PRELIMINARY HYDROLOGY
FOR
TROON NORTH RESORT SITE
CASE: 409-PA-93

GAI 38401

Prepared by:

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Scottsdale, Arizona 85255-3465

February 4, 1994

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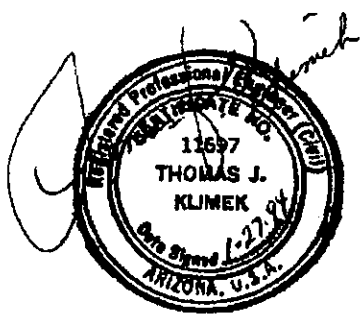
Page No.



1.0 INTRODUCTION

This preliminary drainage report has been prepared to accompany a submission for rezoning of Parcels V_1 and V_2 at Troon North.

The property is located North of Dynamite Boulevard in Section 29, Township 5 North, Range 5 East of the Gila and Salt River Base and Meridian, in Maricopa County, Arizona. Figure 1, provides a Vicinity Map depicting the location of Parcels V_1 and V_2 within Troon North. Development abutting the proposed project includes the Troon North Golf Clubhouse.

This report utilizes HEC-1 models from Addendum No. 2 to the *Master Drainage Plan for Troon North*, by P & D Technologies, August 1990 to quantify storm water runoff. The models utilized may be found in Appendix I.

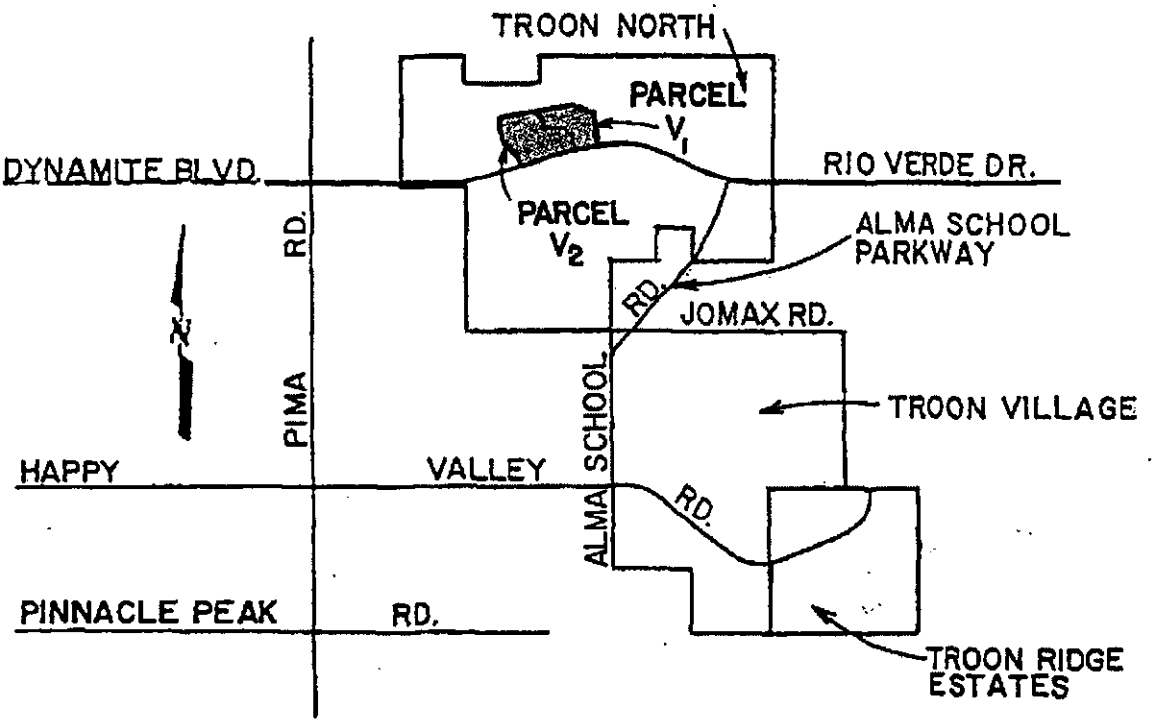


FIGURE 1
VICINITY MAP

TROON NORTH RESORT SITE

2.0 DESCRIPTION OF STUDY AREA

2.1 Existing Conditions

The Property consists of six parcels located adjacent to and abutting Holes 1, 9 and 10 of the Troon North Golf Course. The area of the proposed development is approximately 54 acres. Figure 2 shows the configuration of the drainage basins used in this study. The flood plain shown in Figure 2 was in effect prior to the construction of the golf course and does not reflect the post-development conditions. The flood plain delineation for post-development conditions is shown on Figure 4.

2.1.1 Basin 4

Runoff from Basin 4 enters the property between the tees at Hole 10 and flows southwesterly adjacent Hole 1. The 100-year, 24-hour calculated peak discharge of this wash is approximately 660 cfs as it exits the property.

2.1.2 Basin 3

Runoff from Sub-Basins 3B and 3C enter the site via drainage structures located on Dynamite boulevard. The 100-year peak discharges are 56 cfs and 173 cfs for Sub-Basins 3B and 3C respectively. Sub-Basin 3C runoff enters the property via a box culvert/cart underpass and storm water is conveyed through the property in a wash adjacent Hole 9. Sub-Basin 3B runoff enters the site via two (2) 36" concrete culverts. Runoff from Sub-Basin 3D enters the site to the east of the Hole 9 green. The combined

discharge of the above Sub-Basins B, C, & D is 582 cfs at the western boundary of the property.

