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Subject: *Drainage Memo for Channel Road – Phase 1 (Osuna Road to Hawkins Street), Albuquerque, New Mexico Albuquerque Project No. 6920.91* *December 22, 2011*

T.Y. Lin International (TYLI) has provided this *Drainage Memo* as a supplement to the *Drainage Report, Essayons Boulevard, Osuna Road to Alameda Boulevard (Report)*, dated April 2011 and submitted to the City of Albuquerque as a part of the *Essayons Boulevard, Osuna Road to Alameda Boulevard, Feasibility Study.* This letter is intended to document the drainage design for the segment of Channel Road (formally called Essayons Boulevard) between Osuna Road and Hawkins Street. Included with this letter are the hydrologic calculations for the on-site drainage areas and the off-site watersheds that impact the project site and the hydraulic calculations that were performed to size the various drainage appurtenances for the project. A HEC-RAS model was also prepared to analyze the impacts of the Channel Road crossing on the South Pino Arroyo. These calculations can be found in Appendix A.

SITE DESCRIPTION

Channel Road is located in Albuquerque, New Mexico and will be constructed in AMAFCA's North Diversion Channel right-of-way. The roadway will extend along the east bank of the diversion channel between Osuna Road and Hawkins Street. The roadway is bounded on the east by a moderately developed industrial area. Approximately ½ mile north of Osuna Road, the South Pino Arroyo intersects Channel Road and immediately discharges into the North Diversion Channel. This crossing acts as a dividing line for the methodology used to convey the stormwater impacting the project.

PROPOSED DRAINAGE PLAN

South of the South Pino Arroyo, stormwater generated off-site is collected in a roadside ditch and is conveyed to the north before being passed beneath Channel Road in two separate culvert crossings. Both of these culverts discharge to the North Diversion Channel. Within this segment of roadway on-site generated stormwater is conveyed along the east gutter to two low points within the roadway. The roadway is drained at these locations utilizing sidewalk scuppers which discharge to the roadside ditch.

North of the South Pino Arroyo, stormwater generated both on-site and off-site are collected using two storm drain systems. These systems discharge to the North Diversion Channel near the intersection of Channel Road and Hawkins Street.

HYDROLOGIC CALCULATIONS

A hydrologic evaluation was performed using the methodology from Chapter 22 of the City Development Process Manual (DPM), Volume 2. The peak discharges for the 2-year, 10-year, and 100-year frequency design storms were calculated. As specified in the DPM the 6-hour duration for these events was utilized. These calculations along with both an on-site and off-site exhibit (Exhibit 1 and 2 respectively) showing the subbasin boundaries are included in Appendix A. Additional information can be found in the original R*eport.*

HYDRAULIC CALCULATIONS

Inlet Capacity

Inlet capacity was calculated using Bentley FlowMaster V8i. This program calculates inlet interception capacity and spread for various types of stormwater inlets based on various roadway variables including cross-slope, pavement grade, etc. The output from the program has been included within Appendix A.

Area Drain Capacity

Two off-site drainage areas require the use of area drains to collect runoff. These drainage areas are being drained using catchments per NMDOT Detail 623-06. The capacity of these catch basins was calculated based on the ponded depth of water above the inlet grate. The grate capacity was calculated for various ponded depths for the inlet acting as both a weir and an orifice. The lesser of these two capacities was selected as the design inlet capacity. See Appendix A for the included spreadsheet for the area drain calculations.

Storm Drain

Two storm drain systems are used to collect stormwater and convey it to the North Diversion Channel. These systems were analyzed using Bentley StormCAD V8i. A profile showing the hydraulic grade line (100-year frequency event) for the two trunklines is provided in the Appendix.

Culvert Capacity

Two culverts are used to convey stormwater from the roadside ditch to the North Diversion Channel. These culverts were sized using Bently CulvertMaster v3.3. The output from this program can be found in Appendix A.

Roadside Ditch Capacity

The capacity of the roadside ditch was calculated at 50-foot increments using Manning's equation and the designed physical features of the channel. At each section the channel has sufficient capacity to convey the 100-year offsite flows that impact the channel. A summary table for the channel geometry and resultant capacity can be found in Appendix A.

HEC-RAS

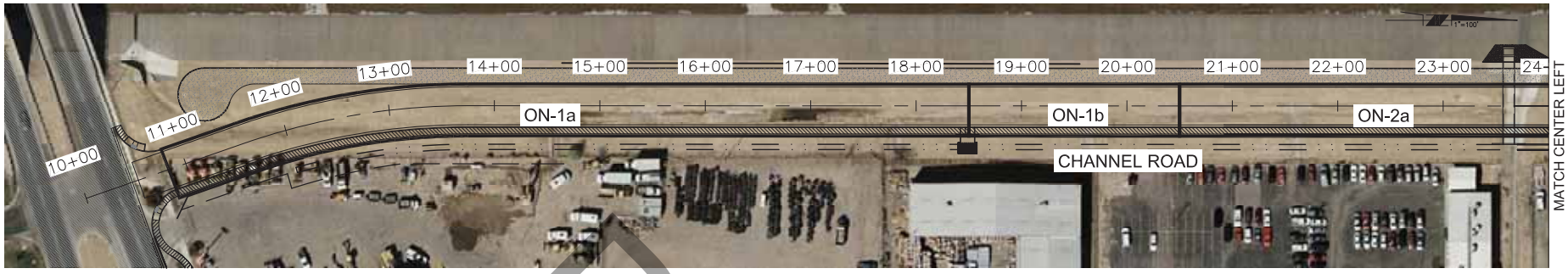
A box culvert has been designed to allow Channel Road to cross over the existing South Pino Arroyo. Transitions into and out of the box culvert have also been designed. These improvements were modeled using HEC-RAS 4.1.0 and compared to an existing condition model which was also prepared. Two 500-year flow profiles (2,000 and 4,100 cfs) were provided to TYLI by AMAFACA for use in sizing the box culvert. Output from HEC-RAS is included in the Appendix. In general, the box culvert and transitions provided increase the capacity of the South Pino Arroyo for the two flow profiles analyzed.

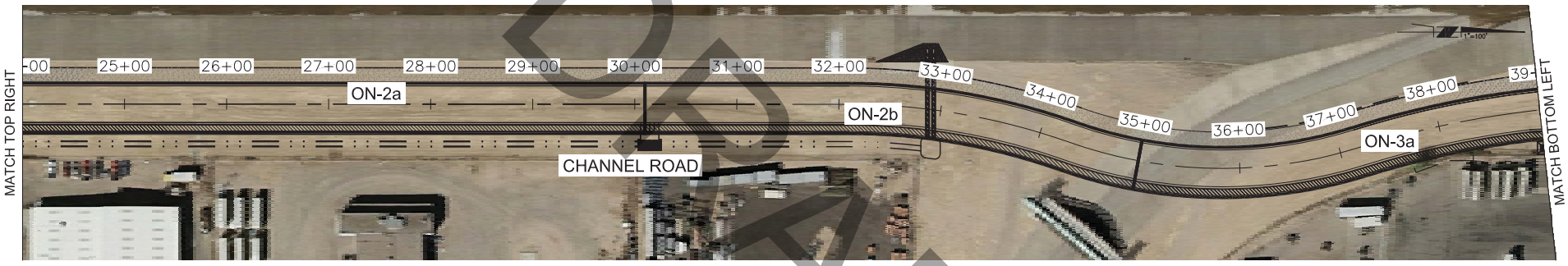
The existing condition and the proposed condition HEC-RAS models were also analyzed using HEC-RAS to determine their top of bank capacities. The capacity of the existing condition configuration was determined to be approximately 11,000 cfs while the proposed condition capacity is also approximately 11,000 cfs. The controlling cross sections are River Stations 1650 and 2000. At this flow rate, the water surface elevation increases for the proposed condition. However, since the flow is over two times the 500-year event the box culvert is unlikely to ever see flows this high.

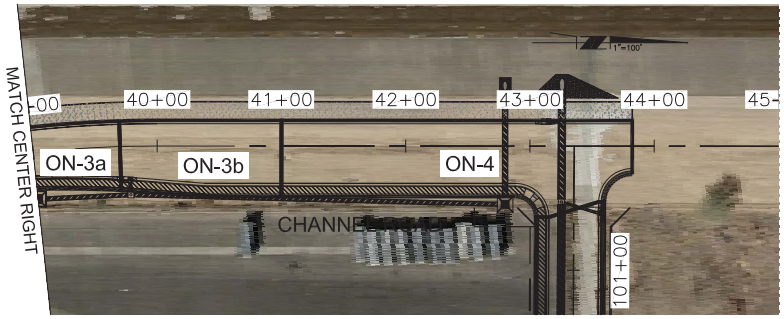
Sincerely,

Eric Froberg, P.E.
Project Manager
T.Y. Lin International

APPENDIX A







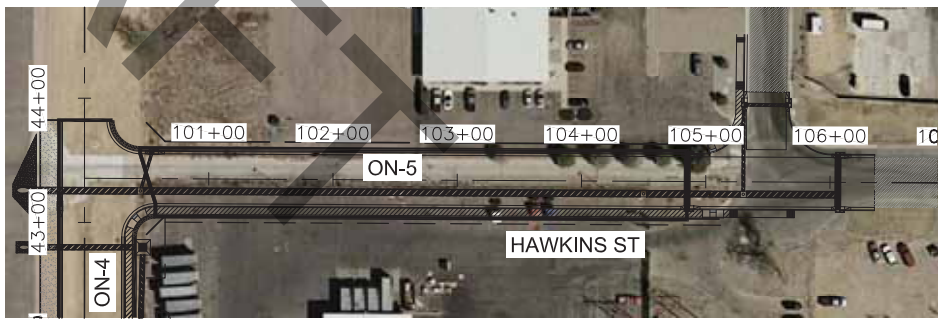


EXHIBIT 1 - ON-SITE SUBBASIN DRAINAGE MAP

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On-Site Subbasin Calculations

Project: Channel Road
Location: Albuquerque, NM
Date: December 20, 2011

Proj. Number: 221706
Proj. Engineer: R Strickland
Checker: E Froberg

References: Chapter 22, Drainage, Flood Control and Erosion Control

Precipitation Zone: 2

Intensity	
2-yr, 6-hr=	2.04
10-yr, 6-hr=	3.41
100-yr, 6-hr=	5.05

Basin ID: ON-01a

1. Land Treatment Areas

A:	0	sq.ft.	0.00	ac.
B:	0	sq.ft.	0.00	ac.
C:	0	sq.ft.	0.00	ac.
D:	37700	sq.ft.	0.87	ac.
Total:	37700	sq.ft.	0.87	ac.

2. Weighted C*A, Rational Coefficient*Acre

$C*A_2$=	0.8
$C*A_{10}$=	0.8
$C*A_{100}$=	0.8

3. Peak Discharge, Q

Q_2=	1.6	cfs
Q_{10}=	2.7	cfs
Q_{100}=	4.1	cfs

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On-Site Subbasin Calculations

Project: Channel Road
Location: Albuquerque, NM
Date: December 20, 2011

Proj. Number: 221706
Proj. Engineer: R Strickland
Checker: E Froberg

References: Chapter 22, Drainage, Flood Control and Erosion Control

Precipitation Zone: 2

Intensity	
2-yr, 6-hr=	2.04
10-yr, 6-hr=	3.41
100-yr, 6-hr=	5.05

Basin ID: ON-01b

1. Land Treatment Areas

A:	0 sq.ft.	0.00 ac.
B:	0 sq.ft.	0.00 ac.
C:	0 sq.ft.	0.00 ac.
D:	9610 sq.ft.	0.22 ac.
Total:	9610 sq.ft.	0.22 ac.

2. Weighted C*A, Rational Coefficient*Acre

$C*A_2$=	0.2
$C*A_{10}$=	0.2
$C*A_{100}$=	0.2

3. Peak Discharge, Q

Q_2=	0.4 cfs
Q_{10}=	0.7 cfs
Q_{100}=	1.0 cfs

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On-Site Subbasin Calculations

Project:	Channel Road	**Proj. Number:**	221706
Location:	Albuquerque, NM	**Proj. Engineer:**	R Strickland
Date:	December 20, 2011	**Checker:**	E Froberg

References: Chapter 22, Drainage, Flood Control and Erosion Control

Precipitation Zone: 2

Intensity	
2-yr, 6-hr=	2.04
10-yr, 6-hr=	3.41
100-yr, 6-hr=	5.05

Basin ID: ON-01

1. Land Treatment Areas

A:	0	sq.ft.	0.00	ac.
B:	0	sq.ft.	0.00	ac.
C:	0	sq.ft.	0.00	ac.
D:	47310	sq.ft.	1.09	ac.
Total:	47310	sq.ft.	1.09	ac.

2. Weighted C*A, Rational Coefficient*Acre

$C*A_2$=	1.0
$C*A_{10}$=	1.0
$C*A_{100}$=	1.0

3. Peak Discharge, Q

Q_2=	2.0	cfs
Q_{10}=	3.4	cfs
Q_{100}=	5.1	cfs

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On-Site Subbasin Calculations

Project: Channel Road
Location: Albuquerque, NM
Date: December 20, 2011

Proj. Number: 221706
Proj. Engineer: R Strickland
Checker: E Froberg

References: Chapter 22, Drainage, Flood Control and Erosion Control

Precipitation Zone: 2

Intensity	
2-yr, 6-hr=	2.04
10-yr, 6-hr=	3.41
100-yr, 6-hr=	5.05

Basin ID: ON-02a

1. Land Treatment Areas

A:	0	sq.ft.	0.00	ac.
B:	0	sq.ft.	0.00	ac.
C:	0	sq.ft.	0.00	ac.
D:	47280	sq.ft.	1.09	ac.
Total:	47280	sq.ft.	1.09	ac.

2. Weighted C*A, Rational Coefficient*Acre

$C*A_2$=	1.0
$C*A_{10}$=	1.0
$C*A_{100}$=	1.0

3. Peak Discharge, Q

Q_2=	2.0	cfs
Q_{10}=	3.4	cfs
Q_{100}=	5.1	cfs

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On-Site Subbasin Calculations

Project: Channel Road
Location: Albuquerque, NM
Date: December 20, 2011

Proj. Number: 221706
Proj. Engineer: R Strickland
Checker: E Froberg

References: Chapter 22, Drainage, Flood Control and Erosion Control

Precipitation Zone: 2

Intensity	
2-yr, 6-hr=	2.04
10-yr, 6-hr=	3.41
100-yr, 6-hr=	5.05

Basin ID: ON-02b

1. Land Treatment Areas

A:	0	sq.ft.	0.00	ac.
B:	0	sq.ft.	0.00	ac.
C:	0	sq.ft.	0.00	ac.
D:	24096	sq.ft.	0.55	ac.
Total:	24096	sq.ft.	0.55	ac.

2. Weighted C*A, Rational Coefficient*Acre

$C*A_2$=	0.5
$C*A_{10}$=	0.5
$C*A_{100}$=	0.5

3. Peak Discharge, Q

Q_2=	1.0	cfs
Q_{10}=	1.7	cfs
Q_{100}=	2.6	cfs

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On-Site Subbasin Calculations

Project: Channel Road
Location: Albuquerque, NM
Date: December 20, 2011

Proj. Number: 221706
Proj. Engineer: R Strickland
Checker: E Froberg

References: Chapter 22, Drainage, Flood Control and Erosion Control

Precipitation Zone: 2

Intensity	
2-yr, 6-hr=	2.04
10-yr, 6-hr=	3.41
100-yr, 6-hr=	5.05

Basin ID: ON-02

1. Land Treatment Areas

A:	0	sq.ft.	0.00	ac.
B:	0	sq.ft.	0.00	ac.
C:	0	sq.ft.	0.00	ac.
D:	71376	sq.ft.	1.64	ac.
Total:	71376	sq.ft.	1.64	ac.

2. Weighted C*A, Rational Coefficient*Acre

$C*A_2$=	1.5
$C*A_{10}$=	1.5
$C*A_{100}$=	1.5

3. Peak Discharge, Q

Q_2=	3.0	cfs
Q_{10}=	5.1	cfs
Q_{100}=	7.7	cfs

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On-Site Subbasin Calculations

Project:	Channel Road	**Proj. Number:**	221706
Location:	Albuquerque, NM	**Proj. Engineer:**	R Strickland
Date:	December 20, 2011	**Checker:**	E Froberg

References: Chapter 22, Drainage, Flood Control and Erosion Control

Precipitation Zone: 2

Intensity	
2-yr, 6-hr=	2.04
10-yr, 6-hr=	3.41
100-yr, 6-hr=	5.05

Basin ID: ON-03a

1. Land Treatment Areas

A:	0	sq.ft.	0.00	ac.
B:	0	sq.ft.	0.00	ac.
C:	0	sq.ft.	0.00	ac.
D:	23449	sq.ft.	0.54	ac.
Total:	23449	sq.ft.	0.54	ac.

2. Weighted C*A, Rational Coefficient*Acre

$C*A_2$=	0.5
$C*A_{10}$=	0.5
$C*A_{100}$=	0.5

3. Peak Discharge, Q

Q_2=	1.0	cfs
Q_{10}=	1.7	cfs
Q_{100}=	2.5	cfs

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On-Site Subbasin Calculations

Project: Channel Road
Location: Albuquerque, NM
Date: December 20, 2011

Proj. Number: 221706
Proj. Engineer: R Strickland
Checker: E Froberg

References: Chapter 22, Drainage, Flood Control and Erosion Control

Precipitation Zone: 2

Intensity	
2-yr, 6-hr=	2.04
10-yr, 6-hr=	3.41
100-yr, 6-hr=	5.05

Basin ID: ON-03b

1. Land Treatment Areas

A:	0	sq.ft.	0.00	ac.
B:	0	sq.ft.	0.00	ac.
C:	0	sq.ft.	0.00	ac.
D:	7762	sq.ft.	0.18	ac.
Total:	7762	sq.ft.	0.18	ac.

