Stantec Consulting Ltd.
100-300 Hagey Boulevard, Waterloo ON N2L 0A4

July 6, 2017
File: 160960595

Attention: Mr. Sean Fairfield, Director Project Planning and Permitting
Algonquin Power Co.
354 Davis Road
Suite 100
Oakville, ON L6J 2X1

Dear Mr. Fairfield,

Reference: Amherst Island Wind Energy Project – Eves Property Man-made Ditch Realignment Design Brief

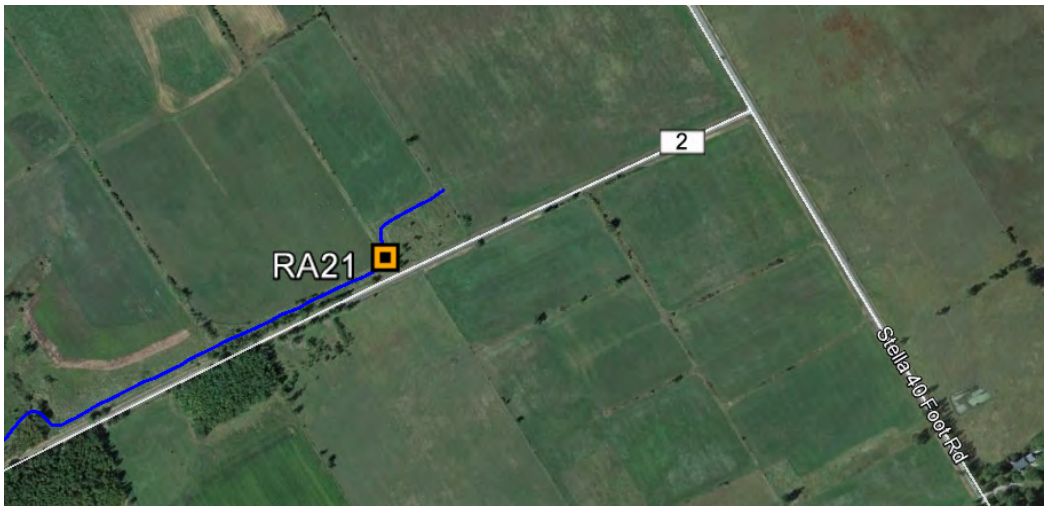
INTRODUCTION AND BACKGROUND

In response to the Government of Ontario's recent promotion of renewable energy development, Algonquin Power Co. (Algonquin), on behalf of Windlectric Inc., is proposing to construct and operate the Amherst Island Wind Energy Project located in Loyalist Township, Ontario.

As part of this work, an entrance from Concession Road 2 is required to be built over the Eves Property Man-made Ditch ("Ditch") located to the south of the Central Staging Area (CSA) Stormwater Management (SWM) facility, providing access to the CSA and substation access roads. This technical letter brief ("Brief") focuses on the Ditch and documents the methodology and assumptions used to determine an appropriate Ditch realignment and culvert sizing to accommodate the proposed entrance. The location of the crossing location is identified in Figure 1.

Reference: Amherst Island Wind Energy Project – Eves Property Man-made Ditch Realignment Design Brief

Figure 1 - Proposed Crossing Location



EXISTING CONDITIONS

A site visit was completed by Stantec on May 25, 2017. The Ditch was walked from upstream to downstream. Cross-sections were surveyed along the length of the feature. No water was observed in the Ditch at the time of site investigation and there was no evidence of sustained flow (i.e. erosion, deposition, lateral and longitudinal sorting of substrate etc.). The Ditch cross-section is uniform along its entire length and the cross-section is dominated by grasses. The straightened planform and uniform cross-section are indicative of a constructed feature. A review of historic air photos confirms that the watercourse is a constructed feature.