2.2 Proposed Development

The proposed zoning for the Property is R1-7HD for parcels 1 and 2; and R4-RHD for Parcels 3, 4, 5, and 6. A total of 424 units are proposed. Large reserves of Natural Area Open Space (NAOS) will be provided and left undisturbed to accommodate the existing washes that flow through the property. *Figure 3 shows the flood routing.*

During the site planning process, lotting concepts will be developed for the site considering the unique constraints and opportunities of this location. The proposed site plan was prepared with a goal of preserving, to the maximum extent possible, significant stands of vegetation, preserving the natural drainage corridor and providing meaningful NAOS areas. Storm water management will be handled at regional facilities located downstream of the Property.

3.0 METHOD OF ANALYSIS

Addendum No. 2 to the *Master Drainage Plan for Troon North* was used as the basis for the hydrology and hydraulic analysis contained in this report. The flow for the floodplain delineation for Drainage Area 4 were taken directly from the HEC-1 models contained in the No. 2 Addendum. For Drainage Area 3 the Addendum No. 2 HEC-1 models were modified to include the flows form sub-basins 3C and 3B. The Peak discharge of the Modified HEC-1 models corresponded closely to the Peak discharges for these sub-basins calculated in the Addendum No. 2 HEC-1 models. The modified HEC-1 models for Drainage Area 3 are included in Appendix II.

Delineation of the flood plain was accomplished by determining the depth of flow in representative channel cross-sections using Manning's equation with a conservative Peak discharge selected for a HEC-1 model. A trapezoidal approximation of the channel cross-sections along with the channel slope and Peak discharge was input into Haestad Methods, Flowmaster program and the depth of flow determined. Appendix II contains the output from the Flowmaster program. The location of the cross-sections used to determine the depth of flow, the flood routing and the flood plain delineations are shown on Figure 4.

The discharges used to determine the flow depth in Basin 4 was 2 cfs greater than the discharge at CP-4.3 in the developed conditions HEC-1 by P & D Technologies. The HEC-1 model is located in Appendix I. The discharge used for the depth of flow determination in Basin 3 was 582 cfs. The above flow is the peak discharge for developed conditions at CP-3D, in the modified HEC-1 model located in Appendix II.

4.0 PROPOSED DRAINAGE SYSTEM

4.1 Identification of Major Drainage Courses

There are no washes with an existing flow greater than 750 cfs that impact the site.

4.2 Proposed Drainage System

The existing drainage pattern and washes have been maintained in their existing locations and conditions where possible. Bank protection consisting of natural boulders and vegetation will be utilized to approximate natural wash conditions where necessary. Drainage ways shown in Figure 4 have width ranging from 50 to 100 feet. On preliminary analysis sufficient width is available to accommodate the maximum expected 100 year flows of 660 cfs.

4.3 Easement Requirements

All washes with flows greater than 50 cfs will be contained within drainage tracts or will require registration of a drainage easement. The washes which require drainage tracts will be identified as part of the final platting process for each parcel. The preliminary plat outlines the locations where drainage tracts are presently anticipated.

4.4 Roadway Crossings at Natural or Man-Made Drainage Channels

In accordance with the City of Scottsdale Flood Plain Ordinance #1993, minor and local collector streets shall have a culvert capable of conveying the 10 year storm beneath the roadway and the depth on the roadway for

the 25 year event may not exceed 6 inches. All major collector and arterial streets must convey the entire 50 year storm beneath the roadway and the depth on the roadway for the 100 year storm may not exceed 6 inches.

4.5 Implementation

Construction of all drainage improvements and the dedication of all drainage easements are the responsibility of the developer. Easements will be provided as part of the final platting and design plans. Construction of the approved drainage improvements will occur along with the infrastructure improvements.

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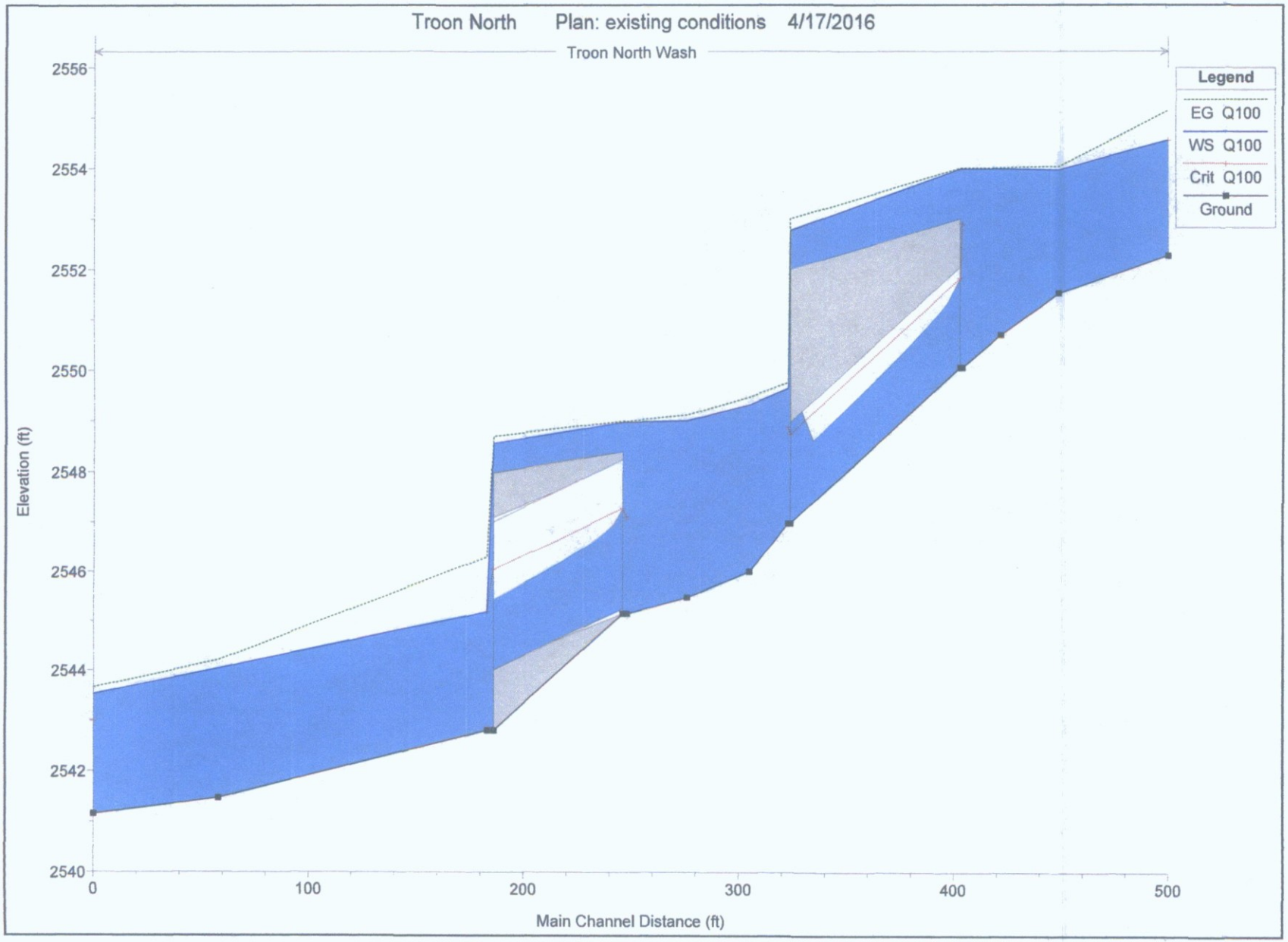
FIGURE 3

