock Hill erupted closely in time to the Red Hill eruptions as well. Note that although the Obsidian Butte ^{238}U-^{230}Th isochron age (2.86 ± 0.48 ka) is nearly identical to the combined Red Hill age, its paleomagnetic direction is just outside the 95% confidence radius of North and South Red Hills and Rock Hill domes. This difference and the relative location of its VGP pole suggest a slightly older age (years to one hundred years) for Obsidian Butte relative to the Red Hills. Reference to the calibrated ^{14}C ages on the secular variation curve assigns an age of 2000 ± 100 cal BP for Obsidian Butte. These age constraints are consistent with the 2.48 ± 0.47 ka (U-Th)/He age of South Red Hill and thermoluminescence (<3.3 ± 0.5 ka) constraints on the Obsidian Butte age. The difference in paleomagnetic direction and older ^{238}U-^{230}Th and $^{40}Ar/^{39}Ar$ ages suggest that Mullet Island dome is older than the other domes, as little as 500 years older than the Red Hill eruptions or as much as ~5000 years older.

Acknowledgments

Supplementary data for this paper are available in supporting information Figures S1–S3 and Tables S1–S3. Kari Cooper would like to acknowledge funding from NSF award EAR-1144945 for U-Th analyses of glasses. We would like to acknowledge CalEnergy for access to drillcore samples from Obsidian Butte and for discussions about the geology of the volcanic buttes. We thank Marsha Lidzbarski for assistance with sample preparation, and Brad Ito for technical assistance in the SHRIMP laboratory. We thank Axel Schmitt and Erik Klemetti for helpful reviews.

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BRGP Attachment DRR 55 County Concurrence Letter

Imperial County Planning & Development Services
Planning / Building

Jim Minnick
DIRECTOR

September 28, 2023

Mr. Eric Veerkamp
California Energy Commission
715 P Street
Sacramento, CA 95814

Imperial County Response to Data Request Set 1 (TN #252096) for the Black Rock Geothermal Project (23-AFC-03)

Dear Mr. Eric Veerkamp:

In response to the California Energy Commission (CEC) Staff's Data Requests Set 1 for the Black Rock Geothermal Project (BRGP) (23-AFC-03), this letter is intended to clarify Imperial County's (County) perspective on the potential project. Specifically, this letter addresses applicability of County development standards on the project's ancillary components and the County's perspective on potential findings for issuance of Conditional Use Permits (CUP).

Applicability of Development Standards on Ancillary Components

BRGP Data Request #55 requests information on how the development of each ancillary facility is consistent with the development standards for each site's zoning designation. Ancillary facilities for the project includes aboveground and underground production and injection wells, aboveground production and injection pipelines, generation tie-lines (transmission lines and poles), underground freshwater supply lines, and temporary laydown yards, parking areas, borrow pits, and construction camps.

The wells (includes production and injection), aboveground pipelines (includes production and injection), and construction camps require County review and approval of a Conditional Use Permit (CUP). During the CUP process, the County will determine applicable development standards (if any), including setbacks and maximum structure height, for the wells, pipelines, and construction camps. The County will require consistency with applicable development standards prior to the issuance of a CUP or as conditions of approval.

The generation interconnection transmission line (gen-tie) is under jurisdiction of the Imperial Irrigation District and is not subject to County development standards. The freshwater supply lines and connections are located underground and are not subject to County development standards. Due to the temporary nature of laydown yards, parking areas, and borrow pits, development standards are not applicable.

Potential to Make Required Findings for Issuance of CUPs

BRGP Data Request #56 requests information on how the development of each project element, which would require a CUP if reviewed by the County, would meet the findings required for issuance of a CUP.

801 Main St. El Centro, CA. 92243 (442) 265-1736 Fax (442) 265-1735 planninginfo@co.imperial.ca.us www.icpds.com

The BRGP components which would be subject to a CUP, if reviewed by the County, include the following:

- Primary powerplant: Per Section 90509.02 of the County's Land Use Ordinance, major geothermal projects are permitted as conditional uses.
- Production and injection wells and production and injection pipelines: Per Section 90509.02 and 90507.02 of the County's Land Use Ordinance, mineral extraction and resource extraction are permitted as conditional uses.
- Temporary laydown yards and parking areas: Per Section 90509.02 and 90518.02 of the County's Land Use Ordinance, temporary contractor storage yards are permitted as conditional uses.
- Temporary construction camps: Per Section 90509.02 and 90518.02 of the County's Land Use Ordinance, labor camps are permitted as conditional uses.
- Temporary borrow pits: Per Section 90509.02 and 90507.02 of the County's Land Use Ordinance, mineral extraction and resource extraction are permitted as conditional uses.

In order to issue CUPs, the County would need to make the following findings, pursuant to Section 90203.09 of the County's Land Use Ordinance:

A. The proposed use is consistent with the goals and policies of the adopted county general plan;
B. The proposed use is consistent with the purpose of the zone or sub-zone within which the use will be located;
C. The proposed use is listed as a use within the zone or sub-zone or is found to be similar to a listed conditional use according to the procedures of Section 90203.10;
D. The proposed use meets the minimum requirements of this title applicable to the use and complies with all applicable laws, ordinances and regulations of the county of Imperial and the state of California;
E. The proposed use will not be detrimental to the health, safety, and welfare of the public or to the property and residents in the vicinity;
F. The proposed use does not violate any other law or ordinance;
G. The proposed use is not granting a special privilege.

A high-level informal review indicates the following:

Finding A: There are no initial concerns regarding significant inconsistencies with the projects and the goals and policies of the adopted general plan.

Finding B: As shown in the bullet list above, the proposed uses appear to generally align with uses identified in the County's Land Use Ordinance as permitted conditional uses. If the proposed uses are consistent with the permitted conditional uses identified in the code, the proposed uses would be consistent with the purpose of the zone designation which they are located in.

Finding C: As shown in the bullet list above, the proposed uses appear to generally align with uses identified in the County's Land Use Ordinance as permitted conditional uses.

Finding D: The project does not appear to be inconsistent with applicable laws, ordinances, and regulations of the County or State.

Finding E: There are no initial concerns with the proposed uses being detrimental to the health, safety, and welfare of the public or to the property and residents in the vicinity.

Finding F: The proposed uses do not appear to violate any other law or ordinance.

Finding G: The project is similar to other existing geothermal powerplants in the area. There are no initial concerns regarding the granting of a special privilege if a CUP is issued.

In summary, based upon the information we have reviewed to date, we are presently aware of no facts that would prevent the County from issuing CUP(s) for the elements of the projects that would require a CUP if reviewed by the County. However, this is an informal and non-binding opinion. It is critical to note that the County would require formal review to determine if the required findings, set forth in Section 90203.09 of the County's Land Use Ordinance, can be made for each instance.

If the County's perspective on these land use issues requires further clarification, please feel free to contact me at (442) 265-1736 or via email at jimminnick@co.imperial.ca.us.

Sincerely,

Jim Minnick, Director
Imperial County Planning & Development Services

CC: Michael Abraham, AICP, Assistant Planning & Development Services Director
Diana Robinson, Planning Division Manager
Files: 10.102; 10.101;10.104
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BRGP Attachment DRR 63 Construction Health Risk Assessment

Native files for Attachment DRR 63 have been provided separately and are available upon request.

BRGP Attachment DRR 74 Raw Traffic Count Data

Counts Unlimited, Inc.
PO Box 1178
Corona, CA 92878
(951)268-6268

County of Imperial
N/S: SR-111
E/W: Sinclair Road
Weather: Clear

File Name : 01_CIM_111_Sinc Wed AM
Site Code : 23022885
Start Date : 10/5/2022
Page No : 1

Groups Printed- Total Volume

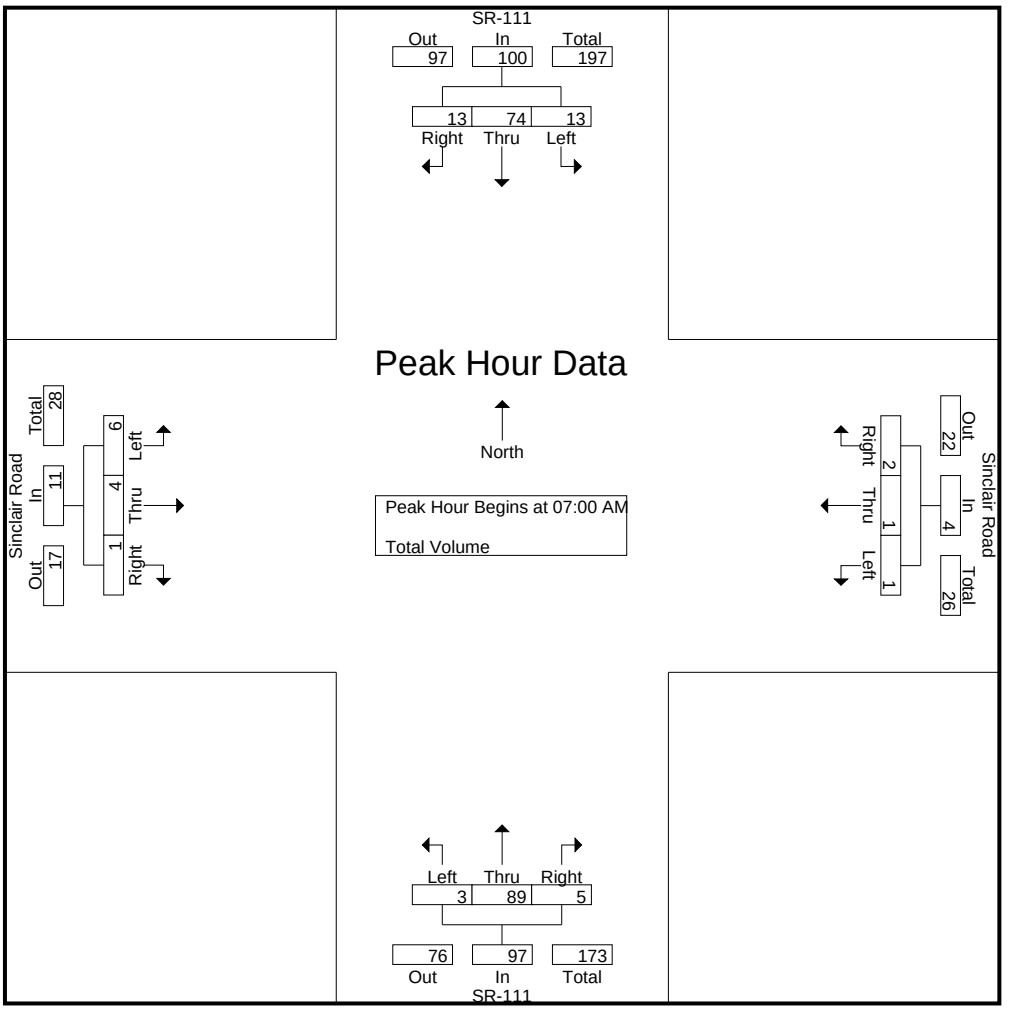
	SR-111 Southbound				Sinclair Road Westbound				SR-111 Northbound				Sinclair Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
05:00 AM	1	3	1	5	0	0	0	0	0	21	0	21	0	0	1	1	27
05:15 AM	1	4	0	5	0	0	0	0	1	16	0	17	1	0	2	3	25
05:30 AM	6	6	3	15	0	0	0	0	3	27	0	30	0	1	1	2	47
05:45 AM	3	6	5	14	0	0	0	0	8	21	1	30	2	0	1	3	47
Total	11	19	9	39	0	0	0	0	12	85	1	98	3	1	5	9	146
06:00 AM	3	21	3	27	0	0	0	0	2	11	0	13	0	0	1	1	41
06:15 AM	1	18	1	20	0	0	0	0	1	15	0	16	2	0	0	2	38
06:30 AM	3	17	1	21	0	2	1	3	1	16	0	17	1	0	0	1	42
06:45 AM	5	11	0	16	0	0	0	0	1	23	0	24	2	0	1	3	43
Total	12	67	5	84	0	2	1	3	5	65	0	70	5	0	2	7	164
07:00 AM	4	13	3	20	0	0	1	1	0	14	1	15	4	2	0	6	42
07:15 AM	2	21	5	28	0	0	0	0	3	23	0	26	1	1	1	3	57
07:30 AM	3	21	4	28	0	0	0	0	0	27	1	28	0	1	0	1	57
07:45 AM	4	19	1	24	1	1	1	3	0	25	3	28	1	0	0	1	56
Total	13	74	13	100	1	1	2	4	3	89	5	97	6	4	1	11	212
Grand Total	36	160	27	223	1	3	3	7	20	239	6	265	14	5	8	27	522
Apprch %	16.1	71.7	12.1		14.3	42.9	42.9		7.5	90.2	2.3		51.9	18.5	29.6		
Total %	6.9	30.7	5.2	42.7	0.2	0.6	0.6	1.3	3.8	45.8	1.1	50.8	2.7	1	1.5	5.2	

	SR-111 Southbound				Sinclair Road Westbound				SR-111 Northbound				Sinclair Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 05:00 AM to 07:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	**4**	13	3	20	0	0	**1**	1	0	14	1	15	**4**	**2**	0	**6**	42
07:15 AM	2	**21**	**5**	**28**	0	0	0	0	**3**	23	0	26	1	1	**1**	3	**57**
07:30 AM	3	21	4	28	0	0	0	0	0	**27**	1	**28**	0	1	0	1	57
07:45 AM	4	19	1	24	**1**	**1**	1	**3**	0	25	**3**	28	1	0	0	1	56
Total Volume	13	74	13	100	1	1	2	4	3	89	5	97	6	4	1	11	212
% App. Total	13	74	13		25	25	50		3.1	91.8	5.2		54.5	36.4	9.1		
PHF	.813	.881	.650	.893	.250	.250	.500	.333	.250	.824	.417	.866	.375	.500	.250	.458	.930

Counts Unlimited, Inc.
PO Box 1178
Corona, CA 92878
(951)268-6268

County of Imperial
N/S: SR-111
E/W: Sinclair Road
Weather: Clear

File Name : 01_CIM_111_Sinc Wed AM
Site Code : 23022885
Start Date : 10/5/2022
Page No : 2



Peak Hour Analysis From 05:00 AM to 07:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM				06:15 AM				05:00 AM				06:30 AM			
+0 mins.	**4**	13	3	20	0	0	0	0	0	21	0	21	1	0	0	1
+15 mins.	2	**21**	**5**	**28**	0	**2**	**1**	**3**	1	16	0	17	2	0	**1**	3
+30 mins.	3	21	4	28	0	0	0	0	3	**27**	0	**30**	**4**	**2**	0	**6**
+45 mins.	4	19	1	24	0	0	1	1	**8**	21	**1**	30	1	1	1	3
Total Volume	13	74	13	100	0	2	2	4	12	85	1	98	8	3	2	13
% App. Total	13	74	13		0	50	50		12.2	86.7	1		61.5	23.1	15.4	
PHF	.813	.881	.650	.893	.000	.250	.500	.333	.375	.787	.250	.817	.500	.375	.500	.542

Counts Unlimited, Inc.
PO Box 1178
Corona, CA 92878
(951)268-6268

County of Imperial
N/S: SR-111
E/W: Sinclair Road
Weather: Clear

File Name : 01_CIM_111_Sinc Wed PM
Site Code : 23022885
Start Date : 10/5/2022
Page No : 1

Groups Printed- Total Volume

	SR-111 Southbound				Sinclair Road Westbound				SR-111 Northbound				Sinclair Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	0	34	1	35	1	0	2	3	0	22	0	22	0	0	1	1	61
04:15 PM	1	20	1	22	0	0	2	2	0	16	0	16	1	0	0	1	41
04:30 PM	0	21	2	23	0	0	2	2	1	23	0	24	3	2	0	5	54
04:45 PM	0	14	0	14	0	0	3	3	0	12	1	13	1	1	0	2	32
Total	1	89	4	94	1	0	9	10	1	73	1	75	5	3	1	9	188
05:00 PM	0	19	2	21	0	2	0	2	0	18	0	18	3	0	0	3	44
05:15 PM	0	13	1	14	0	1	0	1	1	22	0	23	2	0	1	3	41
05:30 PM	0	13	0	13	0	0	0	0	0	22	0	22	1	1	2	4	39
05:45 PM	0	12	0	12	0	0	0	0	0	12	0	12	1	0	1	2	26
Total	0	57	3	60	0	3	0	3	1	74	0	75	7	1	4	12	150
06:00 PM	0	15	2	17	0	0	1	1	0	16	0	16	0	0	1	1	35
06:15 PM	0	21	0	21	0	0	0	0	0	21	0	21	0	1	0	1	43
06:30 PM	1	20	1	22	0	0	0	0	0	15	0	15	1	0	0	1	38
06:45 PM	0	11	1	12	0	0	1	1	0	8	0	8	0	0	0	0	21
Total	1	67	4	72	0	0	2	2	0	60	0	60	1	1	1	3	137
07:00 PM	0	11	1	12	0	0	0	0	1	10	0	11	0	0	1	1	24
07:15 PM	0	16	3	19	0	0	0	0	0	11	0	11	0	0	0	0	30
07:30 PM	0	5	1	6	1	0	0	1	0	12	0	12	2	0	0	2	21
07:45 PM	0	8	0	8	0	0	0	0	0	10	0	10	0	0	0	0	18
Total	0	40	5	45	1	0	0	1	1	43	0	44	2	0	1	3	93
Grand Total	2	253	16	271	2	3	11	16	3	250	1	254	15	5	7	27	568
Apprch %	0.7	93.4	5.9		12.5	18.8	68.8		1.2	98.4	0.4		55.6	18.5	25.9		
Total %	0.4	44.5	2.8	47.7	0.4	0.5	1.9	2.8	0.5	44	0.2	44.7	2.6	0.9	1.2	4.8	

	SR-111 Southbound				Sinclair Road Westbound				SR-111 Northbound				Sinclair Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 07:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	0	**34**	1	**35**	**1**	0	2	**3**	0	22	0	22	0	0	**1**	1	**61**
04:15 PM	**1**	20	1	22	0	0	2	2	0	16	0	16	1	0	0	1	41
04:30 PM	0	21	**2**	23	0	0	2	2	**1**	**23**	0	**24**	**3**	**2**	0	**5**	54
04:45 PM	0	14	0	14	0	0	**3**	3	0	12	**1**	13	1	1	0	2	32
Total Volume	1	89	4	94	1	0	9	10	1	73	1	75	5	3	1	9	188
% App. Total	1.1	94.7	4.3		10	0	90		1.3	97.3	1.3		55.6	33.3	11.1		
PHF	.250	.654	.500	.671	.250	.000	.750	.833	.250	.793	.250	.781	.417	.375	.250	.450	.770

Counts Unlimited, Inc.
PO Box 1178
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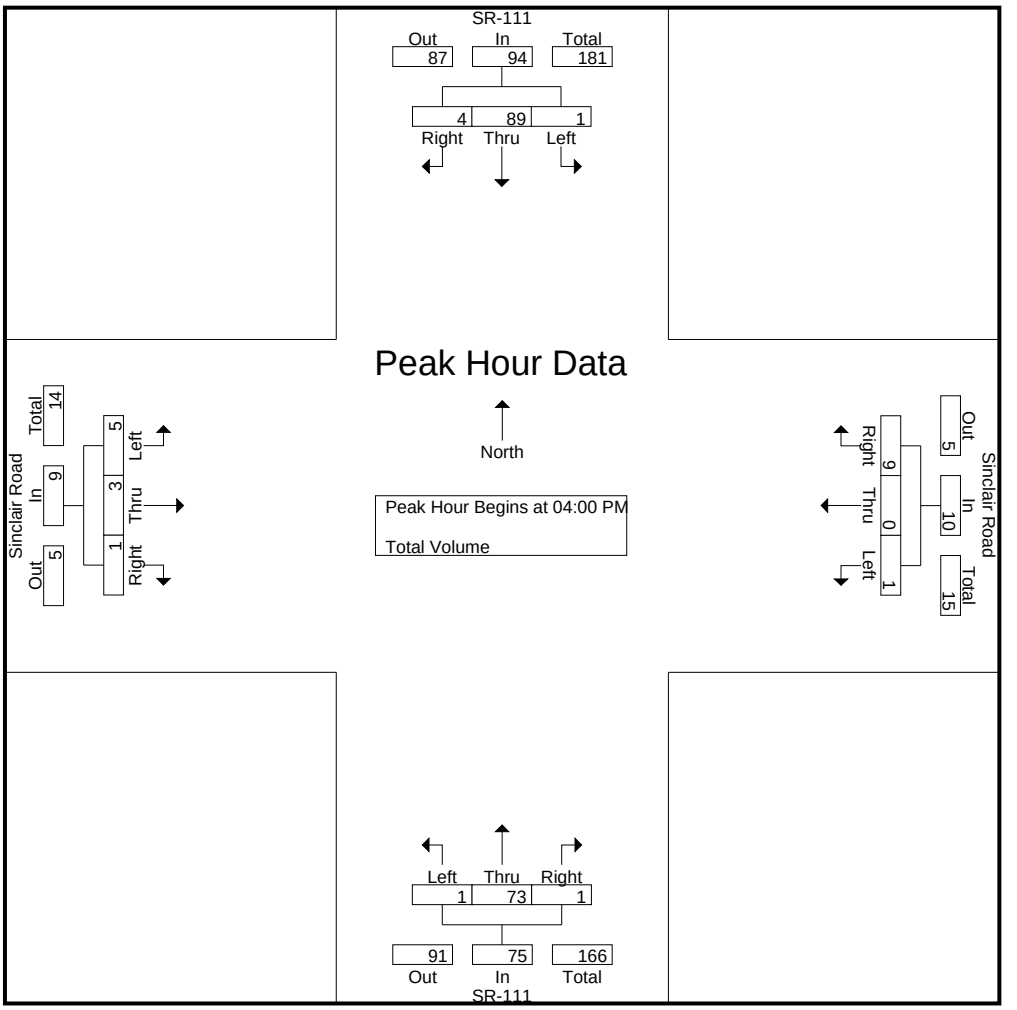
County of Imperial
N/S: SR-111
E/W: Sinclair Road
Weather: Clear

File Name : 01_CIM_111_Sinc Wed PM
Site Code : 23022885
Start Date : 10/5/2022



Peak Hour Analysis From 04:00 PM to 07:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM				04:00 PM				04:30 PM				04:30 PM			
+0 mins.	0	**34**	1	**35**	**1**	0	2	**3**	**1**	**23**	0	**24**	**3**	**2**	0	**5**
+15 mins.	**1**	20	1	22	0	0	2	2	0	12	**1**	13	1	1	0	2
+30 mins.	0	21	**2**	23	0	0	2	2	0	18	0	18	3	0	0	3
+45 mins.	0	14	0	14	0	0	**3**	3	1	22	0	23	2	0	**1**	3
Total Volume	1	89	4	94	1	0	9	10	2	75	1	78	9	3	1	13
% App. Total	1.1	94.7	4.3		10	0	90		2.6	96.2	1.3		69.2	23.1	7.7	
PHF	.250	.654	.500	.671	.250	.000	.750	.833	.500	.815	.250	.813	.750	.375	.250	.650

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County of Imperial
N/S: SR-111
E/W: Sinclair Road
Weather: Clear

File Name : 01_CIM_111_Sinc Thu AM
Site Code : 23022885
Start Date : 10/6/2022
Page No : 1

Groups Printed- Total Volume

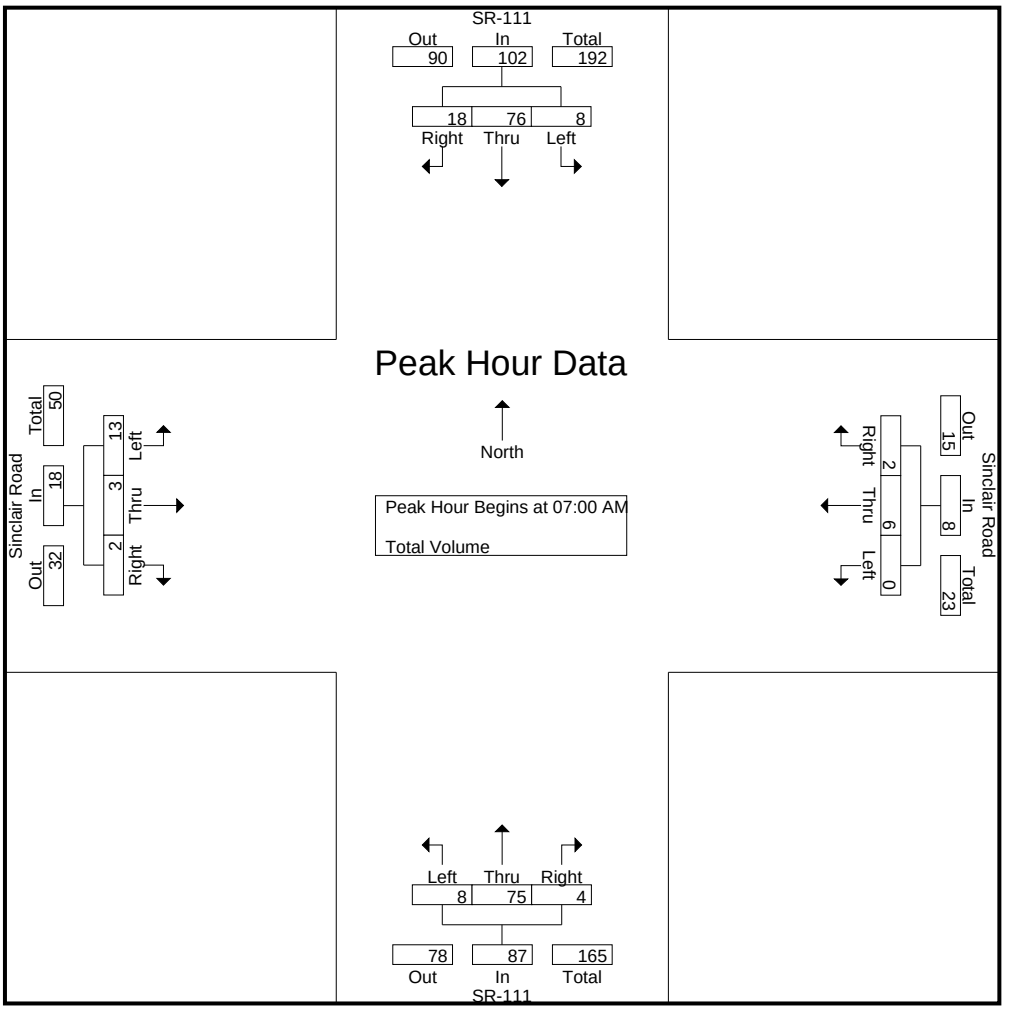
	SR-111 Southbound				Sinclair Road Westbound				SR-111 Northbound				Sinclair Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
05:00 AM	0	7	1	8	0	0	0	0	0	13	1	14	0	0	1	1	23
05:15 AM	3	3	1	7	0	0	1	1	1	15	0	16	0	0	2	2	26
05:30 AM	2	4	3	9	0	0	0	0	2	25	0	27	1	0	0	1	37
05:45 AM	2	12	4	18	0	1	0	1	0	21	0	21	0	0	0	0	40
Total	7	26	9	42	0	1	1	2	3	74	1	78	1	0	3	4	126
06:00 AM	3	16	1	20	0	0	0	0	2	22	0	24	0	0	2	2	46
06:15 AM	1	14	1	16	0	1	0	1	0	30	0	30	2	2	0	4	51
06:30 AM	0	21	3	24	0	0	0	0	0	22	0	22	1	0	1	2	48
06:45 AM	3	13	2	18	0	0	1	1	1	18	0	19	0	2	1	3	41
Total	7	64	7	78	0	1	1	2	3	92	0	95	3	4	4	11	186
07:00 AM	0	20	6	26	0	1	0	1	0	15	0	15	2	0	0	2	44
07:15 AM	0	12	6	18	0	0	1	1	3	22	2	27	4	2	1	7	53
07:30 AM	2	20	3	25	0	2	1	3	3	21	0	24	3	1	0	4	56
07:45 AM	6	24	3	33	0	3	0	3	2	17	2	21	4	0	1	5	62
Total	8	76	18	102	0	6	2	8	8	75	4	87	13	3	2	18	215
Grand Total	22	166	34	222	0	8	4	12	14	241	5	260	17	7	9	33	527
Apprch %	9.9	74.8	15.3		0	66.7	33.3		5.4	92.7	1.9		51.5	21.2	27.3		
Total %	4.2	31.5	6.5	42.1	0	1.5	0.8	2.3	2.7	45.7	0.9	49.3	3.2	1.3	1.7	6.3	

	SR-111 Southbound				Sinclair Road Westbound				SR-111 Northbound				Sinclair Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 05:00 AM to 07:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	0	20	**6**	26	0	1	0	1	0	15	0	15	2	0	0	2	44
07:15 AM	0	12	6	18	0	0	**1**	1	**3**	**22**	**2**	**27**	**4**	**2**	**1**	**7**	53
07:30 AM	2	20	3	25	0	2	1	**3**	3	21	0	24	3	1	0	4	56
07:45 AM	**6**	**24**	3	**33**	0	**3**	0	3	2	17	2	21	4	0	1	5	**62**
Total Volume	8	76	18	102	0	6	2	8	8	75	4	87	13	3	2	18	215
% App. Total	7.8	74.5	17.6		0	75	25		9.2	86.2	4.6		72.2	16.7	11.1		
PHF	.333	.792	.750	.773	.000	.500	.500	.667	.667	.852	.500	.806	.813	.375	.500	.643	.867

Counts Unlimited, Inc.
PO Box 1178
Corona, CA 92878
(951)268-6268

County of Imperial
N/S: SR-111
E/W: Sinclair Road
Weather: Clear

File Name : 01_CIM_111_Sinc Thu AM
Site Code : 23022885
Start Date : 10/6/2022



Peak Hour Analysis From 05:00 AM to 07:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM				07:00 AM				05:30 AM				07:00 AM			
+0 mins.	0	20	**6**	26	0	1	0	1	**2**	25	0	27	2	0	0	2
+15 mins.	0	12	6	18	0	0	**1**	1	0	21	0	21	**4**	**2**	**1**	**7**
+30 mins.	2	20	3	25	0	2	1	**3**	2	22	0	24	3	1	0	4
+45 mins.	**6**	**24**	3	**33**	0	**3**	0	3	0	**30**	0	**30**	4	0	1	5
Total Volume	8	76	18	102	0	6	2	8	4	98	0	102	13	3	2	18
% App. Total	7.8	74.5	17.6		0	75	25		3.9	96.1	0		72.2	16.7	11.1	
PHF	.333	.792	.750	.773	.000	.500	.500	.667	.500	.817	.000	.850	.813	.375	.500	.643

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County of Imperial
N/S: SR-111
E/W: Sinclair Road
Weather: Clear

File Name : 01_CIM_111_Sinc Thu PM
Site Code : 23022885
Start Date : 10/6/2022
Page No : 1

Groups Printed- Total Volume

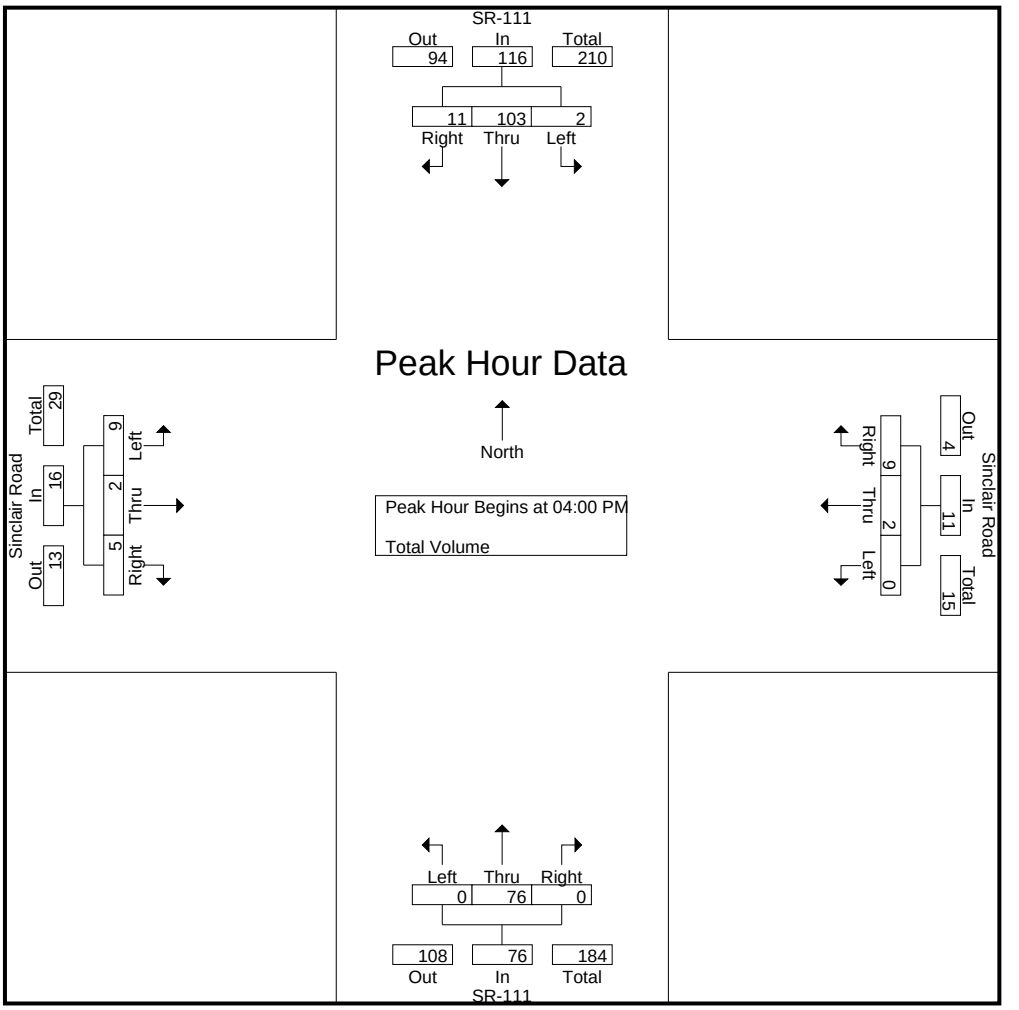
	SR-111 Southbound				Sinclair Road Westbound				SR-111 Northbound				Sinclair Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	1	29	3	33	0	0	1	1	0	22	0	22	3	0	3	6	62
04:15 PM	1	30	6	37	0	1	4	5	0	9	0	9	3	0	0	3	54
04:30 PM	0	27	2	29	0	0	3	3	0	21	0	21	3	2	1	6	59
04:45 PM	0	17	0	17	0	1	1	2	0	24	0	24	0	0	1	1	44
Total	2	103	11	116	0	2	9	11	0	76	0	76	9	2	5	16	219
05:00 PM	0	30	1	31	0	0	1	1	2	21	0	23	4	0	0	4	59
05:15 PM	0	10	1	11	0	2	1	3	0	27	0	27	1	0	0	1	42
05:30 PM	0	15	1	16	0	0	0	0	0	13	0	13	0	0	1	1	30
05:45 PM	0	21	1	22	0	1	0	1	0	6	0	6	0	0	0	0	29
Total	0	76	4	80	0	3	2	5	2	67	0	69	5	0	1	6	160
06:00 PM	0	32	0	32	0	0	2	2	0	20	0	20	0	1	0	1	55
06:15 PM	0	19	0	19	0	0	0	0	0	12	0	12	0	0	2	2	33
06:30 PM	0	17	1	18	0	0	0	0	0	11	0	11	2	0	0	2	31
06:45 PM	0	10	1	11	0	0	1	1	0	9	0	9	0	0	2	2	23
Total	0	78	2	80	0	0	3	3	0	52	0	52	2	1	4	7	142
07:00 PM	0	12	1	13	0	0	0	0	0	10	0	10	0	2	0	2	25
07:15 PM	0	10	1	11	0	0	0	0	0	20	0	20	0	0	0	0	31
07:30 PM	0	14	1	15	1	0	1	2	0	11	0	11	0	0	0	0	28
07:45 PM	0	7	0	7	0	0	0	0	0	16	0	16	0	0	0	0	23
Total	0	43	3	46	1	0	1	2	0	57	0	57	0	2	0	2	107
Grand Total	2	300	20	322	1	5	15	21	2	252	0	254	16	5	10	31	628
Apprch %	0.6	93.2	6.2		4.8	23.8	71.4		0.8	99.2	0		51.6	16.1	32.3		
Total %	0.3	47.8	3.2	51.3	0.2	0.8	2.4	3.3	0.3	40.1	0	40.4	2.5	0.8	1.6	4.9	

	SR-111 Southbound				Sinclair Road Westbound				SR-111 Northbound				Sinclair Road Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 07:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	**1**	29	3	33	0	0	1	1	0	22	0	22	**3**	0	**3**	**6**	**62**
04:15 PM	1	**30**	**6**	**37**	0	**1**	**4**	**5**	0	9	0	9	3	0	0	3	54
04:30 PM	0	27	2	29	0	0	3	3	0	21	0	21	3	**2**	1	6	59
04:45 PM	0	17	0	17	0	1	1	2	0	**24**	0	**24**	0	0	1	1	44
Total Volume	2	103	11	116	0	2	9	11	0	76	0	76	9	2	5	16	219
% App. Total	1.7	88.8	9.5		0	18.2	81.8		0	100	0		56.2	12.5	31.2		
PHF	.500	.858	.458	.784	.000	.500	.563	.550	.000	.792	.000	.792	.750	.250	.417	.667	.883

Counts Unlimited, Inc.
PO Box 1178
Corona, CA 92878
(951)268-6268

County of Imperial
N/S: SR-111
E/W: Sinclair Road
Weather: Clear

File Name : 01_CIM_111_Sinc Thu PM
Site Code : 23022885
Start Date : 10/6/2022
Page No : 2



Peak Hour Analysis From 04:00 PM to 07:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM				04:00 PM				04:30 PM				04:00 PM			
+0 mins.	**1**	29	3	33	0	0	1	1	0	21	0	21	**3**	0	**3**	**6**
+15 mins.	1	**30**	**6**	**37**	0	**1**	**4**	**5**	0	24	0	24	3	0	0	3
+30 mins.	0	27	2	29	0	0	3	3	**2**	21	0	23	3	**2**	1	6
+45 mins.	0	17	0	17	0	1	1	2	0	**27**	0	**27**	0	0	1	1
Total Volume	2	103	11	116	0	2	9	11	2	93	0	95	9	2	5	16
% App. Total	1.7	88.8	9.5		0	18.2	81.8		2.1	97.9	0		56.2	12.5	31.2	
PHF	.500	.858	.458	.784	.000	.500	.563	.550	.250	.861	.000	.880	.750	.250	.417	.667

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PO Box 1178
Corona, CA 92878
(951)268-6268

City of Calipatria
N/S: SR-111 (Sorensen Avenue)
E/W: Main Street
Weather: Clear

File Name : 02_CPA_111_Main Wed AM
Site Code : 23022885
Start Date : 10/5/2022
Page No : 1

Groups Printed- Total Volume

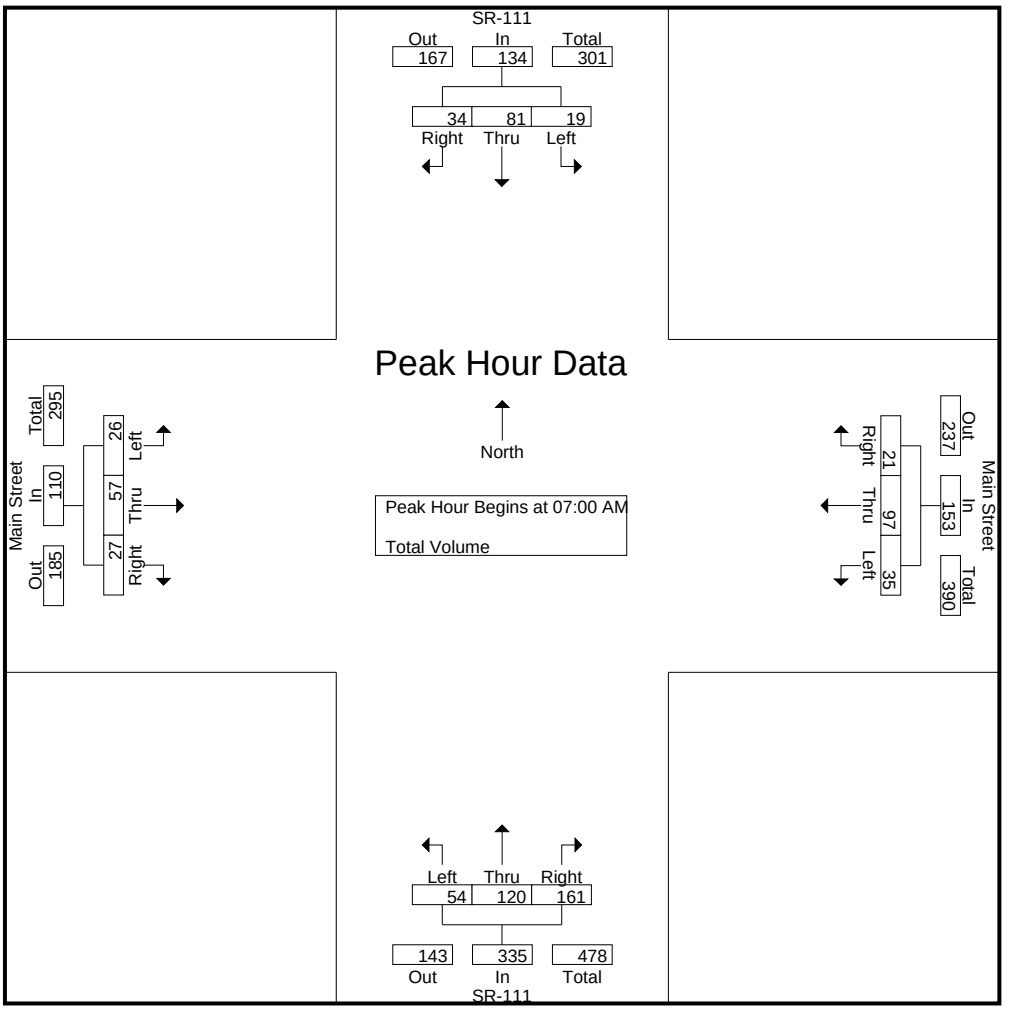
	SR-111 Southbound				Main Street Westbound				SR-111 Northbound				Main Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
05:00 AM	3	5	3	11	6	7	0	13	3	19	14	36	2	4	2	8	68
05:15 AM	5	6	4	15	7	2	1	10	4	20	30	54	3	6	5	14	93
05:30 AM	2	3	3	8	4	13	1	18	14	29	73	116	7	17	4	28	170
05:45 AM	7	4	3	14	11	13	6	30	6	29	47	82	8	21	1	30	156
Total	17	18	13	48	28	35	8	71	27	97	164	288	20	48	12	80	487
06:00 AM	2	15	8	25	37	9	3	49	4	11	11	26	4	7	4	15	115
06:15 AM	2	14	5	21	19	5	2	26	13	19	14	46	6	12	5	23	116
06:30 AM	2	19	5	26	10	8	2	20	16	16	33	65	4	15	3	22	133
06:45 AM	1	11	4	16	6	7	4	17	8	18	58	84	9	14	4	27	144
Total	7	59	22	88	72	29	11	112	41	64	116	221	23	48	16	87	508
07:00 AM	1	16	4	21	10	7	6	23	9	24	29	62	9	7	5	21	127
07:15 AM	3	21	10	34	8	10	4	22	6	24	37	67	4	15	8	27	150
07:30 AM	5	17	12	34	8	25	3	36	14	27	39	80	6	10	4	20	170
07:45 AM	10	27	8	45	9	55	8	72	25	45	56	126	7	25	10	42	285
Total	19	81	34	134	35	97	21	153	54	120	161	335	26	57	27	110	732
Grand Total	43	158	69	270	135	161	40	336	122	281	441	844	69	153	55	277	1727
Apprch %	15.9	58.5	25.6		40.2	47.9	11.9		14.5	33.3	52.3		24.9	55.2	19.9		
Total %	2.5	9.1	4	15.6	7.8	9.3	2.3	19.5	7.1	16.3	25.5	48.9	4	8.9	3.2	16	

	SR-111 Southbound				Main Street Westbound				SR-111 Northbound				Main Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 05:00 AM to 07:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	1	16	4	21	**10**	7	6	23	9	24	29	62	**9**	7	5	21	127
07:15 AM	3	21	10	34	8	10	4	22	6	24	37	67	4	15	8	27	150
07:30 AM	5	17	**12**	34	8	25	3	36	14	27	39	80	6	10	4	20	170
07:45 AM	**10**	**27**	8	**45**	9	**55**	**8**	**72**	**25**	**45**	**56**	**126**	7	**25**	**10**	**42**	**285**
Total Volume	19	81	34	134	35	97	21	153	54	120	161	335	26	57	27	110	732
% App. Total	14.2	60.4	25.4		22.9	63.4	13.7		16.1	35.8	48.1		23.6	51.8	24.5		
PHF	.475	.750	.708	.744	.875	.441	.656	.531	.540	.667	.719	.665	.722	.570	.675	.655	.642

Counts Unlimited, Inc.
PO Box 1178
Corona, CA 92878
(951)268-6268

City of Calipatria
N/S: SR-111 (Sorensen Avenue)
E/W: Main Street
Weather: Clear

File Name : 02_CPA_111_Main Wed AM
Site Code : 23022885
Start Date : 10/5/2022
Page No : 2



Peak Hour Analysis From 05:00 AM to 07:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM				07:00 AM				07:00 AM				07:00 AM			
+0 mins.	1	16	4	21	**10**	7	6	23	9	24	29	62	**9**	7	5	21
+15 mins.	3	21	10	34	8	10	4	22	6	24	37	67	4	15	8	27
+30 mins.	5	17	**12**	34	8	25	3	36	14	27	39	80	6	10	4	20
+45 mins.	**10**	**27**	8	**45**	9	**55**	**8**	**72**	**25**	**45**	**56**	**126**	7	**25**	**10**	**42**
Total Volume	19	81	34	134	35	97	21	153	54	120	161	335	26	57	27	110
% App. Total	14.2	60.4	25.4		22.9	63.4	13.7		16.1	35.8	48.1		23.6	51.8	24.5	
PHF	.475	.750	.708	.744	.875	.441	.656	.531	.540	.667	.719	.665	.722	.570	.675	.655

Counts Unlimited, Inc.
PO Box 1178
Corona, CA 92878
(951)268-6268

City of Calipatria
N/S: SR-111 (Sorensen Avenue)
E/W: Main Street
Weather: Clear

File Name : 02_CPA_111_Main Wed PM
Site Code : 23022885
Start Date : 10/5/2022
Page No : 1

Groups Printed- Total Volume

	SR-111 Southbound				Main Street Westbound				SR-111 Northbound				Main Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	5	34	16	55	51	21	7	79	10	14	11	35	13	17	11	41	210
04:15 PM	8	29	8	45	22	9	3	34	11	17	3	31	4	15	11	30	140
04:30 PM	6	22	8	36	34	29	9	72	11	16	10	37	9	16	13	38	183
04:45 PM	3	22	15	40	18	16	3	37	14	15	12	41	10	24	16	50	168
Total	22	107	47	176	125	75	22	222	46	62	36	144	36	72	51	159	701
05:00 PM	6	25	8	39	10	5	1	16	14	23	9	46	12	21	20	53	154
05:15 PM	2	25	6	33	15	20	6	41	8	18	6	32	12	10	13	35	141
05:30 PM	4	14	10	28	18	9	8	35	14	18	8	40	17	9	2	28	131
05:45 PM	3	14	4	21	8	17	7	32	11	11	12	34	4	7	3	14	101
Total	15	78	28	121	51	51	22	124	47	70	35	152	45	47	38	130	527
06:00 PM	7	14	7	28	12	15	5	32	11	20	8	39	16	29	9	54	153
06:15 PM	7	16	5	28	4	21	0	25	10	13	9	32	4	13	2	19	104
06:30 PM	7	20	9	36	8	19	5	32	7	9	5	21	9	15	5	29	118
06:45 PM	3	10	6	19	1	18	1	20	7	8	5	20	5	9	6	20	79
Total	24	60	27	111	25	73	11	109	35	50	27	112	34	66	22	122	454
07:00 PM	5	14	3	22	10	15	3	28	7	19	7	33	10	15	8	33	116
07:15 PM	4	11	1	16	14	6	5	25	6	15	8	29	4	12	5	21	91
07:30 PM	4	10	4	18	13	12	4	29	4	18	9	31	1	13	1	15	93
07:45 PM	3	5	2	10	16	8	5	29	7	6	7	20	2	9	2	13	72
Total	16	40	10	66	53	41	17	111	24	58	31	113	17	49	16	82	372
Grand Total	77	285	112	474	254	240	72	566	152	240	129	521	132	234	127	493	2054
Apprch %	16.2	60.1	23.6		44.9	42.4	12.7		29.2	46.1	24.8		26.8	47.5	25.8		
Total %	3.7	13.9	5.5	23.1	12.4	11.7	3.5	27.6	7.4	11.7	6.3	25.4	6.4	11.4	6.2	24	

	SR-111 Southbound				Main Street Westbound				SR-111 Northbound				Main Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 07:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	5	**34**	**16**	**55**	**51**	21	7	**79**	10	14	11	35	**13**	17	11	41	**210**
04:15 PM	**8**	29	8	45	22	9	3	34	11	**17**	3	31	4	15	11	30	140
04:30 PM	6	22	8	36	34	**29**	**9**	72	11	16	10	37	9	16	13	38	183
04:45 PM	3	22	15	40	18	16	3	37	**14**	15	**12**	**41**	10	**24**	**16**	**50**	168
Total Volume	22	107	47	176	125	75	22	222	46	62	36	144	36	72	51	159	701
% App. Total	12.5	60.8	26.7		56.3	33.8	9.9		31.9	43.1	25		22.6	45.3	32.1		
PHF	.688	.787	.734	.800	.613	.647	.611	.703	.821	.912	.750	.878	.692	.750	.797	.795	.835

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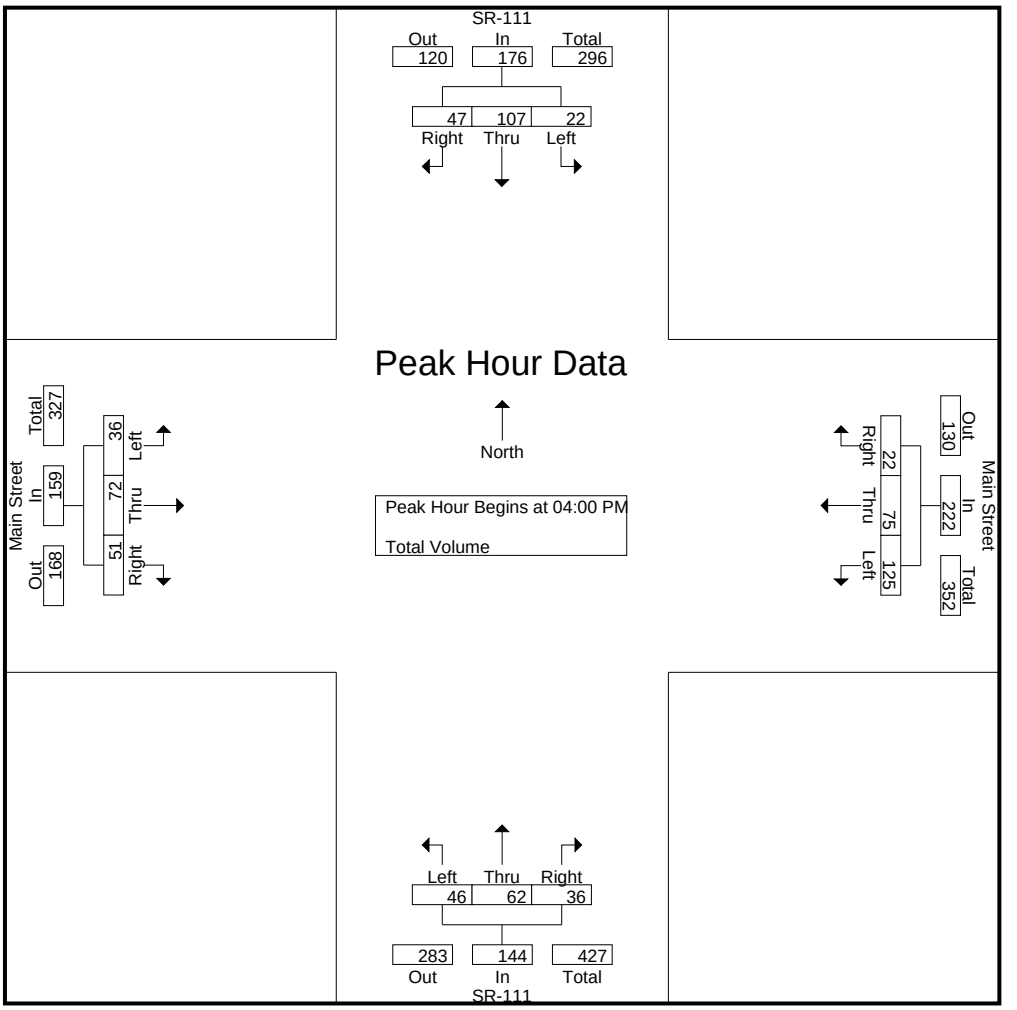
City of Calipatria
N/S: SR-111 (Sorensen Avenue)
E/W: Main Street
Weather: Clear

File Name : 02_CPA_111_Main Wed PM
Site Code : 23022885
Start Date : 10/5/2022



Peak Hour Analysis From 04:00 PM to 07:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM				04:00 PM				04:45 PM				04:30 PM			
+0 mins.	5	**34**	**16**	**55**	**51**	21	7	**79**	**14**	15	**12**	41	9	16	13	38
+15 mins.	**8**	29	8	45	22	9	3	34	14	**23**	9	**46**	10	**24**	16	50
+30 mins.	6	22	8	36	34	**29**	**9**	72	8	18	6	32	**12**	21	**20**	**53**
+45 mins.	3	22	15	40	18	16	3	37	14	18	8	40	12	10	13	35
Total Volume	22	107	47	176	125	75	22	222	50	74	35	159	43	71	62	176
% App. Total	12.5	60.8	26.7		56.3	33.8	9.9		31.4	46.5	22		24.4	40.3	35.2	
PHF	.688	.787	.734	.800	.613	.647	.611	.703	.893	.804	.729	.864	.896	.740	.775	.830

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City of Calipatria
N/S: SR-111 (Sorensen Avenue)
E/W: Main Street
Weather: Clear

File Name : 02_CPA_111_Main Thu AM
Site Code : 23022885
Start Date : 10/6/2022

Groups Printed- Total Volume

	SR-111 Southbound				Main Street Westbound				SR-111 Northbound				Main Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
05:00 AM	2	9	0	11	7	4	0	11	4	18	12	34	2	9	2	13	69
05:15 AM	5	8	1	14	0	4	1	5	9	18	44	71	4	7	2	13	103
05:30 AM	0	4	3	7	8	8	2	18	11	21	61	93	7	14	0	21	139
05:45 AM	1	8	6	15	18	18	3	39	8	33	40	81	8	15	0	23	158
Total	8	29	10	47	33	34	6	73	32	90	157	279	21	45	4	70	469
06:00 AM	2	15	4	21	19	8	1	28	3	27	11	41	7	9	3	19	109
06:15 AM	4	13	6	23	12	9	3	24	7	18	11	36	6	11	2	19	102
06:30 AM	9	17	7	33	4	3	4	11	10	15	27	52	9	14	1	24	120
06:45 AM	2	13	6	21	8	13	4	25	8	19	60	87	11	11	3	25	158
Total	17	58	23	98	43	33	12	88	28	79	109	216	33	45	9	87	489
07:00 AM	2	12	9	23	6	11	5	22	11	17	19	47	4	6	4	14	106
07:15 AM	3	18	6	27	10	16	11	37	7	24	33	64	7	18	5	30	158
07:30 AM	3	13	8	24	10	17	5	32	9	28	44	81	5	17	11	33	170
07:45 AM	3	21	5	29	12	52	7	71	25	29	71	125	6	27	12	45	270
Total	11	64	28	103	38	96	28	162	52	98	167	317	22	68	32	122	704
Grand Total	36	151	61	248	114	163	46	323	112	267	433	812	76	158	45	279	1662
Apprch %	14.5	60.9	24.6		35.3	50.5	14.2		13.8	32.9	53.3		27.2	56.6	16.1		
Total %	2.2	9.1	3.7	14.9	6.9	9.8	2.8	19.4	6.7	16.1	26.1	48.9	4.6	9.5	2.7	16.8	

	SR-111 Southbound				Main Street Westbound				SR-111 Northbound				Main Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 05:00 AM to 07:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 07:00 AM																	
07:00 AM	2	12	**9**	23	6	11	5	22	11	17	19	47	4	6	4	14	106
07:15 AM	**3**	18	6	27	10	16	**11**	37	7	24	33	64	**7**	18	5	30	158
07:30 AM	3	13	8	24	10	17	5	32	9	28	44	81	5	17	11	33	170
07:45 AM	3	**21**	5	**29**	**12**	**52**	7	**71**	**25**	**29**	**71**	**125**	6	**27**	**12**	**45**	**270**
Total Volume	11	64	28	103	38	96	28	162	52	98	167	317	22	68	32	122	704
% App. Total	10.7	62.1	27.2		23.5	59.3	17.3		16.4	30.9	52.7		18	55.7	26.2		
PHF	.917	.762	.778	.888	.792	.462	.636	.570	.520	.845	.588	.634	.786	.630	.667	.678	.652

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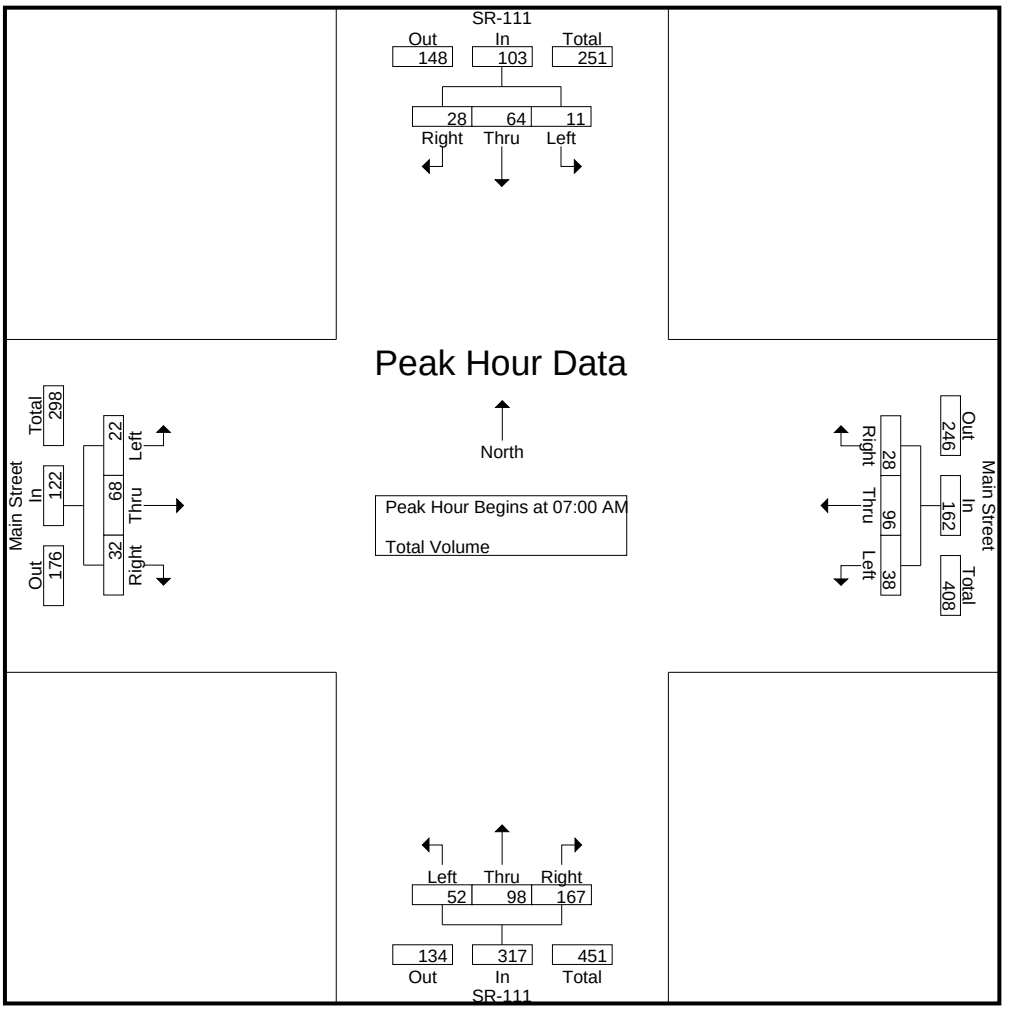
(951)268-6268

City of Calipatria
N/S: SR-111 (Sorensen Avenue)
E/W: Main Street
Weather: Clear

File Name : 02_CPA_111_Main Thu AM
Site Code : 23022885
Start Date : 10/6/2022



Peak Hour Analysis From 05:00 AM to 07:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	06:30 AM				07:00 AM				07:00 AM				07:00 AM			
+0 mins.	**9**	17	7	**33**	6	11	5	22	11	17	19	47	4	6	4	14
+15 mins.	2	13	6	21	10	16	**11**	37	7	24	33	64	**7**	18	5	30
+30 mins.	2	12	**9**	23	10	17	5	32	9	28	44	81	5	17	11	33
+45 mins.	3	**18**	6	27	**12**	**52**	7	**71**	**25**	**29**	**71**	**125**	6	**27**	**12**	**45**
Total Volume	16	60	28	104	38	96	28	162	52	98	167	317	22	68	32	122
% App. Total	15.4	57.7	26.9		23.5	59.3	17.3		16.4	30.9	52.7		18	55.7	26.2	
PHF	.444	.833	.778	.788	.792	.462	.636	.570	.520	.845	.588	.634	.786	.630	.667	.678

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City of Calipatria
N/S: SR-111 (Sorensen Avenue)
E/W: Main Street
Weather: Clear

File Name : 02_CPA_111_Main Thu PM
Site Code : 23022885
Start Date : 10/6/2022
Page No : 1

Groups Printed- Total Volume

	SR-111 Southbound				Main Street Westbound				SR-111 Northbound				Main Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	7	37	13	57	55	21	3	79	17	19	15	51	10	16	14	40	227
04:15 PM	9	24	11	44	12	30	5	47	11	18	4	33	7	22	11	40	164
04:30 PM	5	28	10	43	30	29	4	63	12	13	11	36	6	25	6	37	179
04:45 PM	9	15	14	38	16	16	4	36	19	17	9	45	17	18	7	42	161
Total	30	104	48	182	113	96	16	225	59	67	39	165	40	81	38	159	731
05:00 PM	12	24	9	45	14	18	6	38	16	17	16	49	9	18	16	43	175
05:15 PM	3	21	7	31	19	14	5	38	8	12	8	28	10	14	8	32	129
05:30 PM	4	12	6	22	8	18	2	28	7	11	5	23	4	17	10	31	104
05:45 PM	5	15	13	33	13	15	5	33	11	12	8	31	8	15	8	31	128
Total	24	72	35	131	54	65	18	137	42	52	37	131	31	64	42	137	536
06:00 PM	3	25	10	38	13	22	6	41	17	15	7	39	8	22	5	35	153
06:15 PM	4	27	2	33	11	13	4	28	9	14	9	32	8	17	9	34	127
06:30 PM	2	21	6	29	7	13	5	25	6	13	8	27	5	14	4	23	104
06:45 PM	3	17	7	27	8	18	4	30	9	9	3	21	5	18	3	26	104
Total	12	90	25	127	39	66	19	124	41	51	27	119	26	71	21	118	488
07:00 PM	3	20	5	28	8	10	0	18	6	12	15	33	7	12	7	26	105
07:15 PM	3	11	6	20	9	6	4	19	12	10	9	31	15	16	0	31	101
07:30 PM	2	8	4	14	14	8	4	26	6	12	6	24	4	8	4	16	80
07:45 PM	3	8	3	14	4	6	2	12	4	13	5	22	6	6	3	15	63
Total	11	47	18	76	35	30	10	75	28	47	35	110	32	42	14	88	349
Grand Total	77	313	126	516	241	257	63	561	170	217	138	525	129	258	115	502	2104
Apprch %	14.9	60.7	24.4		43	45.8	11.2		32.4	41.3	26.3		25.7	51.4	22.9		
Total %	3.7	14.9	6	24.5	11.5	12.2	3	26.7	8.1	10.3	6.6	25	6.1	12.3	5.5	23.9	

	SR-111 Southbound				Main Street Westbound				SR-111 Northbound				Main Street Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 07:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:00 PM																	
04:00 PM	7	**37**	13	**57**	**55**	21	3	**79**	17	**19**	**15**	**51**	10	16	**14**	40	**227**
04:15 PM	**9**	24	11	44	12	**30**	**5**	47	11	18	4	33	7	22	11	40	164
04:30 PM	5	28	10	43	30	29	4	63	12	13	11	36	6	**25**	6	37	179
04:45 PM	9	15	**14**	38	16	16	4	36	**19**	17	9	45	**17**	18	7	**42**	161
Total Volume	30	104	48	182	113	96	16	225	59	67	39	165	40	81	38	159	731
% App. Total	16.5	57.1	26.4		50.2	42.7	7.1		35.8	40.6	23.6		25.2	50.9	23.9		
PHF	.833	.703	.857	.798	.514	.800	.800	.712	.776	.882	.650	.809	.588	.810	.679	.946	.805

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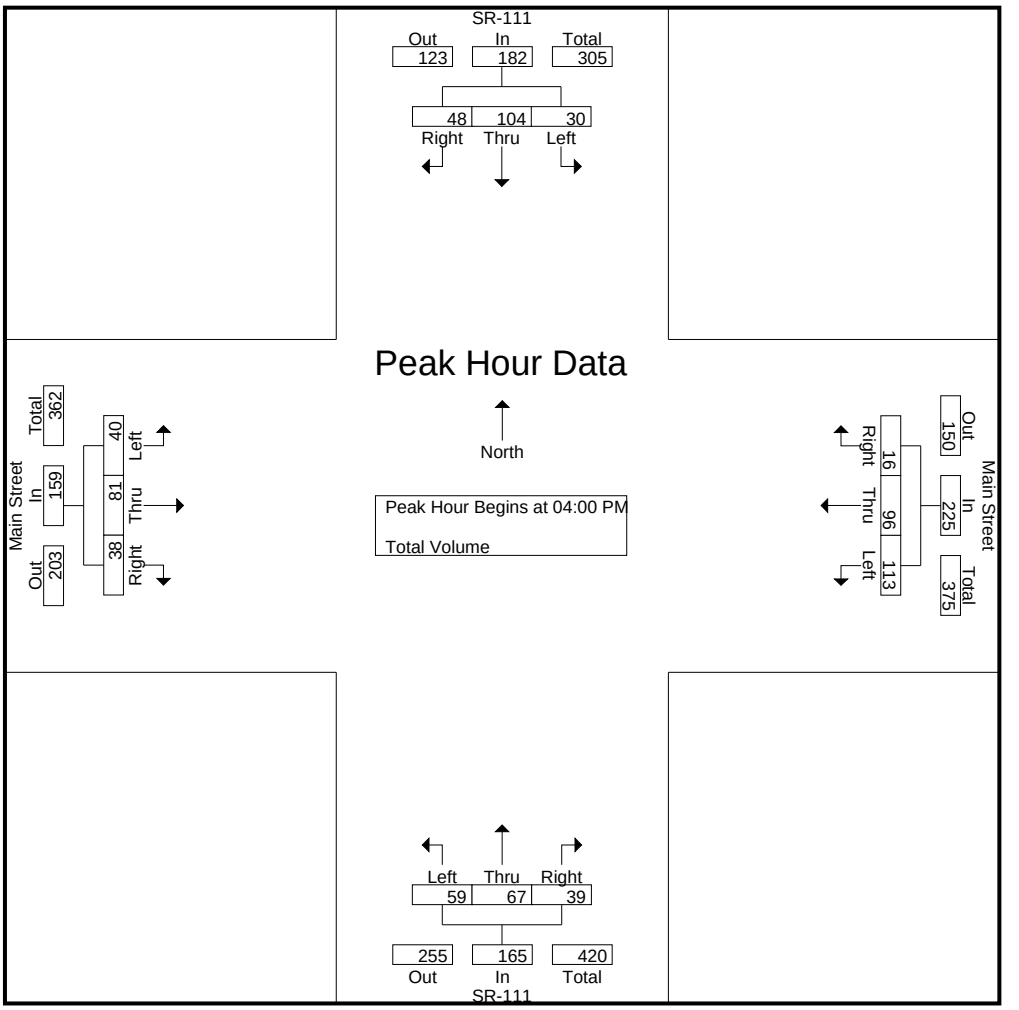
City of Calipatria
N/S: SR-111 (Sorensen Avenue)
E/W: Main Street
Weather: Clear

File Name : 02_CPA_111_Main Thu PM
Site Code : 23022885
Start Date : 10/6/2022



Peak Hour Analysis From 04:00 PM to 07:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM				04:00 PM				04:00 PM				04:15 PM			
+0 mins.	7	**37**	13	**57**	**55**	21	3	**79**	17	**19**	**15**	**51**	7	22	11	40
+15 mins.	**9**	24	11	44	12	**30**	**5**	47	11	18	4	33	6	**25**	6	37
+30 mins.	5	28	10	43	30	29	4	63	12	13	11	36	**17**	18	7	42
+45 mins.	9	15	**14**	38	16	16	4	36	**19**	17	9	45	9	18	**16**	**43**
Total Volume	30	104	48	182	113	96	16	225	59	67	39	165	39	83	40	162
% App. Total	16.5	57.1	26.4		50.2	42.7	7.1		35.8	40.6	23.6		24.1	51.2	24.7	
PHF	.833	.703	.857	.798	.514	.800	.800	.712	.776	.882	.650	.809	.574	.830	.625	.942

Counts Unlimited, Inc.

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Phone: (951) 268-6268
email: counts@countsunlimited.com

County of Imperial
Brandt Road
S/ Sinclair Road
48 Hour Directional Volume Count

CIM002
Site Code: 230-22885

Start Time	10/5/22 Wed	Northbound Morning	Northbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Southbound Morning	Southbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		0	0			0	0				
12:15		0	0			0	0				
12:30		0	1			0	1				
12:45		0	1	0	2	0	1	0	2	0	4
01:00		0	**0**			0	0				
01:15		0	**0**			0	**1**				
01:30		0	**2**			0	**1**				
01:45		0	**5**	0	7	0	**1**	0	3	0	10
02:00		0	0			0	**5**				
02:15		0	0			0	1				
02:30		0	1			0	0				
02:45		0	1	0	2	0	0	0	6	0	8
03:00		0	0			0	0				
03:15		0	0			0	0				
03:30		0	2			0	2				
03:45		0	0	0	2	0	4	0	6	0	8
04:00		0	1			0	2				
04:15		0	0			1	0				
04:30		0	0			0	1				
04:45		0	0	0	1	2	0	3	3	3	4
05:00		2	0			0	1				
05:15		1	0			0	1				
05:30		**1**	0			1	1				
05:45		**4**	0	8	0	0	0	1	3	9	3
06:00		**3**	0			1	1				
06:15		**3**	0			0	1				
06:30		0	0			0	0				
06:45		1	0	7	0	1	0	2	2	9	2
07:00		0	0			0	1				
07:15		2	0			1	0				
07:30		0	0			1	2				
07:45		2	0	4	0	0	0	2	3	6	3
08:00		1	0			0	1				
08:15		2	1			0	1				
08:30		1	0			1	0				
08:45		1	0	5	1	2	0	3	2	8	3
09:00		1	0			1	0				
09:15		1	2			0	0				
09:30		2	1			2	0				
09:45		1	0	5	3	2	0	5	0	10	3
10:00		0	0			0	0				
10:15		4	0			**1**	1				
10:30		2	0			**3**	0				
10:45		0	0	6	0	**3**	2	7	3	13	3
11:00		1	0			**1**	0				
11:15		2	0			0	1				
11:30		2	0			2	0				
11:45		1	0	6	0	1	1	4	2	10	2
Total		41	18	41	18	27	35	27	35	68	53
Combined Total		59		59		62		62		121	
AM Peak	-	05:30	-	-	-	10:15	-	-	-	-	-
Vol.	-	11	-	-	-	8	-	-	-	-	-
P.H.F.		0.688				0.667					
PM Peak	-	-	01:00	-	-	-	01:15	-	-	-	-
Vol.	-	-	7	-	-	-	8	-	-	-	-
P.H.F.			0.350				0.400				
Percentage		69.5%	30.5%			43.5%	56.5%				
ADT/AADT		ADT 121		AADT 121							

Counts Unlimited, Inc.

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County of Imperial
Gentry Road
S/ Sinclair Road
48 Hour Directional Volume Count

CIM003
Site Code: 230-22885

Start Time	10/5/22 Wed	Northbound Morning	Northbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Southbound Morning	Southbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		0	4			0	**4**				
12:15		0	7			1	**8**				
12:30		2	4			2	**16**				
12:45		1	8	3	23	0	**6**	3	34	6	57
01:00		0	6			0	3				
01:15		0	7			1	8				
01:30		3	4			2	6				
01:45		0	**8**	3	25	2	3	5	20	8	45
02:00		0	**12**			1	8				
02:15		0	**10**			0	6				
02:30		1	**9**			0	5				
02:45		0	6	1	37	0	6	1	25	2	62
03:00		0	4			0	4				
03:15		1	6			0	2				
03:30		0	1			3	2				
03:45		2	1	3	12	2	2	5	10	8	22
04:00		1	6			1	1				
04:15		0	2			0	3				
04:30		0	4			1	4				
04:45		1	1	2	13	0	0	2	8	4	21
05:00		0	1			1	0				
05:15		4	1			2	3				
05:30		1	1			0	1				
05:45		6	1	11	4	2	0	5	4	16	8
06:00		5	0			2	0				
06:15		6	1			**5**	1				
06:30		7	1			**17**	0				
06:45		6	1	24	3	**12**	0	36	1	60	4
07:00		6	1			**8**	1				
07:15		5	1			4	0				
07:30		8	2			8	3				
07:45		6	0	25	4	4	4	24	8	49	12
08:00		**10**	3			14	3				
08:15		**10**	4			10	0				
08:30		**10**	0			10	0				
08:45		**12**	1	42	8	3	1	37	4	79	12
09:00		7	1			13	2				
09:15		8	0			9	0				
09:30		6	0			8	0				
09:45		4	0	25	1	10	1	40	3	65	4
10:00		9	2			9	0				
10:15		4	1			15	0				
10:30		10	1			5	2				
10:45		12	2	35	6	12	1	41	3	76	9
11:00		4	1			6	1				
11:15		6	1			6	0				
11:30		8	2			5	0				
11:45		10	1	28	5	2	2	19	3	47	8
Total		202	141	202	141	218	123	218	123	420	264
Combined Total		343		343		341		341		684	
AM Peak	-	08:00	-	-	-	06:15	-	-	-	-	-
Vol.	-	42	-	-	-	42	-	-	-	-	-
P.H.F.		0.875				0.618					
PM Peak	-	-	01:45	-	-	-	12:00	-	-	-	-
Vol.	-	-	39	-	-	-	34	-	-	-	-
P.H.F.			0.813				0.531				
Percentage		58.9%	41.1%			63.9%	36.1%				
ADT/AADT		ADT 684		AADT 684							

Counts Unlimited, Inc.