2. Weighted C*A, Rational Coefficient*Acre

$C*A_2$=	0.2
$C*A_{10}$=	0.2
$C*A_{100}$=	0.2

3. Peak Discharge, Q

Q_2=	0.3	cfs
Q_{10}=	0.6	cfs
Q_{100}=	0.8	cfs

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On-Site Subbasin Calculations

Project:	Channel Road	**Proj. Number:**	221706
Location:	Albuquerque, NM	**Proj. Engineer:**	R Strickland
Date:	December 20, 2011	**Checker:**	E Froberg

References: Chapter 22, Drainage, Flood Control and Erosion Control

Precipitation Zone: 2

Intensity	
2-yr, 6-hr=	2.04
10-yr, 6-hr=	3.41
100-yr, 6-hr=	5.05

Basin ID: ON-03

1. Land Treatment Areas

A:	0	sq.ft.	0.00 ac.
B:	0	sq.ft.	0.00 ac.
C:	0	sq.ft.	0.00 ac.
D:	31211	sq.ft.	0.72 ac.
Total:	31211	sq.ft.	0.72 ac.

2. Weighted C*A, Rational Coefficient*Acre

$C*A_2$=	0.7
$C*A_{10}$=	0.7
$C*A_{100}$=	0.7

3. Peak Discharge, Q

Q_2=	1.3	cfs
Q_{10}=	2.2	cfs
Q_{100}=	3.4	cfs

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On-Site Subbasin Calculations

Project:	Channel Road	**Proj. Number:**	221706
Location:	Albuquerque, NM	**Proj. Engineer:**	R Strickland
Date:	December 20, 2011	**Checker:**	E Froberg

References: Chapter 22, Drainage, Flood Control and Erosion Control

Precipitation Zone: 2

Intensity	
2-yr, 6-hr=	2.04
10-yr, 6-hr=	3.41
100-yr, 6-hr=	5.05

Basin ID: ON-04

1. Land Treatment Areas

A:	0	sq.ft.	0.00 ac.
B:	0	sq.ft.	0.00 ac.
C:	0	sq.ft.	0.00 ac.
D:	17666	sq.ft.	0.41 ac.
Total:	17666	sq.ft.	0.41 ac.

2. Weighted C*A, Rational Coefficient*Acre

$C*A_2$=	0.4
$C*A_{10}$=	0.4
$C*A_{100}$=	0.4

3. Peak Discharge, Q

Q_2=	0.8	cfs
Q_{10}=	1.3	cfs
Q_{100}=	1.9	cfs

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On-Site Subbasin Calculations

Project: Channel Road
Location: Albuquerque, NM
Date: December 20, 2011

Proj. Number: 221706
Proj. Engineer: R Strickland
Checker: E Froberg

References: Chapter 22, Drainage, Flood Control and Erosion Control

Precipitation Zone: 2

Intensity	
2-yr, 6-hr=	2.04
10-yr, 6-hr=	3.41
100-yr, 6-hr=	5.05

Basin ID: ON-05

1. Land Treatment Areas

A:	0	sq.ft.	0.00	ac.
B:	0	sq.ft.	0.00	ac.
C:	0	sq.ft.	0.00	ac.
D:	23942	sq.ft.	0.55	ac.
Total:	23942	sq.ft.	0.55	ac.

2. Weighted C*A, Rational Coefficient*Acre

$C*A_2$=	0.5
$C*A_{10}$=	0.5
$C*A_{100}$=	0.5

3. Peak Discharge, Q

Q_2=	1.0	cfs
Q_{10}=	1.7	cfs
Q_{100}=	2.6	cfs

EXHIBIT 2 - OFF-SITE SUBBASIN DRAINAGE MAP

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Albuquerque, NM 87102

Smaller than 40 Acres Offsite Sub Basin Calculations

Project: Channel Road
Location: Albuquerque, NM
Date: December 20, 2011

Proj. Number: 221706
Proj. Engineer: R Strickland
Checker: E Froberg

References: Chapter 22, Drainage, Flood Control and Erosion Control

Subbasin ID	Contributing Area (ac)	Weighted C	C x A	Q_{P2} Discharge (cfs)	Q_{P10} Discharge (cfs)	Q_{P100} Discharge (cfs)
OFF-1	16.48	0.89	14.67	30	50	74
OFF-3	16.65	0.89	14.82	30	51	75
OFF-4	8.56	0.89	7.62	16	26	38
OFF-5	16.48	0.89	14.67	30	50	74

For Zone 2 I_{100}=5.05 for Tc=0.2 hr

For Zone 2 I_{10}=3.41 for Tc=0.2 hr

For Zone 2 I_{2}=2.04 for Tc=0.2 hr

Larger than 40 Acres Offsite Sub Basin Calculations

Project: Channel Road
Location: Albuquerque, NM
Date: December 20, 2011

Proj. Number: 221706
Proj. Engineer: R Strickland
Checker: E Froberg

References: Chapter 22, Drainage, Flood Control and Erosion Control

Subbasin ID	Contributing Area (ac)	Weighted C	C x A	Flowpath Length (ft)	Flowpath Slope (ft/ft)	K Convey Factor	K_N Lag Factor	L/L_{CA} Percent L To Centroid	Tc Time (hr)	I_2 Intensity (in/hr)	Q_{P2} Flow (cfs)	I_{10} Intensity (in/hr)	Q_{P10} Flow (cfs)	I_{100} Intensity (in/hr)	Q_{P100} Flow (cfs)
OFF-2	46.40	0.89	41.29	2680	0.0150	3.00	N/A	N/A	0.203	2.0	83.61	3.1	129.10	5.0	207
OFF-6	59.65	0.89	53.09	2680	0.0150	3.00	N/A	N/A	0.203	2.0	107.49	3.1	165.98	5.0	267

Scupper 18+48

Project Description

Solve For	Spread

Input Data

Discharge		5.10	ft³/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.06	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		20.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		0.00	in
Local Depression Width		0.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	10.33	ft
Depth	0.29	ft
Gutter Depression	0.09	ft
Total Depression	0.09	ft

Scupper 30+15

Project Description

Solve For	Spread

Input Data

Discharge		7.70	ft^3/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.06	ft/ft
Road Cross Slope		0.02	ft/ft
Curb Opening Length		28.00	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Local Depression		0.00	in
Local Depression Width		0.00	ft
Throat Incline Angle		90.00	degrees

Results

Spread	11.19	ft
Depth	0.31	ft
Gutter Depression	0.09	ft
Total Depression	0.09	ft

Inlet 39+78

Project Description

Solve For	Spread

Input Data

Discharge		3.40	ft³/s
Gutter Width		2.00	ft
Gutter Cross Slope		0.06	ft/ft
Road Cross Slope		0.02	ft/ft
Local Depression		2.75	in
Local Depression Width		2.00	ft
Grate Width		2.00	ft
Grate Length		3.33	ft
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")		
Clogging		20.00	%
Curb Opening Length		7.50	ft
Opening Height		0.73	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option	Use Both

Results

Spread	8.38	ft
Depth	0.25	ft
Gutter Depression	0.09	ft
Total Depression	0.31	ft
Open Grate Area	4.26	ft²
Active Grate Weir Length	6.53	ft

Inlet 43+15

Project Description

Solve For	Efficiency

Input Data

Discharge	1.90	ft³/s
Slope	0.00500	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.06	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.017	
Local Depression	2.75	in
Local Depression Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.33	ft
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")	
Clogging	20.00	%
Curb Opening Length	0.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	68.53	%
Intercepted Flow	1.30	ft³/s
Bypass Flow	0.60	ft³/s
Spread	10.00	ft
Depth	0.29	ft
Flow Area	1.09	ft²
Gutter Depression	0.09	ft
Total Depression	0.31	ft
Velocity	1.75	ft/s
Splash Over Velocity	5.68	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.32	
Grate Flow Ratio	0.54	
Equivalent Cross Slope	0.10475	ft/ft
Active Grate Length	2.66	ft
Length Factor	0.00	
Total Interception Length	7.15	ft

Inlet 100+54

Project Description

Solve For	Efficiency

Input Data

Discharge	2.60	ft³/s
Slope	0.01260	ft/ft
Gutter Width	2.00	ft
Gutter Cross Slope	0.06	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.017	
Local Depression	2.75	in
Local Depression Width	2.00	ft
Grate Width	2.00	ft
Grate Length	3.33	ft
Grate Type	P-50 mm x 100 mm (P-1-7/8"-4")	
Clogging	20.00	%
Curb Opening Length	0.00	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	64.52	%
Intercepted Flow	1.68	ft³/s
Bypass Flow	0.92	ft³/s
Spread	9.38	ft
Depth	0.27	ft
Flow Area	0.96	ft²
Gutter Depression	0.09	ft
Total Depression	0.31	ft
Velocity	2.70	ft/s
Splash Over Velocity	5.68	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.18	
Grate Flow Ratio	0.57	
Equivalent Cross Slope	0.10947	ft/ft
Active Grate Length	2.66	ft
Length Factor	0.00	
Total Interception Length	10.49	ft

Trench Grate 105+85

Project Description

Solve For	Efficiency

Input Data

Roughness Coefficient	0.016	
Slope	0.01000	ft/ft
Left Side Slope	0.08	ft/ft (H:V)
Right Side Slope	0.08	ft/ft (H:V)
Bottom Width	40.00	ft
Discharge	82.00	ft³/s
Grate Width	40.00	ft
Grate Length	3.00	ft
Grate Type	Reticuline	
Clogging	25.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	96.20	%
Intercepted Flow	78.88	ft³/s
Bypass Flow	3.12	ft³/s
Flow Area	16.28	ft²
Wetted Perimeter	40.82	ft
Top Width	40.07	ft
Velocity	5.04	ft/s
Splash Over Velocity	4.61	ft/s
Frontal Flow Factor	0.96	
Side Flow Factor	0.97	
Grate Flow Ratio	1.00	
Active Grate Length	2.25	ft
Critical Depth	0.51	ft
Critical Slope	0.00483	ft/ft
Froude Number	1.39	
Flow Type	Supercritical	
Specific Energy	0.80	ft
Velocity Head	0.39	ft
Depth	0.41	ft

Trench Grate 106+06

Project Description

Solve For	Efficiency

Input Data

Roughness Coefficient	0.016	
Slope	0.01000	ft/ft
Left Side Slope	0.08	ft/ft (H:V)
Right Side Slope	0.08	ft/ft (H:V)
Bottom Width	40.00	ft
Discharge	267.00	ft³/s
Grate Width	40.00	ft
Grate Length	3.00	ft
Grate Type	Reticuline	
Clogging	25.00	%

Options

Grate Flow Option	Exclude None

Results

Efficiency	69.50	%
Intercepted Flow	185.56	ft³/s
Bypass Flow	81.44	ft³/s
Flow Area	33.34	ft²
Wetted Perimeter	41.67	ft
Top Width	40.14	ft
Velocity	8.01	ft/s
Splash Over Velocity	4.61	ft/s
Frontal Flow Factor	0.69	
Side Flow Factor	0.92	
Grate Flow Ratio	1.00	
Active Grate Length	2.25	ft
Critical Depth	1.11	ft
Critical Slope	0.00385	ft/ft
Froude Number	1.55	
Flow Type	Supercritical	
Specific Energy	1.83	ft
Velocity Head	1.00	ft
Depth	0.83	ft

CATCH BASIN INTERCEPTION CAPACITY

Project:	Channel Road	**Proj. Number:**	221706
Location:	Albuquerque, NM	**Proj. Engineer:**	R Strickland
Date:	December 21, 2011	**Checker:**	E Froberg

Description: Calculation of Catch Basin Interception Capacity

Calculated Values: $Q_i=EC_wPd^{1.5}$ Inlet Acting as a Weir

$Q_i=EC_oA_g(2gd)^5$ Inlet Acting as an Orifice

Where,

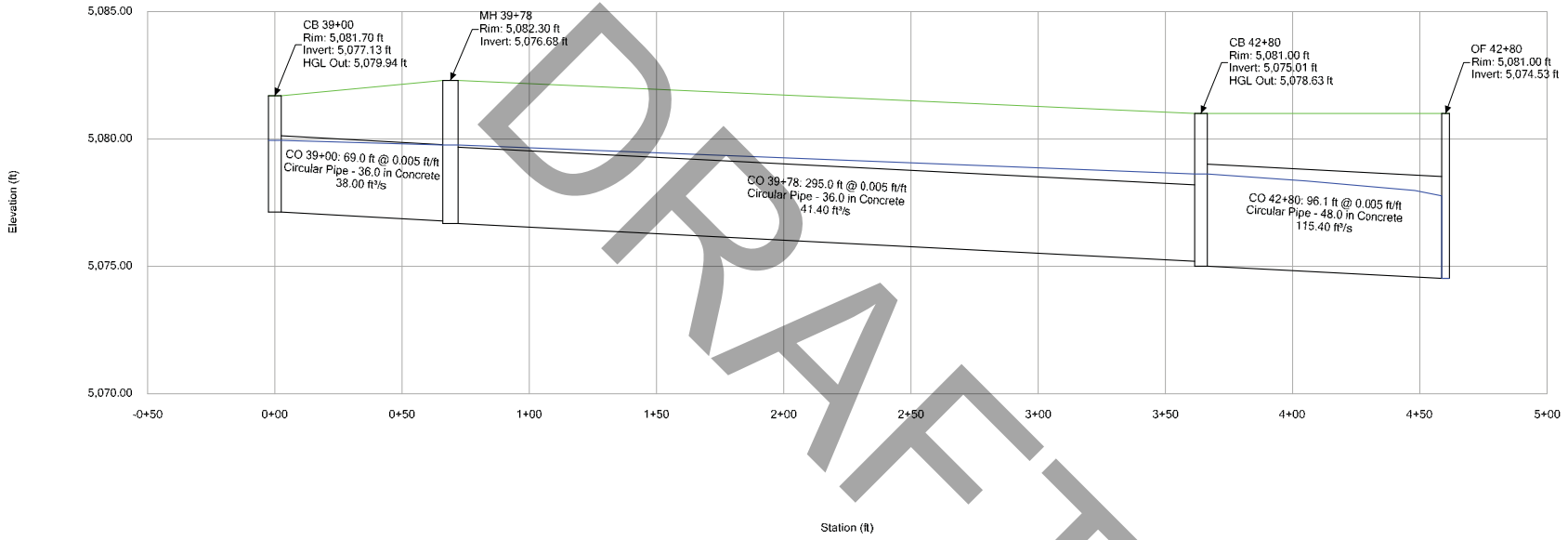
C_w=	3.0		
C_o=	0.67		
P=	20	(ft)	Grate Perimeter
d=	Water Depth		
A_g=	20	(ft^2)	Grate Clear Area
g=	32.2	(ft/s^2)	Gravity
E=	80%		Efficiency

Catch Basin: NMDOT 623-06

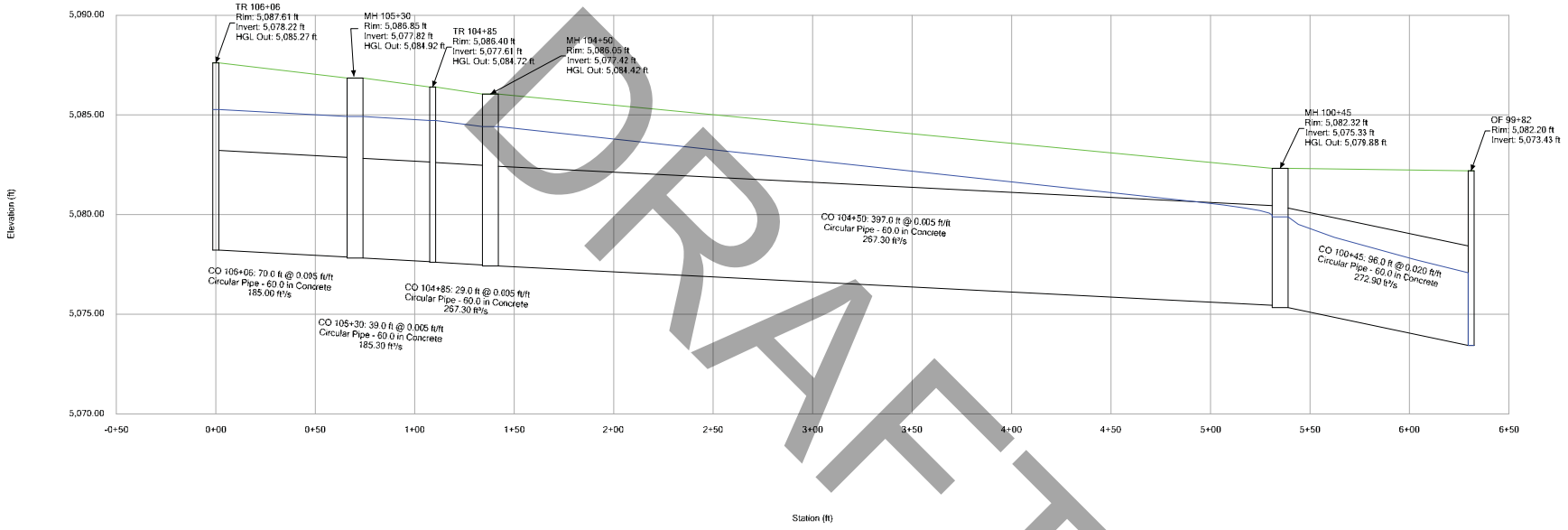
Water Depth (ft)	Grate Capacity		Grate Interception (cfs)
	Weir (cfs)	Orifice (cfs)	
0.00	0.0	0.0	0.0
0.10	1.5	27.2	1.5
0.20	4.3	38.5	4.3
0.86	38.3	79.8	38.3
1.00	48.0	86.0	48.0
1.20	63.1	94.2	63.1
1.40	79.5	101.8	79.5
1.60	97.1	108.8	97.1
1.80	115.9	115.4	115.4
2.00	135.8	121.7	121.7
2.06	141.9	123.5	123.5
2.40	178.5	133.3	133.3