DEVELOPED CONDITIONS FLOOD ROUTING

FEBRUARY 1994 | Job No. 93481 | Sheet of

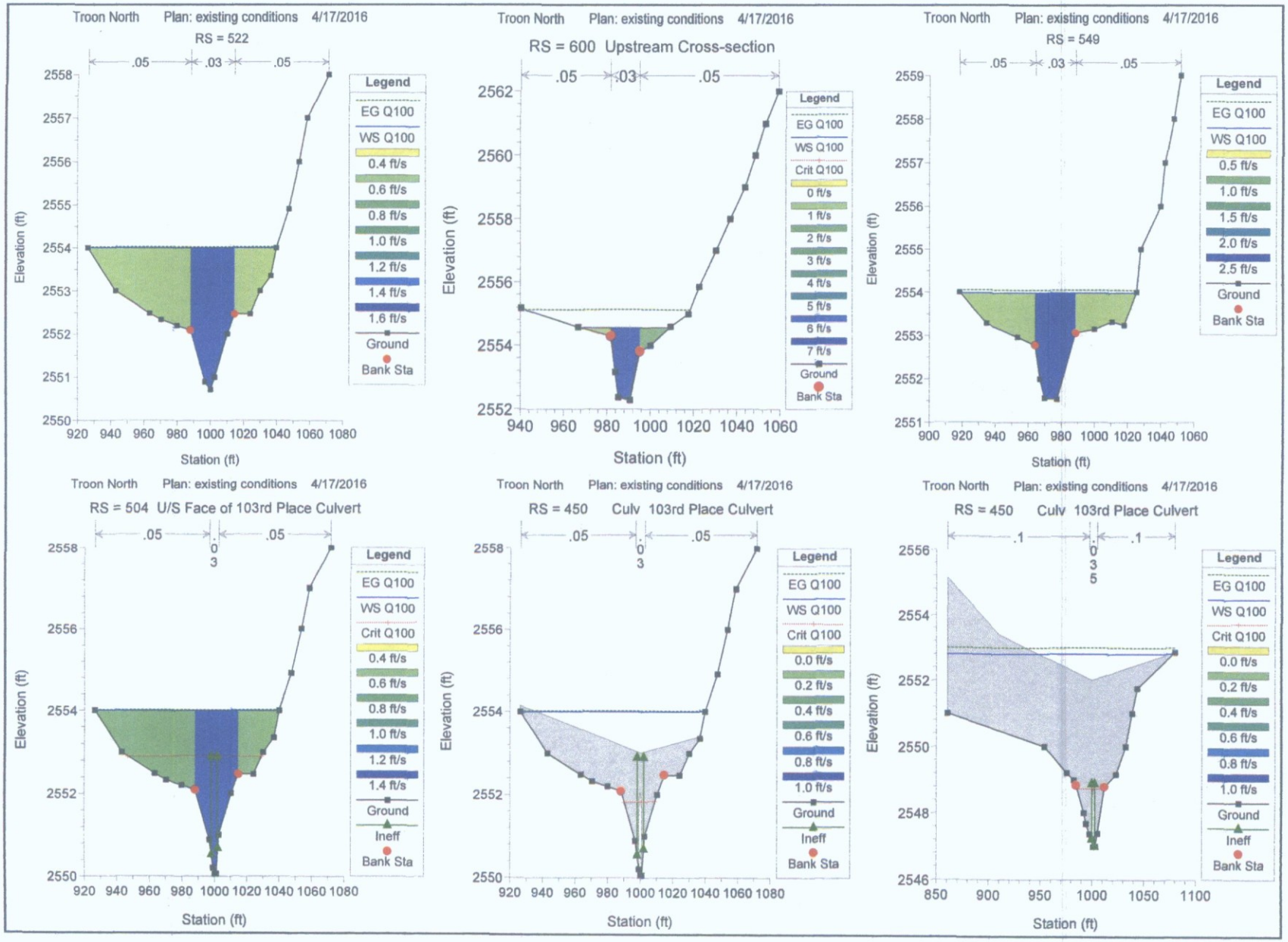
EXHIBIT-9: HEC-RAS Analysis Selected Output Pages