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County of Imperial
Highway 111
S/ Sinclair Road
48 Hour Directional Volume Count

CIM001
Site Code: 230-22885

Start Time	10/5/22 Wed	Northbound Morning	Northbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Southbound Morning	Southbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		4	24			5	22				
12:15		1	23			2	33				
12:30		1	13			3	20				
12:45		4	21	10	81	1	24	11	99	21	180
01:00		3	20			0	27				
01:15		3	15			1	31				
01:30		0	21			3	19				
01:45		1	31	7	87	2	28	6	105	13	192
02:00		0	22			2	28				
02:15		0	16			0	28				
02:30		2	26			1	**31**				
02:45		1	13	3	77	1	**32**	4	119	7	196
03:00		1	**30**			3	**36**				
03:15		3	**30**			2	**32**				
03:30		1	**18**			8	25				
03:45		2	**23**	7	101	3	35	16	128	23	229
04:00		6	22			0	36				
04:15		4	16			2	20				
04:30		7	24			3	21				
04:45		8	13	25	75	7	14	12	91	37	166
05:00		21	18			4	19				
05:15		17	23			6	14				
05:30		30	22			7	15				
05:45		30	12	98	75	7	13	24	61	122	136
06:00		13	16			22	16				
06:15		16	21			18	21				
06:30		17	15			17	20				
06:45		24	8	70	60	12	11	69	68	139	128
07:00		15	11			13	12				
07:15		26	11			22	16				
07:30		28	12			21	6				
07:45		**28**	10	97	44	20	8	76	42	173	86
08:00		**27**	13			14	5				
08:15		**27**	10			22	7				
08:30		**32**	8			21	2				
08:45		23	5	109	36	**24**	4	81	18	190	54
09:00		21	7			**26**	7				
09:15		18	4			**21**	4				
09:30		19	8			**33**	5				
09:45		32	7	90	26	18	4	98	20	188	46
10:00		24	4			20	5				
10:15		30	3			21	2				
10:30		20	4			28	2				
10:45		22	7	96	18	15	5	84	14	180	32
11:00		20	7			17	6				
11:15		18	7			23	4				
11:30		28	1			21	5				
11:45		22	6	88	21	20	2	81	17	169	38
Total		700	701	700	701	562	782	562	782	1262	1483
Combined Total		1401		1401		1344		1344		2745	
AM Peak	-	07:45	-	-	-	08:45	-	-	-	-	-
Vol.	-	114	-	-	-	104	-	-	-	-	-
P.H.F.		0.891				0.788					
PM Peak	-	-	03:00	-	-	-	02:30	-	-	-	-
Vol.	-	-	101	-	-	-	131	-	-	-	-
P.H.F.			0.842				0.910				
Percentage		50.0%	50.0%			41.8%	58.2%				

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County of Imperial
Highway 111
S/ Sinclair Road
48 Hour Directional Volume Count

CIM001
Site Code: 230-22885

Start Time	10/6/22 Thu	Northbound Morning	Northbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Southbound Morning	Southbound Afternoon	Hour Totals Morning	Hour Totals Afternoon	Combined Totals Morning	Combined Totals Afternoon
12:00		2	22			2	29				
12:15		4	27			3	36				
12:30		3	22			1	27				
12:45		7	27	16	98	1	15	7	107	23	205
01:00		4	20			0	24				
01:15		1	17			0	23				
01:30		5	18			1	23				
01:45		1	16	11	71	1	18	2	88	13	159
02:00		3	19			4	30				
02:15		0	24			1	32				
02:30		3	20			1	34				
02:45		1	**21**	7	84	5	26	11	122	18	206
03:00		1	**25**			1	24				
03:15		4	**23**			2	31				
03:30		0	**32**			5	17				
03:45		6	16	11	96	1	**34**	9	106	20	202
04:00		3	22			5	**32**				
04:15		4	9			7	**30**				
04:30		11	21			4	**28**				
04:45		13	24	31	76	7	18	23	108	54	184
05:00		14	23			8	30				
05:15		16	27			5	10				
05:30		27	13			4	16				
05:45		21	6	78	69	12	21	29	77	107	146
06:00		24	20			18	32				
06:15		30	12			14	21				
06:30		22	11			22	17				
06:45		19	9	95	52	14	12	68	82	163	134
07:00		15	10			20	12				
07:15		27	20			13	10				
07:30		24	11			20	15				
07:45		21	16	87	57	25	7	78	44	165	101
08:00		21	8			27	9				
08:15		**29**	3			23	7				
08:30		**24**	9			**29**	3				
08:45		**29**	12	103	32	**25**	4	104	23	207	55
09:00		**30**	13			**25**	7				
09:15		23	10			**34**	5				
09:30		17	13			21	1				
09:45		29	6	99	42	26	5	106	18	205	60
10:00		18	5			24	5				
10:15		18	1			25	5				
10:30		18	6			24	3				
10:45		22	0	76	12	29	5	102	18	178	30
11:00		15	5			17	1				
11:15		20	5			39	1				
11:30		27	2			23	3				
11:45		26	4	88	16	16	0	95	5	183	21
Total		702	705	702	705	634	798	634	798	1336	1503
Combined Total		1407		1407		1432		1432		2839	
AM Peak	-	08:15	-	-	-	08:30	-	-	-	-	-
Vol.	-	112	-	-	-	113	-	-	-	-	-
P.H.F.		0.933				0.831					
PM Peak	-	-	02:45	-	-	-	03:45	-	-	-	-
Vol.	-	-	101	-	-	-	124	-	-	-	-
P.H.F.			0.789				0.912				
Percentage		49.9%	50.1%			44.3%	55.7%				
ADT/AADT		ADT 2,792		AADT 2,792							

DISTRICT	RTE	RTE_SFX	CNTY	PM_PFX	PM	PM_SFX	DESCRIPTION	BACK_PEAK_HOUR	BACK_PEAK_MADT	BACK_AADT	AHEAD_PEAK_HOUI	AHEAD_PEAK_MAD	AHEAD_AADT
11	078		SD		0.004		OCEANSIDE, JCT. RTE. 5				8200	81000	78000
11	078		SD		0.741		OCEANSIDE, JEFFERSON STREET	9100	122000	1180000	9300	128000	125000
11	078		SD		1.498		OCEANSIDE, EL CAMINO REAL	9300	128000	124000	10800	148000	138000
11	078		SD		3.315		OCEANSIDE, COLLEGE BOULEVARD	10500	144000	138000	10200	131000	128000
11	078		SD		4.384		VISTA, EMERALD DRIVE	10200	131000	128000	10000	137000	128000
11	078		SD		5.944		VISTA, MELROSE DRIVE	10000	137000	128000	10900	141000	123000
11	078		SD		6.940		VISTA, SUNSET DRIVE	10900	141000	123000	11200	146000	128000
11	078		SD		7.710		VISTA, MAR VISTA DRIVE	11200	146000	128000	11100	145000	126000
11	078		SD		9.083		SYCAMORE AVENUE	11100	145000	126000	11000	147000	142000
11	078		SD		10.606		SAN MARCOS,RANCHO SANTA FE	11000	146000	142000	10600	146000	142000
11	078		SD		11.183		SAN MARCOS, LAS POSAS ROAD	10600	145000	142000	10000	142000	141000
11	078		SD		12.134		SAN MARCOS, SAN MARCOS BOULEVARD	10000	142000	141000	11100	169000	167000
11	078		SD		12.911		SAN MARCOS, TWIN OAKS VALLEY ROAD	11100	169000	167000	12800	169000	168000
11	078		SD		14.241		SAN MARCOS, WOODLAND PARKWAY	12800	169000	168000	11200	168000	167000
11	078		SD		15.486		NORDAHL ROAD	11200	168000	167000	11900	172000	168000
11	078		SD	R	16.539		ESCONDIDO, JCT. RTE. 15	11800	171000	168000	6900	92000	86000
11	078		SD	R	17.268		ESCONDIDO, CENTRE CITY PARKWAY	6900	92000	86000	4400	59000	58000
11	078		SD	N	17.680		ESCONDIDO, BROADWAY/LINCOLN PARKWAY	4400	59000	58000	4400	59000	58000
11	078		SD	T	17.678		BROADWAY AND RTE 78	4400	59000	58000	2750	33500	33000
11	078		SD	T	17.822		ESCONDIDO, MISSION AVENUE	2750	33500	33000	2850	34500	34000
11	078		SD	T	18.072		ESCONDIDO, WASHINGTON AVENUE	2850	34500	34000	2650	32000	31500
11	078		SD	T	18.408		ESCONDIDO, HICKORY STREET	2650	32000	31500	1350	15600	15400
11	078		SD	T	19.094		ESCONDIDO ASH STREET	1400	15700	15400	1650	19300	19300
11	078		SD	T	19.271		ESCONDIDO, VALLEY PARKWAY BOULEVARD	1650	19300	19300	1550	17300	17000
11	078		SD	T	19.525		ESCONDIDO, GRAND AVENUE	1550	17300	17000	1400	17000	16800
11	078		SD		19.221		ESCONDIDO, OAK HILL DRIVE/5TH AVENUE	1400	17000	16800	1400	15700	15500
11	078		SD		20.190		17TH AVENUE	1400	15700	15500	1350	15600	15400
11	078		SD		20.640		BEAR VALLEY PARKWAY	1350	15600	15400	1350	16400	16300
11	078		SD		20.950		SUMMIT DRIVE	1350	16400	16300	1000	13400	13300
11	078		SD	R	22.560		CLOVERDALE/SAN PASQUAL ROAD	1000	13400	13300	1300	11900	10200
11	078		SD		23.000		SAN PASQUAL VALLEY ROAD	1200	10700	10200	1200	10700	10200
11	078		SD		24.023		WILD ANIMAL PARK ROAD	1200	10700	10200	840	8400	7300
11	078		SD	R	27.315		BANDY CANYON ROAD	840	8400	7300	1000	10500	9300
11	078		SD		33.050		WEEKEND VILLA ROAD	1000	10500	9300	1000	10800	9700

11	078	SD		34.352	ASH ST	1000	10800	9700	1150	11900	11000
11	078	SD		35.120	OLIVE STREET	1150	11900	11000	850	10700	10400
11	078	SD		35.519	JCT. RTE. 67 SOUTHWEST	850	10700	10400	2000	22000	21100
11	078	SD		35.741	RAMONA, EIGHTH STREET	1950	22000	21100	1650	21000	20700
11	078	SD		35.850	RAMONA, SEVENTH STREET	1650	21000	20700	1400	17000	16800
11	078	SD		35.960	RAMONA, SIXTH STREET	1400	17000	16800	1250	15200	14900
11	078	SD		36.290	RAMONA, THIRD STREET	1250	15200	14900	690	17500	8700
11	078	SD		37.110	MAGNOLIA AVENUE	690	17500	8700	690	7200	7000
11	078	SD		41.960	SUTHERLAND DAM ROAD	690	7200	7000	580	5300	5000
11	078	SD		51.108	WEST JCT. RTE. 79	1100	7200	6000	770	5200	4650
11	078	SD		56.910	PINE HILLS ROAD	780	5300	4650	920	6000	5100
11	078	SD		57.880	JULIAN, MAIN/ WASHINGTON STREETS	920	6000	5100	660	5100	5000
11	078	SD		58.133	EAST JCT. RTE. 79	740	5500	5000	520	4700	4200
11	078	SD		58.640	MANZANITA ROAD	490	4600	4200	280	2700	2450
11	078	SD		59.240	CANYON DRIVE	280	2700	2450	210	1900	1750
11	078	SD		60.273	WYNOLA ROAD	210	1900	1750	150	1450	1350
11	078	SD		69.693	VALLECITOS ROAD	150	1450	1350	140	1300	1250
11	078	SD		70.010	SAN FELIPE ROAD	140	1300	1250	240	2250	1350
11	078	SD		76.840	YAQUI PASS ROAD	250	2350	1350	250	1600	1150
11	078	SD		85.610	BORREGO SPRINGS ROAD	250	1600	1150	340	2250	1600
11	078	SD		95.313	SAN DIEGO/IMPERIAL COUNTY LINE	340	2250	1600			
11	078	IMP		0.000	SAN DIEGO/IMPERIAL COUNTY LINE				300	1500	1200
11	078	IMP		13.169	NORTH JCT. RTE 86	260	1350	1200	260	1300	1200
11	078	IMP	R	9.203	SOUTH JCT RTE 86	300	1950	1200	800	10200	9000
11	078	IMP	R	10.809	BRANDT RD	780	10400	9000	1100	14000	12200
11	078	IMP	R	12.891	JCT 78/111 - WEST	2850	14700	12200	2900	16300	13600
11	078	IMP	R	13.897	BEST ROAD	1150	15200	13600	1200	13200	11800
11	078	IMP		15.499	E JCT RTE 78/111	970	13200	11800	510	5200	4550
11	078	IMP		18.651	WEST JCT. RTE. 115	500	4850	4550	450	4500	3700
11	078	IMP		21.023	EAST JCT. RTE. 115	490	4350	3700	360	2500	2100
11	078	IMP		25.927	GREEN ROAD	480	2500	2100	410	2050	1800
11	078	IMP		41.004	GLAMIS	410	2050	1800	440	2100	1900
11	078	IMP		52.348	OGILBY ROAD	440	2100	1900	520	2400	2050
11	078	IMP		80.442	PALO VERDE, FOURTH/MAIN STREETS	550	2600	2150	360	2250	1950
11	078	IMP		80.743	PALO VERDE, IMPERIAL/RIVERSIDE COUNTY LINE	330	2250	1950			
08	078	RIV		0.000	PALO VERDE, IMPERIAL/RIVERSIDE COUNTY LINE				220	1600	1500
08	078	RIV		3.060	32ND AVENUE/PALO VERDE BOULEVARD	220	1600	1500	260	1900	1800
08	078	RIV		6.350	CRANNELLS BOULEVARD/28TH AVENUE	260	1900	1800	240	1950	1700
08	078	RIV		9.352	28TH AVENUE/NEIGHBORS BOULEVARD	240	1950	1700	270	2150	1900
08	078	RIV		10.620	RIPLEY, BROADWAY STREET	270	2150	1900	270	3100	2800
08	078	RIV		16.169	JCT. RTE. 10	270	3100	2800	390	3350	2800
08	078	RIV		16.411	HOBSON WAY F-OLD RTE 10	390	3350	2800			

11	086	IMP	R	0.000	JCT. RTE. 111				620	5800	4850
11	086	IMP		2.077	DOGWOOD ROAD	540	5600	5100	460	4550	4200
11	086	IMP		3.050	WEST HEBER TURN	460	4550	4200	350	3500	3300
11	086	IMP		4.530	MC CABE ROAD	350	3500	3300	630	8200	8100
11	086	IMP		6.006	JCT. RTE. 8	2100	24600	22400	3000	33500	32000
11	086	IMP	L	6.534	EL CENTRO, ROSS AVENUE	3000	33500	32000	2900	31000	30000
11	086	IMP		7.240	EL CENTRO, STATE STREET	2900	31000	30000	2650	30000	29000
11	086	IMP	L	7.308	MAIN STREET	2650	30000	29000	1700	20600	19000
11	086	IMP	L	8.028	EL CENTRO, EIGHTH STREET	1700	20600	19000	1550	18000	17000
11	086	IMP	L	8.525	ADAMS/IMPERIAL AVENUES	1600	18400	17000	2600	31500	28500
11	086	IMP		7.430	EL CENTRO, EUCLID/HOGAR AVENUES	2600	31500	28500	2350	28000	26000
11	086	IMP		7.490	EL CENTRO, WOODWARD AVENUE	2350	28000	26000	2450	29000	26500
11	086	IMP		7.643	SCOTT AVENUE	2450	29000	26500	2450	30500	27500
11	086	IMP		7.930	PICO AVENUE	2450	30500	27500	2450	29000	26500
11	086	IMP		8.180	EL DORADO AVENUE	2450	29000	26500	2000	23700	22100
11	086	IMP		15.320	KEYSTONE ROAD	1300	14500	13800	1300	15800	14000
11	086	IMP		19.190	LEGION ROAD	1350	16100	14300	1950	21700	19600
11	086	IMP		20.080	BRAWLEY, WESTERN AVENUE	1950	21700	19600	1700	19100	16900
11	086	IMP		20.250	BRAWLEY, K STREET	1700	19100	16900	1100	12900	12200
11	086	IMP		20.627	SOUTH JCT. RTE. 78	1100	12900	12300	1550	17900	17200
11	086	IMP		20.990	BRAWLEY, RIO VISTA AVENUE	1550	17900	17200	1800	20900	20000
11	086	IMP		21.250	LAS FLORES DRIVE	1800	20900	20000	1700	20700	19600
11	086	IMP	R	22.882	KALIN ROAD	1700	20700	19600	770	9500	8800
11	086	IMP	R	24.057	JCT RTE 78	760	9400	8700	1450	17200	16400
11	086	IMP	R	27.211	WESTMORLAND, B STREET	1450	17200	16400	1450	16400	15300
11	086	IMP		27.510	WESTMORLAND, CENTER STREET	1450	16400	15300	1900	24600	23400
11	086	IMP		27.760	WESTMORLAND, WEST CITY LIMITS/ H STREET	1900	24600	23400	1150	13400	12700
11	086	IMP		28.006	MARTIN ROAD	1150	13400	12700	1150	14600	12800
11	086	IMP	R	29.005	LACK ROAD	1150	14600	12800	1250	19000	17300
11	086	IMP	R	33.757	BANNISTER ROAD	1250	19000	17300	1150	14900	13200
11	086	IMP		43.559	NORTH JCT. RTE. 78	1100	14600	12400	1100	13300	11900
11	086	IMP		53.900	AIR PARK DRIVE	1100	13600	12100	2250	20000	18400
11	086	IMP		56.120	SALTON CITY, SOUTH MARINA DRIVE	2250	20000	18400	2250	20600	18900
11	086	IMP		63.630	SALTON SEA BEACH ROAD	2250	20600	18900	1500	19900	16900
11	086	IMP		66.143	DESERT SHORES DRIVE	1700	19400	16800	1500	19900	16800
11	086	IMP		67.824	IMPERIAL/RIVERSIDE COUNTY LINE	1500	19900	16800			
08	086	RIV		0.000	IMPERIAL/RIVERSIDE COUNTY LINE				1500	19900	16800
08	086	RIV		1.710	LINCOLN ST - RT	1500	19900	16800	1500	19900	16800
08	086	RIV	R	3.484	81ST AVE	1500	19900	16800	1400	19600	16800
08	086	RIV	R	11.031	JCT RTE 195	1550	19000	16500	1400	18600	16500
08	086	RIV	R	12.477	JCT RTE 111	1400	18600	16500	1650	22600	19400
08	086	RIV	R	16.744	AIRPORT BLVD	1950	27500	23500	2450	34500	29500

08	086	RIV	R	22.157	DILLON RD	2450	34500	29500	2800	39000	33500
08	086	RIV	R	23.000	JCT RTE 10	2800	39000	33500			
11	111	IMP	R	0.000	CALEXICO, SOUTH CITY LIMITS, AT MEXICAN BOUNDARY				2300	30500	29500
11	111	IMP	R	0.200	CALEXICO, SECOND STREET	2300	30500	29500	2300	32000	29500
11	111	IMP	R	0.273	THIRD ST	2300	32000	29500	2600	35500	34000
11	111	IMP		0.836	CALEXICO, GRANT STREET (EIGHTH STREET)	2600	35500	34000	2600	35500	34000
11	111	IMP	R	1.183	JCT. RTE. 98	2600	35500	34000	2500	32500	31500
11	111	IMP	R	2.211	COLE ROAD	2600	33500	31500	2850	37500	34500
11	111	IMP	R	4.741	JCT. RTE. 86 WEST	2850	37500	34500	3000	36500	34500
11	111	IMP	R	6.242	MC CABE ROAD	2950	36000	34500	2650	36000	34000
11	111	IMP	R	7.714	JCT. RTE. 8	2650	36000	34000	2800	31500	29500
11	111	IMP	R	9.503	EVAN HEWES HWY	2000	26500	24000	2000	25500	22900
11	111	IMP	R	11.299	ATEN RD	2050	26500	22900	1300	17400	16900
11	111	IMP	R	12.874	WORTHINGTON ROAD	1300	17400	16900	1450	17700	15800
11	111	IMP	R	17.385	KEYSTONE ROAD	1450	17700	15800	1300	16400	15300
11	111	IMP	R	22.015	JCT. RTE. 78	1400	17500	15300	880	8000	7600
11	111	IMP		23.538	SHANK ROAD	880	8000	7600	620	6400	6000
11	111	IMP		23.787	DEL RIO RD. RT. Y	620	6400	6000	630	6500	6000
11	111	IMP		24.682	ANDRE RD. F	620	6400	6000	710	6800	5300
11	111	IMP		26.670	RUTHERFORD ROAD	810	7700	6000	900	8600	6800
11	111	IMP		32.010	CALIPATRIA, SOUTH CITY LIMITS	800	7700	6100	790	7600	6000
11	111	IMP		32.513	JCT. RTE. 115 EAST	750	7200	5700	710	6700	5400
11	111	IMP		32.740	CALIFORNIA STREET	710	6700	5400	860	7800	5900
11	111	IMP		36.090	SINCLAIR ROAD	860	7800	5900	620	5600	3500
11	111	IMP		39.820	NILAND AVENUE	620	5600	3500	400	3550	2800
11	111	IMP		40.400	THIRD STREET	400	3550	2800	470	4100	3150
11	111	IMP		40.710	BEAL ROAD	470	4100	3150	320	3150	2350
11	111	IMP		42.470	ENGLISH ROAD	310	2950	2250	300	2800	2200
11	111	IMP		57.625	BOMBAY BEACH ROAD	260	2200	1700	240	1850	1750
11	111	IMP		65.394	IMPERIAL/RIVERSIDE COUNTY LINE	270	2150	1800			
08	111	RIV		0.001	IMPERIAL/RIVERSIDE COUNTY LINE				240	1900	1650
08	111	RIV		7.670	SALTON SEA STATE PARK ROAD	170	1750	1650	340	3450	3300
08	111	RIV		18.428	MECCA,	580	5700	5000	890	8800	7700
08	111	RIV	R	18.511	LINCOLN ST -RT	570	5800	5500	730	7400	7000
08	111	RIV	R	19.318	JCT RTE 86	730	7400	7000	730	7400	7000
08	111	RIV		47.252	PALM SPRINGS, GOLF CLUB DRIVE	2850	31500	29000	3200	35500	32600
08	111	RIV	T	47.795	EAST PALM CANYON/GENE AUTRY TRAIL	2850	31500	29000	1300	13500	12700
08	111	RIV	T	48.318	GENE AUTRY TR N/O PALM CYN	1300	13500	12700	1250	13500	12700
08	111	RIV	T	49.370	PALM SPRINGS, RAMON ROAD	1250	13500	12700	1950	20100	18900
08	111	RIV	T	51.588	VISTA CHINO	2100	21700	20400	2700	31500	29600
08	111	RIV	T	52.371	PALM SPRINGS, FARRELL DRIVE	2700	31500	29600	2150	25000	23500
08	111	RIV	T	52.876	PALM SPRINGS, SUNRISE WAY	2150	25000	23500	2000	22800	21400

08	111	RIV	T	53.376	PALM SPRINGS, AVENIDA CABALLEROS	2000	22800	21400	1300	15000	14100
08	111	RIV	T	53.627	PALM SPRINGS, VIA MIRALESTE	1300	15000	14100	1300	15000	14100
08	111	RIV	T	53.877	PALM SPRINGS, INDIAN CANYON	1300	15000	14100	990	11400	10700
08	111	RIV	T	53.944	VISTA CHINO @ PALM CNYN	990	11400	10700	2200	20800	18500
08	111	RIV		54.955	PALM SPRINGS, TRAMWAY DRIVE	2000	19100	17000	2000	19100	17000
08	111	RIV	R	63.378	JCT. RTE. 10	1650	15700	14000			

RTE	RTE_SFX	DIST	CNTY	POSTMILE_PFX	POSTMILE	POSTMILE_SFX	LEG	DESCRIPTION	VEHICLE_AADT_TOTAL	TRUCK_AADT_TOTAL	TRK_PERCENT_TOT	TRK_2_AXLE	TRK_3_AXLE	TRK_4_AXLE	TRK_5_AXLE	TRK_2_AXLE_PCT	TRK_3_AXLE_PCT	TRK_4_AXLE_PCT	TRK_5_AXLE_PCT	EAL	YEAR_VER	EST
078		11	SD		0.004		A	OCEANSIDE, JCT. RTE. 5	78000	3643	4.67	1709	369	283	1282	46.92	10.12	7.77	35.19	578	07	E
078		11	SD		1.498		A	OCEANSIDE, EL CAMINO REAL	138000	6721	4.87	3153	680	522	2365	46.92	10.12	7.77	35.19	1,066	07	E
078		11	SD		5.944		B	VISTA, MELROSE DRIVE	128000	6618	5.17	3105	670	514	2329	46.92	10.12	7.77	35.19	1,049	07	E
078		11	SD		5.944		A	VISTA, MELROSE DRIVE	123000	5867	4.77	2753	594	456	2065	46.92	10.12	7.77	35.19	930	07	E
078		11	SD		10.606		X	SAN MARCOS,RANCHO SANTA FE	118000	5410	4.58	3523	464	209	1214	65.12	8.58	3.86	22.44	616	19	V
078		11	SD	R	16.539		B	ESCONDIDO, JCT. RTE. 15	168000	7644	4.55	3587	774	594	2690	46.92	10.12	7.77	35.19	1,212	07	V
078		11	SD	R	17.268		B	ESCONDIDO, CENTRE CITY PARKWAY	86000	4558	5.3	2484	428	246	1399	54.50	9.40	5.40	30.70	645	97	E
078		11	SD	N	17.68		B	ESCONDIDO, BROADWAY/LINCOLN PARKWAY	58000	580	1	310	138	89	44	53.40	23.80	15.30	7.50	52	86	E
078		11	SD	T	19.094		B	ESCONDIDO ASH STREET	15400	924	6	645	114	22	143	69.80	12.30	2.40	15.50	86	96	E
078		11	SD	T	19.094		A	ESCONDIDO ASH STREET	19300	1158	6	808	142	27	181	69.80	12.30	2.30	15.60	108	96	E
078		11	SD		18.94		A	ESCONDIDO, GRAND AVENUE	16800	1025	6.1	715	126	25	159	69.80	12.30	2.40	15.50	95	96	E
078		11	SD	R	22.56		A	CLOVERDALE/SAN PASQUAL ROAD	10200	599	5.87	424	60	31	84	70.78	10.02	5.18	14.02	54	19	V
078		11	SD	R	27.315		A	BANDY CANYON ROAD	9300	874	9.4	438	139	53	244	50.10	15.90	6.10	27.90	120	81	E
078		11	SD		35.519		B	JCT. RTE. 67 SOUTHWEST	10400	229	2.2	91	51	10	77	39.80	22.30	4.20	33.70	36	87	E
078		11	SD		35.519		A	JCT. RTE. 67 SOUTHWEST	21100	1161	5.5	802	132	51	175	69.10	11.40	4.40	15.10	108	87	V
078		11	SD		51.108		B	WEST JCT. RTE. 79	6000	360	6	255	42	31	32	70.90	11.60	8.50	9.00	28	93	V
078		11	SD		51.108		A	WEST JCT. RTE. 79	4650	291	6.26	246	21	10	14	84.54	7.22	3.44	4.81	17	19	V
078		11	SD		58.133		B	EAST JCT. RTE. 79	5000	830	16.6	652	104	37	37	78.50	12.50	4.50	4.50	51	88	E
078		11	SD		58.133		A	EAST JCT. RTE. 79	4200	1021	24.3	825	123	36	38	80.80	12.00	3.50	3.70	59	88	E
078		11	IMP	R	9.203		A	SOUTH JCT RTE 86	9000	2800	31.11	604	173	83	1940	21.57	6.17	2.96	69.30	719	18	V
078		11	IMP	R	12.891		X	JCT 78/111 - WEST	8450	5141	60.84	2636	176	166	2164	51.27	3.42	3.22	42.09	879	18	V
078		11	IMP	R	12.891		B	JCT 78/111 - WEST	12200	5704	46.75	2924	195	184	2401	51.27	3.42	3.22	42.09	976	18	V
078		11	IMP	R	12.891		A	JCT 78/111 - WEST	13600	5592	41.12	2867	191	180	2354	51.27	3.42	3.22	42.09	957	18	V
078		11	IMP		15.499		B	E JCT RTE 78/111	11800	5461	46.28	3092	419	291	1659	56.62	7.68	5.33	30.37	762	17	E
078		11	IMP		15.499		A	E JCT RTE 78/111	4550	2397	52.68	1346	159	141	751	56.17	6.64	5.87	31.32	342	18	V
078		11	IMP		18.651		A	WEST JCT. RTE. 115	3700	1158	31.3	272	71	5	811	23.50	6.10	0.40	70.00	297	85	V
078		11	IMP		21.023		A	EAST JCT. RTE. 115	2100	572	27.24	202	35	24	311	35.31	6.12	4.20	54.37	121	19	V
078		08	RIV		9.352		B	28TH AVENUE/NEIGHBORS BOULEVARD	1700	204	12	31	20	16	137	15.10	9.80	7.80	67.30	53	93	E
078		08	RIV		9.352		A	28TH AVENUE/NEIGHBORS BOULEVARD	1900	143	7.5	22	14	11	96	15.30	9.70	7.60	67.40	37	93	E
078		08	RIV		16.169		B	JCT. RTE. 10	2800	171	6.1	26	17	13	115	15.00	10.00	7.50	67.50	44	93	E
086		11	IMP	R	0		A	JCT. RTE. 111	4850	315	6.5	229	21	13	52	72.70	6.70	4.10	16.50	30	78	V
086		11	IMP		6.006		B	JCT. RTE. 8	22400	1344	6	927	101	44	271	69.00	7.50	3.30	20.20	142	78	E
086		11	IMP		6.006		A	JCT. RTE. 8	32000	2016	6.3	1339	163	44	470	66.40	8.10	2.20	23.30	230	78	V
086		11	IMP	L	8.525		B	ADAMS/IMPERIAL AVENUES	17000	1122	6.6	679	86	66	291	60.50	7.70	5.90	25.90	142	79	V
086		11	IMP	L	8.525		A	ADAMS/IMPERIAL AVENUES	28500	1796	6.3	867	199	32	697	48.30	11.10	1.80	38.80	294	78	V
086		11	IMP		15.32		B	KEYSTONE ROAD	13800	4658	33.75	4450	79	39	90	95.53	1.70	0.84	1.93	200	19	V
086		11	IMP	R	24.057		B	JCT RTE 78	8700	1092	12.55	537	77	55	423	49.22	7.03	5.00	38.75	180	18	V
086		11	IMP	R	27.211		B	WESTMORLAND, B STREET	16400	4659	28.41	699	388	932	2640	15.00	8.33	20.00	56.67	1,108	03	E
086		11	IMP		27.51		B	WESTMORLAND, CENTER STREET	15300	4312	28.18	834	96	113	3269	19.35	2.22	2.62	75.81	1,182	03	E
086		11	IMP		28.006		A	MARTIN ROAD	12800	4068	31.78	1221	401	314	2132	30.01	9.86	7.72	52.41	861	19	V
086		11	IMP		43.559		B	NORTH JCT. RTE. 78	12400	2874	23.18	556	64	75	2179	19.35	2.22	2.62	75.81	788	03	E
086		11	IMP		43.559		A	NORTH JCT. RTE. 78	11900	4284	36	651	286	1002	2343	15.19	6.68	23.40	54.70	1,005	03	E
086		11	IMP		67.824		B	IMPERIAL/RIVERSIDE COUNTY LINE	16800	4091	24.35	963	428	297	2402	23.55	10.47	7.26	58.72	945	16	E
086		08	RIV	R	16.744		B	AIRPORT BLVD	23500	4521	19.24	939	184	76	3322	20.77	4.07	1.67	73.49	1,207	18	V
111		11	IMP	R	0		A	CALEXICO, SOUTH CITY LIMITS, AT MEXICAN BOUNDARY	29500	1062	3.6	592	188	21	261	55.70	17.70	2.00	24.60	131	78	V
111		11	IMP		1.183		B	JCT. RTE. 98	34000	1632	4.8	1102	150	54	326	67.50	9.20	3.30	20.00	173	78	V
111		11	IMP	R	1.183		A	JCT. RTE. 98	31500	2520	8	1391	262	38	829	55.20	10.40	1.50	32.90	364	78	V
111		11	IMP	R	4.741		B	JCT. RTE. 86 WEST	34500	2760	8	1524	287	41	908	55.20	10.40	1.50	32.90	399	78	E
111		11	IMP	R	4.741		A	JCT. RTE. 86 WEST	34500	2415	7	1273	362	116	664	52.70	15.00	4.80	27.50	324	81	E
111		11	IMP	R	7.714		B	JCT. RTE. 8	34000	2380	7	1254	357	114	655	52.70	15.00	4.80	27.50	319	81	V
111		11	IMP	R	7.714		A	JCT. RTE. 8	29500	3658	12.4	1716	351	55	1536	46.90	9.60	1.50	42.00	630	78	V
111		11	IMP	R	12.874		A	WORTHINGTON ROAD	15800	7635	48.32	4711	203	120	2601	61.70	2.66	1.57	34.07	1,099	19	V
111		11	IMP	R	17.385		A	KEYSTONE ROAD	15300	3317	21.68	1154	221	147	1795	34.79	6.67	4.42	54.12	702	15	E
111		11	IMP		23.787		A	DEL RIO RD. RT. Y	6000	1711	28.52	1333	89	67	222	77.92	5.19	3.90	12.99	141	15	E
111		11	IMP		26.67		B	RUTHERFORD ROAD	6000	900	15	433	49	12	407	48.10	5.40	1.30	45.20	162	85	E
111		11	IMP		26.67		A	RUTHERFORD ROAD	6800	1435	21.1	508	75	33	819	35.40	5.20	2.30	57.10	312	78	V
111		11	IMP		32.513		B	JCT. RTE. 115 EAST	5700	1203	21.1	426	63	28	687	35.40	5.20	2.30	57.10	262	78	E
111		11	IMP		32.513		A	JCT. RTE. 115 EAST	5400	869	16.1	364	45	23	436	41.90	5.20	2.70	50.20	171	85	V
111		11	IMP		39.82		B	NILAND AVENUE	3500	644	18.4	270	33	17	323	41.90	5.20	2.70	50.20	126	85	E
111		11	IMP		39.82		A	NILAND AVENUE	2800	501	17.9	210	26	14	252	41.90	5.20	2.70	50.20	99	85	E
111		11	IMP		65.394		B	IMPERIAL/RIVERSIDE COUNTY LINE	1800	474	26.33	115	71	53	235	24.30	14.94	11.14	49.62	99	15	E
111		08	RIV		18.428		B	MECCA,	5000	985	19.7	413	51	27	494	41.90	5.20	2.70	50.20	194	85	E
111		08	RIV		18.428		A	MECCA,	7700	1348	17.5	519	67	55	706	38.50	5.00	4.10	52.40	276	85	V
111		08	RIV	T	50.8		O	TAMARISK ROAD	18900	2098	11.1	1733	183	40	143	82.60	8.70	1.90	6.80	133	92	V
111		08	RIV	T	51.588		B	VISTA CHINO	20400	2285	11.2	1887	199	43	155	82.60	8.70	1.90	6.80	144	91	V
111		08	RIV	T	51.588		A	VISTA CHINO	29600	2279	7.7	2072	148	18	41	90.90	6.50	0.80	1.80	103	91	V
111		08	RIV	R	63.378		B	JCT. RTE. 10	14000	756	5.4	547	54	20	135	72.30	7.20	2.60	17.90	74	90	V

BRGP Attachment DRR 75 Existing LOS Calculations

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↰	↱		↰	↱	
Traffic Vol, veh/h	14	5	3	2	5	3	9	107	8	15	99	22
Future Vol, veh/h	14	5	3	2	5	3	9	107	8	15	99	22
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	250	-	-	290	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	14	5	3	2	5	3	10	118	9	16	109	24

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	300	300	121	300	308	123	133	0	0	127	0	0
Stage 1	153	153	-	143	143	-	-	-	-	-	-	-
Stage 2	147	147	-	157	165	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	656	616	936	656	609	933	1464	-	-	1472	-	-
Stage 1	854	775	-	865	782	-	-	-	-	-	-	-
Stage 2	860	779	-	850	766	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	640	605	936	640	598	933	1464	-	-	1472	-	-
Mov Cap-2 Maneuver	640	605	-	640	598	-	-	-	-	-	-	-
Stage 1	848	766	-	859	777	-	-	-	-	-	-	-
Stage 2	845	774	-	832	758	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.6	10.4	0.5	0.8
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1464	-	-	661	680	1472	-	-
HCM Lane V/C Ratio	0.007	-	-	0.034	0.016	0.011	-	-
HCM Control Delay (s)	7.5	-	-	10.6	10.4	7.5	-	-
HCM Lane LOS	A	-	-	B	B	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0	0	-	-

Intersection	
Intersection Delay, s/veh	17.9
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	31	82	40	49	127	34	69	143	214	21	95	41
Future Vol, veh/h	31	82	40	49	127	34	69	143	214	21	95	41
Peak Hour Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	31	126	62	75	195	52	106	220	329	32	146	63
Number of Lanes	0	2	0	0	2	0	0	2	0	0	2	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	2
HCM Control Delay	12.8	14.2	23.3	12.6
HCM LOS	B	B	C	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	49%	0%	43%	0%	44%	0%	31%	0%
Vol Thru, %	51%	25%	57%	51%	56%	65%	69%	54%
Vol Right, %	0%	75%	0%	49%	0%	35%	0%	46%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	141	286	72	81	113	98	69	89
LT Vol	69	0	31	0	49	0	21	0
Through Vol	72	72	41	41	64	64	48	48
RT Vol	0	214	0	40	0	34	0	41
Lane Flow Rate	216	439	94	125	173	150	105	136
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.427	0.772	0.21	0.258	0.374	0.304	0.225	0.272
Departure Headway (Hd)	7.114	6.328	8.018	7.44	7.78	7.306	7.689	7.198
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	506	571	448	482	462	492	467	498
Service Time	4.855	4.069	5.767	5.189	5.527	5.053	5.441	4.95
HCM Lane V/C Ratio	0.427	0.769	0.21	0.259	0.374	0.305	0.225	0.273
HCM Control Delay	15.1	27.4	12.9	12.8	15.1	13.2	12.7	12.6
HCM Lane LOS	C	D	B	B	C	B	B	B
HCM 95th-tile Q	2.1	7.1	0.8	1	1.7	1.3	0.9	1.1

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	4	4	2	2	12	2	99	2	3	126	11
Future Vol, veh/h	10	4	4	2	2	12	2	99	2	3	126	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	250	-	-	290	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	12	5	5	2	2	14	2	119	2	4	152	13

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	299	292	159	296	297	120	165	0	0	121	0	0
Stage 1	167	167	-	124	124	-	-	-	-	-	-	-
Stage 2	132	125	-	172	173	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	657	622	892	660	618	937	1426	-	-	1479	-	-
Stage 1	840	764	-	885	797	-	-	-	-	-	-	-
Stage 2	876	796	-	835	760	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	643	620	892	651	616	937	1426	-	-	1479	-	-
Mov Cap-2 Maneuver	643	620	-	651	616	-	-	-	-	-	-	-
Stage 1	839	762	-	884	796	-	-	-	-	-	-	-
Stage 2	859	795	-	823	758	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.5	9.4	0.1	0.2
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1426	-	-	680	837	1479	-	-
HCM Lane V/C Ratio	0.002	-	-	0.032	0.023	0.002	-	-
HCM Control Delay (s)	7.5	-	-	10.5	9.4	7.4	-	-
HCM Lane LOS	A	-	-	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.1	0.1	0	-	-

Intersection	
Intersection Delay, s/veh	12.9
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	50	101	60	156	113	25	63	86	56	35	139	63
Future Vol, veh/h	50	101	60	156	113	25	63	86	56	35	139	63
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	61	123	73	190	138	30	77	105	68	43	170	77
Number of Lanes	0	2	0	0	2	0	0	2	0	0	2	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	2
HCM Control Delay	11.7	15	11.9	12.1
HCM LOS	B	B	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	59%	0%	50%	0%	73%	0%	33%	0%
Vol Thru, %	41%	43%	50%	46%	27%	69%	67%	52%
Vol Right, %	0%	57%	0%	54%	0%	31%	0%	48%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	106	99	101	111	213	82	105	133
LT Vol	63	0	50	0	156	0	35	0
Through Vol	43	43	51	51	57	57	70	70
RT Vol	0	56	0	60	0	25	0	63
Lane Flow Rate	129	121	123	135	259	99	127	162
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.263	0.222	0.24	0.244	0.502	0.176	0.252	0.296
Departure Headway (Hd)	7.316	6.608	7.187	6.519	7.095	6.502	7.115	6.604
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	494	546	503	553	511	556	507	546
Service Time	5.025	4.316	4.887	4.245	4.795	4.202	4.824	4.313
HCM Lane V/C Ratio	0.261	0.222	0.245	0.244	0.507	0.178	0.25	0.297
HCM Control Delay	12.6	11.2	12.1	11.3	16.7	10.6	12.2	12.1
HCM Lane LOS	B	B	B	B	C	B	B	B
HCM 95th-tile Q	1	0.8	0.9	1	2.8	0.6	1	1.2

BRGP Attachment DRR 78 Construction LOS Calculations

Intersection	
Int Delay, s/veh	2.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	17	5	6	2	5	3	44	107	8	15	99	58
Future Vol, veh/h	17	5	6	2	5	3	44	107	8	15	99	58
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	250	-	-	290	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	91	91	91	91	91	91	91	91	91	91	91	91
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	19	5	7	2	5	3	48	118	9	16	109	64

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	396	396	141	398	424	123	173	0	0	127	0	0
Stage 1	173	173	-	219	219	-	-	-	-	-	-	-
Stage 2	223	223	-	179	205	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	568	544	912	566	525	933	1416	-	-	1472	-	-
Stage 1	834	760	-	788	726	-	-	-	-	-	-	-
Stage 2	784	723	-	827	736	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	542	520	912	538	501	933	1416	-	-	1472	-	-
Mov Cap-2 Maneuver	542	520	-	538	501	-	-	-	-	-	-	-
Stage 1	806	752	-	761	701	-	-	-	-	-	-	-
Stage 2	749	698	-	806	728	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	11.4	11.2	2.1	0.7
HCM LOS	B	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1416	-	-	589	591	1472	-	-
HCM Lane V/C Ratio	0.034	-	-	0.052	0.019	0.011	-	-
HCM Control Delay (s)	7.6	-	-	11.4	11.2	7.5	-	-
HCM Lane LOS	A	-	-	B	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	-	0.2	0.1	0	-	-

Intersection	
Intersection Delay, s/veh	21.5
Intersection LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	31	82	40	49	141	34	81	178	214	21	98	41
Future Vol, veh/h	31	82	40	49	141	34	81	178	214	21	98	41
Peak Hour Factor	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	48	126	62	75	217	52	125	274	329	32	151	63
Number of Lanes	0	2	0	0	2	0	0	2	0	0	2	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	2
HCM Control Delay	13.6	15.3	29.8	13.4
HCM LOS	B	C	D	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	48%	0%	43%	0%	41%	0%	30%	0%
Vol Thru, %	52%	29%	57%	51%	59%	67%	70%	54%
Vol Right, %	0%	71%	0%	49%	0%	33%	0%	46%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	170	303	72	81	120	105	70	90
LT Vol	81	0	31	0	49	0	21	0
Through Vol	89	89	41	41	71	71	49	49
RT Vol	0	214	0	40	0	34	0	41
Lane Flow Rate	262	466	111	125	184	161	108	138
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.532	0.851	0.256	0.267	0.411	0.339	0.24	0.29
Departure Headway (Hd)	7.318	6.569	8.306	7.727	8.04	7.595	8.019	7.535
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	492	550	432	464	447	473	447	476
Service Time	5.067	4.318	6.066	5.487	5.795	5.349	5.78	5.296
HCM Lane V/C Ratio	0.533	0.847	0.257	0.269	0.412	0.34	0.242	0.29
HCM Control Delay	18.1	36.3	13.9	13.3	16.3	14.2	13.3	13.4
HCM Lane LOS	C	E	B	B	C	B	B	B
HCM 95th-tile Q	3.1	9.1	1	1.1	2	1.5	0.9	1.2

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	49	4	53	2	2	12	2	99	2	3	126	11
Future Vol, veh/h	49	4	53	2	2	12	2	99	2	3	126	11
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	250	-	-	290	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	83	83	83	83	83	83	83	83	83	83	83	83
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	59	5	64	2	2	14	2	119	2	4	152	13

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	299	292	159	325	297	120	165	0	0	121	0	0
Stage 1	167	167	-	124	124	-	-	-	-	-	-	-
Stage 2	132	125	-	201	173	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	657	622	892	632	618	937	1426	-	-	1479	-	-
Stage 1	840	764	-	885	797	-	-	-	-	-	-	-
Stage 2	876	796	-	805	760	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	643	620	892	581	616	937	1426	-	-	1479	-	-
Mov Cap-2 Maneuver	643	620	-	581	616	-	-	-	-	-	-	-
Stage 1	839	762	-	884	796	-	-	-	-	-	-	-
Stage 2	859	795	-	741	758	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	10.8	9.5	0.1	0.2
HCM LOS	B	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1426	-	-	746	821	1479	-	-
HCM Lane V/C Ratio	0.002	-	-	0.171	0.023	0.002	-	-
HCM Control Delay (s)	7.5	-	-	10.8	9.5	7.4	-	-
HCM Lane LOS	A	-	-	B	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0.6	0.1	0	-	-

Intersection	
Intersection Delay, s/veh	13.8
Intersection LOS	B

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	50	115	72	156	113	25	63	86	56	35	188	63
Future Vol, veh/h	50	115	72	156	113	25	63	86	56	35	188	63
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	61	140	88	190	138	30	77	105	68	43	229	77
Number of Lanes	0	2	0	0	2	0	0	2	0	0	2	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	2	2	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	2	2
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	2	2
HCM Control Delay	12.6	16.2	12.5	13.4
HCM LOS	B	C	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	SBLn1	SBLn2
Vol Left, %	59%	0%	47%	0%	73%	0%	27%	0%
Vol Thru, %	41%	43%	53%	44%	27%	69%	73%	60%
Vol Right, %	0%	57%	0%	56%	0%	31%	0%	40%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	106	99	108	130	213	82	129	157
LT Vol	63	0	50	0	156	0	35	0
Through Vol	43	43	58	58	57	57	94	94
RT Vol	0	56	0	72	0	25	0	63
Lane Flow Rate	129	121	131	158	259	99	157	191
Geometry Grp	7	7	7	7	7	7	7	7
Degree of Util (X)	0.273	0.231	0.27	0.297	0.53	0.187	0.317	0.363
Departure Headway (Hd)	7.607	6.896	7.405	6.768	7.369	6.775	7.253	6.827
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	472	520	485	531	490	530	496	527
Service Time	5.351	4.64	5.148	4.511	5.11	4.515	4.994	4.568
HCM Lane V/C Ratio	0.273	0.233	0.27	0.298	0.529	0.187	0.317	0.362
HCM Control Delay	13.2	11.7	12.9	12.4	18.2	11.1	13.3	13.4
HCM Lane LOS	B	B	B	B	C	B	B	B
HCM 95th-tile Q	1.1	0.9	1.1	1.2	3.1	0.7	1.3	1.6

BRGP Attachment DRR 94 LOMR Application

Massoud Rezakhani

From: Ibrahim osman <iosmanmrc@outlook.com>
Sent: Friday, May 19, 2023 3:07 AM
To: Massoud Rezakhani
Subject: Fw: Revision Project is Created with Case Number = 23-09-0889P

From: no-reply@fema.dhs.gov <no-reply@fema.dhs.gov>
Sent: Thursday, May 18, 2023 4:02 PM
To: iosmanmrc@outlook.com <iosmanmrc@outlook.com>
Subject: Revision Project is Created with Case Number = 23-09-0889P

We have received your request that the Department of Homeland Security?s Federal Emergency Management Agency (FEMA) issue a revision to the flood hazard information on the applicable National Flood Insurance Program (NFIP) map for: IMPERIAL COUNTY *, Imperial County, CA; and IMPERIAL COUNTY *, Imperial County, CA.

The Case Number assigned to your request is 23-09-0889P, and the Project ID is Alamo River.
Your Online LOMC Application ID was R4651623459011.

We are reviewing your submitted data and will contact you if additional information is required to process your request.

If additional information is not required, we will issue a final determination letter within 90 days.

You may obtain project status information from MIP via the Online LOMC homepage. To return to your application, click on the following link or copy and paste the link into the address bar of your browser:

https://hazards.fema.gov/femaportal/onlinelomc

Inquiries concerning the status of your request should be made by calling the FEMA Map Information eXchange (FMIX) toll free at (877) 336-2627 (877-FEMA-MAP).

Please be assured we will do our best to respond to all inquiries in a timely manner.

This message has been generated automatically. Please do not reply to this message.

LOMC Application

Application ID: R4651623459011 **Revision** All (*) indicate a required field.

Project Submission Details

Case Number 23-09-0889P successfully created.

You will receive a confirmation e-mail shortly regarding your case creation. Please be sure to login to Online LOMC with your registered e-mail address and check periodically for status updates on this case.

OK

Certain documents require a plug-in. To download plug-in for Adobe Acrobat Reader click here and/or Microsoft Word click here.

TECHNICAL STUDY DATA NOTEBOOK IN SUPPORT OF A

LETTER OF MAP REVISION

MR Consulting
water resources engineering

REGISTERED PROFESSIONAL ENGINEER
IBRAHIM OSMAN
C69825
Exp 6/30/2024
CIVIL
STATE OF CALIFORNIA
3/25/2023

ALAMO RIVER, IMPERIAL COUNTY

PREPARED FOR

Mr. Jerry Salamy
2485 Natomas Park Drive, Suite 600
Sacramento, CA 95833

PREPARED BY

MRC, LLC
29830 N. 78th Way
Scottsdale, Arizona 85266

TECHNICAL SUPPORT DATA NOTEBOOK

In Support of a Letter of Map Revision

for

The Property Located Along Alamo River, Imperial County, CA

Prepared for:

Mr. Jerry Salamy, Project Manager
Jacobs
2485 Natomas Park Drive, Suite 600
Sacramento, CA 95833

Submitted by MRC, LLC

Dated: March 25, 2023

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EXECUTIVE SUMMARY

This report summarizes the results of the MRC, LLC ("MRC") updated detailed floodplain study along the Alamo River within Imperial County, California. This study focuses on the proposed sites located immediately adjacent east to the Salton Sea, on the southwest corner of the intersection of McKendry Road and Boyle Road. These sites are located in flood zone A, as shown on the Digital Flood Insurance Rate Map (DFIRM) Panel No. 06025C0700C and 06025C0725C for Imperial County, CA, and Incorporated Areas, dated September 26, 2008.

The floodplain boundary for the sites, which is subject to flood hazards along the Alamo River, is currently designated as Zone A (according to FEMA, Zone A is "subject to inundation by the 1-percent-annual-chance flood event") and is depicted on the aforementioned DFIRM panel.

Results of MRC's analyses are hereby released to Jacobs for their use in evaluating potential hazards associated with the project site and for further detailed evaluation of the project area in the future.

STATEMENT OF LIMITATIONS

This report has been prepared to investigate the potential flood hazard associated along the southwest corner of the intersection of McKendry Road and Boyle Road project site. MRC performed an investigation of the project area to further the understanding of the Zone A floodplain boundaries shown on the effective Flood Insurance Rate Map (FIRM) panel. The scope of services performed during this investigation may not adequately address the needs of other users, and any re-use of this report or the findings, conclusions, or recommendations presented herein are at the sole risk of the user.

Our investigation included aerial map inspection of the project area and an evaluation of the contributing watershed based upon the updated topographic map from Jacobs.

MRC has no direct knowledge of and offers no warranty for information provided by others. Comments outlined in the report are derived from the engineering experience and judgment of MRC staff, in accordance with current standards of professional practice. The investigation outlined in this report may be invalidated, wholly or in part, by changes beyond our control.

We have made every effort to perform our investigation based on conventional professional civil engineering standards of care and the stipulations provided in our contract. If new data becomes available, or there are perceived omissions or misstatements in this report regarding any aspect of our work, we ask that they be brought to our attention as soon as possible so that we have the opportunity to fully address them.

SECTION 1.0 INTRODUCTION

1.1 Purpose of Study

Jacobs has retained MRC to investigate and revise the flood hazard information for the project area located on the southwest corner of the intersection of McKendry Road and Boyle Road in Imperial County, CA. The vicinity map and project location are provided as ***Figure 1*** below.

This report summarizes the results of MRC's scope of work to revise the flood hazard information for the project area located at the southwest corner of the intersection of McKendry Road and Boyle Road in Imperial County, CA. The results of MRC's analyses are hereby released to Jacobs for its use in evaluating potential hazards associated with the project site and for further detailed evaluation of the project area in the future.

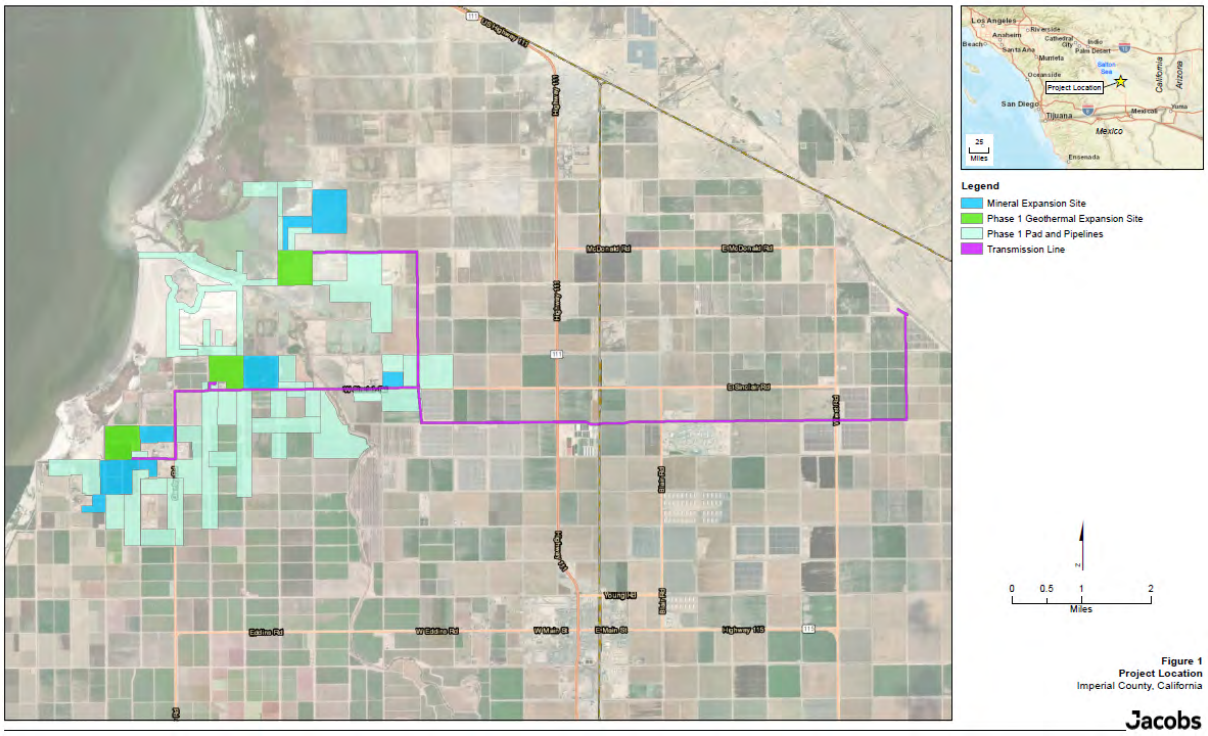


Figure 1 (Vicinity Map)

1.2 Authority and Acknowledgement

MRC was contracted by Jacobs to evaluate and (if appropriate) revise the flood hazard risk in support of a Letter of Map Revision (LOMR).

1.3 Review of Existing Studies

MRC made a request for obtaining back up data from the Federal Emergency Management Agency (FEMA) Engineering Library. No backup engineering data was available.

SECTION 2.0 SURVEY AND MAPPING INFORMATION

2.1 Topographic Map

Updated topographic data and aerial maps prepared by Jacobs were used in our hydraulic modeling. A copy of the topographic map is attached under Exhibit 2. A terrain DEM raster and TIN data set was also developed from the topographic data for use in our hydraulic modeling of floodplain mapping.

2.2 As-Built Conditions

There are no as-built conditions for this LOMR.

SECTION 3.0 HYDRAULICS

The Alamo River has been modeled (HEC-RAS 5.07 1D) to study the hydraulic behavior of the river in existing conditions. The river is intended to be studied against base flow of one percent annual chance of flood discharge of 4500 cfs. The hydraulic analysis of the existing condition is based on updated topographic information. This hydraulic model along with other associated geometric data was used to establish the 100-year water surface elevations along a reach of the Alamo River.

The hydraulic analysis results reveals that the floodplain boundaries are reduced, and the associated 100-year water surface elevations are lower when compared to the effective flood risk information depicted on FIRM panels.

The main channel and overbanks were modeled together for final mapping and combined into a single model at the final stage. (Input/output of models are attached)

Channel and Flow Path Representation

Alamo River stream centerline and flow paths on the left and right overbanks were digitized in ArcGIS and imported into the HEC-RAS model. Overbank flow paths were delineated based on topographic data, aerial imagery and results from preliminary runs.

Cross Sections

Cross sections for the Alamo River main channel were limited to the channel banks. Geometry for the channel portion was obtained from a triangulated irregular network (TIN). Cross sections on the overbanks were oriented based on preliminary modeling results by determining the flow direction and deepest parts of the overbanks.

In addition, 2-foot contours were used along with aerial imagery to appropriately define the effective portion of the cross sections. The overbank cross sections were connected to the main channel cross sections at locations where the main channel overtopped.

Roughness Coefficients

Landcover information from Imperial County has been used and augmented at several locations in the channel to match the existing conditions information from the imagery data. Channel has a roughness value of 0.036 and an overbank roughness value of 0.045.

Starting Condition (Boundary Condition)

The upstream flow boundary feeds the inflow to the hydraulic model. No flow change locations have been modeled other than use of lateral structure to carry the flow out of the 1-D system. Downstream boundary conditions are based on slope area method as the downstream revision is at the confluence with Alamo River. Normal slope has been used to control the left and right areas.

Flow Regime

A supercritical flow regime was used in the hydraulic model to evaluate changes in the water surface elevation that could result as the slope in the channel profile changes.

Floodplain Delineation

Floodplains for the main channel and left and right overbank areas were delineated using RAS-Mapper and a 2-foot ground surface DEM. The generated draft floodplain boundaries from RAS-Mapper are exported to ArcMAP to develop the final floodplain mapping. No floodway analysis was conducted as part of the study. No encroachment will be allowed within the constructed channel. Furthermore, the channel is either dedicated right away or drainage easement. Currently, no floodway is designated for the Alamo River on the effective FIRM Panels.

SECTION 4.0 DISCUSSIONS AND CONCLUSION

The HEC-RAS model analysis results show that by using the updated topography along a reach of the Alamo River results in changes to the FEMA DFIRM Panel No. 06025C0700C and 06025C0725C. A LOMR application has been prepared and submitted to revise the floodplain boundaries and flood elevations for the above-mentioned reach of Alamo River. Also, the revised analysis results show that the revised floodplain will not negatively impact the adjacent properties.

SECTION 5.0: REFERENCES

1. Federal Emergency Management Agency (FEMA), *Flood Insurance Rate Map, Panel Nos.* 06025C0700C and 06025C0725C for Imperial County, CA, and Incorporated Areas, dated September 26, 2008.

APPENDICES

APPENDIX A

(Mapping Support Information)

LiDAR Validation Report

Document no: 01
Version: 02

BHE Renewables, LLC
Black Rock, Elmore North, and Morton Bay Geothermal Projects

Letter of Map Revision/Conditional Letter of Map Revision
April 27, 2023

LiDAR Validation Report

Client name:	BHE Renewables, LLC		
Project name:	Letter of Map Revision/Conditional Letter of Map Revision		
Client reference:	Black Rock, Elmore North, and Morton Bay Geothermal Projects	Project no:	*[Project number]*
Document no:	01	Project manager:	*[Project manager]*
Version:	02	Prepared by:	Kristopher Andersen
Date:	April 27, 2023	File name:	BHER_Lidar_Validation_Report_Final.docx

Document status: *[Document suitability – Delete row if not applicable]*

Document history and status

Version	Date	Description	Author	Checked	Reviewed	Approved
01	4/19/2023	Final	Andersen	Vossman	Engesath	
02	4/27/2023	Edits	Andersen	Vossman		

Distribution of copies

Version	Issue approved	Date issued	Issued to	Comments

[Legal entity]

[Address]

Contents

1. Introduction

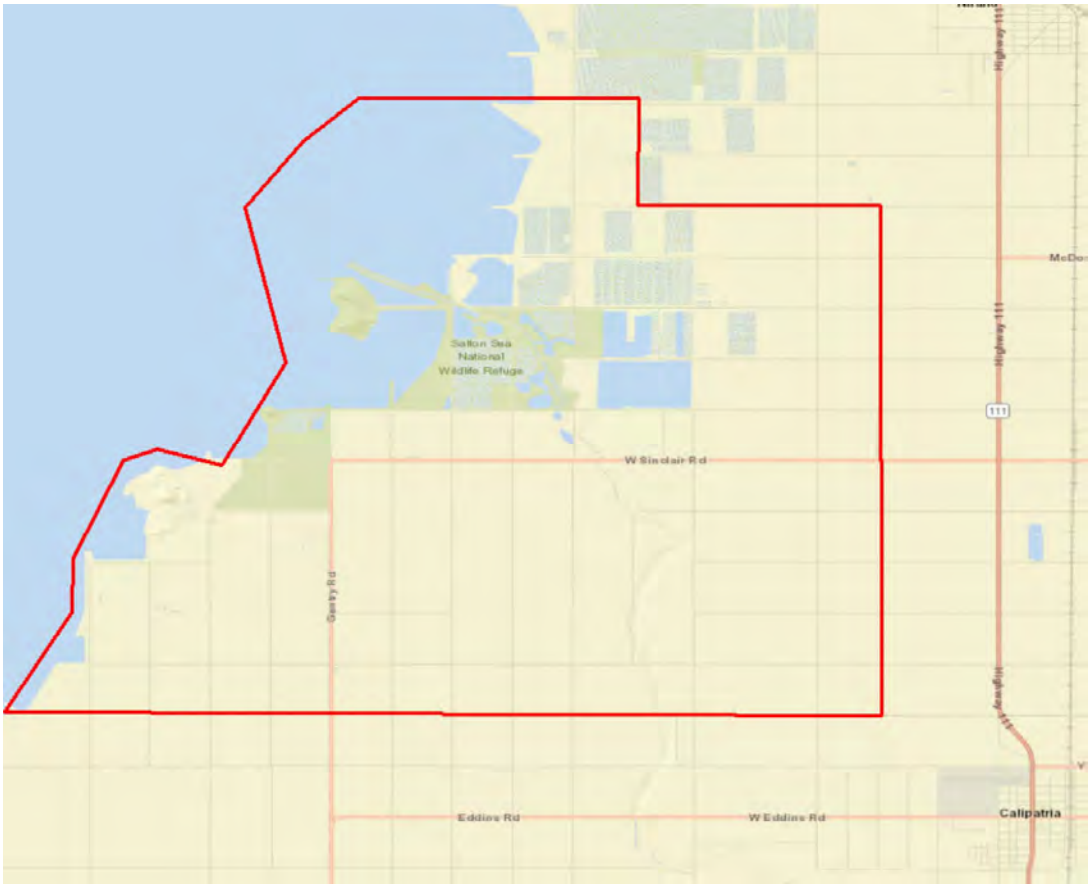
In late spring and early summer of 2022, a LiDAR survey was performed on 21,418 acres. This summary report provides the process used to generate detailed terrain models derived from 10 points per square meter Airborne LiDAR as well as the numerous QC steps within the workflow.

The vertical accuracy was verified following the guidelines in the 2014 ASPRS positional accuracy standards at the 95% confidence interval.

Horizontal Accuracy was calculated following the 2014 ASPRS positional accuracy standards, section 7.5. Derived from estimated GNSS errors, IMU errors, and flying altitude. Visual inspection was also performed. Checking for point cloud misalignment and horizontal location based on ground control points that were visible in the Lidar intensity. Horizontal accuracy is stated as laid out in USGS Lidar Base Specification 2022 rev.

The LiDAR was captured from a sensor in the belly hole of a fixed wing aircraft. This sensor is sending and receiving constant GPS data from a base station rover located at a nearby airfield, which ensures the sensor is constantly adjusting and correcting the millions of positional data points being collected.

The project area shown below is located along the southeast shore of the Salton Sea just to the northwest of Calipatria, California. The ground conditions are mostly low vegetation and hard packed loose surface. The LiDAR was not used to capture any data about the bathymetry of the adjacent water.



1.1 Horizontal and Vertical Control Used

(REF FRAME): NAD_83(2011)	
EPOCH:2010.0000	
Mapping System: CA State Plane Zone 6 Vertical Datum: NAVD88 (GEOID18)	
Units: US Survey Feet	

1.2 LiDAR Acquisition Summary

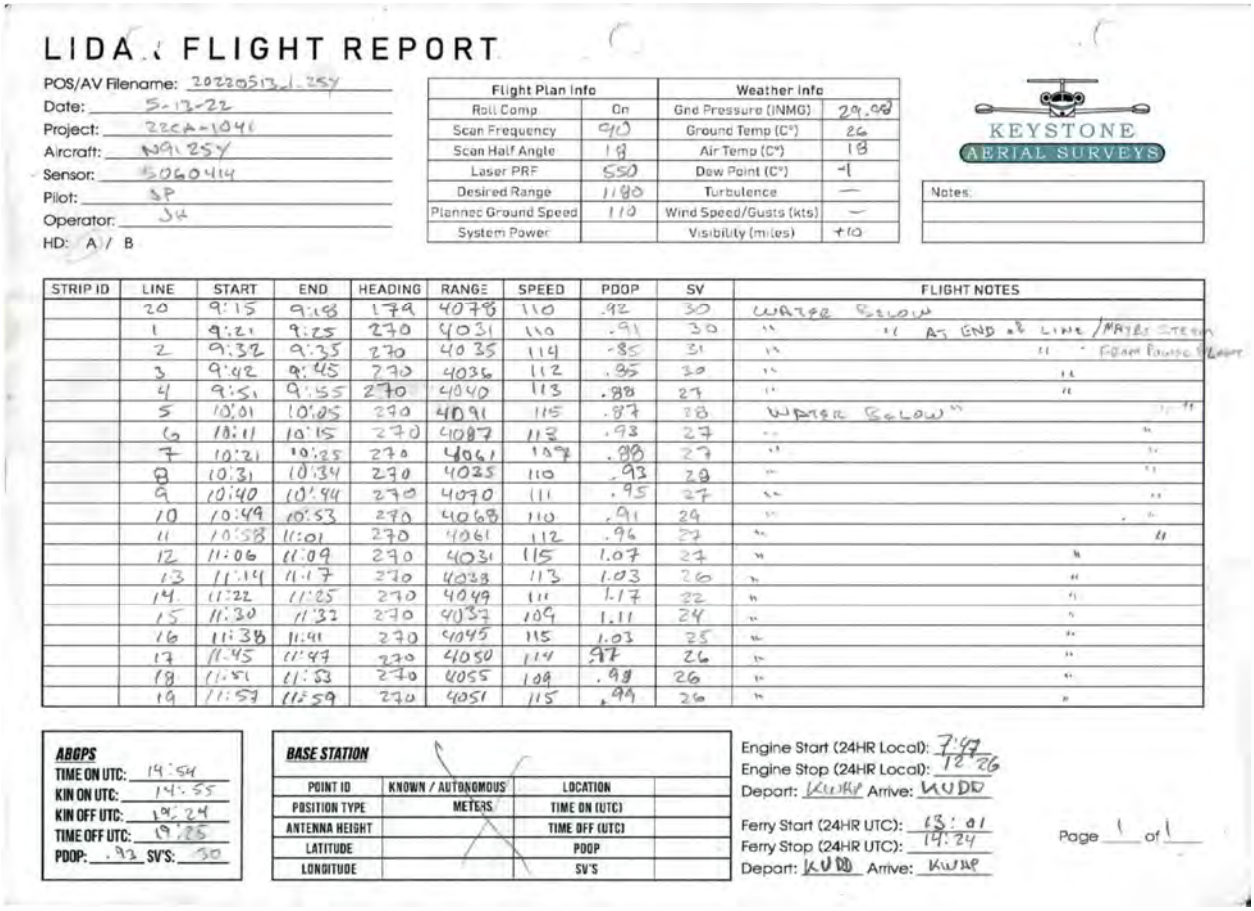
The LiDAR data was flown on May 13, 2022 using a Cessna 206 Fixed Wing single engine aircraft. Conditions were clear and there was no turbulence.

The LiDAR was collected with an ALTM Galaxy T1000 fixed mount LiDAR system. This system is common for large collection areas due to its consistent point coverage and distribution as well as its reliability in challenging airspaces.

Parameter	Specification
Sensor Performance	
Performance envelope [1,2,3,4]	150-4700 m AGL, nominal
Absolute horizontal accuracy [2,3]	1/10,000 x altitude; 1 σ
Absolute elevation accuracy [2,3]	< 0.03-0.20 m RMSE from 150-4700 m A
Laser Configuration	
Topographic laser	1064-nm near-infrared
Laser classification	Class IV (US FDA 21 CFR 1040.10 and 1040.11; IEC/EN 60825-1)
Pulse repetition frequency (effective)	Programmable, 50-1000 kHz
Beam divergence	0.25 mrad (1/e)
Laser range precision [5]	< 0.008 m, 1 σ
Minimum target separation distance	< 0.7 m (discrete)
Range capture	Up to 8 range measurements, including last
Intensity capture	Up to 8 intensity measurements, including last (12-bit)
Sensor Configuration	
Position and orientation system	POS AV™ AP60 (OEM); 220-channel dual frequency GNSS receiver; GNSS airborne antenna with Iridium filters; high-accuracy AIMU (Type 57); non-ITAR
Scan angle (FOV)	10-60°
Swath width	10-115% of altitude AGL
Scan frequency	0-120 Hz advertised (0-240 scan lines/sec)
Scan product	2000 maximum
Flight management system	Optech FMS (Airborne Mission Manager and Nav) with operator console
SwathTRAK™	Dynamic FOV for fixed-width data swaths in variable terrain
PulseTRAK™	Multipulse tracking algorithm with no density loss across PIA transition zones
Roll compensation	±5° minimum
Data storage	Internal solid-state drive (SSD)
Power requirements	28 V; 300 W
Dimensions and weight	Sensor: 0.34 × 0.34 × 0.25 m, 27 kg — PDU: 0.42 × 0.33 × 0.10 m, 6.5 kg
Operating temperature	0 to +35°C
Optional Peripherals	
External data storage	Ruggedized, removable 2.5" SSD
Image capture	Compatible with all Optech CS-Series and most 3rd party digital metric cameras
Full waveform capture	12-bit Optech IWR-3 Intelligent Waveform Recorder with removable SSD
Gyro-stabilization	SOMAG GSM 3000/4000 integration kit
Multi-sensor mounts and pods	2 and 4-station machined aluminum sensor mounts (aircraft and/or helicopter) Carbon-fiber sensor mounts supporting nadir and fore/aft oblique cameras Heli-pod mount options for Bell 206/407 (FAA-approved)

1. Target reflectivity ≥20%; 90% detection probability
2. Dependent on selected operational parameters; assumes nominal FOV of up to 40° in standard atmospheric conditions (i.e. 23-km visibility) and use of Optech LMS Professional software suite
3. Angle of incidence ≤20°
4. Target size ≥ laser footprint
5. Under Teledyne Optech test conditions, 1 sigma

The flight log below shows the start and end time of each flight line, the heading, altitude above mean sea level, the aircraft speed and the strength of the satellite signal. All of these inputs are critical when calibrating the swaths post-collection as well as for potential troubleshooting if anomalies are discovered.



LIDAR FLIGHT REPORT

POS/AV Filename: 20220513_1.25Y
Date: 5-13-22
Project: 22CA-1041
Aircraft: N91 25Y
Sensor: 5060414
Pilot: SP
Operator: JH
HD: A / B

Flight Plan Info		Weather Info	
Roll Comp	On	Gnd Pressure (INMG)	29.98
Scan Frequency	90	Ground Temp (C°)	26
Scan Half Angle	18	Air Temp (C°)	18
Laser PRF	550	Dew Point (C°)	-1
Desired Range	1180	Turbulence	—
Planned Ground Speed	110	Wind Speed/Gusts (kts)	—
System Power		Visibility (miles)	+10

KEYSTONE AERIAL SURVEYS

Notes:

STRIP ID	LINE	START	END	HEADING	RANGE	SPEED	PDOP	SV	FLIGHT NOTES
	20	9:15	9:18	179	4078	110	.92	30	WATER BELOW
	1	9:21	9:25	270	4031	110	.91	30	" " AT END OF LINE / MAYBE STEEP
	2	9:32	9:35	270	4035	114	.85	31	" " FOAM POSSIBLE
	3	9:42	9:45	270	4036	112	.95	30	" "
	4	9:51	9:55	270	4040	113	.88	27	" "
	5	10:01	10:05	270	4091	115	.87	28	WATER BELOW"
	6	10:11	10:15	270	4087	113	.93	27	" "
	7	10:21	10:25	270	4061	107	.88	27	" "
	8	10:31	10:34	270	4035	110	.93	28	" "
	9	10:40	10:44	270	4090	111	.95	27	" "
	10	10:49	10:53	270	4068	110	.91	29	" "
	11	10:58	11:01	270	4061	112	.96	27	" "
	12	11:06	11:09	270	4031	115	1.07	27	" "
	13	11:14	11:17	270	4038	113	1.03	26	" "
	14	11:22	11:25	270	4049	111	1.17	32	" "
	15	11:30	11:32	270	4037	109	1.11	24	" "
	16	11:38	11:41	270	4045	115	1.03	25	" "
	17	11:45	11:47	270	4050	114	.97	26	" "
	18	11:51	11:53	270	4055	109	.98	26	" "
	19	11:57	11:59	270	4051	115	.99	26	" "

ABGPS
TIME ON UTC: 14:54
KIN ON UTC: 14:55
KIN OFF UTC: 19:24
TIME OFF UTC: 19:25
PDOP: .93 SV'S: 30

BASE STATION

POINT ID	KNOWN / AUTONOMOUS	LOCATION	
POSITION TYPE	METERS	TIME ON (UTC)	
ANTENNA HEIGHT		TIME OFF (UTC)	
LATITUDE		PDOP	
LONGITUDE		SV'S	

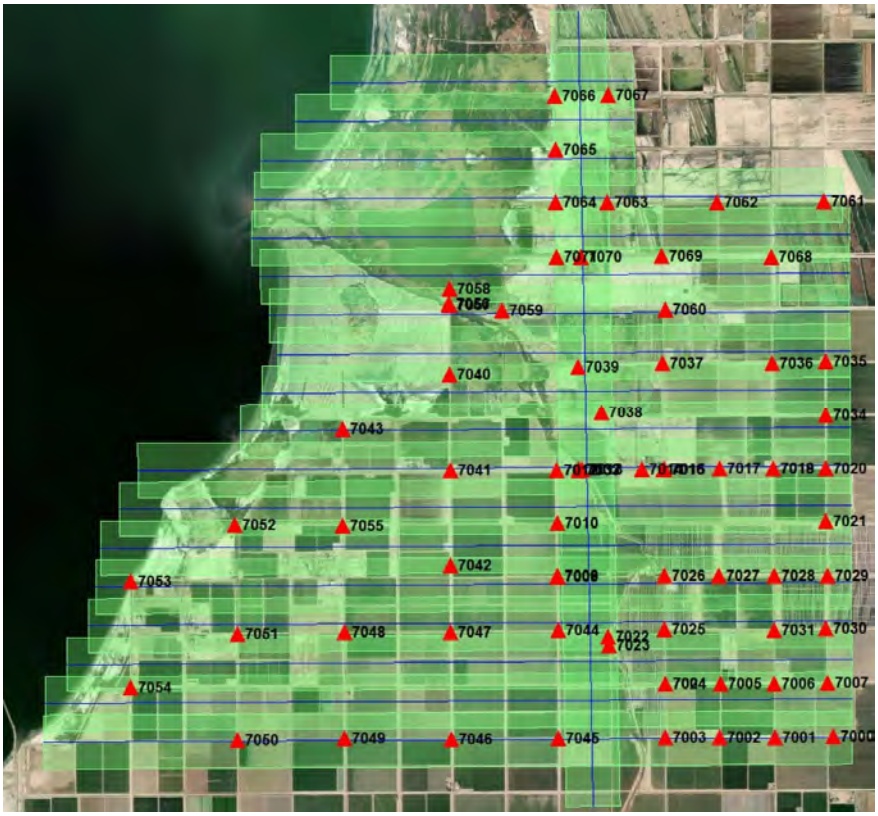
Engine Start (24HR Local): 7:47
Engine Stop (24HR Local): 12:26
Depart: KWJP Arrive: KUDD

Ferry Start (24HR UTC): 13:01
Ferry Stop (24HR UTC): 19:24
Depart: KUDD Arrive: KWJP

Page 1 of 1

The target area was collected in 19 passes, each overlapping on the side by about 40% to ensure complete coverage as well as giving several returns on the ground from different passes. This is important in the calibration of the data, to ensure the entire area is not only stitched together within itself, but also can be anchored to real world location.

As instructed by the project team, our flight lines extended further into the lakebed as water levels have been receding at the time of the collection and we needed to ensure capture was performed right up the water's edge. No bathymetric LiDAR was used for this project.



The table below demonstrates the vertical deviation of the flight lines when the data was registered and calibrated. As shown, this LiDAR data was very accurate and well within acceptable tolerance for the topography and surface model generation specifications.

Average magnitude: 0.12424

Flightline	Points	Magnitude	Dz
111	124673002	0.1119	-0.0101
1911	32175966	0.1789	-0.0629
2011	17507927	0.1444	+0.0343
1711	44893167	0.1532	-0.0269
1811	32806676	0.1942	-0.0261
1511	53602324	0.1140	+0.0147
1611	55595377	0.1295	-0.0029
1211	58922201	0.1143	+0.0042
1311	57381122	0.1010	+0.0167
1411	54823390	0.1004	-0.0033
1011	61692424	0.1014	-0.0014
1111	59096512	0.1166	-0.0163
811	69509505	0.1278	+0.0121
911	66435038	0.1067	+0.0039
511	73284233	0.1297	+0.0132
611	71984174	0.1362	+0.0276
711	70532714	0.1353	-0.0070
311	77404169	0.1286	-0.0328
411	74441623	0.1281	+0.0159
211	41688967	0.1108	+0.0463

1.3 LiDAR Accuracy Validation

The absolute vertical accuracy was verified following the guidelines in the 2014 ASPRS positional accuracy standards. The table below shows the results of z values of the LiDAR compared against the surveyed ground control.

POINT ID	NORTHING	EASTING	SURVEYED ELEV.	LIDAR ELEV.	Dz
7000	1995400.203	6780356.69	-191.466	-191.594	-0.128
7001	1995378.057	6777490.936	-193.682	-193.754	-0.072
7002	1995358.153	6774770.65	-198.627	-198.699	-0.072
7003	1995345.93	6772085.065	-199.614	-199.642	-0.028
7004	1998003.294	6772079.427	-202.251	-202.228	0.023
7005	1998008.09	6774826.208	-201.879	-201.917	-0.038
7006	1998014.248	6777464.947	-197.378	-197.401	-0.023
7007	1998037.72	6780080.617	-194.782	-194.829	-0.047
7008	2003321.693	6766770.981	-212.211	-212.159	0.052
7009	2003277.622	6766760.261	-211.995	-211.963	0.032
7010	2005911.973	6766733.614	-215.553	-215.613	-0.06
7011	2008510.916	6766720.115	-216.343	slope	*
7012	2008532.727	6766707.287	-216.258	-216.263	-0.005
7013	2008562.873	6767955.275	-214.438	-214.541	-0.103
7014	2008575.139	6770912.424	-214.684	-214.712	-0.028
7015	2008570.641	6772014.298	-213.014	-212.999	0.015
7016	2008589.433	6772002.423	-212.783	-212.831	-0.048
7017	2008610.318	6774762.813	-208.956	-208.898	0.058
7018	2008602.731	6777397.864	-204.761	-204.653	0.108
7019	2008624.044	6777417.239	-204.366	-204.246	0.12
7020	2008622.749	6780014.234	-198.664	-198.608	0.056
7021	2006041.029	6780019.891	-196.826	-196.836	-0.01
7022	2000322.909	6769268.298	-205.721	removed	*
7023	1999912.328	6769292.566	-205.918	-205.918	0
7024	1998008.121	6772079.272	-202.212	-202.21	0.002
7025	2000694.001	6772055.286	-206.091	-206.087	0.004
7026	2003350.886	6772025.856	-209.364	-209.321	0.043
7027	2003357.542	6774729.877	-205.075	-205.145	-0.07
7028	2003323.192	6777437.271	-201.254	-201.304	-0.05
7029	2003327.356	6780081.76	-198.881	-198.899	-0.018
7030	2000740.658	6780030.512	-195.075	-195.042	0.033
7031	2000665.85	6777455.173	-199.849	-199.807	0.042
7032	2008578.239	6767801.702	-214.595	slope	*
7033	2008545.435	6767801.825	-214.518	-214.489	0.029
7034	2011254.16	6780022.151	-197.662	-197.528	0.134
7035	2013928.342	6779994.883	-197.973	-197.88	0.093

7036	2013880.806	6777359.744	-203.378	-203.401	-0.023
7037	2013843.231	6771949.319	-214.758	-214.786	-0.028
7038	2011412.346	6768946.966	-217.441	-217.38	0.061
7039	2013675.821	6767770.249	-219.997	-220.045	-0.048
7040	2013307.346	6761422.4	-224.373	-224.253	0.12
7041	2008510.723	6761461.448	-225.073	-225.111	-0.038
7042	2003840.914	6761462.537	-218.396	-218.42	-0.024
7043	2010578.278	6756135.792	-222.307	-222.343	-0.036
7044	2000635.814	6766783.382	-208.85	-208.871	-0.021
7045	1995324.998	6766817.694	-203.122	-203.098	0.024
7046	1995292.07	6761525.03	-207.11	-207.063	0.047
7047	2000566.602	6761485.366	-212.631	-212.492	0.139
7048	2000554.537	6756209.756	-216.342	-216.266	0.076
7049	1995316.795	6756244.166	-211.216	-211.206	0.01
7050	1995206.066	6750953.914	-218.439	-218.53	-0.091
7051	2000441.676	6750930.627	-225.434	-225.383	0.051
7052	2005851.8	6750825.617	-221.374	-221.441	-0.067
7053	2003076.979	6745671.395	-220.923	-220.972	-0.049
7054	1997836.012	6745680.381	-220.846	-220.965	-0.119
7055	2005812.034	6756156.241	-223.77	-223.882	-0.112
7056	2016759.314	6761385.155	-224.55	-224.459	0.091
7057	2016750.764	6761417.211	-224.926	slope	*
7058	2017534.6	6761428.196	-227.028	-227.139	-0.111
7059	2016469.475	6764019.964	-222.531	-222.605	-0.074
7060	2016509.733	6772100.516	-216.137	-216.128	0.009
7061	2021817.317	6779898.653	-192.893	-192.798	0.095
7062	2021788.42	6774651.661	-208.666	-208.526	0.14
7063	2021783.705	6769230.355	-221.237	-221.159	0.078
7064	2021769.049	6766662.715	-224.323	-224.285	0.038
7065	2024401.316	6766636.742	-222.432	-222.316	0.116
7066	2027042.71	6766612.824	-221.003	-220.894	0.109
7067	2027055.951	6769272.41	-217.526	-217.569	-0.043
7068	2019109.073	6777308.319	-201.619	-201.712	-0.093
7069	2019119.08	6771906.114	-214.563	-214.587	-0.024
7070	2019102.04	6767916.305	-218.046	-218.167	-0.121
7071	2019104.613	6766700.395	-223.329	-223.474	-0.145

Average Dz	0.000
Minimum DZ	-0.145
Maximum DZ	0.140
Average Magnitude	0.061
STD Deviation	0.073

Confidence Level(95.0%)	0.018
Lower CI (95%)	-0.018
Upper CI (95%)	0.017
RMSE	0.073
	Units Feet

The relative vertical accuracy was also compared for each swath (flightline) captured to ensure there were no fatal flaws in the calibration of the swaths prior to classification.

Flightline	Magnitude	Abs(DZ)	Dz
111	0.112	0.010	-0.010
1911	0.179	0.063	-0.063
2011	0.144	0.034	0.034
1711	0.153	0.027	-0.027
1811	0.194	0.026	-0.026
1511	0.114	0.015	0.015
1611	0.130	0.003	-0.003
1211	0.114	0.004	0.004
1311	0.101	0.017	0.017
1411	0.100	0.003	-0.003
1011	0.101	0.001	-0.001
1111	0.117	0.016	-0.016
811	0.128	0.012	0.012
911	0.107	0.004	0.004
511	0.130	0.013	0.013
611	0.136	0.028	0.028
711	0.135	0.007	-0.007
311	0.129	0.033	-0.033
411	0.128	0.016	0.016
211	0.111	0.046	0.046

Average Dz	0.000
Minimum DZ	-0.063
Maximum DZ	0.046
Average Magnitude	0.128
STD Deviation	0.025
Confidence Level(95.0%)	0.012
Lower CI (95%)	-0.012
Upper CI (95%)	0.012
RMSE	0.025
	Units Feet

Additional LiDAR relative accuracy provided by the aerial contractor is provided in Attachment 1.

1.4 LiDAR Field Survey

This project also included the delivery of rectified orthophotography, which requires an even distribution of fixed visible targets. These targets can be existing permanent features visible on the ground. We were able to use these hard surface known points to calibrate and validate the accuracy of the LiDAR as well as rectify the orthoimagery. The exact values of each control point are shown in the table below.