Under existing conditions, the upstream catchment, identified as RA21 in the *Amherst Island Wind Energy Project, Erosion and Sediment Control and Stormwater Management Report – Phase 4*, is used for agricultural purposes. RA21 consists of 22 ha draining southwest to the upstream end of the Eves Property Man-made Ditch. The existing slope of the watercourse throughout the site area is approximately 0.30 %. The Ditch cross-section has an average top width of approximately 5.0 m, bottom width of 1.5 m, and 2:1 side slopes. A photograph of the site is presented in Figure 2.

Reference: Amherst Island Wind Energy Project – Eves Property Man-made Ditch Realignment Design Brief

Figure 2 - Looking Upstream on Eves Property Man-made Ditch at Approximate Entrance Crossing Location

PROPOSED CONDITIONS

To accommodate the access road, a crossing of the Ditch and some minor ditch realignment is required. The dimensions of the realigned portion of the watercourse were developed based on the average dimensions of the existing Ditch and are presented in Drawing C-501. The slope of the proposed Ditch is 0.30%, which is the same as the slope of the existing feature. Substrate will be used to line the bottom of the Ditch and will be comprised of a 150 mm layer of 50 mm minus stone mixed with topsoil. This will protect the ditch against erosion, prior to the establishment of vegetation.

SEEDING

Ditch banks and all disturbed areas are to be seeded and secured with erosion control blankets. The proposed seeding plan will maintain a drainage feature dominated by flood tolerant native grasses. The proposed seed mix is OSC Seed Mix #8215 – Creek Bank Seed Mixture (or equivalent approved by the engineer), as described in Table 1. Erosion control blankets (700 G Coir Fiber Blanket or equivalent approved by the engineer) are to extend from the toe of the Ditch bank to 2.0 m beyond the top of bank.

Reference: Amherst Island Wind Energy Project – Eves Property Man-made Ditch Realignment Design Brief

Table 1 - Proposed Creek Bank Seed Mixture (OSC Seed Mix #8215)

Quantity (%)	Botanical Name	Common Name	Application
30	Andropogon Gerrardi	Big Bluestem	Rate of Application: 22-25 kg/ha with a nurse crop of annual oat grass, seeded at 22 Kg/ha
6	Rudeckia Hirta	Black Eyed Susan	
5	Elymus Hystrix	Bottlebrush Grass	
30	Paa Palustris	Fowl Bluegrass / Fowl Meadowgrass	
2	Glyceria Striata	Fowl Mannagrass	
25	Carex Vulpinoidea	Fox Sedge	
2	Aster Novae-Anglaie	New England Aster	

DESIGN CRITERIA AND ASSUMPTIONS

HYDROLOGIC CHARACTERIZATION

The hydrologic model SWMHYMO (Stormwater Management Hydrologic Model) was used to predict peak flows at the RA21 Ditch crossing and determine site specific culvert size requirements.

Inputs to the model included contributing drainage area, catchment slopes, land use, and soil types. Drainage areas, as illustrated in Figure 5 (attached), were delineated using GIS data and aerial imagery showing local drains and drainage patterns within the watersheds. Catchment slopes, land use and soil types were defined using GIS data, aerial photo interpretation, and observations made during site visits. Specific parameter considerations include:

- Surficial soil type information was obtained from GIS data provided by the Ontario Ministry of Natural Resources and Forestry (MNRF). The predominant surficial soil type in the project area is clay, corresponding to hydrologic soil group type 'CD' (Figure 6, attached)
- Active agriculture (cropland) was determined to be the dominant land use. Forest blocks and minimal impervious coverage in the forms of roads, structures, and driveways are also present. (Figure 7, attached). Land slope was assessed using Ontario Base Mapping (OBM) contour data.
- Reach lengths, necessary in the assessment of hydrograph time-to-peak, were estimated using OBM data, aerial photos, and direct measurement.