Catch Basin --	Q (cfs)	Depth (ft)	Grate Elevation (ft)	Ponded Elevation (ft)
OFF-4	38	0.86	5081.7	5082.56
OFF-5	74	2.06	5081	5083.06

Profile Report
Engineering Profile - Channel Road 1 (Channel Road.stc)



Profile Report
Engineering Profile - Hawkins Road 1 (Channel Road.stc)



Storm Drain, Inlet, and Manhole Summary

Project: Channel Road
Location: Albuquerque, NM
Date: December 22, 2011

Proj. Number: 221706
Proj. Engineer: R Strickland
Checker: E Froberg

Storm Drain Pipe Summary								
Label	Length (ft)	Total Flow (ft^3/s)	Diameter (in)	Capacity (Full Flow) (ft^3/s)	Velocity (ft/s)	Upstream Invert (ft)	Downstream Invert (ft)	Slope (ft/ft)
CO 39+78	7	3.4	24	64.55	1.08	5,077.35	5,076.78	0.081
CO 39+00	69	38	36	47.5	7.47	5,077.13	5,076.78	0.005
CO 39+78	295	41.4	36	47.24	5.86	5,076.68	5,075.20	0.005
CO 42+80	96.1	115.4	48	101.5	9.18	5,075.01	5,074.53	0.005
CO 106+06	70	185	60	184.15	9.42	5,078.22	5,077.87	0.005
CO 105+64	32	0.15	24	21.9	0.05	5,078.90	5,078.60	0.009
CO 105+33	67	0.3	24	23.61	0.1	5,078.60	5,077.87	0.011
CO 105+30	39	185.3	60	176.93	9.44	5,077.82	5,077.64	0.005
CO 104+85	29	267.3	60	180.95	13.61	5,077.61	5,077.47	0.005
CO 104+50	397	267.3	60	183.45	13.61	5,077.42	5,075.45	0.005
CO 100+54	27	5.6	18	11.07	3.17	5,075.75	5,075.45	0.011
CO 100+45	96	272.9	60	366.38	20.45	5,075.33	5,073.43	0.02

Catch Basin Summary				
Label	Rim Elevation (ft)	Invert Elevation (ft)	Hydraulic Grade Line (ft)	Inlet Flow (ft^3/s)
CB 39+00	5,081.70	5,077.13	5,079.94	38
CB 42+80	5,081.00	5,075.01	5,078.63	74
TR 106+06	5,087.61	5,078.22	5,085.27	185
TR 104+85	5,086.40	5,077.61	5,084.72	82
CB 105+64	5,087.00	5,078.90	5,084.92	0.15
CB 105+33	5,086.69	5,078.60	5,084.92	0.15
CB 100+54	5,082.25	5,075.75	5,079.96	5.6
CB 39+78	5,081.48	5,077.35	5,079.77	3.4

Manhole Summary				
Label	Rim Elevation (ft)	Invert Elevation (ft)	Diameter (in)	Hydraulic Grade Line (ft)
MH 39+78	5,082.30	5,076.68	72	5,079.77
MH 105+30	5,086.85	5,077.82	96	5,084.92
MH 100+45	5,082.32	5,075.33	96	5,079.88
MH 104+50	5,086.05	5,077.42	96	5,084.42

Culvert Analysis Report
23+62

Analysis Component			
Storm Event	Design	Discharge	281.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	281.00 cfs	Check Discharge	300.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	1-10 x 3 ft Box	281.00 cfs	5,084.80 ft	12.82 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
23+62

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	5,084.80	ft	Discharge	281.00	cfs
Inlet Control HW Elev.	5,084.80	ft	Tailwater Elevation	N/A	ft
Outlet Control HW Elev.	5,084.25	ft	Control Type	Inlet Control	
Headwater Depth/Height	1.73				

Grades					
Upstream Invert	5,079.60	ft	Downstream Invert	5,078.69	ft
Length	90.89	ft	Constructed Slope	0.010012	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	2.19	ft
Slope Type	Steep		Normal Depth	1.96	ft
Flow Regime	Supercritical		Critical Depth	2.91	ft
Velocity Downstream	12.82	ft/s	Critical Slope	0.003179	ft/ft

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	10.00	ft
Section Size	10 x 3 ft		Rise	3.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev.	5,084.25	ft	Upstream Velocity Head	1.45	ft
Ke	0.20		Entrance Loss	0.29	ft

Inlet Control Properties					
Inlet Control HW Elev.	5,084.80	ft	Flow Control	Submerged	
Inlet Type	90° headwall w 45° bevels		Area Full	30.0	ft²
K	0.49500		HDS 5 Chart	10	
M	0.66700		HDS 5 Scale	2	
C	0.03140		Equation Form	2	
Y	0.82000				

Culvert Analysis Report
32+90

Analysis Component			
Storm Event	Design	Discharge	75.00 cfs

Peak Discharge Method: User-Specified			
Design Discharge	75.00 cfs	Check Discharge	100.00 cfs

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	N/A ft

Name	Description	Discharge	HW Elev.	Velocity
Culvert-1	2-36 inch Circular	75.00 cfs	5,081.14 ft	11.57 ft/s
Weir	Not Considered	N/A	N/A	N/A

Culvert Analysis Report
32+90

Component:Culvert-1

Culvert Summary					
Computed Headwater Elevation	5,081.14	ft	Discharge	75.00	cfs
Inlet Control HW Elev.	5,080.95	ft	Tailwater Elevation	N/A	ft
Outlet Control HW Elev.	5,081.14	ft	Control Type	Entrance Control	
Headwater Depth/Height	1.10				

Grades					
Upstream Invert	5,077.83	ft	Downstream Invert	5,076.26	ft
Length	78.50	ft	Constructed Slope	0.020000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.40	ft
Slope Type	Steep		Normal Depth	1.32	ft
Flow Regime	Supercritical		Critical Depth	1.99	ft
Velocity Downstream	11.57	ft/s	Critical Slope	0.005198	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev.	5,081.14	ft	Upstream Velocity Head	0.88	ft
Ke	0.50		Entrance Loss	0.44	ft

Inlet Control Properties					
Inlet Control HW Elev.	5,080.95	ft	Flow Control	Unsubmerged	
Inlet Type	Square edge w/headwall		Area Full	14.1	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

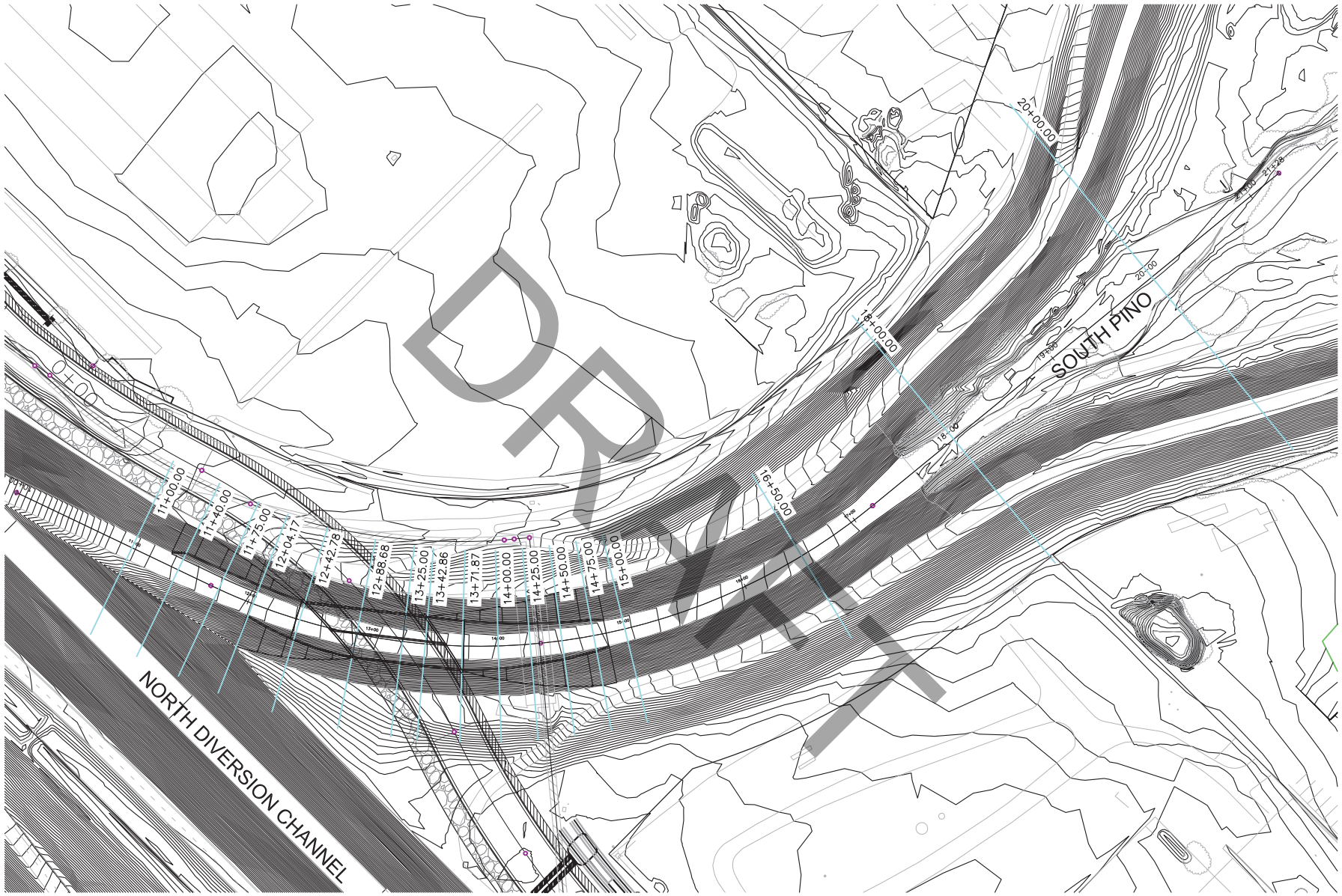
Roadside Ditch Capacity

Project: Channel Road
Location: Albuquerque, NM
Date: December 22, 2011

Proj. Number: 221706
Proj. Engineer: R Strickland
Checker: E Froberg

Mannings n-value 0.03
Channel Bottom Width 5

Station	Lt Slope	Rt Slope	Channel Depth (ft)	Channel Slope (ft/ft)	Channel 100-YR Flow (cfs)	Channel Capacity (cfs)	Full Flow Velocity (ft/s)
1250	51.34%	50%	3.2	0.025	74	432	12.0
1275	48.64%	50%	3.8	0.025	74	630	13.2
1350	36.06%	50%	2.8	0.025	74	362	11.1
1400	28.22%	50%	2.2	0.014	74	172	7.2
1450	24.06%	50%	1.9	0.005	74	77	3.9
1500	23.94%	50%	1.8	0.005	74	76	3.9
1550	23.94%	50%	1.8	0.005	74	76	3.9
1600	23.94%	50%	1.8	0.005	74	76	3.9
1650	23.94%	50%	1.8	0.005	74	76	3.9
1700	23.94%	50%	1.8	0.005	74	76	3.9
1750	23.94%	50%	1.8	0.005	74	76	3.9
1800	23.94%	50%	1.8	0.005	74	76	3.9
1850	25.56%	50%	2.0	0.005	74	86	4.0
1900	30.43%	50%	2.4	0.005	74	118	4.5
1950	36.93%	50%	2.9	0.005	74	168	5.0
2000	42.61%	50%	3.3	0.005	178	220	5.5
2050	46.67%	50%	3.6	0.005	178	261	5.7
2100	49.11%	50%	3.8	0.005	178	287	5.9
2150	49.92%	50%	3.9	0.005	281	297	6.0
2200	49.92%	50%	3.9	0.005	281	297	6.0
2250	49.92%	50%	3.9	0.005	281	297	6.0
2300	49.92%	50%	3.9	0.005	281	297	6.0
2350	49.92%	50%	3.9	0.005	281	292	6.0
2400	38.94%	50%	3.0	0.005	75	187	5.2
2450	38.94%	50%	3.0	0.005	75	187	5.2
2500	38.94%	50%	3.0	0.005	75	187	5.2
2550	38.94%	50%	2.6	0.005	75	131	4.7
2600	38.94%	50%	2.8	0.005	75	156	4.9
2650	38.94%	50%	2.7	0.005	75	141	4.8
2700	38.94%	50%	2.5	0.005	75	120	4.6
2750	38.94%	50%	2.2	0.005	75	99	4.4
2800	38.94%	50%	2.3	0.005	75	108	4.5
2850	38.94%	50%	2.5	0.005	75	125	4.7
2900	38.94%	50%	2.7	0.005	75	146	4.9
2950	38.94%	50%	2.8	0.005	75	158	5.0
3000	39.44%	50%	2.6	0.005	75	135	4.8
3050	43.44%	50%	2.8	0.005	75	157	5.0
3100	51.44%	50%	3.1	0.005	75	187	5.3
3150	50.00%	50%	3.4	0.005	75	223	5.5
3200	50.00%	50%	3.5	0.005	75	238	5.6
3250	50.00%	50%	3.5	0.005	75	230	5.6
3300	50.00%	50%	3.4	0.005	7	225	5.6



SOUTH PINO ARROYO

HEC-RAS SECTIONS

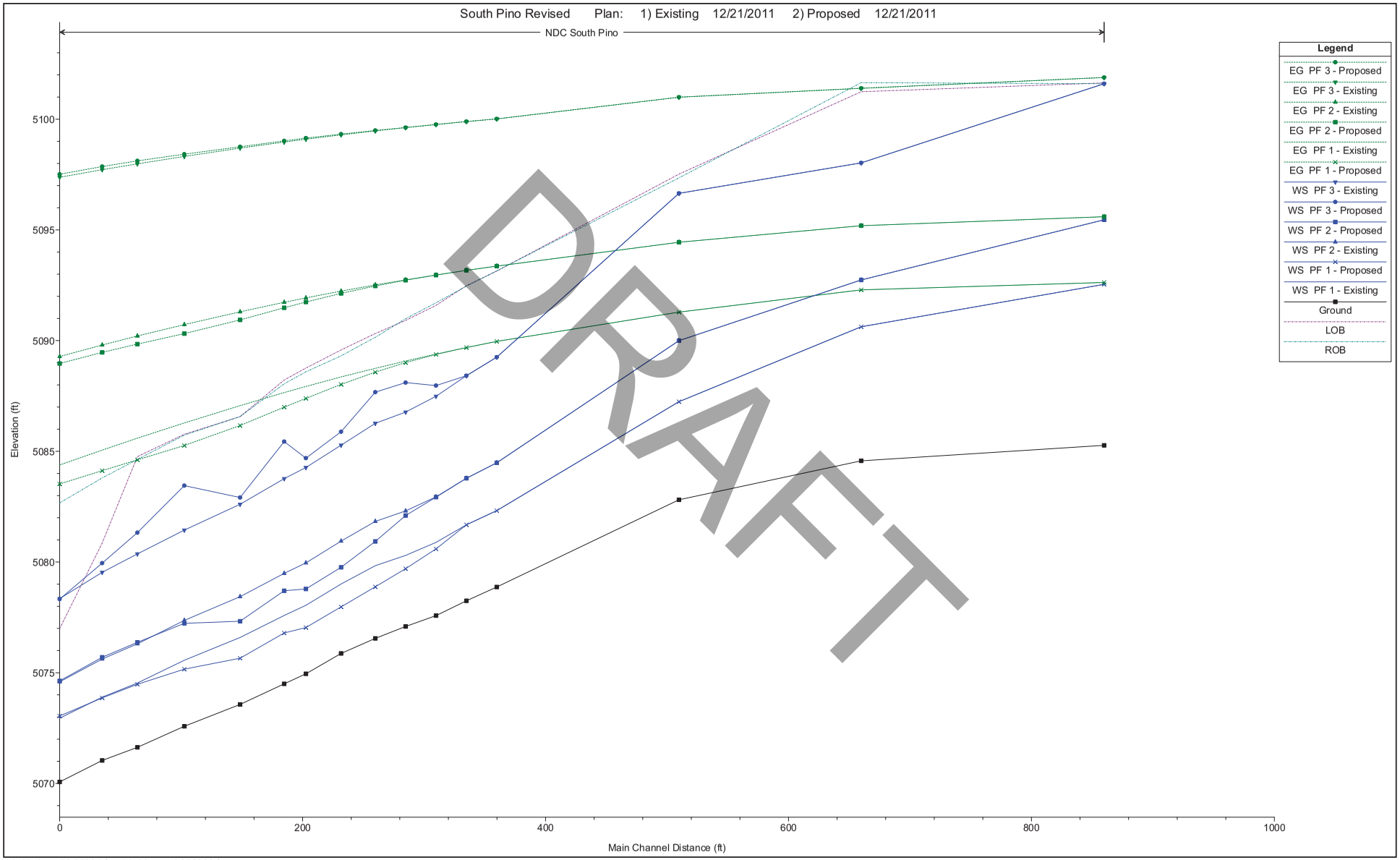
T·Y· LIN INTERNATIONAL
engineers | planners | scientists
500 4th Street NW, Suite 403
Albuquerque, NM 87102