Existing Conditions



HEC-RAS Plan: exconds River: Troon North Reach: Wash Profile: Q100

Reach	River Sta	Profile	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)	
Wash	600	Q100	155.00	2552.29	2554.56	2554.56	2555.14	0.008384	6.30	30.54	40.76	0.84
Wash	549	Q100	155.00	2551.53	2553.98		2554.05	0.000910	2.33	107.74	106.93	0.29
Wash	522	Q100	155.00	2550.71	2554.00		2554.02	0.000257	1.47	172.11	113.47	0.16
Wash	504	Q100	155.00	2550.06	2554.00	2552.91	2554.01	0.000343	1.29	174.43	113.44	0.14
Wash	450		Culvert									
Wash	423	Q100	155.00	2546.98	2549.65	2548.89	2549.76	0.011953	2.82	65.81	64.66	0.37
Wash	405	Q100	155.00	2546.00	2549.32		2549.48	0.018503	3.30	51.54	51.75	0.45
Wash	376	Q100	155.00	2545.48	2549.01		2549.12	0.008247	3.20	81.72	82.43	0.34
Wash	348	Q100	155.00	2545.15	2548.98	2547.10	2549.00	0.001808	1.36	163.43	134.70	0.16
Wash	300		Culvert									
Wash	283	Q100	155.00	2542.80	2545.19	2545.19	2546.30	0.013898	8.46	18.33	19.21	1.01
Wash	158	Q100	155.00	2541.47	2544.04		2544.20	0.004516	3.25	47.74	38.68	0.51
Wash	100	Q100	155.00	2541.15	2543.53	2542.99	2543.66	0.028026	2.94	52.77	50.09	0.50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Ground
Bank Sta
Elevation (ft)
Station (ft)
Troon North Plan: existing conditions 4/17/2016
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Legend
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WS Q100
Crit Q100
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5 ft/s
6 ft/s
7 ft/s
Ground
Bank Sta
Elevation (ft)
Station (ft)