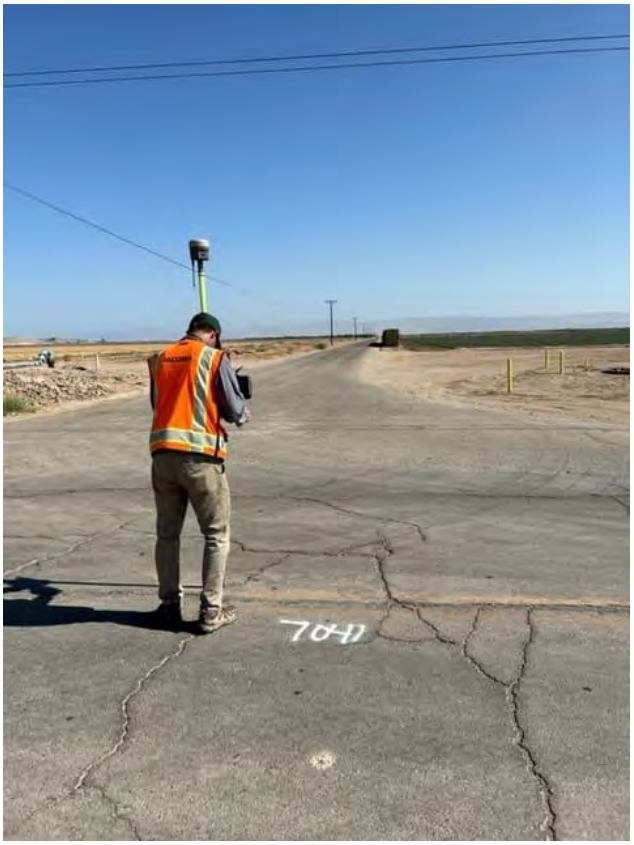
Point ID	Northing	Easting	Elevation	Description
7000	1995400.203	6780356.69	-191.466	GROUND DIRT RD
7001	1995378.057	6777490.936	-193.682	GROUND ASPHALT RD
7002	1995358.153	6774770.65	-198.627	GROUND DIRT RD
7003	1995345.93	6772085.065	-199.614	GROUND ASPHALT RD
7004	1998003.294	6772079.427	-202.251	GROUND ASPHALT RD
7005	1998008.09	6774826.208	-201.879	GROUND DIRT RD
7006	1998014.248	6777464.947	-197.378	ASPHALT RD
7007	1998037.72	6780080.617	-194.782	GROUND DIRT RD
7008	2003321.693	6766770.981	-212.211	CONCRETE SOUTH EAST CORNER
7009	2003277.622	6766760.261	-211.995	ASPHALT
7010	2005911.973	6766733.614	-215.553	ASPHALT
7011	2008510.916	6766720.115	-216.343	STOP BAR NORTH ANGLE POINT
7012	2008532.727	6766707.287	-216.258	ASPHALT
7013	2008562.873	6767955.275	-214.438	END OF YELLOW SKIPPY STRIPE
7014	2008575.139	6770912.424	-214.684	END OF YELLOW SKIPPY STRIPE
7015	2008570.641	6772014.298	-213.014	STOP BAR NORTH ANGLE POINT
7016	2008589.433	6772002.423	-212.783	ASPHALT
7017	2008610.318	6774762.813	-208.956	END OF YELLOW SKIPPY STRIPE
7018	2008602.731	6777397.864	-204.761	END OF YELLOW SOLID STRIPE
7019	2008624.044	6777417.239	-204.366	END OF YELLOW SOLID STRIPE
7020	2008622.749	6780014.234	-198.664	END OF YELLOW SKIPPY STRIPE
7021	2006041.029	6780019.891	-196.826	DIRT ROAD
7022	2000322.909	6769268.298	-205.721	CON N EDGE
7023	1999912.328	6769292.566	-205.918	DIRT ROAD
7024	1998008.121	6772079.272	-202.212	ASPHALT
7025	2000694.001	6772055.286	-206.091	END OF YELLOW SKIPPY STRIPE
7026	2003350.886	6772025.856	-209.364	ASPHALT
7027	2003357.542	6774729.877	-205.075	DIRT ROAD
7028	2003323.192	6777437.271	-201.254	ASPHALT
7029	2003327.356	6780081.76	-198.881	DIRT ROAD

Point ID	Northing	Easting	Elevation	Description
7030	2000740.658	6780030.512	-195.075	DIRT ROAD
7031	2000665.85	6777455.173	-199.849	ASPHALT
7032	2008578.239	6767801.702	-214.595	CONCRETE NW CORNER BRIDGE
7033	2008545.435	6767801.825	-214.518	CONCRETE SW CORNER BRIDGE
7034	2011254.16	6780022.151	-197.662	DIRT ROAD
7035	2013928.342	6779994.883	-197.973	DIRT ROAD
7036	2013880.806	6777359.744	-203.378	GRAVEL ROAD
7037	2013843.231	6771949.319	-214.758	DIRT ROAD
7038	2011412.346	6768946.966	-217.441	DIRT ROAD
7039	2013675.821	6767770.249	-219.997	DIRT ROAD
7040	2013307.346	6761422.4	-224.373	DIRT ROAD
7041	2008510.723	6761461.448	-225.073	END OF YELLOW SOLID STRIPE
7042	2003840.914	6761462.537	-218.396	DIRT ROAD
7043	2010578.278	6756135.792	-222.307	DIRT ROAD
7044	2000635.814	6766783.382	-208.85	ASPHALT
7045	1995324.998	6766817.694	-203.122	ASPHALT
7046	1995292.07	6761525.03	-207.11	DIRT ROAD
7047	2000566.602	6761485.366	-212.631	DIRT ROAD
7048	2000554.537	6756209.756	-216.342	END OF YELLOW SKIPPY STRIPE
7049	1995316.795	6756244.166	-211.216	END OF YELLOW SKIPPY STRIPE
7050	1995206.066	6750953.914	-218.439	DIRT ROAD
7051	2000441.676	6750930.627	-225.434	DIRT ROAD
7052	2005851.8	6750825.617	-221.374	DIRT ROAD
7053	2003076.979	6745671.395	-220.923	DIRT ROAD
7054	1997836.012	6745680.381	-220.846	STOP BAR ANGLE POINT WEST
7055	2005812.034	6756156.241	-223.77	CONCRETE NW CORNER
7056	2016759.314	6761385.155	-224.55	CONCRETE NW CORNER
7057	2016750.764	6761417.211	-224.926	CONCRETE NE CORNER
7058	2017534.6	6761428.196	-227.028	DIRT ROAD
7059	2016469.475	6764019.964	-222.531	DIRT ROAD
7060	2016509.733	6772100.516	-216.137	DIRT ROAD
7061	2021817.317	6779898.653	-192.893	DIRT ROAD
7062	2021788.42	6774651.661	-208.666	DIRT ROAD
7063	2021783.705	6769230.355	-221.237	DIRT ROAD
7064	2021769.049	6766662.715	-224.323	DIRT ROAD

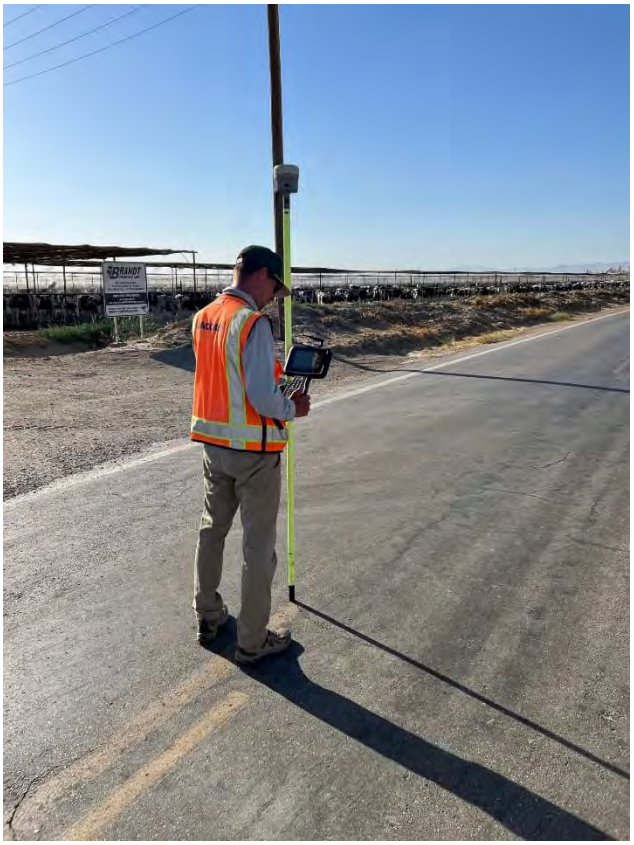
Point ID	Northing	Easting	Elevation	Description
7065	2024401.316	6766636.742	-222.432	DIRT ROAD
7066	2027042.71	6766612.824	-221.003	DIRT ROAD
7067	2027055.951	6769272.41	-217.526	DIRT ROAD
7068	2019109.073	6777308.319	-201.619	STOP BAR EAST ANGLE POINT
7069	2019119.08	6771906.114	-214.563	AC
7070	2019102.04	6767916.305	-218.046	END OF YELLOW SOLID STRIPE
7071	2019104.613	6766700.395	-223.329	STOP BAR SW CORNER

The following pages are examples of the survey control points used for calibration of the LiDAR and validation of the data's accuracy. Visible paint markings, corners of concrete pads and defined structures were used as the control targets. All these points were observed using RTK GPS and tied to a local benchmark.

As shown in many of these photos, the number painted on the ground corresponds directly to the target locations shown in the flight plan on the previous page. This allows each surveyed location to be checked against the LiDAR point cloud and derived surface, to ensure accuracy was within the specifications of this project.




7032

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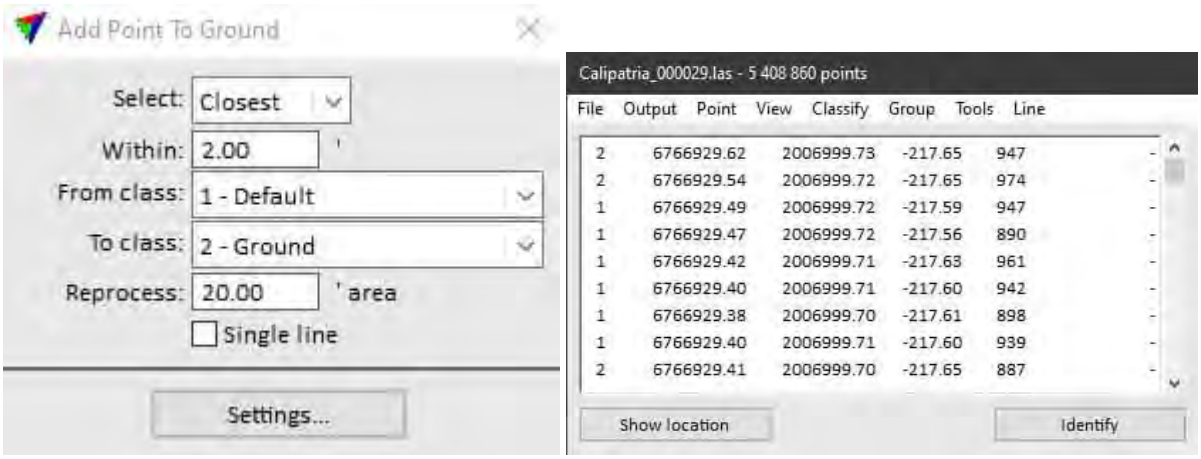
1.5 LiDAR Data Processing

LiDAR Classification Process:

The first step in the process is the calibration of the LiDAR data immediately after it's been flown. This is done in the event of a system malfunction, a reflight can quickly be performed prior to demobilization. The calibration process uses the ground control values and the airborne GPS data to properly align and orient the swaths and create a single point cloud of all swaths combined and tied together.

The calibrated, unclassified point cloud is loaded into a processing program called TerraScan and split into smaller parcels for automatic classification. A macro is run on the dataset to determine ground points using algorithms imbedded in the program to decipher which LiDAR returns from the scan are ground. Once ground points are determined, additional macro processes can be run to classify vegetation, buildings, etc. A team of processors work through each of the smaller parcels for an overall QC on the automatic classifications and adjust where needed.



A final macro process can be run on the ground points to pull "key" ground points for surface mapping. The purpose of the key ground point process is to help thin the dataset to a smaller file size allowing the LiDAR deliverable to be a more user friendly file for the end user to work with. The thinning process still maintains an accurate representation of the surface as a final product. All classification and exporting is conducted in the program TerraScan.

Once the data is classified to ground, the accuracy is then checked against the control. This check compares the surveyed values with the LiDAR derived value. Below is the result of the accuracy checks. The “Dz” column shows how much higher or lower the LiDAR point is versus the surveyed control. Units are in feet. The rule of thumb is there should be half as much variation in elevation as the intended contour interval. For example, for 1’ contours, Dz values of .5 or less are acceptable.

LiDAR Accuracy Reports

Point ID	Northing	Easting	Surveyed Elev.	LiDAR Elev.	Dz
7000	1995400.203	6780356.69	-191.466	-191.594	-0.128
7001	1995378.057	6777490.936	-193.682	-193.754	-0.072
7002	1995358.153	6774770.65	-198.627	-198.699	-0.072
7003	1995345.93	6772085.065	-199.614	-199.642	-0.028
7004	1998003.294	6772079.427	-202.251	-202.228	0.023
7005	1998008.09	6774826.208	-201.879	-201.917	-0.038
7006	1998014.248	6777464.947	-197.378	-197.401	-0.023
7007	1998037.72	6780080.617	-194.782	-194.829	-0.047
7008	2003321.693	6766770.981	-212.211	-212.159	0.052
7009	2003277.622	6766760.261	-211.995	-211.963	0.032
7010	2005911.973	6766733.614	-215.553	-215.613	-0.06
7011	2008510.916	6766720.115	-216.343	slope	*
7012	2008532.727	6766707.287	-216.258	-216.263	-0.005
7013	2008562.873	6767955.275	-214.438	-214.541	-0.103
7014	2008575.139	6770912.424	-214.684	-214.712	-0.028
7015	2008570.641	6772014.298	-213.014	-212.999	0.015

Point ID	Northing	Easting	Surveyed Elev.	LiDAR Elev.	Dz
7016	2008589.433	6772002.423	-212.783	-212.831	-0.048
7017	2008610.318	6774762.813	-208.956	-208.898	0.058
7018	2008602.731	6777397.864	-204.761	-204.653	0.108
7019	2008624.044	6777417.239	-204.366	-204.246	0.12
7020	2008622.749	6780014.234	-198.664	-198.608	0.056
7021	2006041.029	6780019.891	-196.826	-196.836	-0.01
7022	2000322.909	6769268.298	-205.721	removed	*
7023	1999912.328	6769292.566	-205.918	-205.918	0
7024	1998008.121	6772079.272	-202.212	-202.21	0.002
7025	2000694.001	6772055.286	-206.091	-206.087	0.004
7026	2003350.886	6772025.856	-209.364	-209.321	0.043
7027	2003357.542	6774729.877	-205.075	-205.145	-0.07
7028	2003323.192	6777437.271	-201.254	-201.304	-0.05
7029	2003327.356	6780081.76	-198.881	-198.899	-0.018
7030	2000740.658	6780030.512	-195.075	-195.042	0.033
7031	2000665.85	6777455.173	-199.849	-199.807	0.042
7032	2008578.239	6767801.702	-214.595	slope	*
7033	2008545.435	6767801.825	-214.518	-214.489	0.029
7034	2011254.16	6780022.151	-197.662	-197.528	0.134
7035	2013928.342	6779994.883	-197.973	-197.88	0.093
7036	2013880.806	6777359.744	-203.378	-203.401	-0.023
7037	2013843.231	6771949.319	-214.758	-214.786	-0.028
7038	2011412.346	6768946.966	-217.441	-217.38	0.061
7039	2013675.821	6767770.249	-219.997	-220.045	-0.048
7040	2013307.346	6761422.4	-224.373	-224.253	0.12
7041	2008510.723	6761461.448	-225.073	-225.111	-0.038
7042	2003840.914	6761462.537	-218.396	-218.42	-0.024
7043	2010578.278	6756135.792	-222.307	-222.343	-0.036
7044	2000635.814	6766783.382	-208.85	-208.871	-0.021
7045	1995324.998	6766817.694	-203.122	-203.098	0.024
7046	1995292.07	6761525.03	-207.11	-207.063	0.047
7047	2000566.602	6761485.366	-212.631	-212.492	0.139
7048	2000554.537	6756209.756	-216.342	-216.266	0.076
7049	1995316.795	6756244.166	-211.216	-211.206	0.01
7050	1995206.066	6750953.914	-218.439	-218.53	-0.091

Point ID	Northing	Easting	Surveyed Elev.	LiDAR Elev.	Dz
7051	2000441.676	6750930.627	-225.434	-225.383	0.051
7052	2005851.8	6750825.617	-221.374	-221.441	-0.067
7053	2003076.979	6745671.395	-220.923	-220.972	-0.049
7054	1997836.012	6745680.381	-220.846	-220.965	-0.119
7055	2005812.034	6756156.241	-223.77	-223.882	-0.112
7056	2016759.314	6761385.155	-224.55	-224.459	0.091
7057	2016750.764	6761417.211	-224.926	slope	*
7058	2017534.6	6761428.196	-227.028	-227.139	-0.111
7059	2016469.475	6764019.964	-222.531	-222.605	-0.074
7060	2016509.733	6772100.516	-216.137	-216.128	0.009
7061	2021817.317	6779898.653	-192.893	-192.798	0.095
7062	2021788.42	6774651.661	-208.666	-208.526	0.14
7063	2021783.705	6769230.355	-221.237	-221.159	0.078
7064	2021769.049	6766662.715	-224.323	-224.285	0.038
7065	2024401.316	6766636.742	-222.432	-222.316	0.116
7066	2027042.71	6766612.824	-221.003	-220.894	0.109
7067	2027055.951	6769272.41	-217.526	-217.569	-0.043
7068	2019109.073	6777308.319	-201.619	-201.712	-0.093
7069	2019119.08	6771906.114	-214.563	-214.587	-0.024
7070	2019102.04	6767916.305	-218.046	-218.167	-0.121
7071	2019104.613	6766700.395	-223.329	-223.474	-0.145
	Average dz	0			
	Minimum dz	-0.145			
	Maximum dz	0.14			
	Average magnitude	0.061			
	Root mean square	0.073			
	Std deviation	0.073			

1.6 Conclusion

The LiDAR data is validated and checked at several gates throughout the process. The first QC check is performed immediately off the plane with the initial calibration of the data. If there is a fatal flaw in the data, it would be caught in this QC check.

The second check is performed during the classification. The classification will reveal if there are any abnormal spikes of dips in the LiDAR returns.

The final check is performed after the data has been classified and thinned. This is where the accuracy is thoroughly vetted using the provided control values and measured against the values of that same point in the LiDAR surface.

The data collected, processed and delivered for this project passed every QC check through the process and the resulting data is well within specification for detailed design and construction planning.

1.7 Certification

I, Aaron D. Willis, a Licensed Land Surveyor with license number 8881, hereby certify that I have reviewed and verified this LiDAR Validation Report.

I affirm that the LiDAR data was collected, processed, and analyzed as presented in this report, and that this work took place under my oversight.

Aaron D. Willis, PLS
License No. 8881
Date: 05/03/2023

Attachment 1 LiDAR Accuracy Validation by Keystone Aerial Surveys, Incorporated

General Information

Mission Information

Project name	22CA-1041
Processing date	2022-05-19 18:15:22
Mission date	2022-05-13 14:49:43
Mission duration	02:51:20.391
Processing mode	IN-Fusion SmartBase
GPS Station	ASB

Rover Hardware Information

Product	POS AV 610 VER6 HW2.5-12
Serial number	S/N9297
IMU type	57
Receiver type	BD982
Antenna type	AT1675-80

Project File List

Rover Data Files

File name	File type
20220513_1_25Y.659	POS Data
20220513_1_25Y.660	POS Data
20220513_1_25Y.661	POS Data
20220513_1_25Y.662	POS Data
20220513_1_25Y.663	POS Data
20220513_1_25Y.664	POS Data
20220513_1_25Y.665	POS Data
20220513_1_25Y.666	POS Data
20220513_1_25Y.667	POS Data
20220513_1_25Y.668	POS Data
20220513_1_25Y.669	POS Data
20220513_1_25Y.670	POS Data
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20220513_1_25Y.673	POS Data
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20220513_1_25Y.675	POS Data
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20220513_1_25Y.678	POS Data
20220513_1_25Y.679	POS Data
20220513_1_25Y.680	POS Data
20220513_1_25Y.681	POS Data
20220513_1_25Y.682	POS Data
20220513_1_25Y.683	POS Data
20220513_1_25Y.684	POS Data

Input Files

File Name	File Type
Ephm1330.22g	GLONASS Broadcast Ephemeris
Ephm1330.22n	GPS Broadcast Ephemeris
bomg1330.22o	GNSS SingleBase
crrs1330.22o	GPS SingleBase
errg1330.22o	GNSS SingleBase
glrs1330.22o	GNSS SingleBase
p4951330.22o	GPS SingleBase
p4991330.22o	GNSS SingleBase
p5021330.22o	GPS SingleBase
p5031330.22o	GPS SingleBase
p5061330.22o	GNSS SingleBase
p5071330.22o	GPS SingleBase
p5081330.22o	GNSS SingleBase
p5101330.22o	GNSS SingleBase

Output Files

Filename	File type
sbet_Mission 1.out	SBET Trajectory File
NAD83(2011)_Ep2010_Sbet.out	Custom Smoothed BET Export Output

Rover Data Summary

First raw data file	20220513_1_25Y.659		
Last raw data file	20220513_1_25Y.684		
Start GPS week	2209		
Start time	485382.542 (5/13/2022 2:49:42 PM)		
End time	501947.422 (5/13/2022 7:25:47 PM)		
Start of fine alignment	490287.980 (5/13/2022 4:11:27 PM)		
Available subsystems	Primary GNSS, IMU		
POS Event Input	None		
Correction data	None		
IMU Installation Lever Arms & Mounting Angles			
Reference to IMU lever arm (m)	0.000	0.000	0.000
Reference to IMU mounting angles (deg)	0.000	0.000	180.000
Reference to Primary GNSS lever arm (m)	-0.485	-0.379	-1.141
Reference to Primary GNSS lever arm std dev (m)	-1.000		
Aircraft to Reference mounting angles (deg)	0.000	0.000	0.000

Rover Data QC

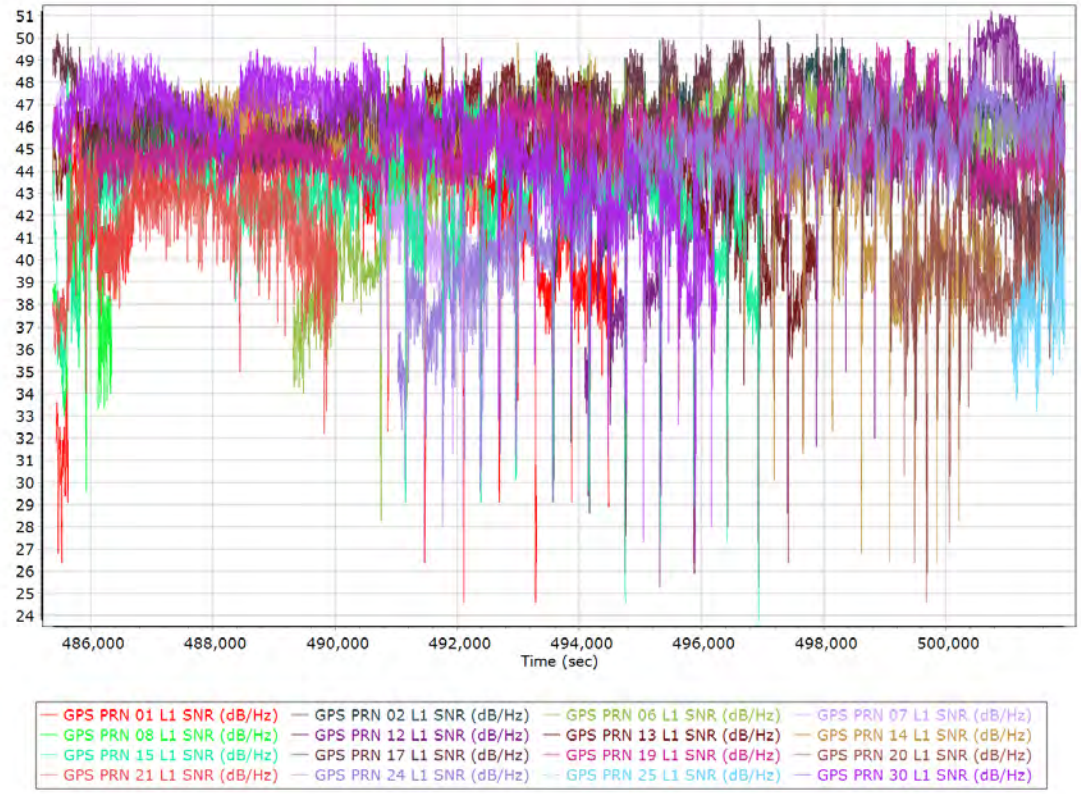
Raw IMU Import QC Summary

IMU data input file	imu_Mission 1.dat
IMU data check log file	imudt_Mission 1.log
IMU Records Processed	3312377
Termination Status	Normal
IMU Anomalies	0

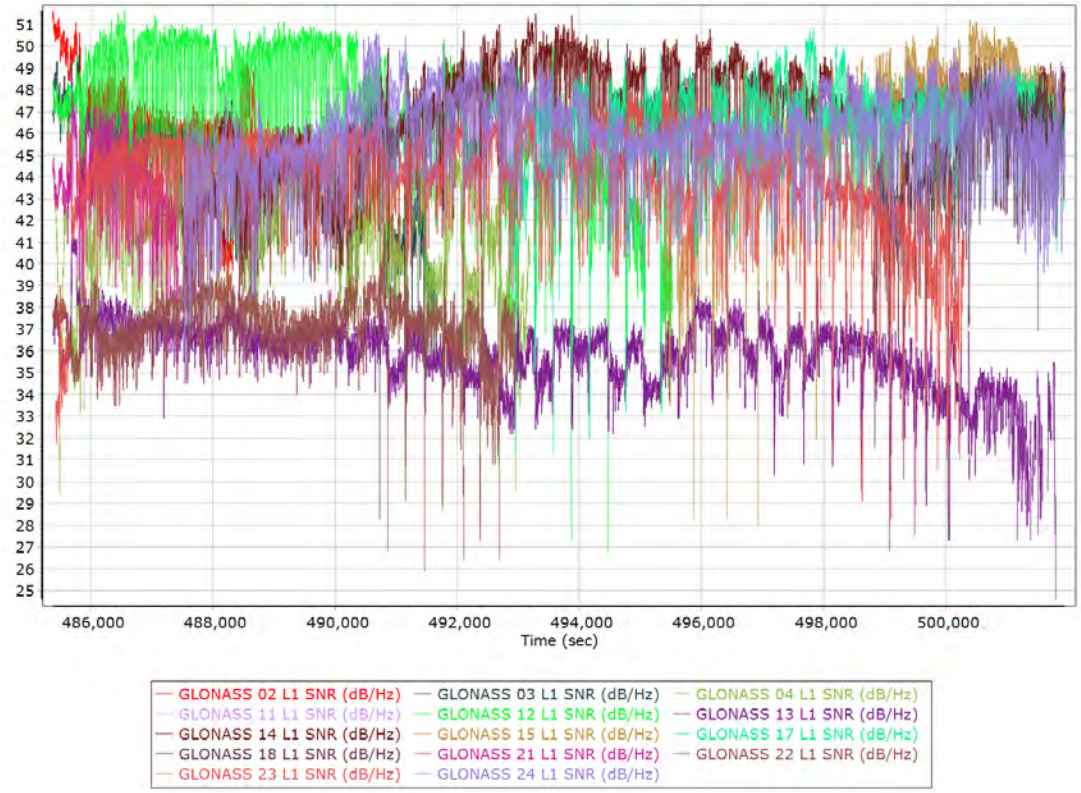
Primary Observables & Satellite Data

GPS/GLONASS L1 Satellite Lock/Elevation

GPS L1 SNR

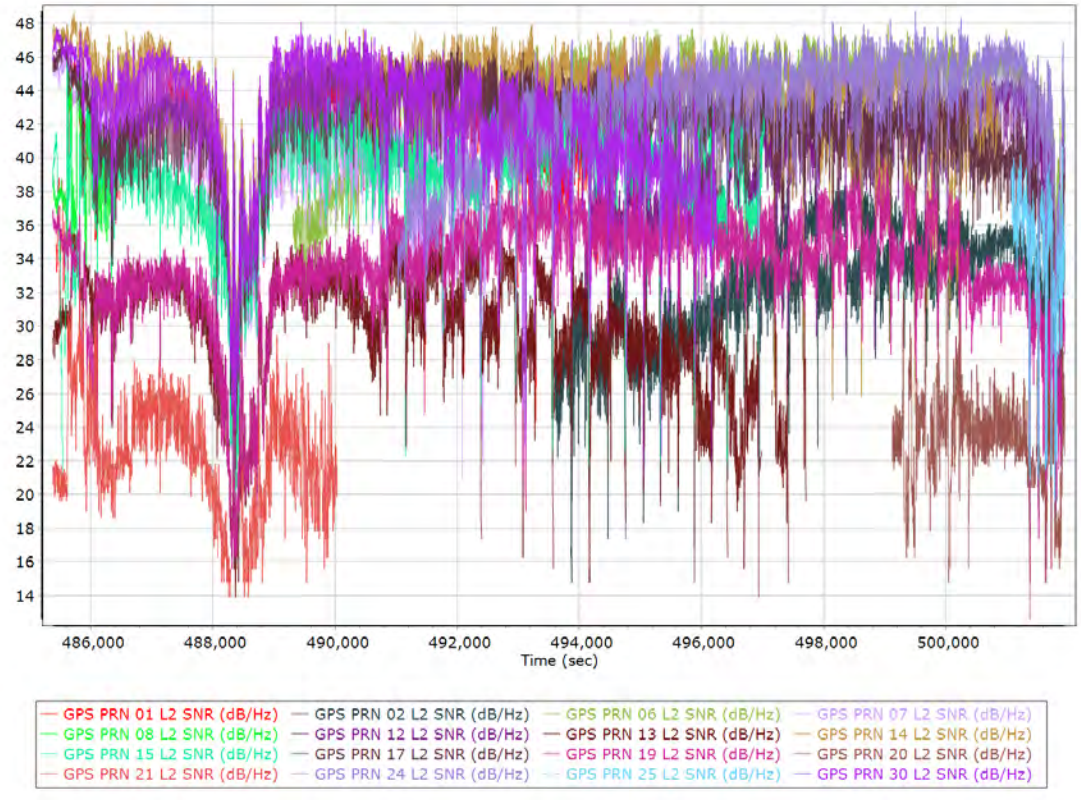


GLONASS L1 SNR

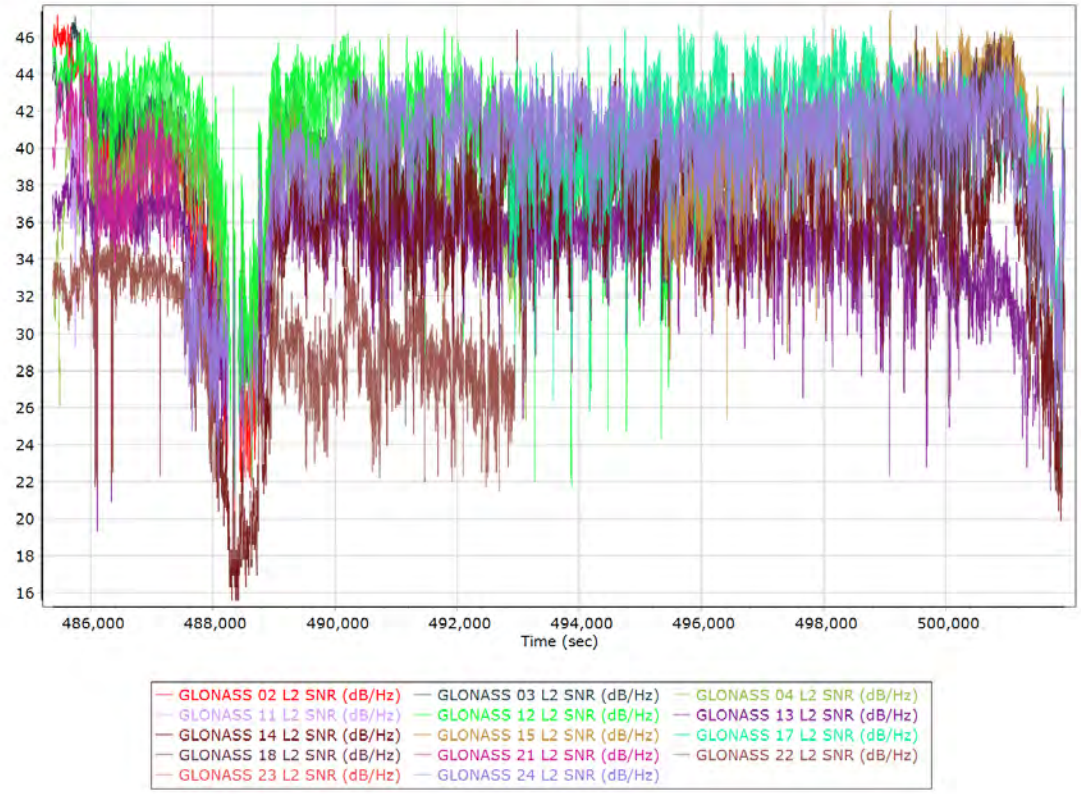


GPS/GLONASS L2 Satellite Lock/Elevation

GPS L2 SNR

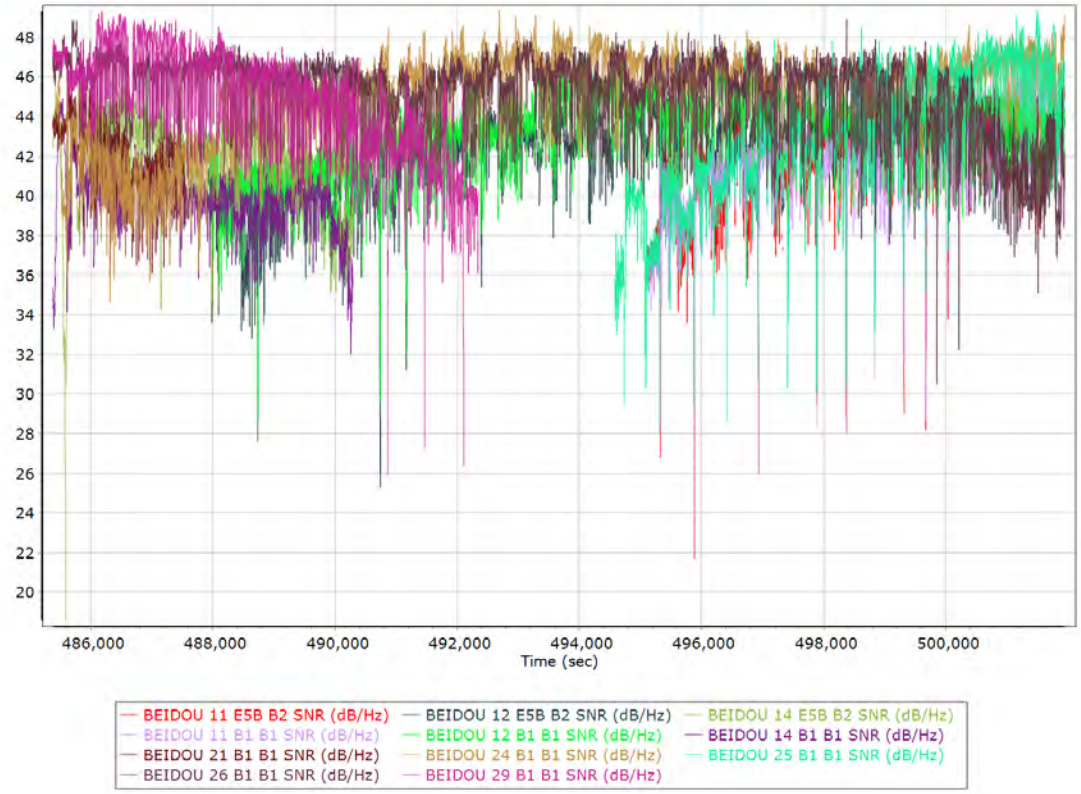


GLONASS L2 SNR



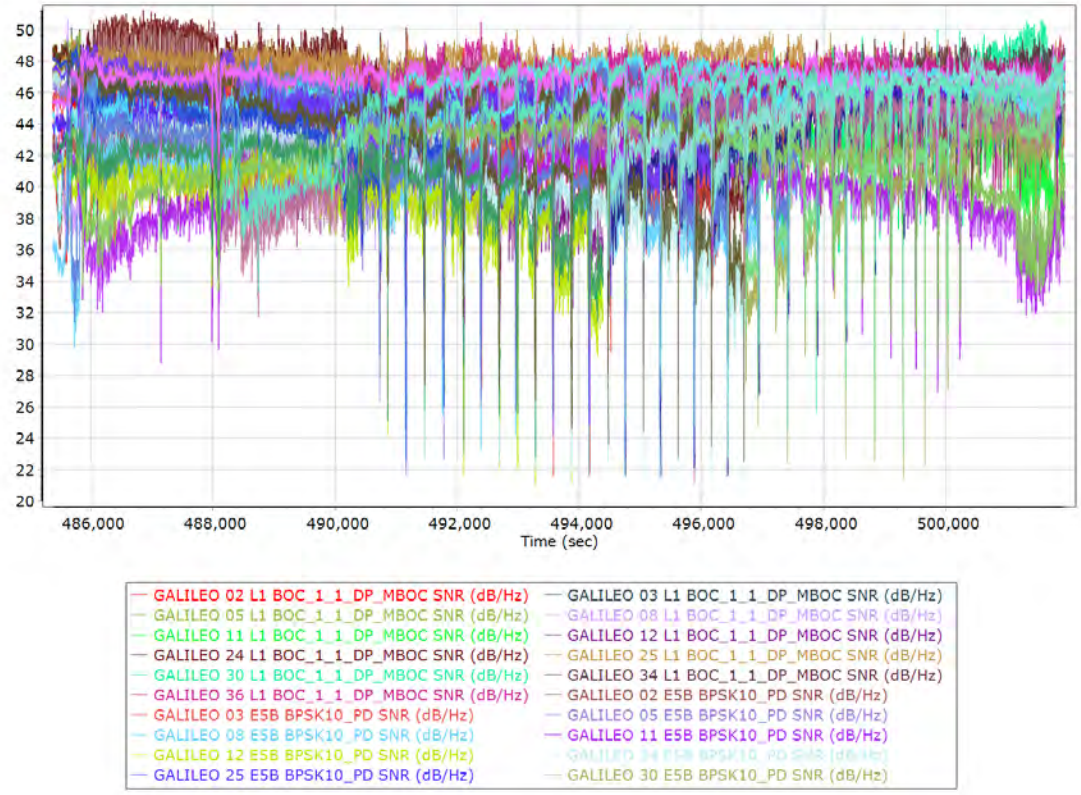
BEIDOU Satellite Lock/Elevation

BEIDOU SNR



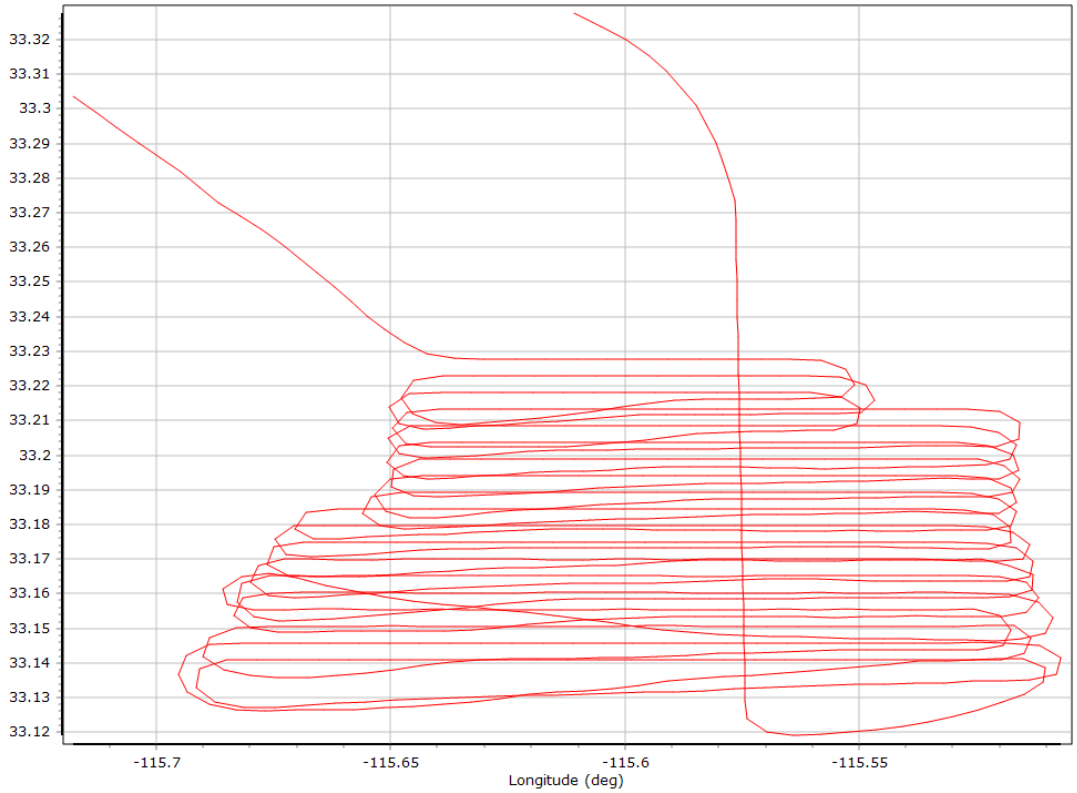
GALILEO Satellite Lock/Elevation

GALILEO SNR

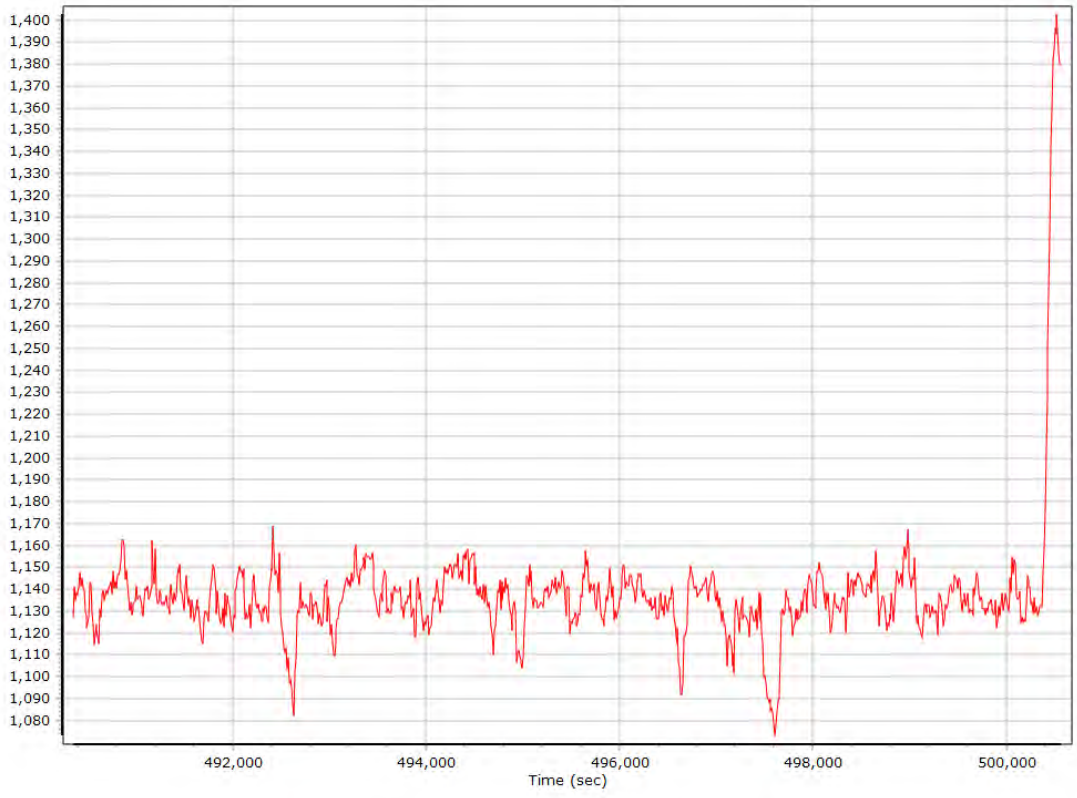

50
48
46
44
42
40
38
36
34
32
30
28
26
24
22
20
486,000
488,000
490,000
492,000
494,000
496,000
498,000
500,000
Time (sec)
GALILEO 02 L1 BOC_1_1_DP_MBOC SNR (dB/Hz)
GALILEO 03 L1 BOC_1_1_DP_MBOC SNR (dB/Hz)
GALILEO 05 L1 BOC_1_1_DP_MBOC SNR (dB/Hz)
GALILEO 08 L1 BOC_1_1_DP_MBOC SNR (dB/Hz)
GALILEO 11 L1 BOC_1_1_DP_MBOC SNR (dB/Hz)
GALILEO 12 L1 BOC_1_1_DP_MBOC SNR (dB/Hz)
GALILEO 24 L1 BOC_1_1_DP_MBOC SNR (dB/Hz)
GALILEO 25 L1 BOC_1_1_DP_MBOC SNR (dB/Hz)
GALILEO 30 L1 BOC_1_1_DP_MBOC SNR (dB/Hz)
GALILEO 34 L1 BOC_1_1_DP_MBOC SNR (dB/Hz)
GALILEO 36 L1 BOC_1_1_DP_MBOC SNR (dB/Hz)
GALILEO 02 E5B BPSK10_PD SNR (dB/Hz)
GALILEO 03 E5B BPSK10_PD SNR (dB/Hz)
GALILEO 05 E5B BPSK10_PD SNR (dB/Hz)
GALILEO 08 E5B BPSK10_PD SNR (dB/Hz)
GALILEO 11 E5B BPSK10_PD SNR (dB/Hz)
GALILEO 12 E5B BPSK10_PD SNR (dB/Hz)
GALILEO 25 E5B BPSK10_PD SNR (dB/Hz)
GALILEO 30 E5B BPSK10_PD SNR (dB/Hz)

Smoothed Trajectory Information

Top View

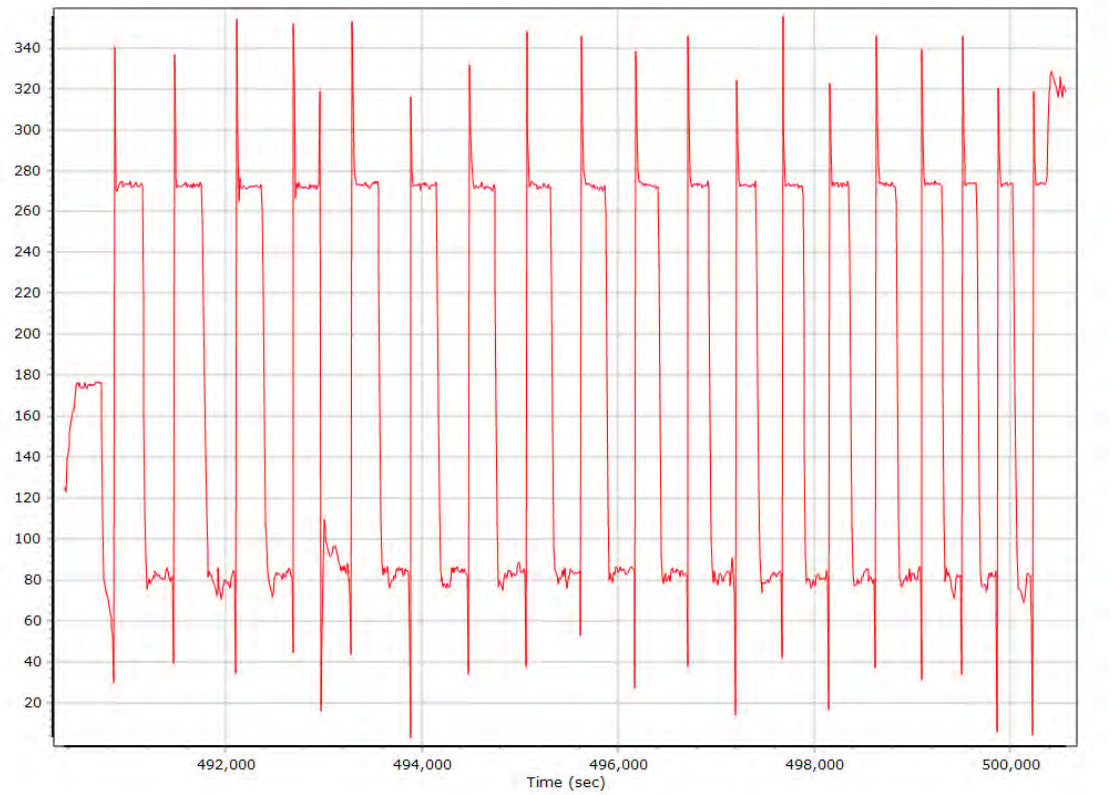


Altitude

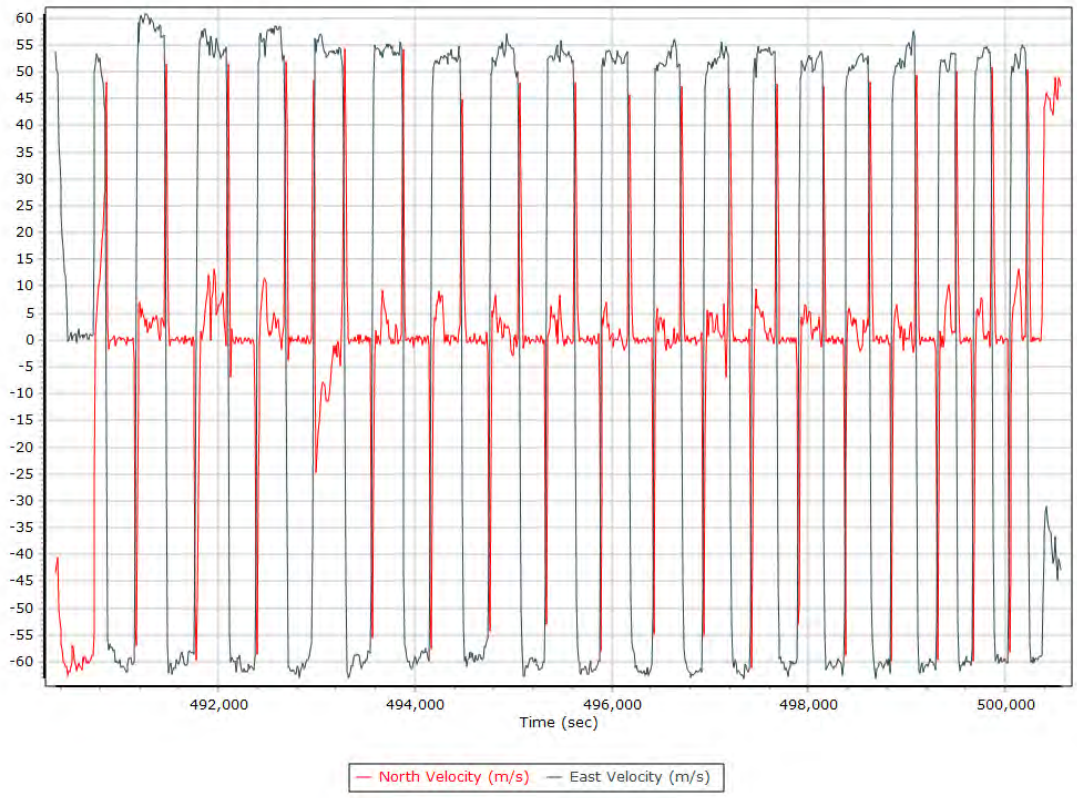


Roll/Pitch

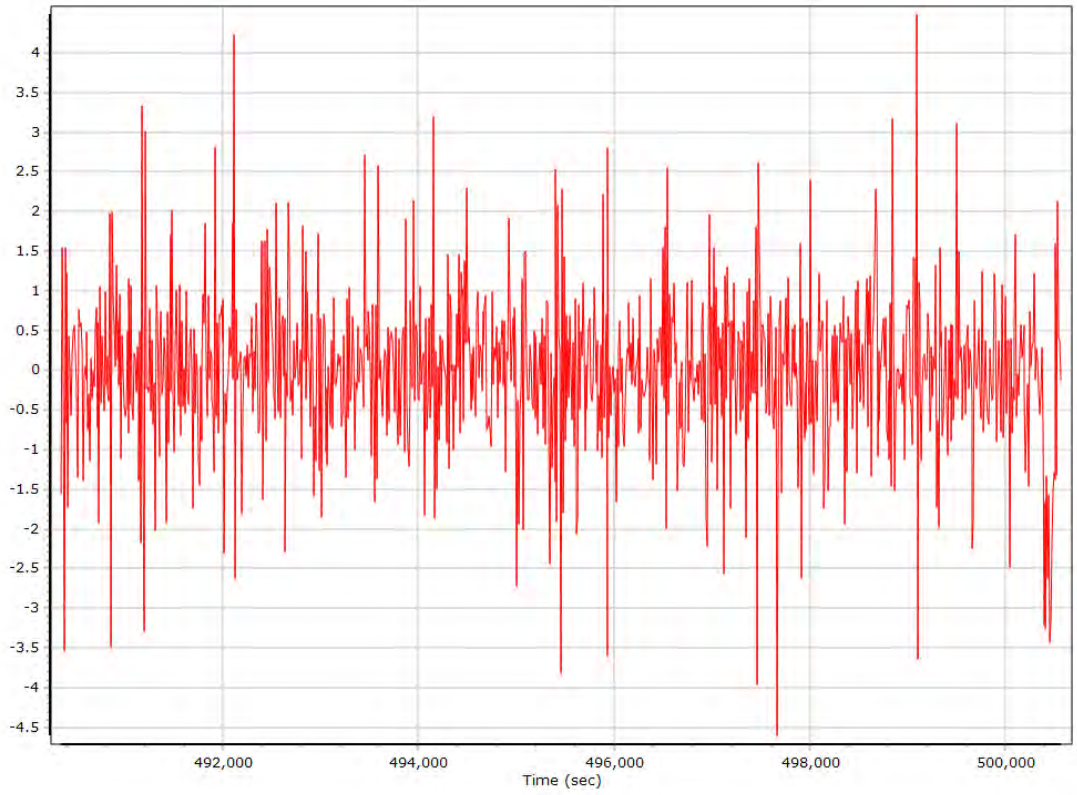
Heading



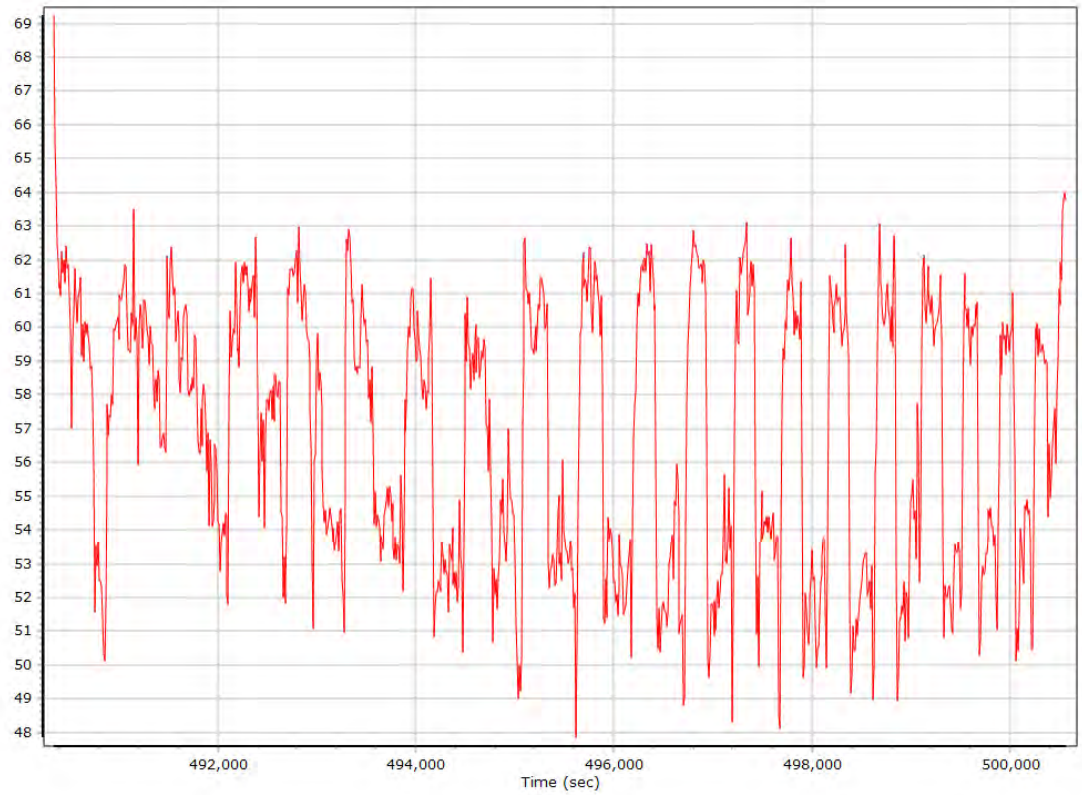
North/East Velocity



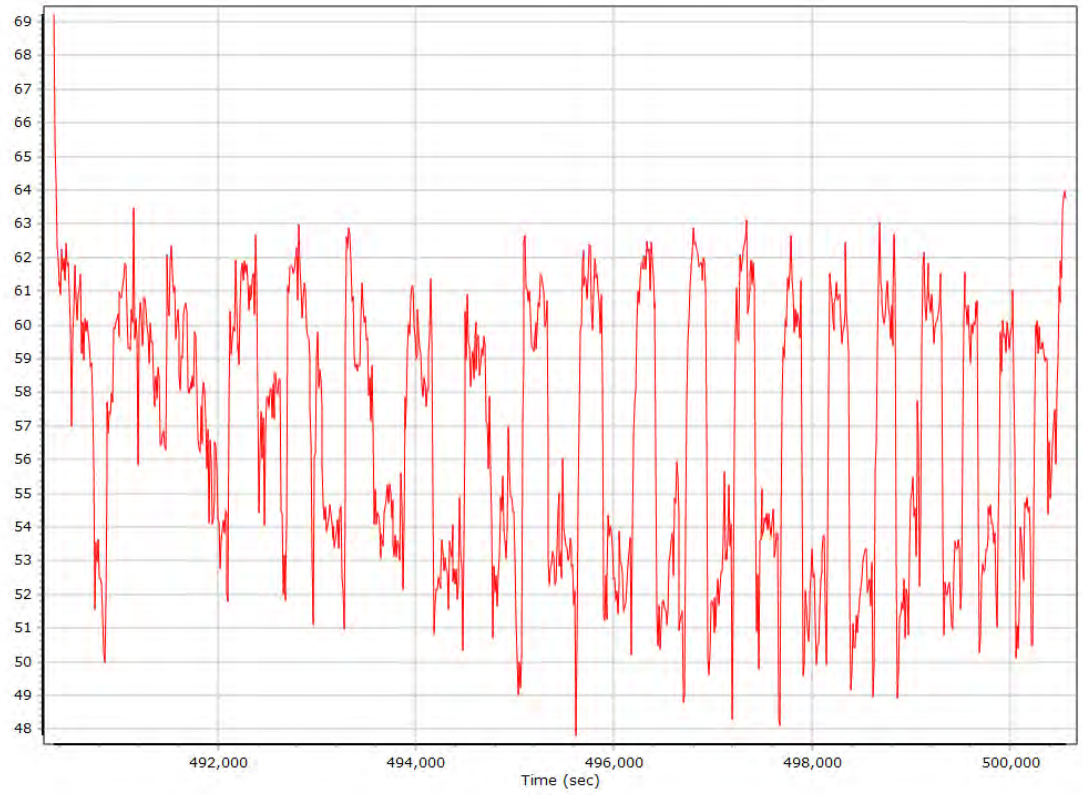
Down Velocity



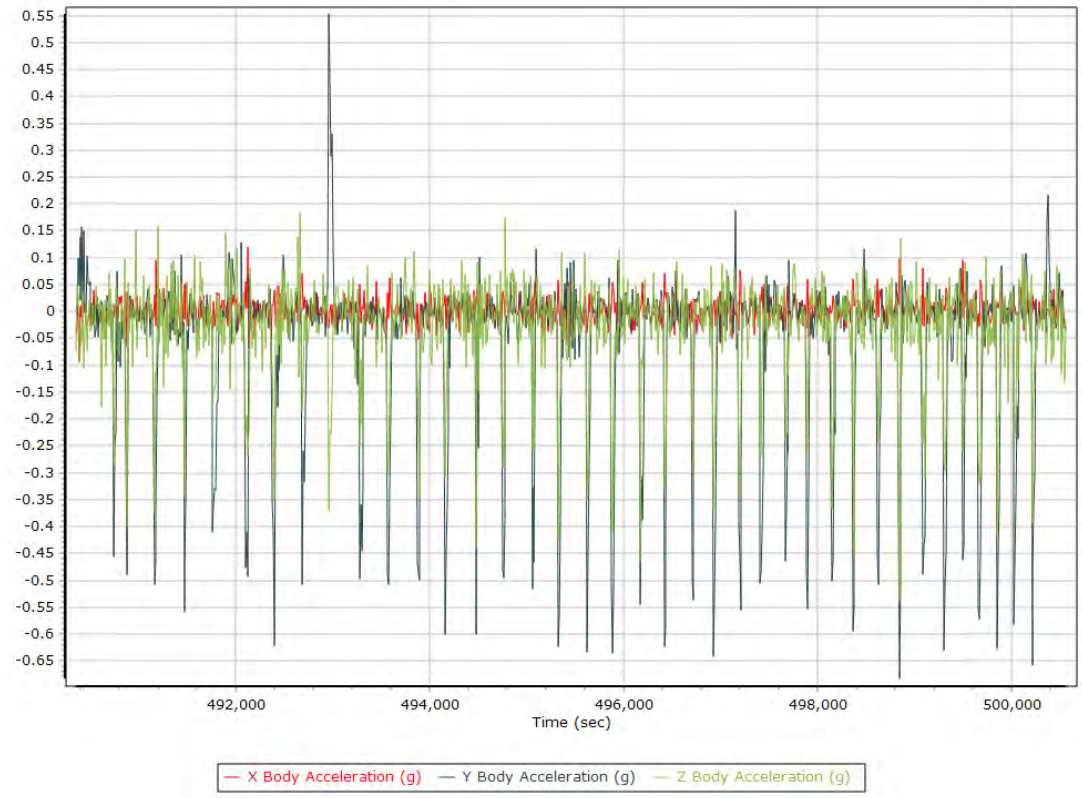
Total Speed



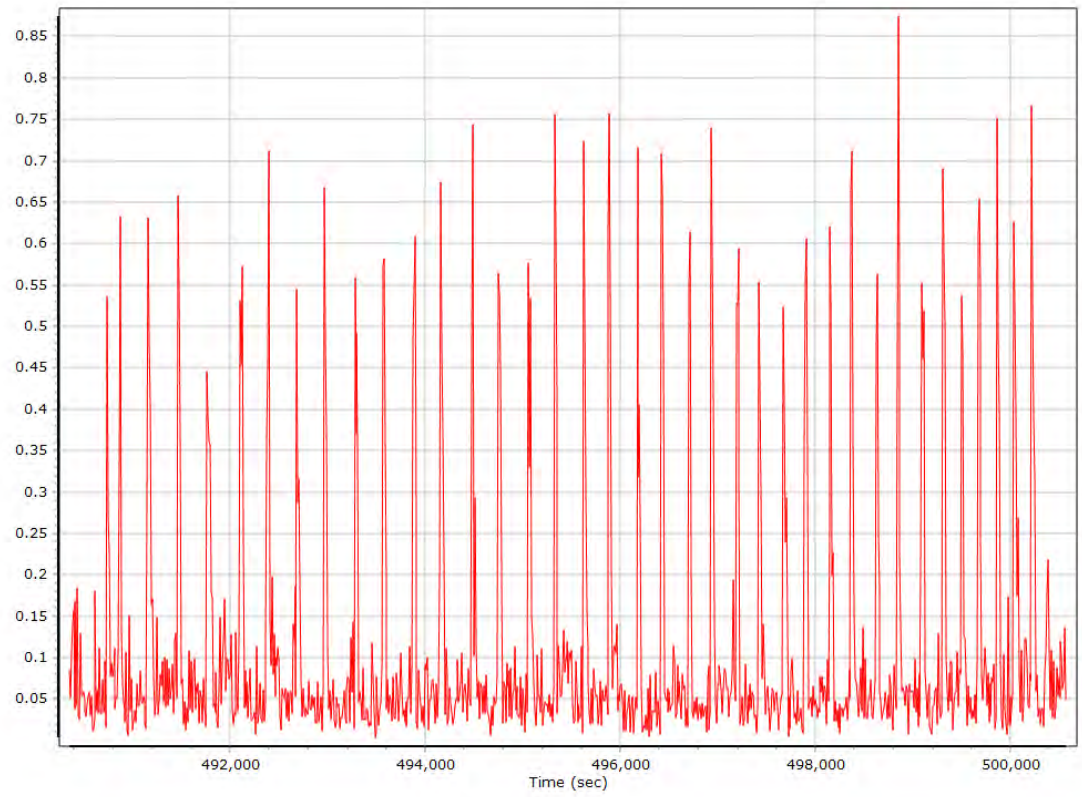
Ground Speed



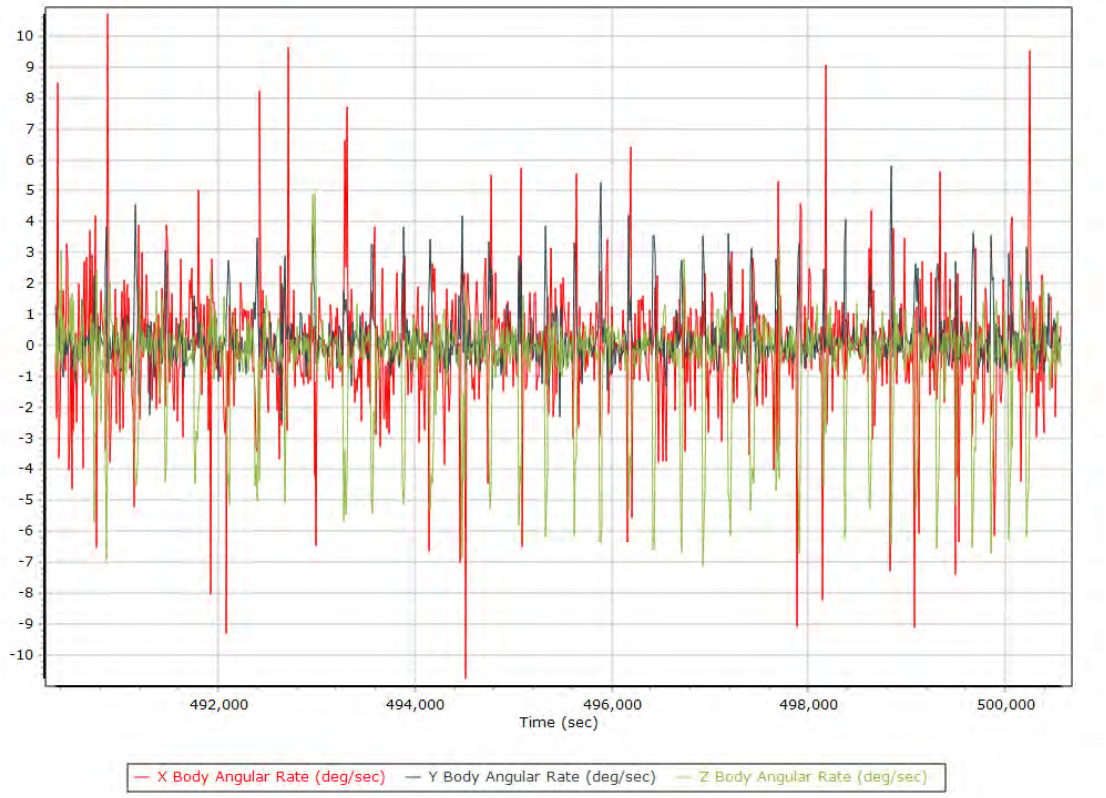
Body Acceleration



Total Body Acceleration

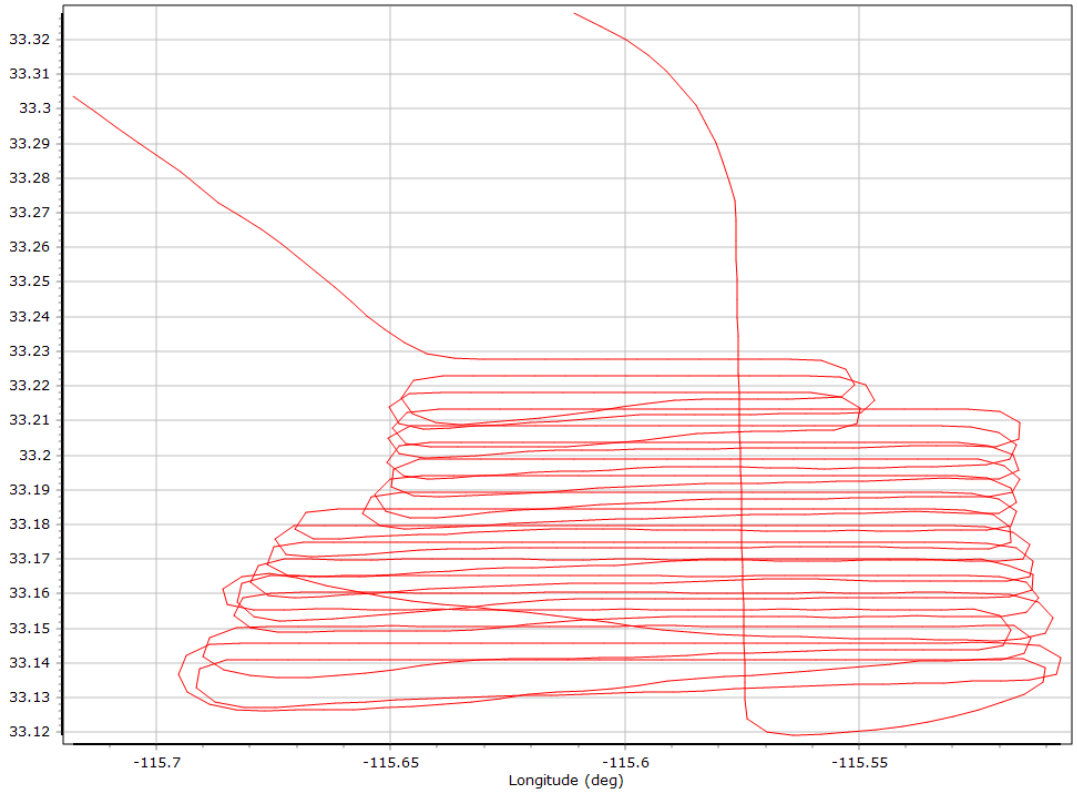


Body Angular Rate

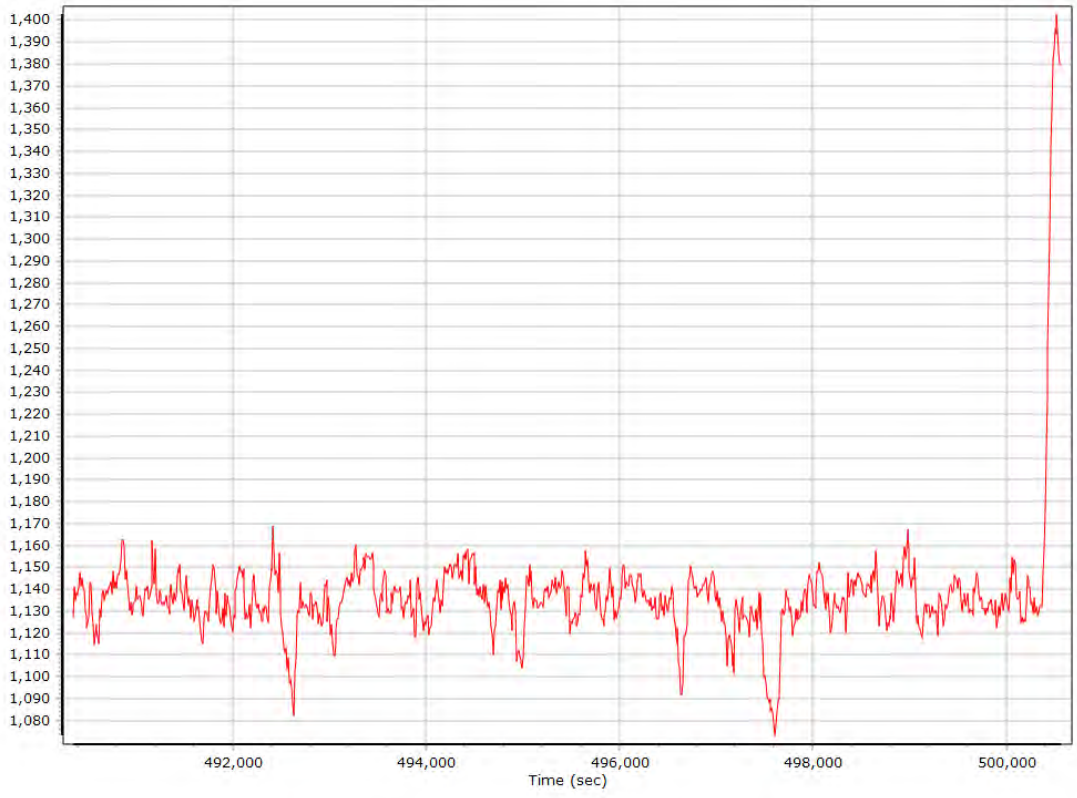


Forward Processed Trajectory Information

Top View

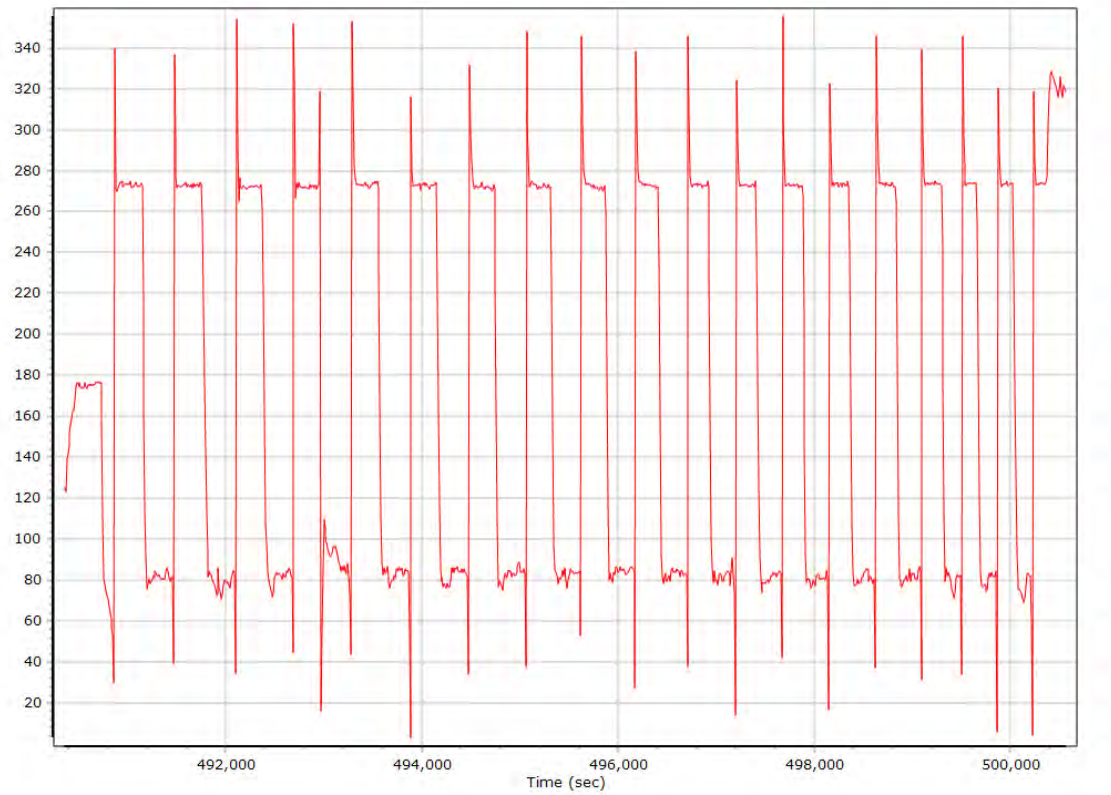


Altitude

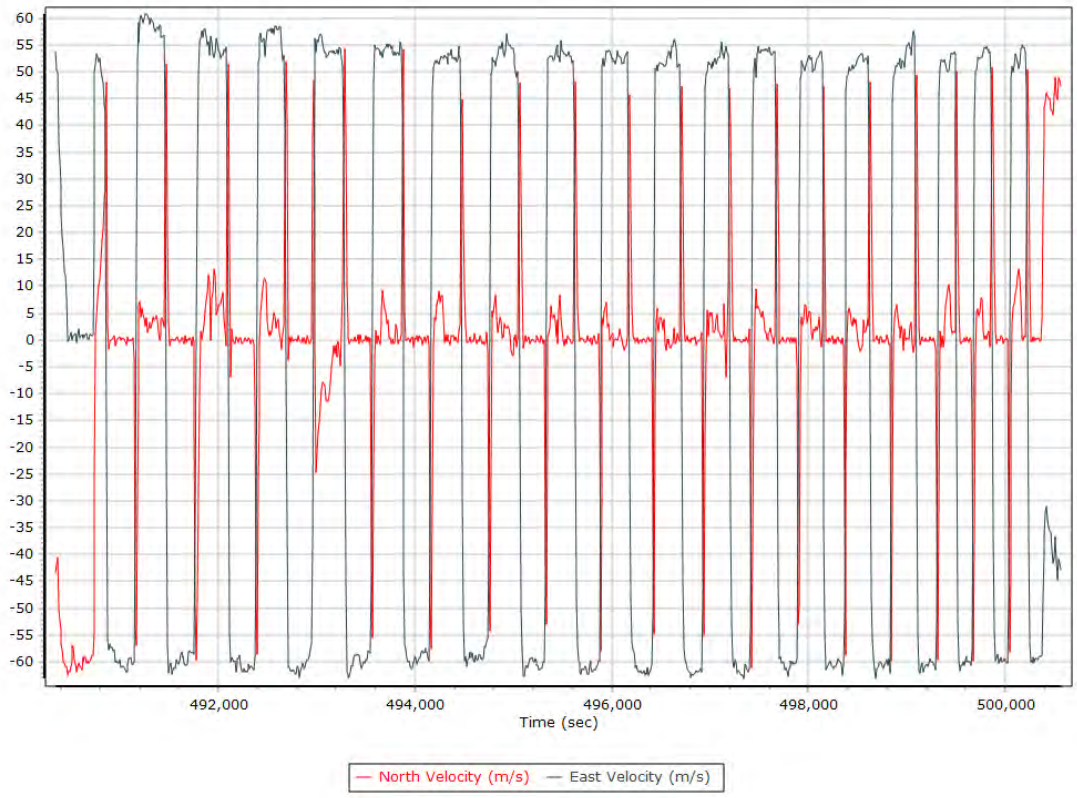


Roll/Pitch

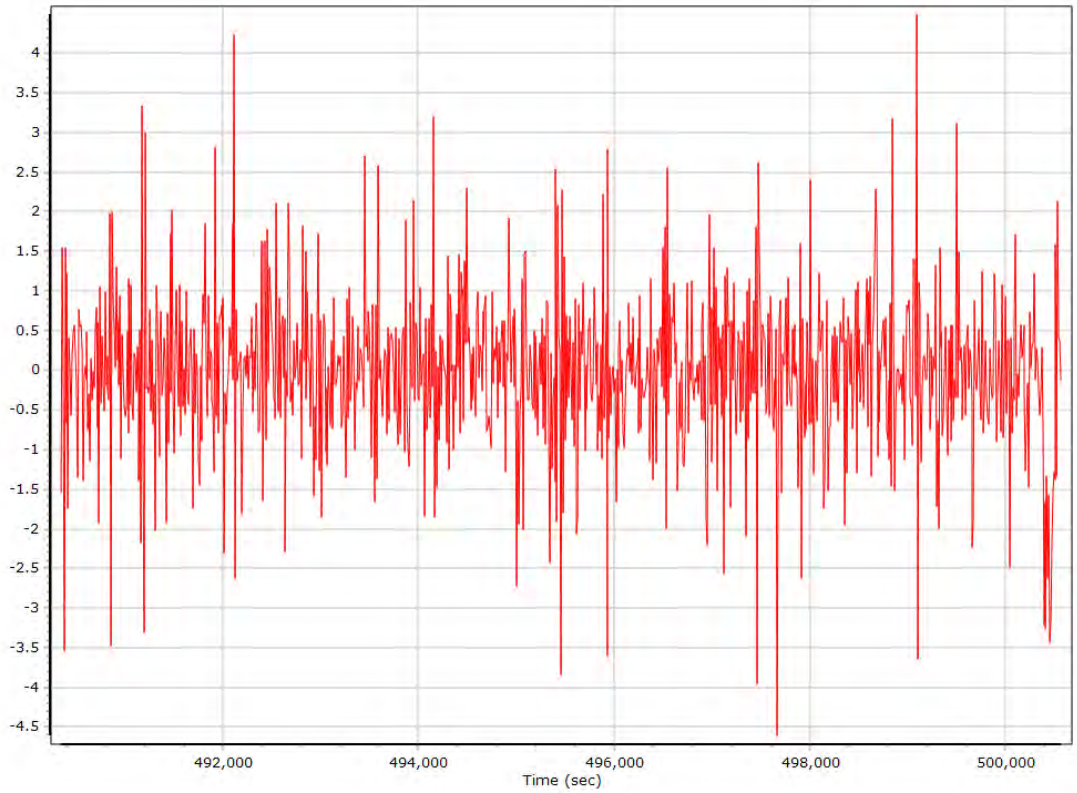
Heading



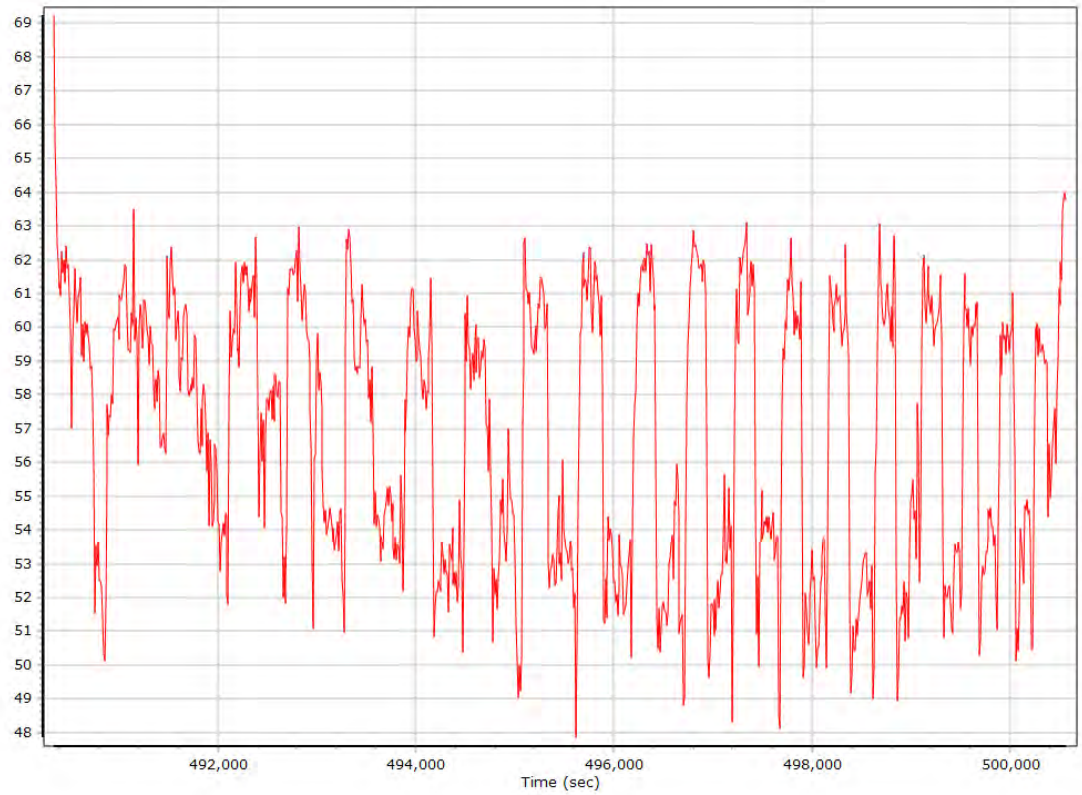
North/East Velocity



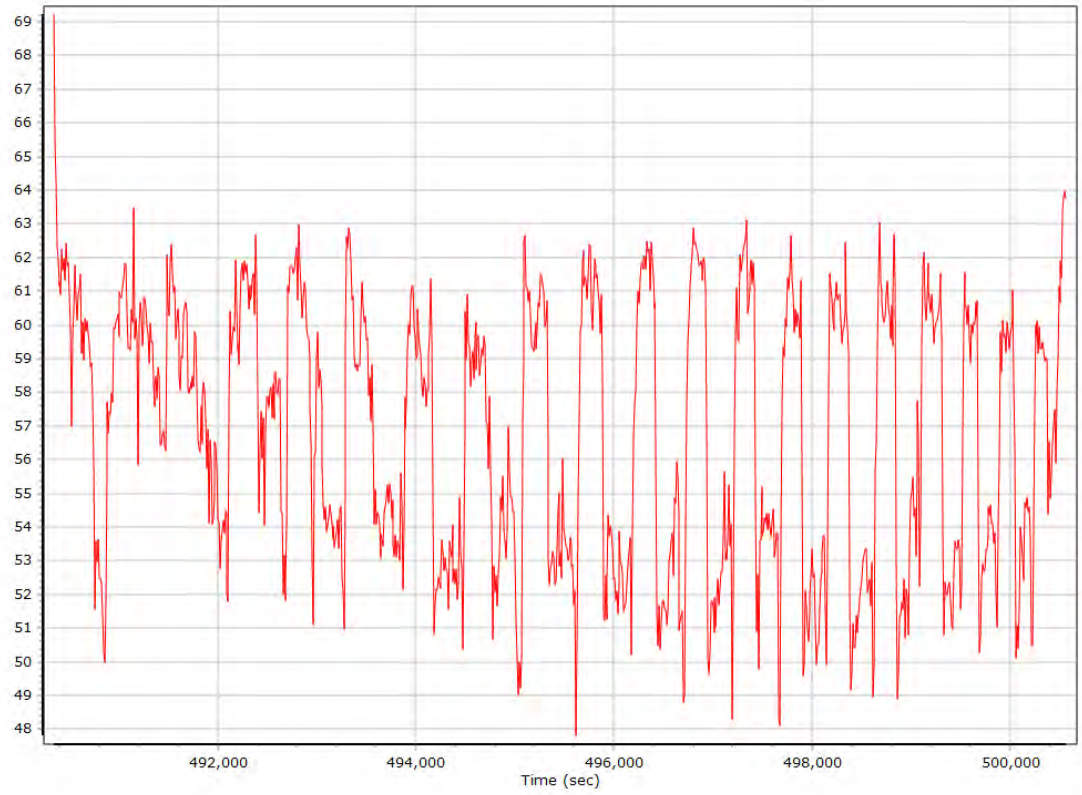
Down Velocity



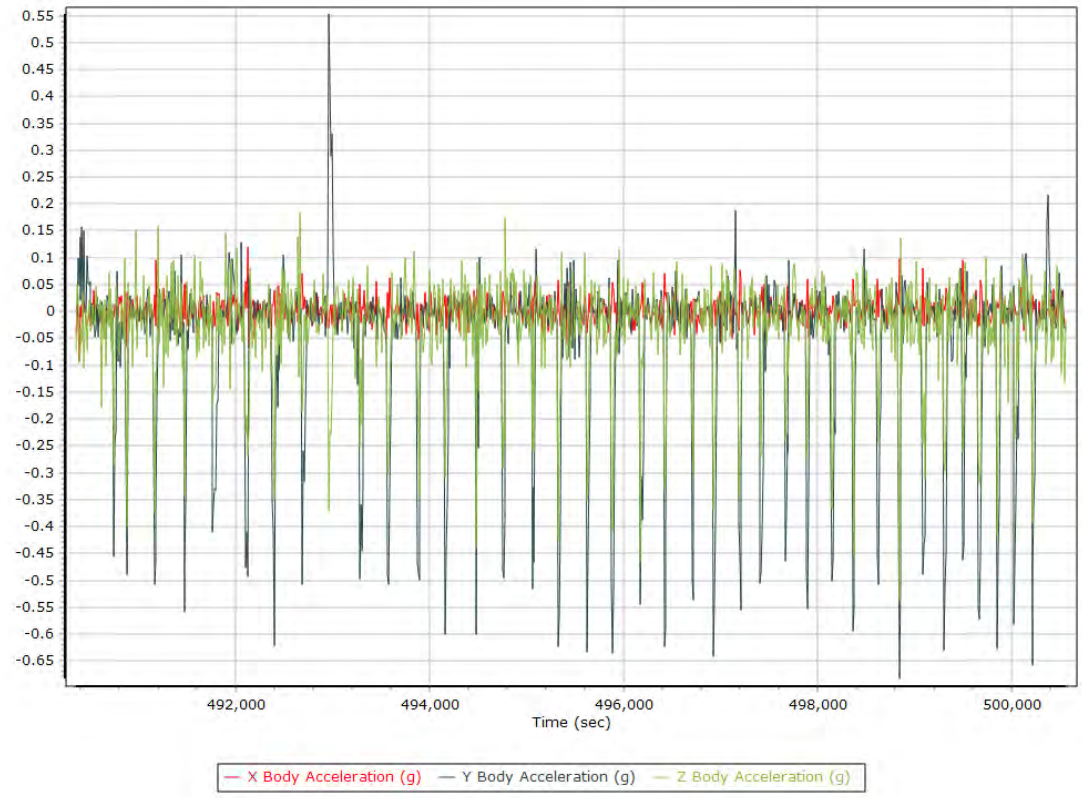
Total Speed



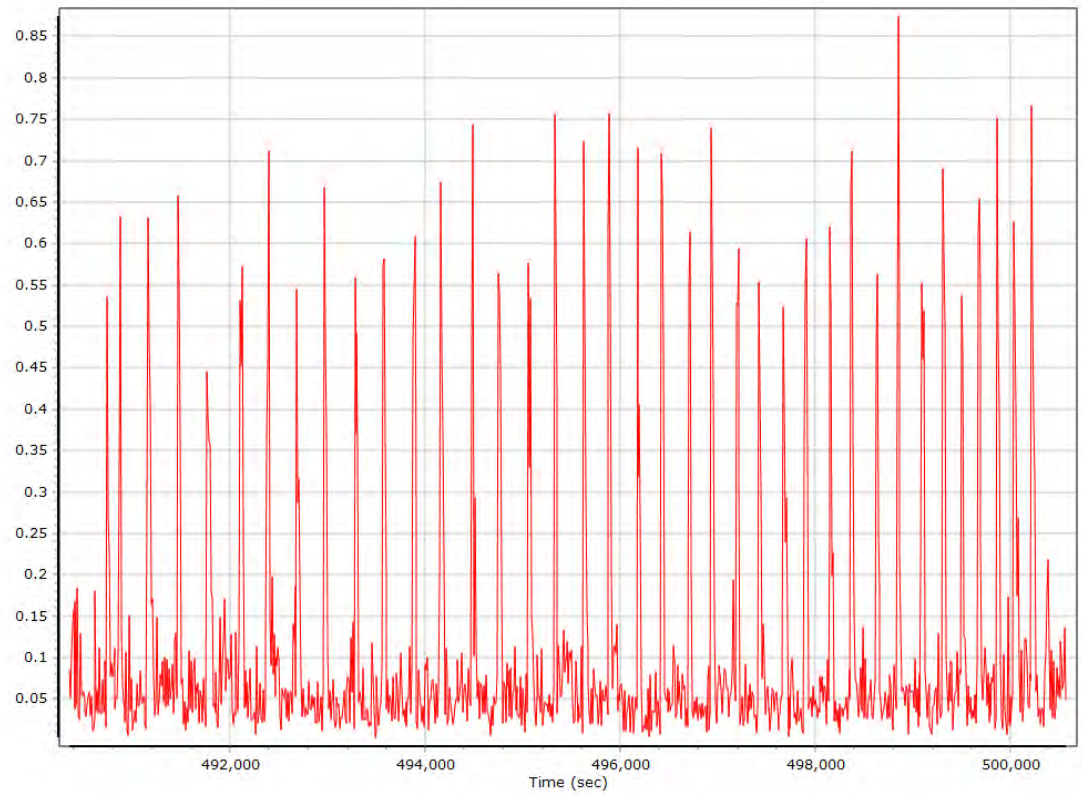
Ground Speed



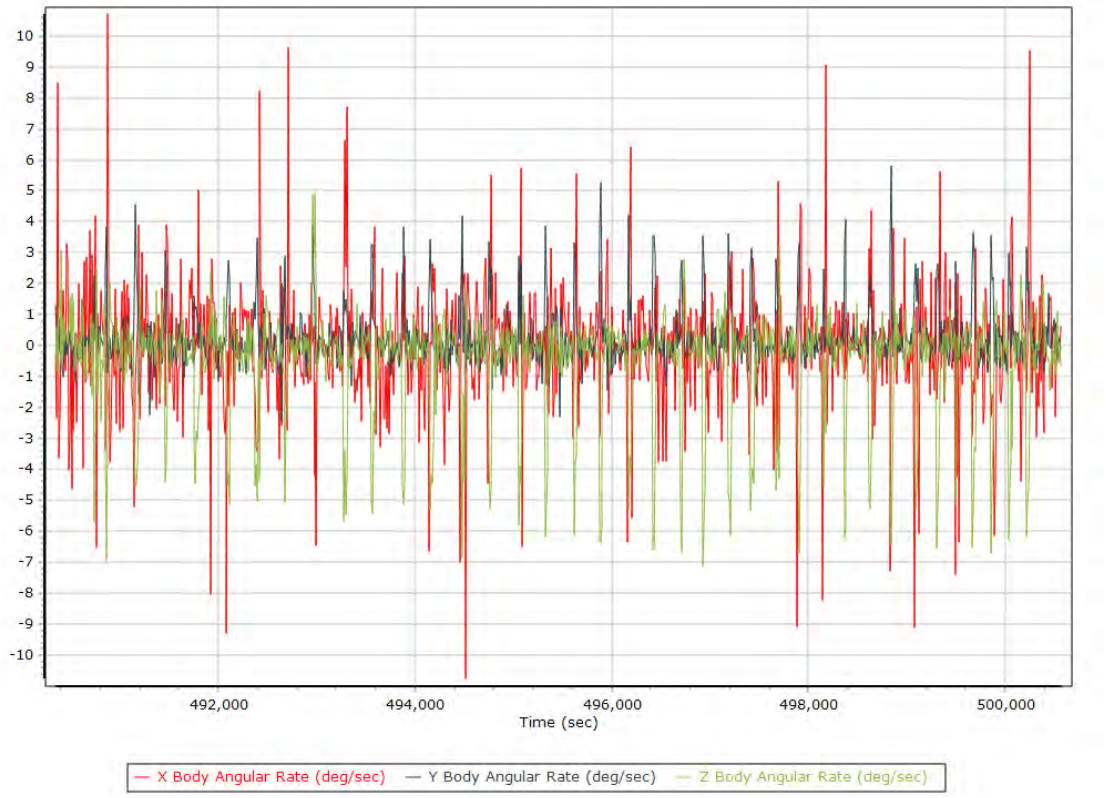
Body Acceleration



Total Body Acceleration



Body Angular Rate



SmartBase Processing Summary

Smart Select Options

Archive enabled	False
User database enabled	False
Include high-rate data sites	False
Include RINEX 3 data sites	False
Target GNSS Selection	GNSS