The storm files used in the hydrologic model employed 1:5, 1:10 and 1:100-year, 24-hour, Soil Conservation Service (SCS) Type II distributions and are based on data obtained using the Ministry of Transportation Ontario Intensity Duration Frequency (IDF) Curve Lookup tool for the project (44.154167 N, 76.712500 W). The SCS is mainly utilized in undeveloped rural watersheds and has been determined to be an appropriate method to use in Southern Ontario.

Reference: Amherst Island Wind Energy Project – Eves Property Man-made Ditch Realignment Design Brief

Hydrologic modeling of the area downstream of the proposed RA21 Ditch crossing was provided in the *Amherst Island Wind Energy Project – Erosion and Sediment Control and Stormwater Management Report – Phase 2* (Stantec, February 2017), which detailed stormwater management controls for the Central Staging Area, and approved by both the Ministry of Environmental and Climate change on March 13, 2017 and Cataraqui Region Conservation Authority on April 19, 2017.

DESIGN FLOW ESTIMATION

The SWMHYMO hydrologic model was used to determine 5-, 10- and 100-year runoff flow rates for the catchment. A Summary table of design flow rates are summarized in Table 2.

Table 2 - Existing and Proposed Flows for South Ditch

	Return Period	RA 21 Crossing (m^3/s)	Central Staging Area (m^3/s)	Total Discharge (m^3/s)
Existing Conditions	5-Year	1.02	1.85	2.87
	10-Year	1.27	2.31	3.58
	100-Year	2.10	3.80	5.90
CSA with SWM Controls	5-Year	1.02	0.80	1.82
	10-Year	1.27	1.22	2.49
	100-Year	2.10	2.98	5.08
Ultimate Conditions (CSA Removed)	5-Year	1.02	1.85	2.87
	10-Year	1.27	2.31	3.58
	100-Year	2.10	3.80	5.90

HYDRAULIC ANALYSIS

Hydraulic analysis was completed using HEC-RAS v4.1.0 to estimate water levels at the proposed access road culvert location and to verify that backwater effects as a result of culvert installation would be minimal. The 5, 10, and 100-year flow rates were modeled under existing and proposed conditions. The following parameters were used in model development:

- The cross sections were obtained from topographic surveys of the area completed in November 2015 and November 2016. Additional site specific topographic information was collected in May 2017 to augment the model.
- The stream bed at the crossings are primarily earth with some grass. The channel morphology is consistent both upstream and downstream.

Reference: Amherst Island Wind Energy Project – Eves Property Man-made Ditch Realignment Design Brief

- The Manning's roughness coefficient values used in this analysis (0.05) were selected based on a visual inspection of the existing channel.
- The culvert will convey the peak predicted flow associated with a 1:5-year storm event applying the same requirements as for the other crossings over defined watercourses within this project.
- A final culvert length of 26.5 m was used per the attached design drawings
- 600 mm of cover has been assumed for the pipe arch culvert

Table 3 - Culvert Sizing

Shape	Material	Dimensions Span x Rise mm
Pipe Arch	HE CSP	1630 x 1120

MODEL RESULTS

Under proposed conditions the water levels differ slightly from existing conditions but are not significant enough to affect freeboard or flood levels experienced by landowners upstream. Table 4 summarizes the results of the HEC-RAS hydraulic modelling for the 5, 10, and 100-year return periods, for existing and proposed conditions. Figure 3 illustrates the locations of HEC-RAS sections used to compare modelling results between existing and proposed conditions. Full tabular results and plots from the HEC-RAS model are attached.