Troon North Plan: existing conditions 4/17/2016
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.05 .03 .05
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WS Q100
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Ground
Bank Sta
Elevation (ft)
Station (ft)
Troon North Plan: existing conditions 4/17/2016
RS = 504 U/S Face of 103rd Place Culvert
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Legend
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WS Q100
Crit Q100
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0.6 ft/s
0.8 ft/s
1.0 ft/s
1.2 ft/s
1.4 ft/s
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)
Troon North Plan: existing conditions 4/17/2016
RS = 450 Culv 103rd Place Culvert
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Legend
EG Q100
WS Q100
Crit Q100
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Elevation (ft)
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Troon North Plan: existing conditions 4/17/2016
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Elevation (ft)
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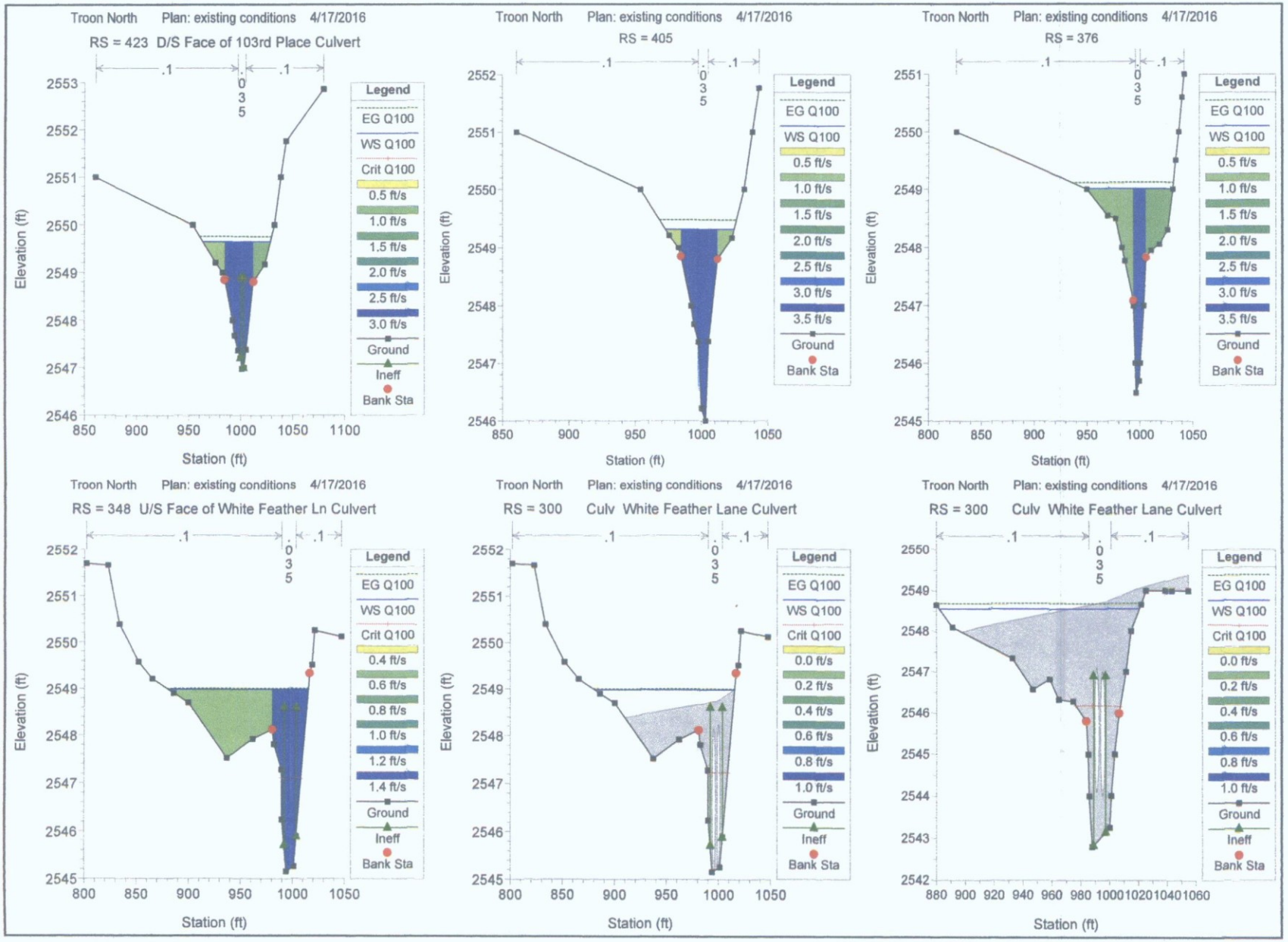
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Bank Sta
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Station (ft)
Legend
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Ground
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Troon North Plan: existing conditions 4/17/2016
RS = 376
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