Basestation Selection

Date	ID	Dist	System	Rate	Service	Database	Status
05/13/2022	P507	3.11	GPS	15	UNAVCO (daily)	Smart Base	Imported
05/13/2022	GLRS	12.69	GNSS	30	CORS (daily)	Smart Base	Imported
05/13/2022	P506	13.43	GNSS	30	CORS (daily)	Smart Base	Imported
05/13/2022	P495	15.24	GPS	15	UNAVCO (daily)	Smart Base	Imported
05/13/2022	P508	17.29	GNSS	15	UNAVCO (daily)	Smart Base	Imported
05/13/2022	CRRS	17.88	GPS	15	UNAVCO (daily)	Smart Base	Imported
05/13/2022	ERRG	22.42	GNSS	15	UNAVCO (daily)	Smart Base	Imported
05/13/2022	P510	23.79	GNSS	15	UNAVCO (daily)	Smart Base	Imported
05/13/2022	BOMG	24.17	GNSS	15	UNAVCO (daily)	Smart Base	Imported
05/13/2022	P499	24.28	GNSS	15	UNAVCO (daily)	Smart Base	Imported
05/13/2022	P502	27.14	GPS	15	UNAVCO (daily)	Smart Base	Imported
05/13/2022	P503	28.10	GPS	15	UNAVCO (daily)	Smart Base	Imported

SmartBase Results

SmartBase status	PROC_STATUS_OK
Primary station Id	GLRS
Primary station data rate (sec)	30.0
VRS/ASB generation rate (sec)	1.0
VRS/ASB timespan	16564 s (2209 485383 - 2209 501947)
Number of reference stations	9
Primary station GPS measurement usage (%)	98.8
Primary station GLONASS measurement usage (%)	69.6
Average number of satellites per epoch	13.0
Max number of GPS stations used	6
Min number of GPS stations used	3
Max number of GLONASS stations used	5
Min number of GLONASS stations used	3
Total full data gap (sec)	0
Total GPS full data gaps	0
Total GLONASS full data gaps	0
Total individual satellite data gap (sec)	34802
GPS precise vs. broadcast ephemeris used	0.0 % / 100.0 %
GLONASS precise vs. broadcast ephemeris used	0.0 % / 100.0 %
Termination Status	Normal

SmartBase Quality Check

Base Station - BOMG

Status	OK	**SBQI**	9	
Duration (Hours)	22.67	**Output Coordinates**	Original	
Solution Epochs	2720	**Mean Epoch SVs**	8.8	
Base Station Coordinates		**Latitude**	**Longitude**	**Height (m)**
Original		N33°21'52.66064"	W115°43'46.94756"	84.258
Adjusted		N33°21'52.66077"	W115°43'46.94765"	84.242
Coordinate Adjustments		**Horizontal (m)**	**Vertical (m)**	**Total (m)**
Adjustments		0.005	0.016	0.017

Base Station Information

Station ID	BOMG		
Filename	bomg1330.22o		
Start date	5/13/2022 12:00:00 AM		
End date	5/13/2022 11:59:45 PM		
Duration	23:59:45.000		
Data type	GNSS		
Receiver manufacturer, model, serial no.	Trimble	NetR9	5301K55926
Antenna manufacturer, model	Trimble	Zephyr Geodetic 2 RoHS	
Antenna height [m]	0.035		
Antenna measurement method	Bottom of antenna mount		
Offset from measured point to APC (m)	0.08546		
Latitude	N33°21'52.66064"		
Longitude	W115°43'46.94756"		
Ellipsoidal height (m)	-84.25789		
Frame	ITRF00		
Epoch	2022.3616		
Ellipsoid	WGS84		
Velocity North (mm/y)	-5.55559013037266		
Velocity East (mm/y)	-19.6092420728597		
Velocity Up (mm/y)	-1.01167654566297		

Base Station - P510

Status	OK	**SBQI**	9	
Duration (Hours)	22.67	**Output Coordinates**	Original	
Solution Epochs	2720	**Mean Epoch SVs**	7.6	
Base Station Coordinates		**Latitude**	**Longitude**	**Height (m)**
Original		N33°08'36.86350"	W115°20'36.00324"	1.511
Adjusted		N33°08'36.86299"	W115°20'36.00314"	1.501
Coordinate Adjustments		**Horizontal (m)**	**Vertical (m)**	**Total (m)**
Adjustments		0.016	0.010	0.019

Base Station Information

Station ID	P510		
Filename	p5101330.22o		
Start date	5/13/2022 12:00:00 AM		
End date	5/13/2022 11:59:45 PM		
Duration	23:59:45.000		
Data type	GNSS		
Receiver manufacturer, model, serial no.	Septentrio	PolaRx5	3075033
Antenna manufacturer, model	UNAVCO	TRM 59800.99 w/SCIT	
Antenna height [m]	0.008		
Antenna measurement method	Bottom of antenna mount		
Offset from measured point to APC (m)	0.08569		
Latitude	N33°08'36.86350"		
Longitude	W115°20'36.00324"		
Ellipsoidal height (m)	1.51071		
Frame	ITRF00		
Epoch	2022.3616		
Ellipsoid	WGS84		
Velocity North (mm/y)	-4.99201912005521		
Velocity East (mm/y)	-12.5953844555759		
Velocity Up (mm/y)	0.64242134555524		

Base Station - ERRG

Status	OK	**SBQI**	7	
Duration (Hours)	22.14	**Output Coordinates**	Original	
Solution Epochs	2657	**Mean Epoch SVs**	8.4	
Base Station Coordinates		**Latitude**	**Longitude**	**Height (m)**
Original		N33°06'59.20370"	W115°49'21.84761"	92.415
Adjusted		N33°06'59.20400"	W115°49'21.84774"	92.389
Coordinate Adjustments		**Horizontal (m)**	**Vertical (m)**	**Total (m)**
Adjustments		0.010	0.027	0.028

Base Station Information

Station ID	ERRG		
Filename	errg1330.22o		
Start date	5/13/2022 12:00:00 AM		
End date	5/13/2022 11:59:45 PM		
Duration	23:59:45.000		
Data type	GNSS		
Receiver manufacturer, model, serial no.	Topcon	NET-G3A	618-01043
Antenna manufacturer, model	Topcon	TPS CR.G3 w/SCIT	
Antenna height [m]	0.008		
Antenna measurement method	Bottom of antenna mount		
Offset from measured point to APC (m)	0.1051		
Latitude	N33°06'59.20370"		
Longitude	W115°49'21.84761"		
Ellipsoidal height (m)	-92.41514		
Frame	ITRF00		
Epoch	2022.3616		
Ellipsoid	WGS84		
Velocity North (mm/y)	3.66763783722735		
Velocity East (mm/y)	-28.2142966146359		
Velocity Up (mm/y)	-1.28262669274541		

Base Station - CRRS

Status	OK	**SBQI**	9	
Duration (Hours)	22.67	**Output Coordinates**	Original	
Solution Epochs	2720	**Mean Epoch SVs**	8.6	
Base Station Coordinates		**Latitude**	**Longitude**	**Height (m)**
Original		N33°04'11.30859"	W115°44'06.16250"	81.905
Adjusted		N33°04'11.30875"	W115°44'06.16226"	81.891
Coordinate Adjustments		**Horizontal (m)**	**Vertical (m)**	**Total (m)**
Adjustments		0.008	0.014	0.016

Base Station Information

Station ID	CRRS		
Filename	crrs1330.22o		
Start date	5/13/2022 12:00:00 AM		
End date	5/13/2022 11:59:45 PM		
Duration	23:59:45.000		
Data type	GPS		
Receiver manufacturer, model, serial no.	Trimble	NetRS	4427235662
Antenna manufacturer, model	Trimble	TRM59800-80 w/SCIT Dome	
Antenna height [m]	0.008		
Antenna measurement method	Bottom of antenna mount		
Offset from measured point to APC (m)	0.11		
Latitude	N33°04'11.30859"		
Longitude	W115°44'06.16250"		
Ellipsoidal height (m)	-81.90516		
Frame	ITRF00		
Epoch	2022.3616		
Ellipsoid	WGS84		
Velocity North (mm/y)	5.8325629808463		
Velocity East (mm/y)	-25.5660240595239		
Velocity Up (mm/y)	1.04648697700421		

Base Station - P508

Status	OK	**SBQI**	9	
Duration (Hours)	22.67	**Output Coordinates**	Original	
Solution Epochs	2720	**Mean Epoch SVs**	6.7	
Base Station Coordinates		**Latitude**	**Longitude**	**Height (m)**
Original		N33°14'52.00508"	W115°25'43.34564"	10.685
Adjusted		N33°14'52.00449"	W115°25'43.34597"	10.685
Coordinate Adjustments		**Horizontal (m)**	**Vertical (m)**	**Total (m)**
Adjustments		0.020	0.000	0.020

Base Station Information

Station ID	P508		
Filename	p5081330.22o		
Start date	5/13/2022 12:00:00 AM		
End date	5/13/2022 11:59:45 PM		
Duration	23:59:45.000		
Data type	GNSS		
Receiver manufacturer, model, serial no.	Septentrio	PolaRx5	3012393
Antenna manufacturer, model	Trimble	GNSS Choke w/SCIT Dome	
Antenna height [m]	0.008		
Antenna measurement method	Bottom of antenna mount		
Offset from measured point to APC (m)	0.11		
Latitude	N33°14'52.00508"		
Longitude	W115°25'43.34564"		
Ellipsoidal height (m)	10.68466		
Frame	ITRF00		
Epoch	2022.3616		
Ellipsoid	WGS84		
Velocity North (mm/y)	-5.00219586573782		
Velocity East (mm/y)	-12.5913783711368		
Velocity Up (mm/y)	0.649036271159588		

Base Station - P495

Status	OK	**SBQI**	9	
Duration (Hours)	22.67	**Output Coordinates**	Original	
Solution Epochs	2720	**Mean Epoch SVs**	8.5	
Base Station Coordinates		**Latitude**	**Longitude**	**Height (m)**
Original		N33°02'41.85729"	W115°37'42.22588"	84.079
Adjusted		N33°02'41.85782"	W115°37'42.22590"	84.052
Coordinate Adjustments		**Horizontal (m)**	**Vertical (m)**	**Total (m)**
Adjustments		0.016	0.027	0.031

Base Station Information

Station ID	P495		
Filename	p4951330.22o		
Start date	5/13/2022 12:00:00 AM		
End date	5/13/2022 11:59:45 PM		
Duration	23:59:45.000		
Data type	GPS		
Receiver manufacturer, model, serial no.	Trimble	NetRS	4522251529
Antenna manufacturer, model	Trimble	Choke Ring w/SCIT Dome	
Antenna height [m]	0.008		
Antenna measurement method	Bottom of antenna mount		
Offset from measured point to APC (m)	0.11		
Latitude	N33°02'41.85729"		
Longitude	W115°37'42.22588"		
Ellipsoidal height (m)	-84.07864		
Frame	ITRF00		
Epoch	2022.3616		
Ellipsoid	WGS84		
Velocity North (mm/y)	4.66481805281871		
Velocity East (mm/y)	-22.1107184742231		
Velocity Up (mm/y)	-6.23487857957138		

Base Station - P506

Status	OK	**SBQI**	9	
Duration (Hours)	22.67	**Output Coordinates**	Original	
Solution Epochs	2720	**Mean Epoch SVs**	8.0	
Base Station Coordinates		**Latitude**	**Longitude**	**Height (m)**
Original		N33°04'53.14484"	W115°30'36.72012"	83.465
Adjusted		N33°04'53.14495"	W115°30'36.71968"	83.457
Coordinate Adjustments		**Horizontal (m)**	**Vertical (m)**	**Total (m)**
Adjustments		0.012	0.008	0.014

Base Station Information

Station ID	P506		
Filename	p5061330.22o		
Start date	5/13/2022 12:00:00 AM		
End date	5/13/2022 11:59:30 PM		
Duration	23:59:30.000		
Data type	GNSS		
Receiver manufacturer, model, serial no.	Trimble	NetR9	5303K57612
Antenna manufacturer, model	Trimble	TRM59800-80 w/SCIT Dome	
Antenna height [m]	0.008		
Antenna measurement method	Bottom of antenna mount		
Offset from measured point to APC (m)	0.11		
Latitude	N33°04'53.14484"		
Longitude	W115°30'36.72012"		
Ellipsoidal height (m)	-83.46520		
Frame	ITRF00		
Epoch	2022.3616		
Ellipsoid	WGS84		
Velocity North (mm/y)	-9.81504405388771		
Velocity East (mm/y)	-16.0580103205209		
Velocity Up (mm/y)	-5.67072439392276		

Base Station - P507

Status	OK	**SBQI**	9	
Duration (Hours)	22.67	**Output Coordinates**	Adjusted	
Solution Epochs	2720	**Mean Epoch SVs**	8.7	
Base Station Coordinates		**Latitude**	**Longitude**	**Height (m)**
Original		N33°11'59.90938"	W115°36'44.66647"	78.539
Adjusted		N33°11'59.90752"	W115°36'44.66739"	78.600
Coordinate Adjustments		**Horizontal (m)**	**Vertical (m)**	**Total (m)**
Adjustments		0.000	0.000	0.000

Base Station Information

Station ID	P507		
Filename	p5071330.22o		
Start date	5/13/2022 12:00:00 AM		
End date	5/13/2022 11:59:45 PM		
Duration	23:59:45.000		
Data type	GPS		
Receiver manufacturer, model, serial no.	Trimble	NetRS	4537257368
Antenna manufacturer, model	Trimble	Choke Ring w/SCIT Dome	
Antenna height [m]	0.008		
Antenna measurement method	Bottom of antenna mount		
Offset from measured point to APC (m)	0.11		
Latitude	N33°11'59.90938"		
Longitude	W115°36'44.66647"		
Ellipsoidal height (m)	-78.53851		
Frame	ITRF00		
Epoch	2022.3616		
Ellipsoid	WGS84		
Velocity North (mm/y)	-5.02433337898832		
Velocity East (mm/y)	-12.5826635389121		
Velocity Up (mm/y)	0.686968671025071		

Base Station - GLRS

Status	CONTROL	**SBQI**	9	
Duration (Hours)	22.67	**Output Coordinates**	Control	
Solution Epochs	2720	**Mean Epoch SVs**	7.8	
Base Station Coordinates		**Latitude**	**Longitude**	**Height (m)**
Original		N33°16'29.31835"	W115°31'16.94681"	48.658
Adjusted		N33°16'29.31835"	W115°31'16.94681"	48.658
Coordinate Adjustments		**Horizontal (m)**	**Vertical (m)**	**Total (m)**
Adjustments		0.000	0.000	0.000

Base Station Information

Station ID	GLRS		
Filename	glrs1330.22o		
Start date	5/13/2022 12:00:00 AM		
End date	5/13/2022 11:59:30 PM		
Duration	23:59:30.000		
Data type	GNSS		
Receiver manufacturer, model, serial no.	Trimble	NetR9	5303K57560
Antenna manufacturer, model	Trimble	TRM59800-80 w/SCIT Dome	
Antenna height [m]	0.008		
Antenna measurement method	Bottom of antenna mount		
Offset from measured point to APC (m)	0.11		
Latitude	N33°16'29.31835"		
Longitude	W115°31'16.94681"		
Ellipsoidal height (m)	-48.65782		
Frame	ITRF00		
Epoch	2022.3616		
Ellipsoid	WGS84		
Velocity North (mm/y)	-10.5091987226116		
Velocity East (mm/y)	-16.4922887886943		
Velocity Up (mm/y)	-1.15019153195771		

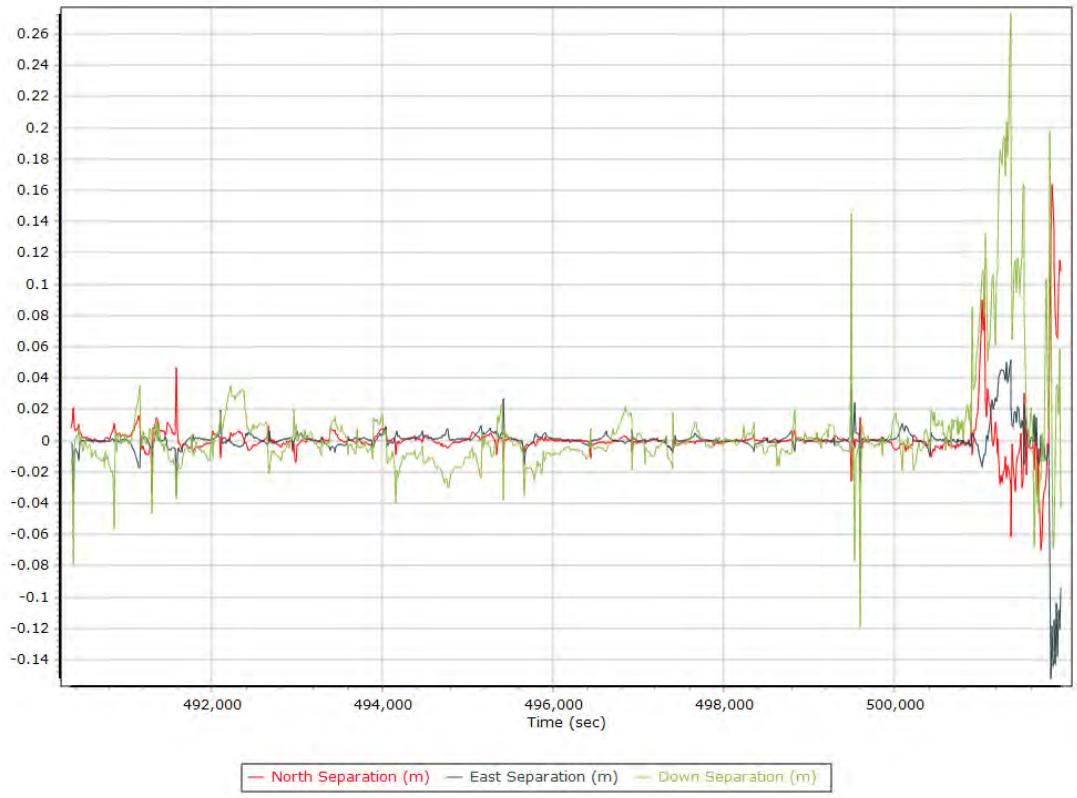
GNSS QC

GNSS QC Statistics

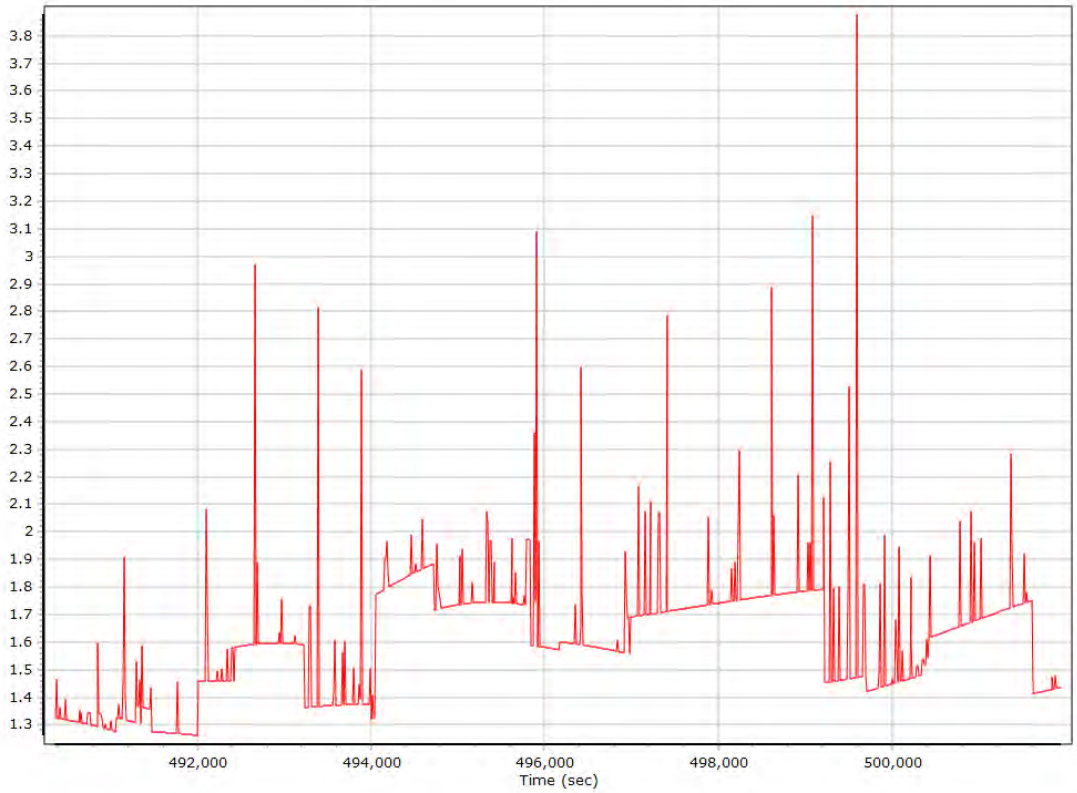
Statistics	Min	Max	Mean
Baseline length (km)	0.05	288.00	
Number of GPS SV	3	10	8
Number of GLONASS SV	0	6	4
Number of QZSS SV	0	0	0
Number of BEIDOU SV	0	0	0
Number of GALILEO SV	0	0	0
Total number of SV	5	15	13
PDOP	1.26	6.23	1.62
QC Solution Gaps	1.00	2.00	
Solution Type	Fixed	Float	No solution
Epoch (sec)	15811.00	734.00	8.00
Percentage	95.52	4.43	0.05

Num SVs in solution

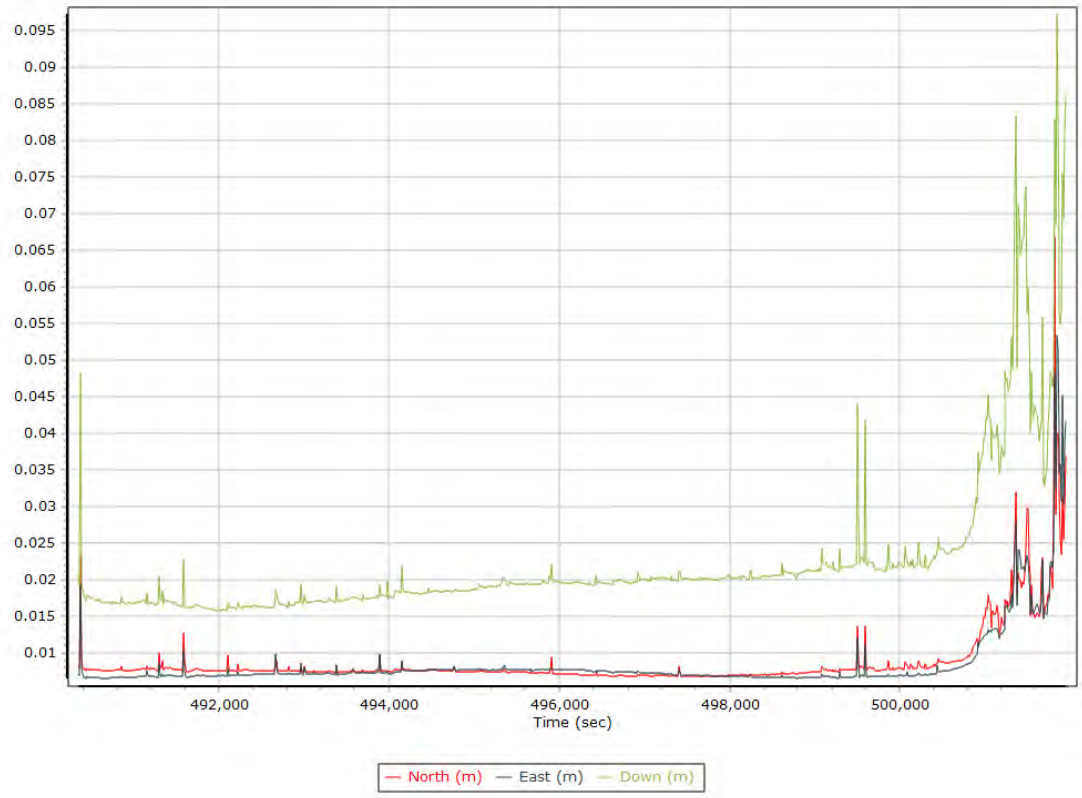
Forward/Reverse Separation



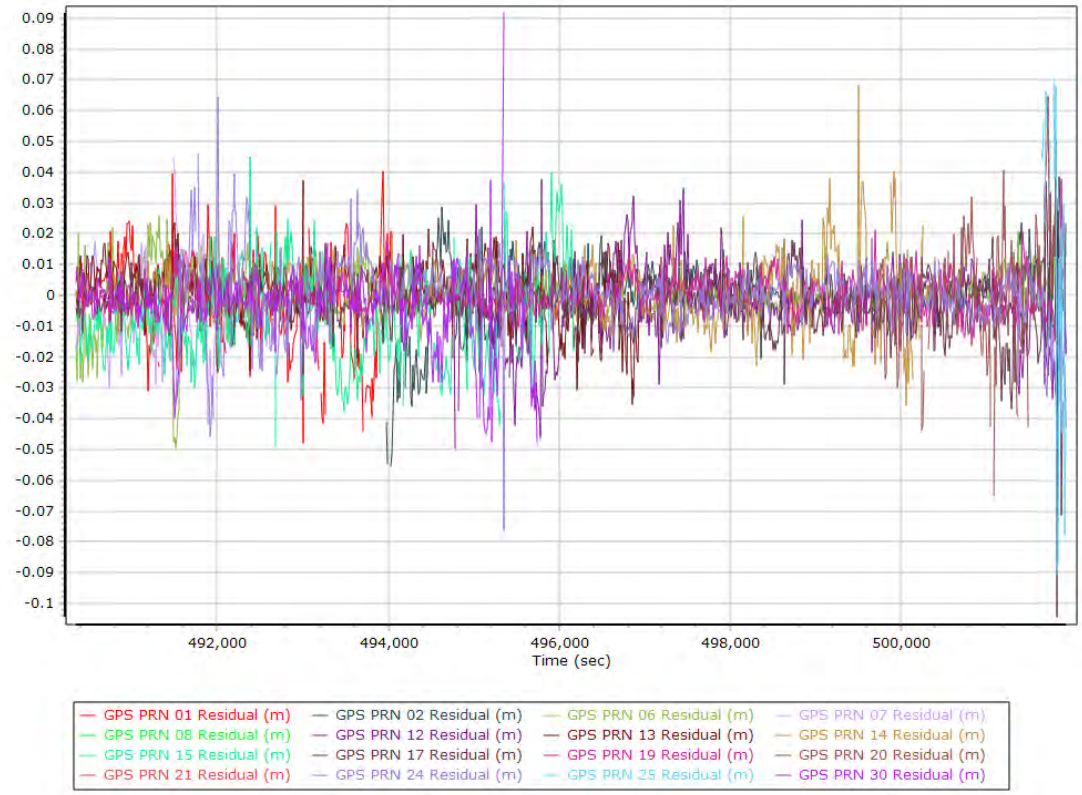
PDOP



Estimated Position Accuracy



GPS Residuals



GLONASS Residuals

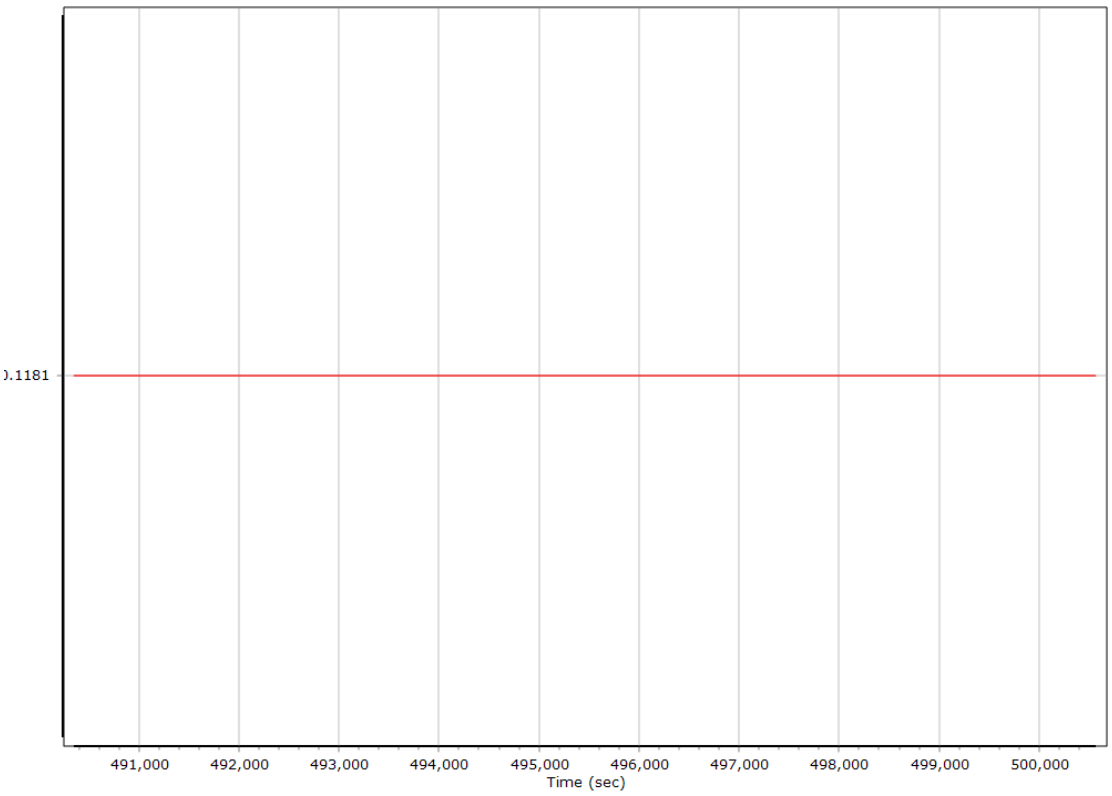
GNSS-Inertial Processor Configuration

Processing mode	IN-Fusion SmartBase		
Stabilized mount	False		
Base station	ASB		
Processing start time	490287.709 (5/13/2022 4:11:27 PM)		
Processing end time	500568.100 (5/13/2022 7:02:48 PM)		
Initial attitude source	Real-Time VNAV/RNAV Attitude		
IMU Sensor Context	Processing with Onboard IMU		
Reference to IMU lever arm (m)	0.000	0.000	0.000
Reference to IMU mounting angles (deg)	0.000	0.000	180.000
Reference to Primary GNSS lever arm (m)	0.118	-0.185	-0.949
Reference to Primary GNSS lever arm std dev (m)	0.030	0.030	0.030
Aircraft to Reference mounting angles (deg)	0.000	0.000	0.000

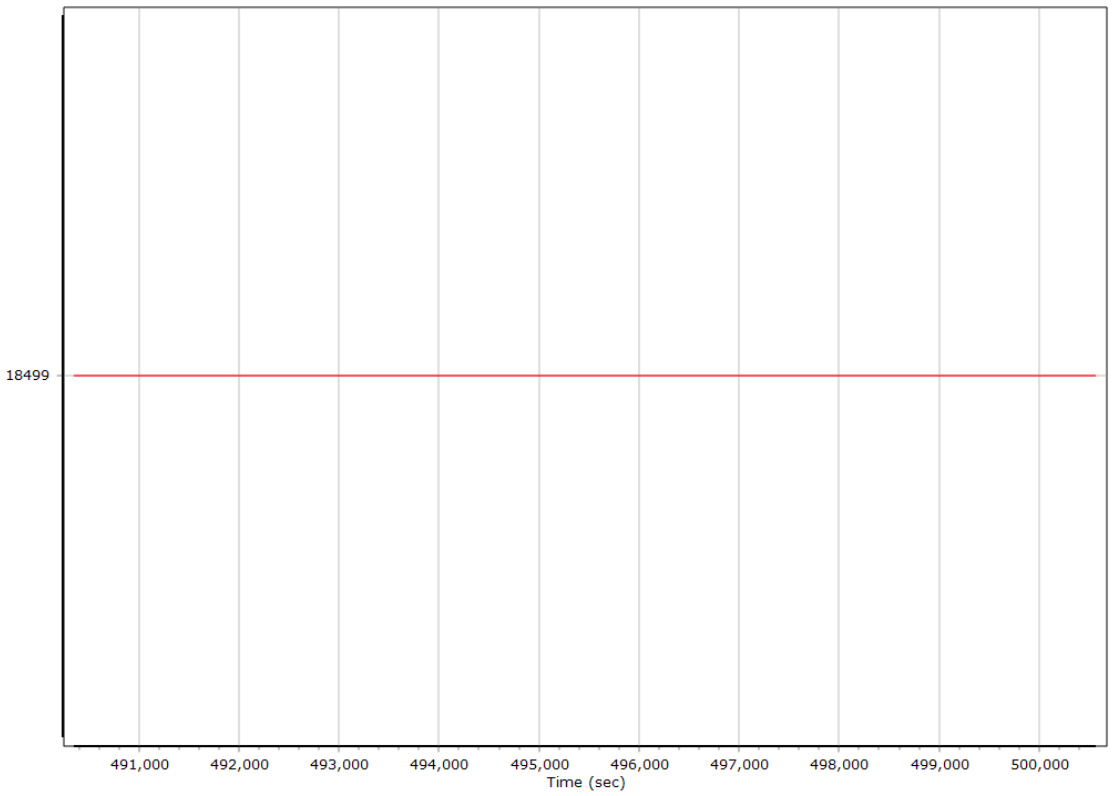
Calibrated Installation Parameters

Reference-Primary GNSS Lever Arm (m)

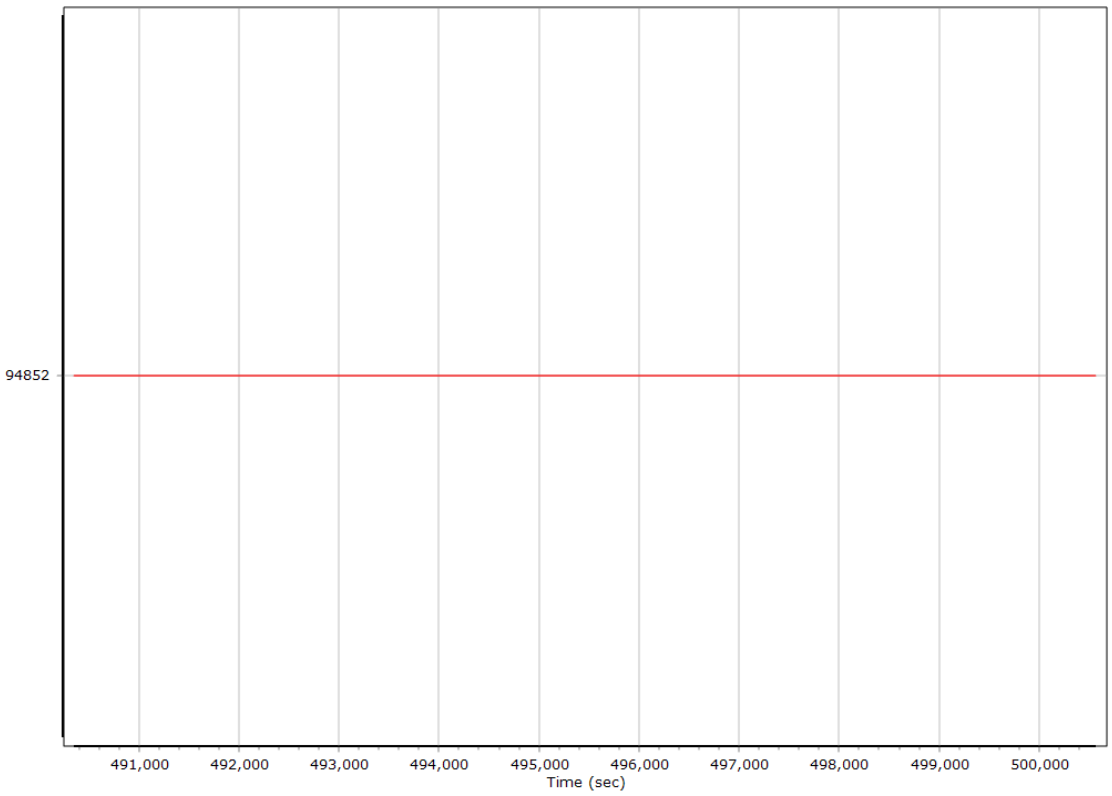
X Reference-Primary GNSS Lever Arm (m)



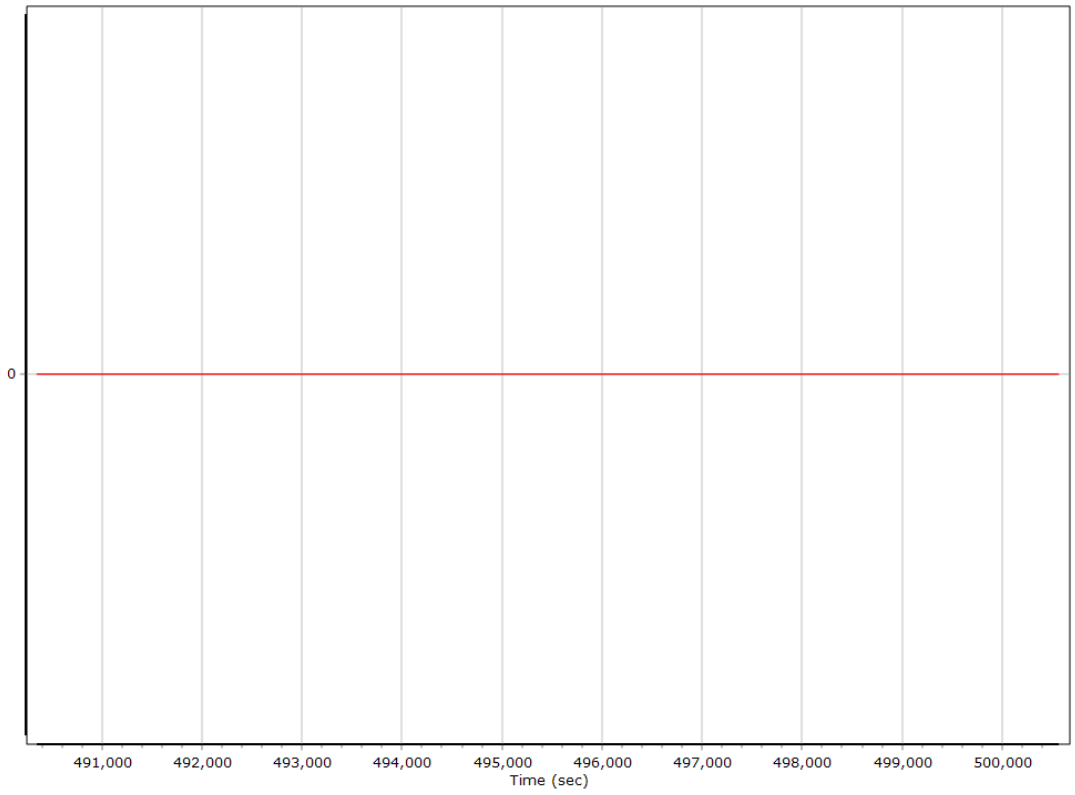
Y Reference-Primary GNSS Lever Arm (m)



Z Reference-Primary GNSS Lever Arm (m)



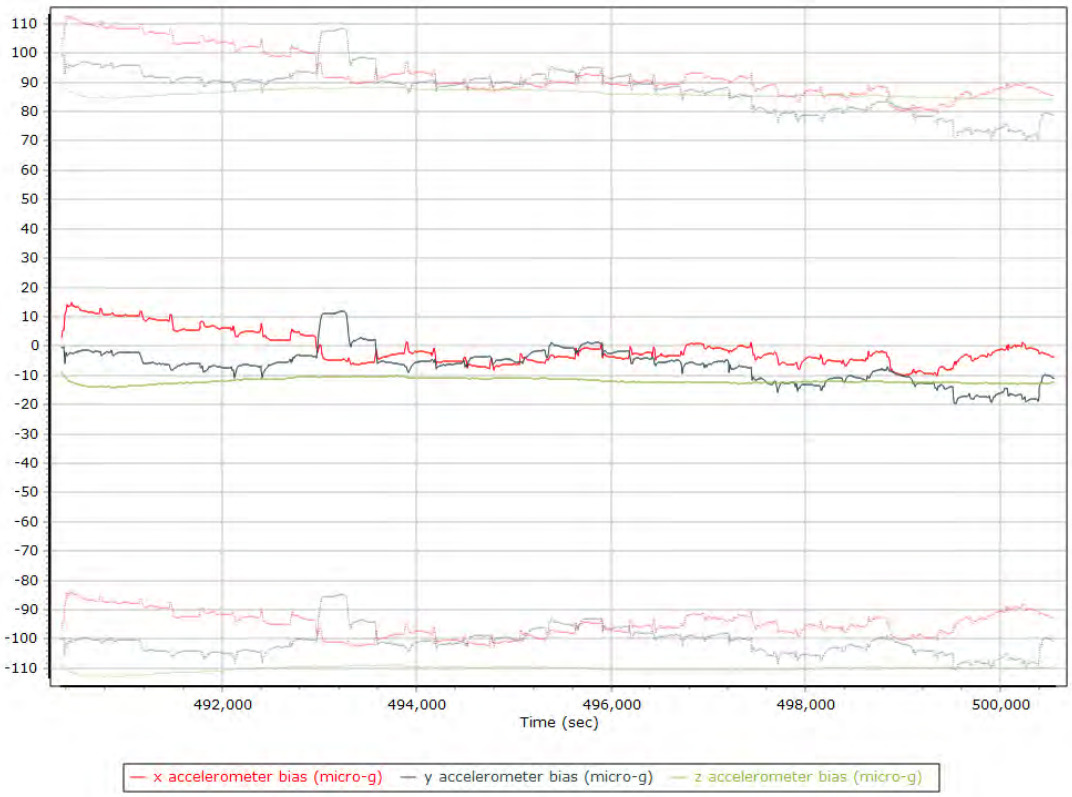
Reference-Primary GNSS Lever Arm Figure of Merit



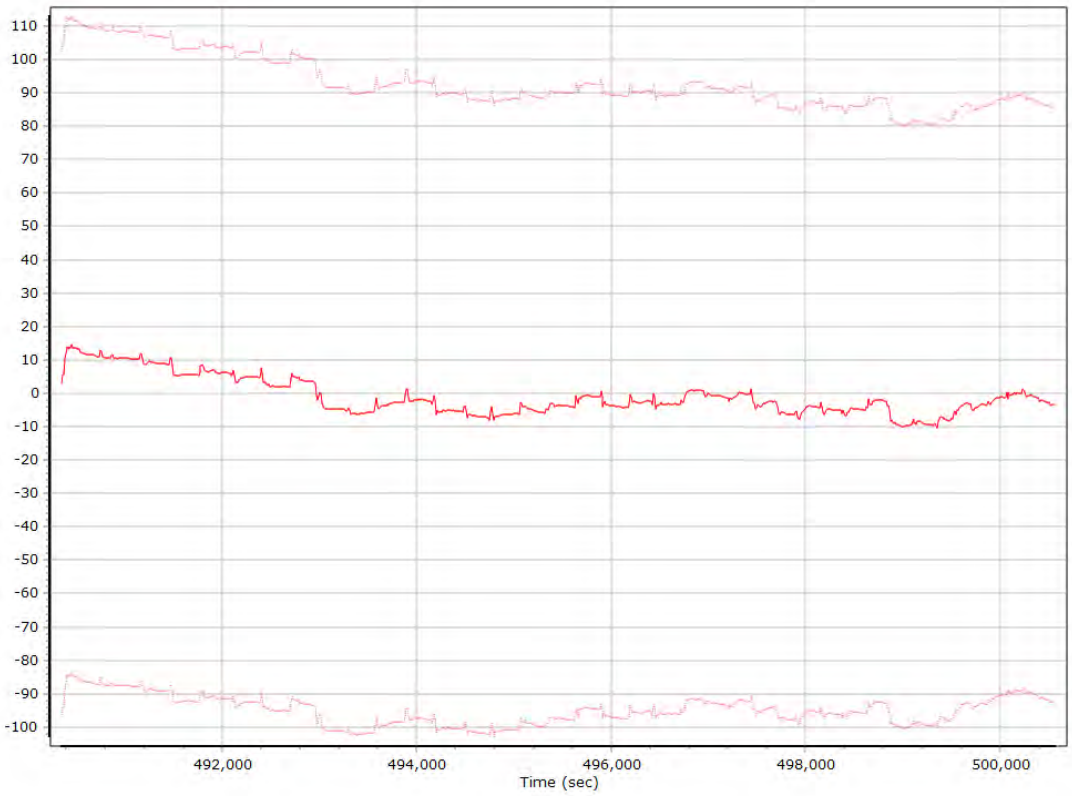
IN-Fusion QC

Forward Processed Estimated Errors, Reference Frame

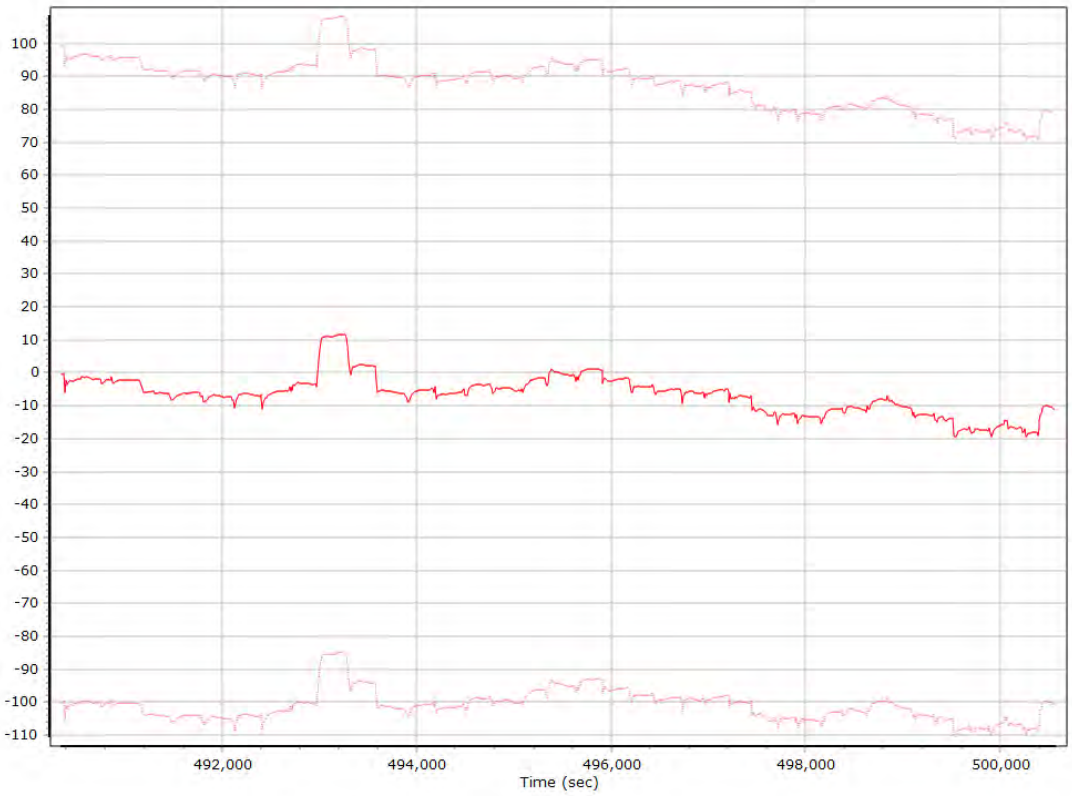
Accelerometer Bias (micro-g)



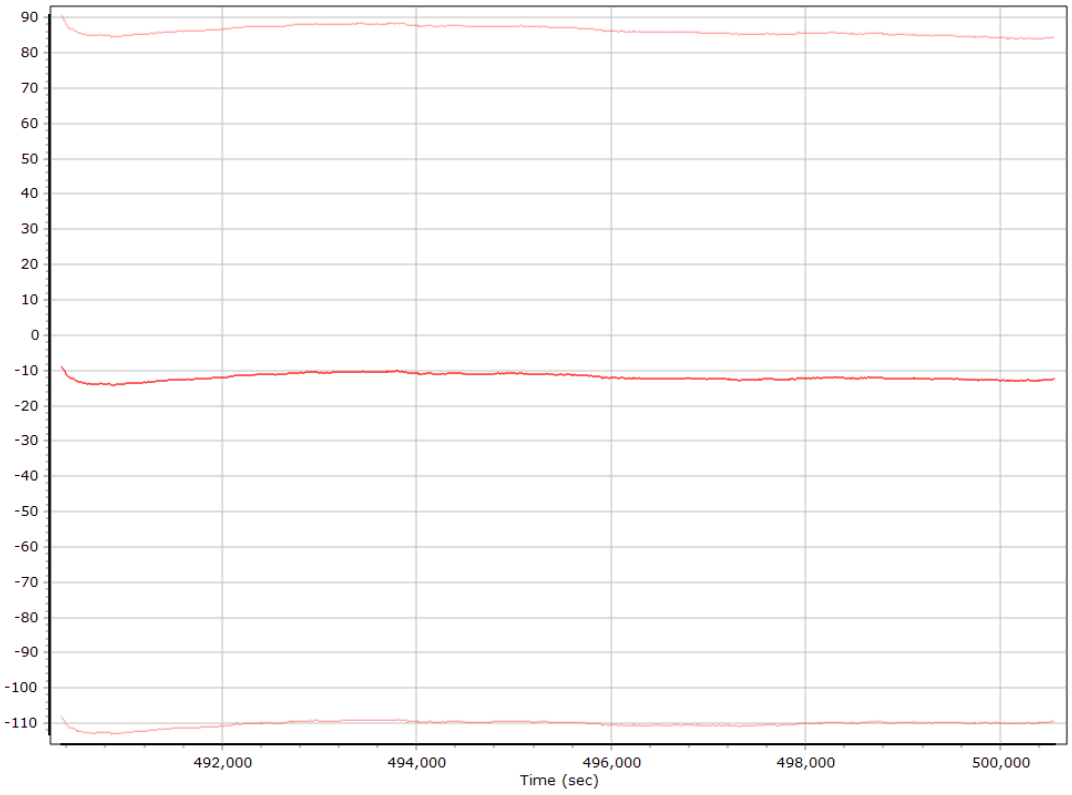
X Accelerometer Bias (micro-g)



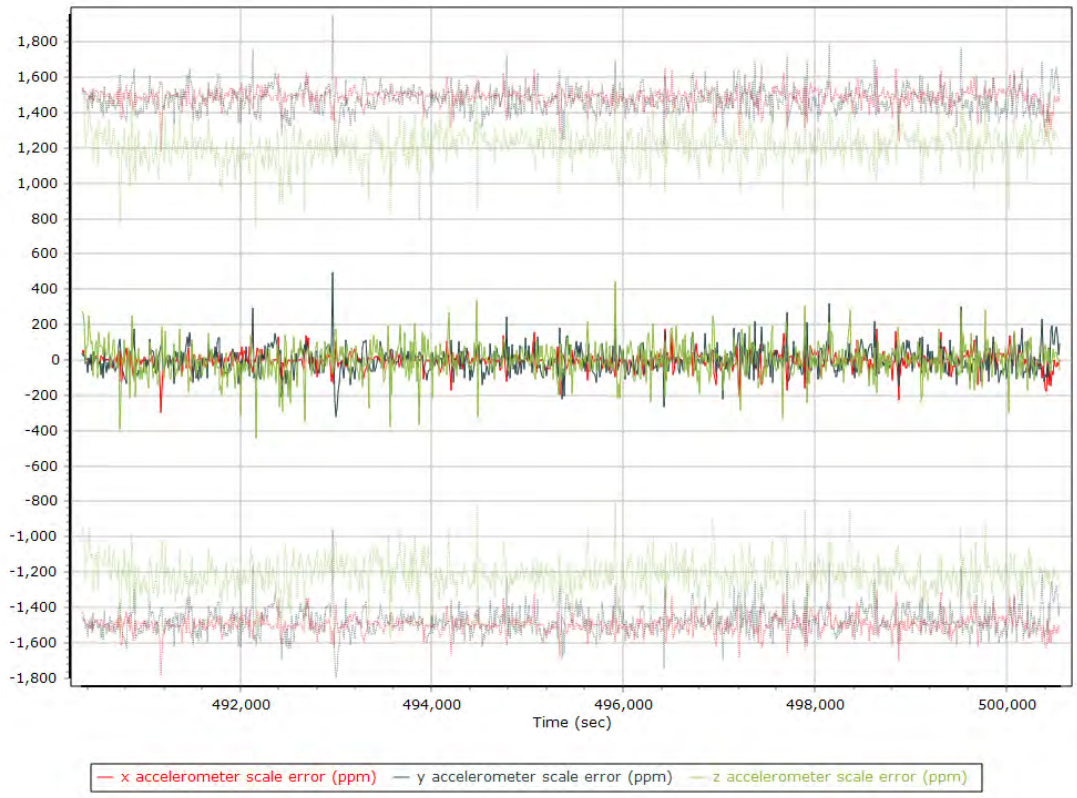
Y Accelerometer Bias (micro-g)



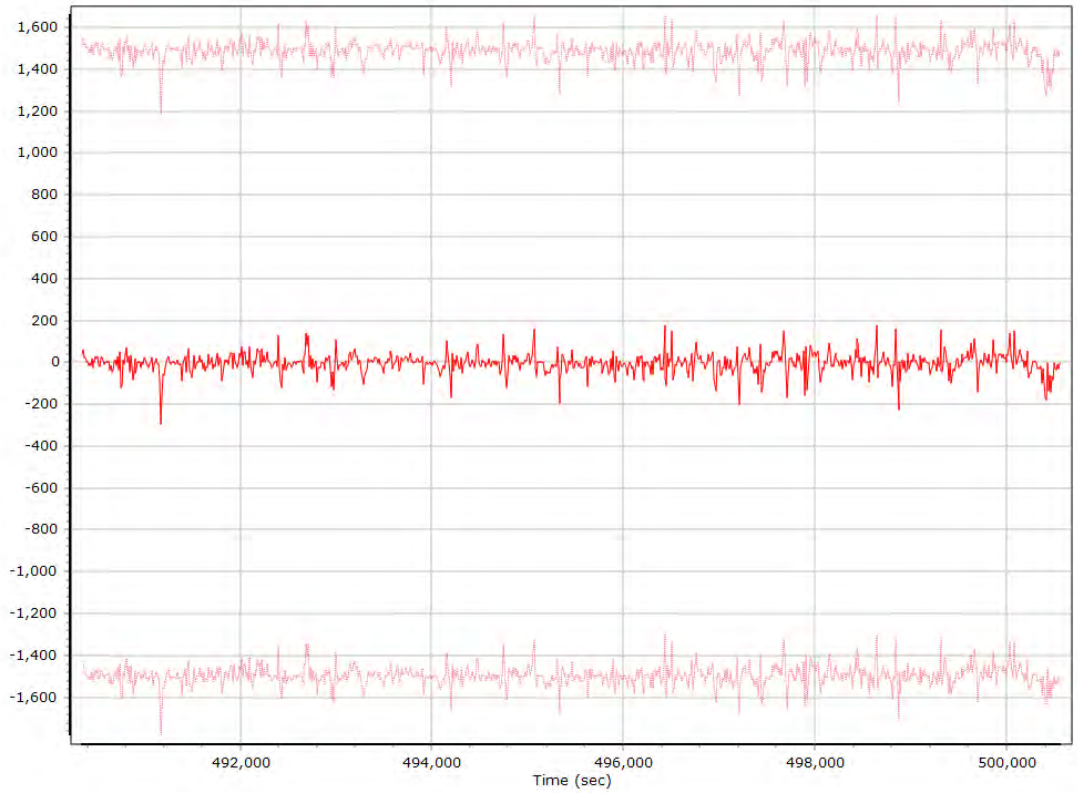
Z Accelerometer Bias (micro-g)



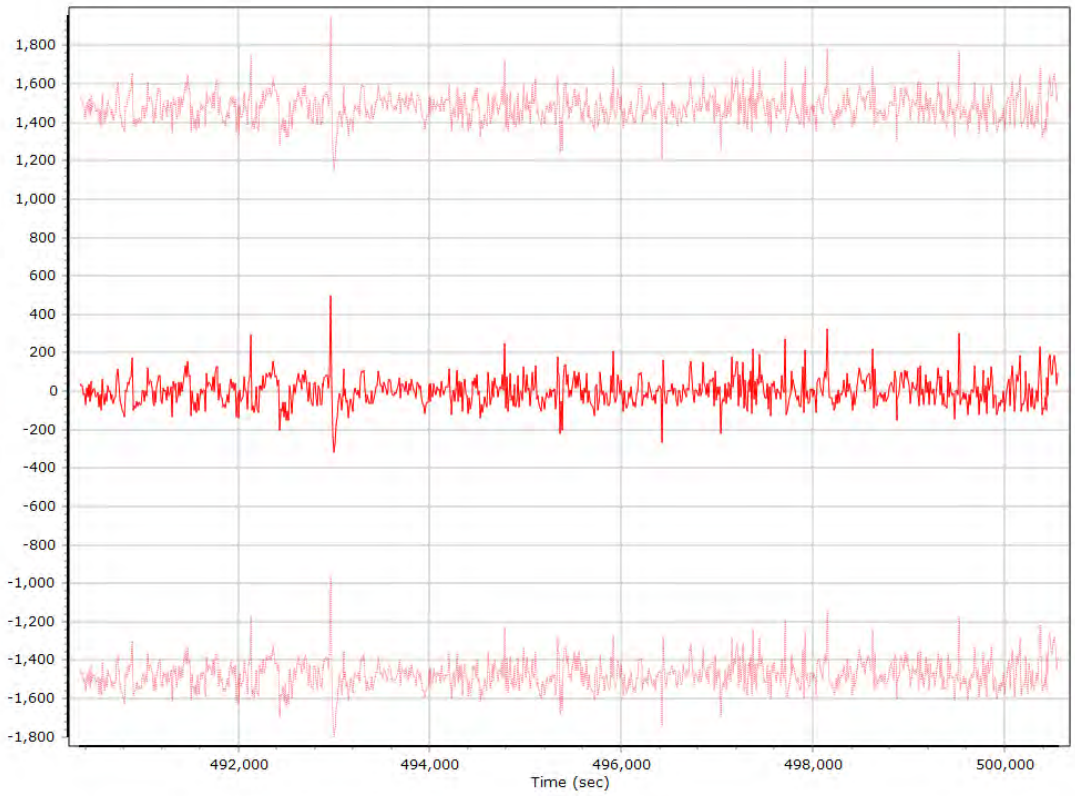
Accelerometer Scale Error (ppm)



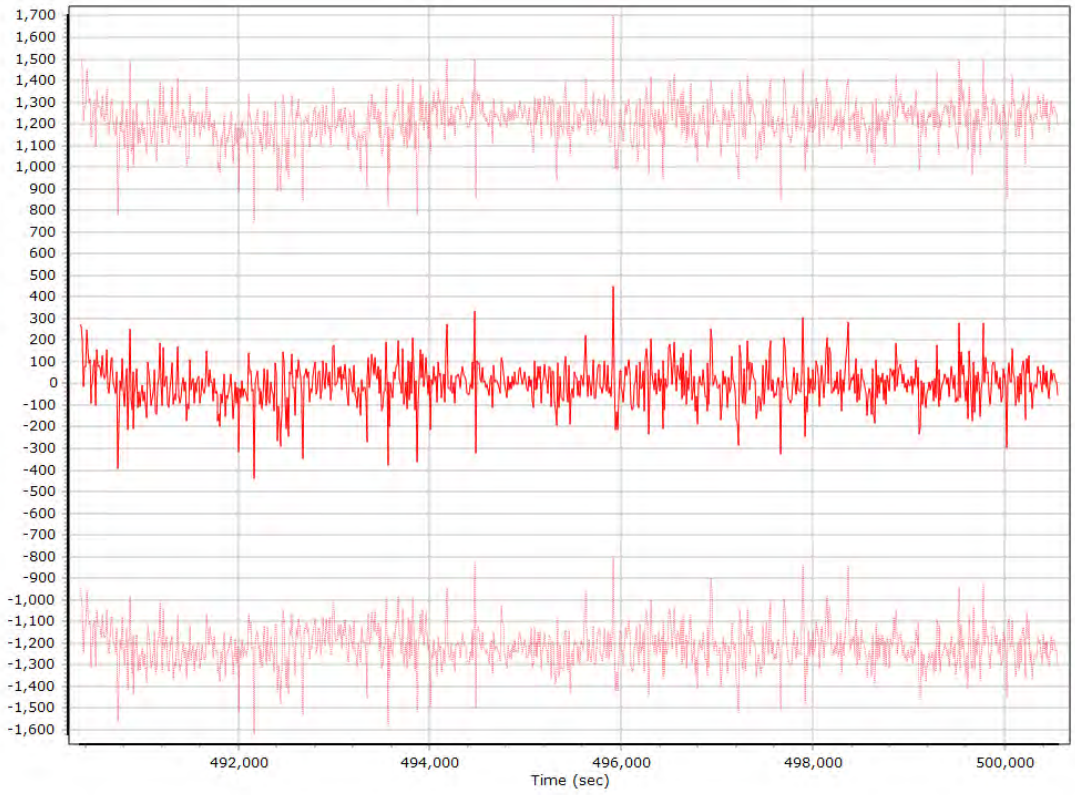
X Accelerometer Scale Error (ppm)



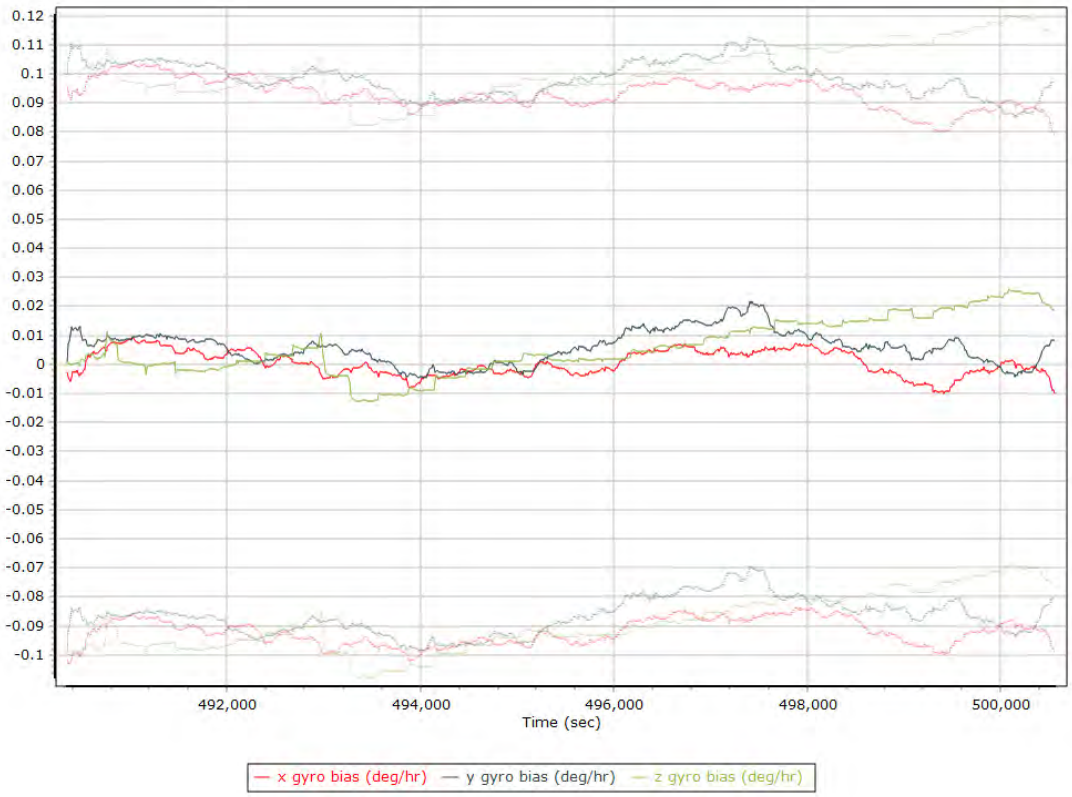
Y Accelerometer Scale Error (ppm)



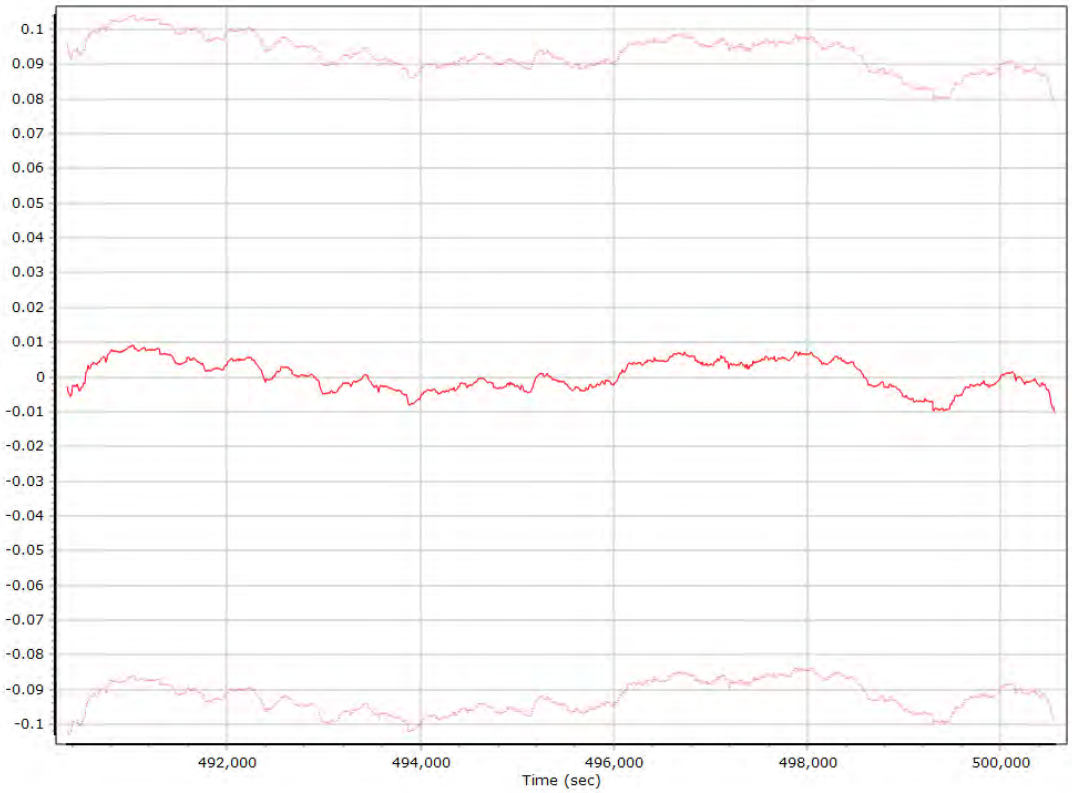
Z Accelerometer Scale Error (ppm)



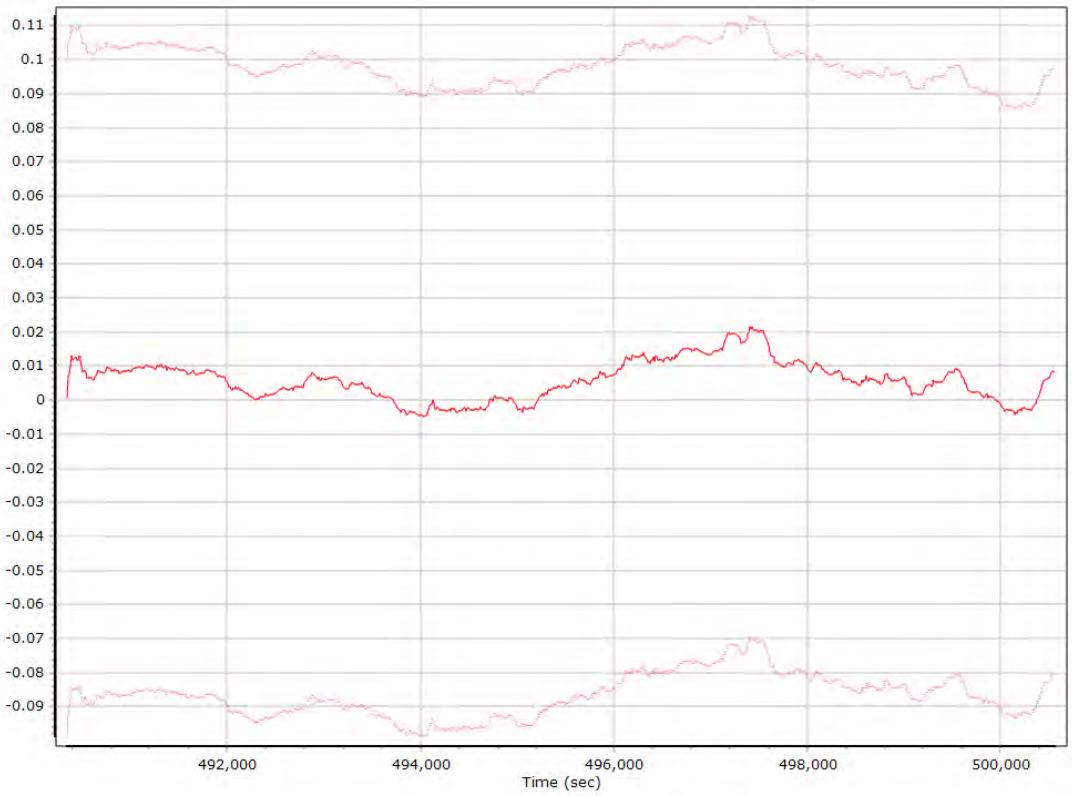
Gyro Bias (deg/h)



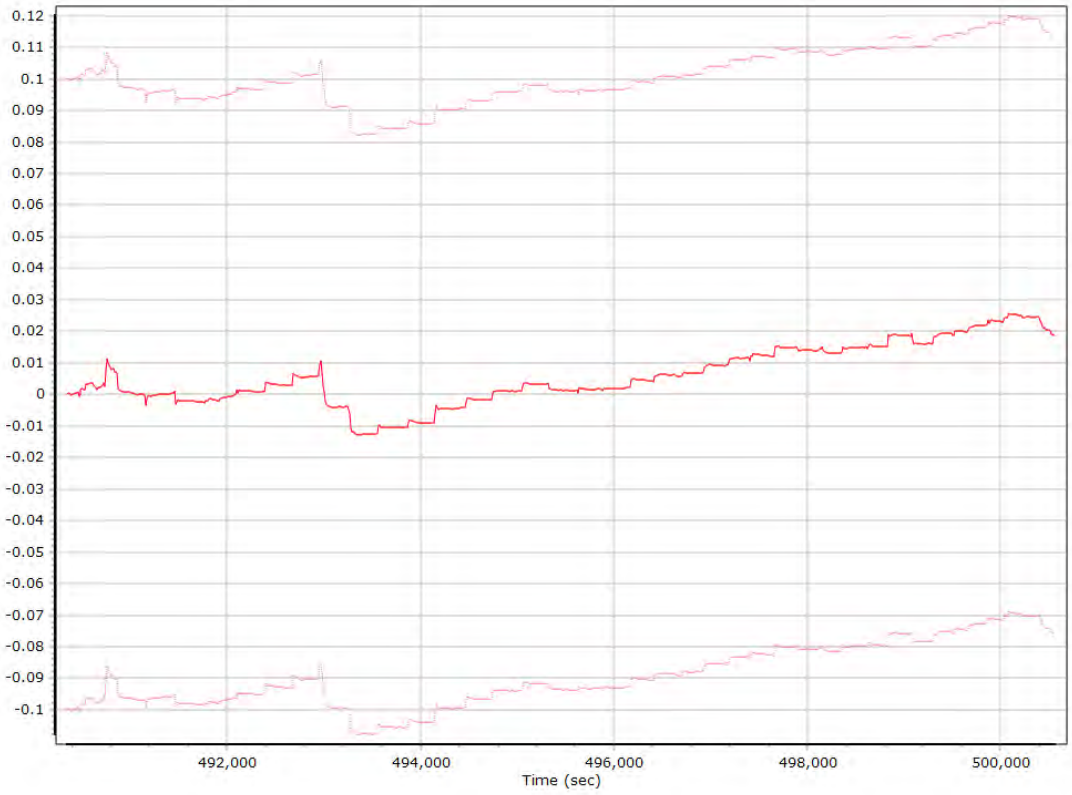
X Gyro Bias (deg/h)