HEC-RAS River: NDC Reach: South Pino

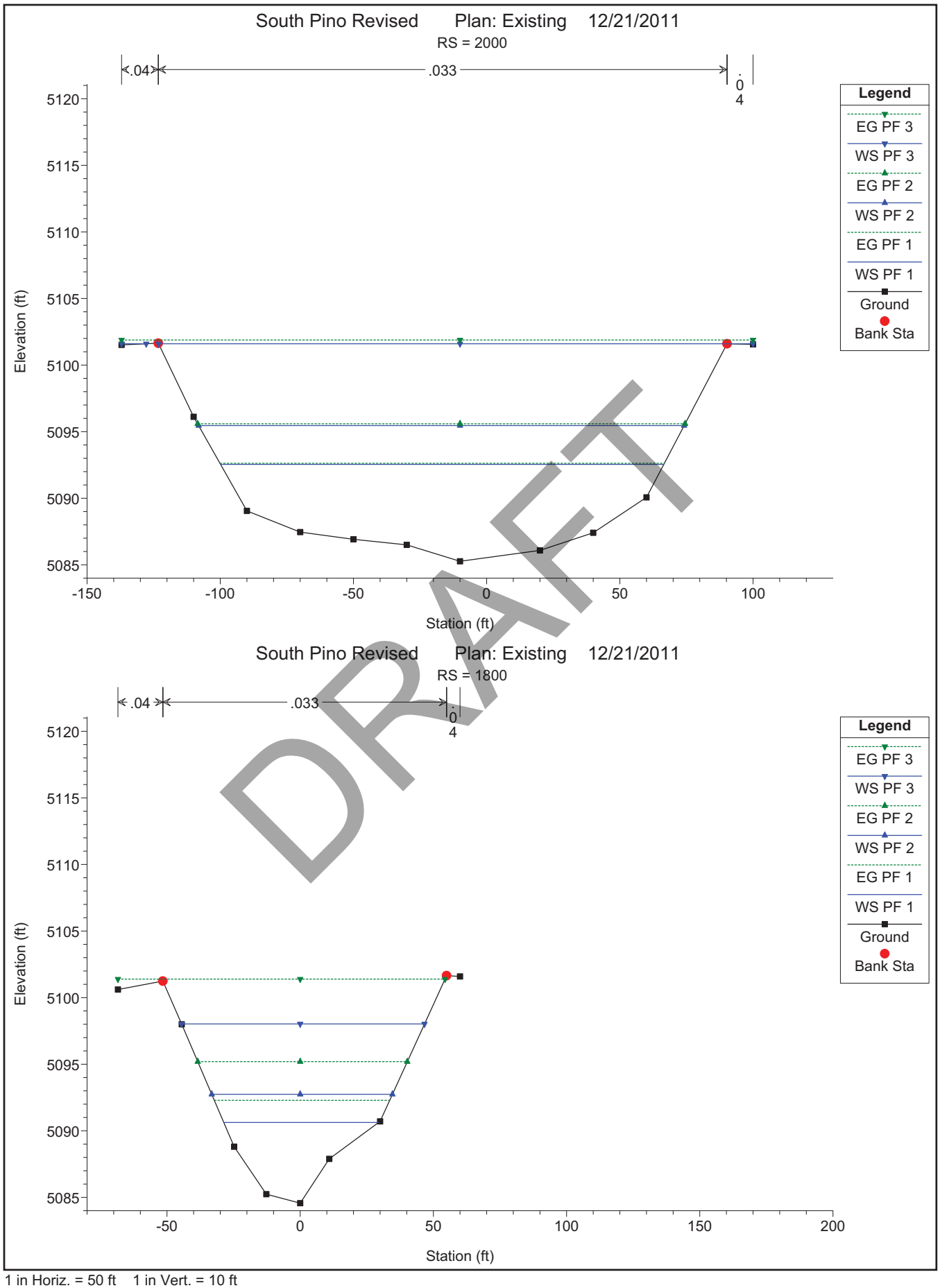
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
South Pino	2000	PF 1	Existing	2000.00	5085.27	5092.54	5088.55	5092.63	0.000295	2.31	865.90	166.37	0.18
South Pino	2000	PF 1	Proposed	2000.00	5085.27	5092.54	5088.55	5092.63	0.000295	2.31	865.90	166.37	0.18
South Pino	2000	PF 2	Existing	4100.00	5085.27	5095.46	5089.77	5095.60	0.000303	2.98	1373.85	182.26	0.19
South Pino	2000	PF 2	Proposed	4100.00	5085.27	5095.46	5089.77	5095.60	0.000303	2.98	1373.85	182.26	0.19
South Pino	2000	PF 3	Existing	11000.00	5085.27	5101.60	5092.45	5101.88	0.000328	4.25	2590.74	232.42	0.21
South Pino	2000	PF 3	Proposed	11000.00	5085.27	5101.60	5092.45	5101.88	0.000328	4.25	2590.74	232.42	0.21
South Pino	1800	PF 1	Existing	2000.00	5084.57	5090.63	5090.63	5092.29	0.011080	10.36	193.04	58.10	1.00
South Pino	1800	PF 1	Proposed	2000.00	5084.57	5090.63	5090.63	5092.29	0.011084	10.36	193.02	58.10	1.00
South Pino	1800	PF 2	Existing	4100.00	5084.57	5092.74	5092.74	5095.19	0.010037	12.55	326.62	67.83	1.01
South Pino	1800	PF 2	Proposed	4100.00	5084.57	5092.74	5092.74	5095.19	0.010055	12.56	326.42	67.82	1.01
South Pino	1800	PF 3	Existing	11000.00	5084.57	5098.03	5097.41	5101.40	0.006938	14.73	747.03	91.21	0.91
South Pino	1800	PF 3	Proposed	11000.00	5084.57	5098.03	5097.41	5101.40	0.006938	14.73	747.03	91.21	0.91
South Pino	1650	PF 1	Existing	2000.00	5082.81	5087.24	5088.49	5091.29	0.004307	16.14	123.94	37.26	1.56
South Pino	1650	PF 1	Proposed	2000.00	5082.81	5087.24	5088.48	5091.29	0.004307	16.14	123.94	37.26	1.56
South Pino	1650	PF 2	Existing	4100.00	5082.81	5090.00	5091.19	5094.44	0.002810	16.92	242.35	48.67	1.34
South Pino	1650	PF 2	Proposed	4100.00	5082.81	5090.00	5091.19	5094.44	0.002810	16.92	242.35	48.67	1.34
South Pino	1650	PF 3	Existing	11000.00	5082.81	5096.65	5096.65	5101.00	0.001346	16.73	657.54	76.20	1.00
South Pino	1650	PF 3	Proposed	11000.00	5082.81	5096.65	5096.65	5101.00	0.001346	16.73	657.54	76.20	1.00
South Pino	1500	PF 1	Existing	2000.00	5078.87	5082.32	5084.52	5089.96	0.010586	22.18	90.16	33.20	2.37
South Pino	1500	PF 1	Proposed	2000.00	5078.87	5082.32	5084.52	5089.96	0.010586	22.18	90.16	33.20	2.37
South Pino	1500	PF 2	Existing	4100.00	5078.87	5084.48	5087.24	5093.36	0.007269	23.91	171.45	41.99	2.09
South Pino	1500	PF 2	Proposed	4100.00	5078.87	5084.48	5087.24	5093.36	0.007269	23.91	171.45	41.99	2.09
South Pino	1500	PF 3	Existing	11000.00	5078.87	5089.25	5092.73	5100.01	0.004549	26.33	417.83	61.39	1.78
South Pino	1500	PF 3	Proposed	11000.00	5078.87	5089.25	5092.73	5100.01	0.004549	26.33	417.83	61.39	1.78
South Pino	1475	PF 1	Existing	2000.00	5078.25	5081.68	5083.94	5089.69	0.011381	22.71	88.07	33.11	2.45
South Pino	1475	PF 1	Proposed	2000.00	5078.25	5081.68	5083.94	5089.69	0.011381	22.71	88.07	33.11	2.45
South Pino	1475	PF 2	Existing	4100.00	5078.25	5083.78	5086.62	5093.17	0.007904	24.59	166.71	41.77	2.17
South Pino	1475	PF 2	Proposed	4100.00	5078.25	5083.78	5086.62	5093.17	0.007904	24.59	166.71	41.77	2.17
South Pino	1475	PF 3	Existing	11000.00	5078.25	5088.42	5092.13	5099.89	0.004994	27.19	404.61	60.89	1.86
South Pino	1475	PF 3	Proposed	11000.00	5078.25	5088.42	5092.13	5099.89	0.004994	27.19	404.61	60.89	1.86
South Pino	1450	PF 1	Existing	2000.00	5077.55	5080.89	5083.23	5089.39	0.012372	23.40	85.46	32.70	2.55
South Pino	1450	PF 1	Proposed	2000.00	5077.58	5080.59	5083.09	5089.38	0.013181	23.79	84.08	28.84	2.46
South Pino	1450	PF 2	Existing	4100.00	5077.55	5082.94	5085.91	5092.96	0.008643	25.41	161.38	41.20	2.26
South Pino	1450	PF 2	Proposed	4100.00	5077.58	5082.93	5085.98	5092.96	0.008845	25.41	161.34	37.53	2.16
South Pino	1450	PF 3	Existing	11000.00	5077.55	5087.49	5091.40	5099.76	0.005473	28.12	391.20	59.98	1.94
South Pino	1450	PF 3	Proposed	11000.00	5077.58	5087.97	5092.03	5099.76	0.005294	27.56	399.19	56.85	1.83
South Pino	1425	PF 1	Existing	2000.00	5077.03	5080.30	5082.70	5089.08	0.013006	23.78	84.11	32.65	2.61
South Pino	1425	PF 1	Proposed	2000.00	5077.09	5079.70	5082.11	5089.01	0.015669	24.48	81.70	31.28	2.67
South Pino	1425	PF 2	Existing	4100.00	5077.03	5082.31	5085.39	5092.75	0.009172	25.93	158.15	40.99	2.33
South Pino	1425	PF 2	Proposed	4100.00	5077.09	5082.10	5085.52	5092.73	0.008884	26.16	156.71	31.46	2.07
South Pino	1425	PF 3	Existing	11000.00	5077.03	5086.77	5090.82	5099.62	0.005835	28.77	382.36	59.48	2.00
South Pino	1425	PF 3	Proposed	11000.00	5077.09	5088.10	5092.16	5099.62	0.005140	27.23	403.91	52.90	1.74
South Pino	1400	PF 1	Existing	2000.00	5076.50	5079.84	5082.24	5088.75	0.013139	23.95	83.50	32.29	2.62
South Pino	1400	PF 1	Proposed	2000.00	5076.55	5078.88	5081.26	5088.58	0.018331	24.99	80.03	34.34	2.88
South Pino	1400	PF 2	Existing	4100.00	5076.50	5081.84	5084.93	5092.52	0.009424	26.23	156.34	40.62	2.36
South Pino	1400	PF 2	Proposed	4100.00	5076.55	5080.93	5084.19	5092.47	0.010742	27.26	150.42	34.34	2.30
South Pino	1400	PF 3	Existing	11000.00	5076.50	5086.26	5090.48	5099.47	0.006053	29.16	377.19	59.10	2.03
South Pino	1400	PF 3	Proposed	11000.00	5076.55	5087.67	5092.01	5099.49	0.005006	27.59	398.68	45.16	1.64
South Pino	1371.87	PF 1	Existing	2000.00	5075.84	5079.01	5081.46	5088.36	0.014284	24.55	81.48	32.39	2.73
South Pino	1371.87	PF 1	Proposed	2000.00	5075.87	5077.98	5080.33	5088.02	0.021147	25.43	78.63	37.33	3.09
South Pino	1371.87	PF 2	Existing	4100.00	5075.84	5080.94	5084.14	5092.24	0.010258	26.97	152.03	40.43	2.45
South Pino	1371.87	PF 2	Proposed	4100.00	5075.87	5079.76	5083.06	5092.13	0.012826	28.23	145.26	37.33	2.52
South Pino	1371.87	PF 3	Existing	11000.00	5075.84	5085.28	5089.66	5099.29	0.006571	30.04	366.14	58.40	2.11
South Pino	1371.87	PF 3	Proposed	11000.00	5075.87	5085.89	5091.24	5099.32	0.005439	29.42	373.94	37.33	1.64
South Pino	1342.86	PF 1	Existing	2000.00	5074.93	5078.05	5080.57	5087.93	0.015347	25.23	79.28	31.89	2.82
South Pino	1342.86	PF 1	Proposed	2000.00	5074.95	5077.04	5079.43	5087.39	0.021977	25.82	77.47	37.01	3.14
South Pino	1342.86	PF 2	Existing	4100.00	5074.93	5079.96	5083.27	5091.93	0.011021	27.76	147.68	39.62	2.53
South Pino	1342.86	PF 2	Proposed	4100.00	5074.95	5078.79	5082.18	5091.74	0.013678	28.89	141.93	37.01	2.60
South Pino	1342.86	PF 3	Existing	11000.00	5074.93	5084.27	5088.87	5099.10	0.007015	30.90	355.99	57.04	2.18
South Pino	1342.86	PF 3	Proposed	11000.00	5074.95	5084.69	5090.50	5099.15	0.006020	30.51	360.50	37.01	1.72
South Pino	1325	PF 1	Existing	2000.00	5074.42	5077.59	5080.15	5087.65	0.015674	25.46	78.55	31.65	2.85
South Pino	1325	PF 1	Proposed	2000.00	5074.50	5076.80	5079.24	5087.00	0.022848	25.63	78.03	34.00	2.98
South Pino	1325	PF 2	Existing	4100.00	5074.42	5079.49	5082.86	5091.73	0.011349	28.08	146.01	39.37	2.57
South Pino	1325	PF 2	Proposed	4100.00	5074.50	5078.70	5082.15	5091.48	0.015865	28.69	142.92	34.00	2.47
South Pino	1325	PF 3	Existing	11000.00	5074.42	5083.76	5088.45	5098.97	0.007262	31.29	351.54	56.74	2.22
South Pino	1325	PF 3	Proposed	11000.00	5074.50	5085.44	5090.54	5099.02	0.008309	29.58	371.91	34.00	1.58
South Pino	1288.68	PF 1	Existing	2000.00	5073.56	5076.59	5079.19	5087.06	0.016763	25.97	77.02	31.74	2.94
South Pino	1288.68	PF 1	Proposed	2000.00	5073.57	5075.66	5078.07	5086.17	0.022435	26.02	76.87	36.86	3.18
South Pino	1288.68	PF 2	Existing	4100.00	5073.56	5078.44	5081.87	5091.30	0.012248	28.78	142.45	39.25	2.66

HEC-RAS River: NDC Reach: South Pino (Continued)

Reach	River Sta	Profile	Plan	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
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
South Pino	1288.68	PF 2	Proposed	4100.00	5073.57	5077.33	5080.83	5090.94	0.014707	29.60	138.50	36.86	2.69
South Pino	1288.68	PF 3	Existing	11000.00	5073.56	5082.61	5087.39	5098.69	0.007871	32.18	341.80	56.27	2.30
South Pino	1288.68	PF 3	Proposed	11000.00	5073.57	5082.91	5088.45	5098.75	0.006855	31.94	344.41	36.86	1.84
South Pino	1242.78	PF 1	Existing	2000.00	5072.54	5075.56	5078.20	5086.28	0.017342	26.27	76.13	31.65	2.98
South Pino	1242.78	PF 1	Proposed	2000.00	5072.58	5075.16	5077.69	5085.26	0.017322	25.50	78.42	30.36	2.80
South Pino	1242.78	PF 2	Existing	4100.00	5072.54	5077.36	5080.88	5090.72	0.012950	29.33	139.80	39.10	2.73
South Pino	1242.78	PF 2	Proposed	4100.00	5072.58	5077.23	5081.06	5090.32	0.011860	29.03	141.25	30.36	2.37
South Pino	1242.78	PF 3	Existing	11000.00	5072.54	5081.44	5086.34	5098.32	0.008448	32.96	333.69	55.97	2.38
South Pino	1242.78	PF 3	Proposed	11000.00	5072.58	5083.45	5088.48	5098.42	0.006637	31.05	354.28	40.22	1.84
South Pino	1204.17	PF 1	Existing	2000.00	5071.63	5074.54	5077.19	5085.59	0.018218	26.68	74.95	31.57	3.05
South Pino	1204.17	PF 1	Proposed	2000.00	5071.63	5074.48	5077.07	5084.61	0.016324	25.55	78.28	30.30	2.80
South Pino	1204.17	PF 2	Existing	4100.00	5071.63	5076.31	5079.89	5090.21	0.013638	29.92	137.03	38.61	2.80
South Pino	1204.17	PF 2	Proposed	4100.00	5071.63	5076.37	5080.09	5089.84	0.012549	29.45	139.21	34.03	2.57
South Pino	1204.17	PF 3	Existing	11000.00	5071.63	5080.37	5085.39	5097.98	0.008852	33.68	326.57	54.77	2.43
South Pino	1204.17	PF 3	Proposed	11000.00	5071.63	5081.33	5086.45	5098.12	0.007957	32.88	334.51	46.94	2.17
South Pino	1175	PF 1	Existing	2000.00	5070.93	5073.90	5076.56	5085.05	0.018619	26.81	74.61	31.81	3.08
South Pino	1175	PF 1	Proposed	2000.00	5071.04	5073.86	5076.52	5084.13	0.016811	25.71	77.79	30.59	2.84
South Pino	1175	PF 2	Existing	4100.00	5070.93	5075.62	5079.22	5089.80	0.014272	30.22	135.65	39.12	2.86
South Pino	1175	PF 2	Proposed	4100.00	5071.04	5075.70	5079.42	5089.47	0.013282	29.78	137.70	35.00	2.65
South Pino	1175	PF 3	Existing	11000.00	5070.93	5079.53	5084.50	5097.72	0.009474	34.22	321.42	55.75	2.51
South Pino	1175	PF 3	Proposed	11000.00	5071.04	5079.95	5084.98	5097.86	0.009345	33.96	323.87	52.64	2.41
South Pino	1140	PF 1	Existing	2000.00	5070.07	5072.95	5075.61	5084.39	0.019871	27.14	73.69	32.51	3.18
South Pino	1140	PF 1	Proposed	2000.00	5070.07	5073.05	5075.60	5083.53	0.017510	25.97	77.00	32.98	3.00
South Pino	1140	PF 2	Existing	4100.00	5070.07	5074.59	5078.14	5089.28	0.015517	30.76	133.28	40.09	2.97
South Pino	1140	PF 2	Proposed	4100.00	5070.07	5074.63	5078.14	5088.97	0.014992	30.39	134.93	40.28	2.93
South Pino	1140	PF 3	Existing	11000.00	5070.07	5078.35	5083.55	5097.38	0.009965	35.01	314.22	53.90	2.56
South Pino	1140	PF 3	Proposed	11000.00	5070.07	5078.33	5083.55	5097.51	0.010085	35.15	312.93	53.85	2.57