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Ground
Bank Sta
Troon North Plan: existing conditions 4/17/2016
RS = 348 U/S Face of White Feather Ln Culvert
Elevation (ft)
Station (ft)
Legend
EG Q100
WS Q100
Crit Q100
0.4 ft/s
0.6 ft/s
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1.2 ft/s
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Ground
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Bank Sta
Troon North Plan: existing conditions 4/17/2016
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Elevation (ft)
Station (ft)
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WS Q100
Crit Q100
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Troon North Plan: existing conditions 4/17/2016
RS = 300 Culv White Feather Lane Culvert
Elevation (ft)
Station (ft)
Legend
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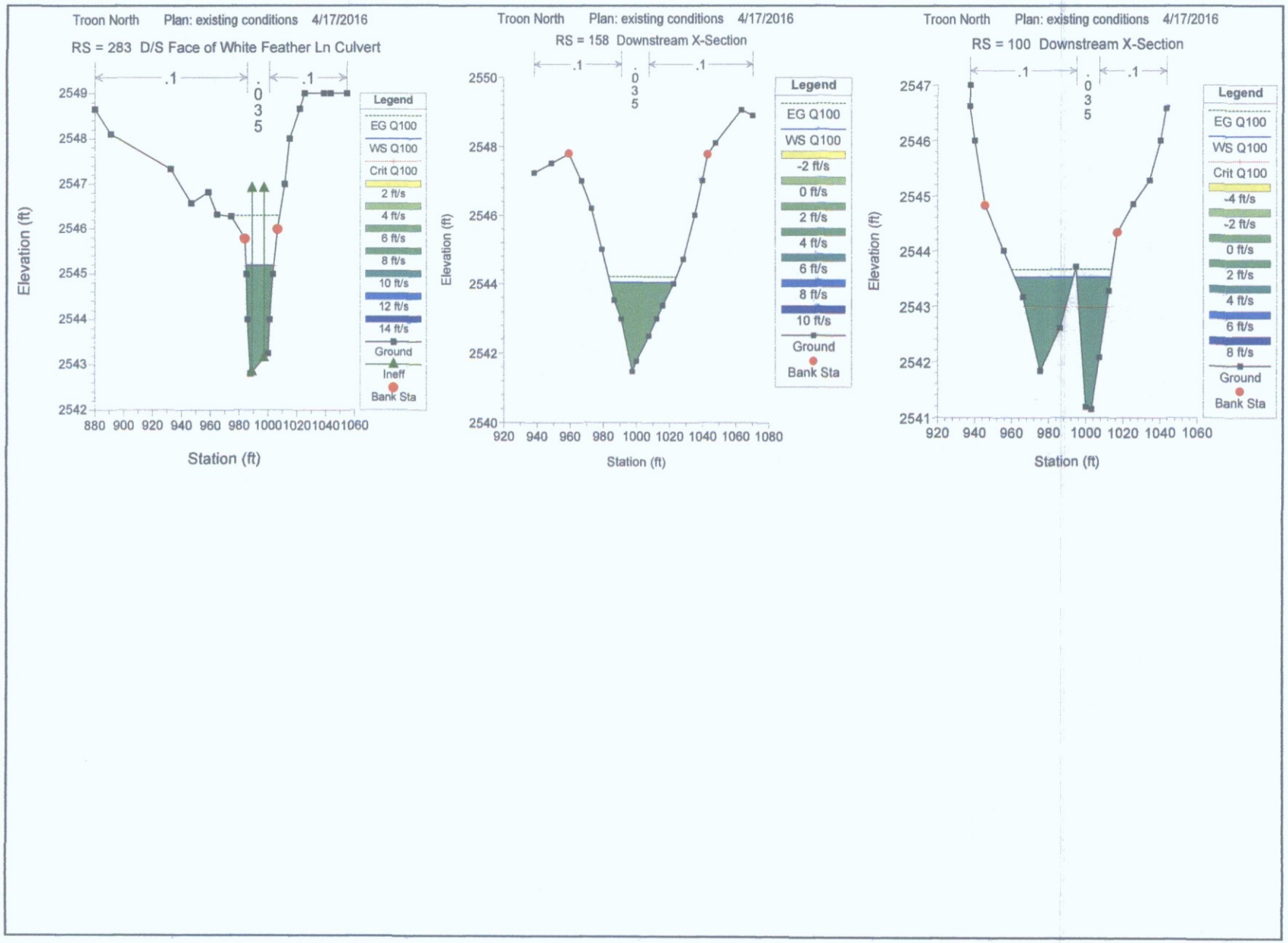
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Elevation (ft)
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Troon North Plan: existing conditions 4/17/2016
RS = 158 Downstream X-Section
Elevation (ft)
Station (ft)
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EG Q100
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Ground
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Troon North Plan: existing conditions 4/17/2016
RS = 100 Downstream X-Section
Elevation (ft)
Station (ft)
Legend
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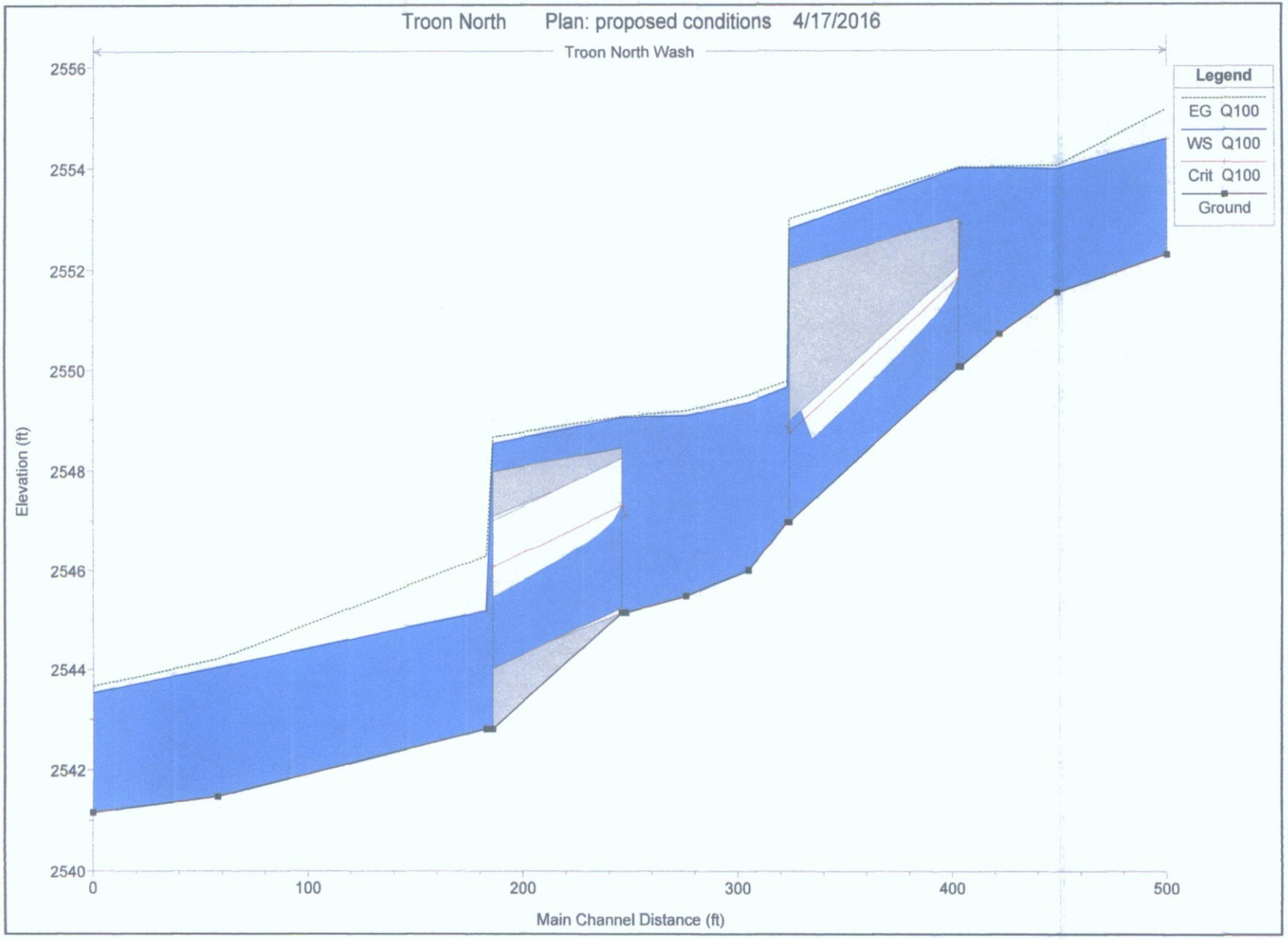
Proposed Conditions