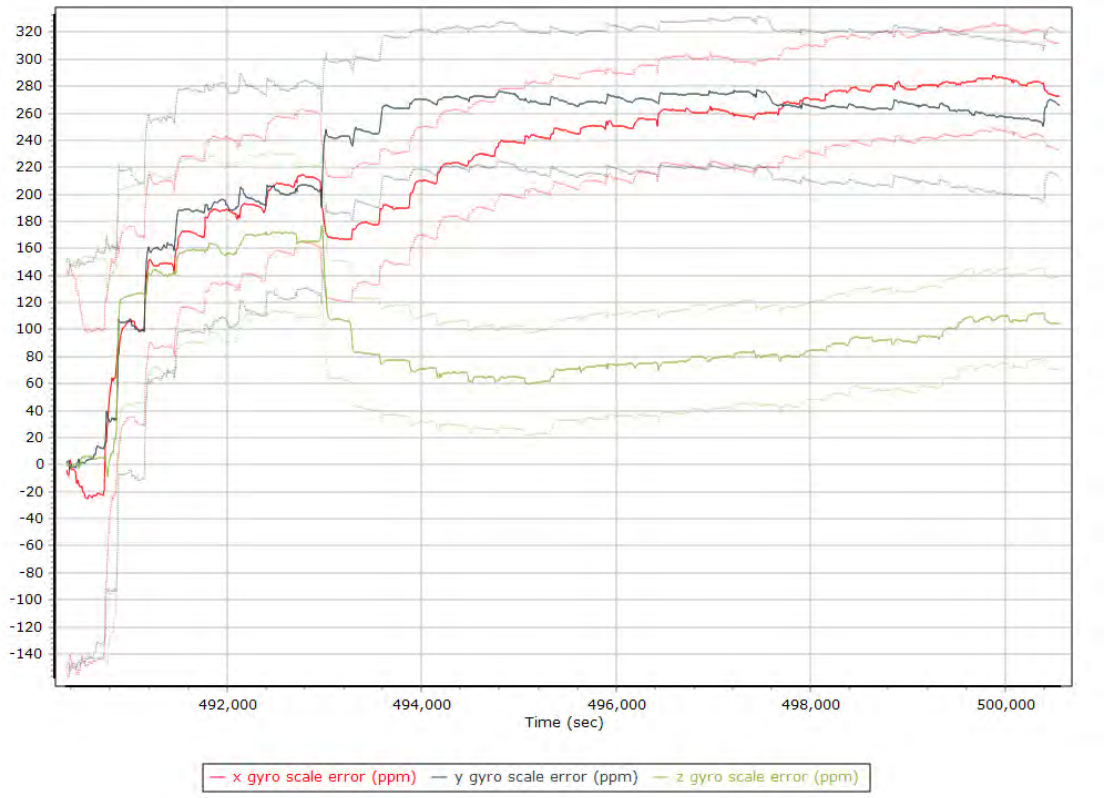
Y Gyro Bias (deg/h)



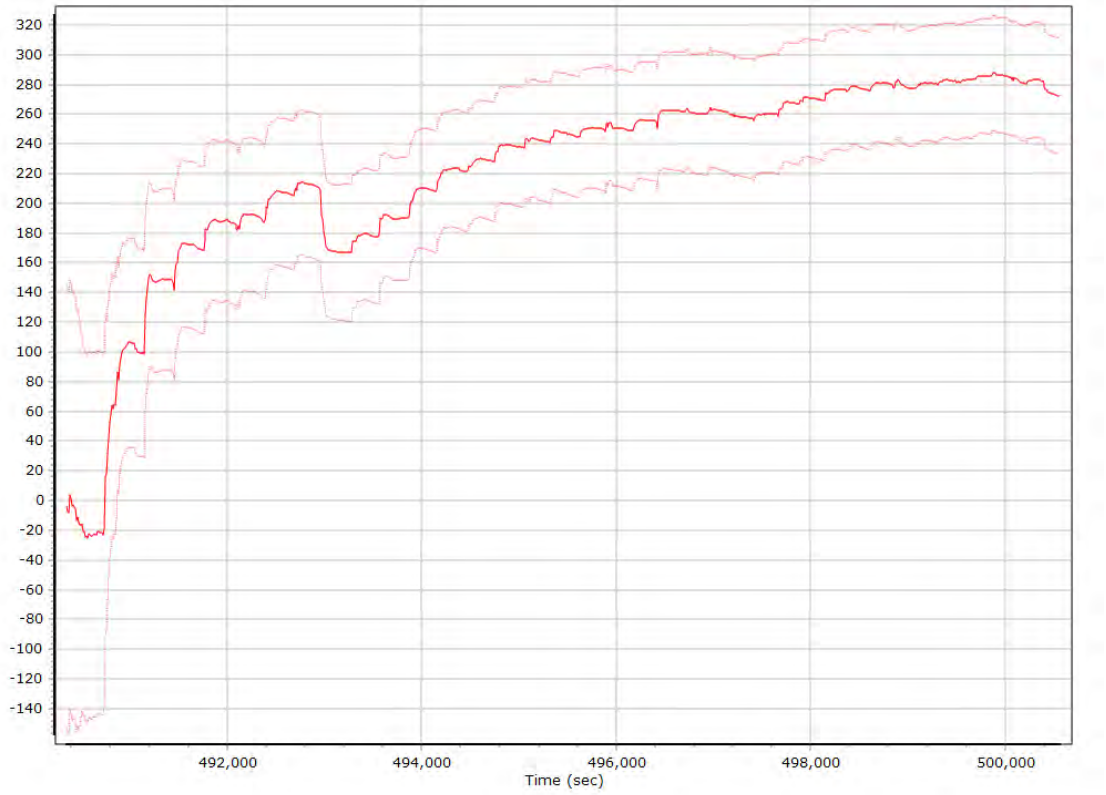
Z Gyro Bias (deg/h)



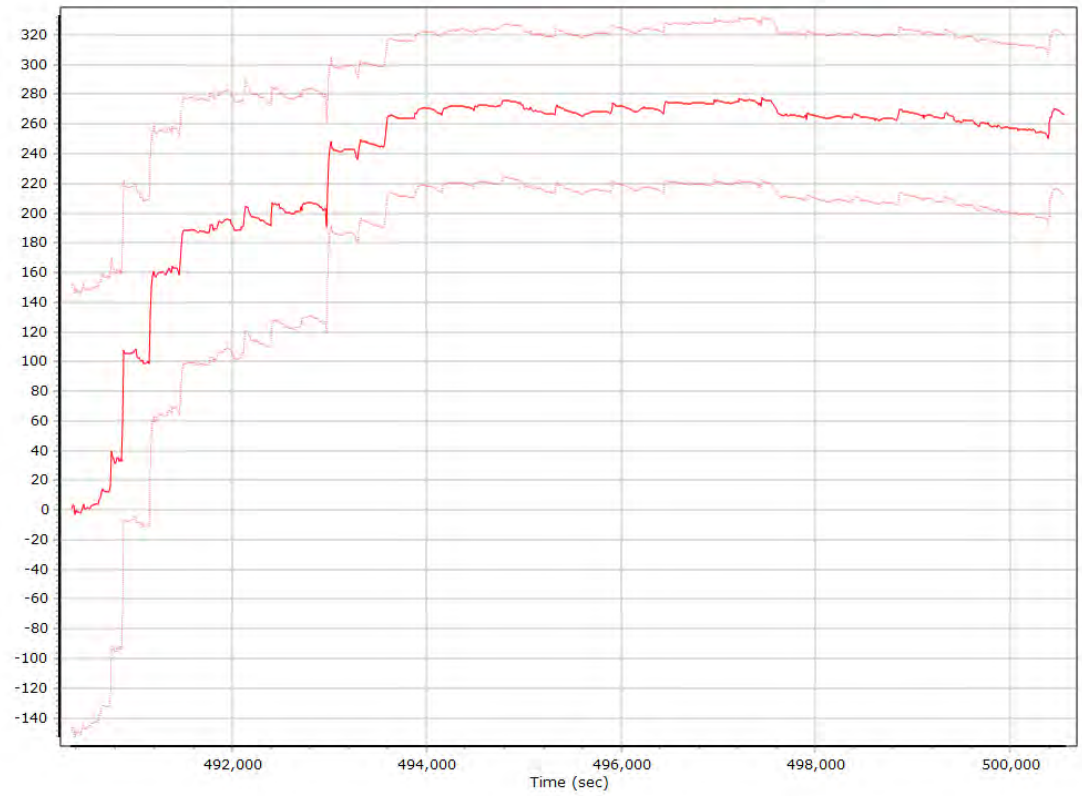
Gyro Scale Error (ppm)



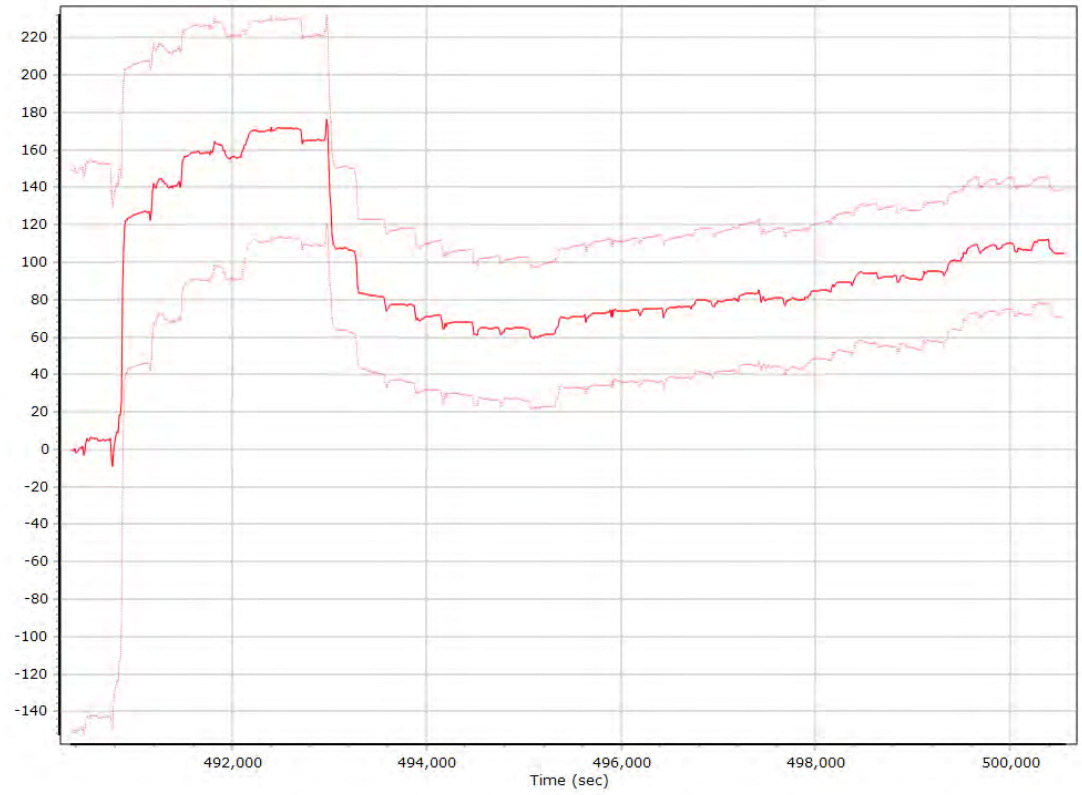
X Gyro Scale Error (ppm)



Y Gyro Scale Error (ppm)

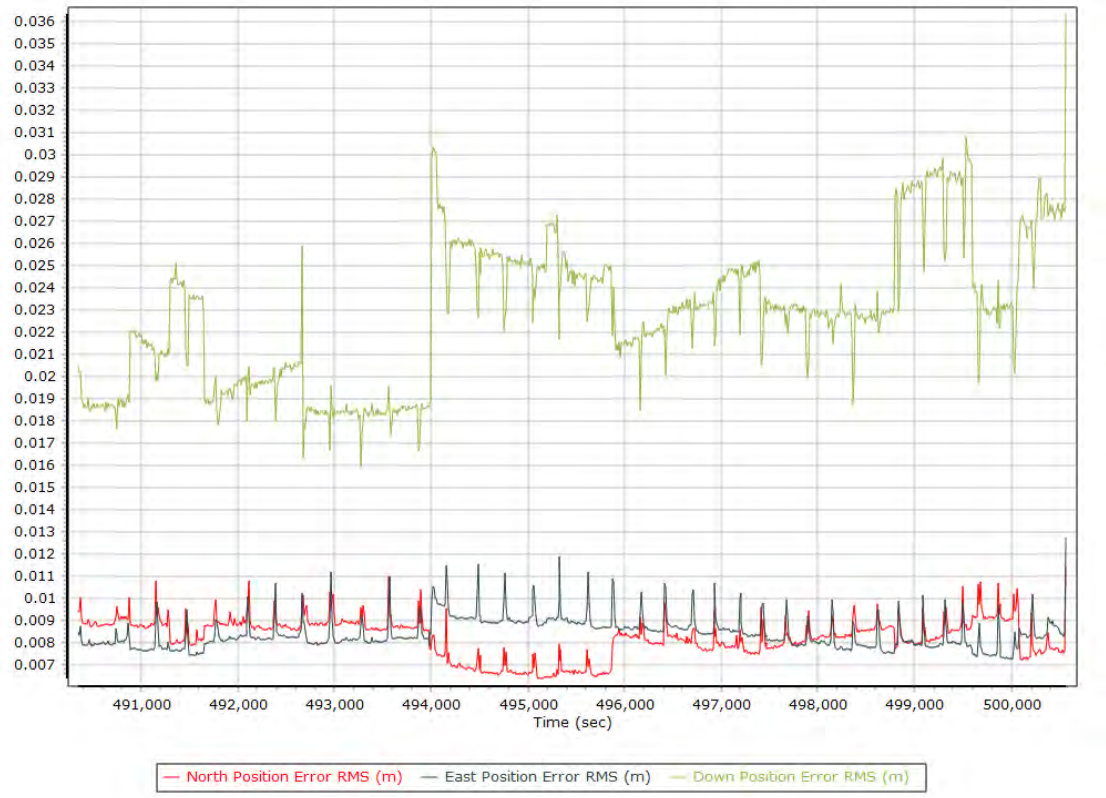


Z Gyro Scale Error (ppm)

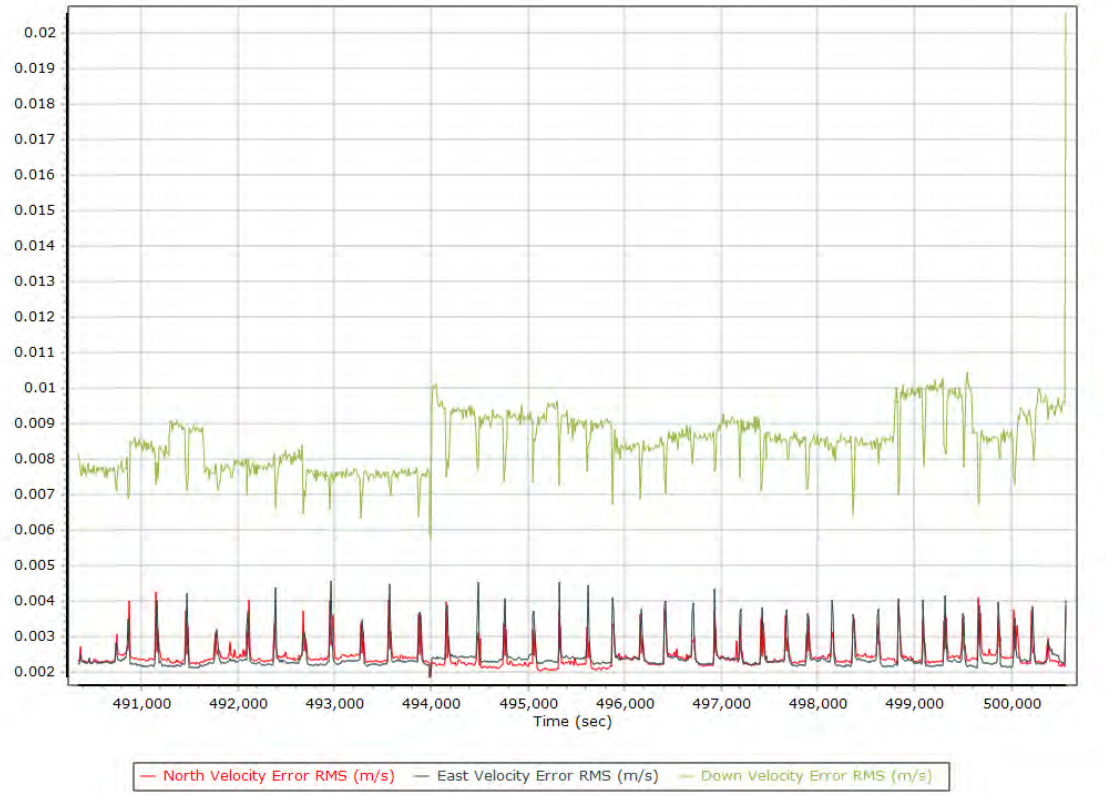


Smoothed Performance Metrics

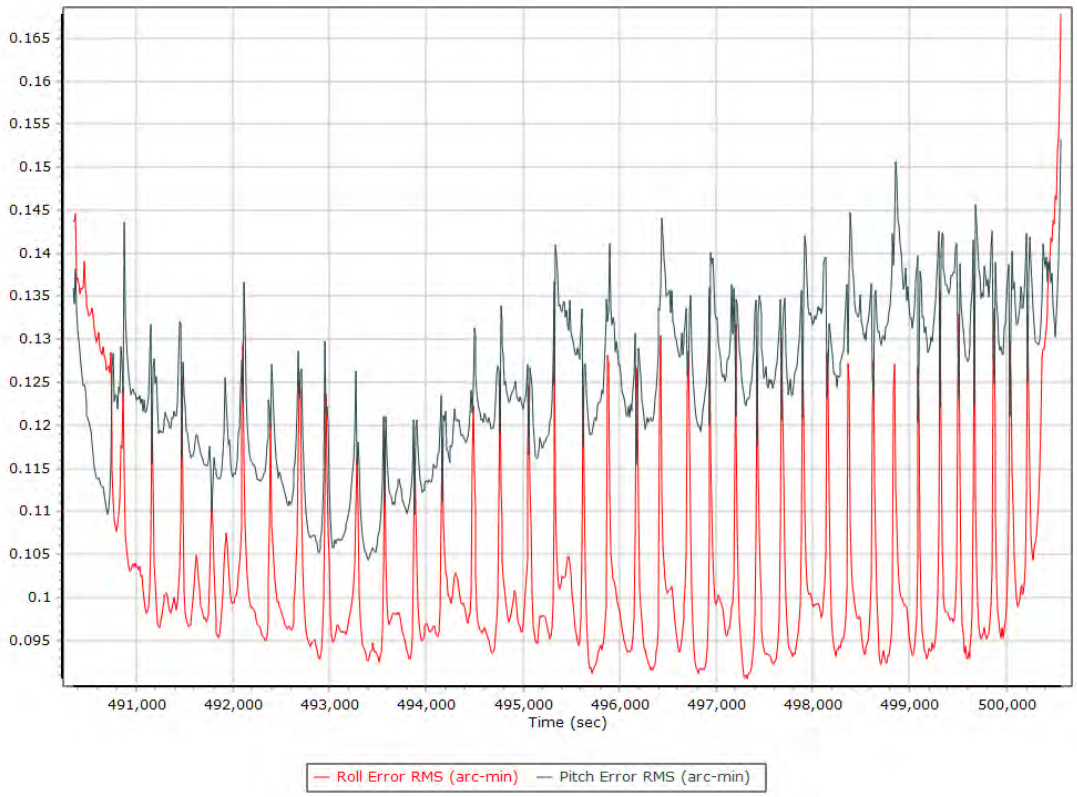
Position Error RMS (m)



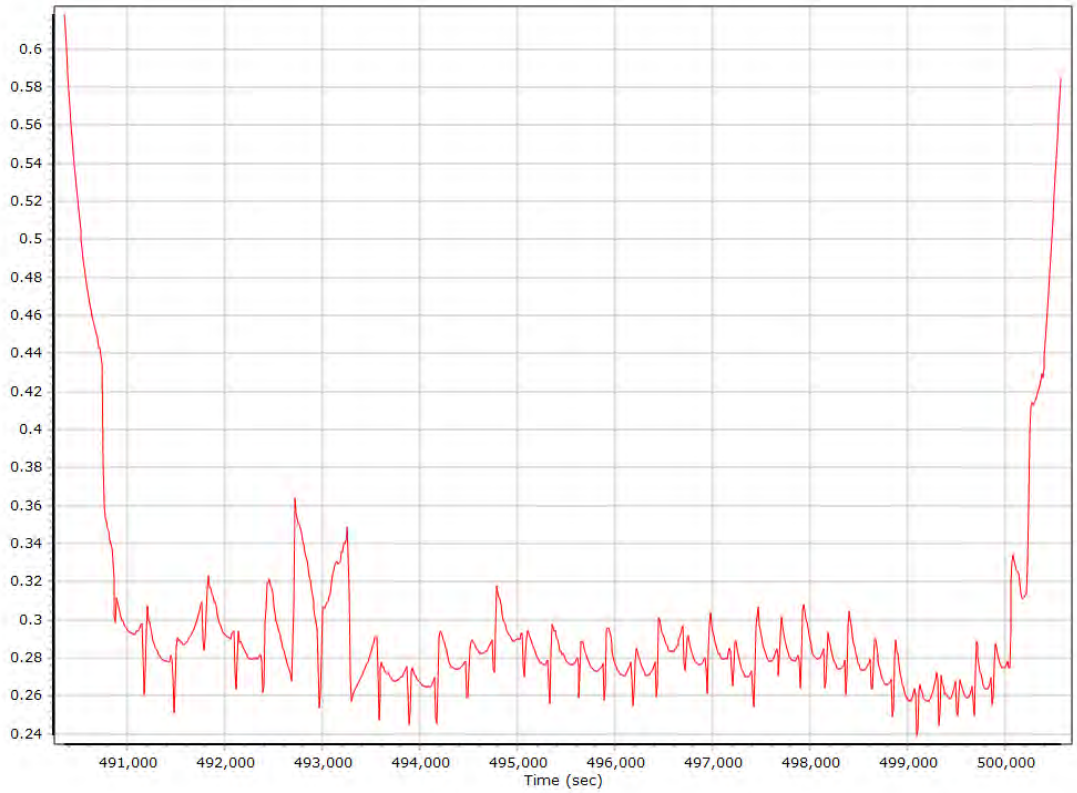
Velocity Error RMS (m/s)



Roll/Pitch Error RMS (arc-min)

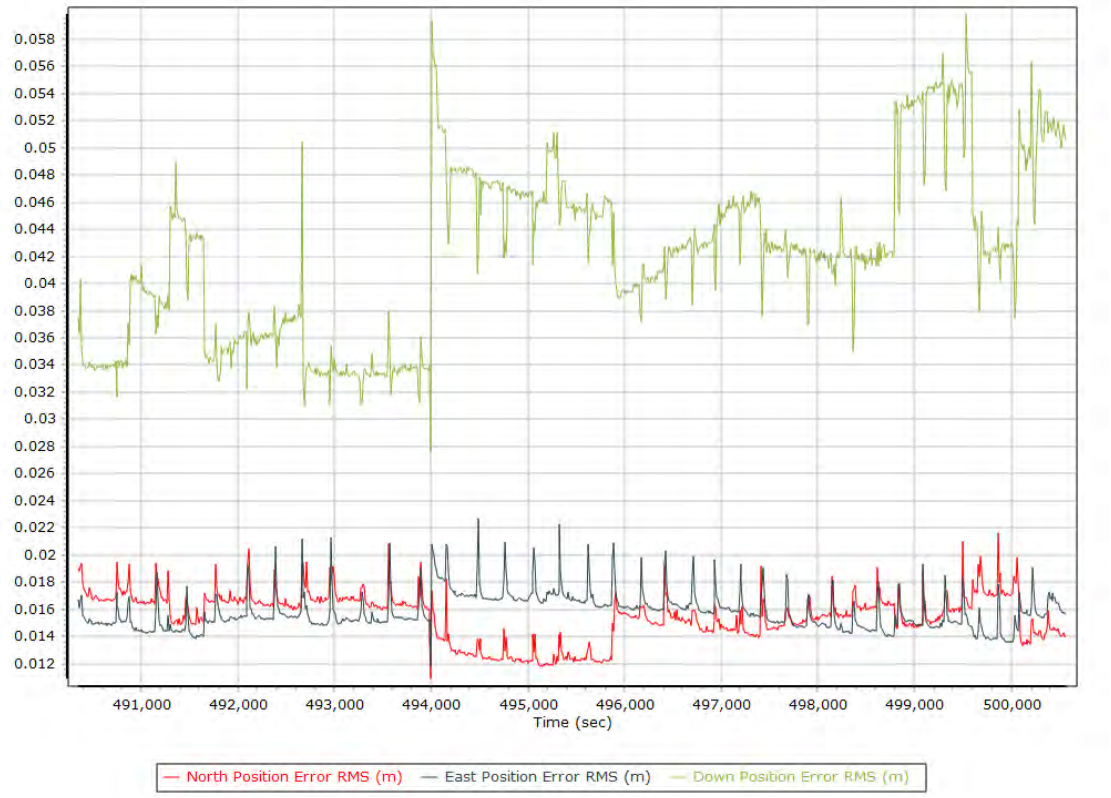


Heading Error RMS (arc-min)

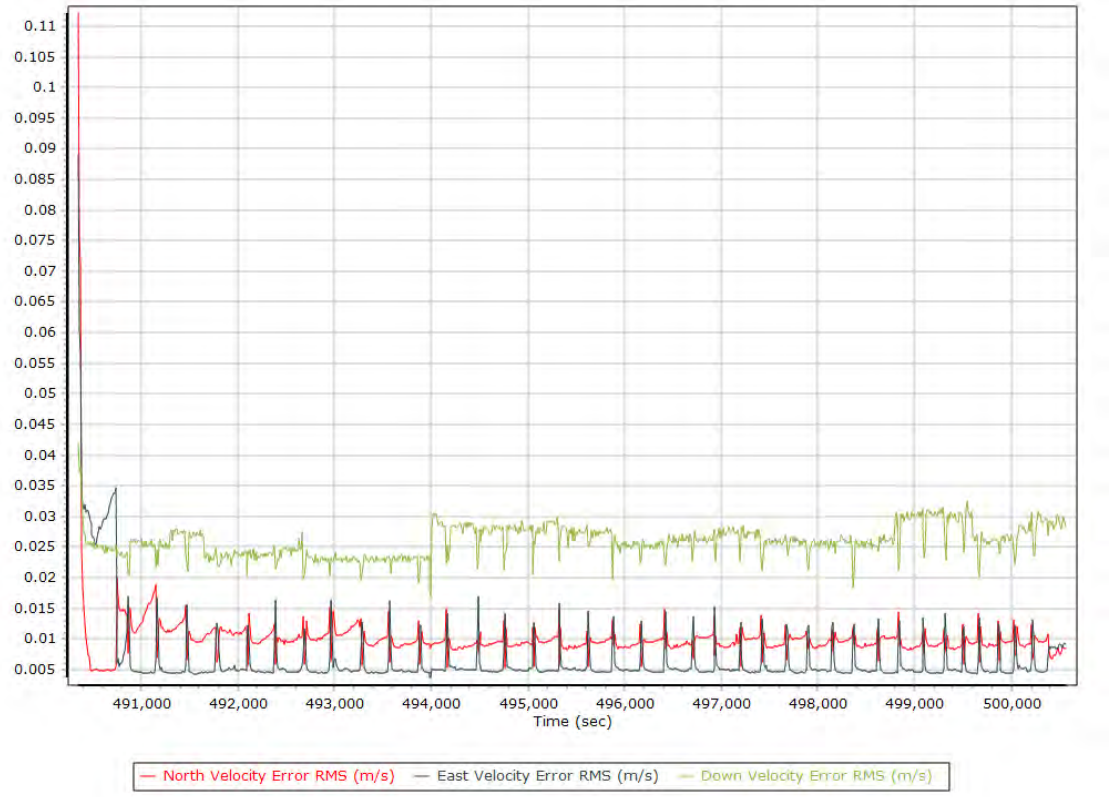


Forward Processed Performance Metrics

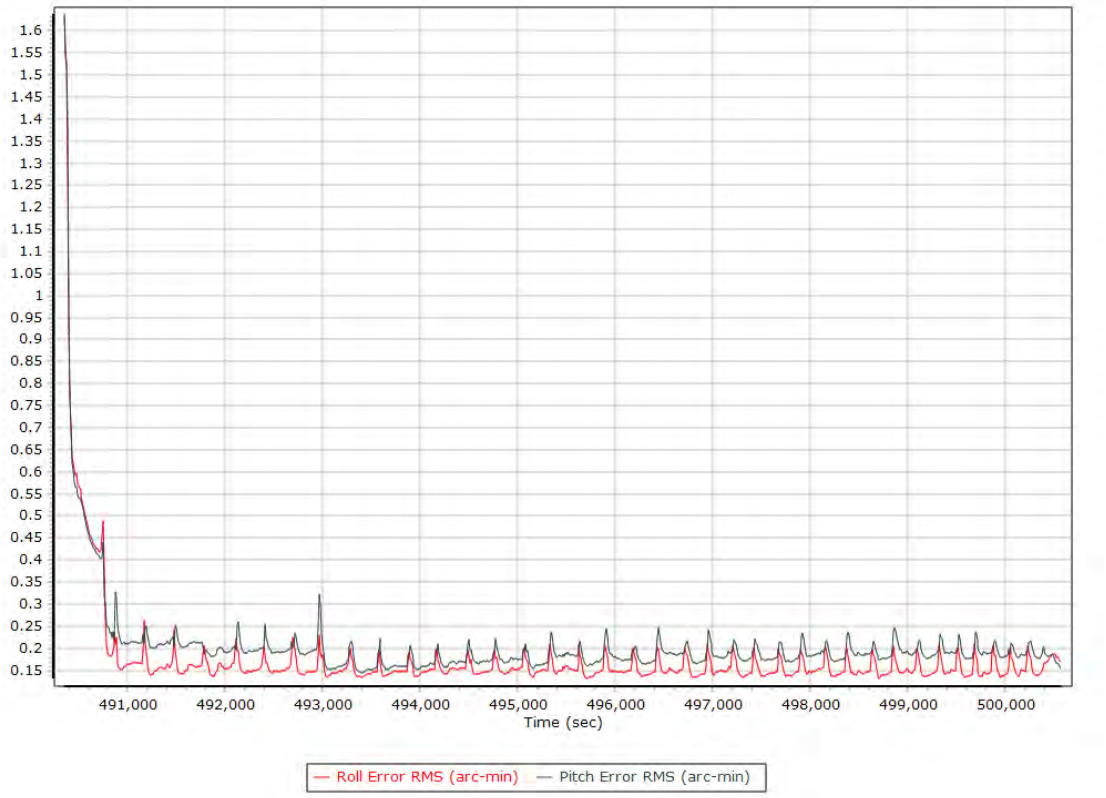
Position Error RMS (m)



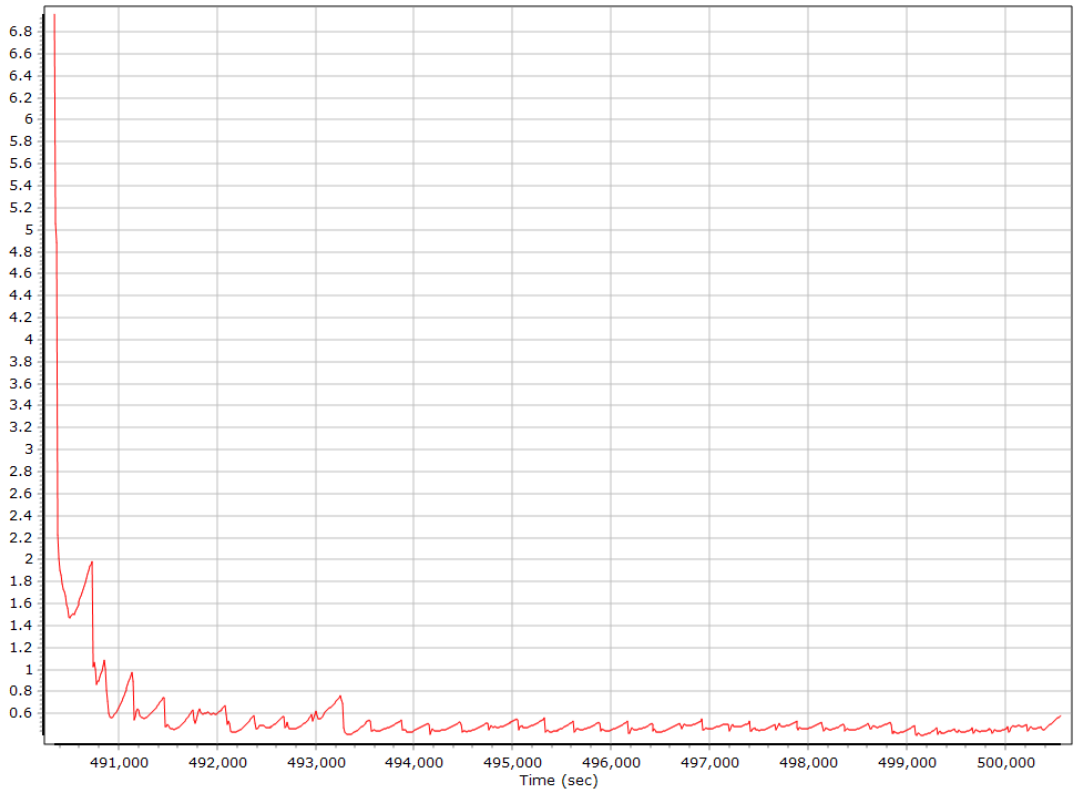
Velocity Error RMS (m/s)



Roll/Pitch Error RMS (arc-min)

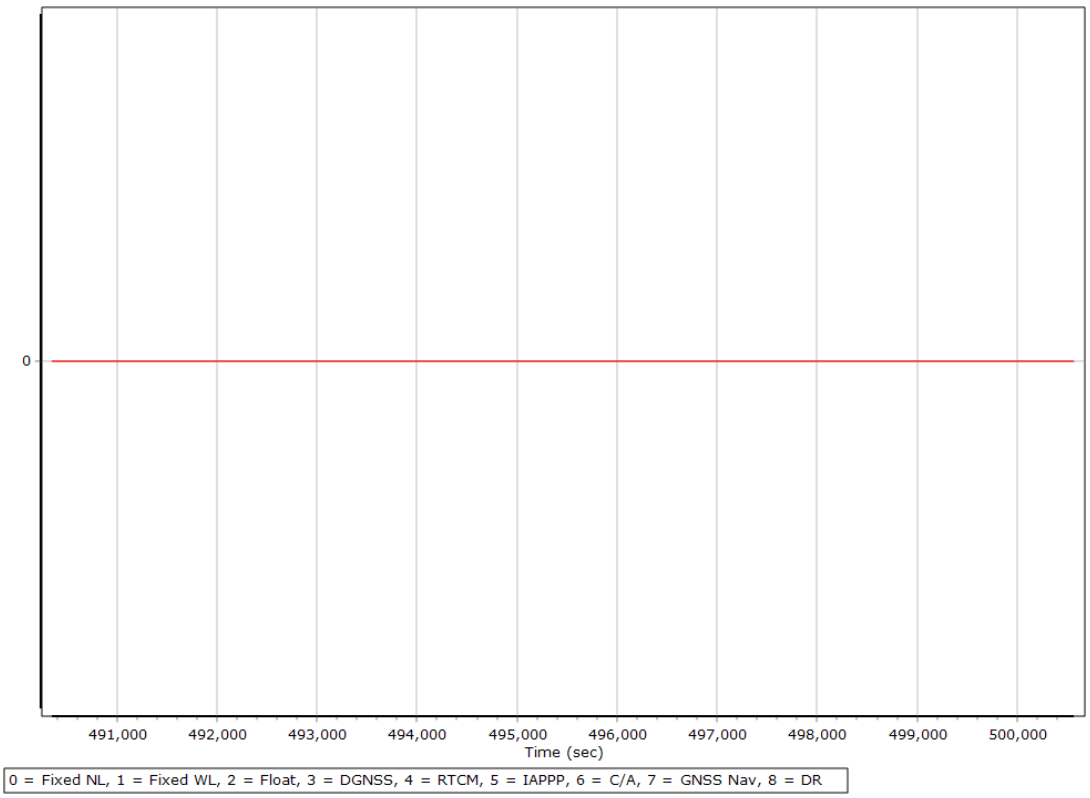


Heading Error RMS (arc-min)

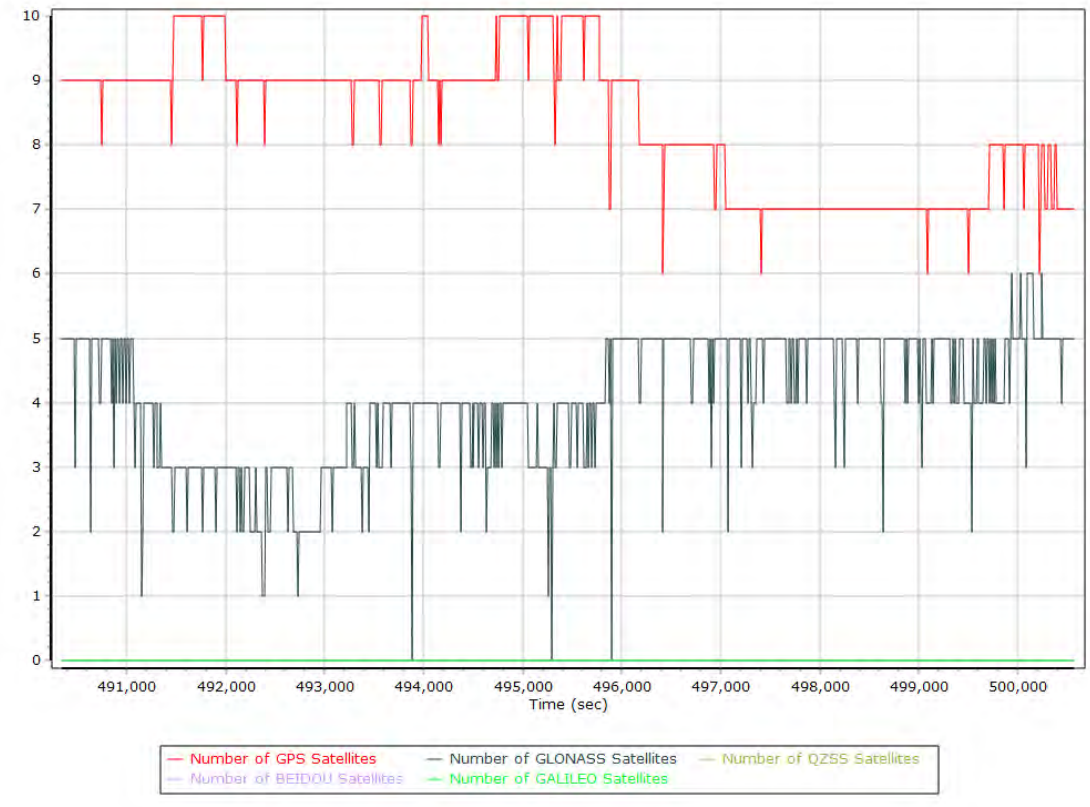


Smoothed Solution Status

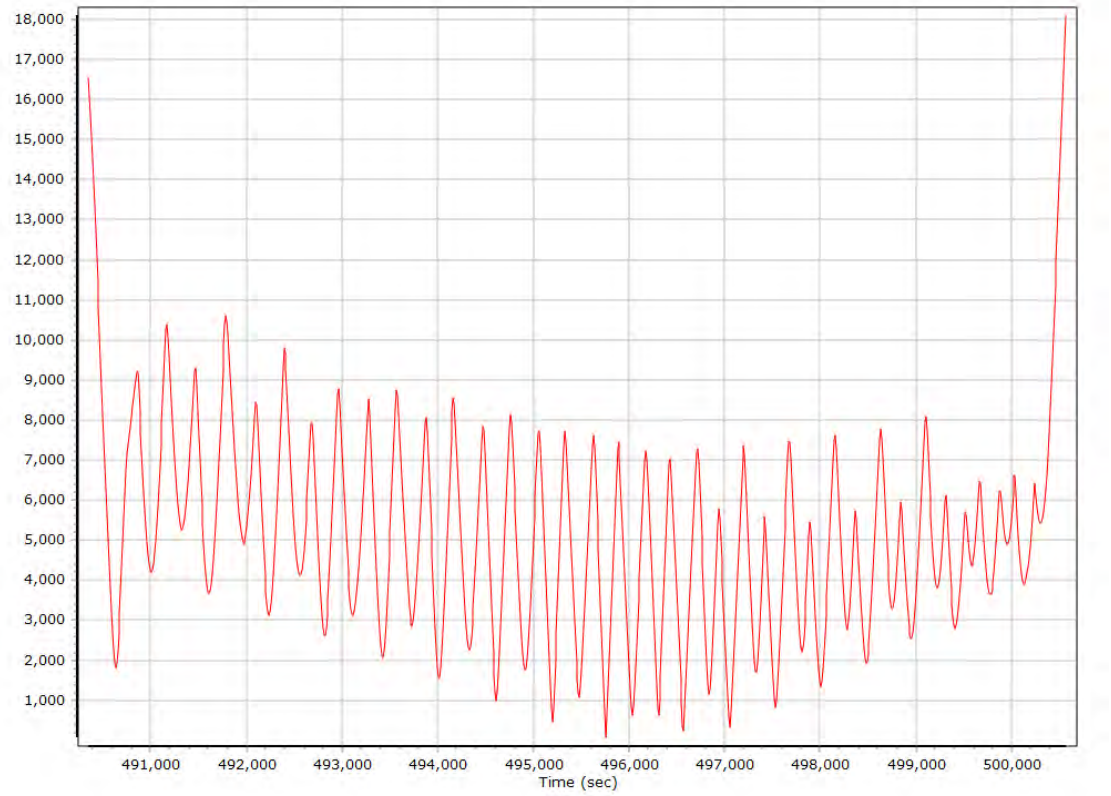
Processing Mode



Number of Satellites

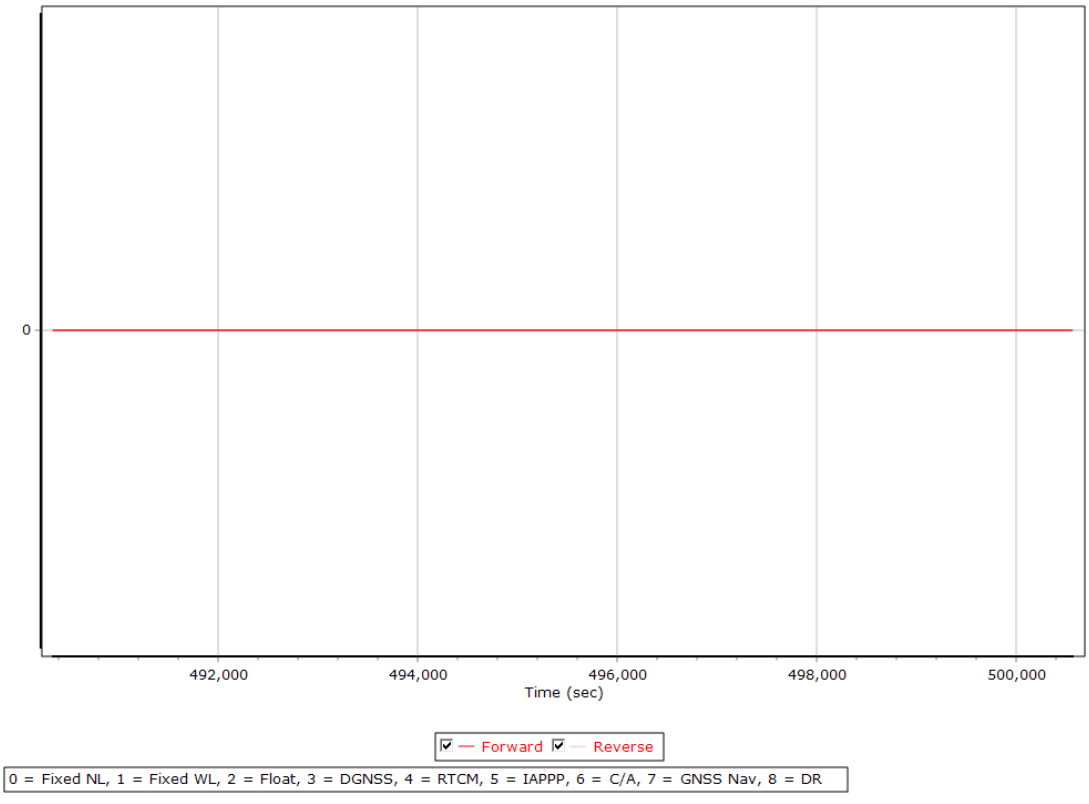


Baseline Length

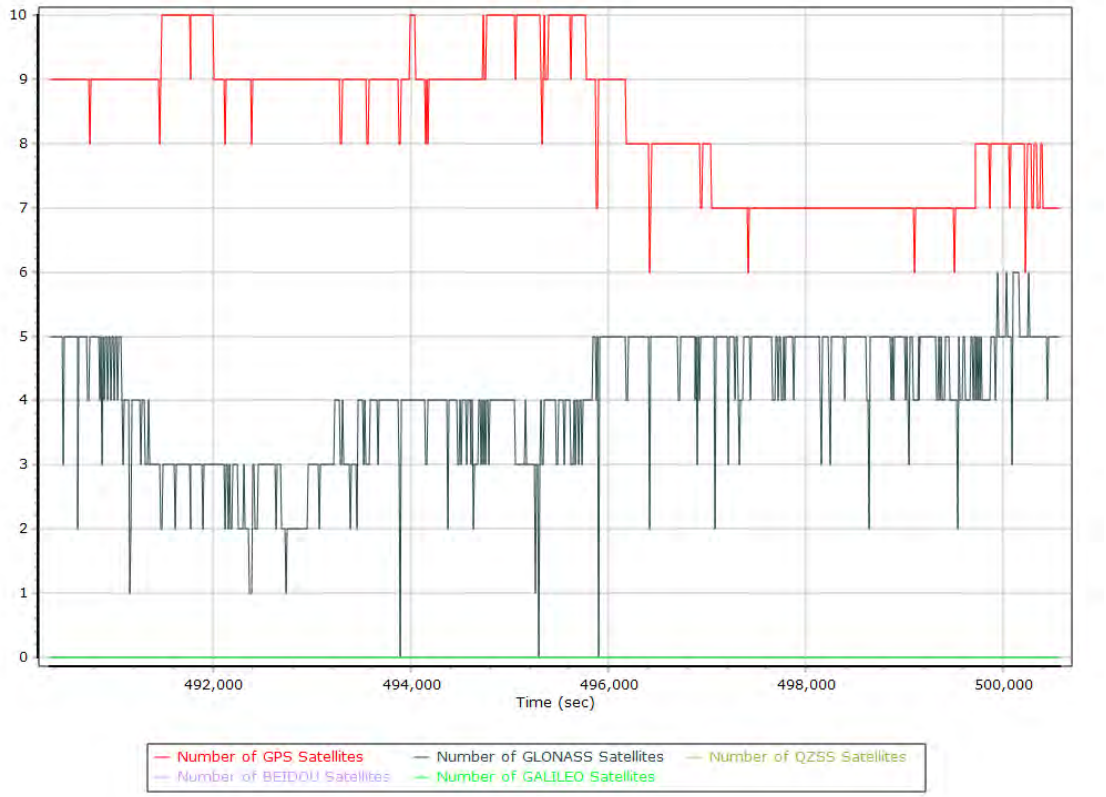


Forward Processed Solution Status

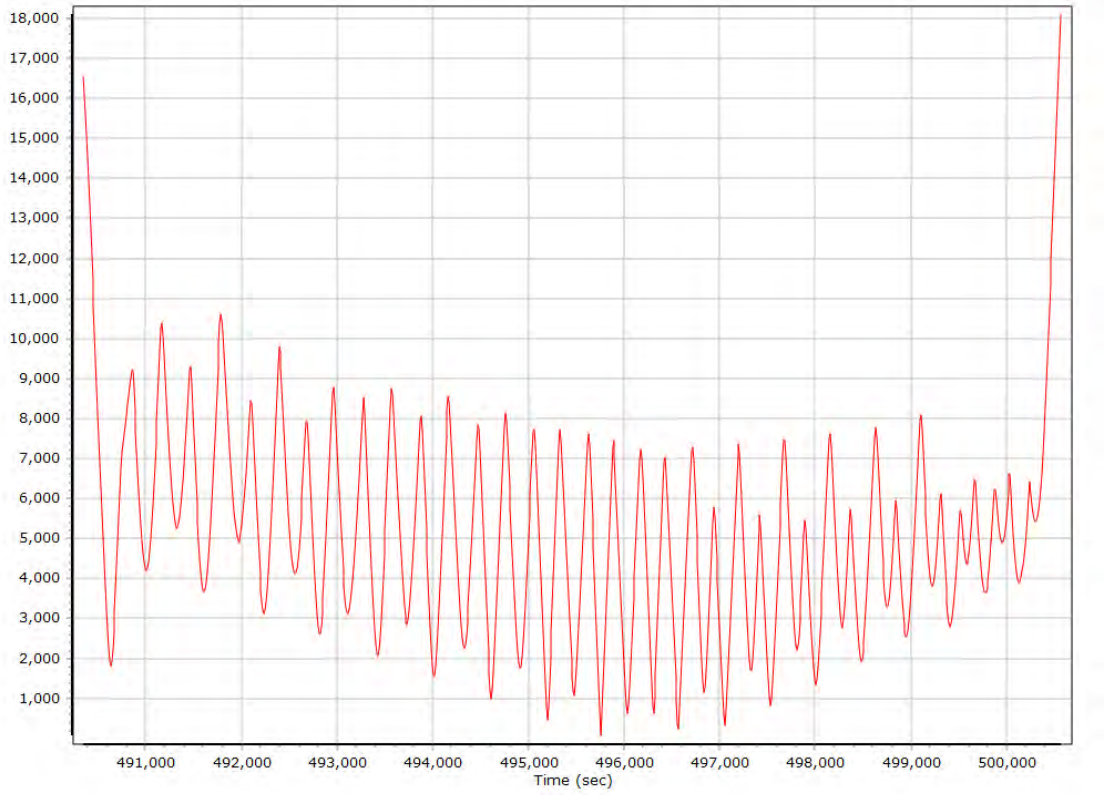
Processing Mode



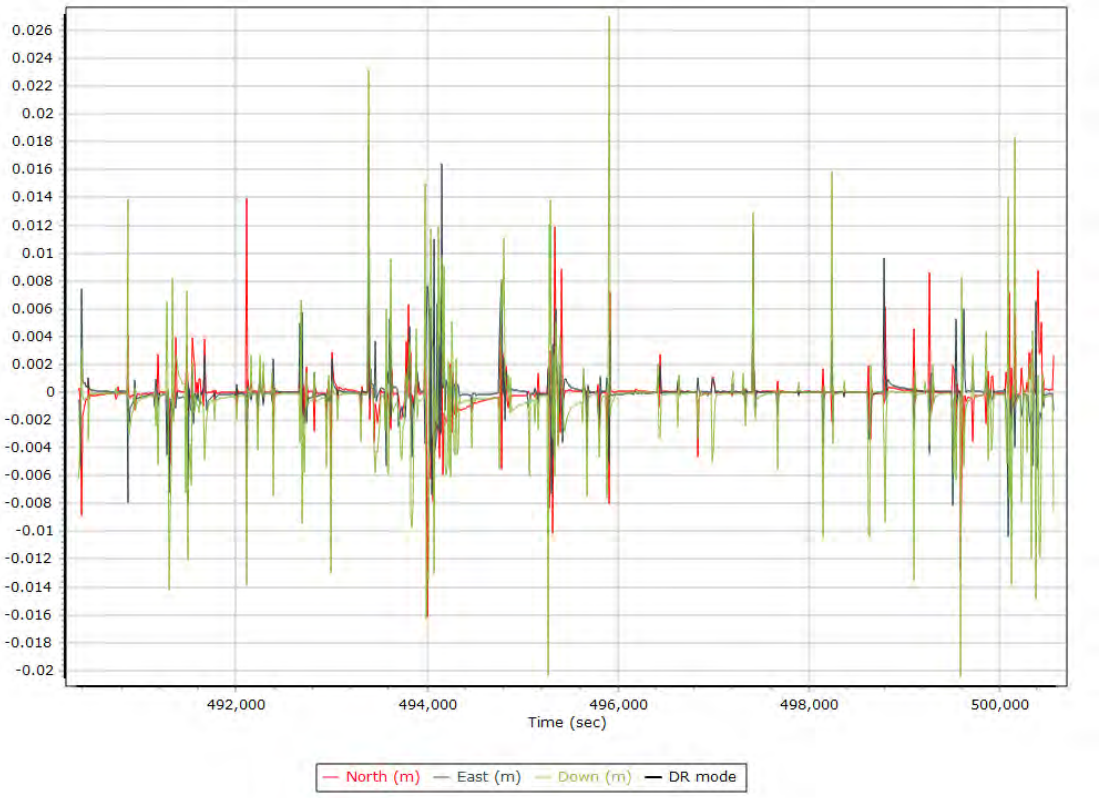
Number of Satellites



Baseline Length



SBET IAKAR Separation



Export Summary

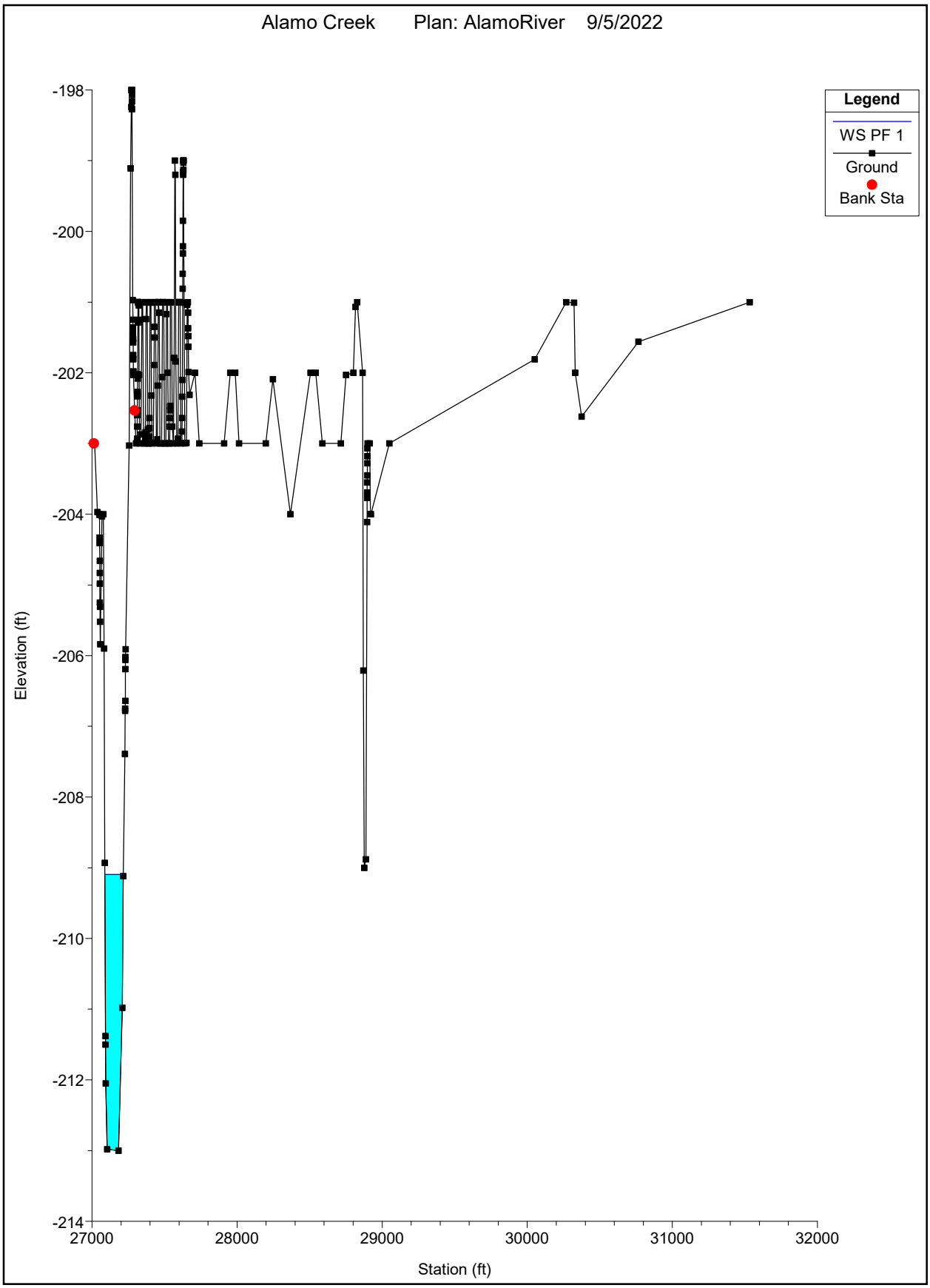
Export file	NAD83(2011)_Ep2010_Sbet.out		
Export format	Custom Smoothed BET		
Solution in use	Post-processed		
Output rate	All Records		
Reference to Output lever arm (m)	0.000	0.000	0.000
Reference mounting angles (deg)	0.000	0.000	0.000
Output units (Coordinate / Lat & Lon)	Meter	Deg Decimal	
Export start time	490289.005 (5/13/2022 4:11:29 PM)		
Export end time	500568.105 (5/13/2022 7:02:48 PM)		
Height option	Ellipsoid Height		
WGS84 height flag	False		
Grid	Universal Transverse Mercator		
Zone	UTM North 11 (120W to 114W)		
Datum	NAD83 (2011)		
Ellipsoid	GRS 1980		
Local Transformation	NONE		
Target Epoch	2010		

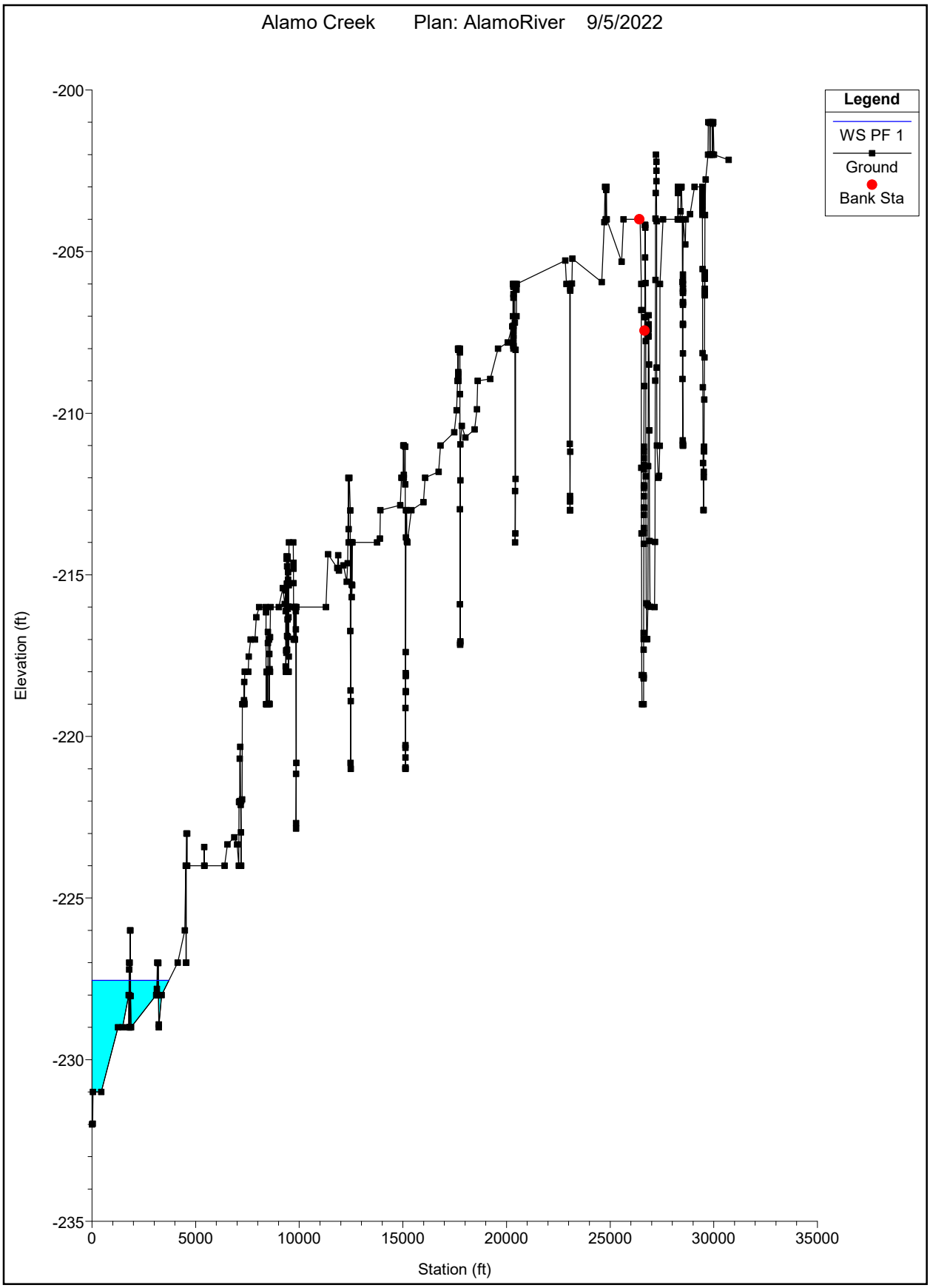
APPENDIX B

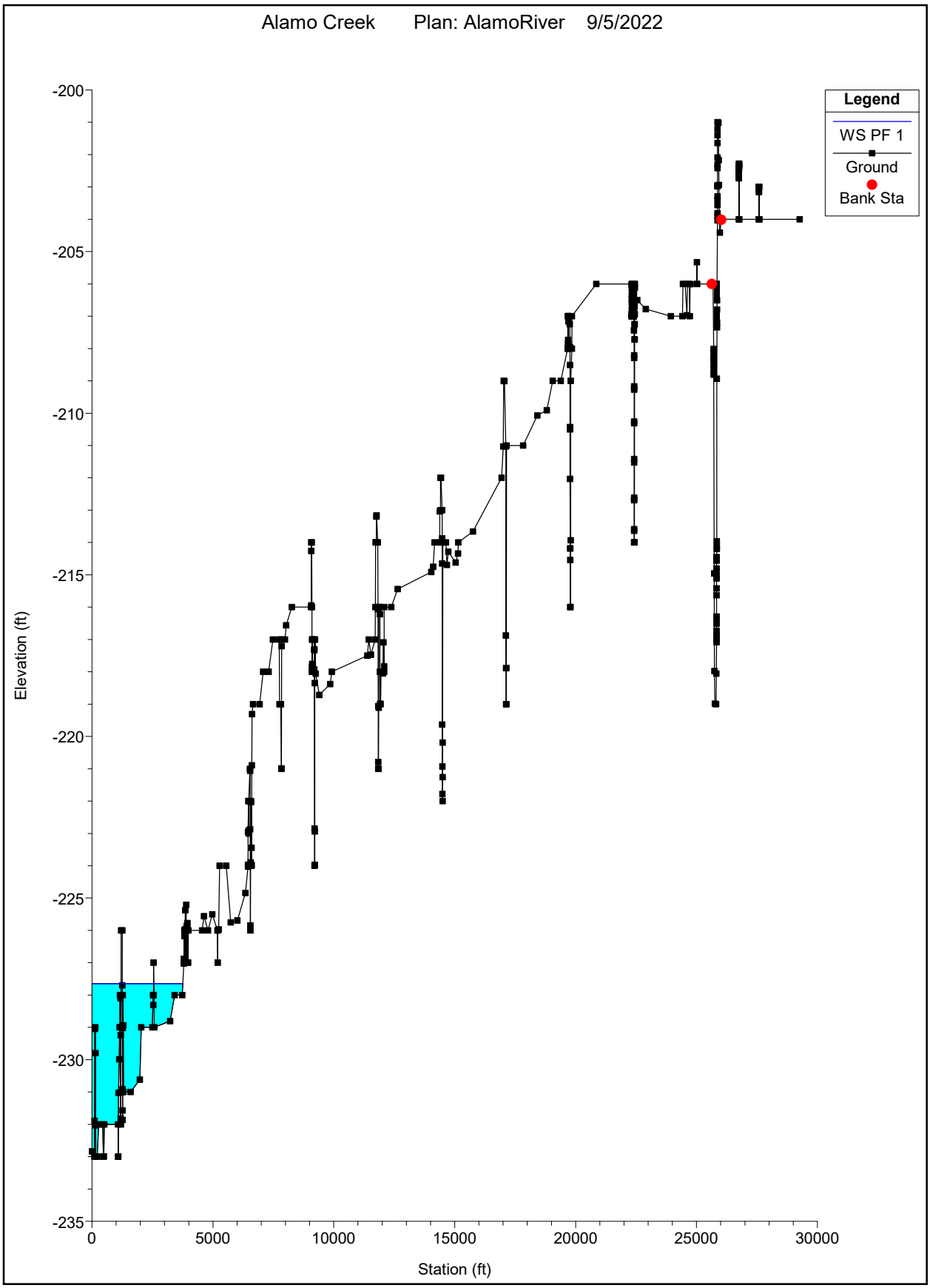
(HEC-RAS Output Files for Existing Condition [LOMR])

HEC-RAS Plan: 01 River: Alamo River Reach: Alamo River Profile: PF 1

Reach	River Sta	Profile	Hydr Depth	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(ft)	(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Alamo River	37000	PF 1	3.37	4500.00	-213.00	-209.09	-209.09	-207.40	0.012807	10.44	430.90	127.91	1.00
Alamo River	36071	PF 1	1.56	4500.00	-219.00	-227.54		-227.54	0.000247		5639.52	3612.20	0.00
Alamo River	34926	PF 1	2.52	4500.00	-219.00	-227.65		-227.64	0.000047		9304.69	3692.09	0.00
Alamo River	33520	PF 1	2.35	4500.00	-219.00	-227.70		-227.70	0.000046		10255.89	4373.10	0.00
Alamo River	32581	PF 1	3.20	4500.00	-219.00	-227.72		-227.72	0.000011		15943.71	4989.96	0.00
Alamo River	31366	PF 1	3.60	4500.00	-219.00	-227.73		-227.73	0.000007		18752.25	5211.75	0.00
Alamo River	30072	PF 1	3.30	4500.00	-219.00	-227.75		-227.75	0.000014		14413.13	4372.41	0.00
Alamo River	28816	PF 1	1.30	4500.00	-221.00	-227.82		-227.81	0.000476		4999.53	3850.64	0.00
Alamo River	25128	PF 1	1.61	4500.00	-222.00	-228.56		-228.55	0.000292		5448.83	3383.47	0.00
Alamo River	22693	PF 1	2.07	4500.00	-223.00	-229.01		-229.00	0.000152		6078.26	2940.98	0.00
Alamo River	19983	PF 1	1.97	4500.00	-224.00	-229.48		-229.47	0.000230		5439.90	2763.89	0.00
Alamo River	16662	PF 1	2.18	4500.00	-226.00	-229.61		-229.61	0.000021		16059.27	7367.41	0.00
Alamo River	13897	PF 1	2.02	4500.00	-228.00	-229.67		-229.67	0.000025		15007.94	7421.09	0.00
Alamo River	10023	PF 1	1.78	4500.00	-231.00	-229.83		-229.82	0.000136	0.51	6054.11	3391.89	0.09
Alamo River	4195	PF 1	2.32	4500.00	-234.00	-230.83		-230.82	0.000227	1.05	4578.00	1969.34	0.12
Alamo River	1623	PF 1	0.94	4500.00	-234.00	-231.67	-232.67	-231.66	0.000500	1.36	5289.16	5640.39	0.18


Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-198
-200
-202
-204
-206
-208
-210
-212
-214
Elevation (ft)
27000
28000
29000
30000
31000
32000
Station (ft)


Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-200
-205
-210
-215
-220
-225
-230
-235
Elevation (ft)
0
5000
10000
15000
20000
25000
30000
35000
Station (ft)


Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-200
-205
-210
-215
-220
-225
-230
-235
Elevation (ft)
0
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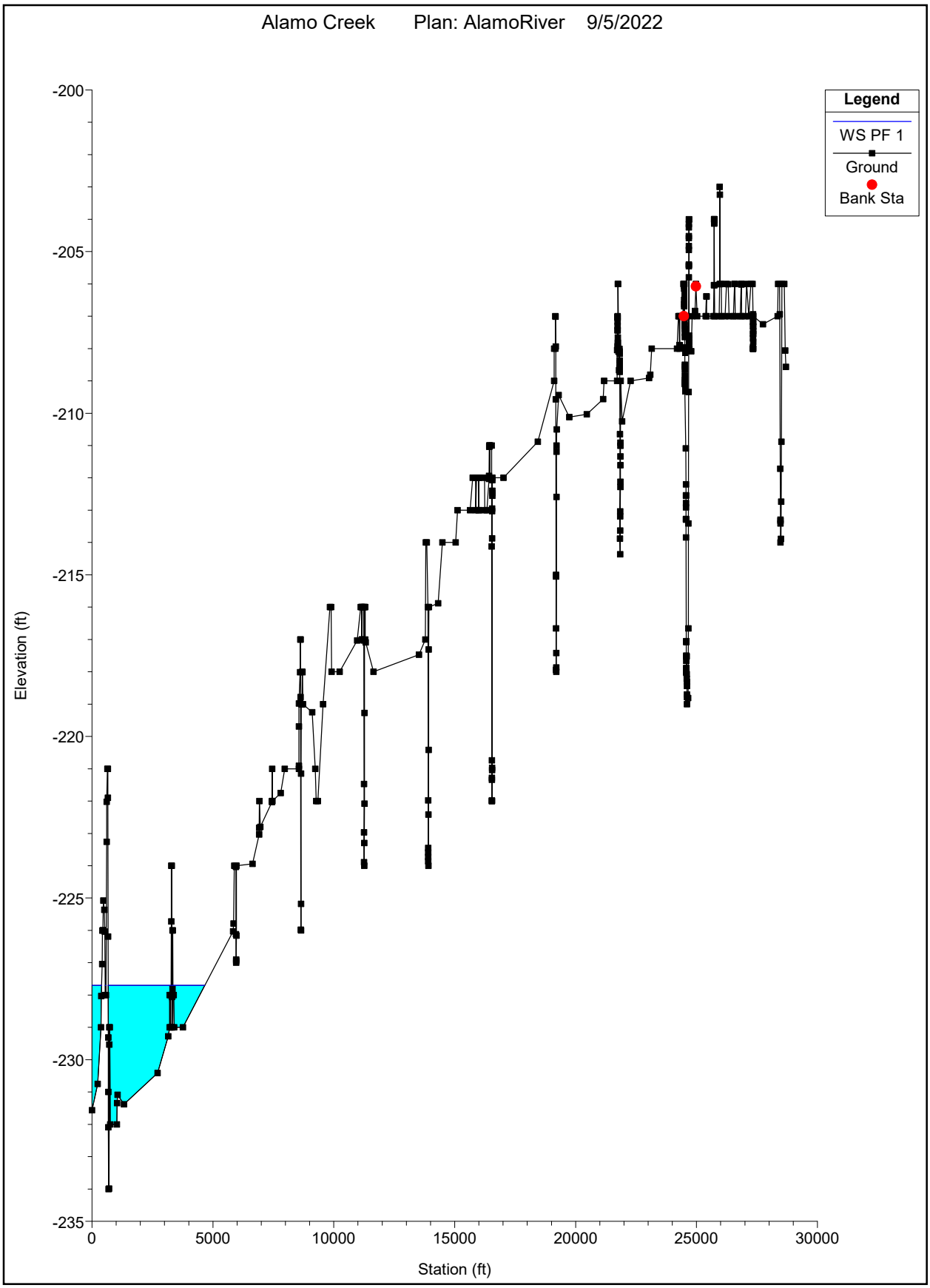
10000
15000
20000
25000
30000
Station (ft)


Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-200
-205
-210
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-225
-230
-235
Elevation (ft)
0
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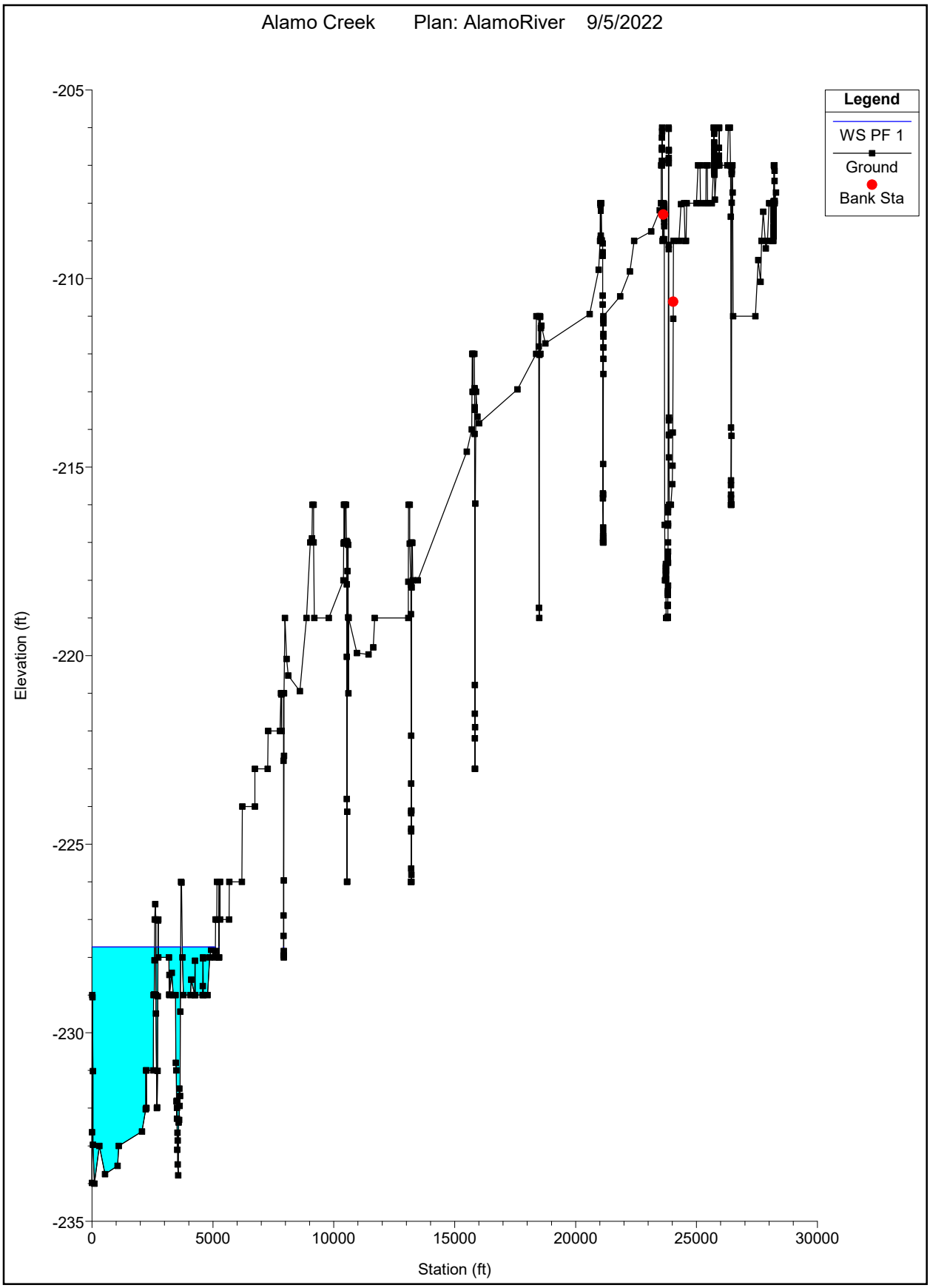
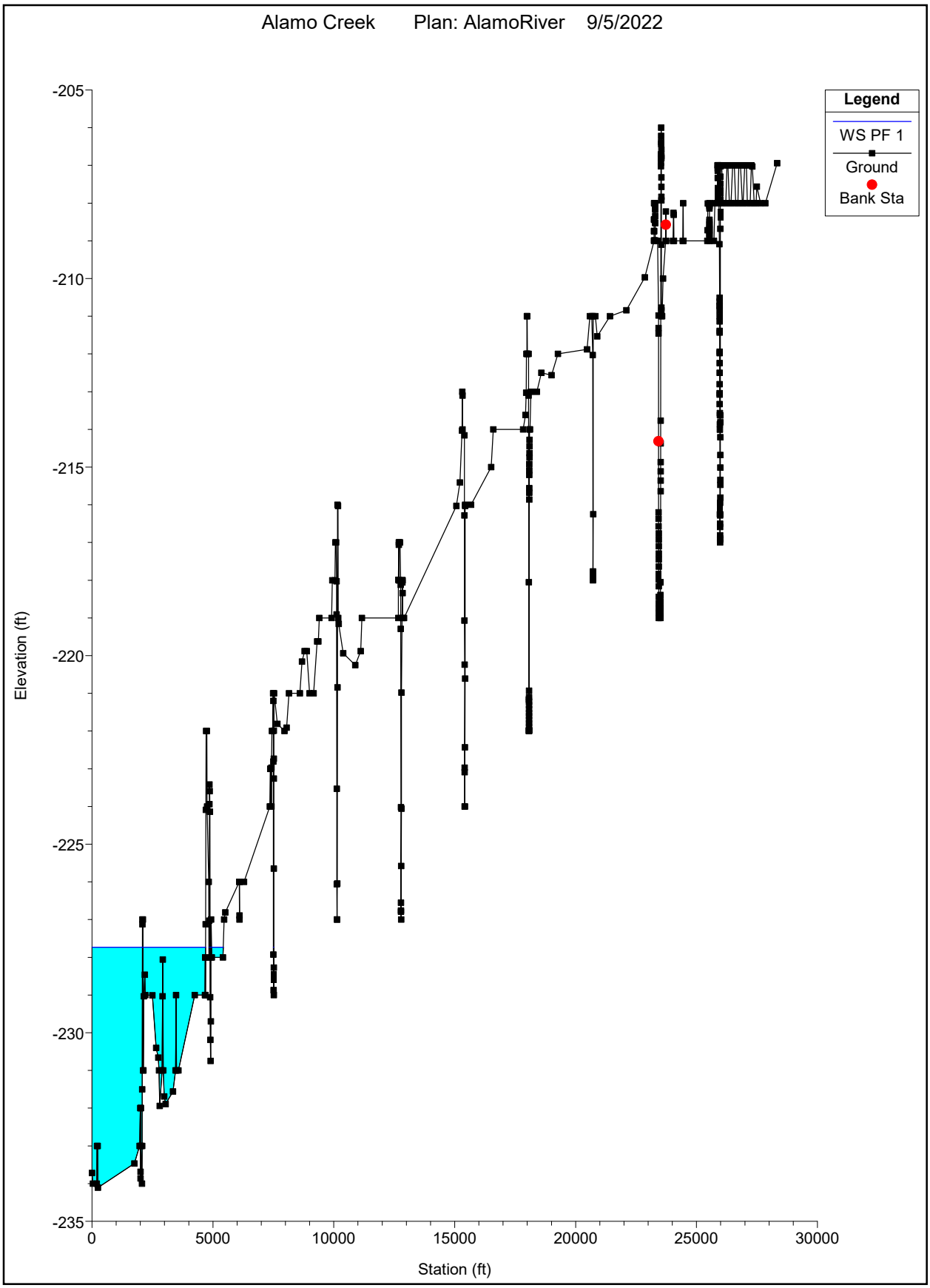
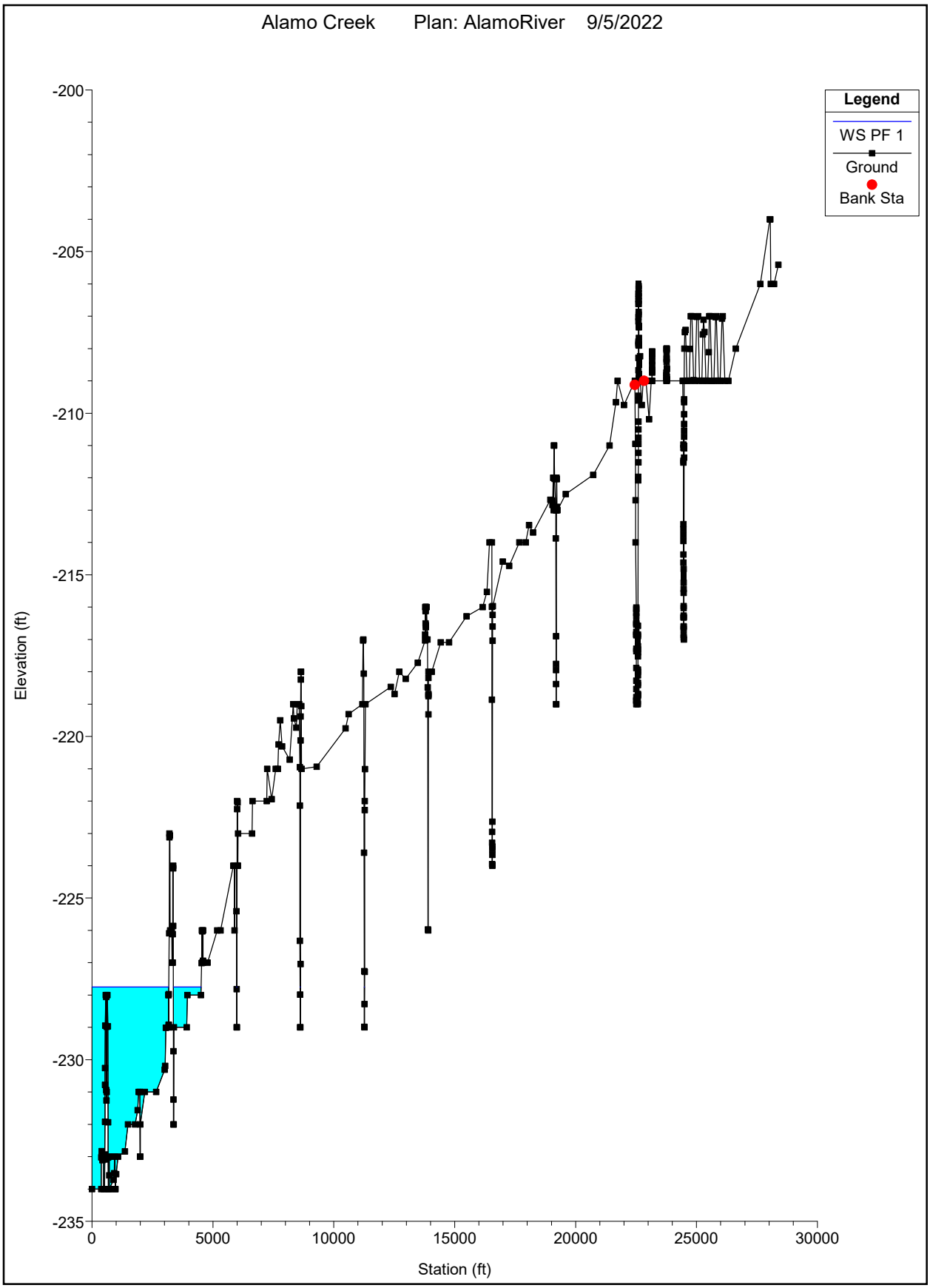
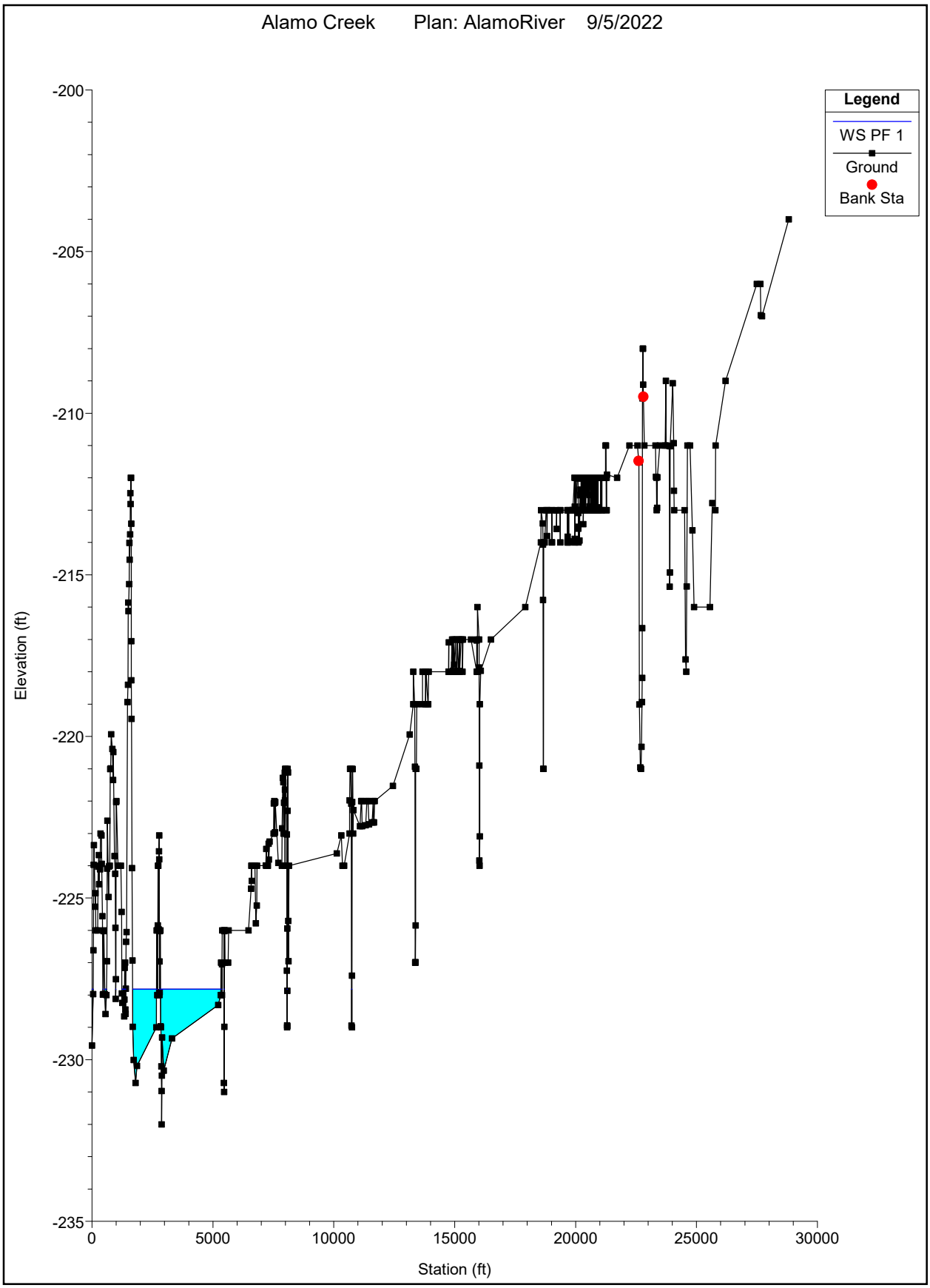
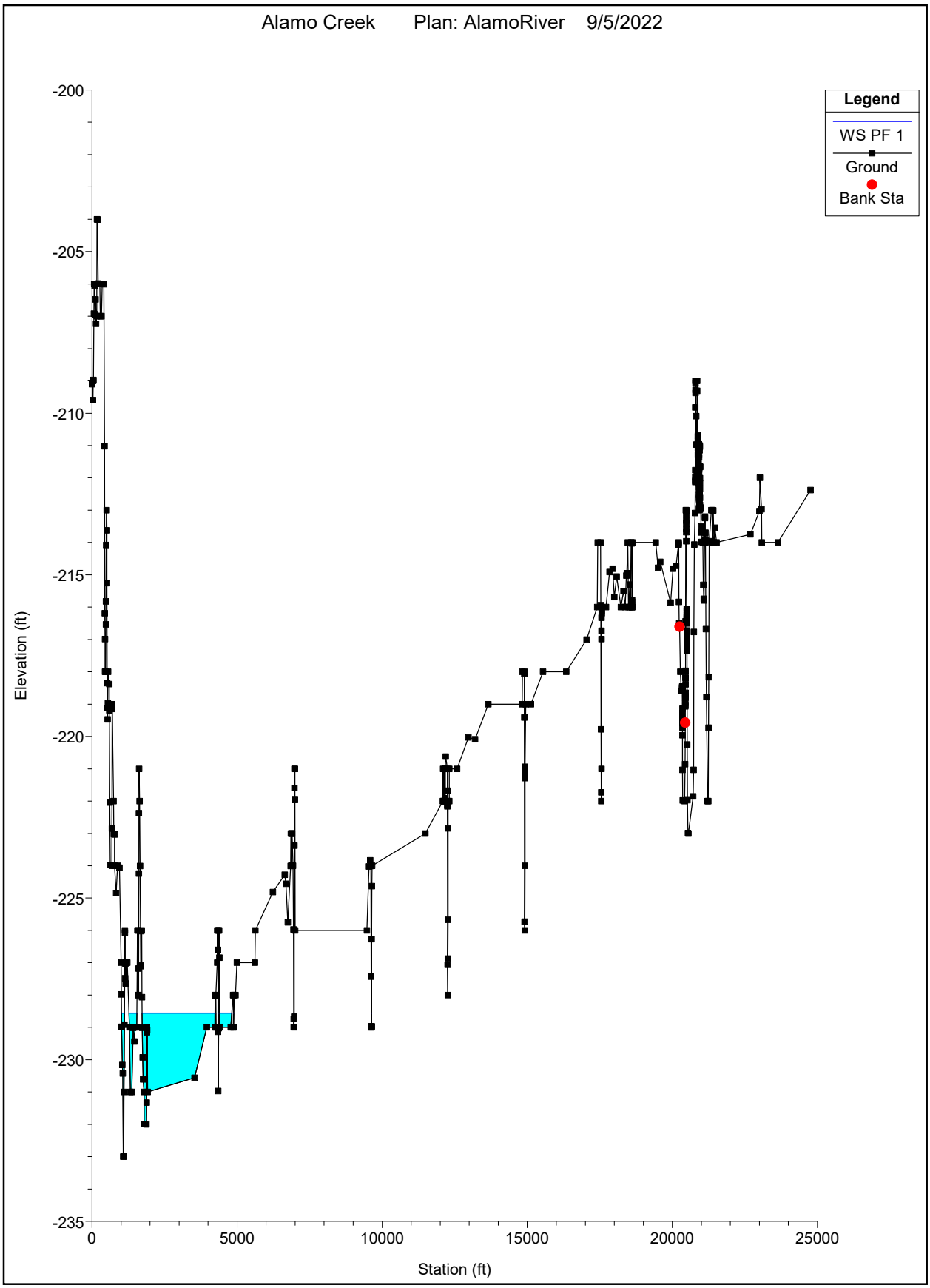
10000
15000
20000
25000
30000
Station (ft)