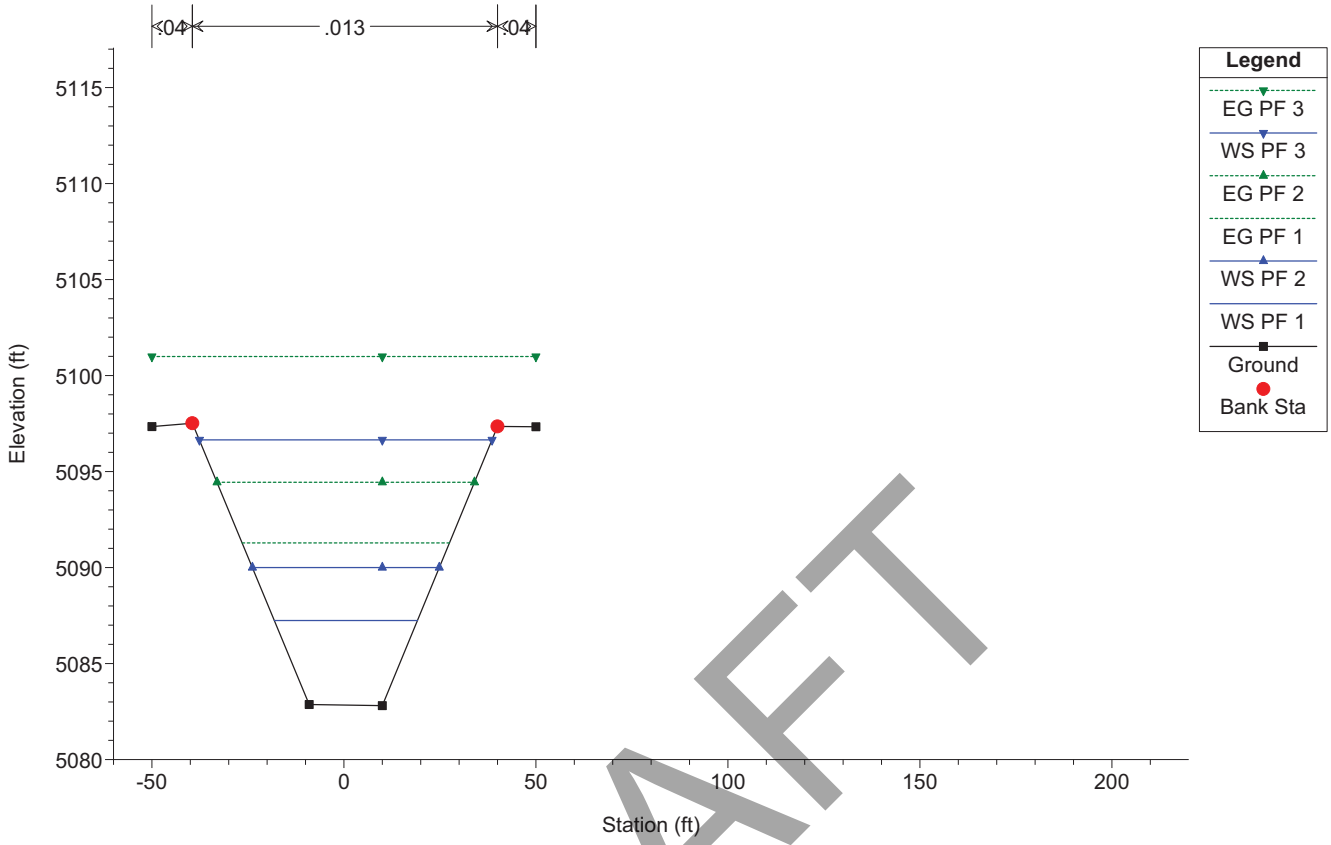
1 in Horiz. = 73.95994 ft 1 in Vert. = 4.058363 ft



1 in Horiz. = 50 ft 1 in Vert. = 10 ft

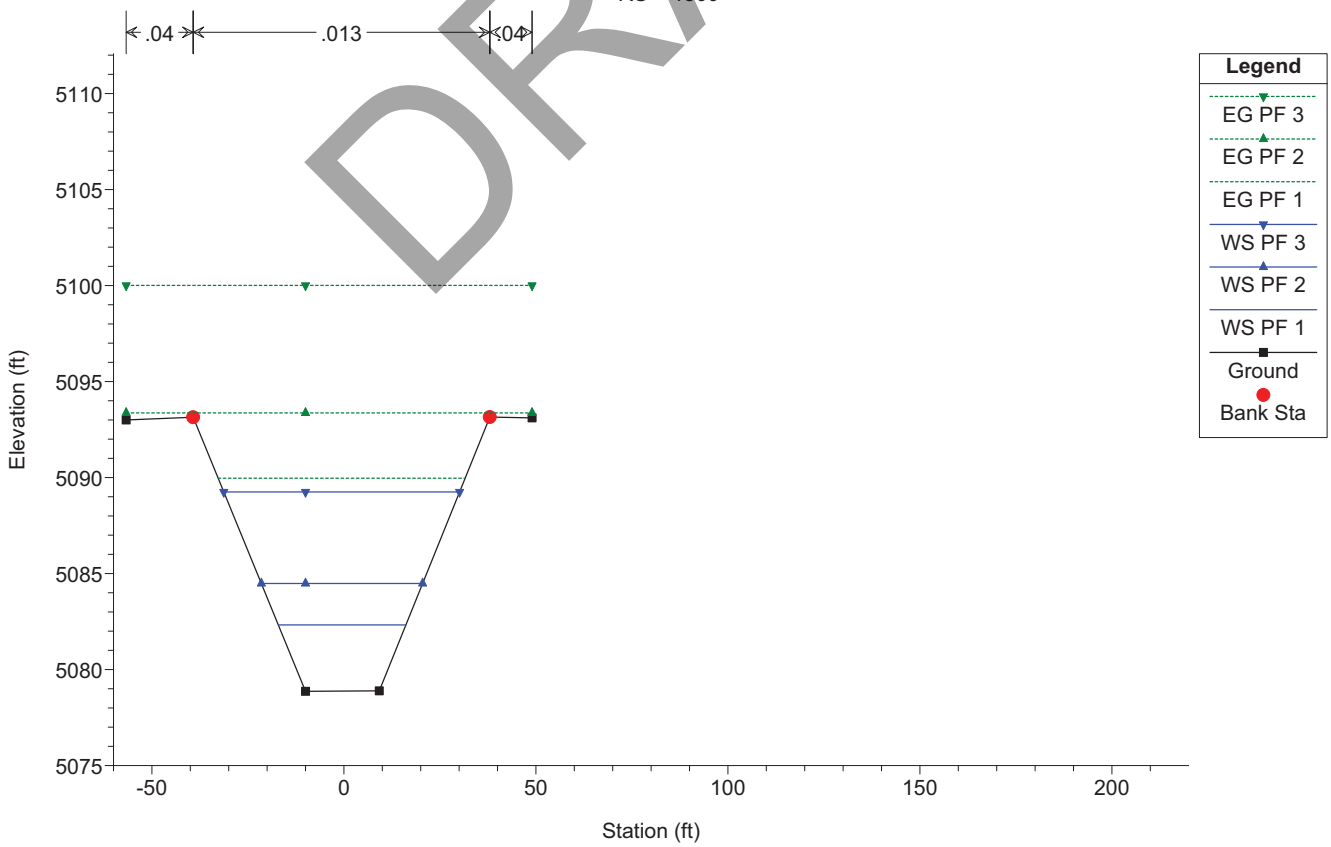
South Pino Revised Plan: Existing 12/21/2011

RS = 1650



South Pino Revised Plan: Existing 12/21/2011

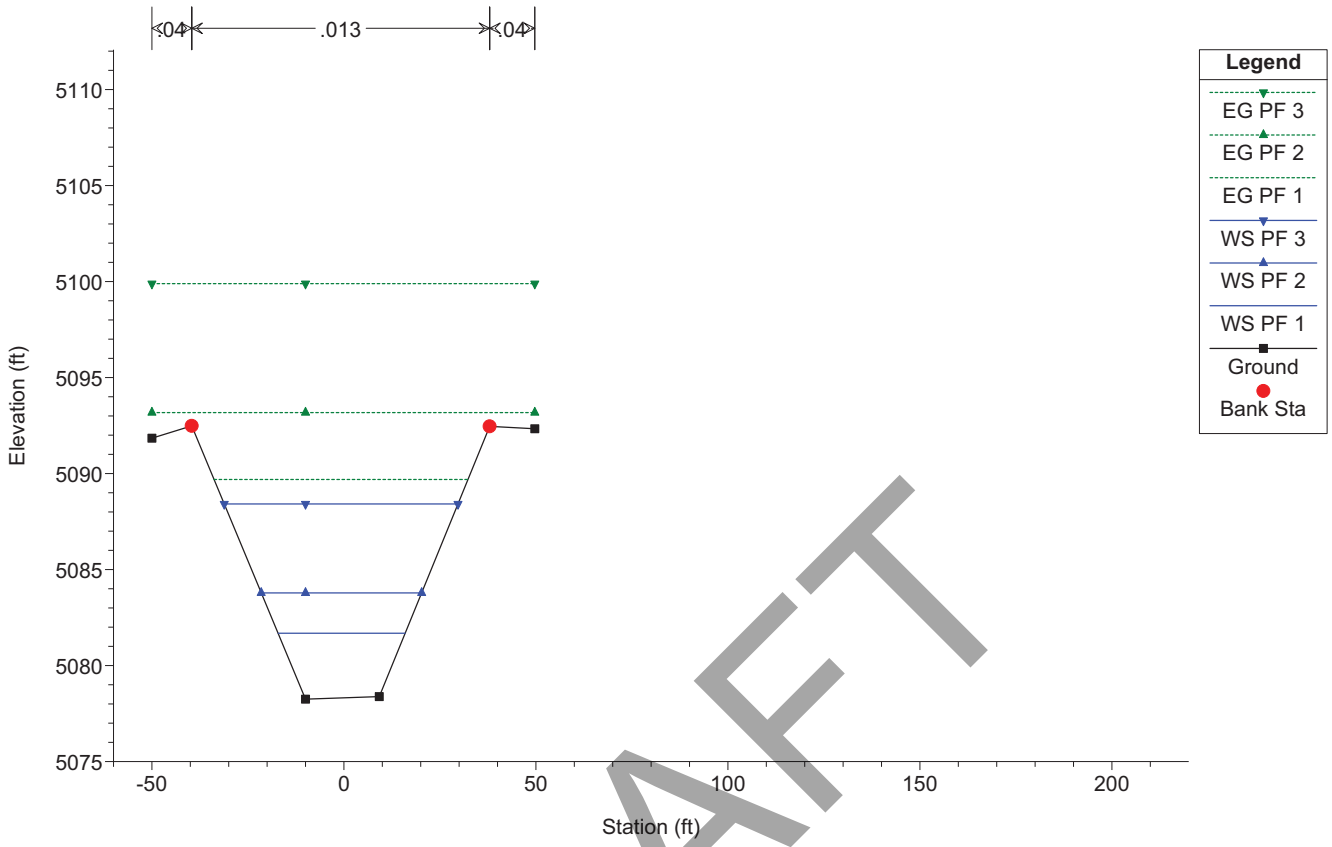
RS = 1500



1 in Horiz. = 50 ft 1 in Vert. = 10 ft

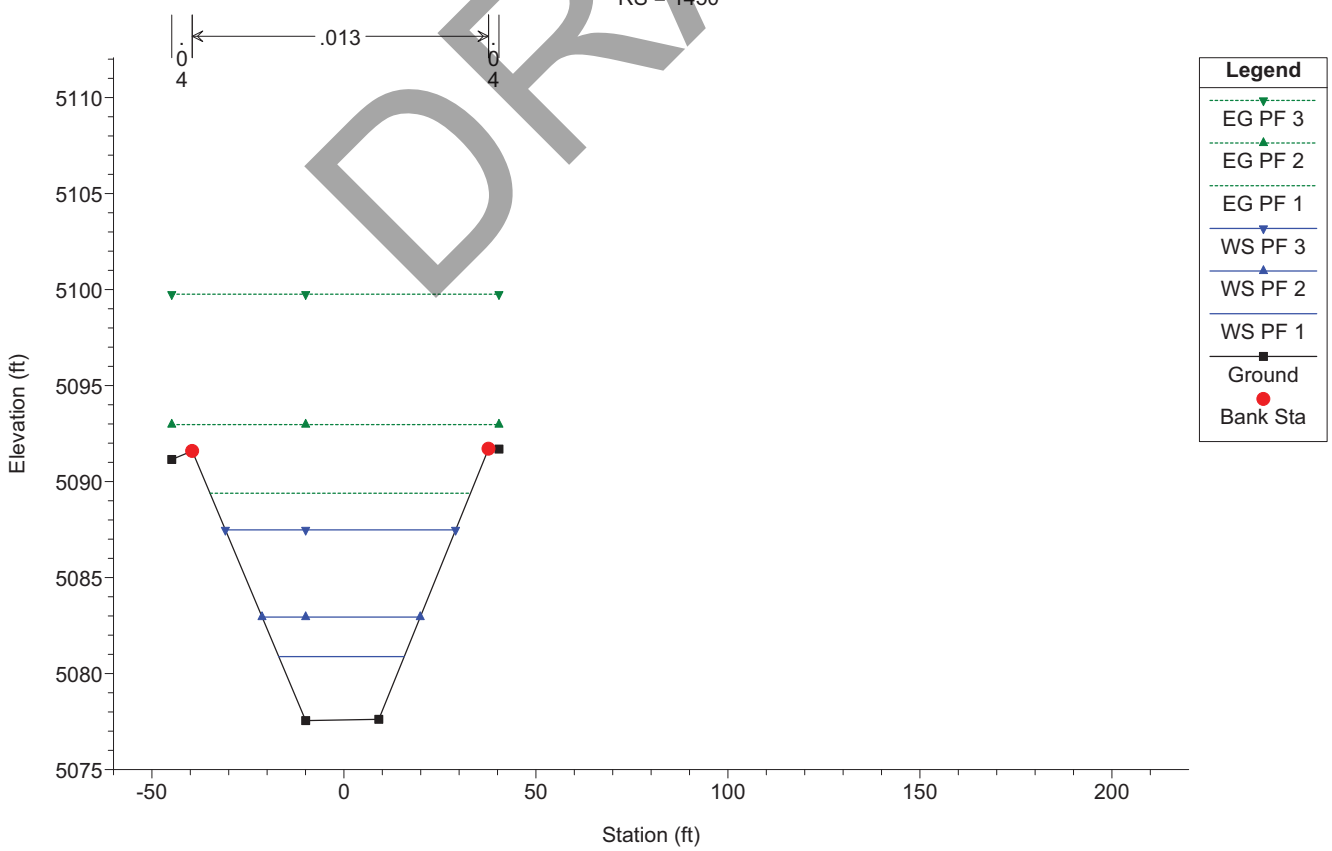
South Pino Revised Plan: Existing 12/21/2011