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Wash	450		Culvert									
Wash	423	Q100	155.00	2546.98	2549.66	2548.89	2549.77	0.011600	2.79	66.67	65.17	0.36
Wash	405	Q100	155.00	2546.00	2549.35		2549.51	0.017035	3.22	53.44	53.15	0.43
Wash	376	Q100	155.00	2545.48	2549.08		2549.18	0.007216	3.05	88.24	92.05	0.32
Wash	348	Q100	155.00	2545.15	2549.05	2547.10	2549.08	0.001628	1.31	152.38	92.06	0.15
Wash	300		Culvert									
Wash	283	Q100	155.00	2542.80	2545.19	2545.19	2546.30	0.013898	8.46	18.33	19.21	1.01
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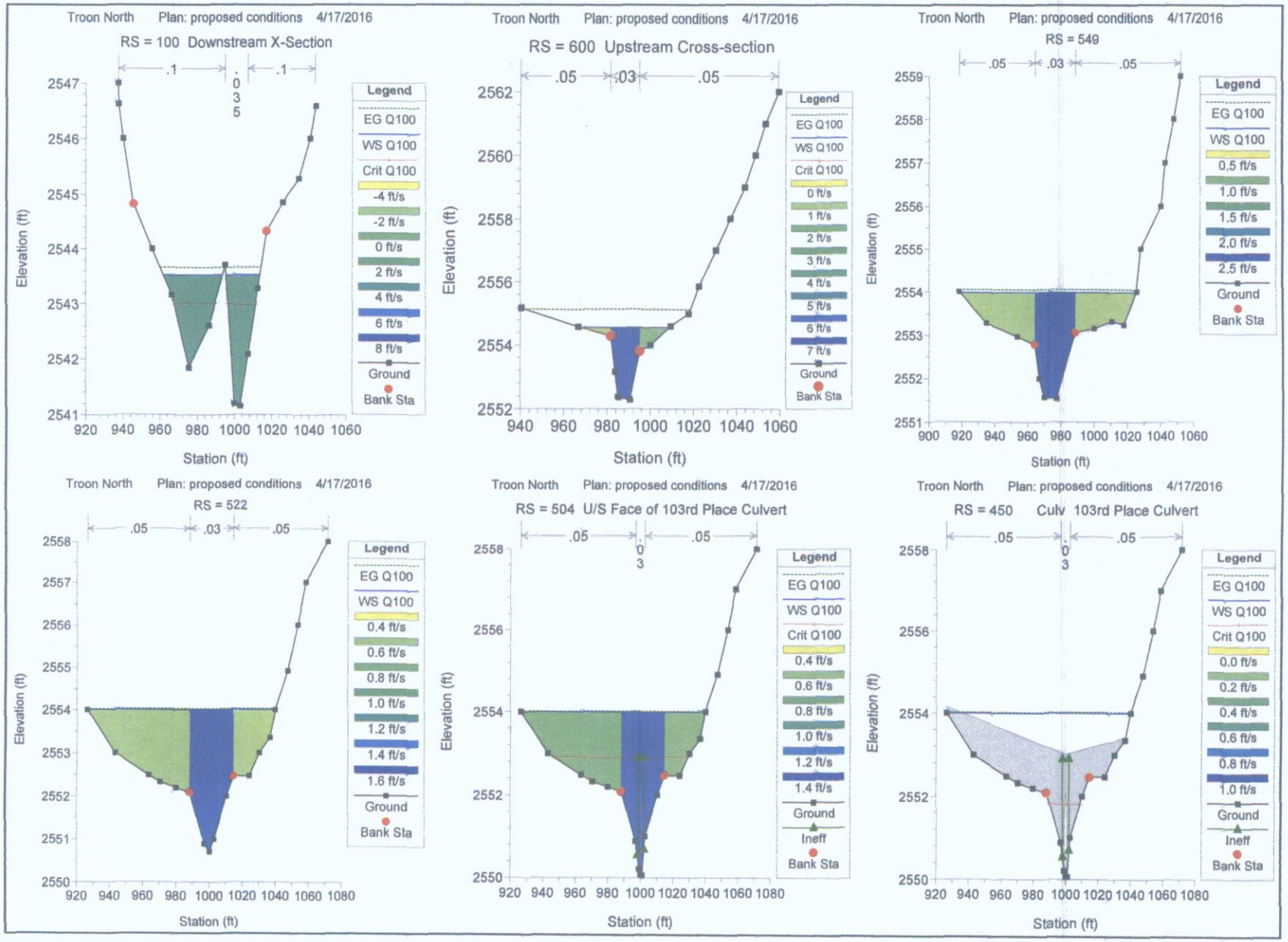
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RS = 504 U/S Face of 103rd Place Culvert
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Troon North Plan: proposed conditions 4/17/2016