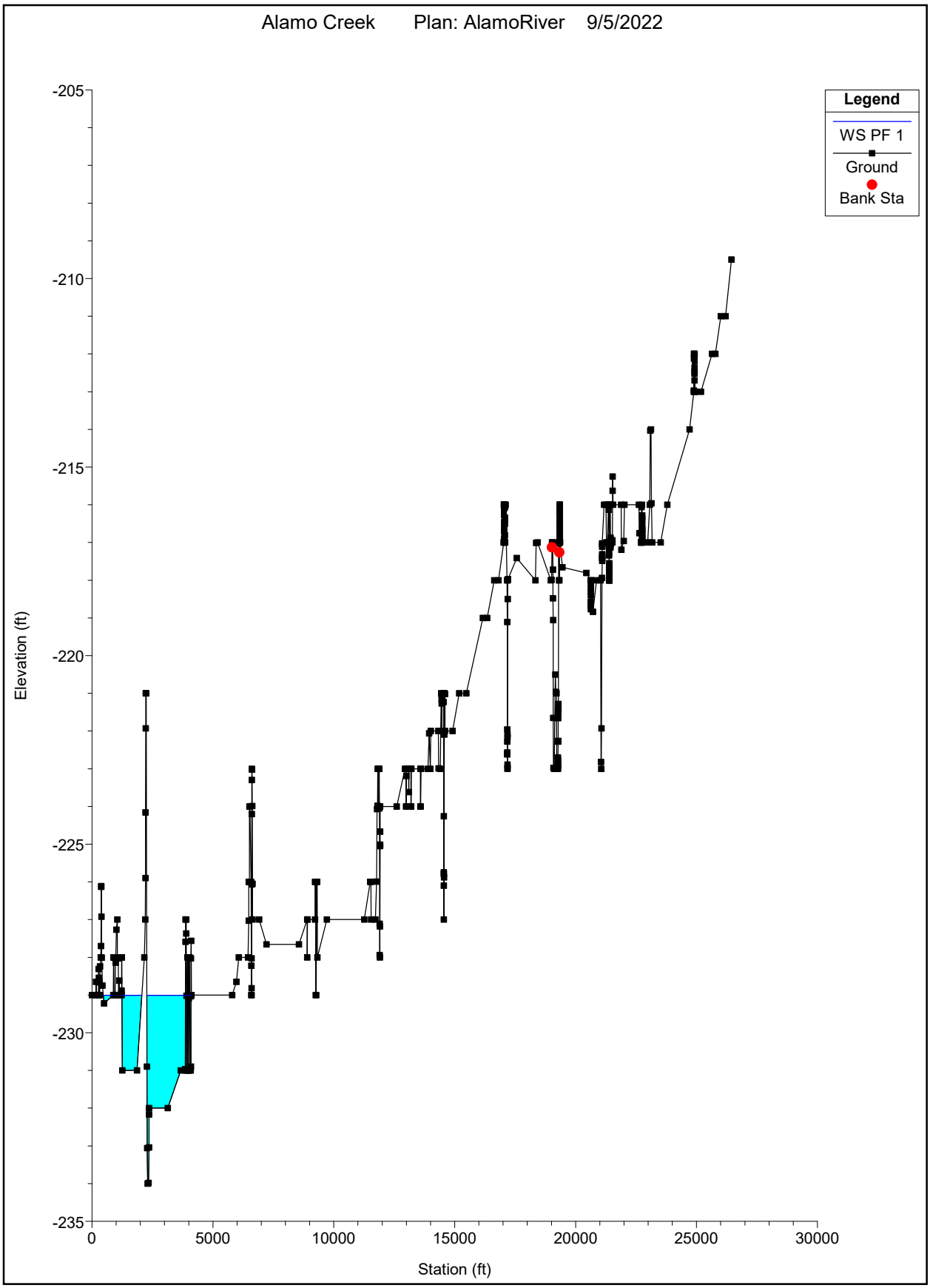

Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-205
-210
-215
-220
-225
-230
-235
Elevation (ft)
0
5000
10000
15000
20000
25000
30000
Station (ft)

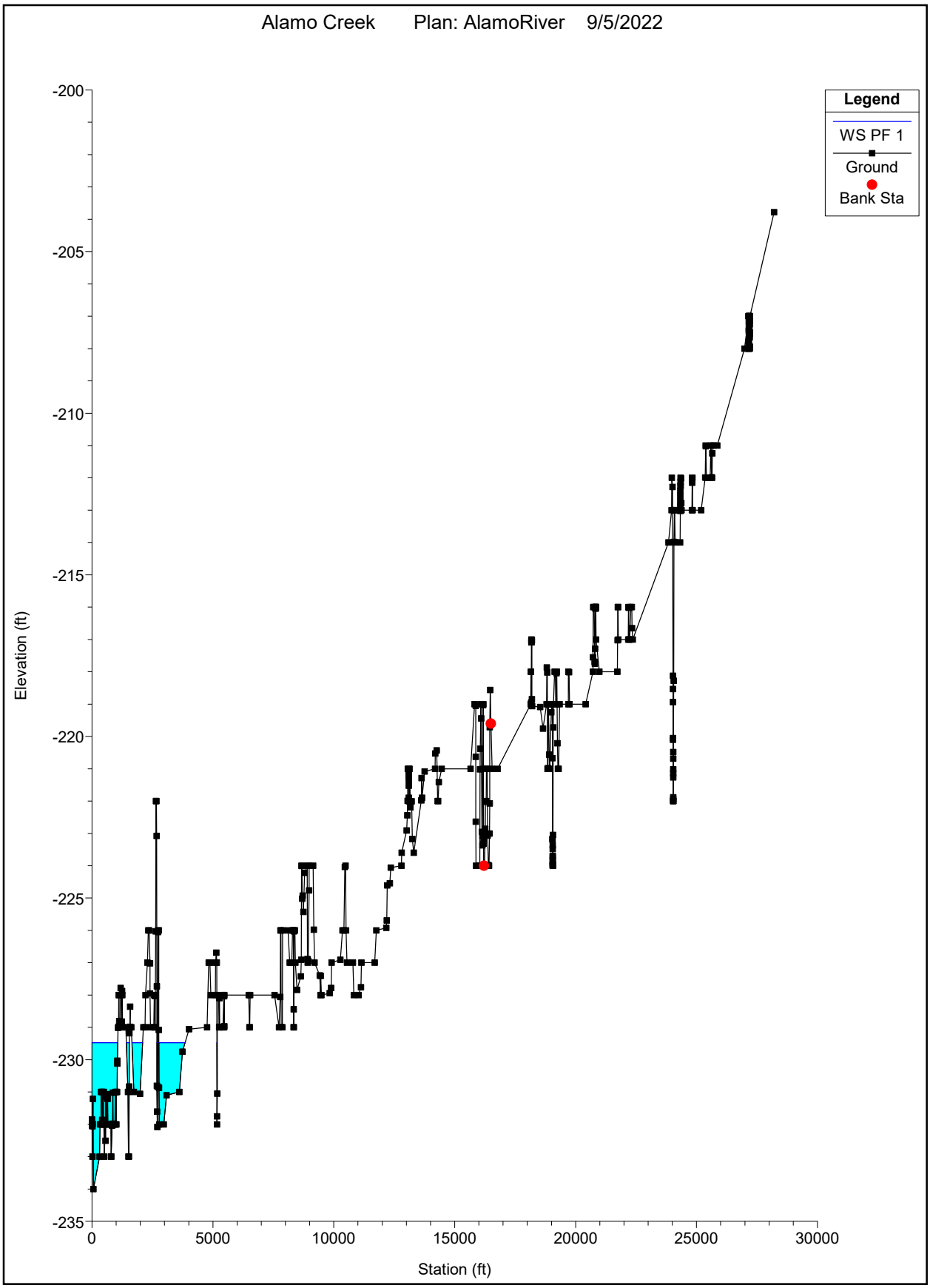

Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-205
-210
-215
-220
-225
-230
-235
Elevation (ft)
0
5000
10000
15000
20000
25000
30000
Station (ft)

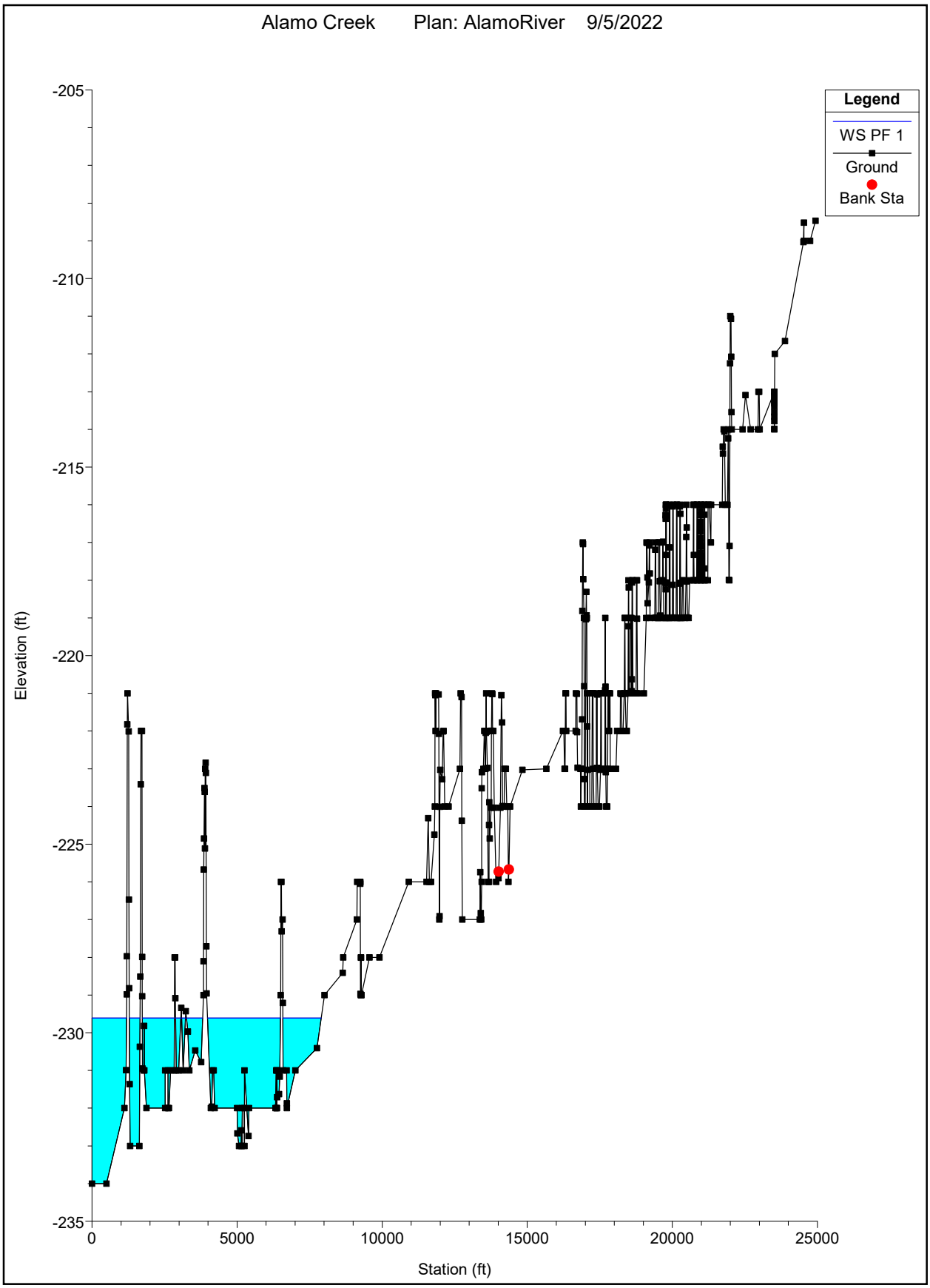

Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-200
-205
-210
-215
-220
-225
-230
-235
Elevation (ft)
0
5000
10000
15000
20000
25000
30000
Station (ft)

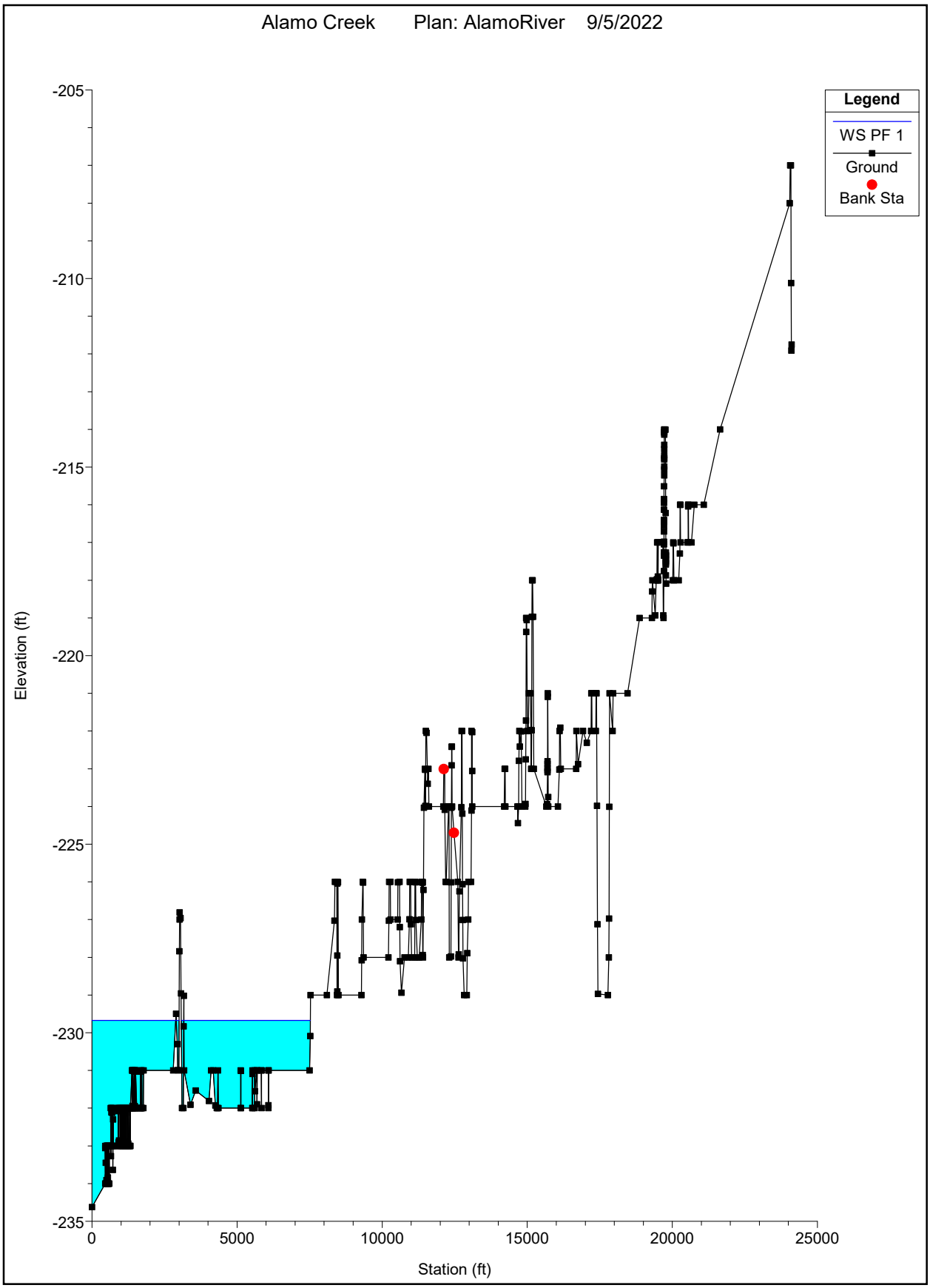

Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-200
-205
-210
-215
-220
-225
-230
-235
Elevation (ft)
0
5000
10000
15000
20000
25000
30000
Station (ft)

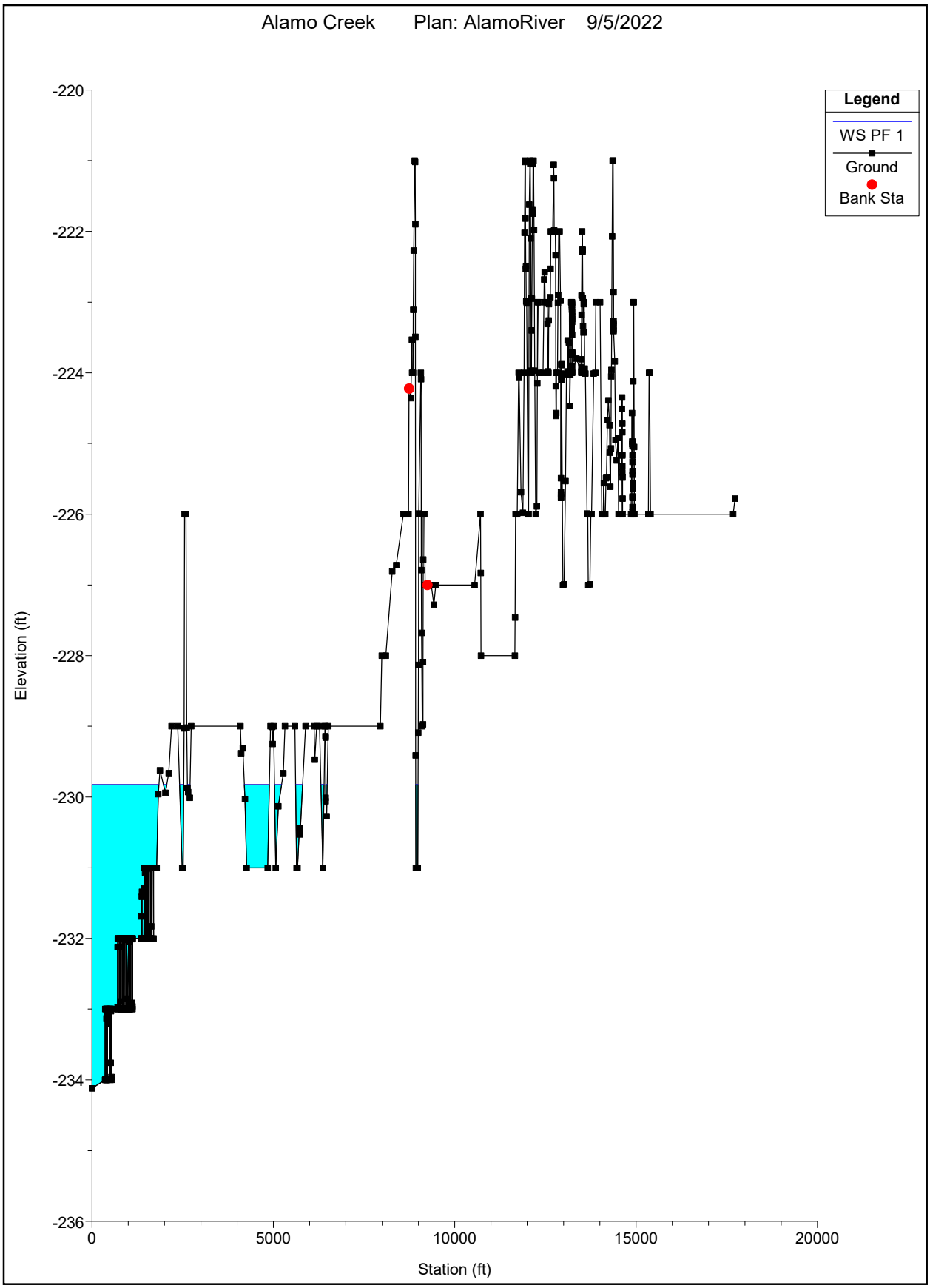

Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-200
-205
-210
-215
-220
-225
-230
-235
Elevation (ft)
0
5000
10000
15000
20000
25000
Station (ft)

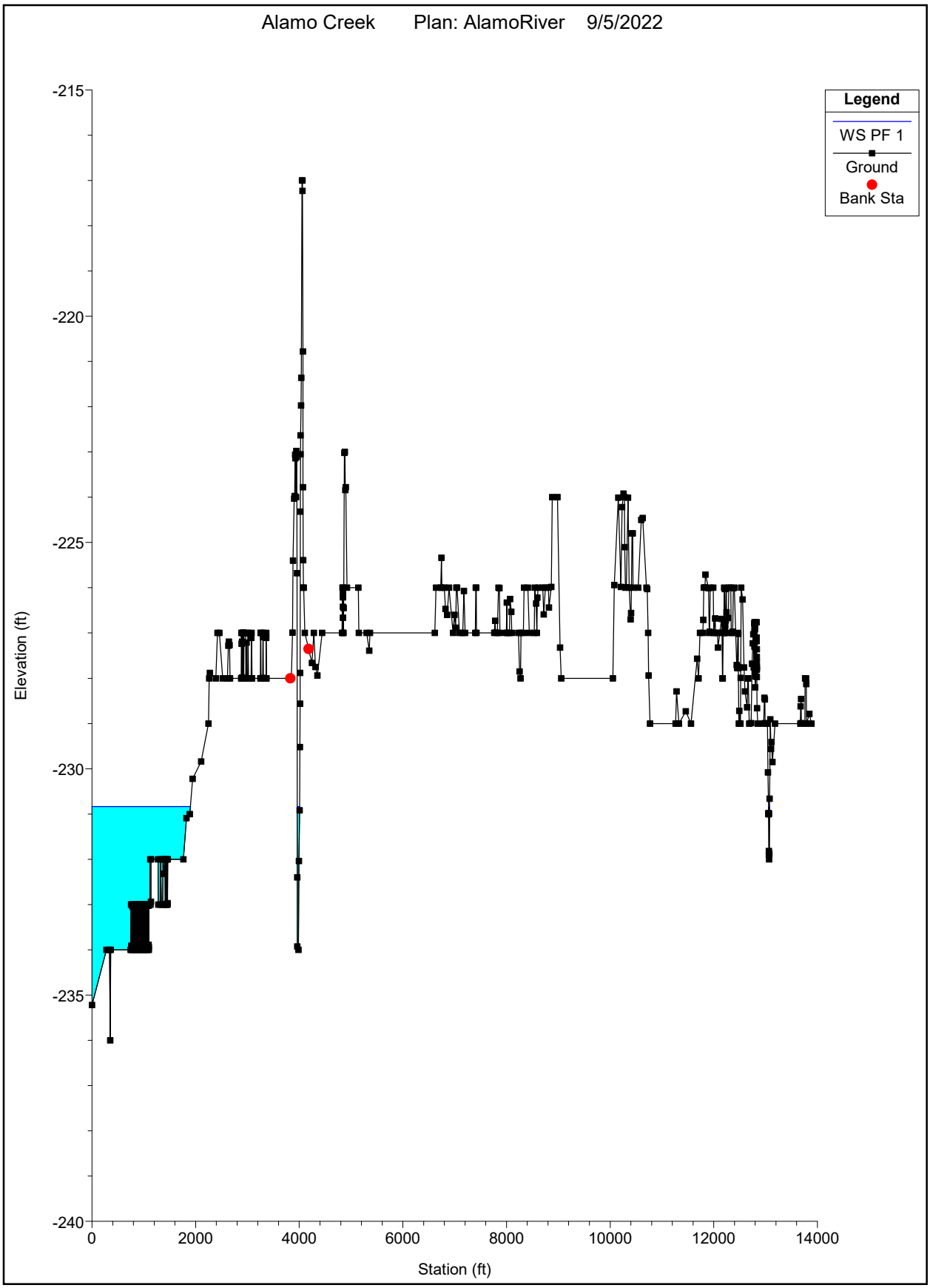

Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-205
-210
-215
-220
-225
-230
-235
Elevation (ft)
0
5000
10000
15000
20000
25000
30000
Station (ft)


Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-200
-205
-210
-215
-220
-225
-230
-235
Elevation (ft)
0
5000
10000
15000
20000
25000
30000
Station (ft)


Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-205
-210
-215
-220
-225
-230
-235
Elevation (ft)
0
5000
10000
15000
20000
25000
Station (ft)


Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-205
-210
-215
-220
-225
-230
-235
Elevation (ft)
0
5000
10000
15000
20000
25000
Station (ft)


Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-220
-222
-224
-226
-228
-230
-232
-234
-236
Elevation (ft)
0
5000
10000
15000
20000
Station (ft)


Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
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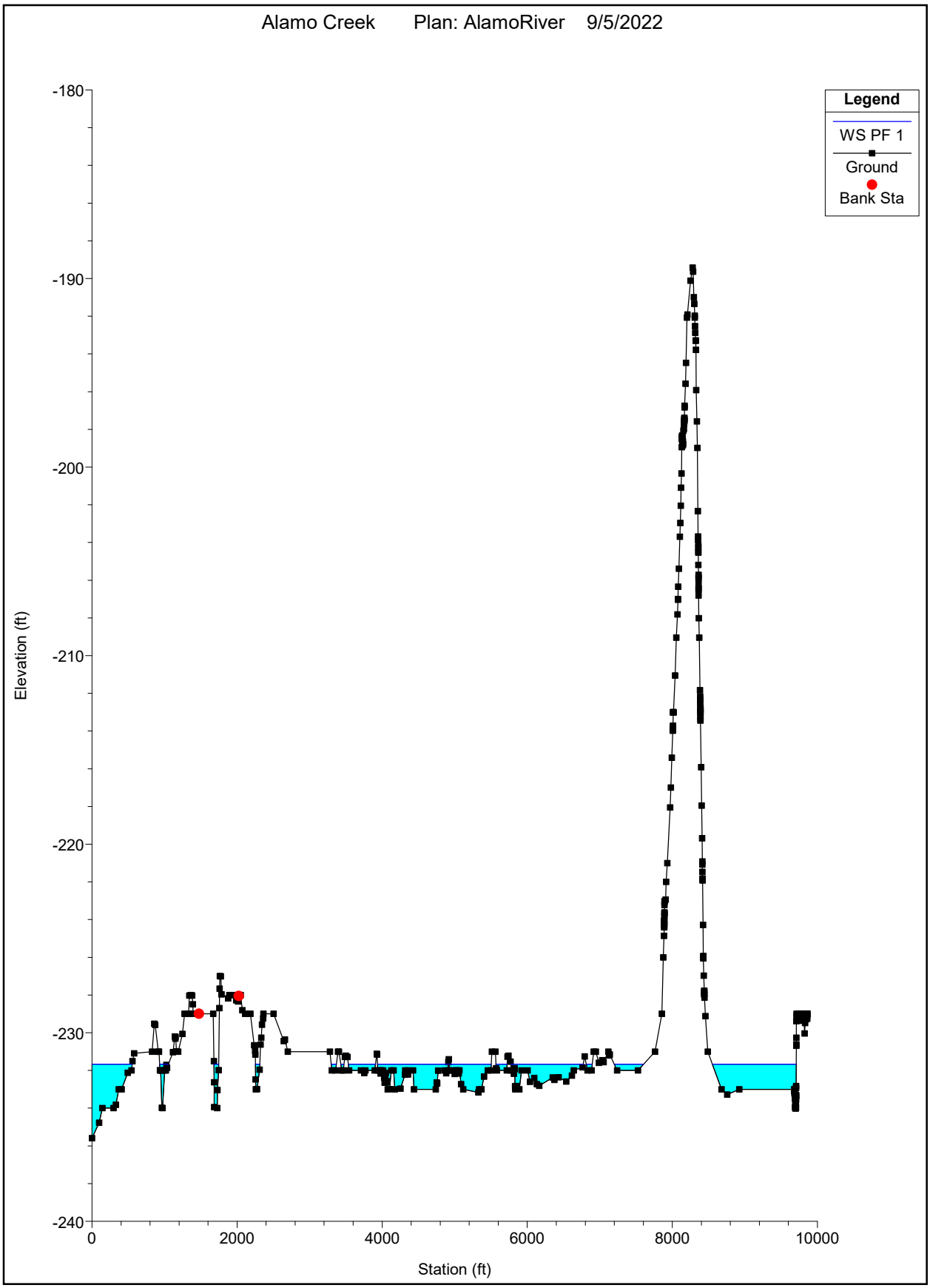
-220
-225
-230
-235
-240
Elevation (ft)
0
2000
4000
6000
8000
10000
12000
14000
Station (ft)


Alamo Creek Plan: AlamoRiver 9/5/2022
Legend
WS PF 1
Ground
Bank Sta
-180
-190
-200
-210
-220
-230
-240
Elevation (ft)
0
2000
4000
6000
8000
10000
Station (ft)

HEC-RAS HEC-RAS 5.0.7 March 2019
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X    X
X     X  X        X           X   X    X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X     X    X        X
X     X  X        X    X      X   X    X    X        X
X     X  XXXXXX    XXXX       X    X   X    X   XXXXX
```

PROJECT DATA
Project Title: Alamo Creek
Project File : AlamoCreek.prj
Run Date and Time: 9/5/2022 2:46:32 PM

Project in English units

PLAN DATA

Plan Title: AlamoRiver

Geometry Title: Alamo Creek

Flow Title : Alamo River

Plan Summary Information:
Number of: Cross Sections = 16 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01

```
    Maximum number of iterations         =  20
    Maximum difference tolerance         =  0.3
    Flow tolerance factor                =  0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method:         Average Conveyance
    Computational Flow Regime:     Subcritical Flow



FLOW DATA

Flow Title: Alamo River



Flow Data (cfs)

  River           Reach           RS                  PF 1
  Alamo River     Alamo River     37000               4500


Boundary Conditions


  River           Reach           Profile                       Upstream
    Downstream


  Alamo River     Alamo River     PF 1
Normal S = 0.0005




GEOMETRY DATA

Geometry Title: Alamo Creek



CROSS SECTION


RIVER: Alamo River
REACH: Alamo River        RS: 37000
```

INPUT
Description:
Station Elevation Data num= 232

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
27012.3	-203	27017.2	-203	27037	-203.97	27051.5	-204	27051.5	-204.01
27052.4	-204.33	27052.6	-204.41	27053.2	-204.66	27053.6	-204.83	27054	-204.98
27054.6	-205.25	27054.8	-205.31	27055.3	-205.52	27056.7	-205.84	27068.1	-204.03
27078.5	-204	27083.2	-205.9	27088	-208.93	27093.1	-211.38	27093.4	-211.5
27095.3	-212.05	27104.2	-212.98	27183.5	-213	27208.8	-210.98	27216.1	-209.12
27226.5	-207.39	27229.1	-206.78	27229.2	-206.75	27229.4	-206.64	27230.2	-206.19
27230.7	-206.06	27230.8	-206.02	27231.3	-205.91	27256.2	-203.03	27266.6	-199.11
27271.3	-198.24	27272.8	-198	27272.9	-198	27274.2	-198	27274.5	-198
27274.9	-198	27275.3	-198.07	27275.7	-198.16	27276.1	-198.27	27281.4	-200.97
27282.2	-201.25	27282.6	-201.36	27282.9	-201.44	27283.2	-201.52	27283.4	-201.57
27284	-201.75	27284.2	-201.8	27284.2	-201.81	27285	-201.98	27285.3	-202.03
27294.4	-202.534	27302.8	-203	27310.4	-202.98	27310.9	-202.93	27311.7	-202.76
27312.3	-202.6	27312.6	-202.53	27313.3	-202.33	27313.3	-202.31	27313.4	-202.3
27313.5	-202.27	27314.2	-202.08	27314.4	-202.02	27315.8	-201.29	27316.4	-201
27316.6	-201	27317.2	-201	27317.4	-201	27317.5	-201	27317.6	-201
27318.2	-201	27318.5	-201	27319	-201	27319.6	-201	27322.3	-201.04
27322.7	-201.05	27323.1	-201.25	27324.8	-202.03	27327.9	-203	27338.5	-202.87
27345	-201	27349.7	-201	27355.9	-203	27367.3	-203	27367.7	-202.95
27368.2	-202.87	27368.4	-202.84	27371.7	-201.24	27375	-201	27379.8	-201
27385.6	-202.8	27387.1	-203	27395.2	-203	27395.7	-202.9	27396	-202.78
27396.4	-202.64	27399.6	-201	27401.7	-201	27406.6	-201.01	27409.9	-202.32
27414.5	-203	27422.4	-202.99	27427.8	-201.89	27428.6	-201.5	27429	-201.35
27429.7	-201	27430.1	-201	27436.6	-201	27444.2	-203	27450.5	-202.94
27453.6	-202.18	27456.7	-201	27456.8	-201	27457.3	-201	27457.6	-201
27457.7	-201	27463.7	-201.15	27468.1	-203	27479.5	-203	27483.7	-202.06
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27494.1	-201	27499.3	-203	27508.5	-203	27512.7	-201.17	27514.3	-201
27520	-201	27522.1	-202	27527.3	-203	27535.5	-203	27537.1	-202.76
27537.4	-202.64	27537.7	-202.53	27537.9	-202.47	27540.8	-201	27548.4	-201
27553.3	-202.76	27561.6	-203	27566.4	-201.79	27571	-199	27574.1	-199.2
27578.4	-201.84	27583.4	-203	27592.4	-202.93	27597	-201	27597.5	-201
27597.9	-201	27598.7	-201	27599	-201	27599.5	-201	27599.6	-201
27606.3	-201	27611.5	-203	27619.9	-202.99	27620.8	-202.83	27621.4	-202.64
27622.2	-202.34	27622.8	-202.1	27624.6	-201.01	27625	-200.81	27625.4	-200.6
27626	-200.31	27626.2	-200.21	27627.1	-199.85	27628.6	-199.2	27628.7	-199.16
27629.2	-199	27629.5	-199	27630	-199	27630.2	-199	27630.3	-199.03
27630.7	-199.13	27639.5	-203	27650.3	-202.99	27656	-201.04	27660.2	-201
27662.7	-201.15	27663.3	-201.37	27663.5	-201.48	27663.9	-201.63	27665.2	-201.99
27671.6	-202.31	27709.2	-202	27739.3	-203	27911	-203	27953.3	-202
27987.6	-202	28012.9	-203	28197.4	-203	28246.3	-202.09	28367.8	-204
28507	-202	28542.2	-202	28588.1	-203	28715.7	-203	28751.3	-202.03
28802.1	-202	28817	-201.07	28827	-201	28864.4	-202	28870.7	-206.21
28876.9	-209	28887.5	-208.88	28895.6	-204.11	28896.4	-203.77	28896.6	-203.69
28897	-203.55	28897.2	-203.45	28897.7	-203.28	28898.1	-203.18	28898.4	-203.07
28898.7	-203	28914.3	-203	28918.7	-204	28922.4	-204	29049.4	-203

```
 30050.9 -201.81 30267.9    -201   30322 -201.01 30330.3    -202 30374.9 -202.62
 30765.6 -201.56 31533.1    -201

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
 27012.3    .045 27012.3    .036 27294.4    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       27012.3 27294.4              952   929.5   971.1             .1       .3

CROSS SECTION


RIVER: Alamo River
REACH: Alamo River        RS: 36071

INPUT
Description:
Station Elevation Data    num=     452
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    -232    30.6 -231.98    47.6    -231   444.6    -231  1261.6    -229
  1478.8    -229  1771.5    -228  1782.6    -228  1786.6    -229  1790.6 -227.21
  1792.5    -227  1810.6    -227  1817.6    -229  1829.6    -229  1834.6    -226
  1852.6    -226  1865.6 -228.03  1888.6    -229  3100.6    -228  3130.6 -227.81
  3156.6    -227  3165.6    -227  3168.6    -228  3179.5    -228  3181.6    -227
  3196.9 -227.01  3216.6 -228.91  3223.6    -229  3360.6    -228  4140.3    -227
  4481.6    -226  4525.6    -224  4529.6    -224  4535.6    -227  4546.6    -227
  4550.6    -224  4554.6    -223  4587.6    -223  4591.9    -224  5411.6    -224
  5419.8 -223.42  5425.6    -224  6399.7    -224  6531.7 -223.34  6865.7 -223.12
  7006.7 -223.34  7087.7    -224  7097.7 -222.03  7123.4    -222  7128.4 -220.69
  7152.3 -220.32  7176.7 -222.12  7181.7 -222.97  7183.7    -224  7193.7    -224
  7197.7    -222  7240.7 -221.95  7255.7    -219  7335.7 -218.88  7344.7 -218.31
  7349.5 -218.95  7356.7    -219    7368    -218  7542.7    -218  7556.7 -217.53
  7656.7    -217  7857.7    -217  7931.7 -216.31  8061.4    -216  8389.7    -216
  8390.7 -216.16  8395.7    -219  8428.7    -219  8431.8 -218.01  8433.8    -218
  8437.7    -219  8441.7    -219  8443.7    -218  8465.6    -219  8485.7    -219
  8488.5 -217.11  8489.7 -216.77  8548.7    -217  8551.3 -217.45  8553.7 -218.99
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  9009.7    -216    9212 -215.41  9296.7  -215.9  9338.7 -215.48  9347.5 -216.12
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  9488.7 -217.53  9493.2 -215.32  9498.7    -214  9713.7    -214  9715.7 -214.81
  9718.7 -214.63  9723.7 -215.26  9726.7    -217  9751.3 -216.98  9767.7    -216
  9777.4    -216  9780.7    -217  9785.7    -217  9788.7    -216  9836.7    -216
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  9854.7 -220.82  9860.7    -216 11289.7    -216 11384.4 -214.36 11839.7 -214.79
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15407.6 -213 15993.7 -212.75 16071.7 -212 16725.9 -211.81 16814.8 -211
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20336.2 -207.93 20336.4 -207.91 20336.8 -207.84 20337.2 -207.67 20337.3 -207.61
20337.8 -207.44 20340.8 -206 20402.8 -206 20406.1 -207.2 20412.5 -212.41
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24759.2 -203 24780.2 -203 24788 -204 24798.8 -204 24808.2 -203.09
24820.7 -203 24832 -204 25557.6 -205.31 25642.7 -204 26414.9 -204
26440 -204 26496.2 -206 26498.3 -206.81 26505.8 -211.69 26510.7 -213.72
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26618.9 -218.11 26620.4 -217.32 26620.9 -216.99 26621.2 -216.8 26625.2 -214.04
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26688.2 -204.18 26691.6 -204.26 26708.2 -205.97 26713.4 -207.77 26721.7 -211.95
26737 -215.88 26759.1 -216.99 26785.1 -216.99 26820.5 -215.94 26837.1 -211.64
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27234.1 -202.5 27235.3 -202.82 27238.3 -204.06 27246.4 -208.59 27254.9 -211
27327.4 -212 27356.8 -211.94 27389.8 -211.01 27405.6 -206 27548 -204
28261 -204 28266.2 -203.19 28270.1 -203 28277.6 -203 28281.8 -204
28367.3 -204 28401.3 -203.75 28416.7 -203.02 28447.1 -203 28479.3 -204
28484.5 -205.94 28489.8 -208.94 28501.1 -210.84 28506.6 -211 28507.2 -211
28507.3 -211 28507.4 -210.95 28511.5 -208.15 28513 -207.27 28513.1 -207.23
28514.4 -206.65 28514.6 -206.59 28514.7 -206.56 28515.5 -206.28 28515.7 -206.23
28515.9 -206.15 28516.3 -206 28516.7 -205.89 28517.3 -205.71 28525 -204
28629 -204.78 28649.2 -204 28858.6 -203.84 29076.9 -203 29446.8 -203

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 29446.9 -203.02   29447 -203.03   29448 -203.19 29448.4 -203.27 29448.5 -203.28
   29449 -203.37 29449.3 -203.44 29449.9 -203.57   29450 -203.61 29450.5 -203.71
   29451 -203.86 29457.1 -205.54 29464.6 -208.14 29469.8  -209.2   29485 -211.54
 29499.9    -213 29505.2 -212.99 29511.4 -211.81   29518 -211.98 29525.3 -211.18
 29525.5 -211.16 29530.1 -211.04 29537.6 -209.58 29549.9 -208.27 29557.2  -205.7
 29557.9 -205.68 29558.1 -205.66 29558.6 -205.65 29558.7 -205.65 29559.2 -205.64
 29559.5  -205.7 29560.1 -205.82 29560.2 -205.84 29561.9 -206.15 29562.3 -206.22
 29562.7  -206.3 29565.1 -206.35 29579.7 -203.87 29610.1 -202.77 29725.4    -202
 29732.9    -201 29804.9 -201.02 29817.3    -202 29824.3    -202 29839.8    -201
 29919.8    -201   29928    -202 29941.5    -202 29951.5 -201.04 29971.7    -201
 30013.4    -202   30720 -202.16

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045 26414.9    .036 26664.7    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       26414.9 26664.7           1189.4  1144.6  1141.6             .1       .3

CROSS SECTION


RIVER: Alamo River
REACH: Alamo River        RS: 34926

INPUT
Description:
Station Elevation Data    num=     444
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 -232.84    97.3    -233   109.3 -231.89   119.3 -229.05   137.3    -229
   142.3  -229.8   147.3 -232.03   161.3    -233   213.3    -233   276.3    -232
   436.3    -232   468.3    -233   490.3 -232.99   513.3    -232  1073.3    -232
  1081.3    -233  1089.3    -233  1096.6 -231.03  1128.1 -229.99  1143.3    -229
  1154.3    -229  1157.3    -228  1179.3  -228.1  1181.3 -229.24  1184.3 -231.82
  1193.3    -232  1195.4 -231.01  1202.3    -226  1251.3    -226  1254.4  -227.7
  1258.3    -231  1259.3 -231.57  1261.3 -231.86  1267.3 -230.91  1270.4 -229.02
  1274.3    -228  1294.3 -228.94  1300.3    -231  1597.5    -231  1982.6 -230.62
  2041.2    -229  2498.4    -229  2521.3    -228  2531.3    -228  2533.3 -228.31
  2544.3    -228  2547.3    -227  2574.2    -229  3232.8 -228.81  3414.3    -228
  3732.3    -228  3800.5 -227.03  3802.3 -226.88  3805.3    -226  3807.2 -226.18
  3809.3    -227  3814.3 -226.88  3816.4    -226  3839.3    -226  3842.2 -226.98
  3847.3    -227  3850.3 -225.97  3861.3 -225.38  3892.3 -225.21  3896.3 -225.96
  3898.3    -227  3911.3    -227  3915.3 -225.86  3944.3 -225.77  3950.3 -225.94
  3954.3    -227  3975.3    -227  3986.6    -226  4555.3    -226  4627.3 -225.56
  4793.2    -226  4969.3  -225.5  5193.3    -226  5197.3    -227  5201.3    -226
  5240.2 -225.97  5273.3    -224  5552.1    -224  5736.3 -225.75  6012.3 -225.69
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  6473.3    -222  6477.3 -222.91  6483.2    -223  6486.3    -222  6529.3    -221
  6539.3 -221.06  6544.4 -222.87  6549.3 -225.85  6554.3    -226  6560.2  -223.9
  6569.3    -222  6583.3 -222.03  6595.3 -223.97  6599.3    -224  6602.5 -223.44
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6608.3	-220.89	6622.3	-219.31	6657	-219	6928.4	-219	7079.3	-218
7300.3	-218	7476.2	-217	7747.3	-217	7754.3	-219	7817.4	-219
7831.3	-220.99	7835.3	-221	7841.3	-217.21	7842.3	-217	7978	-217
8029.3	-216.56	8264.2	-216	9061.3	-216	9062.3	-215.95	9065.6	-214.26
9067.3	-214	9081.3	-214	9091.3	-216	9094.3	-218	9099.1	-217.95
9103.5	-217	9107.3	-217	9109.2	-217.76	9109.3	-217.84	9109.5	-217.87
9110.3	-218	9113.3	-218	9116.3	-217	9193.3	-217	9194.3	-217.3
9194.3	-217.31	9194.4	-217.33	9195.4	-217.93	9200.3	-222.85	9202.3	-224
9209.4	-223.97	9211.4	-222.94	9216.2	-218.35	9219.3	-217	9248.2	-218.06
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11534.3	-217.47	11714.3	-217	11723.1	-216	11733.3	-214	11754.5	-213.99
11763.2	-213.2	11772.2	-213.16	11813.4	-214	11829.3	-216.06	11833.3	-219.06
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11951.6	-218	12037.3	-218.05	12051.3	-217.09	12061.8	-217.99	12081.3	-218
12082.3	-217.83	12086.3	-216	12374.1	-216	12636.3	-215.44	14026.4	-214.91
14105.2	-214.75	14168.3	-214	14383.3	-214	14386.3	-213.04	14410.3	-213
14414.3	-212	14430.3	-212	14476.3	-213	14478.3	-213.87	14479.3	-214.65
14485.3	-219.63	14487.3	-220.93	14489.3	-221.78	14499.3	-222	14501.3	-221.26
14503.3	-220.19	14511.3	-214	14639.3	-214	14677.3	-214.69	14738.8	-214.28
15040.3	-214.62	15136.8	-214.34	15150.3	-214	15756.2	-213.66	16943.3	-212
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17120.3	-217.89	17125.3	-219	17130.3	-219	17133.3	-217.88	17142.3	-211
17825.3	-211	18412.5	-210.07	18806.3	-209.91	19057.3	-209	19386.3	-209
19671.3	-208	19677.3	-207	19691.1	-207	19693.1	-207.73	19693.3	-207.84
19693.6	-207.88	19694.1	-207.97	19694.3	-208	19699.3	-208	19701.3	-207.16
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22412.4	-206.02	22413.3	-206.27	22415.4	-206.84	22415.4	-206.87	22416.4	-207.44
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22419.3	-210.26	22419.4	-210.31	22420.3	-211.42	22420.4	-211.52	22421.3	-212.61
22421.4	-212.66	22421.4	-212.69	22422.3	-213.59	22422.4	-213.64	22423.3	-213.99
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24703.5	-206	24718.3	-207	24730.5	-206.01	25004.7	-206	25015.9	-205.33
25029.5	-206	25637.5	-206	25682.4	-206	25712.4	-208.01	25712.5	-208.04
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 25845.9 -206.79 25846.6 -206.51 25846.9 -206.38 25847.4 -206.21 25847.5 -206.18
 25847.9    -206 25865.8 -204.03 25866.2  -203.9 25866.6 -203.81 25867.2 -203.56
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 25871.4  -201.2 25871.7    -201   25909 -201.01 25916.1 -202.17 25929.7 -202.94
 25935.7 -203.97 25966.8 -204.41 26026.4-204.016 26028.9    -204 26745.9    -204
 26752.2 -202.73 26752.5 -202.68 26753.2 -202.57 26753.3 -202.56 26753.3 -202.55
 26753.4 -202.53 26754.1 -202.42 26754.3  -202.4 26754.6 -202.38 26755.3 -202.33
 26755.7 -202.31   26756 -202.29 26756.6 -202.28 26771.9    -204 27575.8    -204
 27579.9 -203.16 27580.1 -203.14   27581    -203 27581.5    -203   27582    -203
 27582.9    -203 27587.1    -203 27600.6    -204 29263.8    -204

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045 25637.5    .036 26026.4    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       25637.5 26026.4             1203  1406.4  1411.4             .1       .3

CROSS SECTION


RIVER: Alamo River
REACH: Alamo River        RS: 33520

INPUT
Description:
Station Elevation Data    num=     438
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 -231.56     237 -230.75     375    -229     386 -228.03   419.5 -227.04
     432 -226.01   451.7 -225.99     471 -225.08   509.9 -225.36   527.2 -226.04
     548    -228   579.1    -228   606.1 -223.26     610 -222.02     634    -221
     657    -221     659  -221.9     665 -226.19     671 -229.31     675    -231
   680.3 -232.09     686    -234     705 -233.99     712 -229.53     714    -229
     731    -229     756    -232  1025.1    -232  1036.1 -231.34  1053.1 -231.09
  1320.1 -231.38  2712.1 -230.41  3156.1 -229.28  3210.1    -229  3214.1    -228
  3251.1    -229  3254.1    -228  3273.1    -228    3278 -225.72  3283.1    -224
  3300.1    -224    3306 -228.06    3309    -229  3321.1    -229  3324.1 -227.81
  3327.1    -226  3342.1    -226  3348.1    -228  3382.1    -228  3394.1    -229
  3754.9    -229  5834.1 -226.03  5854.1 -225.79  5882.1    -224  5952.1    -224
  5953.1 -224.04  5956.9 -226.12  5959.2  -226.9  5966.1    -227  5967.1 -226.94
  5969.1 -226.16  5973.1    -224  6637.1 -223.94  6911.1 -223.03  6915.8 -222.83
  6919.1    -222  6961.1  -222.8  7439.1 -222.03  7445.1    -222  7450.1    -221
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7460.1	-222	7808.1	-221.75	7971.1	-221	8554.1	-221	8555.1	-220.91
8557.1	-219.69	8559.1	-218.98	8602.7	-218.01	8613.1	-217	8625.1	-217
8629.1	-218.78	8638.1	-225.98	8645.1	-226	8646.3	-225.18	8650.1	-221.15
8655.1	-219	8685.1	-219	8691.1	-218	8704.2	-218.01	8722	-219
9110.1	-219.25	9233.1	-221	9268.1	-222	9338.1	-222	9560.9	-219
9841.9	-216	9885.1	-216	9909.1	-218	10238.1	-218	10969.1	-217.03
11109.1	-216	11156.1	-216	11159.1	-217	11163.1	-217	11166.1	-216
11232.1	-216	11241.1	-217.03	11245.6	-221.47	11248.1	-222.97	11253.1	-223.89
11260.1	-224	11263.1	-223.3	11265.6	-222.08	11269.6	-219.27	11273.1	-216
11299.1	-216	11302.1	-217	11315.1	-217.09	11641.6	-218	13521.1	-217.47
13788.1	-217	13806.1	-214	13842.1	-214	13893.1	-216	13901.4	-221.98
13904.1	-223.45	13904.4	-223.59	13904.8	-223.73	13905.1	-223.86	13913.1	-224
13917.5	-222.42	13920.5	-220.42	13924.1	-217.31	13928.1	-216	14312.1	-215.88
14494.1	-214	15041.1	-214	15113.1	-213	15641.1	-213	15745	-212
15860.1	-212	15875.7	-213	15902.1	-212	15985.1	-212	15989.8	-213
15996.1	-213	16000.1	-212	16238.1	-212	16248.1	-213	16327.1	-213
16421.3	-212.03	16421.9	-212.01	16423.1	-211.94	16426.1	-211.04	16426.3	-211.03
16427.1	-211	16441	-211	16444.1	-212	16449.1	-212	16452.1	-211
16524.1	-211	16528	-214.12	16534.1	-220.74	16535	-221.28	16535.1	-221.34
16537	-221.98	16537.1	-222	16541.1	-222	16543	-221.04	16543.1	-220.97
16550.1	-213.87	16551.1	-213.03	16551.2	-212.95	16552	-212.55	16552.1	-212.47
16552.3	-212.4	16553	-212.07	16553.1	-212	17014.1	-212	18434.1	-210.88
19109.1	-209	19112.1	-208	19157	-208	19162.1	-207	19167.2	-207.01
19177.1	-207.94	19180.1	-209.57	19186	-215	19186.1	-215.05	19188.1	-216.66
19190.1	-217.94	19200.1	-218	19202.1	-217.87	19203.1	-217.42	19209.1	-212.59
19211.1	-211.19	19212.1	-211	19224.1	-210.5	19300.9	-209.44	19738.5	-210.12
20466.4	-210.03	21141.1	-209.56	21182	-209	21712.1	-209	21716.6	-208.05
21729.1	-207.03	21734.1	-207	21734.6	-207.02	21735.1	-207.05	21735.6	-207.17
21736.1	-207.3	21736.6	-207.43	21736.6	-207.44	21738.6	-207.93	21743.1	-208
21743.6	-207.84	21743.6	-207.82	21744.1	-207.66	21748.1	-206	21758.1	-206
21775.7	-208.1	21797.5	-208.67	21810.1	-208.63	21817.8	-208.01	21826.1	-208.09
21826.4	-208.16	21827.1	-208.37	21827.4	-208.44	21827.9	-208.58	21828.1	-208.65
21828.4	-208.72	21832.4	-210.65	21836.1	-213.88	21845.1	-214.36	21847.3	-213.63
21847.9	-213.19	21848.1	-213.04	21849.1	-212.28	21849.3	-212.12	21849.9	-211.61
21850.3	-211.34	21850.9	-211.01	21851.1	-210.91	21861.1	-209	21927.1	-210.25
22273.1	-209	23040.6	-208.91	23088.1	-208.81	23150.2	-208	24192.2	-208
24255.9	-207	24284.5	-207	24291.1	-207.89	24303.9	-208	24304.3	-207.99
24304.4	-207.99	24304.6	-207.99	24305	-207.98	24305.8	-207.96	24307.1	-207.96
24307.4	-207.9	24313.5	-207	24442	-207	24456.3	-206	24477.1	-206.06
24479.2	-207	24481.9	-207	24485.5	-207	24486.4	-206.69	24486.5	-206.63
24486.9	-206.49	24487.2	-206.41	24487.6	-206.24	24487.9	-206.15	24488.7	-206
24493.9	-206	24510.5	-207	24510.9	-207.04	24511.3	-207.16	24511.7	-207.27
24511.8	-207.31	24512.1	-207.39	24512.5	-207.51	24512.9	-207.64	24513.6	-207.95
24514.1	-208.13	24514.9	-208.5	24515	-208.56	24515.2	-208.65	24515.7	-208.84
24516	-208.98	24516.4	-209.03	24516.8	-209.06	24517.1	-209.09	24517.2	-209.1
24517.7	-209.15	24519.6	-209.33	24558.2	-211.09	24563.2	-212.2	24563.9	-212.54
24564	-212.55	24564.5	-212.78	24564.7	-212.91	24565.5	-213.27	24565.5	-213.28
24565.6	-213.29	24566.6	-213.84	24571.8	-217.05	24571.9	-217.06	24571.9	-217.08
24573.4	-217.5	24573.5	-217.53	24574	-217.66	24574.9	-217.88	24575	-217.9
24575.1	-217.91	24575.8	-217.98	24576.1	-217.99	24576.5	-218	24576.6	-218

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 24600.1 -218.22 24600.4 -218.31 24600.7 -218.44 24601.2  -218.7 24601.3 -218.78
 24602.4    -219 24650.8 -218.81 24659.8 -216.66 24668.5 -213.41 24674.8 -209.34
 24679.5  -205.8 24680.2 -205.45 24680.3 -205.42 24680.3  -205.4 24681.1 -204.95
 24681.4 -204.83 24681.8 -204.58 24681.9 -204.52 24682.4 -204.25 24682.7 -204.15
 24683.5    -204 24689.7    -204   24697  -207.6 24697.2 -207.69 24697.5  -207.8
 24697.8 -207.88 24698.2    -208 24777.2 -208.08 24823.5    -207 24936.4 -206.84
 24977.3    -206 24980.8-206.073 25024.7    -207 25382.5    -207 25403.2 -206.38
 25413.5 -206.39 25421.7    -207 25699.3    -207 25718.3 -206.04 25729.1    -204
 25730.1    -204 25730.2    -204 25731.2    -204 25731.7    -204 25731.8    -204
 25732.3    -204 25732.6 -204.03 25733.3 -204.12 25733.4 -204.13 25739.7 -206.04
 25748.1    -207 25939.7    -207 25951.8 -206.01 25960.8    -203   25967 -203.24
 25975.6    -206 26020.8    -206 26034.5    -207 26180.9    -207 26236.7    -206
 26308.5 -206.01 26349.4    -207 26525.4    -207 26572.7    -206 26582.3    -206
 26601.1    -207 26807.5    -207 26850.3    -206 26850.6    -206 26855.9 -206.01
 26856.1 -206.02 26865.4    -207 27025.4    -207 27072.4    -206 27157.3    -207
 27246.6    -206 27316.9    -206 27335.1 -206.94 27335.4 -206.96 27336.1    -207
 27336.4 -207.17 27336.7 -207.31 27337.1 -207.53 27337.5 -207.69 27338.2    -208
 27339.2    -208 27339.9    -208 27340.7    -208 27341.3    -208 27341.5 -207.95
 27341.8 -207.79 27342.2 -207.55 27342.4 -207.46 27342.7 -207.32   27343 -207.18
 27343.5    -207 27746.6 -207.25 28356.5    -207 28370.2    -206 28429.9    -206
 28439.5 -206.94 28460.2 -211.72 28468.9 -213.29 28469.2 -213.33 28469.7 -213.41
 28474.6    -214 28490.3 -213.89 28500.8 -212.74 28510.9 -210.88   28532    -206
 28627.8    -206 28670.8 -208.06 28698.4 -208.57

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045 24481.9    .036 24980.8    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       24481.9 24980.8           1084.3   938.9   614.4             .1       .3

CROSS SECTION


RIVER: Alamo River
REACH: Alamo River        RS: 32581

INPUT
Description:
Station Elevation Data    num=     452
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 -233.98     2.9 -232.64     7.9    -229    21.9 -229.06    34.9 -231.02
    42.9 -232.97    93.9    -234     308    -233   535.2 -233.75  1056.7 -233.53
    1104    -233  2066.1 -232.62  2226.1 -232.03  2235.1    -231    2244    -232
  2252.1    -232  2255.1    -231  2538.1    -231  2550.1    -229  2576.1 -228.98
  2587.1 -228.08  2592.1    -227  2610.1 -226.59  2639.1    -227  2643.1    -229
  2646.1 -229.49  2683.1    -232  2696.8 -231.98    2712 -231.01  2726.1 -229.03
    2731 -227.02  2740.1    -227  2745.1    -228  3184.1    -228  3190.1 -228.99
  3198.1 -228.47  3206.1    -229  3298.1 -228.41  3357.9    -229  3455.1    -229
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3464.3	-230.8	3486.1	-231	3491.1	-231.82	3507.1	-231.8	3512.1	-232.28
3517.1	-231.99	3527.1	-233.1	3535.1	-232.65	3542.8	-232.86	3548.1	-233.49
3565.2	-233.78	3588.1	-232.38	3602.1	-232.31	3612.1	-231.48	3625.6	-231.94
3645.4	-231.68	3655.1	-229.44	3685.1	-226	3702.1	-226.02	3737.1	-228
3782.9	-229	4069.2	-229	4101.6	-228.59	4245.2	-229	4256.2	-228.09
4270.2	-229	4577.2	-229	4586.2	-228.76	4592.4	-228	4596.2	-228.03
4602.3	-229	4780	-229	4865.9	-228	4925.2	-227.8	5083.2	-228
5098.4	-227.83	5110.5	-227	5160.2	-227	5166.1	-226	5244.2	-226
5250.2	-228	5259.2	-228	5265.2	-226	5294.2	-226	5300.2	-227
5672.3	-227	5683.3	-226	6193.3	-226	6216.2	-224	6736.3	-224
6740.3	-223	7264.5	-223	7281.3	-222	7778.4	-222	7814.4	-221
7834.4	-221.03	7836.4	-222	7839.7	-222	7843.4	-221	7916.4	-221
7919.3	-222.79	7923.2	-226.89	7924.2	-227.43	7925.4	-227.95	7931.4	-228
7931.6	-227.95	7932.4	-227.83	7935.4	-225.96	7938.7	-222.66	7942.4	-221
7981.4	-219	8049.4	-220.09	8116.2	-220.53	8597.4	-220.94	8872.4	-219
9029.3	-217	9094.5	-216.89	9115.3	-216	9163.5	-216	9168.5	-217
9192.5	-219	9791.5	-219	10399.5	-218	10404.5	-217.03	10415.5	-217
10418.5	-216	10447.5	-216	10451.5	-217	10457.5	-217	10460.5	-216
10502.5	-216	10523.3	-216.96	10531.5	-218.11	10534.7	-220.03	10538.5	-223.8
10546.5	-226	10551.6	-225.99	10556.6	-224.14	10564.5	-217.76	10566.5	-217
10590.5	-217.06	10594.5	-218.98	10603.5	-221	10617.5	-219	10958.6	-219.93
11435.2	-219.97	11628.6	-219.78	11694.8	-219	13080.7	-219	13085.7	-218.04
13090.7	-216	13136.7	-216	13141.7	-217.03	13188.7	-218.12	13190.7	-218.9
13194.8	-222.12	13196.6	-223.39	13197.7	-224.12	13197.8	-224.18	13198.7	-224.59
13198.8	-224.66	13200.8	-225.65	13201.7	-226	13201.8	-226	13202.7	-226
13202.9	-226	13203.9	-226	13205.9	-225.81	13210.7	-224.11	13218	-218.19
13220.7	-217	13245.1	-217.01	13263.7	-218	13468.7	-218	15504.2	-214.59
15707.8	-214	15723.8	-212	15735.8	-212	15739.7	-213	15741.7	-213
15744.8	-212	15815.8	-212	15818.8	-212.91	15818.9	-212.95	15819.8	-213.41
15819.8	-213.44	15819.9	-213.48	15820.8	-214.12	15827.8	-220.78	15828.8	-221.54
15829.8	-222.19	15831.9	-223	15838.7	-223	15841	-221.9	15848.8	-215.97
15881.8	-213	15935.8	-213.66	16003.9	-213.84	17594.7	-212.94	18372.9	-212
18377	-211	18473	-211	18475.1	-211.8	18484	-218.73	18497	-219
18507	-212.02	18523	-211	18534.7	-211.02	18539.8	-212	18562	-211.31
18583.7	-211.25	18753.9	-211.72	20580.1	-210.94	20955.1	-209.77	21011.1	-209
21024.1	-208	21029.3	-208.05	21032.4	-208.95	21038.1	-209	21038.4	-208.86
21039.8	-208.21	21040.1	-208.06	21057.6	-208	21084.9	-208.99	21119.3	-209.07
21120	-209.3	21120.3	-209.4	21123.3	-210.45	21123.9	-210.69	21132.1	-215.7
21132.4	-215.83	21134.5	-216.6	21135.1	-216.83	21135.5	-216.89	21135.8	-216.94
21136.1	-217	21136.5	-217	21136.8	-217	21137.1	-217	21137.8	-216.76
21140.1	-215.73	21141.1	-214.92	21144.1	-212.53	21144.7	-212.13	21145.1	-211.83
21145.6	-211.54	21145.7	-211.47	21146.1	-211.19	21146.6	-211.1	21146.7	-211.08
21147.1	-211	21848.1	-210.47	22250.2	-209.81	22422.5	-209	23129.6	-208.75
23478.9	-208.19	23533.1	-208	23533.4	-208	23537.5	-207	23568.7	-207
23568.8	-207	23569	-206.99	23569.8	-206.88	23570.7	-206.58	23570.9	-206.53
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23612.6	-208.96	23627.5	-208.306	23634.5	-208	23662.8	-208.03	23663.2	-208.08
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23665.8	-208.61	23667.6	-208.96	23682.6	-216.53	23691.2	-218	23732.7	-218
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 23735.6 -217.72   23736 -217.67 23736.2 -217.63 23736.6 -217.57 23744.7    -219
 23813.5    -219 23814.3 -218.97 23814.5 -218.97 23815.4 -218.68 23815.5 -218.66
 23815.5 -218.65 23816.4 -218.39 23816.5 -218.34 23816.7 -218.29 23817.2 -218.14
   23819 -217.54 23819.1 -217.52 23819.5 -217.37 23819.9 -217.24 23820.5    -217
 23821.4 -216.55 23821.6  -216.5 23822.2  -216.2 23822.6 -216.06 23836.9 -206.86
 23839.8    -206 23847.8 -206.03 23849.9 -206.59 23849.9 -206.61 23850.7  -206.8
 23851.1 -206.94 23854.9 -209.11 23855.1 -209.22   23862 -213.69 23862.2 -213.76
   23863 -214.14   23863 -214.16 23864.8 -214.74   23870    -216 23942.5    -216
 24002.1 -215.45 24012.7 -214.96 24021.5 -214.08 24032.8 -211.07 24036.1-210.617
 24047.9    -209 24270.4    -209 24361.3 -208.03 24486.7    -208 24529.9    -209
 24562.6    -209 24593.8    -208 25000.3    -208 25060.9    -207 25144.1    -207
   25166    -208 25390.5    -208 25399.6    -207   25452    -207 25460.3    -208
 25630.1    -208 25712.9    -207 25723.8    -206 25724.1    -206 25724.4    -206
 25724.9    -206 25727.1    -206 25728.5  -206.1 25728.8 -206.16 25729.6 -206.39
 25729.7  -206.4 25730.2 -206.53 25730.5 -206.64 25730.9 -206.76 25731.2 -206.86
 25732.1 -207.01 25733.2 -207.06 25734.2 -207.12 25734.9 -207.15 25735.2 -207.16
 25735.8 -207.17 25736.2 -207.19 25736.8 -207.22 25737.2 -207.25 25762.2 -207.91
   25827 -207.01 25924.3    -207 25924.3 -206.99 25925.1 -206.84 25925.5 -206.74
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   26269    -207 26322.6    -206 26375.3    -206 26410.5 -207.01 26414.6 -208.36
 26422.6 -213.95 26426.3 -215.35 26426.7 -215.48 26427.5 -215.73 26427.9 -215.82
 26428.7 -215.99 26428.9    -216 26437.8    -216 26438.2    -216 26439.3 -215.99
 26439.8 -215.99 26443.9 -214.17 26452.4 -207.99 26457.2 -207.23 26457.8 -207.17
 26458.3 -207.12 26461.1    -207 26484.2    -207 26496.4 -207.72 26514.6    -211
 27432.5    -211 27553.9 -209.51 27649.8 -210.09 27688.3    -209   27756 -208.23
 27866.5  -209.2   27936    -209 27999.7    -208 28057.6 -208.01 28139.2    -209
 28183.7    -209 28184.4 -208.88 28184.7 -208.84   28185 -208.79 28185.3 -208.76
 28185.7  -208.7 28186.2 -208.64 28186.2 -208.63 28186.7 -208.56 28187.4 -208.45
 28187.7 -208.41 28187.9 -208.37 28188.6 -208.27 28188.7 -208.25 28188.8 -208.24
 28189.4 -208.14 28189.7  -208.1 28189.7 -208.09 28189.8 -208.09 28190.7 -207.97
   28191 -207.95 28201.9    -207 28221.8    -207 28222.1    -207 28222.3 -207.03
   28223 -207.14 28224.1 -207.41 28226.6 -207.94 28226.7 -207.95 28227.1    -208
 28227.5    -208   28285 -207.72

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045 23627.5    .036 24036.1    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       23627.5 24036.1           1364.6    1215   938.9             .1       .3

CROSS SECTION


RIVER: Alamo River
REACH: Alamo River        RS: 31366

INPUT
Description:
Station Elevation Data    num=     448
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Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	-233.72	37.7	-234	194.7	-234	208.7	-233	235.7	-233
243.7	-234.11	1750.9	-233.47	1963.7	-233	1998.7	-232	2003.7	-233.69
2005.7	-233.86	2011.4	-233	2014.7	-232	2017.7	-232	2021.7	-233
2067.7	-234	2074.7	-233	2077.7	-231.5	2083.7	-227.12	2084.7	-227
2104.7	-227	2112.7	-231	2127.7	-231	2146.4	-229.03	2186.4	-228.46
2206.7	-229	2494.7	-229.01	2652.7	-230.4	2736.9	-230.66	2768.7	-231
2796.7	-231.94	2893.7	-231	2921.7	-229.03	2925.7	-228.06	2942.7	-231
2982.7	-231.69	3044.7	-231.89	3352.8	-231.56	3451.7	-231	3473.7	-229
3496.7	-231	3576.3	-231	4253.7	-229	4671.7	-229	4681.7	-228
4688.7	-228	4690.7	-229	4693.7	-229	4696.8	-227.12	4711.7	-224.09
4718.7	-222	4745.7	-222	4753.7	-224	4829.7	-226	4836.7	-228
4842.5	-228	4850.7	-227.03	4855.7	-223.94	4858.7	-223.42	4870	-223.59
4876.5	-224.14	4889.7	-229.06	4897.7	-230.19	4907.7	-230.75	4912.4	-229.7
4915.7	-228	4921.7	-227	4950.7	-228	5418.7	-228	5461.7	-227
5513.7	-226.81	6091.7	-226	6096.5	-226.89	6100.7	-227	6104.7	-226
6289.6	-226	7353.7	-224	7371.7	-223	7378.7	-223	7381.7	-224
7387.7	-224	7392.3	-223	7409.7	-223	7416.7	-224	7421.7	-224
7424.7	-222.97	7441.7	-222	7472.7	-222	7489.7	-221	7497.7	-221.2
7500.4	-222.81	7504.7	-227.93	7505.7	-228.44	7506.1	-228.59	7506.7	-228.87
7514.7	-229	7516.1	-228.27	7518.4	-225.65	7521	-223.26	7521.7	-222.73
7522.7	-221.99	7524.7	-221	7662.7	-221.81	7963.7	-222	8048.7	-221.91
8141.7	-221	8596.8	-221	8683.7	-220.16	8792.4	-219.88	8878.7	-219.88
8995.7	-221	9166.7	-221	9314.7	-219.62	9358.7	-219.62	9394.7	-219
9905.7	-219	9939.7	-218	10048.7	-218	10062.7	-217	10090.8	-217
10114.7	-218.03	10116.7	-218.91	10122.7	-223.53	10126.7	-226.06	10132.8	-227
10137.7	-227	10144.7	-226.04	10150.8	-220.84	10154.7	-216	10174.9	-216.03
10179.7	-219	10203.7	-219.16	10391.7	-219.94	10885.3	-220.25	11117.7	-219.88
11162.7	-219	12666.7	-219	12672.7	-217.99	12684.7	-217	12691	-217.06
12693.7	-218	12696.7	-218	12700.7	-217	12735.7	-217	12765.7	-218.12
12768.3	-219.29	12774.7	-224.02	12778.7	-226.55	12779.2	-226.76	12779.3	-226.79
12785.7	-227	12790.7	-225.58	12794.7	-224.06	12799.7	-220.98	12834.7	-218
12839.3	-218	12839.7	-218	12840.1	-218.06	12841.3	-218.34	12843.7	-219
12902.7	-219	15071.7	-216.03	15215.7	-215.41	15301.7	-214.03	15316.7	-213
15319.1	-213.1	15322.7	-214	15398.6	-214.16	15402.9	-216.28	15405.9	-219.07
15406.9	-220.24	15408.7	-222.97	15408.9	-223.09	15409.7	-224	15422.7	-224
15425.7	-222.43	15427.7	-220.61	15431.7	-216.03	15432.7	-216	15675.7	-216
16509.7	-215	16592.7	-214	17825.9	-214	17931.7	-213.62	17957.7	-213.03
17962.7	-212	17983.6	-212	17988.7	-211	17997.6	-211	18007.7	-212
18052.7	-212	18055.1	-213.1	18061.4	-218.05	18066.4	-221.16	18068.7	-222
18073.7	-222	18074.1	-221.99	18074.4	-221.98	18074.7	-221.97	18075.1	-221.88
18075.4	-221.79	18075.7	-221.7	18076.1	-221.6	18076.4	-221.52	18076.7	-221.42
18077.1	-221.31	18077.4	-221.22	18077.7	-221.1	18078.1	-220.93	18086.7	-215.86
18087.1	-215.68	18087.4	-215.56	18088.1	-215.21	18088.4	-215.09	18088.7	-214.92
18089.1	-214.74	18089.4	-214.63	18089.7	-214.45	18090.1	-214.28	18090.7	-214
18116.7	-214	18152.7	-213	18396.8	-213	18586.1	-212.5	19001	-212.56
19265	-212	20473.8	-211.88	20594.8	-211	20664.4	-211	20706.8	-212.03
20714.5	-217.77	20715	-217.95	20720.8	-218	20721	-217.97	20721.5	-217.9
20721.8	-217.88	20722	-217.77	20724.8	-216.25	20731.8	-211	20818.8	-211
20898.9	-211.53	21426.8	-211	22094.2	-210.84	22858.6	-209.97	23244.8	-209