RS = 1475



South Pino Revised Plan: Existing 12/21/2011

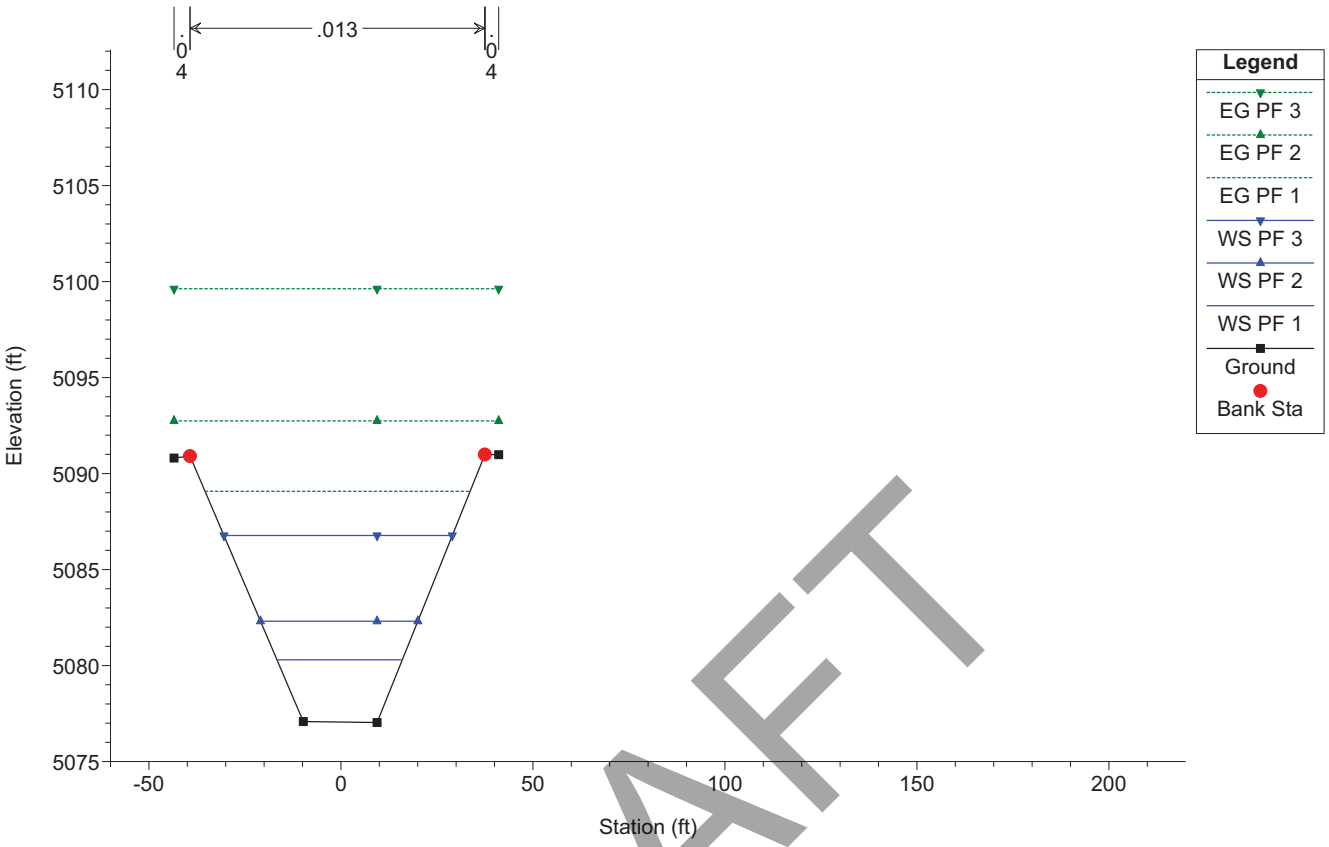
RS = 1450



1 in Horiz. = 50 ft 1 in Vert. = 10 ft

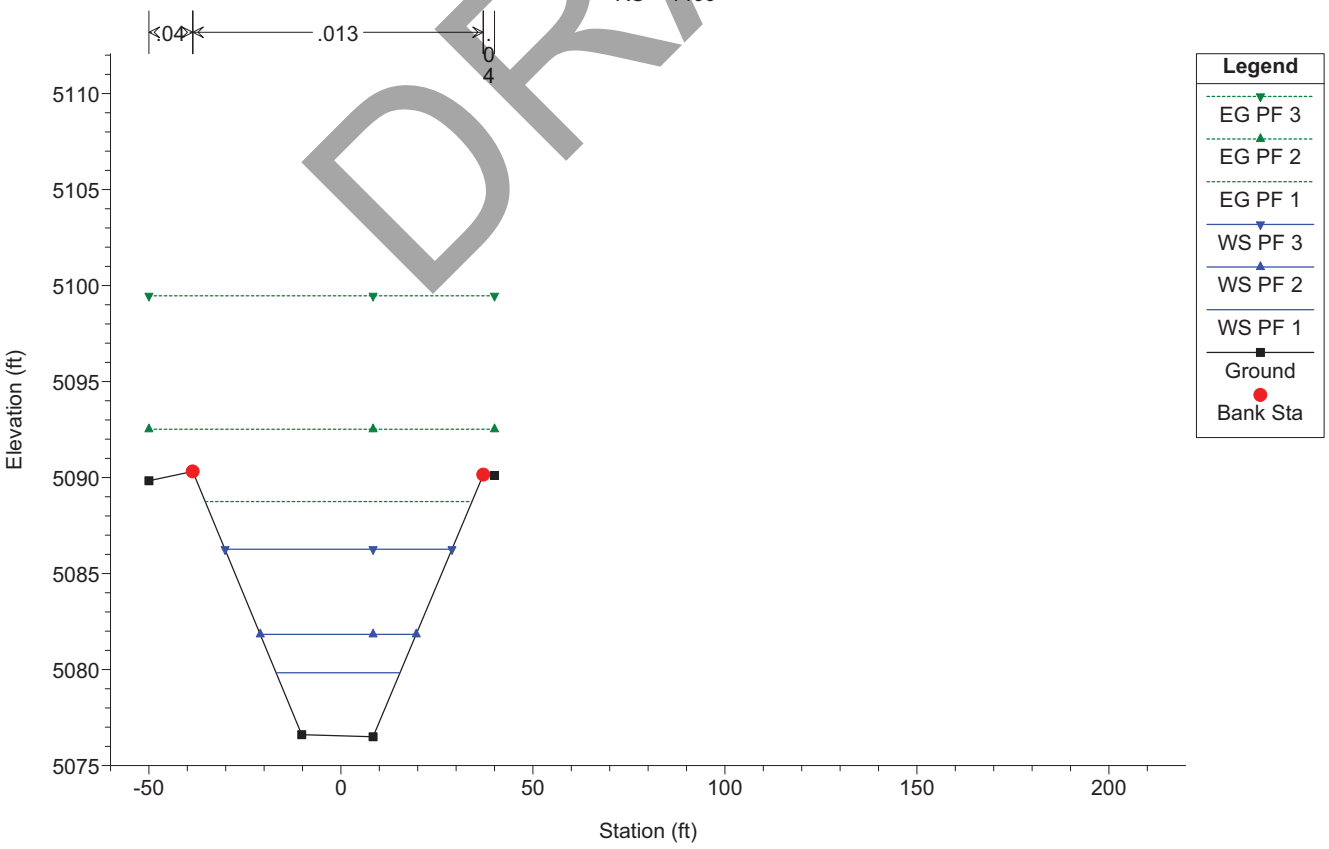
South Pino Revised Plan: Existing 12/21/2011