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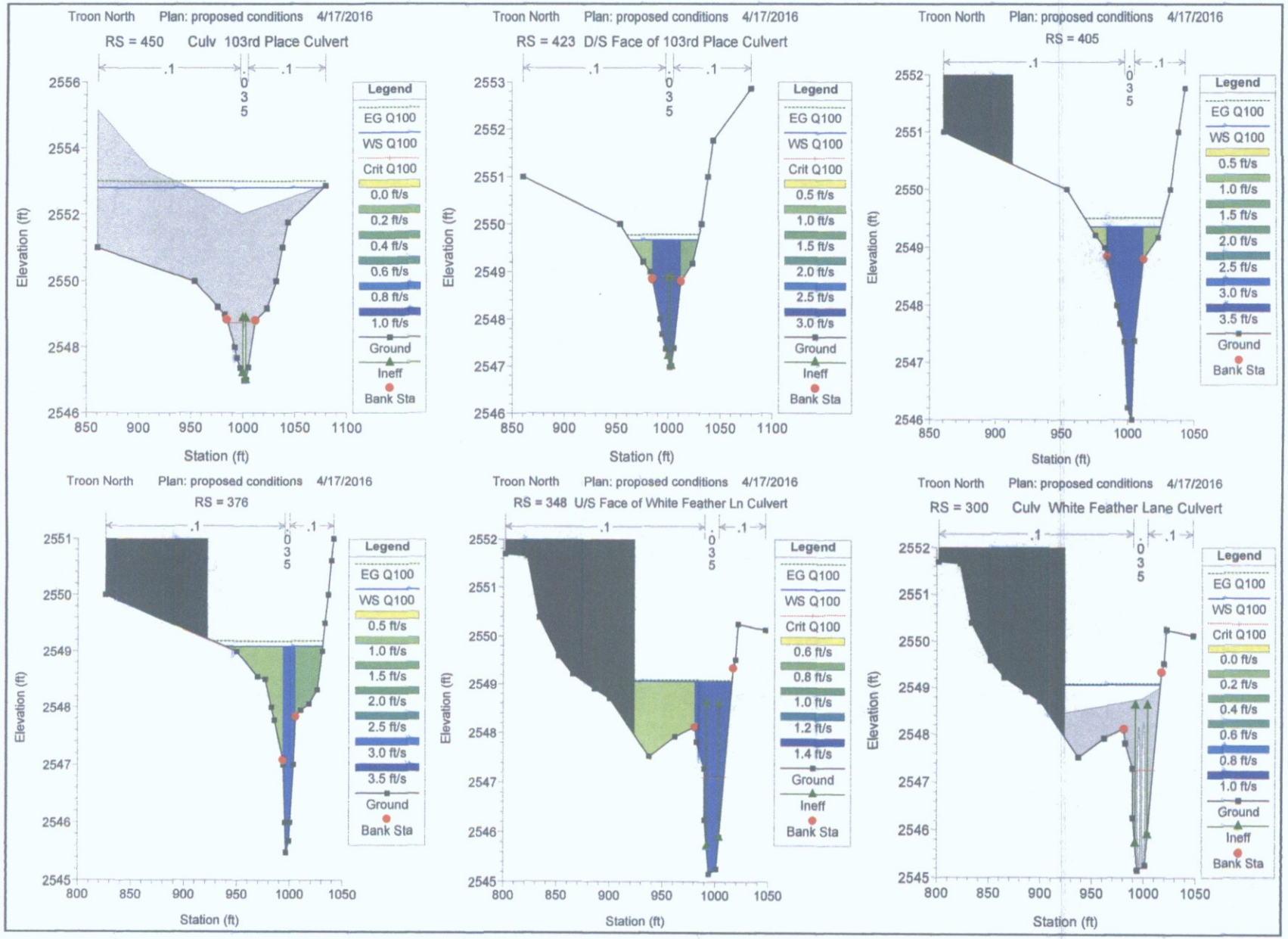
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Troon North Plan: proposed conditions 4/17/2016
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Troon North Plan: proposed conditions 4/17/2016
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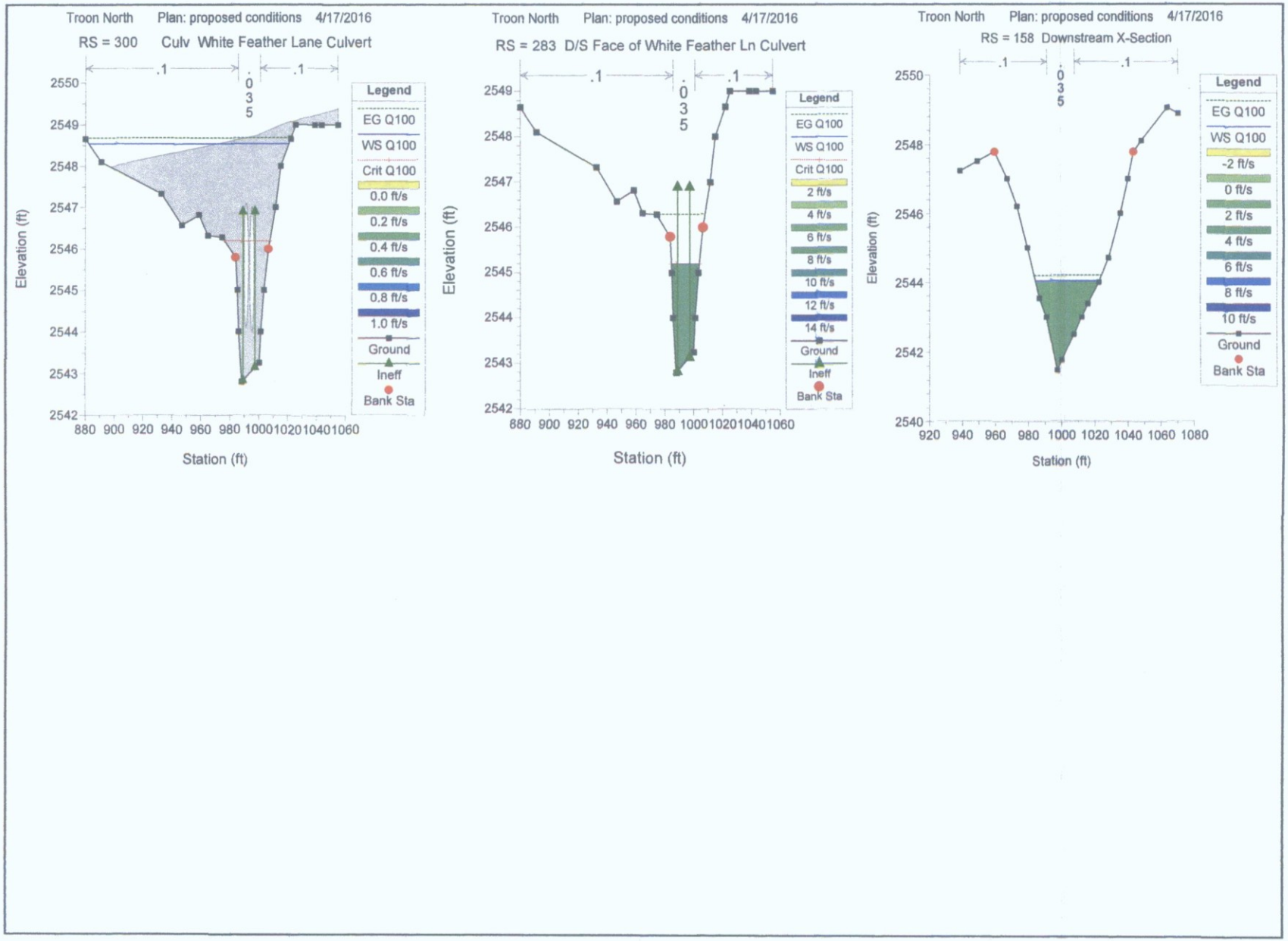
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Elevation (ft)
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Troon North Plan: proposed conditions 4/17/2016
RS = 283 D/S Face of White Feather Ln Culvert
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Ineff
Bank Sta
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RS = 158 Downstream X-Section
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Bank Sta