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 23244.8 -208.99 23245.8 -208.75 23245.8 -208.74 23246.8 -208.44 23246.8 -208.43
 23248.7    -208 23291.8    -208 23291.8 -208.01 23292.7 -208.15 23292.8 -208.17
 23293.8 -208.34 23294.7 -208.52 23294.8 -208.53 23297.7 -208.99 23388.8    -209
 23425.4 -210.98 23426.4 -211.31 23426.8 -211.46 23431.2-214.316 23434.1  -216.2
 23434.4 -216.37 23434.8 -216.57 23435.1 -216.76 23435.4 -216.92 23435.8  -217.1
 23436.1 -217.29 23436.4 -217.45 23436.8 -217.64 23437.1 -217.82 23437.4 -217.97
 23437.8 -218.16 23438.4 -218.44 23438.8 -218.61 23439.1 -218.75 23439.4 -218.86
 23439.8    -219 23506.8    -219 23507.3 -218.95 23507.8 -218.89 23508.3 -218.73
 23508.3 -218.72 23508.8 -218.56 23509.3 -218.39 23510.2 -218.06 23510.3 -218.05
 23516.8 -215.64 23517.3 -215.36 23517.8 -215.11 23518.2 -214.87 23519.2 -214.37
 23520.2 -213.77 23529.8 -207.02 23530.2 -206.93 23530.8 -206.81 23531.3 -206.71
 23535.8    -206 23541.8 -206.22 23542.2 -206.38 23542.3 -206.43 23542.8 -206.58
 23543.2 -206.75 23543.3  -206.8 23544.3 -207.32 23544.8 -207.57 23545.2 -207.83
 23545.3 -207.93 23547.3  -209.1 23551.2 -210.77 23551.4 -210.84 23552.2    -211
 23577.4    -211 23611.8    -210 23721.8    -209 23729.8 -208.22 23737.6-208.577
 23746.8    -209 24025.8    -209 24045.2 -208.26 24053.4 -208.31 24069.8    -209
 24424.8    -209 24447.2    -208 24461.8    -209 25443.3    -209 25460.8 -208.72
 25469.3 -208.01 25531.8    -208 25532.1 -208.03 25532.4 -208.06 25532.8 -208.09
 25533.1 -208.14 25535.4 -208.44 25535.8 -208.49 25536.4 -208.57 25536.8 -208.61
 25537.1 -208.66 25537.4 -208.71 25537.8 -208.76 25538.1 -208.81 25538.4 -208.85
 25539.1 -208.93 25539.8    -209 25716.7    -209 25759.6    -208 25858.4    -208
 25874.8    -207 25880.1    -207 25880.4    -207 25880.8    -207 25881.1 -207.08
 25881.4 -207.14 25882.1 -207.33 25883.1  -207.6 25883.4 -207.66 25883.8 -207.76
 25889.8    -208 25890.2 -207.88 25890.4 -207.82 25890.8 -207.71 25891.8 -207.33
 25892.8    -207 25905.8    -207 25930.8    -208 25947.8 -209.09 25954.3 -210.51
 25954.8 -210.61 25955.2 -210.72 25955.3 -210.73 25955.8 -210.84 25956.3    -211
 25956.8 -211.14 25957.2 -211.39 25957.3 -211.43 25958.2 -211.94 25958.3 -211.98
 25958.8 -212.24 25959.2  -212.5 25959.8  -212.8 25960.2 -213.04 25960.3 -213.08
 25960.8 -213.33 25961.2 -213.57 25961.3 -213.62 25961.8 -213.86 25962.2 -214.01
 25970.8 -216.25 25975.8    -217 25976.2 -216.92 25976.3 -216.89 25976.8 -216.81
 25977.8 -216.59 25978.2  -216.5 25979.2 -216.28 25979.3 -216.25 25979.8 -216.16
 25980.2 -216.01 25980.3 -215.95 25980.8 -215.81 25981.2 -215.47 25981.3 -215.34
 25981.8 -215.01 25982.2 -214.68 25982.8 -214.21 25983.2 -213.81 25983.4 -213.63
 25987.8 -208.68 25988.2 -208.37 25988.4 -208.22 25988.8 -207.91 25989.2 -207.74
 25989.4 -207.66 25989.8 -207.49 25990.2  -207.3 25990.8 -207.02 25991.2 -207.01
 25991.8    -207 26039.5    -207 26082.8    -208 26212.7    -208 26257.8    -207
 26302.8    -207 26356.8    -208 26427.8    -208 26491.8    -207 26558.8    -207
 26622.7    -208 26705.8    -208 26749.8    -207 26818.8    -207 26895.8    -208
 26923.2    -208 26996.8    -207 27063.6    -207 27104.8    -208 27220.9    -208
 27265.8    -207 27305.5 -207.03 27383.8    -208 27460.4    -208 27493.8 -207.56
 27647.8    -208 27843.8    -208 28331.6 -206.94

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045 23431.2    .036 23737.6    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       23431.2 23737.6           1527.4    1294   992.5             .1       .3

CROSS SECTION
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RIVER: Alamo River
REACH: Alamo River RS: 30072

INPUT
Description:
Station Elevation Data num= 450

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	-234	378	-234	386.3	-233.02	398.2	-232.83	426.2	-233.11
471.2	-233	478.2	-234	522.2	-234	527.8	-233.09	533.2	-232.93
536.2	-231.92	538.2	-230.78	540.6	-230.26	551.7	-228.95	570.2	-228
584.2	-228.06	591	-230.94	594.3	-231.26	609.2	-231	611.2	-228.98
613.2	-228	633.2	-228	660.2	-228.97	666.2	-231.94	669.2	-233.03
675.2	-234	702.2	-234	705.2	-233	713.2	-233	715	-233.58
719.1	-234	894.2	-233.72	921.2	-233.51	929.8	-233	949.2	-233
955.2	-234	973.2	-234	994	-233.54	1072.2	-233	1357.2	-232.84
1490.4	-232	1783.2	-232	1894.2	-231.56	1933.2	-231	1979.2	-231
1985.2	-233	1993.2	-233	1998.2	-232	2188.2	-231	2657.2	-231
3009.2	-230.31	3027.2	-230.19	3059.2	-229.01	3159.2	-229	3163.2	-228
3166.2	-228	3168.2	-228.93	3172.3	-229	3173.3	-228.92	3175.2	-227.97
3187.3	-226.09	3197	-223.12	3198.3	-223	3221.3	-223.06	3232.3	-226
3303.2	-226.01	3308.1	-227	3335.3	-227	3337.3	-226.12	3340.3	-224.04
3354.3	-224	3355.3	-224.08	3360.3	-225.86	3366.6	-229.74	3369.6	-231.23
3372.3	-232	3376.3	-232	3385.3	-229	3919.4	-229	3942.3	-228
4505.3	-228	4538.1	-227.01	4546.3	-226	4558.3	-226.03	4564.3	-227
4576.3	-227	4586.3	-226	4591.3	-226	4594.3	-226.94	4595.3	-227
4773.4	-227	5181.3	-226	5316.3	-226	5848.3	-224	5881.3	-224
5898.3	-226	5911.3	-224	5974.4	-224	5977.4	-225.41	5980.3	-227.82
5982.3	-229	5993.3	-229	6004.3	-222.25	6005.3	-222	6021.3	-222.04
6024.3	-223.99	6031.3	-224	6036.3	-223	6614.6	-223	6641.4	-222
7223.4	-222	7242.4	-221	7431.5	-221.94	7599.1	-221	7685.4	-221
7711.4	-220.25	7779.6	-219.5	7866.4	-220.31	8171.4	-220.72	8318.4	-219
8354.4	-219.44	8453.7	-219.73	8487.4	-219	8567.4	-219	8592.4	-220.95
8595	-222.14	8600.9	-226.32	8604.4	-227.99	8608.4	-229	8612.4	-229
8621.4	-227.04	8629.4	-220.12	8630.4	-219.38	8632.7	-218.24	8633.4	-218
8650.4	-218	8653.4	-219.06	8669.4	-221	9287.3	-220.94	10485.5	-219.75
10609.5	-219.31	11178.5	-219	11210.5	-217.03	11224.5	-217	11241.5	-218.06
11249.7	-223.6	11256.2	-227.26	11260.5	-228.98	11268.5	-229	11272.1	-228.28
11275	-227.28	11283.5	-222.28	11284	-222	11286.5	-221.01	11310.5	-219
12358.6	-218.47	12512.1	-218.69	12711.4	-218	12975.2	-218.22	13472.6	-217.72
13772.6	-217.03	13778.6	-216.85	13786.6	-216	13798.5	-216	13798.6	-216
13798.7	-216.01	13799.5	-216.11	13799.6	-216.12	13800.5	-216.5	13800.6	-216.56
13800.7	-216.62	13801.6	-217	13806.4	-217	13810.6	-216	13830.6	-216
13878.6	-217	13881.6	-218.48	13890.6	-225.97	13901.6	-226	13911.7	-219.32
13912.6	-218.75	13912.6	-218.72	13912.7	-218.69	13913.6	-218.19	13914.6	-218
14048.5	-218	14423.9	-217.09	14769.7	-217.09	15491.7	-216.28	16151.7	-216
16326.9	-215.53	16441.7	-214	16532.7	-214	16537.3	-215.99	16540.7	-218.86
16546.7	-222.95	16548	-223.29	16550.7	-223.95	16552.7	-224	16553	-223.97
16554.7	-223.66	16555.4	-223.48	16555.7	-223.41	16558	-222.64	16566.7	-217.04

16567.7 -216.6 16568.5 -216.24 16571.7 -215.97 16984.7 -214.59 17248.7 -214.72
17675.6   -214 17932.7   -214 18072.9 -213.46 18244.2 -213.69 18951.8 -212.68
19045.9 -212.84   19058 -212.7 19072.8   -212 19088.8   -212 19094.8   -213
19101.8   -211 19114.8   -211 19136.7 -212.03 19181.8   -213 19183.5 -213.87
19187.5 -216.9 19188.8 -217.76 19189.1 -217.95 19189.8 -218.38 19190.8   -219
19198.8   -219 19208.2 -213.01 19214.8   -212 19220.2 -212.04 19233.8 -212.9
19252.8   -213 19589.2 -212.5 20729.9 -211.91 21401.8   -211 21668.7 -209.66
21737.2   -209 22003.9 -209.75 22450.6   -209 22451.8-209.122 22469.8 -210.95
22476.7 -212.69 22485.1   -214 22505.1 -216.01 22505.4 -216.06 22505.8 -216.18
22506.3 -216.28   22507 -216.48 22507.1 -216.51 22507.2 -216.54 22507.8 -216.77
22508.1 -216.84 22508.1 -216.85 22508.1 -216.87   22509 -217.29 22509.1 -217.36
22509.9 -217.88 22510.4 -218.28 22510.8 -218.53 22511.1 -218.78 22511.6 -218.88
22511.6 -218.9 22512.1   -219 22572.6   -219 22572.6 -218.99 22572.9 -218.92
22573.5 -218.74 22573.6 -218.72 22573.7 -218.69 22574.6 -218.41 22574.8 -218.34
22575.6 -218.11   22576   -218 22576.2 -217.93 22577.6 -217.52   22578 -217.4
22578.3 -217.31 22578.6 -217.21 22578.9 -217.13 22579.4 -216.96 22579.6 -216.9
22579.8 -216.85 22580.6 -216.58 22592.1 -212.08 22592.3 -211.97 22593.2 -211.52
22593.7 -211.23 22594.1 -210.95 22594.4 -210.76 22594.7 -210.5   22595 -210.26
22595.8 -209.61 22595.9 -209.46 22596.8 -208.67 22597.3 -208.29 22597.7 -207.89
22597.8 -207.84 22597.8 -207.78 22598.6 -207.16 22598.8 -207.03 22599.5 -206.62
22599.8 -206.47 22600.1 -206.3 22600.4 -206.18 22600.8   -206 22609.4 -206.07
22609.9 -206.14 22610.3 -206.29 22610.5 -206.38 22610.9 -206.52 22611.2 -206.62
22611.9 -206.87 22612.1 -206.95 22612.8 -207.3 22612.9 -207.34 22613.5 -207.67
22613.8 -207.86 22613.9 -207.88 22613.9 -207.91 22614.7 -208.33 22615.1 -208.51
22615.6 -208.79 22615.9 -208.92 22616.2 -208.95 22616.5 -208.98 22616.9   -209
22660.2   -209 22665.7 -208.24 22676.4   -209   22737 -209.75 22792.2   -209
22829.4   -209 22914.2   -209 23042.1 -210.19 23124.7   -209   23155   -209
  23161 -208.09 23161.5 -208.1 23161.6 -208.1 23162.1 -208.11 23162.5 -208.17
23162.6 -208.18 23163.1 -208.24 23163.8 -208.39 23164.3 -208.51 23164.9 -208.66
23165.1 -208.7 23165.2 -208.74 23166.1   -209 23756.6   -209 23756.9 -208.91
23757.3 -208.82 23757.6 -208.74 23758.7 -208.41 23759.6 -208.16 23760.7   -208
23761.4   -208 23761.9   -208 23766.8 -208.05 23767.7 -208.31 23767.7 -208.34
23768.6 -208.61 23768.7 -208.64 23769.5 -208.87 23769.7 -208.94 23769.9 -208.96
23770.4 -208.97 23770.7   -209 24433.6   -209 24456.9 -210.97 24457.1 -211.07
24457.9 -211.47   24458 -211.53 24460.7 -213.43 24460.9 -213.59 24461.2 -213.77
24461.6 -213.95 24462.4 -214.37 24462.9 -214.62 24463.4 -214.82 24463.5 -214.91
24463.9 -215.09 24464.3 -215.24 24464.7 -215.44   24465 -215.56 24465.8 -215.97
  24466 -216.03 24466.8 -216.26 24466.9 -216.31   24467 -216.31   24467 -216.32
24467.8 -216.59   24468 -216.62 24468.1 -216.68 24468.7 -216.86   24469 -216.94
24479.1   -217 24487.1 -211.37 24487.6 -211.09 24487.7 -211.01 24488.1 -210.73
24488.5 -210.54 24488.8 -210.33 24489.4 -210.03   24490 -209.66 24490.1 -209.57
24491.2   -209 24498.3   -208 24517.4 -207.49 24545.6 -207.42 24600.4 -208.99
24698.2   -209 24736.8 -208.01 24759.2   -207 24808.6   -207 24876.5 -208.98
24945.7   -209 25009.3 -207.02 25064.5   -207 25119.9 -208.99 25220.9   -209
25263.4 -207.56 25292.6 -207.11 25333.1 -207.49 25386.8 -208.99 25463.1   -209
25502.2 -208.11   25529   -207 25564.1   -207   25636   -209 25725.7   -209
  25788 -207.03 25816.1   -207 25900.9 -208.99 25972.2   -209 26058.9 -207.07
26081.9   -207 26171.9   -209   26316   -209 26619.3   -208 27638.8   -206
28032.1   -204 28049.2   -204 28073.4   -206 28203.6   -206 28386.1 -205.41

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	22451.8	.036	22829.4	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right		Coeff Contr.	Expan.
22451.8	22829.4	1393.8	1255.7	1008.8	.1	.3

CROSS SECTION

RIVER: Alamo River
REACH: Alamo River RS: 28816

INPUT
Description:
Station Elevation Data num= 452

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	-229.56	44.6	-227.97	55.6	-226.62	69.6	-223.97	82.8	-223.36
136.6	-225.27	143.6	-224.85	158.6	-226	236.7	-226	256.1	-224.03
282.7	-223.67	297.8	-224.57	301.7	-224	337.7	-224.11	348.7	-223
392.6	-223.06	397.8	-223.94	430.8	-225.56	452.5	-227.99	468.6	-227.97
481.8	-226.02	493.9	-226	528.8	-227.98	555.8	-228.59	599.9	-228
614.9	-226.95	626	-224.09	639.9	-222.61	684.9	-224.97	701.9	-224.02
731.9	-224	757.7	-221.01	771.6	-220.99	788.9	-219.93	839.2	-220.39
867	-221.35	884.8	-220.48	928	-223.7	956.5	-224.25	970.2	-225.92
981	-228.12	988	-227.51	1001.9	-222.03	1010.2	-222	1079.1	-224
1190.4	-224	1219.2	-225.43	1238.2	-227.95	1250.2	-228.24	1329.3	-228.66
1345.8	-228.14	1350.2	-227.16	1369.9	-227	1377.8	-228.45	1386.2	-228.58
1400.9	-227.8	1412.6	-226.35	1427.3	-226.05	1468.3	-218.94	1491.3	-218.4
1500.3	-215.86	1510.3	-216.12	1535.3	-215.29	1548.2	-214.01	1555.3	-214.53
1572.3	-213.75	1583.3	-212.47	1600.3	-212.81	1605.3	-212	1619.4	-212
1622.4	-213.42	1626.7	-217.05	1629.8	-218.26	1638.4	-219.46	1653.4	-224.07
1676.4	-226.93	1685.2	-228.98	1724.9	-230.01	1806.4	-230.72	1855.5	-230.19
2662.6	-229	2671.8	-226	2696.9	-226	2702.9	-228	2715.9	-228
2721.9	-225.85	2730.9	-224	2744.9	-224	2761.9	-225.97	2769.9	-226
2775.6	-223.55	2778.9	-223.06	2784.5	-223.8	2789.9	-226.96	2792.9	-228
2799.9	-227.91	2809.6	-226.02	2827.9	-226	2837.9	-228.97	2848	-229
2865.9	-230.21	2876	-230.97	2880.5	-232	2886.7	-230.49	2897	-229.31
2967	-230.34	3312.2	-229.34	5216.1	-228.31	5330.2	-228	5340.2	-227
5367.2	-227	5370.2	-228	5376.2	-228	5378.2	-227.05	5388.2	-226
5450.2	-226	5458.2	-230.72	5464.2	-231	5471.2	-228.98	5475.2	-226.02
5476.6	-226	5497	-226	5501.2	-227	5625.3	-227	5645.3	-226
6468.7	-226	6582.6	-224.71	6587.8	-224	6608.8	-224.47	6612.8	-224
6739.9	-224	6774	-225.78	6812.9	-225.23	6820.9	-224	7191.3	-223.99
7205.4	-223.48	7219.1	-224	7277.1	-224	7301.1	-223.32	7315.2	-223.81
7343.1	-223.25	7510.2	-223	7518.2	-222.07	7535.2	-222	7547.2	-223
7567.3	-222.97	7573.1	-222.05	7578.3	-222.03	7705.3	-223.91	7852.4	-224
7857.4	-222.84	7888.4	-221.28	7906.9	-221.41	7920.5	-223	7927.3	-223
7938.4	-222.05	7965.4	-221.12	7978.7	-221.65	7981.3	-221.98	7984.5	-224
7988.5	-224	7993.5	-221	8009.2	-221	8054.5	-223.03	8061.1	-227.25

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   8067 -228.94  8070.8    -229  8076.7 -228.96  8079.6 -227.87  8082.5 -225.94
 8085.6  -222.3  8087.5    -221  8109.5 -221.11  8120.3 -225.71  8129.5 -226.95
 8146.5    -224 10125.3 -223.62 10305.6 -223.06 10355.6    -224 10425.4    -224
10648.8    -223 10653.1 -221.98   10669    -221 10700.8    -221 10722.8 -222.08
10733.6 -228.95 10748.8    -229 10752.4  -227.4 10760.5 -222.03 10764.8    -221
10779.1 -221.01 10794.8    -223   10808 -222.28 11079.3 -222.78 11129.8    -222
11152.1    -222   11171 -222.78 11317.1 -222.75 11366.5    -222 11415.1    -222
11453.2 -222.72 11583.8 -222.66 11630.1    -222 11642.5 -222.66 11665.3 -222.66
11692.3    -222 12447.3 -221.53   13139 -219.94   13283    -219   13286    -218
13343.1    -219 13353.1 -220.94 13365.1    -227 13376.1    -227 13376.5 -226.99
13377.1 -226.98 13379.6 -225.85 13387.1    -221 13416.1    -221 13435.9    -219
13664.2    -219 13672.2    -218 13786.3    -218 13798.7    -219 13819.5    -218
13895.7    -219 13906.3    -219 13918.7    -218 14744.8    -218 14750.5 -217.09
14757.8    -218 14854.8    -218 14891.1    -217 14922.2    -218 14934.8 -217.97
14943.9    -217 14980.9 -217.78 15031.8    -217 15062.9    -218 15093.1 -217.99
15100.9    -217 15163.2    -218   15173 -217.98 15185.9    -217 15195.2 -217.01
  15208    -218 15263.3    -217 15312.9    -217   15324    -218   15345    -217
15675.2    -217 15906.7    -218   15914 -217.03 15931.3    -217 15934.3    -218
15936.3    -218 15942.3    -216 16008.4    -217 16010.4 -217.87 16013.4  -220.9
16017.4 -223.84 16031.4    -224 16034.4 -223.09 16041.4    -219 16078.4 -217.97
16497.6    -217 17920.3    -216 18568.6    -214 18572.6    -213 18640.7 -213.41
18647.7 -214.06 18652.7 -215.78 18661.7    -221 18667.7    -221 18677.7    -214
18720.7    -214 18781.5    -213 18809.8    -213 18815.7  -213.8 18826.7    -213
19008.1    -213 19014.3    -214 19021.2    -214 19025.8    -213 19207.9    -213
19213.6 -213.58   19221 -213.01   19359    -213 19362.7    -214   19368    -213
19662.2    -213 19668.3    -214 19669.1    -214 19669.2    -214 19669.2 -213.99
19670.1 -213.82 19673.2    -213   19710    -213 19712.9 -213.96 19715.8    -214
19722.8 -213.01 19890.3 -212.99 19956.3    -212 19963.2 -212.89 19966.5 -213.89
19969.6    -214   19970    -214 19974.3 -213.01 19974.8 -212.99 19995.3    -212
  20014 -212.99 20064.4 -212.02 20102.8    -212 20114.2 -212.99 20114.4 -213.02
20114.5 -213.09 20115.4 -213.51 20115.5 -213.57 20116.3 -213.95 20123.4    -214
  20131 -213.01 20158.6 -213.01 20164.4 -213.94 20179.4 -212.54 20199.4 -212.36
20221.2    -213 20239.2    -212 20260.1 -212.02   20264 -212.88 20266.8    -213
20284.6    -212 20305.7 -212.02 20319.2 -213.43 20339.4 -212.17 20357.9  -212.2
20366.2    -213 20372.5    -213 20393.5    -212 20412.4 -212.03 20412.5 -212.03
20412.7 -212.09 20413.3 -212.34 20413.5 -212.41 20413.7 -212.48 20415.5    -213
20435.4    -212 20512.1    -212 20516.7    -213 20523.4 -212.99 20528.5    -212
20557.9    -212 20566.2    -213 20570.6 -212.88 20572.4 -212.53 20576.5    -212
20615.2    -212 20618.5    -213 20630.4 -212.98   20641    -212 20658.1 -212.02
20666.5    -213 20675.8 -212.99 20686.8    -212 20714.5    -212 20717.9    -213
20728.9 -212.99   20733    -212 20766.7    -212 20770.8    -213 20779.7    -213
20784.1    -212 20816.9    -212   20820    -213 20835.9    -213 20840.4    -212
  20869    -212 20873.1    -213 20881.2    -213 20887.4    -212 20920.2    -212
20925.3    -213 20930.4    -213   20932 -212.91 20936.5    -212 21027.5    -212
21033.7    -213 21040.8    -212 21078.7    -212 21081.8    -213 21086.8    -213
21089.9    -212 21235.1    -212 21239.2    -211 21255.6    -211 21265.4    -213
21285.3    -213 21288.3    -212 21298.6  -211.9   21721    -212 22225.1    -211
22559.5    -211 22610.3-211.477 22614.8 -211.52 22637.3 -219.01 22680.2 -220.96
22705.6    -221 22727.5 -220.32 22747.6 -218.94 22751.1 -218.19 22754.9 -216.65
22767.9 -209.54 22780.4    -208 22787.6    -208 22794.9 -209.12 22805.1-209.493
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 22846.2    -211   23301    -211 23322.1 -211.97   23345    -212 23350.1    -213
 23371.2 -212.93   23379 -211.98 23481.3    -211 23701.9    -211 23732.6    -209
 23747.9    -211 23873.7 -211.01 23893.2 -215.37 23897.2 -214.93 23909.5 -211.02
 24012.8 -209.07 24059.8 -210.93   24070  -212.4 24079.2    -213 24508.8    -213
 24548.4 -217.62 24574.3    -218   24600 -215.36   24628    -211 24736.9    -211
 24833.3 -213.62 24895.4    -216   25554    -216 25655.9 -212.78 25781.1    -213
 25788.2    -211 26201.4    -209 27495.3    -206 27642.4    -206 27659.8 -206.97
 27704.8    -207 28817.3    -204

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045 22610.3    .036 22805.1    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       22610.3 22805.1            2027.8  3687.7  3404.1             .1       .3

CROSS SECTION


RIVER: Alamo River
REACH: Alamo River        RS: 25128

INPUT
Description:
Station Elevation Data    num=     449
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  -209.1    31.2 -209.59    37.2    -209    46.2 -208.97    62.3 -206.92
    76.3    -206    92.1 -206.05   105.1 -206.94   123.3 -206.48   141.3 -207.23
   163.3    -207   174.3    -204   185.3 -204.01   208.3 -205.99   268.4    -206
   284.4    -207   326.4    -207   353.4    -206     410 -206.01     435 -211.02
   443.4 -216.19   445.4 -216.99   451.4    -218   473.5    -218   479.5 -216.53
   485.4 -215.82   491.5 -214.08   505.5    -213   510.5 -213.62   514.5 -215.26
   519.5 -218.35   523.5 -219.12   534.5 -219.47   550.5 -218.97   554.5    -218
   592.5 -218.38   598.1 -219.19   610.5 -222.04   629.5 -223.98   681.6    -224
   686.6 -222.85   694.6 -219.15   697.6    -219   743.6    -222   753.6 -223.02
   773.6 -223.03   775.6    -224   831.3 -224.84   883.6    -224   946.7 -224.06
  1006.7    -227  1012.7 -227.98  1023.7 -228.98  1042.5 -230.16  1062.7 -230.43
  1076.7    -233  1094.9 -232.99  1098.8    -231  1120.8 -228.92  1130.7    -226
  1133.8 -226.07  1143.8 -227.48  1150.8 -227.03  1161.7 -227.64  1172.8    -227
  1215.8    -227  1287.8    -229  1319.9    -231  1366.9    -231  1416.7 -229.01
  1458.9 -229.44  1484.8    -229    1543    -229    1566    -226    1578    -226
    1582    -228    1607    -228    1610 -227.18  1614.1 -224.24    1618 -222.37
    1623    -221    1643    -222    1653 -224.01  1678.9 -227.11  1691.7 -227.08
    1698 -226.02    1717    -226    1723 -228.07  1727.4 -229.01  1742.1 -229.93
  1762.1 -230.61  1795.1    -231  1799.1 -231.99    1880    -232  1886.1 -231.33
  1893.1 -229.15  1895.1    -229  1901.4 -229.09  1915.1    -231  3529.9 -230.56
  3959.1    -229  4234.3    -229  4242.3    -228  4260.5 -228.02  4265.3    -229
  4268.3    -228  4312.3    -227  4316.3    -226  4339.3    -226  4340.6  -226.6
  4343.3 -229.14  4347.3 -230.97  4361.3 -229.03  4368.3    -226  4379.3    -226
    4387 -226.84  4394.3    -229  4778.3    -229  4862.6    -228  4871.6    -228
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4874.6	-229	4876.7	-229	4903.9	-228	4940.8	-228	4995.6	-227
5615.9	-227	5625.9	-226	6235.3	-224.81	6644.4	-224.28	6686.4	-224.56
6747.7	-225.75	6845.3	-224.01	6850.5	-223	6866.5	-223	6869.5	-224
6876.5	-224	6880.4	-223	6898.5	-223	6927.5	-224	6945.6	-225.97
6949.5	-228.74	6950.5	-228.99	6963.6	-229	6965.1	-228.67	6969.6	-225.99
6972.3	-223.38	6973.6	-221.6	6974.6	-221	6990.6	-221	6993.6	-221.96
7000.6	-226	9476.6	-226	9550.3	-224.02	9590.5	-223.83	9611.8	-224.01
9617.4	-227.43	9620.8	-229	9634.9	-229	9635.7	-228.97	9635.8	-228.97
9639.8	-226.27	9643.8	-224.63	9650.8	-224	11488.7	-223	12089	-222
12102.5	-221	12112.3	-222	12136	-222	12148	-221	12163	-221
12165.4	-221.91	12171.1	-222	12174.1	-220.97	12186.1	-220.62	12244.1	-221
12246.2	-221.68	12247	-222.12	12247.1	-222.16	12254.1	-227.06	12260.1	-228
12266.6	-226.87	12268.7	-225.67	12272.1	-222.84	12274.1	-222	12310.1	-222
12315.1	-221	12585.3	-221	12969.4	-220.03	13204	-220.09	13660.8	-219
14828.3	-219	14835.3	-218	14898.4	-218	14899.4	-218.06	14901.4	-219.41
14908.4	-225.73	14913.4	-226	14920.4	-224	14925.2	-221.29	14925.4	-221.17
14925.6	-221.12	14926.2	-220.98	14926.4	-220.94	14948.4	-219	15124.5	-219
15544.6	-218	16346.3	-218	17047.9	-217	17410.6	-216	17431.6	-214
17524.6	-214	17535.6	-215.94	17541.6	-219.78	17546.6	-222	17553.8	-221.73
17555.6	-221	17561.6	-216.99	17562	-216.73	17562.6	-216.33	17563.1	-216.19
17563.2	-216.14	17563.6	-216	17710.7	-216	17838.7	-214.91	17942.6	-214.81
17999.9	-215.69	18077.5	-215.05	18225.9	-216	18317.8	-215.51	18377	-216
18411.7	-215.02	18434.1	-214.95	18463.4	-214	18490.2	-216	18540.8	-215.3
18553.1	-216	18579.1	-214	18601.1	-214.03	18608.1	-215.78	18608.4	-215.83
18608.9	-215.95	18609.1	-216	18609.3	-216	18612.2	-216	18622.3	-214
19431.1	-214	19510.5	-214.78	19579.9	-214.6	19939.2	-215.86	20023.1	-214.81
20132	-214.72	20215.4	-214	20215.9	-214.06	20222.8	-215.84	20232.2	-216.5
20247.8	-216.604	20254.7	-216.65	20275.2	-218	20311.5	-218.59	20340.3	-218.45
20340.7	-218.47	20340.9	-218.49	20341.4	-218.52	20341.7	-218.55	20342.4	-218.59
20342.5	-218.59	20346.7	-219.14	20347.1	-219.28	20347.6	-219.46	20347.8	-219.54
20347.9	-219.59	20348.2	-219.72	20348.7	-219.96	20351	-221.03	20361.1	-221.98
20423.6	-222	20439.6	-220.86	20447.3	-219.571	20450.3	-219.07	20450.4	-219.04
20450.7	-218.96	20451.2	-218.81	20451.4	-218.76	20451.8	-218.65	20452.8	-218.39
20453.5	-218.19	20453.6	-218.18	20454.3	-217.97	20457.8	-216.44	20464.2	-213
20476	-213	20476.1	-213.03	20476.3	-213.14	20476.8	-213.32	20477	-213.4
20477.4	-213.59	20477.6	-213.68	20478.4	-213.96	20498.4	-216.05	20498.6	-216.11
20499.1	-216.24	20499.4	-216.29	20499.4	-216.32	20499.6	-216.37	20500.1	-216.5
20500.9	-216.72	20501.4	-216.84	20501.6	-216.91	20501.7	-216.94	20502	-217.02
20502.5	-217.17	20502.7	-217.23	20503.1	-217.35	20511	-220.25	20517.6	-221.97
20533.5	-222.99	20550.7	-223	20718.4	-221.85	20729.1	-221.03	20744.1	-216.77
20760	-214.06	20778.2	-213.09	20787.5	-212.13	20787.8	-212.09	20788.3	-211.98
20789.1	-211.76	20793	-209.82	20795.3	-209.06	20796.4	-209	20797.4	-209
20798.2	-209.28	20798.4	-209.37	20804.9	-212	20817.8	-211.99	20824	-210.09
20831.6	-210.97	20835.9	-212	20844.4	-212	20845	-211.94	20845.5	-211.89
20852	-209.31	20856.2	-209	20862.6	-212	20875.3	-211.97	20875.4	-211.97
20876.1	-211.66	20876.5	-211.48	20876.9	-211.29	20877.3	-211.08	20877.5	-210.96
20877.6	-210.93	20877.9	-210.86	20878.4	-210.72	20878.6	-210.69	20886.9	-211
20887.1	-211	20887.5	-211.05	20890.1	-211.95	20890.8	-212.1	20891	-212.12
20891.4	-212.16	20891.6	-212.15	20904	-212	20904.2	-212	20904.6	-211.83
20905.3	-211.57	20907.4	-210.98	20915.7	-210.96	20916	-210.96	20916.6	-211.16

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   20917 -211.29 20917.2 -211.37   20918 -211.71 20918.1 -211.75 20918.3 -211.81
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 20921.3 -212.54 20921.7 -212.62 20921.9 -212.66 20922.4 -212.75 20923.4 -212.93
 20923.4 -212.94 20923.5 -212.94 20930.9    -213 20932.8 -212.79 20938.8 -211.15
 20946.9    -211 20947.5 -211.02   20948 -211.05 20949.1 -211.65 20949.1 -211.66
 20949.1 -211.67 20949.9 -212.01 20950.1 -212.15 20950.6 -212.33 20950.8 -212.38
 20951.2 -212.55 20951.4 -212.62   20952 -212.84 20952.2 -212.94 20952.3 -212.97
 20952.5 -212.98 20973.6 -212.92 20991.8 -213.69 21002.7  -213.5 21013.2 -213.98
 21053.7    -214 21064.4 -215.31 21079.6 -215.74 21090.5 -215.79   21105    -214
 21113.1 -213.96 21124.2  -213.2 21124.6 -213.24 21128.5 -213.94 21135.3    -214
 21135.5    -214   21136    -214 21136.3 -213.98 21137.1  -213.9 21138.6  -213.7
 21142.8 -213.96   21157 -216.68 21171.2 -218.78 21216.8    -222 21239.6    -222
 21248.1 -219.73 21256.7 -218.17 21270.9 -213.96 21347.4    -213 21373.5    -213
 21379.2    -214 21387.7    -214 21394.9    -213 21413.6 -213.01 21430.4    -214
 21467.9 -213.54 21521.5    -214 22693.1 -213.75   23005 -213.03 23019.6    -212
 23073.1 -212.97 23078.7    -214 23636.2    -214 24764.4 -212.38

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045 20247.8    .036 20447.3    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       20247.8 20447.3             2183  2435.1  2561.2             .1       .3

CROSS SECTION


RIVER: Alamo River
REACH: Alamo River        RS: 22693

INPUT
Description:
Station Elevation Data    num=     440
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    -229   153.2    -229   170.2 -228.65   185.2    -229   268.3    -229
   276.3 -228.31   286.3 -228.54   290.3    -229   301.3 -228.66   316.4    -229
   333.3 -228.24   361.4    -228   367.3  -227.7   378.3 -226.11   383.3 -226.13
   389.3 -226.92   404.3 -228.01   428.3 -228.75   503.4 -229.22   884.5    -229
   889.5    -228   904.8 -228.01   910.4    -229   962.5    -229   967.5 -228.02
   982.7 -228.14  1003.9 -227.27  1044.5    -227  1051.6    -228  1086.2 -228.03
  1099.6    -229  1123.6 -228.62  1128.8    -229  1222.9    -229  1224.6 -228.88
  1227.6    -228  1230.6    -228  1249.6    -231  1855.8    -231    2165    -228
    2202    -227    2209  -225.9    2215 -224.16  2220.8 -221.93  2225.7    -221
    2247    -221    2272  -230.9    2284 -233.06  2297.8    -234    2339 -233.98
    2355 -233.04    2358 -232.17    2360    -232  3130.3    -232  3672.5    -231
  3857.6    -231  3858.6 -230.97  3867.6 -227.59  3870.6    -227  3898.6    -227
    3900 -227.37  3902.6 -229.02  3909.6    -231  3931.6    -231  3947.6    -228
  3970.6    -228  3981.6    -231  3986.3 -230.96  4005.6 -229.09  4008.6    -228
  4036.6    -228  4049.6    -231  4087.7    -231  4088.7  -230.9  4092.1 -229.03
  4095.3 -228.03  4103.7 -227.56  4109.7    -229  5796.3    -229  5976.1 -228.65
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6068.4	-228	6455.5	-228	6482.5	-227.03	6485.5	-226	6508.5	-226
6515.5	-224	6530.5	-224	6580.6	-226	6584.6	-228.22	6586.6	-229
6600.6	-229	6601.6	-228.82	6602.6	-228.03	6604.4	-226.07	6606.6	-224.2
6609.2	-223.3	6612	-223	6620	-223.02	6631.5	-223.99	6636.6	-226.05
6641.6	-227	6910.2	-227	7219	-227.66	8561.2	-227.66	8896.4	-227
8901.4	-228	8906.4	-227	9218.5	-227	9225.5	-226	9249.5	-226
9255.5	-229	9273.5	-229	9278.5	-226	9311.5	-226	9317.5	-228
9709.7	-227	11259.3	-227	11503.2	-226	11535.3	-226	11542.5	-227
11724.5	-227	11770.4	-225.99	11787.4	-224.07	11811.5	-223.98	11816.5	-223
11827.5	-223	11834.4	-224	11863.5	-224	11874.6	-223	11878.5	-223
11887.5	-224.05	11892.5	-227.11	11896.2	-227.94	11904.5	-228	11907.7	-227.18
11911.5	-225.05	11911.6	-225.01	11912.6	-224.67	11915.5	-224	12604	-224
12943.8	-223	12984.7	-223	12990.9	-224	12997.5	-224	13002.9	-224
13007.5	-223.19	13009.9	-223	13093.9	-223	13100	-223.62	13108.9	-223
13185	-223	13192	-224	13198	-224	13204	-223	13576.1	-223
13583.1	-224	13592.1	-224	13607.1	-223	13895.2	-223	13940.5	-222.06
13992.4	-223	14010.3	-222	14327.4	-222	14337.9	-222.99	14398.4	-223
14438.4	-221	14457.4	-221.06	14457.7	-221.17	14458.1	-221.27	14460.4	-222
14460.7	-222	14461.4	-222	14462.4	-222	14466.3	-221.01	14540.4	-221
14541.4	-221.23	14545.5	-224.26	14548.4	-225.75	14548.6	-225.79	14549.3	-226.1
14553.7	-227	14560.5	-225.88	14569.1	-222.09	14579.4	-221	14593.8	-221.02
14601.5	-222	14907.3	-222	15185.7	-221	15477.9	-221	16166	-219
16337.4	-219	16637.2	-218	16807.3	-218	17025.3	-217	17032.3	-216
17036.3	-216	17040.3	-217	17041.1	-217	17041.3	-217	17041.6	-217
17042.1	-217	17042.6	-216.89	17043.1	-216.71	17043.3	-216.59	17043.6	-216.46
17044	-216.27	17044.4	-216.12	17044.7	-216.09	17045	-216.04	17045.4	-216
17045.7	-216	17075.4	-216	17075.5	-216.06	17076.2	-216.34	17076.4	-216.41
17076.5	-216.5	17077.2	-216.81	17078.4	-217	17083.4	-217	17085.4	-216.04
17085.8	-216.02	17105.4	-216	17168.4	-218	17171.4	-219.11	17176.5	-221.96
17177.4	-222.28	17178.3	-222.57	17178.4	-222.6	17178.5	-222.62	17179.3	-222.89
17180.4	-223	17184.5	-222.98	17187.4	-222.16	17187.6	-222.09	17193.7	-218.5
17195.4	-218	17200.4	-217.97	17567.1	-217.41	18339.2	-218	18366	-217.01
18427.2	-217	18977.5	-218	19009.4	-217.99	19026.4	-217.131	19029	-217
19056.3	-217	19062.6	-217.72	19066.6	-218.48	19068.8	-219.06	19075	-221.65
19080.6	-222.98	19110	-223	19160.1	-220.5	19181.4	-220.96	19210.4	-221
19221.8	-223	19268.6	-223	19269	-222.98	19269.6	-222.93	19269.8	-222.9
19269.8	-222.89	19270.5	-222.8	19270.9	-222.75	19271.2	-222.7	19274	-222.28
19274.2	-222.26	19282.3	-221.66	19283	-221.53	19283.4	-221.46	19283.8	-221.4
19284.4	-221.28	19297	-217	19308.5	-217.02	19317.6	-218	19326.8	-218
19330.1	-217.261	19335.6	-216.03	19335.9	-216	19337.1	-216	19337.5	-216.07
19338.2	-216.24	19338.2	-216.25	19339	-216.53	19339.4	-216.67	19340.3	-216.96
19340.4	-216.99	19340.5	-217	19340.7	-217	19341.2	-217	19341.6	-217
19341.9	-217	19342.4	-217	19342.8	-217	19343.2	-217	19343.9	-217
19344.5	-216.89	19344.9	-216.8	19345.1	-216.75	19345.6	-216.59	19345.8	-216.54
19346.2	-216.42	19346.3	-216.39	19348.5	-216	19351.9	-216.19	19356.6	-216.99
19452.3	-217.66	20445.2	-217.81	20623.7	-218	20630.2	-218.77	20631	-218.68
20631.5	-218.61	20631.7	-218.59	20631.8	-218.57	20632.4	-218.4	20632.8	-218.31
20633.2	-218.23	20633.8	-218.09	20650.8	-218	20713.4	-218.84	20861.1	-218
21029.8	-218	21051.3	-222.82	21064.6	-223	21074.6	-221.93	21094	-217.94
21098.6	-217.49	21099.1	-217.42	21099.2	-217.41	21099.7	-217.34	21099.9	-217.31

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 21101.4 -217.11 21101.6 -217.08   21102 -217.03 21102.1 -217.02 21174.9    -216
 21252.3    -216 21275.1    -217 21323.5    -217 21355.2    -216   21378    -216
 21378.6 -216.13 21382.2 -217.05 21382.6 -217.12 21382.9 -217.16 21383.7 -217.29
 21384.1 -217.34 21388.6    -218 21388.8    -218 21389.2    -218 21389.7    -218
   21390    -218 21390.5    -218 21391.3 -217.97 21391.4 -217.96   21392 -217.93
 21392.2 -217.92 21392.5 -217.91 21392.9 -217.86 21393.7 -217.76 21393.8 -217.73
 21394.3 -217.67 21394.4 -217.66 21394.6 -217.63 21395.4 -217.55   21405    -216
   21434    -216 21441.1 -216.87 21441.5 -216.91 21442.3    -217   21443 -217.02
 21443.7 -217.04 21444.4 -217.07 21446.7 -217.13 21522.1    -217 21523.2 -216.94
 21529.1 -215.63 21533.5 -215.25 21549.5    -216 21886.9    -216 21897.7 -217.19
 21990.2 -216.96 22022.2    -216 22613.5    -216 22637.8 -216.75 22713.6    -217
 22714.4    -217 22715.1    -217 22715.2    -217 22716.3    -217 22716.6    -217
 22717.2    -217 22717.3 -216.99 22725.4 -216.06 22747.5    -216 22750.3 -216.28
 22750.8 -216.35 22751.2 -216.42 22751.9 -216.54 22752.4 -216.62 22752.7 -216.67
 22752.8 -216.69 22753.3 -216.77 22753.4 -216.78 22753.9 -216.87 22754.1 -216.89
 22754.5 -216.93 22754.9 -216.98 22755.1    -217 22976.6    -217 23065.4    -216
   23085 -214.03 23112.4    -214 23134.7 -215.96 23162.6    -217 23514.3    -217
 23795.1    -216 24715.2    -214 24891.1    -213 24891.3 -212.97 24896.8 -212.13
 24897.2 -212.11 24897.9    -212 24900.2    -212 24903.8    -213 24913.2    -213
 24915.6  -212.7 24916.3 -212.52 24916.5 -212.47   24917 -212.36 24917.8  -212.2
 24918.6 -212.05 24919.2 -212.03 24919.6    -212 24942.4    -213 25186.7    -213
 25641.4    -212 25778.9    -212 26006.6    -211 26203.9    -211 26449.6  -209.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045 19026.4    .036 19330.1    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       19026.4 19330.1           2512.2  2709.9  2712.4             .1       .3

CROSS SECTION


RIVER: Alamo River
REACH: Alamo River        RS: 19983

INPUT
Description:
Station Elevation Data    num=     452
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 -232.04     4.1 -231.85    16.1    -233    24.1 -232.06    33.1 -231.99
    41.1 -231.21    63.1    -234   317.1    -233   329.1    -232   368.1    -232
   372.3    -231   416.1    -231   419.1 -231.86   424.9    -232   440.1    -232
   443.1    -231   486.4    -231   491.3 -231.97   505.1    -233   545.1    -232
   555.1 -232.51   582.2 -231.14   587.2    -232   613.2    -232   630.1 -231.07
   644.2 -231.21   651.2 -231.99   781.2    -232   788.2    -233   797.5    -233
   828.6 -232.04   847.2 -231.98     860 -231.02   873.1    -232   952.2    -232
   959.2 -231.01   974.2    -231   977.2    -232  1006.2    -232  1013.2    -231
  1039.2    -231  1043.2 -230.03  1050.2 -230.12  1072.6 -229.01  1095.9 -228.98
  1104.2    -228  1112.2    -228  1124.1 -228.81  1171.2    -229  1182.2 -227.78
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1215.2	-228	1230.2	-228.82	1239.1	-227.88	1257.2	-228	1262.3	-229
1398.2	-229	1486.2	-231	1503.2	-233	1530.2	-233	1536.5	-230.83
1550.6	-229.18	1569.2	-228.98	1576.2	-228.36	1581.2	-229	1628.2	-229
1732.1	-231	1985.2	-231.06	2123.2	-229	2195.2	-229	2208.2	-228
2287.2	-227	2328.2	-226	2363.2	-226	2394.2	-227.02	2397.6	-227.95
2418.2	-229	2559.2	-229	2579.1	-228	2591.2	-228.03	2604.3	-229
2618.2	-229	2636.9	-226.03	2645.2	-222	2666.2	-222	2669.2	-223.08
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2728.1	-226.05	2729.2	-226	2759.2	-226	2765.2	-229.08	2770.6	-230.87
2781.2	-232	2963.2	-232	3082.2	-231.1	3610.3	-231	3743.3	-229.75
4014.3	-229.06	4756.3	-229	4823.3	-227	4877.3	-227	4918.2	-228
5103.3	-228	5112.3	-227	5140.3	-226.69	5160.3	-227	5168.3	-231.75
5172.3	-232	5175.3	-231.05	5181.3	-228	5236.3	-228.01	5255.3	-229
5264.1	-228.98	5271.3	-228.1	5282.2	-229	5415.3	-229	5456.3	-228
5462.9	-228.04	5468.3	-229	5470.9	-228.97	5476.3	-228	6482.6	-228
6507.3	-229	6523.4	-229	6541.3	-228	7550.4	-228	7730.5	-229
7788.4	-228.06	7796.4	-226	7817.4	-226	7826.4	-228.99	7873.4	-229
7886.4	-226	8110.4	-226	8173.4	-227	8235.4	-227	8263.4	-227
8294.4	-226	8334.4	-226	8335.3	-226.01	8338.4	-229	8344.4	-229
8345.4	-228.44	8347.4	-226.03	8348.4	-226	8395.4	-226	8415.4	-227
8475.4	-227.84	8638.4	-227.42	8655	-226.91	8665.4	-224	8679.1	-224.01
8690.4	-225.02	8717.4	-224.92	8743.4	-225.43	8795.4	-224.22	8898.4	-224
8914.4	-226.89	8921.1	-227	8934.7	-226.94	8974.4	-224.76	8979.4	-224
9149.4	-224	9172.4	-225.98	9203.4	-227	9416.8	-227.39	9446.4	-228
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12191.5	-225.69	12212.5	-224.61	12317.5	-224.54	12359.5	-224.06	12796.3	-224
12809.9	-223.6	13011.5	-222.91	13038.3	-222.44	13048.6	-221.99	13057.6	-221
13099.6	-221	13100.6	-221.04	13100.8	-221.11	13101.3	-221.17	13101.6	-221.23
13101.8	-221.33	13102.3	-221.52	13103.3	-221.9	13105.6	-222	13109.4	-222
13112.7	-221	13133.6	-221	13173.6	-222.19	13214.9	-222.01	13245.6	-223.17
13306.2	-223.6	13618.6	-221.98	13632.6	-221.29	13653.6	-221.9	13758.5	-221.08
14183.6	-221	14194.3	-220.53	14253.7	-220.43	14290.5	-222	14310.9	-222
14344	-221.41	14462.4	-221	15655.1	-221	15824	-219	15866.7	-219.05
15871.1	-220.63	15874.6	-222.64	15878.3	-224	16035	-223.99	16048	-221.02
16052.7	-220.38	16087.1	-219	16096.5	-219.44	16128.3	-222.95	16144.3	-223.37
16147.8	-223.08	16152.7	-221	16172.3	-219.03	16182.3	-219	16191.8	-223.22
16192.1	-223.32	16194.5	-224	16213.9	-224	16231.5	-224	16249.4	-223.04
16263.7	-222.86	16274.5	-222.02	16300.7	-222	16310.4	-221	16344.9	-221
16364.6	-223.07	16387.8	-223.98	16415.3	-224	16440.4	-223	16444.8	-222.07
16452.3	-219.71	16465.4	-218.56	16498.4	-219.6	16542.8	-221	16770	-221
18147.3	-219	18151.1	-218	18156.7	-218	18159.6	-218.95	18165.8	-219
18171.1	-217.09	18171.2	-217.08	18171.3	-217.06	18171.9	-217.01	18172.3	-217
18188.5	-217.03	18193.6	-218.85	18200.1	-219.06	18531.8	-219.09	18655.4	-219.76
18797.7	-219	18808.5	-217.87	18828.9	-218.02	18840.8	-221	18855.1	-220.98
18861.1	-219	18881.4	-219	18907.5	-220.56	18923.5	-221	18997.2	-219.25
19033.9	-219	19041.3	-220.67	19048.5	-223.17	19048.5	-223.19	19049.2	-223.37
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 19194.5    -219 19210.8 -218.04 19220.3    -218 19249.4 -220.21   19272    -221
 19296.4    -221 19334.7    -219 19696.9    -219 19702.6    -218 19725.6 -218.01
 19745.5    -219 20410.7    -219 20715.2    -218 20720.7 -217.55 20727.9    -216
 20762.5    -216 20788.6 -217.69 20798.8 -217.75 20808.2 -217.29 20820.4 -216.04
 20837.4    -216 20837.7    -216 20837.9    -216 20838.9    -216   20840 -216.04
 20843.6    -217 20984.4    -218 21729.4    -218 21740.8 -217.02 21746.1    -216
 21755.4    -216 21765.2    -217 22180.3    -217 22185.5    -216 22196.4 -216.02
 22210.4    -217 22231.9    -217 22283.1    -216 22322.8    -216 22334.2 -216.65
 22366.8    -217 23839.7    -214   23964    -213 23982.5    -212 24011.8 -212.28
 24028.3 -218.12   24029 -218.53 24029.7 -218.94 24031.8 -220.05 24031.9  -220.1
 24032.6 -220.48 24033.1 -220.69 24033.8 -221.02 24034.3 -221.14 24034.8 -221.27
 24037.4 -221.88 24038.4 -221.94 24039.1 -221.99 24039.3    -222 24041.1    -222
 24057.9 -218.28 24070.4 -213.98 24081.4    -213 24094.1    -213 24114.3    -214
 24323.1    -214 24332.5 -213.02 24332.7 -212.99 24333.3 -212.88   24334 -212.75
 24334.7 -212.57 24335.4  -212.4   24336 -212.26 24336.1 -212.23 24336.8 -212.12
 24337.8    -212   24360 -212.02 24365.8 -212.78 24376.3    -213 24814.9    -213
 24820.3 -212.15   24821 -212.05 24821.3 -212.04 24821.8 -212.02 24822.1    -212
 24823.2    -212   24834    -212 24843.6    -213 25197.1    -213 25360.4 -211.99
 25374.6    -211 25387.9 -211.02 25403.7    -212 25569.3    -212 25595.6    -211
 25628.2 -211.98 25644.5    -212 25655.2 -211.24 25704.1    -211   25862    -211
 26984.9    -208 27150.8    -207 27159.6    -207 27160.1    -207 27160.4    -207
   27161 -207.19 27161.6  -207.4 27161.7 -207.46 27162.4 -207.83 27163.2    -208
 27163.7    -208 27163.9    -208 27164.5 -207.93 27164.6 -207.91 27165.2 -207.84
 27165.3 -207.78 27165.6 -207.68 27166.1 -207.46 27166.4 -207.31 27166.8 -207.21
 27167.4 -207.05 27167.5 -207.02 27167.6    -207 27192.1    -207 27192.6    -207
 27192.8 -207.02 27193.5 -207.12 27193.8 -207.16 27194.2 -207.28 27194.9 -207.48
   27195 -207.51 27196.2 -207.94 27196.4 -207.95   27201    -208 27202.2 -207.97
 27203.4 -207.64 27203.6 -207.55 27204.6 -207.25 27205.1 -207.14 27205.6 -207.03
 27205.8    -207 28211.1 -203.78

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045 16213.9    .036 16498.4    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       16213.9 16498.4           2806.8  3320.8  3045.6             .1       .3

CROSS SECTION


RIVER: Alamo River
REACH: Alamo River        RS: 16662

INPUT
Description:
Station Elevation Data    num=     450
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0    -234   498.5    -234  1118.2    -232  1176.2 -230.99  1196.3 -228.98
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1202.3	-227.97	1215.3	-221.82	1221.3	-221	1264.3	-222.01	1273.7	-226.47
1280.3	-228.82	1297.3	-231.36	1314.3	-233	1632.7	-233	1646.6	-230.37
1661.9	-228.51	1680.7	-223.41	1690.7	-222	1717.7	-222	1727.6	-227.99
1730.8	-229.03	1741.7	-230.95	1785.8	-231	1792.8	-229.82	1801.7	-231
1876.8	-232	2517.4	-232	2521.4	-231	2615.3	-231	2621.4	-232
2652.5	-232	2709.5	-231	2832.6	-231	2846.6	-228	2867.7	-228
2873	-229.08	2904.6	-231	2983.9	-231	3077.8	-229.34	3144.9	-231
3233.6	-229.43	3301.1	-229.97	3351.1	-231	3561.2	-230.47	3760.4	-230.78
3839.5	-229	3843.7	-228.1	3849.9	-225.67	3856.5	-224.85	3875.5	-223.51
3881.5	-223.61	3892.5	-225.11	3901.9	-223	3914.5	-222.84	3927.2	-223.11
3937.5	-227.71	3950.6	-228.96	4096.7	-232	4125.7	-231.96	4156.7	-231
4190.8	-231	4225.6	-232	5002.4	-232	5010.2	-232.67	5069.3	-233
5141.4	-233	5147.5	-232.59	5165.7	-233	5178.6	-232	5246.6	-232
5250.6	-233	5254.6	-231	5395.8	-232.74	5412.8	-232	6326.5	-232
6346.9	-231	6359.6	-231	6362.6	-232	6370.6	-232	6374.6	-231
6384.6	-231.71	6442.6	-231.63	6469.6	-231.16	6500.7	-229	6508.7	-226
6527.7	-226	6534.7	-227.31	6570.7	-227	6574.7	-229.21	6583.7	-231
6708.9	-231	6712.1	-231.87	6715.5	-232	7004.9	-231	7750.3	-230.41
8015.9	-229	8639.5	-228.41	8656.5	-228	9130.9	-227	9136.9	-226
9244	-226	9244.4	-226.02	9245	-226.05	9251.7	-228.97	9259	-229
9265.3	-228	9270.4	-228.01	9276.2	-229	9285.8	-229	9566.2	-228
9902.5	-228	10920.4	-226	11529.3	-226	11582.5	-224.31	11625.2	-226
11685.7	-226	11796	-224.75	11815.3	-224	11824.5	-221	11834.8	-221.05
11837.5	-222	11851.8	-222	11858.7	-221	11947.8	-221.03	11952.9	-222.07
11968	-227	11976.3	-226.91	11988.2	-224.01	11998.8	-223.03	12069.5	-223.28
12096.5	-222.01	12116.5	-222	12156.1	-224	12290	-224	12680.8	-223
12703.3	-221	12736.3	-221.1	12746	-224.38	12759.1	-227	13365.1	-227
13384.1	-225.74	13395.5	-226.83	13411.4	-227	13428.1	-226	13433.9	-223.52
13436.3	-223.09	13489.6	-223	13519.2	-222	13557.3	-223	13567.1	-222.05
13576.9	-222	13584.3	-221	13589.9	-222.02	13626.1	-222.98	13649.8	-226
13682.9	-226	13686.6	-224.49	13690.1	-223.89	13704.4	-224.85	13753	-224.03
13765.5	-221.99	13781.5	-221	13796	-221.02	13805.2	-222	13828	-222
13861.4	-224.03	13929.9	-226	14008.4	-225.9	14014.2	-225.726	14070.9	-224.03
14106.6	-221.05	14131.4	-221.77	14144.9	-223.99	14207.3	-224	14212.4	-223
14261.8	-223	14293.8	-224	14323.9	-224.01	14356.1	-226	14365	-225.67
14410.1	-224	14830.1	-223.03	15655.4	-223	16232.2	-222	16263.9	-222
16282.1	-223	16304.2	-223	16317.6	-221	16334.9	-221	16344.2	-222
16673.4	-222	16680.8	-221	16710.6	-221.01	16718	-222.03	16736.6	-222.97
16829.6	-223	16846.3	-224	16866.5	-223	16879.8	-223	16889.7	-221.69
16900.2	-218.81	16915.1	-217	16921	-217.04	16926.7	-217.97	16952.3	-219
16961.3	-220.81	16966	-223.27	16969.1	-224	16995.1	-224	17017	-219.03
17036	-218.31	17043.4	-218.93	17056.3	-219.01	17063.9	-221.88	17073.2	-224
17076.9	-224	17082.4	-223.03	17088.1	-221	17140.2	-221	17155.8	-224
17227	-224	17236.5	-221	17264.9	-221	17272	-223	17294.5	-224
17371.7	-224	17376.3	-222.99	17380	-221	17409.6	-221.03	17414.4	-222.98
17444	-224	17482.8	-224	17524.7	-223.03	17531.8	-221	17553.1	-221
17561.4	-223	17672.9	-223	17677.6	-220.92	17689.5	-219	17700.1	-220.82
17708.5	-223.09	17725.4	-224	17755.9	-224	17770.3	-223	17777.3	-221
17795.7	-221	17800.4	-222	17818.9	-222	17822.4	-221	17850.8	-221
17859.1	-223	18058.6	-223	18098.7	-222	18205.5	-222	18215	-221

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 18248.2 -221.02 18263.8    -222 18301.5    -222   18343    -221 18357.7    -219
 18366.8    -219 18376.5 -221.01 18409.5    -222 18428.4    -222 18472.3 -220.99
 18479.2 -219.22 18487.7    -218 18493.7 -218.19 18506.9    -221   18548    -221
 18557.3    -219 18583.3    -219 18594.5 -220.94 18601.9 -220.98 18606.1 -220.63
 18614.8 -218.06 18618.6    -218 18627.7    -218 18644.3    -221 18748.7    -221
 18764.8    -218 18780.7    -218 18783.5 -219.02 18794.9    -221 19015.5    -221
 19100.9    -219 19105.7    -217 19129.4 -217.01 19137.6 -217.93 19153.1 -218.61
 19189.8 -218.06 19205.7 -217.08 19217.3    -217 19225.3 -217.82 19231.1    -219
   19396    -219 19412.9 -217.19 19422.1    -217 19439.6 -218.99 19498.2    -219
 19517.9    -219 19526.7    -217 19564.7    -217 19569.4 -218.03 19584.8 -218.94
 19600.3    -219 19628.5    -218 19663.1    -218 19669.1    -217 19683.7 -216.98
 19705.8    -219 19764.8    -219 19769.1 -218.24 19769.8 -218.07 19769.9 -218.07
 19769.9 -218.06 19771.3 -217.33 19773.2 -216.37 19773.4 -216.28 19773.5 -216.27
 19774.2 -216.09 19774.6    -216 19774.9    -216 19791.2    -216 19800.7    -219
 19889.7    -219 19896.3 -217.13 19903.7 -216.01 19913.2    -216 19924.1    -219
   20000    -219 20009.5 -218.12 20017.5 -216.04 20030.8    -216 20041.4 -218.99
 20132.7    -219 20143.5    -216 20159.6    -216 20171.9    -219   20248    -219
 20254.5 -218.09   20263 -216.04 20276.1    -216 20278.2 -216.24 20283.4 -218.07
 20292.9    -219 20329.6    -219 20351.4    -218 20371.2    -218 20399.2 -218.99
 20448.3    -219 20474.4 -218.03 20479.6 -216.85   20487    -216 20495.5  -216.6
 20502.9 -218.03 20519.4 -218.99 20558.5    -219 20601.2    -218 20712.8    -218
 20722.3    -216 20738.8    -216 20743.6 -217.33 20748.4    -218 20839.2    -218
   20848    -216 20862.2    -216 20869.3    -218 20966.6    -218   20967 -217.98
 20967.5 -217.93 20967.7 -217.91 20967.8  -217.9 20968.3 -217.77 20968.4 -217.76
   20969 -217.63 20969.1  -217.6 20969.4 -217.55 20969.8 -217.43 20970.2 -217.36
 20970.6 -217.27 20971.3  -217.1 20971.4 -217.09 20971.6 -217.01   20972 -216.88
 20972.5  -216.7 20972.7 -216.61 20973.1 -216.46 20973.5 -216.28 20973.7 -216.17
   20980    -216 20991.5    -216 21001.1    -218   21090    -218 21090.1 -217.99
 21092.3 -217.69 21097.7 -216.26   21103    -216 21116.1    -216 21123.2    -218
 21222.6    -218 21233.5    -216 21268.8    -216 21318.9    -217 21331.8    -217
 21337.8    -216   21717    -216   21736 -214.46 21744.9 -214.64   21765    -214
 21793.2 -214.06 21823.7    -216 21901.1    -216   21920 -214.24   21929    -214
 21947.5 -217.99 21967.6    -218 21973.5 -217.09 21988.8 -212.25 21995.9    -211
 22025.7 -211.07 22032.9 -212.07 22039.5 -213.54 22044.3    -214 22419.5    -214
 22521.8 -213.09 22702.9    -214 22948.4    -214 22966.5    -213   22996    -213
   23007    -214 23511.8    -213 23511.9    -213 23512.4 -213.11 23512.5 -213.14
 23513.1 -213.26 23513.2 -213.31 23513.5 -213.39   23514 -213.55 23514.3 -213.66
 23514.7 -213.78 23515.4 -213.99 23518.9    -214 23528.5    -212 23880.8 -211.66
 24519.9 -209.03 24533.1 -208.52 24536.6    -209 24743.6    -209 24935.9 -208.47

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045 14014.2    .036   14365    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       14014.2   14365           2588.9  2765.6  2982.9             .1       .3

CROSS SECTION
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RIVER: Alamo River
REACH: Alamo River RS: 13897

INPUT
Description:
Station Elevation Data num= 452

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	-234.62	453	-234	456	-233	459	-233.06	462	-234
468.1	-234	471.7	-233.45	484.1	-234	488.1	-233	494.1	-234
500.1	-233.91	503.1	-233	507.2	-233	510.2	-233.99	515.2	-234
518.2	-233	523.2	-233	527.2	-234	529.2	-233.94	532.2	-233
540.2	-233	543.3	-234	547.3	-233.84	549.3	-233	556.3	-233
559.3	-234	562.3	-234	565.3	-233	571.3	-233	576.3	-234
579.4	-233	588.4	-233	592.4	-234	596.4	-233	643.5	-233
648.5	-232	654.6	-233.27	658.6	-233	661.6	-232	665.6	-232.11
668.6	-233	689.6	-233	693.7	-232	696.7	-232.12	700.7	-233
705.7	-233	711.7	-232	718.7	-233.64	727.7	-232.3	732.8	-233
897.2	-233	901.2	-232	906.1	-232.08	909.2	-233	914.2	-232.91
917.1	-232	923.3	-232.04	925.3	-232.95	928	-233	930.3	-232.86
932.3	-232	972.4	-232	977.4	-232.95	980.4	-232.03	1004.5	-232
1008.5	-233	1013.4	-232.01	1053.6	-232	1057.8	-233	1059.6	-233
1063.6	-232	1069.7	-232	1074	-233	1076.7	-232.83	1079.4	-232
1085.7	-232	1088.7	-233	1092.7	-232.96	1095.6	-232	1133.8	-232
1137.8	-233	1141.9	-233	1147.6	-232	1150	-232.02	1153.9	-233
1157.9	-233	1160.9	-232.11	1163.1	-232	1166.9	-232.12	1169.9	-233
1174.9	-233	1177.9	-232	1216	-232	1219.1	-233	1224.1	-232.9
1226.1	-232.01	1232.1	-232.02	1234.1	-232.91	1239.1	-233	1242.1	-232
1248.2	-232.01	1251.1	-232.94	1252.8	-233	1255.2	-233	1258.2	-232
1296.3	-232	1301.3	-233	1306.3	-232	1314.3	-232.01	1317.3	-233
1319.3	-233	1322.3	-232	1375.5	-231	1377.5	-231	1381.5	-232
1385.5	-232	1389.5	-231	1393.5	-231	1397.5	-231.94	1401.3	-232
1406.6	-231	1417.2	-232	1453.6	-231	1460.7	-231.03	1463.7	-232
1466.7	-232	1470.7	-231	1476.7	-231	1479.7	-231.95	1481.9	-232
1483.8	-232	1486.8	-231	1492.7	-231.01	1497	-232	1499.8	-232
1502.8	-231	1544.6	-232	1661.2	-232	1667.3	-231.03	1675.5	-232
1678.3	-232	1682.3	-231	1687.2	-231.03	1690.3	-232	1709.4	-232
1714.5	-231	1720.4	-232	1767.5	-232	1782.5	-231	2797.2	-231
2893.7	-229.5	2939.6	-230.3	2954.1	-230.99	2992.8	-231	3010.8	-227.84
3016.9	-227	3021.9	-226.81	3048.4	-226.96	3066	-228.96	3104.1	-232
3152.2	-232	3157.2	-229.83	3162.2	-229.02	3175.3	-231	3392.9	-231.91
3575.5	-231.53	4031.7	-231.81	4105.8	-231	4175.9	-231	4251	-231.93
4298.3	-232	4323.3	-232	4343.3	-231	4360.4	-232	5124.4	-232
5127.5	-231	5130.5	-231.01	5133.5	-232	5525.4	-232	5528.5	-231.09
5531.6	-231	5534.6	-232	5602.7	-232	5605.8	-231	5611.8	-231.55
5681	-231	5686.9	-231.9	5693	-231	5836.5	-231	5840.4	-232
5843.4	-231	6077	-231	6080.3	-232	6082.2	-231.92	6085	-231
7496.8	-231	7522.9	-230.09	7527.9	-229	8091.4	-229	8354.1	-227.03
8373.1	-226	8434.3	-226	8445.3	-229	8450.7	-228.91	8453.5	-227.95
8456.3	-226.04	8458.6	-226	8481.5	-226.01	8496.5	-229	9283.6	-229
9295.3	-228.08	9302.6	-227	9337.7	-226	9342.7	-226.02	9358.8	-228

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 10217.5    -228 10235.2 -227.03 10241.3    -226 10276.9    -226 10289.4    -227
   10532    -227 10545.6 -226.01 10600.6    -226   10608  -227.2 10618.2  -228.1
 10665.7 -228.94 10769.8    -228 10902.8    -228 10938.5 -226.99 10945.9    -226
 10979.2    -226 10991.3 -227.12 11018.6    -228 11117.9    -228 11129.9    -226
 11156.1 -226.01 11164.7 -227.01 11208.4    -228   11276    -228 11347.4    -227
 11354.8    -226   11393    -226 11393.3 -226.01 11393.6 -226.01   11394 -226.02
 11398.3 -227.94 11410.3    -228 11419.8 -226.21 11442.7 -224.03 11472.8    -223
 11477.8 -223.03 11486.1 -223.99 11495.7 -223.99 11505.1    -222 11530.1 -222.05
 11571.7  -223.4 11592.5    -223 11608.6    -224 12106.2    -224 12126.6 -223.01
 12128.6-223.009 12155.6    -223 12160.4 -224.09 12186.3    -226 12203.6    -226
 12288.5    -224 12306.5    -224 12313.2    -228 12371.1 -227.98 12374.2 -226.01
 12389.5 -224.03 12393.5 -222.91 12396.9 -222.42 12400.6 -222.41 12407.1    -224
 12477.1-224.697 12607.9    -226 12631.3    -228 12639.6 -227.92 12659.3 -226.25
 12728.3 -224.02 12734.5    -222 12755.2    -222 12760.3 -224.19   12769 -226.06
   12774 -227.01   12786 -228.03 12824.1    -229 12914.5    -229 12933.3 -227.89
   12966    -227 12973.4    -226 13065.2    -226 13076.3 -224.11 13082.3    -222
 13099.9 -222.03 13102.4 -223.06 13106.4    -224 14208.3    -224 14217.6    -223
 14239.8    -223 14244.6    -224 14658.5    -224 14675.7 -224.44 14706.5    -224
 14713.9 -222.79 14731.1    -222 14744.2 -222.41 14795.8 -222.01 14815.5    -224
 14929.5    -224 14938.4 -223.93 14949.2 -222.75 14954.1 -221.72 14960.6 -219.37
 14962.7 -219.01 14962.8    -219 14979.9 -219.06 15003.9    -222 15041.4    -222
 15050.2    -221 15110.1    -221 15125.5 -221.97 15132.4    -223 15146.1    -223
 15151.2 -221.98 15159.8 -218.97 15164.9    -218   15187    -218 15200.9 -218.97
 15221.4    -223 15659.9    -224 15685.7 -223.94 15696.4 -223.09 15696.8 -223.04
 15697.1 -222.98 15697.6 -222.87 15697.9  -222.8   15703    -221 15710.4 -221.09
   15719 -223.75 15722.2    -224 16055.4    -224 16105.2 -223.02 16118.1    -222
 16139.9 -221.91 16157.8    -223 16683.5    -223 16694.6    -222 16754.3 -222.88
 16920.4    -222 17048.8 -222.31 17203.3    -222 17208.2    -221 17226.7    -221
 17231.6    -222 17365.8    -222 17374.3    -221 17389.7    -221 17406.6 -223.98
   17421 -227.12 17435.9 -228.97 17779.9    -229 17810.6    -228 17816.7 -226.97
 17825.1 -224.01 17837.7    -221 17939.9    -222 17959.8    -221   18457    -221
 18872.4    -219 19296.1    -219 19304.4  -218.3 19314.2    -218 19407.8 -218.93
 19441.4    -218 19465.8 -217.98   19474    -217 19495.9    -217 19501.8  -217.9
 19502.8 -217.98   19503 -217.99 19503.1    -218 19504.3    -218 19508.2    -218
 19513.8    -217 19669.3    -217   19685 -218.93 19700.1    -219   19709 -217.76
 19710.8 -217.35 19711.2 -217.26 19712.1 -217.05 19712.3 -216.98   19713 -216.71
 19713.4 -216.55 19713.7 -216.45 19713.7 -216.43 19713.8  -216.4 19714.4 -216.13
 19714.9 -215.95 19715.1 -215.85 19716.1 -215.51 19717.3 -215.22 19717.8 -215.06
   19718 -214.99 19718.6  -214.8 19718.7 -214.76 19718.9 -214.69 19719.4 -214.52
 19719.8 -214.41 19720.6 -214.14 19720.9 -214.09 19721.1 -214.07 19721.6 -214.02
 19722.2    -214   19760 -214.01 19768.9 -216.22 19774.8 -217.27 19775.3 -217.33
 19775.4 -217.35   19776 -217.43 19776.5 -217.49 19776.8 -217.53 19777.1 -217.58
 19779.6 -217.87 19788.8 -218.09 20011.8    -218   20029    -217 20039.7 -217.02
 20052.4    -218 20222.4    -218 20263.2 -217.29 20270.4    -216 20277.8    -216
 20282.7    -217 20520.6    -217 20541.4    -217 20546.1 -216.04 20546.3    -216
 20554.8    -216 20558.7    -217 20660.9    -217 20755.7    -216 21084.3    -216
 21645.1    -214 24046.8    -208 24060.5    -207 24087.9    -207 24096.4 -210.12
 24102.8 -211.91 24113.1 -211.75

Manning's n Values        num=       3
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Sta	n Val	Sta	n Val	Sta	n Val
0	.04	12128.6	.036	12477.1	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
12128.6	12477.1	3025.4	3873.6	4625.3	.1	.3

CROSS SECTION

RIVER: Alamo River
REACH: Alamo River RS: 10023

INPUT
Description:
Station Elevation Data num= 451

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	-234.12	361.1	-234	366.2	-233	370.2	-233.99	375.3	-234
381.3	-233	387.3	-234	392.4	-234	396.4	-233	399.5	-233.13
403.5	-234	406.5	-233.99	408.5	-233.1	409.5	-233	416.6	-233
419.6	-234	421.6	-234	424.6	-233	454.9	-233.21	456.9	-233
497.2	-233	501.2	-234	505.2	-233	513.3	-233	517.3	-233.76
520.4	-233.03	529.4	-233	532.4	-233.96	533.5	-234	536.5	-233
704.8	-233	705.8	-232.97	707.8	-232.12	709.8	-232	714.8	-232
718.9	-232.98	720.4	-233	721.9	-233	726.9	-232	766.2	-232
771.3	-232.99	775.3	-232	782.3	-232	786.7	-233	788.4	-232.89
791.4	-232	798.5	-232	802.8	-233	805.5	-233	807.5	-232.12
808.5	-232	847.8	-232	850.9	-233	855	-232.99	857.9	-232.01
858.9	-232	864	-232	868	-233	870	-233	874	-232
881.1	-232	884.1	-233	888.1	-233	891.2	-232	930.5	-232
933.7	-233	937.5	-233	940.5	-232	947.6	-232.02	949.6	-232.85
951.6	-233	953.6	-233	956.7	-232	962.7	-232	965.7	-233
1009.1	-232	1013.1	-232.04	1015.1	-232.98	1016.1	-233	1020.2	-232.94
1023.2	-232	1029.2	-232	1032.2	-233	1033.3	-233	1036.3	-233
1040.3	-232	1044.3	-232.03	1048.4	-232.95	1050.3	-233	1054.4	-232.97
1057.4	-232	1095.7	-232	1098.8	-232.91	1101.8	-233	1104.8	-232
1111.8	-232	1112.9	-232.01	1115.9	-232.96	1117.9	-233	1122.9	-232
1354.7	-232	1360.7	-231.69	1362.8	-232	1367.8	-232	1371.8	-231.41
1374.6	-231.34	1379.9	-232	1432.3	-232	1436.3	-231.29	1442.1	-231
1447.8	-232	1452.4	-231	1459.5	-231.07	1462.7	-232	1503.7	-231
1509.9	-231.02	1512.8	-231.95	1515.2	-232	1519.9	-231	1525	-231
1528	-232	1530.2	-232	1532	-231.94	1535.1	-231	1541.1	-231
1544.1	-231.92	1545.3	-232	1549.2	-231.9	1552.2	-231	1607.6	-231
1610.7	-232	1613.7	-232	1616.7	-231	1624.7	-231	1628.8	-232
1630.8	-231.83	1633.7	-231	1690.4	-231	1695.3	-232	1699.3	-231
1778.9	-231	1824.6	-229.96	1870.5	-229.62	2024.9	-229.94	2113.5	-229.66
2191	-229	2361.3	-229	2485.3	-231	2512.5	-231	2536.7	-229.03
2553.7	-226	2593.1	-226	2612.5	-229.02	2632.4	-229.87	2647.9	-229.93
2695.4	-230.01	2735.2	-229	4094.5	-229	4113.7	-229.38	4155	-229.31
4214.4	-230.03	4262.8	-231	4840.2	-231	4921.8	-229	4969.1	-229.01
4983.2	-229.25	5009.3	-229	5064	-231	5139.3	-230.13	5276.5	-229.66

5316.8	-229	5595.9	-229	5640.4	-231	5666.4	-231	5716.8	-230.44
5739.1	-230.53	5885	-229	6123.9	-229	6141.5	-229.47	6194.4	-229
6276.1	-229	6363.7	-231	6424.9	-229	6438.3	-229	6439.2	-229.14
6439.3	-229.16	6441.3	-230.01	6442.3	-230.06	6467	-230.27	6514.9	-229
7950.1	-229	7991.6	-228	8101.6	-228	8279.7	-226.81	8387.4	-226.72
8581.7	-226	8725.2	-226	8741.5	-224.21	8746.4	-224.224	8793.6	-224.36
8817.3	-223.53	8822.5	-224	8853.8	-224	8858.7	-223.11	8867.6	-222.27
8893.9	-221	8909.5	-221.02	8913.9	-221.9	8916.9	-223.49	8924.1	-229.41
8926.7	-231	8984.5	-231	8994.9	-229.09	9004.2	-228.13	9010	-225.99
9067.8	-224	9071.3	-224.09	9080.7	-226.79	9086.3	-227.68	9104	-229
9122.2	-228.97	9125.7	-228.09	9129.6	-226.64	9132.6	-226	9173.1	-226
9181.2	-227	9248.9	-227	9351.3	-227	9425.8	-227.28	9476.2	-227
10550.2	-227	10708.4	-226	10718	-226.83	10724.3	-228	11658.7	-228
11665.7	-227.46	11676.1	-226	11720.1	-226	11761.8	-224	11777.1	-224.07
11825.4	-225.69	11882.9	-225.98	11915.6	-224	11926	-222.02	11936.4	-221
11947.5	-221.02	11952.6	-221.82	11959.6	-222.53	11967.7	-222.49	11970.9	-222.99
11981.1	-223.02	12022.1	-226	12034.8	-226	12055	-221.62	12075.4	-221
12080.4	-221.04	12096.2	-222.1	12103.5	-222.94	12107.6	-223.97	12109.8	-224
12115.7	-224	12120	-223.4	12129.6	-222.95	12144.1	-221.69	12157.3	-221.75
12163.5	-221.05	12171.2	-221	12189.5	-221.98	12208.4	-223.97	12235.6	-226
12264.9	-225.89	12279	-224.15	12283.6	-223	12308	-223	12324.1	-224
12433.8	-224	12469.6	-222.68	12480.6	-222.58	12496.5	-223	12550.9	-223.01
12560.5	-223.31	12570.7	-223.98	12582.2	-224	12591	-223.26	12598.3	-223.03
12634.9	-222.93	12645.9	-222.53	12651.7	-222	12699.7	-222	12725.7	-221.06
12732.6	-221.25	12740.2	-221.98	12773.2	-222.01	12777.7	-222.34	12787	-224.19
12792.9	-224.61	12798	-224.57	12806.8	-224	12835.6	-224	12844.7	-223.01
12851.4	-222.9	12863.8	-222.01	12894.4	-222	12915.4	-222.98	12930.5	-225.77
12930.9	-225.77	12931.8	-225.72	12932.2	-225.69	12933.3	-225.49	12939.9	-224.1
12940.1	-224.06	12940.6	-224.01	12942	-223.89	12942	-223.88	12942.1	-223.88
12942.8	-223.89	12982.3	-227	13018.9	-226.99	13054.3	-225.53	13082.5	-224.02
13108.1	-223.98	13116.8	-223.54	13123.4	-223.99	13144.5	-223.57	13150.5	-224
13170	-224	13174.6	-224.47	13185.6	-224.03	13204.7	-224	13211.7	-223
13232.3	-223	13232.4	-223.01	13232.5	-223.02	13232.8	-223.04	13233.1	-223.07
13234.2	-223.11	13234.8	-223.15	13235.3	-223.2	13235.6	-223.24	13236	-223.28
13236.2	-223.33	13236.8	-223.41	13237.1	-223.46	13238.2	-223.71	13238.3	-223.72
13238.3	-223.73	13238.4	-223.75	13239	-223.9	13239.7	-223.99	13240.2	-224
13353.8	-223.8	13494	-224	13494.2	-223.98	13494.6	-223.92	13495.2	-223.81
13497.1	-223.18	13498.6	-222.91	13498.6	-222.9	13512.6	-222	13522.7	-222.26
13522.9	-222.26	13523.5	-222.27	13523.7	-222.29	13530.4	-222.94	13539.6	-223.34
13548.4	-223.43	13560.2	-223.03	13570.3	-223	13582	-223.94	13602.5	-224.01
13650	-225.99	13666.4	-226	13682.9	-227	13723.9	-226.99	13753.2	-226
13774.1	-226	13831.2	-224.01	13874.5	-224	13890.6	-223	14009.1	-223
14050.6	-226	14093.4	-226	14111.9	-225.56	14126.8	-226	14154.6	-226
14169.2	-225.49	14182.2	-225.48	14212	-224.67	14236.9	-224.39	14267	-224.74
14272.8	-225.13	14287.8	-225.61	14307.5	-225.07	14317	-224.05	14323.6	-223.96
14339.9	-222.07	14353.5	-221	14368.6	-221	14377.7	-222.86	14380.6	-223.27
14380.9	-223.3	14381.3	-223.33	14382.1	-223.39	14382.5	-223.41	14410.6	-223.84
14429	-224.95	14465.4	-225.24	14506.4	-224.92	14518.1	-226	14593.3	-226
14607.5	-224.51	14616.5	-224.35	14621.4	-224.72	14621.9	-224.84	14623.4	-225.16
14623.5	-225.17	14624.1	-225.32	14624.6	-225.41	14624.9	-225.48	14626.2	-225.78

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 14627.8    -226 14859.9    -226   14886 -224.57 14898.4 -224.97 14898.8 -225.01
 14899.1 -225.04   14900 -225.17 14900.5 -225.26 14901.3 -225.39 14901.6 -225.44
 14902.3 -225.55 14902.8 -225.63 14903.5 -225.75 14903.6 -225.77 14904.2  -225.9
 14904.6 -225.97 14915.9    -226 14916.2    -226 14916.7 -225.98 14917.3 -225.91
 14923.1 -224.12 14927.6    -223 14934.7    -223 14947.3 -225.05 14956.7    -226
 15338.8    -226 15356.7    -224 15374.5    -224 15396.4    -226 17673.1    -226
 17729.6 -225.78

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  8746.4    .036  9248.9    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        8746.4  9248.9           5778.2  5828.6  5753.7             .1       .3