RS = 1425

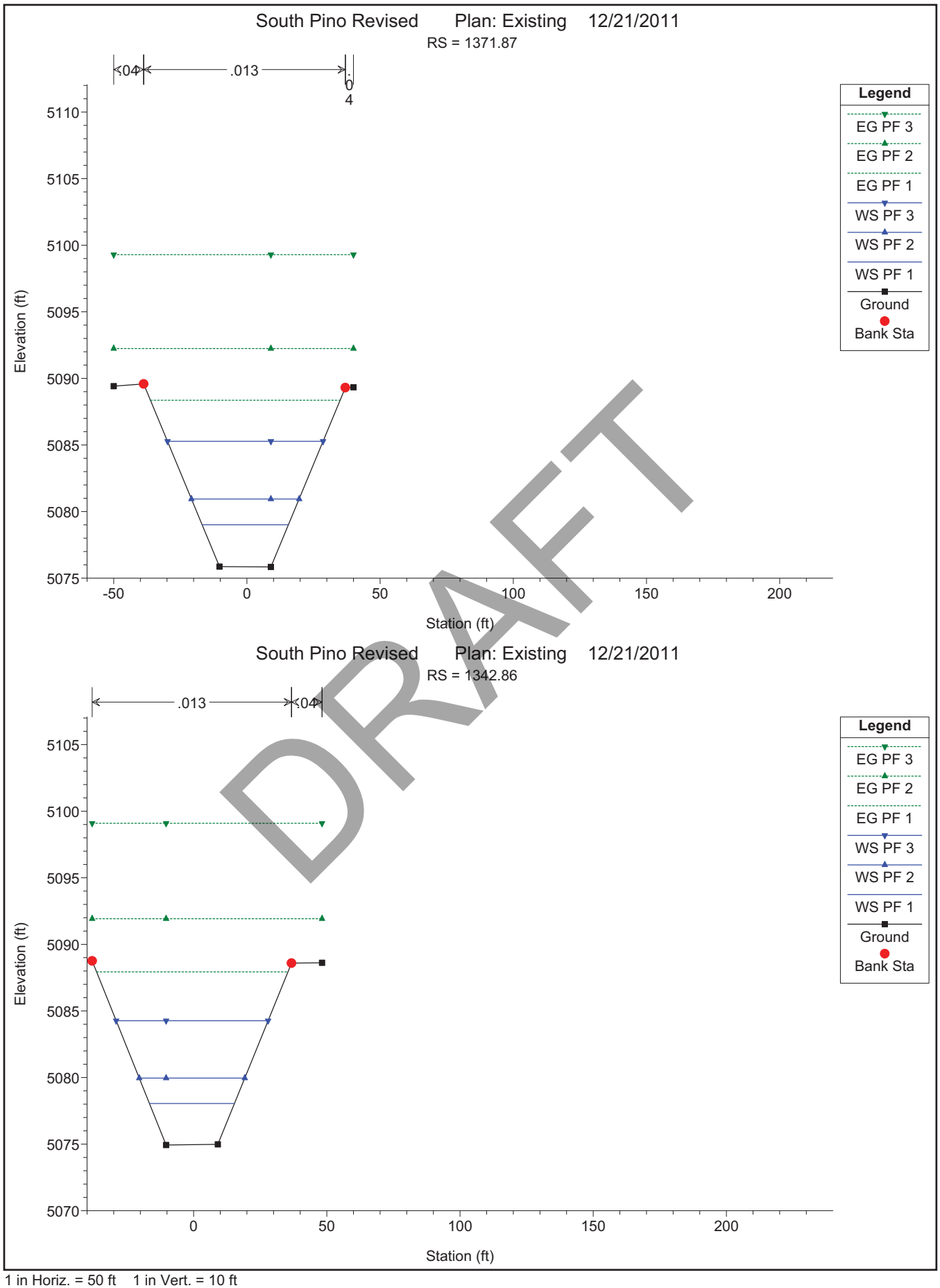


South Pino Revised Plan: Existing 12/21/2011

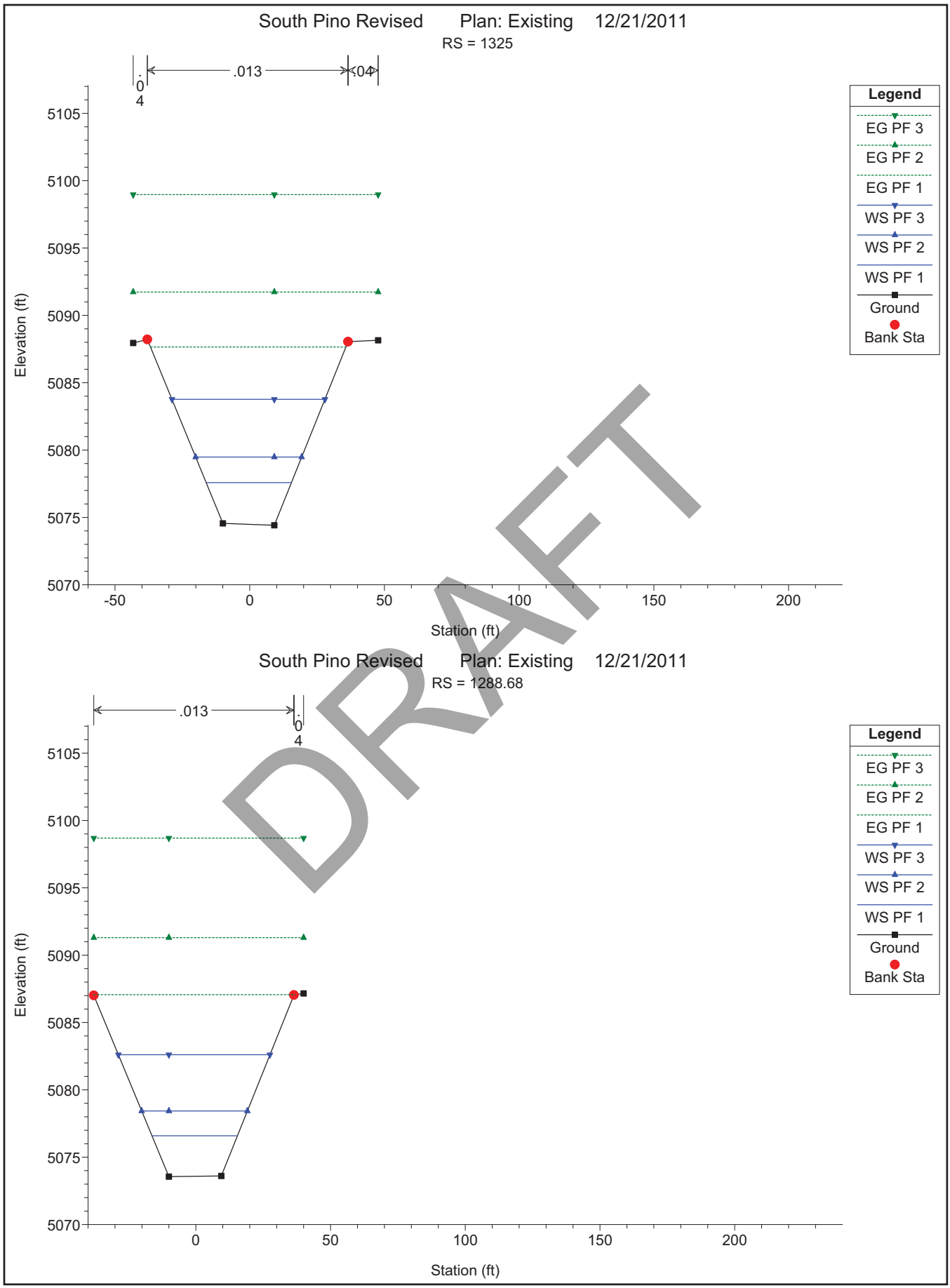
RS = 1400



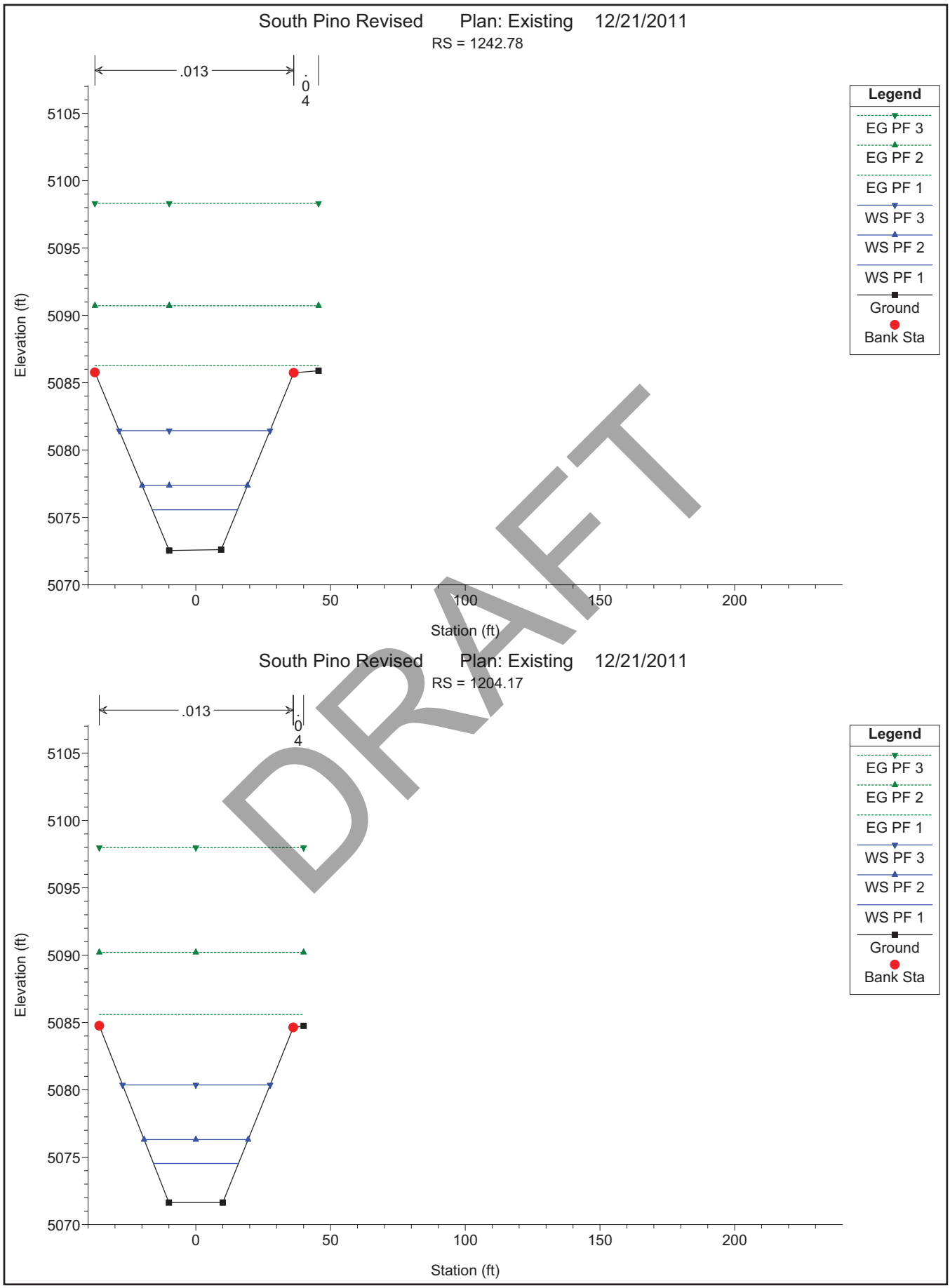
1 in Horiz. = 50 ft 1 in Vert. = 10 ft



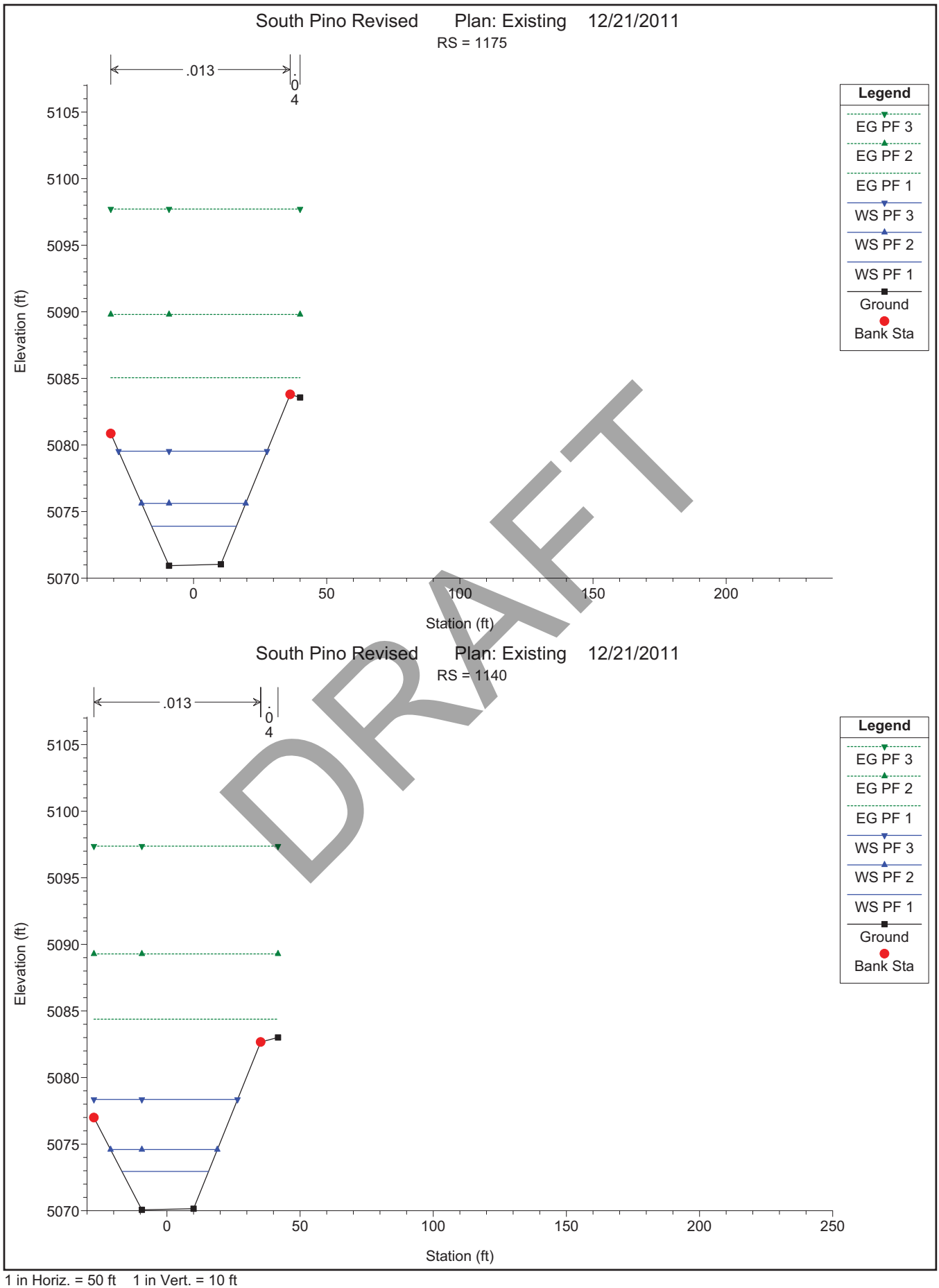
1 in Horiz. = 50 ft 1 in Vert. = 10 ft



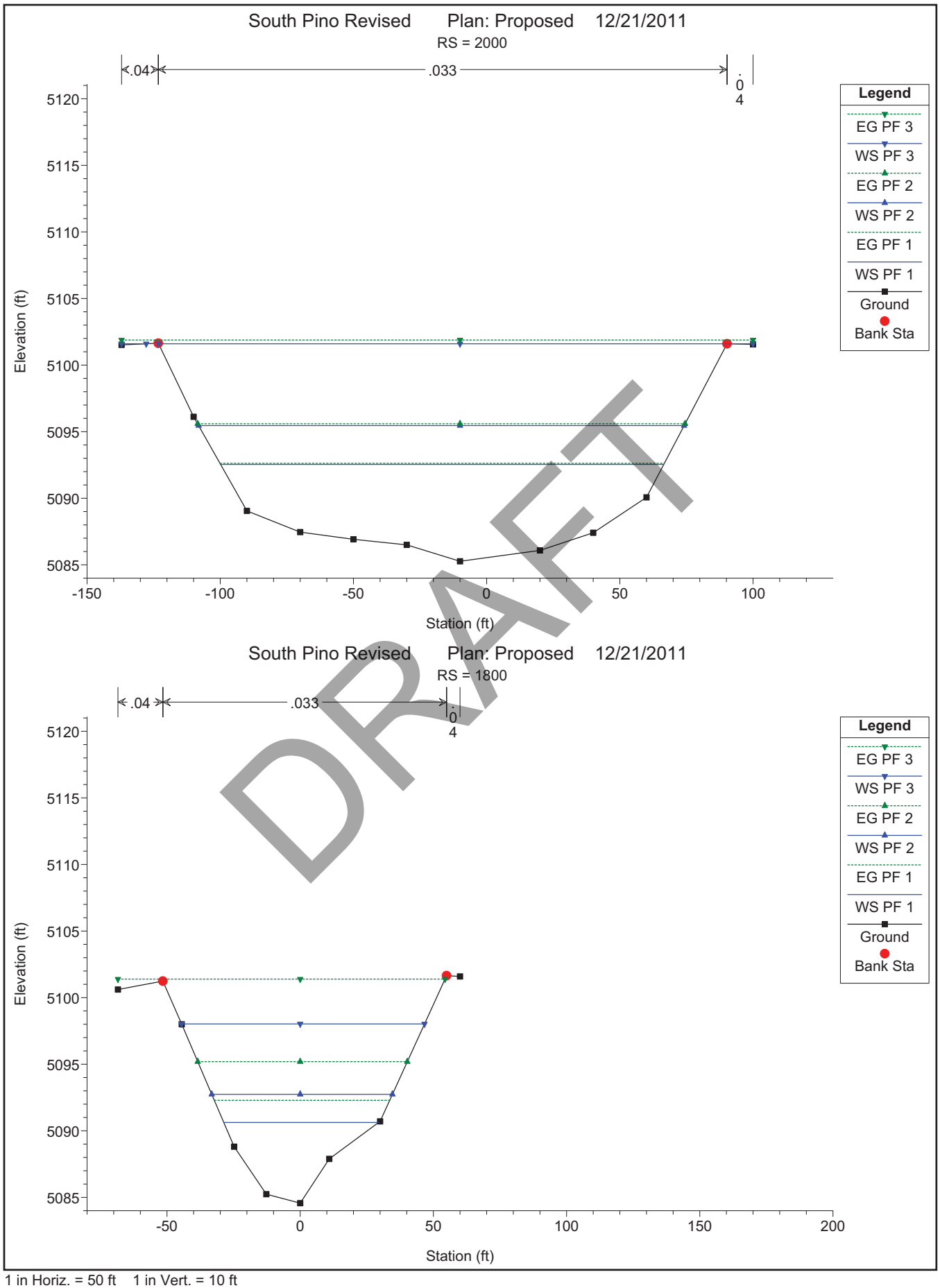
1 in Horiz. = 50 ft 1 in Vert. = 10 ft



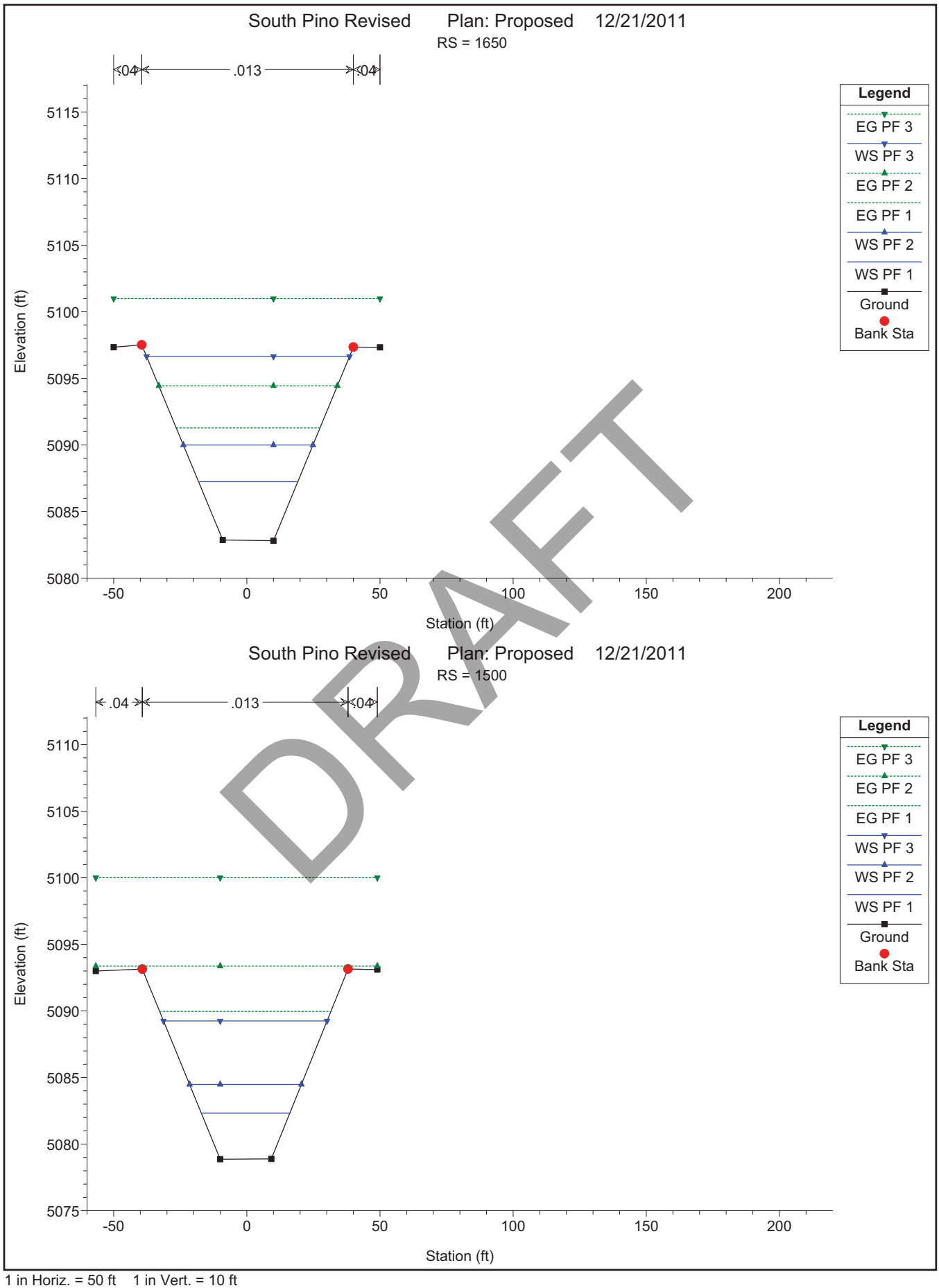
1 in Horiz. = 50 ft 1 in Vert. = 10 ft



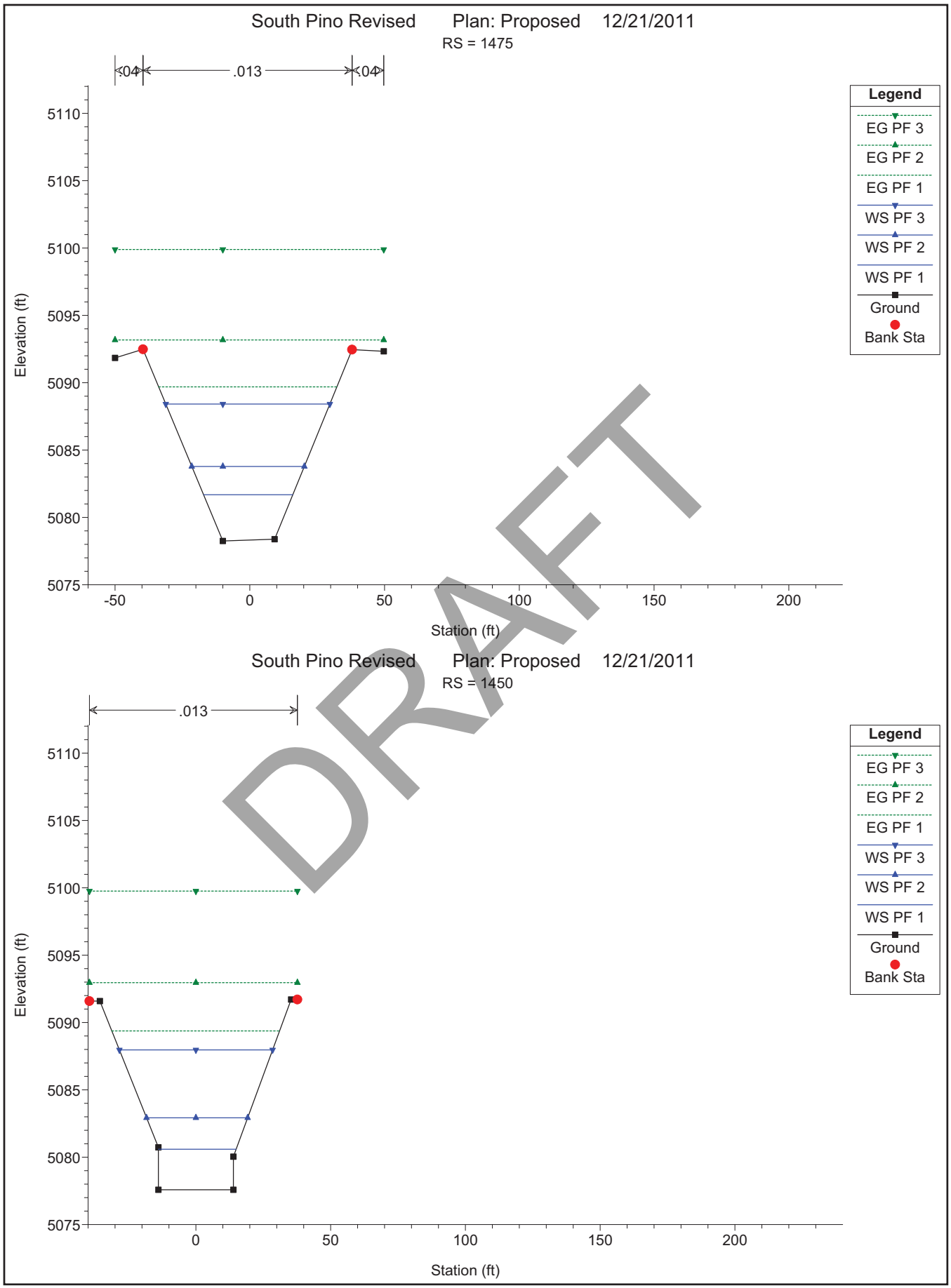
1 in Horiz. = 50 ft 1 in Vert. = 10 ft