Reference: Amherst Island Wind Energy Project – Eves Property Man-made Ditch Realignment Design Brief

Table 4 - Summary of Hydraulic Analysis

HEC-RAS XS ID	Return Period	Existing Water Surface Elevation (masl)	Proposed Water Surface Elevation CSA w/ SWM (masl)	Change in Water Surface Elevation (m)	Ultimate Water Surface Elevation CSA Removed (masl)	Change in Water Surface Elevation (m)
10079	5	84.01	83.99	-0.02	83.99	-0.02
10079	10	84.06	84.05	-0.01	84.05	-0.01
10079	100	84.18	84.18	0.00	84.18	0.00
10051	5	83.93	83.90	-0.03	83.90	-0.03
10051	10	83.99	83.96	-0.03	83.96	-0.03
10051	100	84.11	84.10	-0.01	84.10	-0.01
10022	5	83.87	83.82	-0.05	83.82	-0.05
10022	10	83.93	83.88	-0.05	83.88	-0.05
10022	100	84.03	84.02	-0.01	84.01	-0.02
9990	5	83.83	83.74	-0.09	83.75	-0.08
9990	10	83.87	83.79	-0.08	83.79	-0.08
9990	100	83.95	83.92	-0.03	83.91	-0.04
CULVERT						
9895	5	83.69	83.69	0.00	83.69	0.00
9895	10	83.73	83.73	0.00	83.73	0.00
9895	100	83.80	83.80	0.00	83.80	0.00

Reference: Amherst Island Wind Energy Project – Eves Property Man-made Ditch Realignment Design Brief

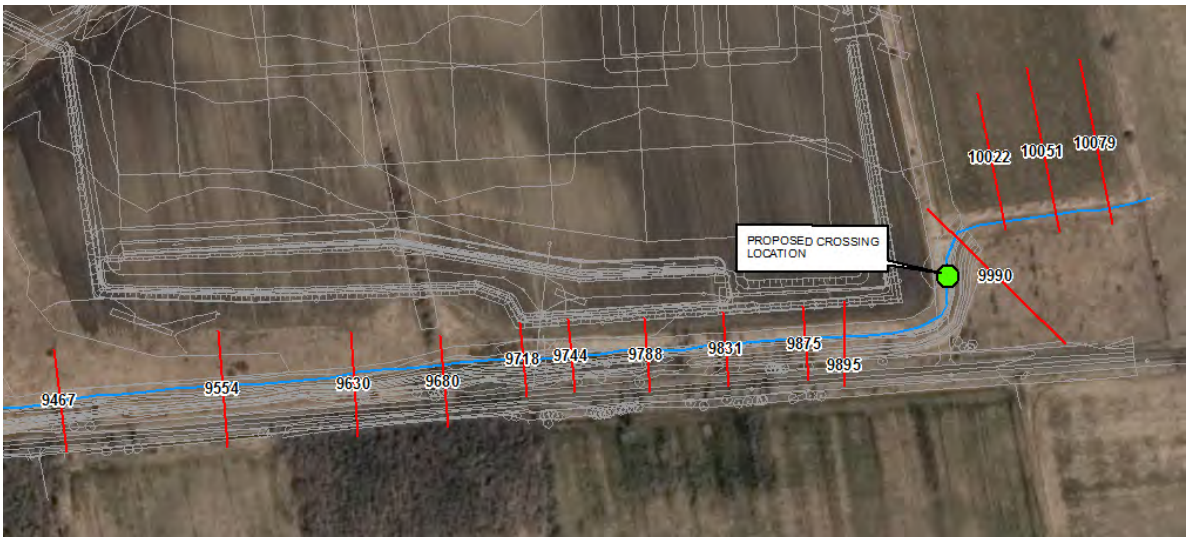
9875	5	83.63	83.63	0.00	83.63	0.00
9875	10	83.68	83.68	0.00	83.68	0.00
9875	100	83.76	83.77	0.01	83.76	0.00
9831	5	83.49	83.45	-0.04	83.49	0.00
9831	10	83.55	83.50	-0.05	83.55	0.00
9831	100	83.68	83.65	-0.03	83.68	0.00
9788	5	83.45	83.36	-0.09	83.45	0.00
9788	10	83.50	83.42	-0.08	83.50	0.00
9788	100	83.64	83.60	-0.04	83.64	0.00
9744	5	83.44	83.34	-0.10	83.44	0.00
9744	10	83.49	83.40	-0.09	83.49	0.00
9744	100	83.62	83.58	-0.04	83.62	0.00
9718	5	83.41	83.32	-0.09	83.41	0.00
9718	10	83.46	83.38	-0.08	83.46	0.00
9718	100	83.58	83.54	-0.04	83.58	0.00
9680	5	83.36	83.29	-0.07	83.36	0.00
9680	10	83.40	83.33	-0.07	83.40	0.00
9680	100	83.50	83.46	-0.04	83.50	0.00