CROSS SECTION


RIVER: Alamo River
REACH: Alamo River        RS: 4195

INPUT
Description:
Station Elevation Data    num=     452
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 -235.22   277.4    -234   338.4    -234   352.2    -236     359    -234
   746.8    -234   752.6    -233   757.2    -233   760.6 -233.91   765.2    -234
   767.5 -233.97   773.2    -233   775.5 -233.03   781.3    -234     787    -234
   790.4 -233.06   793.9    -233   799.6    -234   805.4    -234   808.8    -233
   815.7    -233   821.4    -234   827.2    -234   830.6 -233.02   831.7    -233
   836.3    -233   839.8    -234   845.5 -233.89     849    -233   854.7    -233
   858.1    -234   863.9    -234   868.5    -233     873    -233   876.5    -234
   881.1    -234   885.7    -233   897.1    -234   901.7 -233.98     904 -233.01
   904.9    -233   909.8    -233   913.2    -234   917.8    -234   922.4    -233
   931.6    -233     935    -234   940.7    -234   946.5    -233   951.1    -233
   953.4 -233.97   959.1    -234   963.7    -233   968.4 -233.01   973.1 -233.95
   978.6    -234   983.1    -233   987.8 -233.04   994.1    -234   998.1 -233.95
  1001.6    -233  1010.7 -233.05  1014.2    -234  1017.6 -233.97  1019.9 -233.01
  1029.1    -233  1032.5    -234    1036    -234  1039.4    -233  1049.7    -233
  1053.2    -234  1056.6    -234  1060.1    -233  1069.2    -233  1072.7    -234
    1075 -233.97  1078.4 -233.03  1088.8    -233  1092.2 -233.89  1094.5    -234
  1095.6 -233.94  1097.9 -233.02  1115.1    -233    1122    -232  1130.1    -233
  1135.8 -232.94  1138.1    -232  1273.5    -232  1279.2    -233  1317.1    -233
  1321.7    -232  1337.7    -233  1364.1    -233    1371    -232  1395.1 -232.32
  1405.3    -232  1407.5    -232  1411.1 -232.99  1414.6    -233    1418    -232
  1421.6    -232  1437.6    -233  1439.8    -233  1444.4    -232  1453.6    -232
    1457 -232.97  1458.9    -233  1462.8    -232  1762.2    -232  1821.9 -231.09
  1888.5    -231  1941.2 -230.22  2108.2 -229.84  2246.9    -229    2262    -228
    2277 -227.88  2389.2    -228  2423.9    -227  2456.2    -227  2522.1    -228
  2612.3    -228  2629.6 -227.28  2641.3 -227.19  2656.7 -227.27  2663.4    -228
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2880.5	-228	2885.2	-227	2888.5	-227.24	2892.4	-228	2895.9	-227.98
2899.1	-227.19	2902.6	-227	2904.9	-227	2910.4	-228	2912.4	-228
2916.3	-227.01	2917.6	-227	2920.3	-227	2924.5	-228	2928.3	-228
2932.5	-227	2964.2	-227	2967.6	-227.01	2972.1	-228	2982.3	-227.21
2989.6	-228	3006	-228	3012.2	-227	3019.4	-228	3071.7	-228
3075.7	-227.11	3077.7	-227	3087.6	-228	3249	-228	3254.1	-227
3256.9	-227	3260.9	-228	3295.4	-227.99	3301.2	-227	3303.4	-227.09
3306.7	-228	3356.5	-228	3360.5	-227.1	3363.1	-227	3364.9	-227.11
3368.5	-228	3827.2	-228	3846.5	-228	3869.7	-226.99	3880.6	-225.4
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3943.6	-222.98	3953.8	-223.11	3956.1	-225.68	3959.4	-232.4	3960.6	-233.93
3984.9	-234	3995.3	-232.04	4005.7	-230.92	4010.1	-229.52	4015.3	-228.56
4016.7	-227.88	4021.1	-224.32	4023.3	-223.05	4025.3	-222.63	4035.7	-221.97
4039.4	-221.36	4051.8	-217	4061.2	-217	4062.3	-217.23	4069.3	-220.78
4073	-223.78	4076.7	-225.39	4079.7	-226	4086.9	-226	4109.4	-227
4180.5	-227.352	4242.7	-227.66	4281	-227	4312.3	-227.75	4350.3	-227.94
4440.3	-227	4826.6	-227	4833.6	-226	4841.7	-226	4842.4	-226.08
4842.7	-226.15	4842.8	-226.21	4843.4	-226.42	4844	-226.66	4846.3	-227
4854.4	-227	4858.8	-226.45	4872.9	-223.02	4879.8	-223	4890.2	-223.84
4897.2	-223.78	4922.6	-226	5141.1	-226	5150.4	-227	5302.5	-227
5348.9	-227.39	5362.3	-227	6614.3	-227	6637.3	-226	6732.2	-226
6746.1	-225.34	6755.3	-226	6800.5	-226	6821.2	-226.47	6852.9	-226.6
6889.5	-226	6969.2	-227	6997	-226.6	7019.9	-226.88	7031.7	-226
7046.9	-226	7090.7	-227	7155.4	-227	7178.5	-226.07	7200.2	-227
7399.4	-227	7405.2	-226	7414.4	-226	7419.8	-227	7762.4	-227
7780.3	-226.73	7786.3	-226.99	7820.3	-227	7845.7	-226	7864.2	-226.01
7874.4	-227	7996	-227	8003.1	-226.33	8011.1	-227	8057.3	-227
8071.3	-226.25	8090.2	-226.53	8100.1	-227	8228.5	-227	8251.9	-227.85
8270.3	-228	8280.4	-227	8326.1	-227	8340.4	-226	8412.1	-226
8438.9	-227	8535	-227	8546.4	-226	8570.8	-226.35	8583.4	-227
8595	-226.22	8613.5	-226	8700.2	-226	8718.5	-226.59	8750.3	-226
8807.9	-226	8818.9	-226.44	8862.7	-225.98	8881.7	-224	8983.5	-224
9032.1	-227.32	9057.3	-228	10054.2	-228	10078.5	-225.94	10157.9	-224.01
10209.2	-225.98	10228.6	-224.22	10259.3	-223.92	10276.2	-224	10281.3	-225.1
10292.4	-226	10312.1	-225.99	10345.8	-224.01	10368.7	-226	10393	-226.7
10403.5	-226.56	10423.5	-224.8	10437	-224.8	10442.7	-226	10543.2	-226
10598.8	-224.5	10625.9	-224.46	10700.6	-226	10713.3	-226.03	10734.1	-227
10744.4	-227.94	10769.9	-229	11262.5	-229	11282.2	-228.29	11325.3	-229
11460.6	-228.73	11558.6	-229	11678.6	-227.57	11704.3	-228	11731.9	-227
11787.5	-227	11799.1	-226.71	11808.3	-226	11830.3	-225.99	11838.1	-225.71
11900.3	-226.01	11912.7	-227	11922.2	-226.97	11932	-226	11988.7	-226
11998	-227	12025.7	-226.68	12034.8	-227	12073.1	-227	12081	-227.32
12150.6	-226.69	12157.1	-226.99	12165.6	-228	12174.6	-228	12180.6	-227
12194.2	-227	12201.5	-226	12211.9	-226.03	12216.3	-226.8	12216.5	-226.83
12217.1	-226.92	12217.6	-227	12220	-227	12233.9	-226.72	12240.8	-226.02
12246.3	-226.54	12276.6	-226.67	12292.4	-226	12327.3	-226	12335.6	-227
12355.2	-227	12364.9	-226.97	12379.4	-226.01	12397.8	-226	12440.3	-227.71
12449	-227.77	12464.3	-227	12472.4	-227.02	12475.3	-227.75	12475.5	-227.78
12485	-229	12489.9	-228.72	12514.9	-229	12521.8	-227.99	12528.8	-226
12556.5	-226.26	12581.9	-227.76	12599.7	-228.29	12643.2	-228.64	12658.2	-228

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 12666.2    -228 12682.9    -229 12722.6 -228.99 12739.4 -227.68 12750.4 -227.23
 12761.1 -227.03   12776 -227.76 12776.1 -227.76 12776.6 -227.76 12779.6  -227.7
 12779.8  -227.7 12780.4 -227.71 12780.8  -227.7 12784.1  -227.3 12786.5 -226.97
 12787.7 -226.85 12787.7 -226.84 12788.4 -226.81 12788.9 -226.79 12789.7 -226.77
   12790 -226.76 12790.4 -226.77 12791.2 -226.78 12791.4 -226.79 12791.7 -226.81
 12792.1 -226.84 12792.3 -226.86 12792.8 -226.92 12797.2 -227.89 12800.4  -228.2
 12807.4 -227.96 12823.5 -226.76 12827.2  -227.1 12827.6 -227.18 12828.2 -227.36
 12828.7 -227.53   12829 -227.64 12829.3 -227.75 12829.4 -227.78 12829.6 -227.81
 12830.1 -227.97 12834.5 -228.66 12847.8    -229 12961.3    -229 12978.7 -228.43
 12986.1 -228.47 12992.4 -228.99   13035    -229 13044.5 -230.08 13057.1 -230.98
 13057.7 -230.98 13057.8 -230.99 13058.3    -231 13058.4    -231 13059.1    -231
 13060.5    -231 13064.6 -231.82   13065  -231.9 13066.4    -232 13073.3 -231.88
 13077.9 -230.66 13089.5 -228.91 13104.4 -229.56 13112.5 -229.41   13133 -229.85
 13181.8    -229   13670    -229 13673.7 -228.62 13682.7 -228.46   13689 -228.99
 13757.8    -229 13762.5    -228 13781.9    -228 13784.9 -228.13 13787.9    -229
 13845.6 -228.79   13886    -229

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  3827.2    .036  4180.5    .045

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        3827.2  4180.5             2600  2571.8    2600             .1       .3

CROSS SECTION


RIVER: Alamo River
REACH: Alamo River        RS: 1623

INPUT
Description:
Station Elevation Data    num=     452
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 -235.59    97.5 -234.78   142.9    -234   298.1    -234   330.3 -233.82
   367.4    -233   409.1    -233     492 -232.12   545.2    -232   557.9 -231.51
   582.2 -231.09   829.1    -231   859.5 -229.52   870.3 -229.59   915.3    -231
   922.5    -231   935.4 -231.99   945.5 -232.01     963 -233.98   973.8    -234
  1003.3    -232  1019.2    -232  1023.9 -231.71  1035.1 -231.86    1116 -231.03
  1142.8  -230.2    1150 -230.32  1153.6 -230.22  1164.8 -230.99  1188.7    -231
  1246.2 -230.06    1277    -229  1332.3    -229  1341.4 -228.03    1363    -228
  1379.9 -228.03    1389 -228.49  1395.2    -229  1474.5    -229  1669.8    -229
  1679.7 -231.51    1683 -232.62  1685.4 -233.94  1725.9    -234  1731.3 -233.04
    1746 -231.99  1755.1 -228.69  1759.1 -227.66  1762.9    -227  1774.9 -227.01
  1786.6 -227.97  1876.2 -228.18  1891.9    -228  1962.3    -228  1986.2 -228.28
  2015.1 -228.34  2024.9-228.047  2026.5    -228  2050.4    -228  2071.3 -228.81
  2110.3    -229  2181.9    -229  2235.7 -230.66  2249.4 -230.95  2251.2 -231.16
    2256 -232.48  2258.6    -233  2275.8 -232.99  2310.9 -231.96  2324.1 -230.63
  2334.8 -230.26  2344.5 -229.57  2359.9 -229.24  2363.5    -229  2503.1    -229
    2644 -230.44  2660.2 -230.37    2700    -231  3279.5    -231  3307.7    -232
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3358	-232	3391.5	-231	3403.3	-231	3442.7	-232	3463.1	-232
3486.9	-231.28	3499.7	-231.22	3522.7	-231.28	3544	-232	3706.6	-232
3752.3	-232.14	3770.6	-232	3896.9	-232	3926.2	-231.12	3929.8	-231.16
3938.2	-232	3970.4	-232	3979	-232.16	3986.6	-232	4015.8	-232
4028.8	-232.39	4032.5	-232.65	4040.4	-232.27	4044.7	-232.35	4050.4	-232.13
4059.9	-232.62	4068.6	-232.57	4076.7	-233	4101.3	-232.99	4125.8	-232
4158.9	-232	4175.8	-233	4252.2	-232.97	4314.2	-232.22	4319	-232
4356.2	-232.21	4360.8	-232	4424.2	-232	4439.6	-233	4738.4	-233
4752.2	-232.64	4759.6	-232.69	4771	-232.01	4858.7	-232	4883.9	-232.15
4890.7	-232.01	4907.5	-232	4911.2	-231.56	4918.2	-231.41	4929.1	-232
4984.9	-232	5000.7	-232.19	5016.2	-232	5041.1	-232	5055.6	-232.16
5065.2	-232	5086.7	-232.72	5117.7	-233	5324.8	-233.16	5337.5	-233
5368.4	-233	5403.2	-232.32	5458.2	-232	5499.8	-232	5513.4	-231
5561.8	-231	5570.2	-231.88	5579.6	-232	5717	-232	5729	-231.27
5742.1	-231.22	5769.7	-231.53	5780.3	-232	5805	-232	5814.9	-232.17
5825.2	-231.88	5825.7	-231.89	5826	-231.9	5826.4	-231.92	5826.7	-231.94
5833.2	-232.84	5835.2	-232.97	5840	-233	5840.4	-232.99	5841	-233
5841.1	-233	5843.6	-232.98	5847.2	-232.83	5892.3	-233	5918.8	-232
6006.3	-232	6036.3	-232.6	6097.7	-232.4	6131.3	-232.72	6165.1	-232.81
6350.6	-232.37	6374.9	-232.5	6431.5	-232.36	6537	-232.59	6615.8	-232.28
6642.9	-232	6761.7	-231.84	6792.1	-231.26	6830.9	-232	6885.8	-232
6917.4	-231	6946.7	-231	6987	-231.59	7033.4	-231.46	7053	-231.56
7118.4	-231	7128.1	-231.21	7138.9	-231.16	7239.2	-232	7527	-232
7759.8	-231	7854.3	-228.99	7875.3	-226	7885.1	-224.86	7887.6	-224.41
7887.7	-224.39	7888.3	-224.3	7888.7	-224.22	7889	-224.17	7889.5	-224.09
7889.7	-224.06	7889.9	-224.02	7890.6	-223.82	7891.1	-223.69	7891.2	-223.66
7891.3	-223.62	7892.6	-223.23	7893.2	-223.06	7893.4	-223.01	7907.1	-222.94
7915	-222	7931.7	-221	7968.7	-218.05	7979.9	-217	7991.4	-215.41
8006.7	-213.98	8006.8	-213.96	8006.9	-213.95	8007.3	-213.9	8007.5	-213.88
8008.1	-213.81	8008.2	-213.77	8008.5	-213.72	8011.7	-213.02	8011.9	-213.01
8012.1	-213	8012.6	-213	8013.3	-213	8014	-213	8014.1	-213
8039.1	-211.06	8054.2	-209.05	8072.6	-207.81	8078.3	-207.03	8078.5	-207
8082.1	-206.35	8090.9	-205.39	8103.6	-203.69	8110.9	-202.97	8116.5	-202.05
8120.2	-201.09	8125.1	-200.34	8130.9	-198.95	8133.4	-198.55	8134	-198.5
8134.3	-198.46	8134.6	-198.42	8134.7	-198.42	8134.8	-198.42	8135.4	-198.39
8135.8	-198.36	8136.1	-198.34	8136.6	-198.33	8143.4	-198.85	8143.9	-198.83
8144.1	-198.83	8144.2	-198.82	8144.6	-198.78	8144.8	-198.77	8146.3	-198.64
8151.3	-198.06	8159.3	-197.98	8162.9	-197.7	8163.3	-197.66	8163.6	-197.63
8164.1	-197.57	8164.3	-197.55	8164.5	-197.54	8165.1	-197.47	8165.2	-197.44
8165.7	-197.39	8168.7	-196.84	8169.3	-196.74	8180.6	-195.58	8188.2	-194.47
8202.6	-192.07	8209.1	-191.91	8250.4	-190.11	8280.3	-189.42	8286.3	-189.64
8297	-190.99	8303.1	-191.34	8309.4	-191.97	8310.3	-192.07	8312.8	-192.52
8316.1	-192.88	8321.1	-193.29	8321.5	-193.29	8321.9	-193.29	8324.5	-193.78
8330.4	-195.92	8338.8	-197.57	8344.8	-198.98	8352.6	-202.34	8356.3	-203.68
8356.7	-203.86	8357.3	-204.15	8357.4	-204.25	8357.9	-204.48	8358	-204.53
8359.1	-205.19	8360	-205.72	8360.2	-205.84	8360.3	-205.91	8360.9	-206.19
8361.5	-206.44	8361.6	-206.49	8362.3	-206.81	8365.9	-208.02	8371.2	-209.04
8381.8	-211.84	8383.3	-212.17	8384	-212.32	8384.2	-212.36	8384.9	-212.51
8386.2	-212.75	8386.5	-212.82	8386.9	-212.88	8387.4	-212.97	8387.6	-213.02
8387.7	-213.05	8388.3	-213.23	8388.9	-213.39	8389.1	-213.44	8396.1	-215.92

8403.9	-217.95	8409.4	-219.69	8413	-220.92	8413.6	-221.08	8415.1	-221.47
8416.4	-221.82	8416.5	-221.86	8416.7	-221.92	8422.3	-224.28	8427.1	-225.93
8427.4	-225.99	8427.7	-226.06	8433.1	-226.97	8438.9	-227.78	8439.1	-227.79
8439.6	-227.87	8440.3	-227.96	8440.4	-227.97	8442.3	-228.14	8455.5	-229.12
8488	-231	8678.1	-233	8755.4	-233.28	8923.8	-233	9681.1	-233
9682.5	-233.01	9683.1	-233.01	9683.2	-233.02	9684	-233.06	9684.3	-233.08
9684.7	-233.09	9685.3	-233.12	9685.4	-233.12	9685.5	-233.12	9686.1	-233.16
9686.7	-233.2	9687.1	-233.22	9687.6	-233.25	9689	-233.31	9689.2	-233.32
9689.8	-233.35	9690.3	-233.38	9690.8	-233.42	9691.2	-233.46	9691.4	-233.48
9691.9	-233.52	9695	-233.81	9695.5	-233.86	9696.1	-233.92	9696.2	-233.94
9696.3	-233.94	9697	-233.98	9697.4	-234	9697.7	-234	9698.4	-234
9699.5	-234	9699.9	-234	9700	-234	9700.6	-234	9701	-234
9701.3	-234	9701.8	-234	9702.8	-233.99	9703.4	-233.97	9703.5	-233.95
9703.6	-233.91	9704.2	-233.74	9704.9	-233.54	9705.5	-233.39	9705.6	-233.33
9705.8	-233.3	9707	-232.93	9707.1	-232.83	9709.3	-230.69	9709.4	-230.61
9709.8	-230.26	9710.9	-229.38	9711.4	-229.11	9711.7	-229	9741.6	-229.12
9741.8	-229.1	9742.1	-229.07	9742.5	-229.03	9742.8	-229.02	9743.2	-229.01
9744	-229	9780.5	-229	9780.8	-229.02	9781	-229.04	9781.5	-229.09
9781.9	-229.12	9782.2	-229.15	9782.3	-229.16	9783	-229.22	9783.4	-229.26
9783.7	-229.28	9784.2	-229.33	9784.6	-229.36	9785.1	-229.36	9785.3	-229.33
9785.9	-229.28	9786	-229.26	9786.6	-229.18	9787	-229.12	9787.3	-229.08
9788.2	-229	9812	-229	9824	-230.04	9830.7	-229.49	9832.1	-229.31
9832.3	-229.28	9832.8	-229.23	9833.4	-229.18	9833.5	-229.16	9833.6	-229.15
9835	-229.01	9858.1	-229	9859.2	-229	9859.6	-229	9859.8	-229
9860.3	-229.12	9860.8	-229.26						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	1474.5	.036	2024.9	.045

Bank Sta: Left	Right	Coeff Contr.	Expan.
1474.5	2024.9	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Alamo River

Reach	River Sta.	n1	n2	n3
Alamo River	37000	.045	.036	.045
Alamo River	36071	.045	.036	.045
Alamo River	34926	.045	.036	.045
Alamo River	33520	.045	.036	.045
Alamo River	32581	.045	.036	.045
Alamo River	31366	.045	.036	.045
Alamo River	30072	.045	.036	.045
Alamo River	28816	.045	.036	.045
Alamo River	25128	.045	.036	.045

Alamo River	22693	.045	.036	.045
Alamo River	19983	.045	.036	.045
Alamo River	16662	.045	.036	.045
Alamo River	13897	.04	.036	.045
Alamo River	10023	.04	.036	.045
Alamo River	4195	.04	.036	.045
Alamo River	1623	.04	.036	.045

SUMMARY OF REACH LENGTHS

River: Alamo River

Reach	River Sta.	Left	Channel	Right
Alamo River	37000	952	929.5	971.1
Alamo River	36071	1189.4	1144.6	1141.6
Alamo River	34926	1203	1406.4	1411.4
Alamo River	33520	1084.3	938.9	614.4
Alamo River	32581	1364.6	1215	938.9
Alamo River	31366	1527.4	1294	992.5
Alamo River	30072	1393.8	1255.7	1008.8
Alamo River	28816	2027.8	3687.7	3404.1
Alamo River	25128	2183	2435.1	2561.2
Alamo River	22693	2512.2	2709.9	2712.4
Alamo River	19983	2806.8	3320.8	3045.6
Alamo River	16662	2588.9	2765.6	2982.9
Alamo River	13897	3025.4	3873.6	4625.3
Alamo River	10023	5778.2	5828.6	5753.7
Alamo River	4195	2600	2571.8	2600
Alamo River	1623			

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Alamo River

Reach	River Sta.	Contr.	Expan.
Alamo River	37000	.1	.3
Alamo River	36071	.1	.3
Alamo River	34926	.1	.3
Alamo River	33520	.1	.3
Alamo River	32581	.1	.3
Alamo River	31366	.1	.3
Alamo River	30072	.1	.3

Alamo River	28816	.1	.3
Alamo River	25128	.1	.3
Alamo River	22693	.1	.3
Alamo River	19983	.1	.3
Alamo River	16662	.1	.3
Alamo River	13897	.1	.3
Alamo River	10023	.1	.3
Alamo River	4195	.1	.3
Alamo River	1623	.1	.3

APPENDIX C
(MT-2 Forms)

DEPARTMENT OF HOMELAND SECURITY
Federal Emergency Management Agency

OVERVIEW & CONCURRENCE FORM

OMB Control Number: 1660-0016
Expiration: 1/31/2024

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 1 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington, DC 20472 , Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.
PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).
ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.
DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

A. REQUESTED RESPONSE FROM DHS-FEMA

This request is for a (check one):

☐ CLOMR: A letter from DHS-FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72). All CLOMRs require documentation of compliance with the Endangered Species Act. Refer to the Instructions for details.

☒ LOMR: A letter from DHS-FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See 44 CFR Ch. 1, Parts 60, 65 & 72).

B. OVERVIEW

1. The NFIP map panel(s) affected for all impacted communities is (are):

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
060065	Imperial County	CA	06025C	0700C	09-26-2008
060065	Imperial County	CA	06025C	0725C	09-26-2008

2. a. Flooding Source: Alamo River

b. Types of Flooding: ☒ Riverine ☐ Coastal ☐ Shallow Flooding (e.g., Zones AO and AH) ☐ Alluvial Fan ☐ Lakes ☐ Other (Attach Description)

3. Project Name/Identifier: Alamo River

4. FEMA zone designations (choices: A, AH, AO, A1-A30, A99, AE, AR, V, V1-V30, VE, B, C, D, X)

a. Effective: A, D

b. Revised: A, X

5. Basis for Request and Type of Revision:

a. The basis for this revision request is (check all that apply)

☐ Physical Change	☐ Improved Methodology/Data	☐ Regulatory Floodway Revision	☐ Base Map Changes
☐ Coastal Analysis	☒ Hydraulic Analysis	☐ Hydrologic Analysis	☐ Corrections
☐ Weir-Dam Changes	☐ Levee Certification	☐ Alluvial Fan Analysis	☐ Natural Changes
☒ New Topographic Data	☐ Other (Attach Description)		

Note: A photograph and narrative description of the area of concern is not required, but is very helpful during review.

b. The area of revision encompasses the following structures (check all that apply)

Structures: ☐ Channelization ☐ Levee/Floodwall ☐ Bridge/Culvert

☐ Dam ☐ Fill ☐ Other (Attach Description)

6. ☐ Documentation of ESA compliance is submitted (required to initiate CLOMR review). Please refer to the instructions for more information.

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☐ Yes Fee amount: $ _____

☒ No, Attach Explanation

- **Please see the DHS-FEMA Web site at http://www.fema.gov/forms-documents-and-software/flood-map-related-fees for Fee Amounts and Exemptions.**

D. SIGNATURES

1. REQUESTOR'S SIGNATURE

All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Name: Massoud Rezakhani	Company: MRC LCC
Mailing Address: 29830 N. 78th Way Scottsdale, AZ 85266	Daytime Telephone: 602-317-4303 Fax No.: 480-656-2304
	E-mail Address: mrezakhani@mrcllc.net
	Date: 3/17/2023

Signature of Requestor (required): massoud rezakhani

2. COMMUNITY CONCURRENCE

As the community official responsible for floodplain management, I hereby acknowledge that we have received and reviewed this Letter of Map Revision (LOMR) or conditional LOMR request. Based upon the community's review, we find the completed or proposed project meets or is designed to meet all of the community floodplain management requirements, including the requirements for when fill is placed in the regulatory floodway, and that all necessary Federal, State, and local permits have been, or in the case of a conditional LOMR, will be obtained. For Conditional LOMR requests, the applicant has documented Endangered Species Act (ESA) compliance to FEMA prior to FEMA's review of the Conditional LOMR application. For LOMR requests, I acknowledge that compliance with Sections 9 and 10 of the ESA has been achieved independently of FEMA's process. For actions authorized, funded, or being carried out by Federal or State agencies, documentation from the agency showing its compliance with Section 7(a)(2) of the ESA will be submitted. In addition, we have determined that the land and any existing or proposed structures to be removed from the SFHA are or will be reasonably safe from flooding as defined in 44CFR 65.2(c), and that we have available upon request by FEMA, all analyses and documentation used to make this determination.

Community Official's Name and Title: Jim Minnick - Planning & Development Services Director

Mailing Address: 801 Main St El Centro, CA 92243	Community Name: Imperial County Planning and Development
	Daytime Telephone: 442-265-1736 Fax No.:
	E-mail Address: jimminnick@co.imperial.ca.us
Community Official's Signature (required):	Date:

3. CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

This certification is to be signed and sealed by a licensed land surveyor, registered professional engineer, or architect authorized by law to certify elevation information data, hydrologic and hydraulic analysis, and any other supporting information as per NFIP regulations paragraph 65.2(b) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Certifier's Name: Ibrahim Osman		License No.: C69825	Expiration Date: 6/30/2024
Company Name: MRC, LLC		Mailing Address: 29830 N. 78th Way Scottsdale, AZ 85266	
Telephone No.: 480-513-7263	Fax No.:		
E-mail Address: ibrahimosman@mrcllc.com			
Signature: Ibrahim M. Osman		Date: 3/25/2023	

Ensure the forms that are appropriate to your revision request are included in your submittal.

Form Name and (Number)	Required if …
☒ Riverine Hydrology and Hydraulics Form (Form 2)	New or revised discharges or water-surface elevations
☐ Riverine Structures Form (Form 3)	Channel is modified, addition/revision of bridge/culverts, addition/revision of levee/floodwall, addition/revision of dam
☐ Coastal Analysis Form (Form 4)	New or revised coastal elevations
☐ Coastal Structures Form (Form 5)	Addition/revision of coastal structure
☐ Alluvial Fan Flooding Form (Form 6)	Flood control measures on alluvial fans

Seal (Optional)

DEPARTMENT OF HOMELAND SECURITY

Federal Emergency Management Agency

RIVERINE HYDROLOGY & HYDRAULICS FORM (FORM 2)

OMB Control Number: 1660-0016
Expiration: 1/31/2024

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 3.5 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless it displays a valid OMB control number. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington, DC 20472 , Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.
PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).
ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program (NFIP); Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.
DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a (NFIP) Flood Insurance Rate Maps (FIRM).

Flooding Source: Alamo River

Note: Fill out one form for each flooding source studied

A. HYDROLOGY

1. Reason for New Hydrologic Analysis (check all that apply):

☒ Not revised (skip to section B) ☐ No existing analysis ☐ Improved data
☐ Alternative methodology ☐ Proposed Conditions (CLOMR) ☐ Changed physical condition of watershed

2. Comparison of Representative 1%-Annual-Chance Discharges

Location	Drainage Area (Sq. Mi.)	Effective/FIS (cfs)	Revised (cfs)

3. Methodology for New Hydrologic Analysis (check all that apply)

☐ Precipitation/Runoff Model → Specify Model: _____ Duration: _____ Rainfall Amount: _____

☐ Statistical Analysis of Gage Records

☐ Regional Regression Equations ☐ Other (please attach description)

Please enclose all relevant models in digital format, maps, computations (including computation of parameters), and documentation to support the new analysis.

4. Review/Approval of Analysis

If your community requires a regional, state, or federal agency to review the hydrologic analysis, please attach evidence of approval/review.

5. Impacts of Sediment Transport on Hydrology

Is the hydrology for the revised flooding source(s) affected by sediment transport? ☐ Yes ☒ No

If yes, then fill out Section F (Sediment Transport) of Form 3. If No, then attach your explanation.

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevation (ft.)	
			Effective	Proposed/Revised
Downstream Limit*	Salton Sea Mouth	37000.00	A (No Elevation)	A (-209.09 ft)
Upstream Limit*	Approx 2000 ft upstream of the mouth	1623	A (No Elevation)	A (-231.67 ft)

*Proposed/Revised elevations must tie-into the Effective elevations within 0.5 foot at the downstream and upstream limits of revision.

2. Hydraulic Method/Model Used: HEC-RAS

☐ Steady State ☒ Unsteady State ☒ One-Dimensional ☐ Two-Dimentional

3. Pre-Submittal Review of Hydraulic Models*

DHS-FEMA has developed two review programs, CHECK-2 and CHECK-RAS, to aid in the review of HEC-2 and HEC-RAS hydraulic models, respectively. We recommend that you review your HEC-2 and HEC-RAS models with CHECK-2 and CHECK-RAS.

4. HEC-RAS File Description**:

Models Submitted	Natural Run		Floodway Run		Datum
Duplicate Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	
Corrected Effective Model*	File Name:	Plan Name:	File Name:	Plan Name:	
	AlamoCreek.prj	AlamoRiver			
Existing or Pre-Project Conditions Model	File Name:	Plan Name:	File Name:	Plan Name:	
Revised or Post-Project Conditions Model	File Name:	Plan Name:	File Name:	Plan Name:	
Other - (attach description)	File Name:	Plan Name:	File Name:	Plan Name:	

* For details, refer to the corresponding section of the instructions.
**See instructions for information about modeling other then HEC-RAS. ☐ Digital Models Submitted? (Required)

C. MAPPING REQUIREMENTS

A **certified topographic work map** must be submitted showing the following information (where applicable): the boundaries of the effective, existing, and proposed conditions 1%-annual-chance floodplain (for approximate Zone A revisions) or the boundaries of the 1%- and 0.2%-annual-chance floodplains and regulatory floodway (for detailed Zone AE, AO, and AH revisions); location and alignment of all cross sections with stationing control indicated; stream, road, and other alignments (e.g., dams, levees, etc.); current community easements and boundaries; boundaries of the requester's property; certification of a registered professional engineer registered in the subject State; location and description of reference marks; and the referenced vertical datum (NGVD, NAVD, etc.).

Topographic Information: ☒ Digital Mapping (GIS/CADD) Data Submitted (preferred)

Source: Keystone Aerial Surveys | Date: May 13, 2022

Vertical Datum: NAD 1983 and NAVD(88) | Spatial Projection: State Plane Coordinate System - Zone

Accuracy: 1 ft

Note that the boundaries of the existing or proposed conditions floodplains and regulatory floodway to be shown on the revised FIRM and/or FBFM must tie-in with the effective floodplain and regulatory floodway boundaries. Please attach **a copy of the effective FIRM and/or FBFM**, at the same scale as the original, annotated to show the boundaries of the revised 1%-and 0.2%-annual-chance floodplains and regulatory floodway that tie-in with the boundaries of the effective 1%-and 0.2%-annual-chance floodplain and regulatory floodway at the upstream and downstream limits of the area on revision.

☒ Annotated FIRM and/or FBFM (Required)

D. COMMON REGULATORY REQUIREMENTS*

1. For LOMR/CLOMR requests, do Base Flood Elevations (BFEs) or Special Flood Hazard Areas (SFHAs) increase compared to the effective BFEs? ☐ Yes ☒ No

   If Yes, please attach **proof of property owner notification**. Examples of property owner notifications can be found in the MT-2 Form 2 Instructions.

2. For CLOMR requests, if either of the following is true, please submit **evidence of compliance with Section 65.12 of the NFIP regulations**:

   - The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot compared to pre-project conditions.
   - The proposed project encroaches upon a SFHA with or without BFEs established and would result in increases above 1.00 foot compared to pre-project conditions.

3. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

   If Yes, the community must be able to certify that the area to be removed from the special flood hazard area, to include any structures or proposed structures, meets all of the standards of the local floodplain ordinances, and is reasonably safe from flooding in accordance with the NFIP regulations set forth at 44 CFR 60.3(A)(3), 65.5(a)(4), and 65.6(a)(14). Please see the MT-2 instructions for more information.

4. Does the request involve the placement or proposed placement of fill? ☐ Yes ☒ No

   If Yes, attach **evidence of regulatory floodway revision notification**. As per Paragraph 65.7(b)(1) of the NFIP Regulations, notification is required for requests involving revisions to the regulatory floodway Elements and examples of regulatory floodway revision notification can be found in the MT-2 Form 2 Instructions.

5. For CLOMR requests, please submit documentation to FEMA and the community to show that you have complied with Sections 9 and 10 of the Endangered Species Act (ESA). For actions authorized, funded, or being carried out by Federal or State agencies, please submit documentation from the agency showing its compliance with Section 7(a)(2) of the ESA. Please see the MT-2 instructions for more detail.

EXHIBITS

EXHIBIT 1
(Existing FEMA FIRM Panel)

NOTES TO USERS

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

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

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

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 11. The **horizontal datum** was NAD 83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. Base flood elevations shown on this FIRM may be converted to the Imperial County datum, in NAVD88, by adding 1000 feet. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3 #9202
1315 East-West Highway
Silver Springs, MD 20910-3282

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

Base map information shown on this FIRM was derived from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1992 or later. Additional information was provided by the USDA from photography dated 2004.

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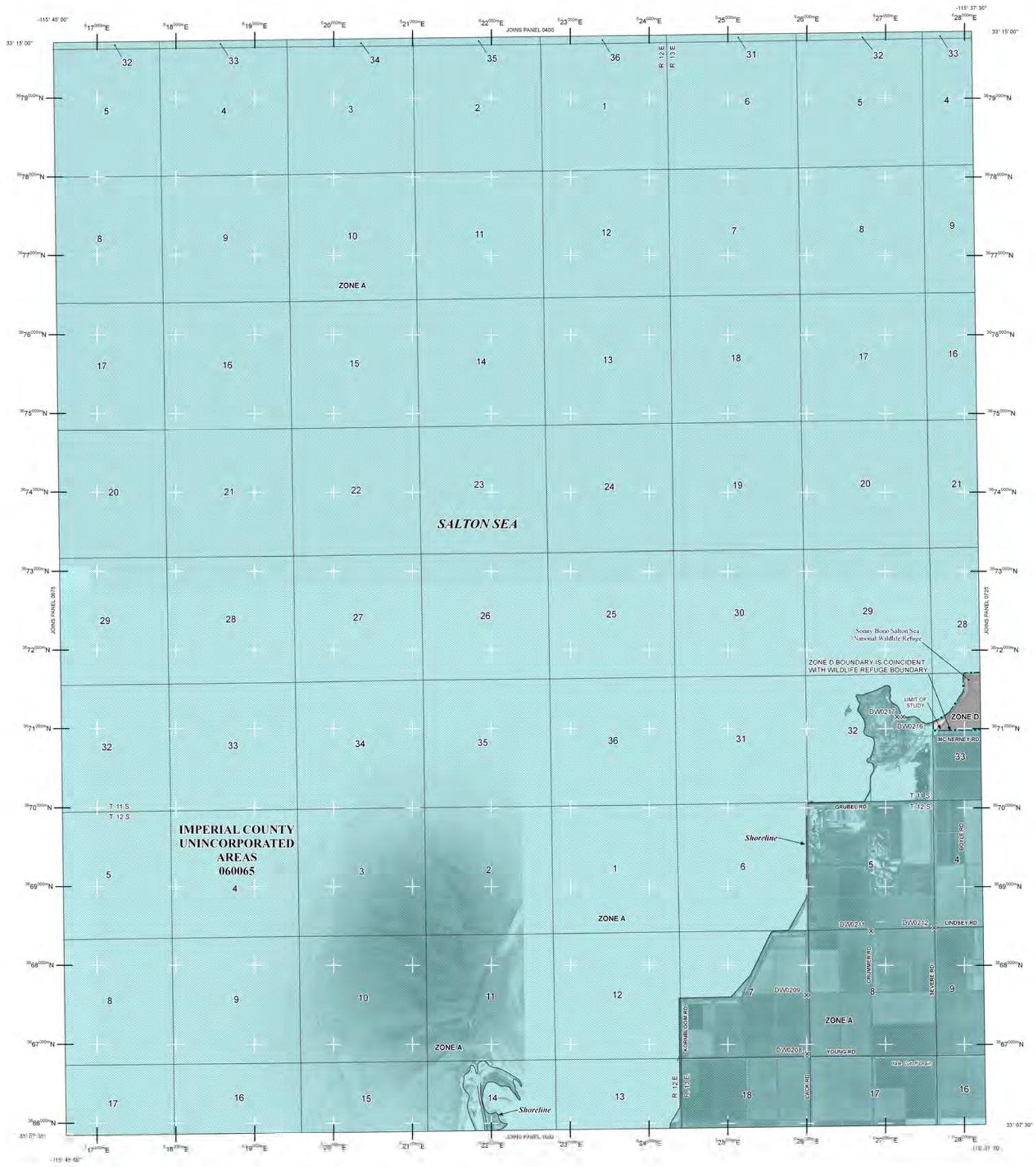
Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which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

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

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



LEGEND

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

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

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

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

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*
A — A	Cross section line
23 — 23	Transect line
97° 07' 30", 32° 22' 30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
3702000m N	1000-meter Universal Transverse Mercator grid values, zone 11
600000 FT	5000-foot grid ticks: California State Plane coordinate system, VI zone (FIPSZONE 0406), Lambert Conformal Conic
DX5510 x	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

*Referenced to the North American Vertical Datum of 1988

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
September 26, 2008
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 2000'
1000 0 2000 4000 FEET
150 0 150 300 METERS

NFIP

PANEL 0700C

FIRM

FLOOD INSURANCE RATE MAP

IMPERIAL COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 700 OF 2300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
IMPERIAL COUNTY UNINCORPORATED AREAS	060065	0700	C

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

MAP NUMBER
06025C0700C

EFFECTIVE DATE
SEPTEMBER 26, 2008

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

NOTES TO USERS

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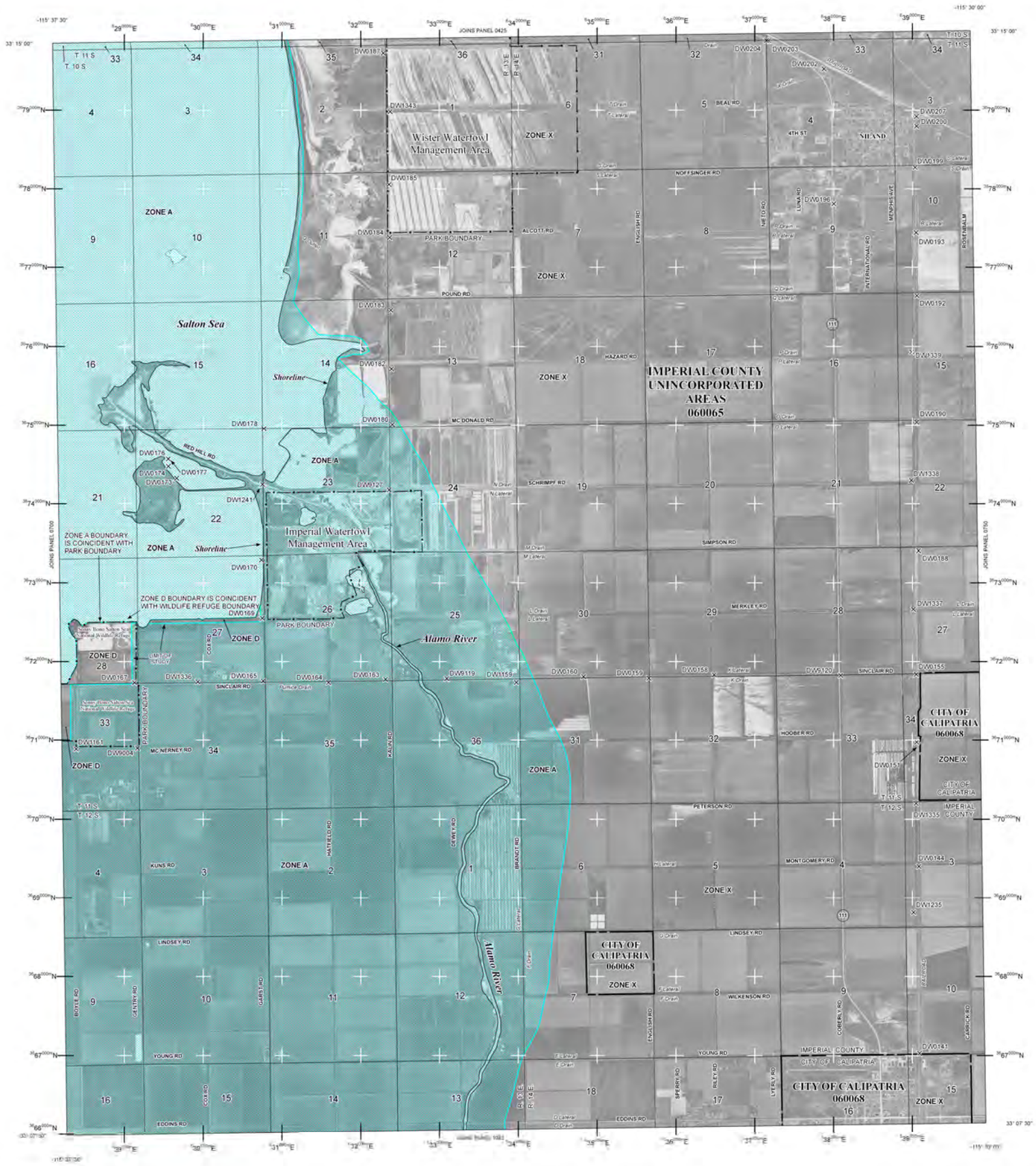

LEGEND

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

*Referenced to the North American Vertical Datum of 1988

A — A	Cross section line
23 — 23	Transect line
97° 07' 30", 32° 22' 30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
3702000mN	1000-meter Universal Transverse Mercator grid values, zone 11
600000 FT	5000-foot grid ticks: California State Plane coordinate system, VI zone (FIPSZONE 0406), Lambert Conformal Conic
DX5510 x	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
September 26, 2008
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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MAP SCALE 1" = 2000'
1000 0 2000 4000 FEET
150 0 150 300 METERS

NFIP

PANEL 0725C

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

IMPERIAL COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 725 OF 2300

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
IMPERIAL COUNTY UNINCORPORATED AREAS	060065	0725	C
CALIPATRIA, CITY OF	060068	0725	C

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

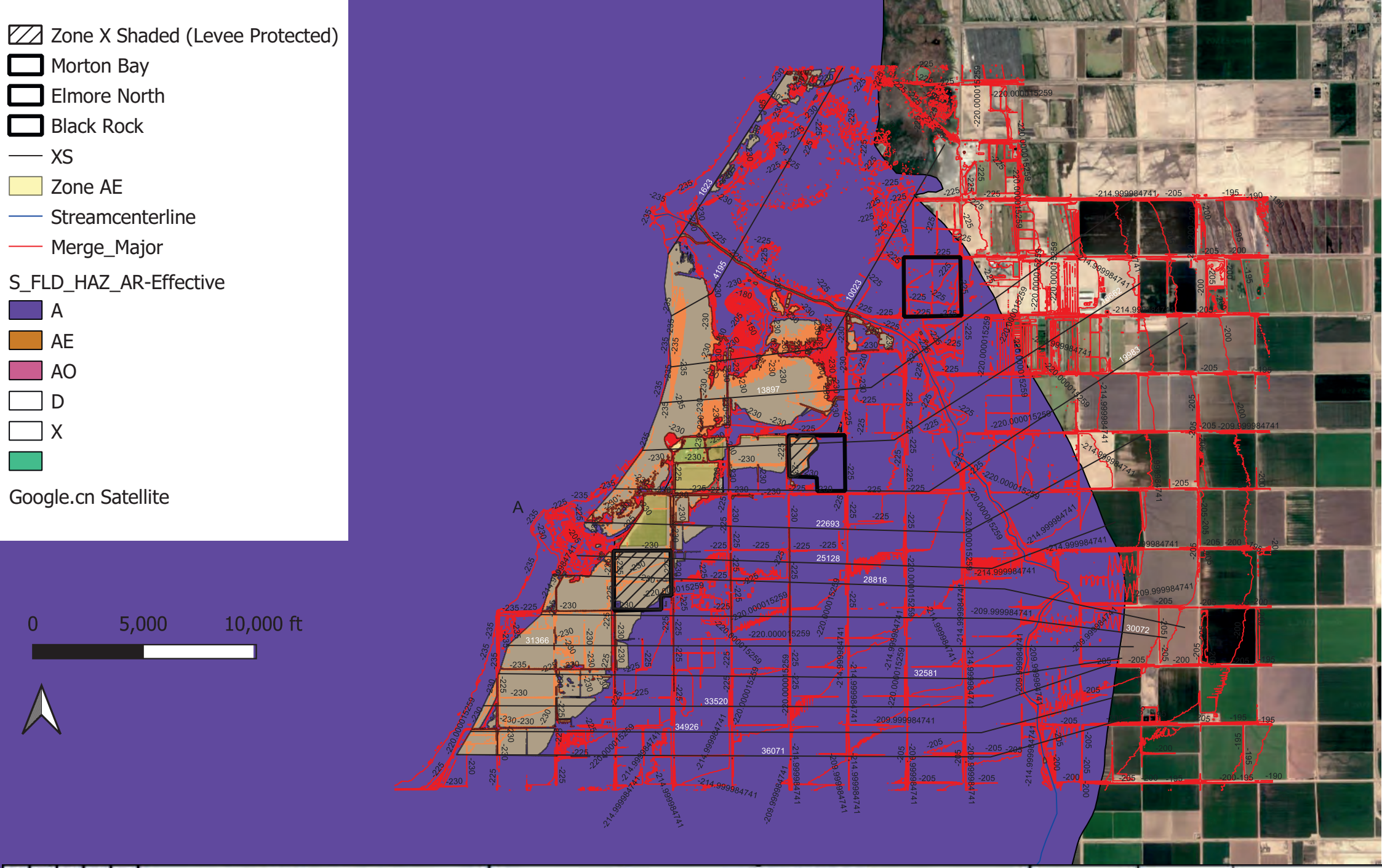
MAP NUMBER 06025C0725C

EFFECTIVE DATE SEPTEMBER 26, 2008

Federal Emergency Management Agency

EXHIBIT 2
(Topographic Map)
(digital file only)

EXHIBIT 3
(Work Map)



ALAMO RIVER
IMPERIAL COUNTY

FLOODPLAIN WORKMAP

Drawing Number:
Scale: As Shown
Date:
Drawn by:
Job Number:

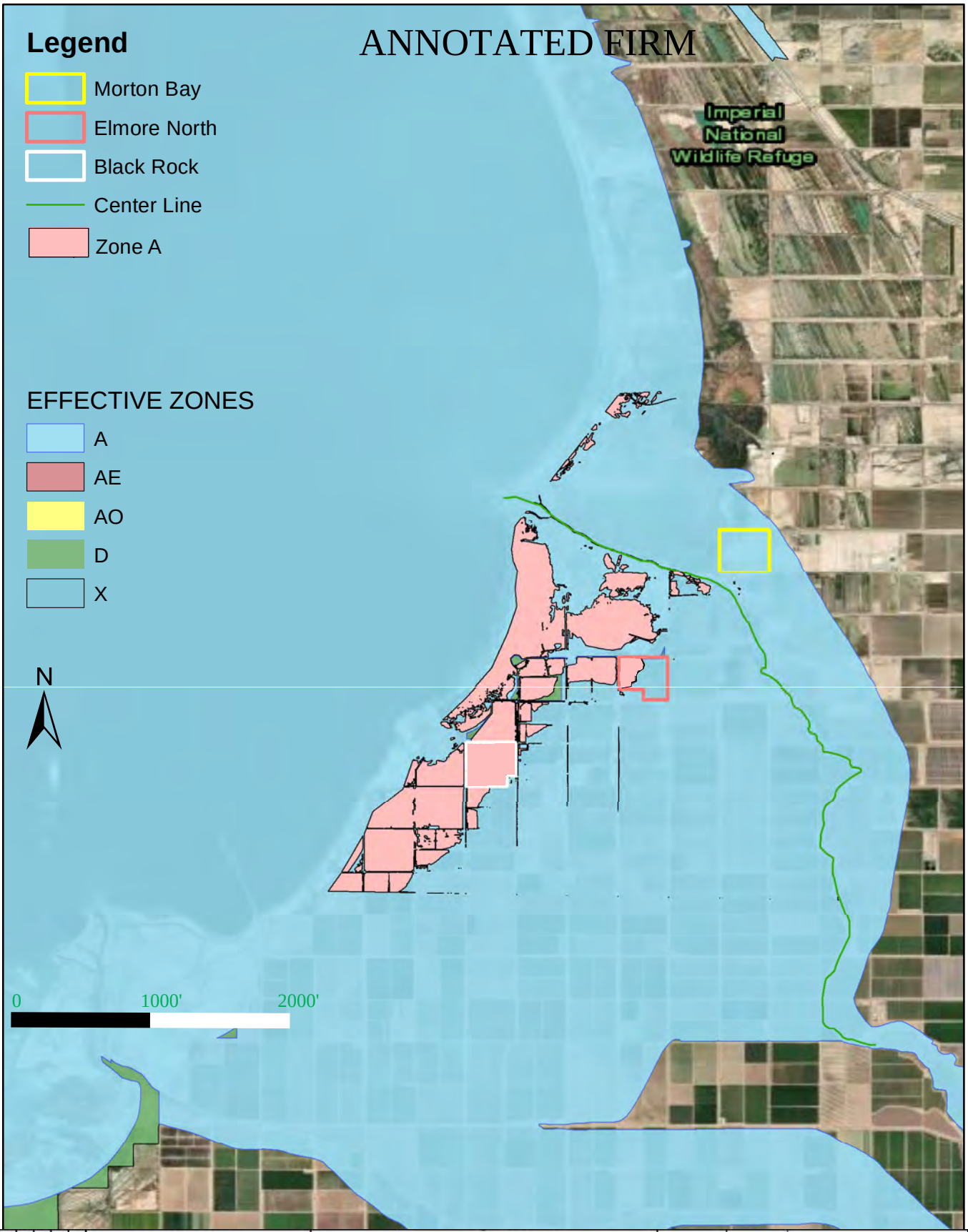
MRC LLC

29830 N. 78TH WAY, SCOTTSDALE, AZ 85266
Phone: (480) 513-7263 Fax: (480) 656-2304
www.mrcllc.net

REGISTERED PROFESSIONAL ENGINEER
IBRAHIM OSMAN
C69825
Exp 6/30/2024
CIVIL
STATE OF CALIFORNIA

EXHIBIT 4
(Annotated FIRM Panel)

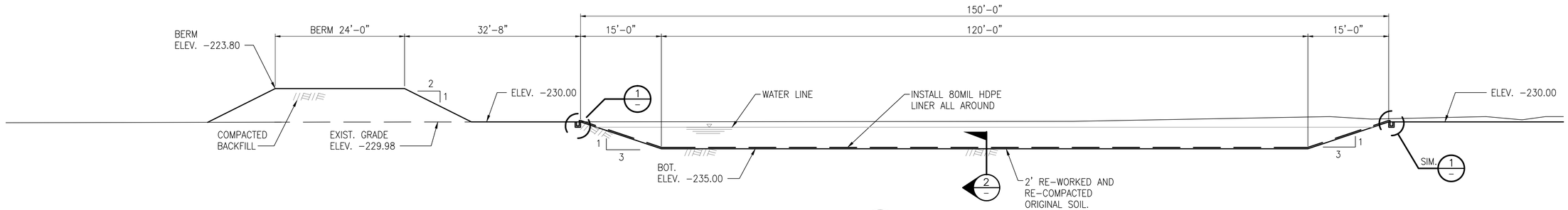
ANNOTATED FIRM



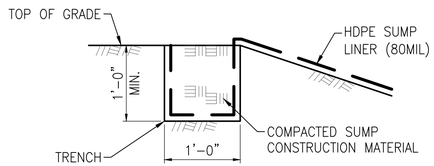
Drawing Number:	ALAMO RIVER IMPERIAL COUNTY ANNOTATED FIRM	MRC LLC 29830 N. 78TH WAY, SCOTTSDALE, AZ 85266 Phone: (480) 513-7263 Fax: (480) 656-2304 www.mrcllc.net
Scale: As Shown		
Date:		
Drawn by:		
Job Number:		

EXHIBIT 5
(Hydraulic Models and Electronic Files)

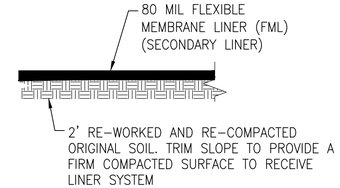
BRGP Attachment DRR 96 Brine Pond Liner Design



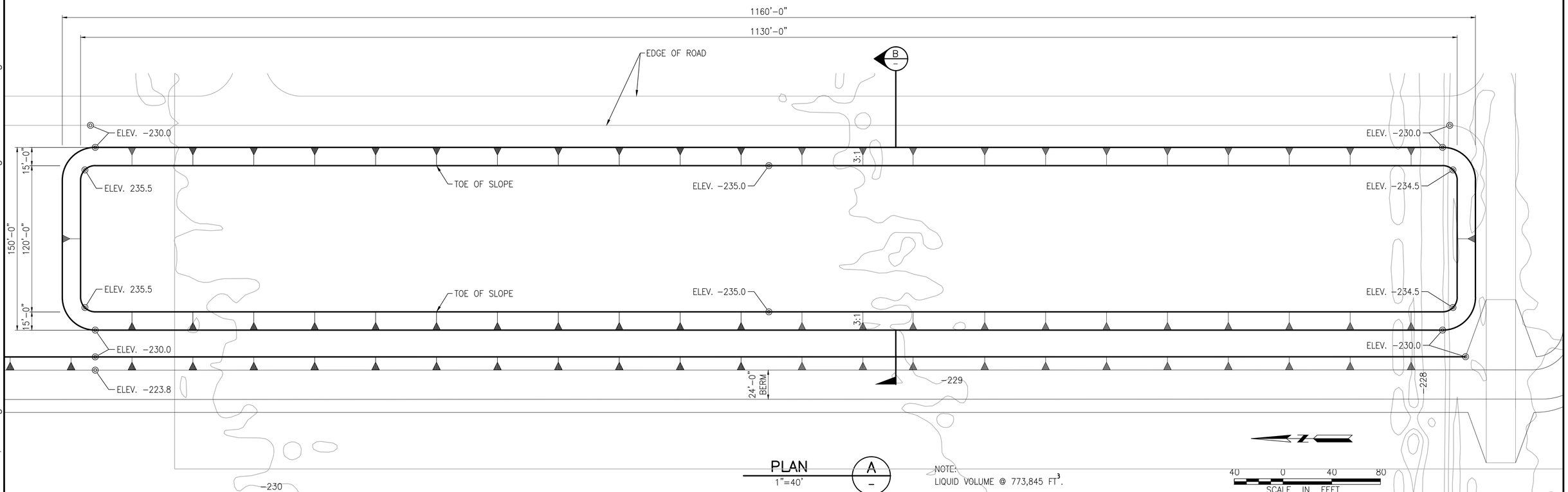
SECTION B
1"=10'



DETAIL 1
1"=1'-0"



LINER SYSTEM 2
NO SCALE



PLAN A
1"=40'

NOTE:
LIQUID VOLUME @ 773,845 FT^3.

NO.	REVISIONS	BY	APPR.	DATE
A	ISSUED FOR REVIEW	BAP	HGV	20/JAN/23

WARNING
IF BAR BELOW DOES NOT MEASURE 1 INCH THEN DRAWING IS NOT TO SCALE
0 1
1 INCH

VEIZADES & ASSOCIATES, INC.
CONSULTING ENGINEERS
5 THIRD STREET • SUITE 400 • SAN FRANCISCO • CA 94103
TEL: 415. 394.8855 FAX: 415. 394.8866

DESIGNED BY	BAP
CHECKED BY	HGV
DRAFTED BY	DA
APPROVED BY	HGV
DATE	01/18/23
SCALE	1"=30'

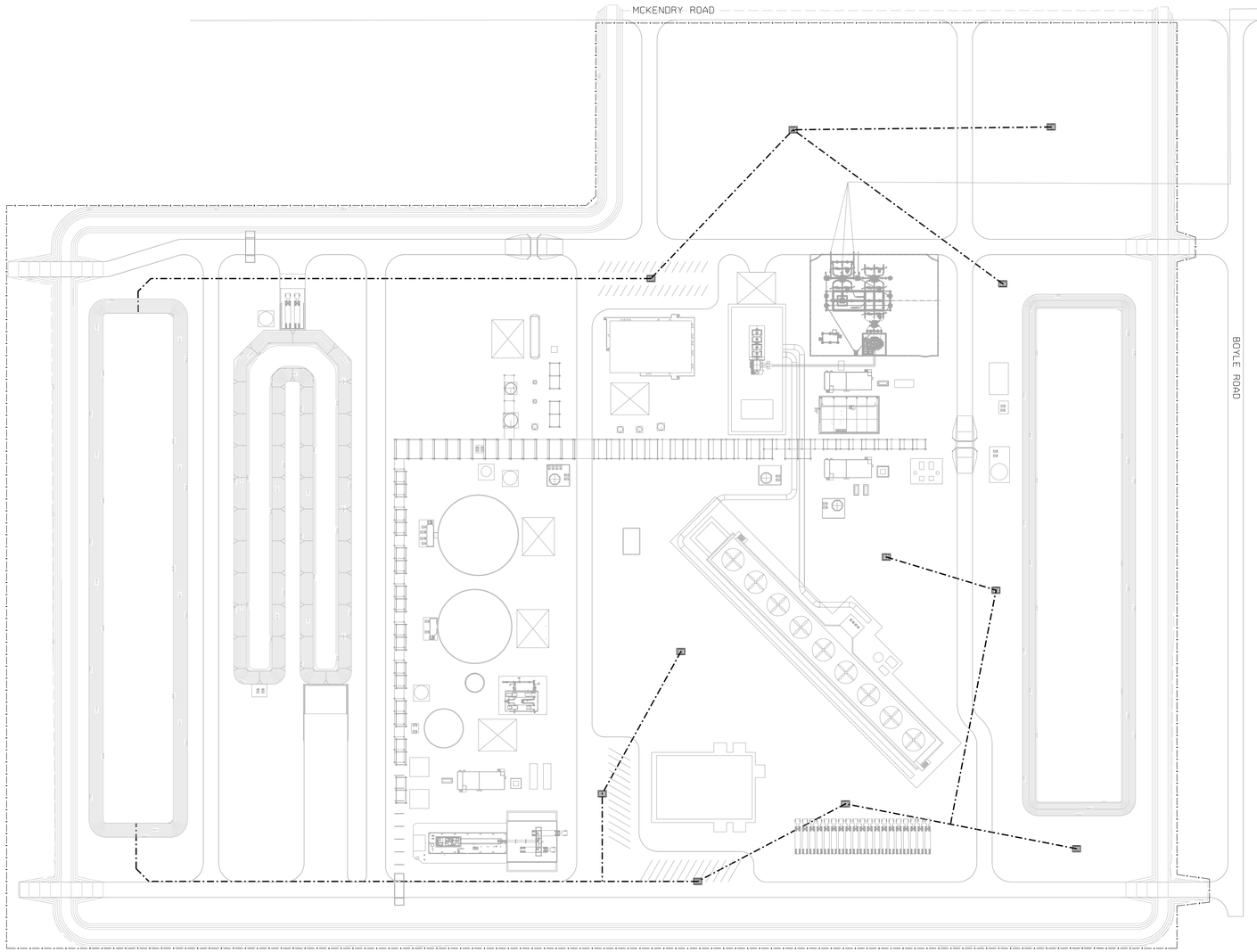
BHE RENEWABLES

NEW GENERATION
BLACK ROCK PROJECT

STORM WATER POND CIVIL PLAN

PROJECT NO.	242-067
CONTRACT NO.	
CADFILE NO.	
SHEET NO.	BR-C3-303-1
REV. NO.	A

Plot Date: 20 Jan 2023, - 15:56:18; Drawing file: S:\CAD Folder\CADFILES\242\067\Civil drawings\ BR-C3-303-1.dwg



LEGEND:

- PROPOSED EQUIPMENT / IMPROVEMENTS
- PROPOSED FENCE
- PROPOSED DRAINAGE INLET
- PROPOSED STORMWATER PIPE
- PROPOSED 1' CONTOURS

PRELIMINARY STORMWATER PIPING PLAN
SCALE: 1"=100'

NORTH

100 0 100 200 300

REV	DATE	REVISION DESCRIPTION	DRAWN	DRAFT CHK	DESIGNED	ENG CHK	APPROVED	CUSTOMER	REF DRAWING No	REFERENCE DRAWING TITLE
B	11/16/22	ISSUED FOR CLIENT REVIEW	JD	RS	JD					
A	10/31/22	ISSUED FOR CLIENT REVIEW	JD	RS	JD					

D SHEET | SCALE N/A

Worley
energy | chemicals | resources

WORLEY PROJECT No
418162-40300

ENGINEERING AND PERMIT STAMPS (As Required)

CUSTOMER

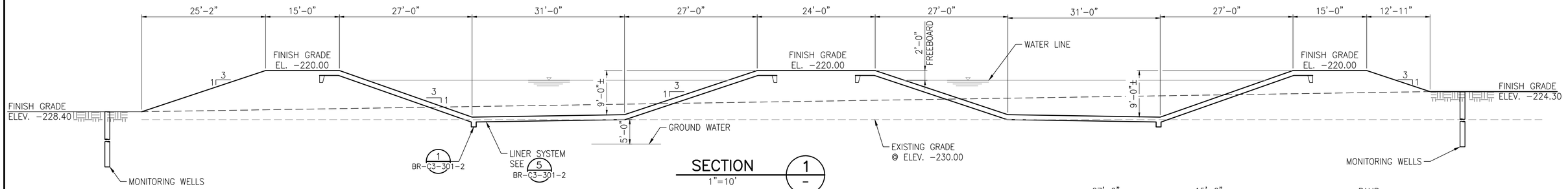
BHE RENEWABLES

DRG TITLE

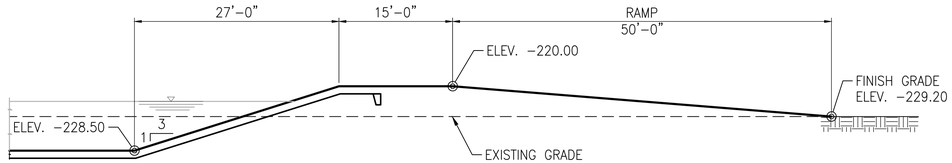
BLACK ROCK
81 MW GEOTHERMAL PLANT
PRELIMINARY
STORMWATER PIPING PLAN

DRG No 418162-40300-BR-CI-UTL-001

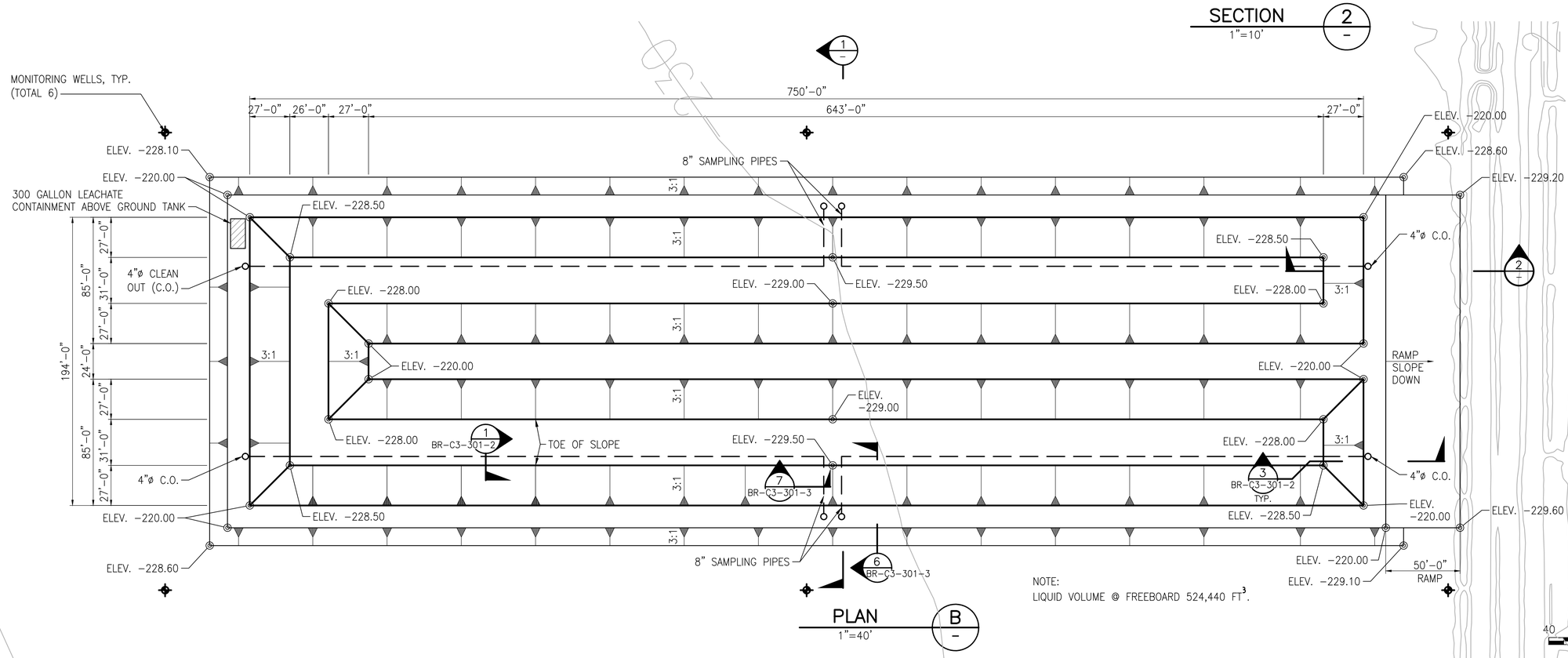
REV B



SECTION 1
1"=10'



SECTION 2
1"=10'



PLAN
1"=40'

NOTE:
LIQUID VOLUME @ FREEBOARD 524,440 FT^3.

NO.	REVISIONS	BY	APPR.	DATE
C	RE-ISSUED FOR REVIEW	BAP	HGV	02/22/23
B	RE-ISSUED FOR REVIEW	BAP	HGV	02/06/23
A	ISSUED FOR REVIEW	BAP	HGV	01/13/23

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0 1
1 INCH

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TEL: 415. 394.8855 FAX: 415. 394.8866

DESIGNED BY	BAP
CHECKED BY	HGV
DRAFTED BY	DA
APPROVED BY	HGV
DATE	12/06/22
SCALE	1"=30'

BHE RENEWABLES

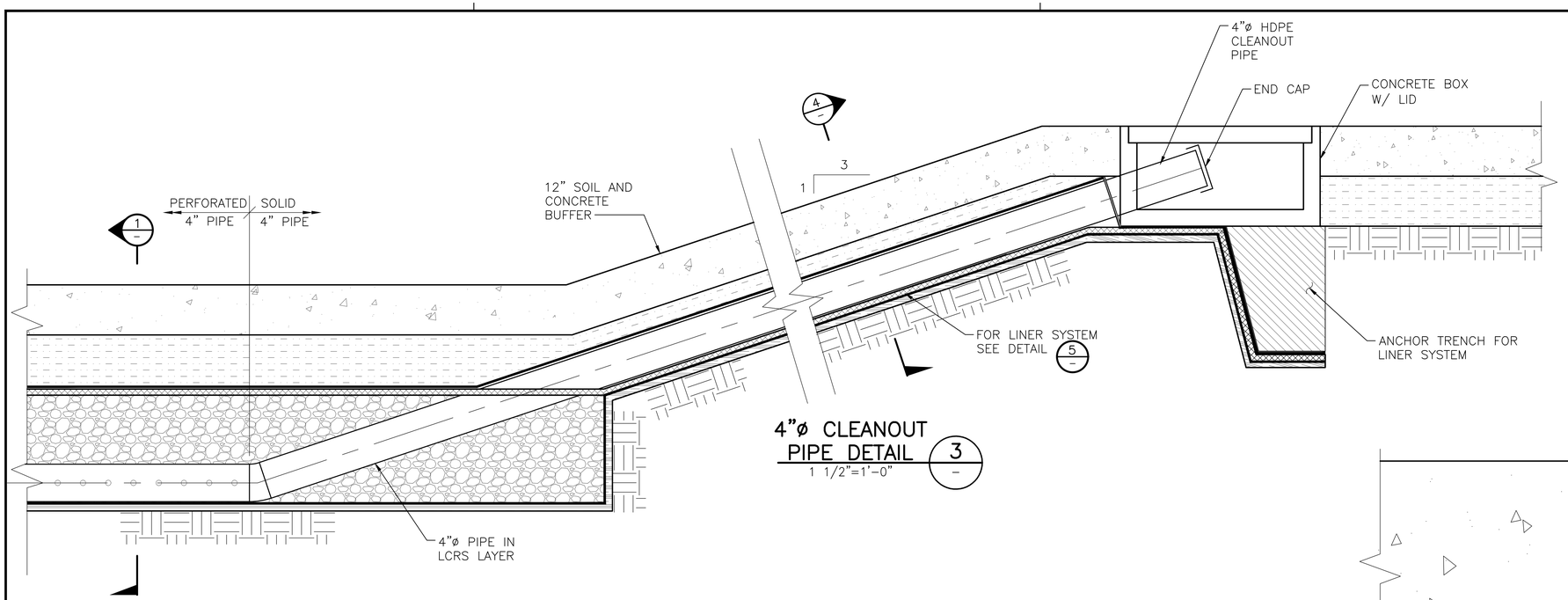
NEW GENERATION
BLACK ROCK PROJECT

BRINE POND CIVIL PLAN

PROJECT NO.	242-067
CONTRACT NO.	
CADFILE NO.	
SHEET NO.	BR-C3-301-1
REV. NO.	C

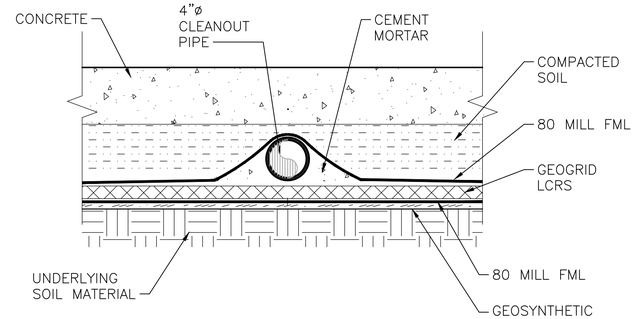
Plot Date: 22 Feb 2023, - 10:44:48; Drawing file: S:\CAD Folder\CADFILES\242\067\Civil drawings\ BR-C3-301-1.dwg

-231



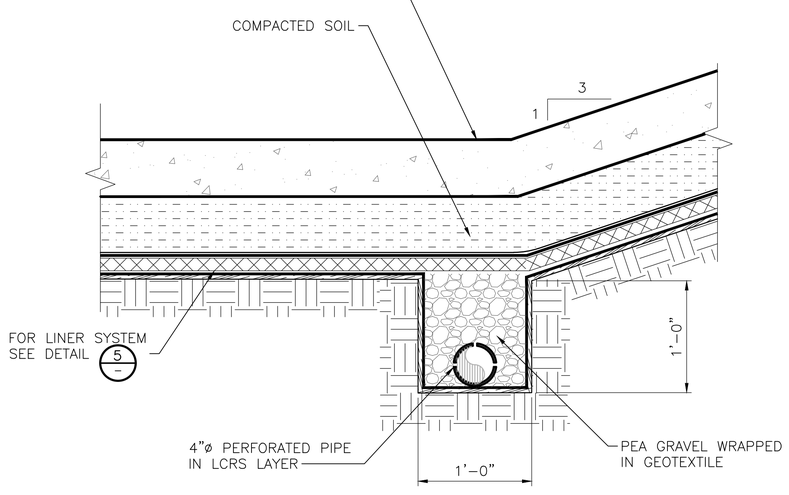
4"ø CLEANOUT PIPE DETAIL 3

1 1/2"=1'-0"



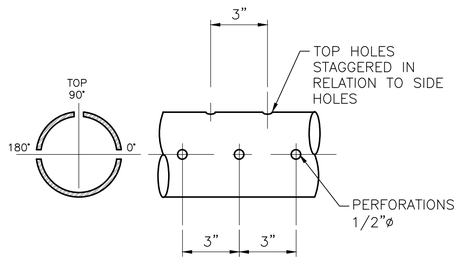
SECTION 4

NO SCALE



4"ø CLEANOUT PIPE SECTION 1

1 1/2"=1'-0"



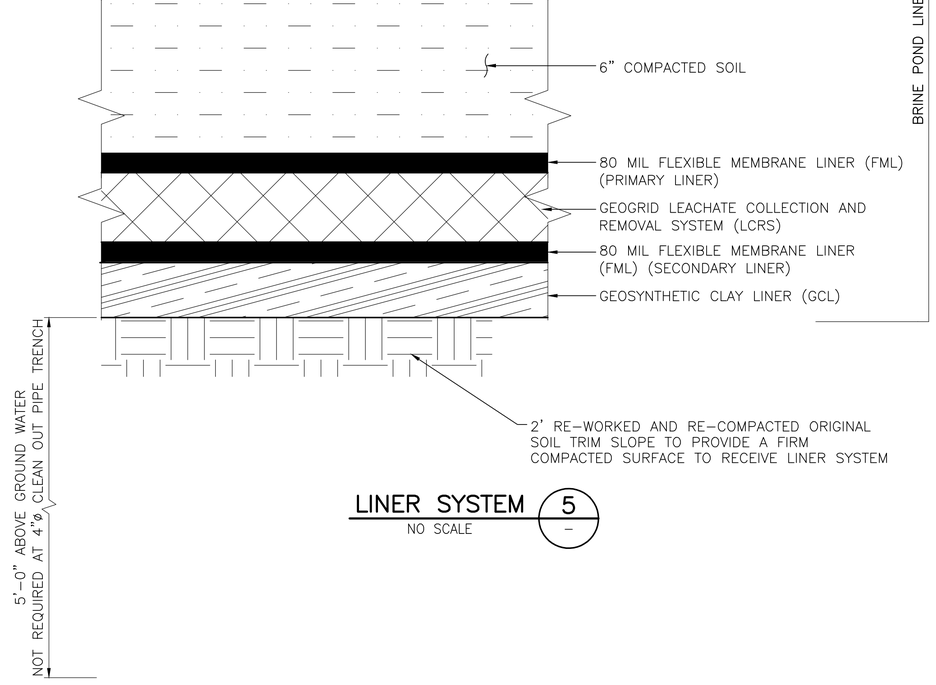
PERFORATED PIPE

NOTES:

1. LEAK DETECTION PIPE SHALL BE DIAMETER SHOWN ON PLANS AND NOT LESS THAN SCHEDULE 80 OR EQUIVALENT STRENGTH AND MADE OF HDPE.
2. THE PIPE SHALL BE DRILLED PER CALTRANS SPECIFICATION 68-2.02
3. THE JOINTS SHALL BE FUSION BUTT WELDED.
4. RAP GEOTEXTILE AROUND THE ENTIRE LENGTH OF PERFORATED PIPE.

PERFORATED PIPE 2

NO SCALE



LINER SYSTEM 5

NO SCALE

NO.	REVISIONS	BY	APPR.	DATE
B	RE-ISSUED FOR REVIEW	BAP	HGV	02/22/23
A	ISSUED FOR REVIEW	BAP	HGV	01/13/23

WARNING

IF BAR BELOW DOES NOT MEASURE 1 INCH THEN DRAWING IS NOT TO SCALE

0 1

1 INCH

VEIZADES & ASSOCIATES, INC.
CONSULTING ENGINEERS
5 THIRD STREET • SUITE 400 • SAN FRANCISCO • CA 94103
TEL: 415. 394.8855 FAX: 415. 394.8866

DESIGNED BY	BAP
CHECKED BY	HGV
DRAFTED BY	DA
APPROVED BY	HGV
DATE	12/06/22
SCALE	1 1/2"=1'-0"

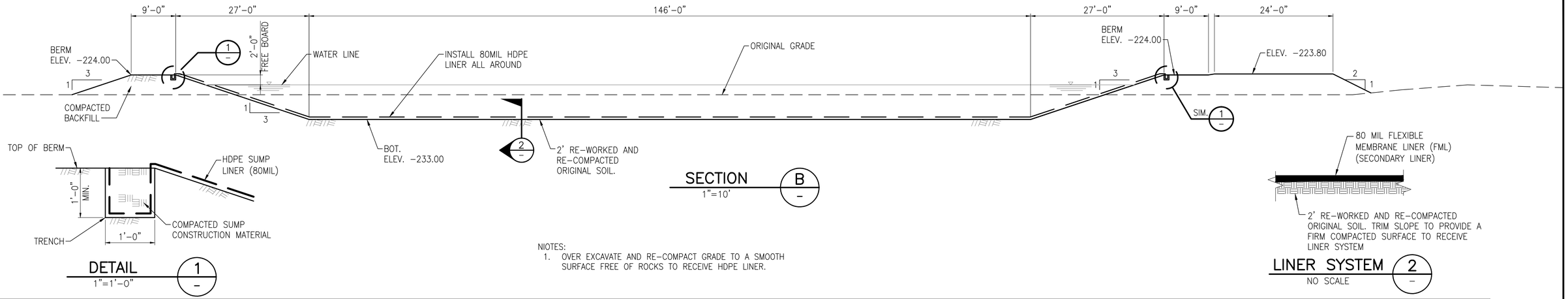
BHE RENEWABLES

NEW GENERATION
BLACK ROCK PROJECT

BRINE POND CIVIL DETAILS – 1

PROJECT NO.	242-067
CONTRACT NO.	
CADFILE NO.	
SHEET NO.	BR-C3-301-2
REV. NO.	B

Plot Date: 22 Feb 2023, - 10:44:03; Drawing file: S:\CAD Folder\CADFILES\242\067\Civil drawings\ BR-C3-301-2,3.dwg

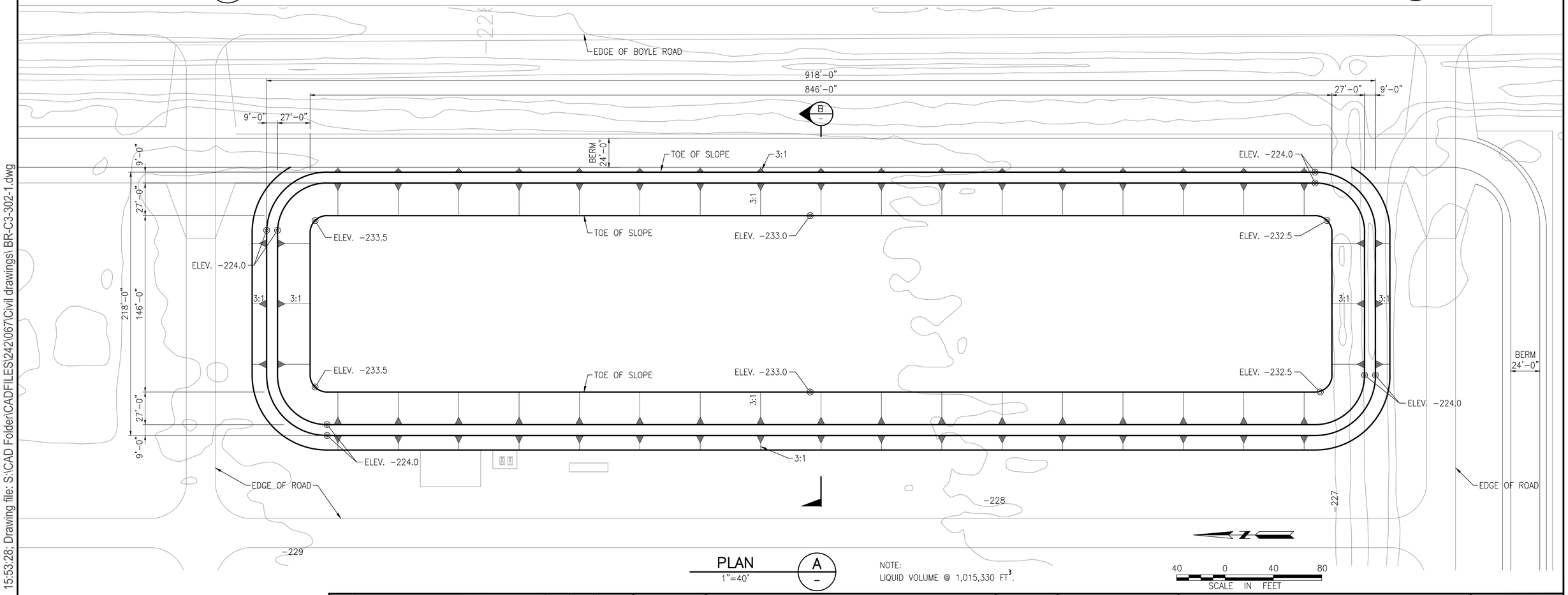


SECTION B
1"=10'

DETAIL 1
1"=1'-0"

LINER SYSTEM 2
NO SCALE

NIOTES:
1. OVER EXCAVATE AND RE-COMPACT GRADE TO A SMOOTH SURFACE FREE OF ROCKS TO RECEIVE HDPE LINER.



PLAN A
1"=40'

NOTE:
LIQUID VOLUME @ 1,015,330 FT^3.

40 0 40 80
SCALE IN FEET

NO.	REVISIONS	BY	APPR.	DATE
A	ISSUED FOR REVIEW	BAP	HGV	20/JAN/23

WARNING
IF BAR BELOW DOES NOT MEASURE 1 INCH THEN DRAWING IS NOT TO SCALE
0 1
1 INCH

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DESIGNED BY	BAP
CHECKED BY	HGV
DRAFTED BY	DA
APPROVED BY	HGV
DATE	01/17/23
SCALE	1"=30'

BHE RENEWABLES

NEW GENERATION
BLACK ROCK PROJECT

FRESH WATER POND CIVIL PLAN

PROJECT NO.	242-067
CONTRACT NO.	
CADFILE NO.	
SHEET NO.	BR-C3-302-1
REV. NO.	A

Plot Date: 20 Jan 2023, - 15:53:28; Drawing file: S:\CAD Folder\CADFILES\242067\Civil drawings\ BR-C3-302-1.dwg

Figures