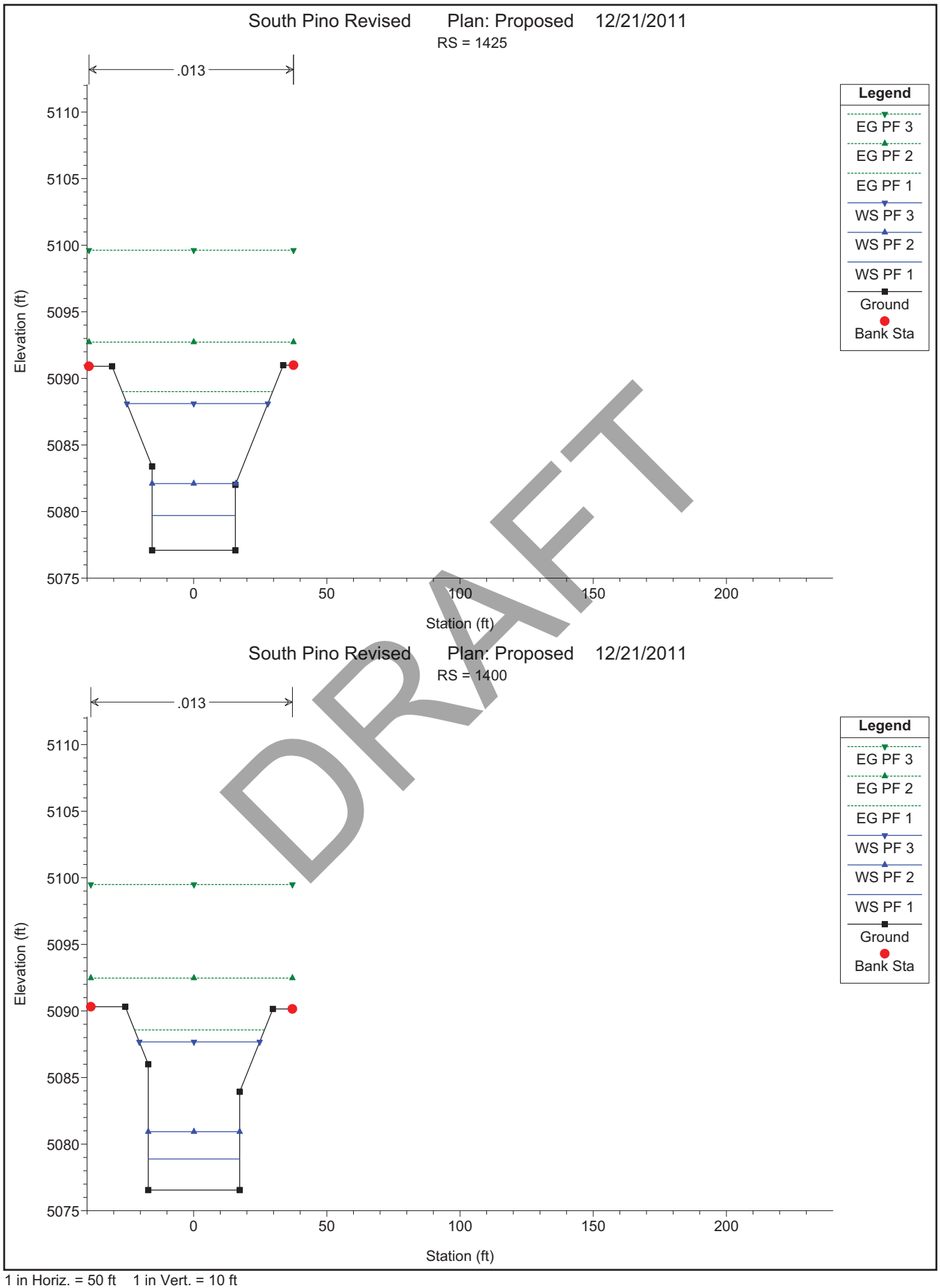
1 in Horiz. = 50 ft 1 in Vert. = 10 ft



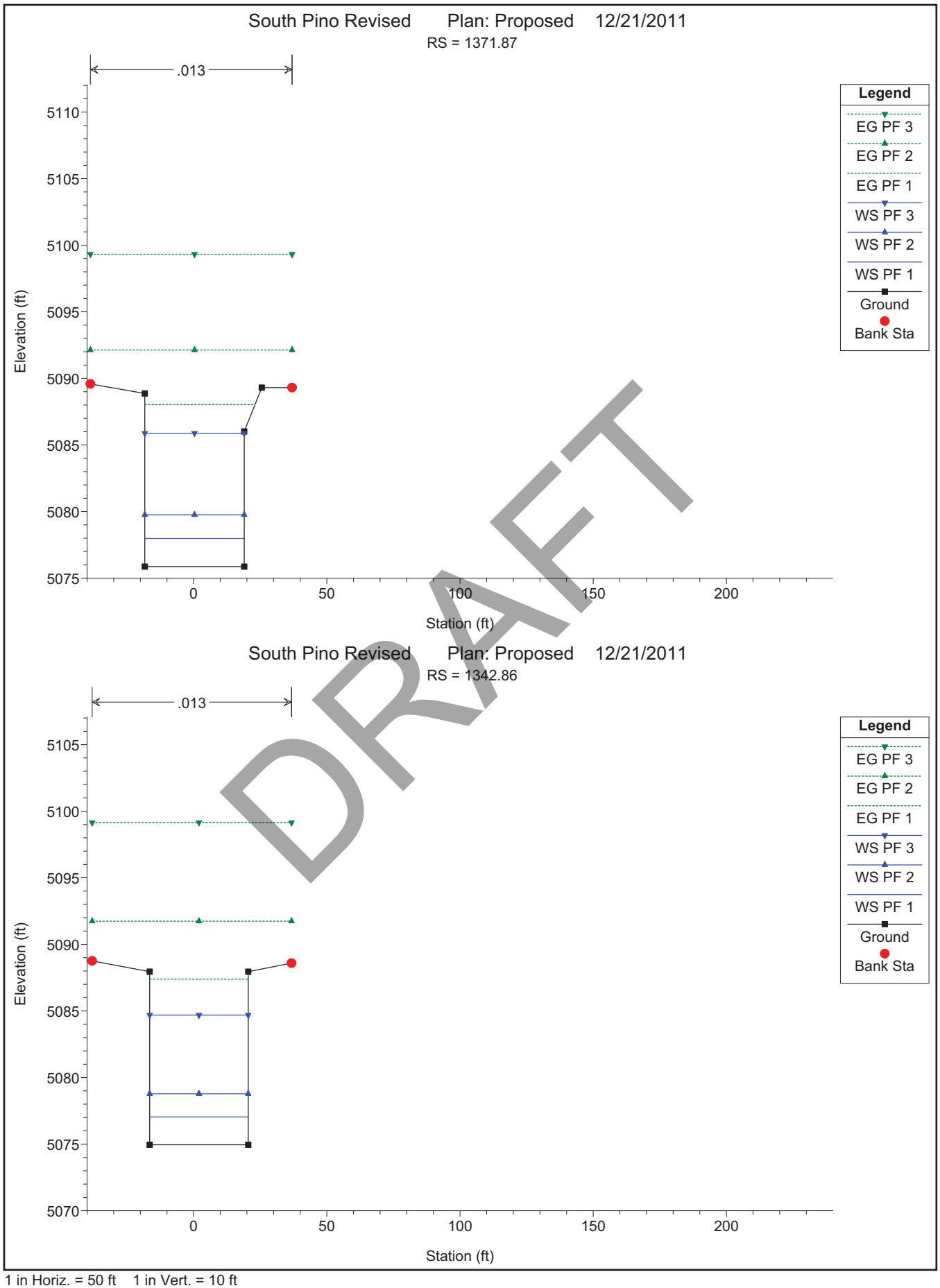
1 in Horiz. = 50 ft 1 in Vert. = 10 ft



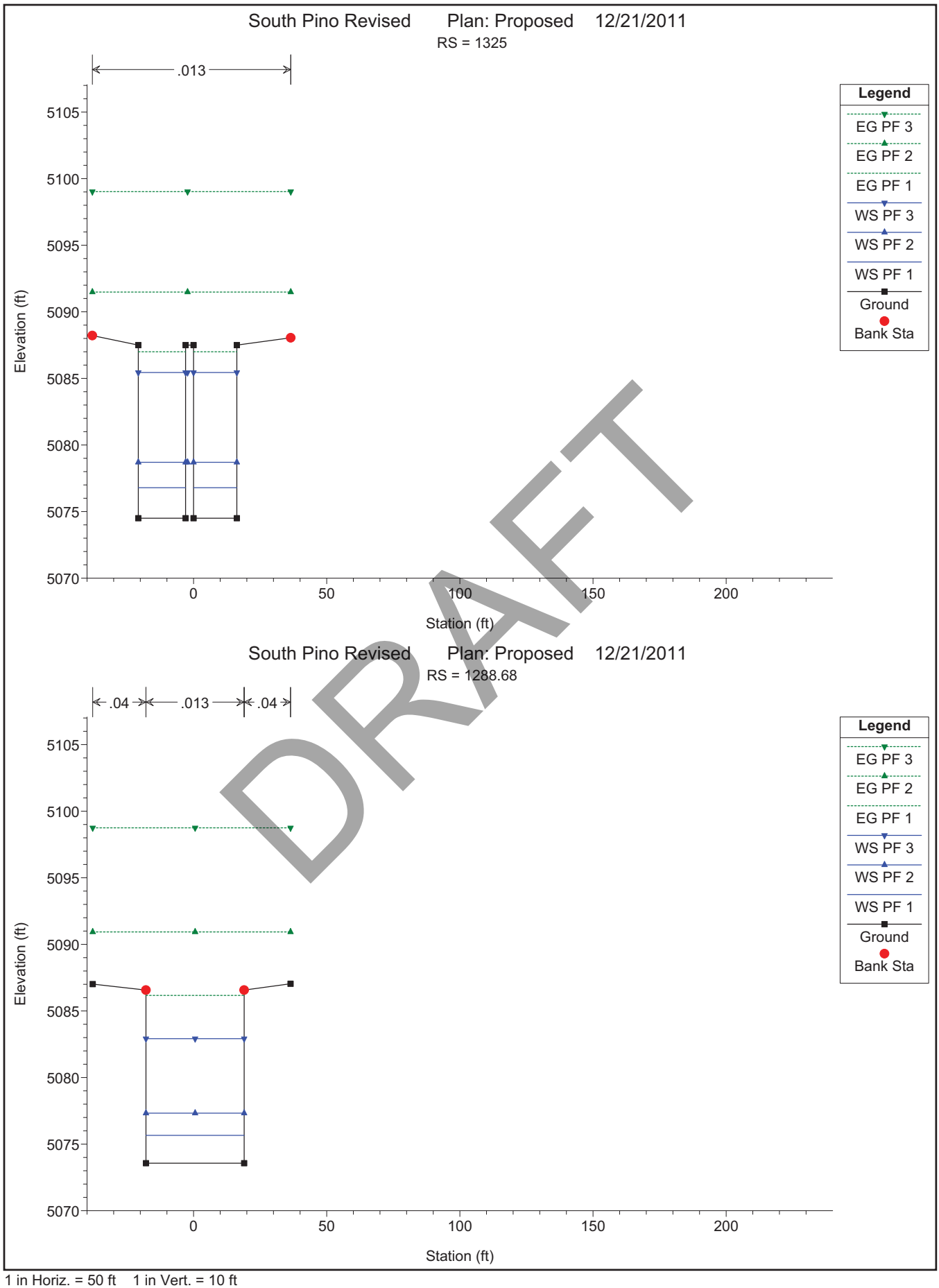
1 in Horiz. = 50 ft 1 in Vert. = 10 ft



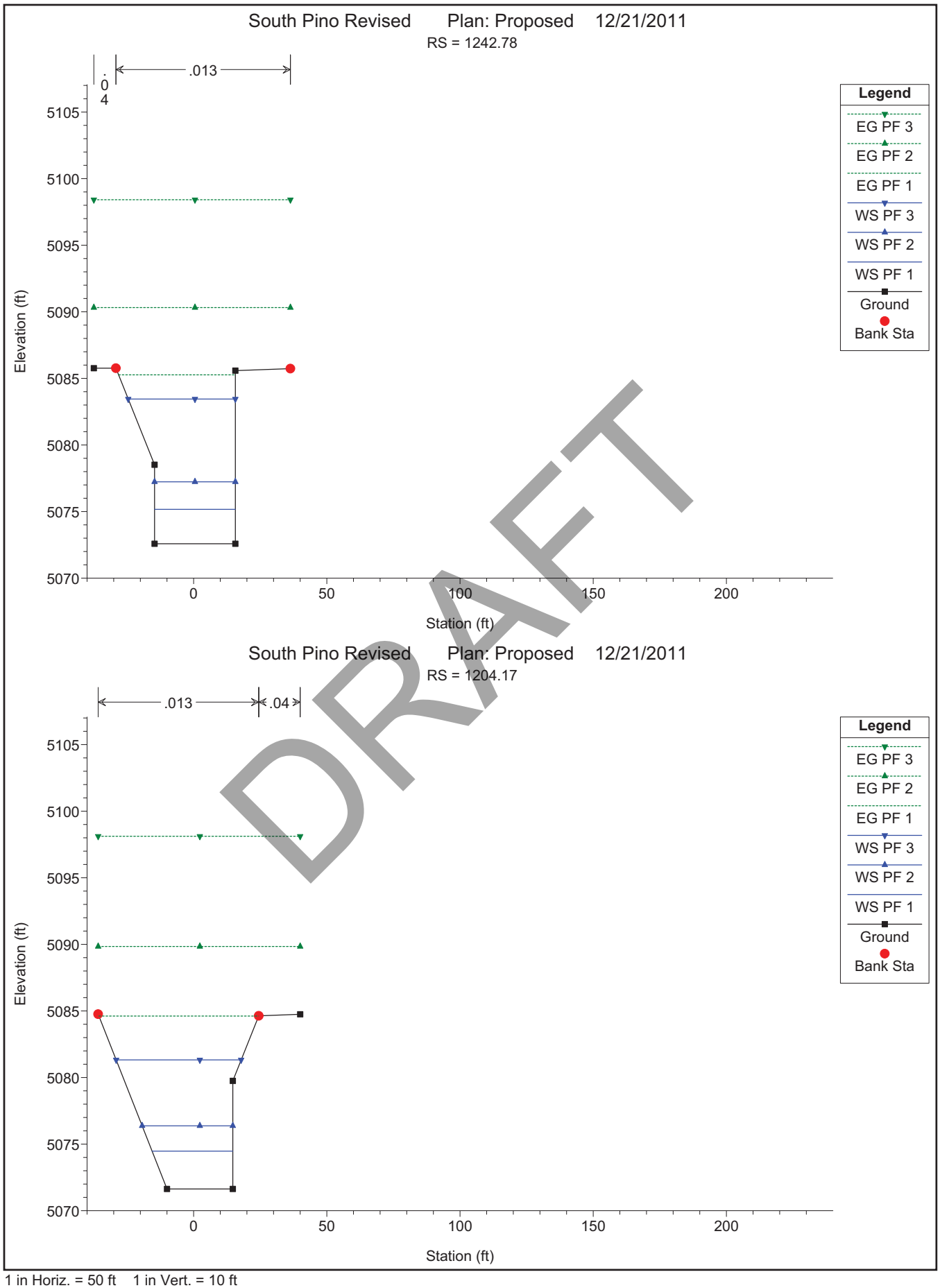
1 in Horiz. = 50 ft 1 in Vert. = 10 ft



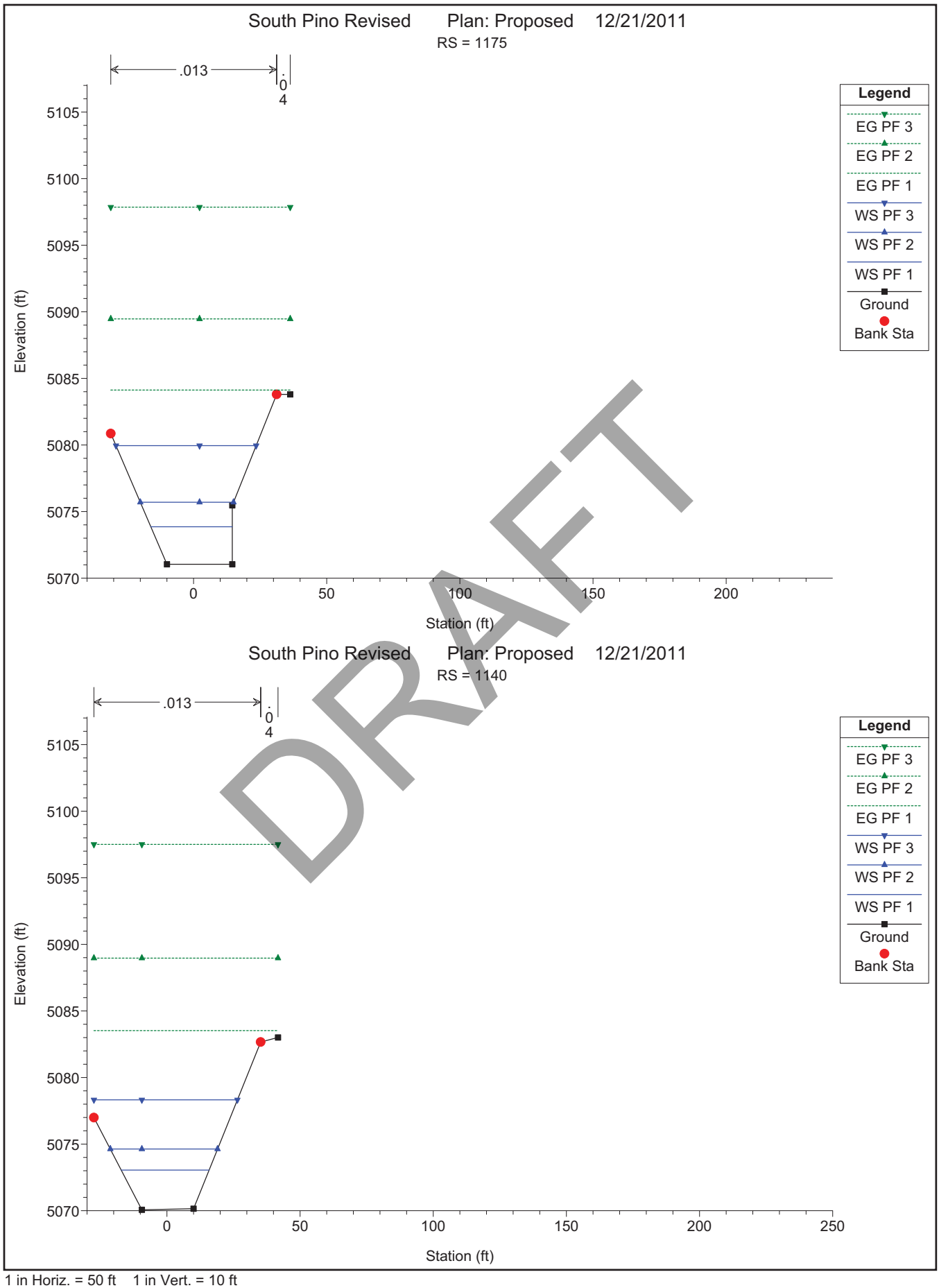
1 in Horiz. = 50 ft 1 in Vert. = 10 ft



1 in Horiz. = 50 ft 1 in Vert. = 10 ft



1 in Horiz. = 50 ft 1 in Vert. = 10 ft



1 in Horiz. = 50 ft 1 in Vert. = 10 ft