Reference: Amherst Island Wind Energy Project – Eves Property Man-made Ditch Realignment Design Brief

9630	5	83.30	83.24	-0.06	83.30	0.00
9630	10	83.34	83.28	-0.06	83.34	0.00
9630	100	83.43	83.40	-0.03	83.43	0.00
9554	5	83.17	83.11	-0.06	83.17	0.00
9554	10	83.21	83.15	-0.06	83.21	0.00
9554	100	83.29	83.27	-0.02	83.29	0.00
9467	5	83.04	82.98	-0.06	83.04	0.00
9467	10	83.08	83.03	-0.05	83.08	0.00
9467	100	83.16	83.14	-0.02	83.16	0.00

Reference: Amherst Island Wind Energy Project – Eves Property Man-made Ditch Realignment Design Brief

Figure 3 - HEC-RAS Sections and Proposed Crossing Location



Under proposed conditions flood elevations were equal to or less than existing flood elevations downstream of the crossing and at the upstream limit of the study area. It is noted that under the proposed culvert configuration that peak flows during the 5-, 10-, and 100-year event do not overtop the proposed road.

CULVERT OPENING EROSION PROTECTION

The culvert will be constructed with a rip-rap apron installed at both the entrance and exit of the structure. The apron will be constructed of 150-200 mm rip-rap with a minimum depth of 400 mm. As shown in the HEC-RAS analysis attached, velocities are low (less than 1 m/s) due to the broad and flat nature of the floodplain.

EROSION AND SEDIMENT CONTROL (ESC)

The Ditch only experiences flow during and immediately after rainfall events. Subsequently, construction activities should be timed to allow for construction during the dry. If construction is required when flow is present, flows shall be pumped around the site as per the details provided on Drawing C-501. See Drawings C-500 and C-501 for additional erosion and sediment control notes and layout. The mitigation notes provided on the drawings are intended to minimize the impact of the channel works on nearby areas. If the sediment and erosion control measures are not functioning properly, no further work should occur until the sediment and/or erosion problem is addressed.

Reference: Amherst Island Wind Energy Project – Eves Property Man-made Ditch Realignment Design Brief

In the event of inclement weather or unfavourable terrain for construction, construction best practices such as temporary rig-mats may be used to prevent disruption of surface soils and vegetative cover by construction vehicles and equipment. As these measures are within the constructible areas of the project, it is not anticipated that offsite flows will increase from proposed conditions.

Additional erosion and sediment controls may be required due to unforeseen circumstances, changing site conditions or if the proposed controls do not achieve their anticipated result. In these circumstances, additional controls may be installed consistent with Greater Golden Horseshoe Conservation Authority ESC Guidelines and Ministry of Environment and Climate OECC SWMPD Manual. The locations and application of the controls will be approved by a qualified erosion and sediment control inspector prior to their installation.

CONCLUSION

Based on the preceding design brief the following conclusions can be drawn:

- The proposed culvert and ditch realignment are sufficient to convey existing and proposed conditions flows to the Eves Property Man-made Ditch
- Flood elevations for the 1:5-year, 1:10-year and 1:100-year events are similar under existing and proposed conditions, as confirmed through the detailed HEC-RAS Hydraulic Analysis

We trust the enclosed is sufficient to address the Eves Property Man-made Ditch Realignment requirements for the Amherst Island Wind Energy Project.

Reference: Amherst Island Wind Energy Project – Eves Property Man-made Ditch Realignment Design Brief

Should you have any questions or comments relating to this design, please do not hesitate to contact the undersigned at your convenience.

Regards,

STANTEC CONSULTING LTD.

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Water Resources Engineer
Phone: (519) 585-7320
Dave.Williams@stantec.com

Attachment:
Figure 4 - Surface Water Catchment Area – Culvert RA21
Figure 5 - Soils – Culvert RA21
Figure 6 - Woodlots – Culvert RA21
IDF Parameters – MTO IDF Curve Lookup for Amherst Island
Hydrologic Input Parameters
SWMHYMO Input and Summary Files
CulvertMaster Analysis
HEC-RAS Analysis
SWMHYMO Modeling
RA21 Realignment Design Drawings

c. Mr. Riley Griffin, Algonquin Power Co.
Ms. Kerrie Skillen and Mr. Rob Rowland, Stantec Consulting Ltd.

HYDROLOGIC MODELING

Stantec

Legend

- Turbine
- Access Road
- Laydown Area and Crane Path
- Culvert Location

Existing Features

- Road
- Unopened Road Allowance
- Railway
- Watercourse
- Property Line
- Regulation Limit (CRCA)
- CA Regulation Limit Project Encroachment

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2017; © Cataraqui Region Conservation Authority, 2017.
3. Orthoimagery © Cataraqui Region Conservation Authority, 2017. Imagery taken in 2014.

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Client/Project

Windlectric Inc.
Amherst Island Wind Energy Project

Figure No.

4

Title

Surface Water Catchment Area - Culvert RA21

\\Cd1220-f02\01609\active\160960595\drawing\MXD\Surface_Water\Ph4_SWM\160960595_SW_Ph4_Fig01_SWCatchmentAreas.mxd
Revised: 2017-07-05 By: pworsell

RA21
22.1 ha

Stella 40 Foot Rd

2nd Con Rd

RA21

RA21

3a

3b

3c

N

0 100 200 m

1:4,000

Legend

- Turbine
- Culvert Location
- Access Road
- Laydown Area and Crane Path
- Surface Water Catchment Area

Existing Features

- Road
- Unopened Road Allowance
- Railway
- Watercourse
- Property Line
- Regulation Limit (CRCA)
- CA Regulation Limit Project Encroachment

Soil Unit

- Lansdowne Clay

Notes

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Windlectric Inc.
Amherst Island Wind Energy Project

Figure No.

5

Title

Soils -
Culvert RA21

\\Cd1220-f02\01691\active\160960595\drawing\MXD\Surface_Water\Ph4_SWM\160960595_SW_Ph4_Fig02_SWCatchmentSoils.mxd
Revised: 2017-07-05 By: pworsell

Stantec

Legend

- Turbine
- Access Road
- Laydown Area and Crane Path
- Culvert Location
- Surface Water Catchment Area

Existing Features

- Road
- Unopened Road Allowance
- Railway
- Watercourse
- Property Line
- Regulation Limit (CRCA)
- CA Regulation Limit Project Encroachment
- Woodlot

Notes

1. Coordinate System: NAD 1983 UTM Zone 18N
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © Queen's Printer for Ontario, 2017; © Cataraqui Region Conservation Authority, 2017.

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Client/Project

Windlectric Inc.
Amherst Island Wind Energy Project

Figure No.

6

Title

Woodlots -
Culvert RA21

\\ Cd1220-f02 \01691 active \160960595 \ drawing \ MXD \ Surface_Water \ Ph4_SWM \160960595_SW_Ph4_Fig03_SWCatchmentWoodlots.mxd
Revised: 2017-07-05 By: pworsell

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IDF CURVE LOOKUP

Coordinate Selection | Terms of Use | About

Active coordinate

44° 9' 15" N, 76° 42' 45" W (44.154167,-76.712500) Modify selection

Retrieved: Thu, 04 Dec 2014 15:34:56 GMT

Map options: Modify selection | Show/hide gauging stations | Re-center selection

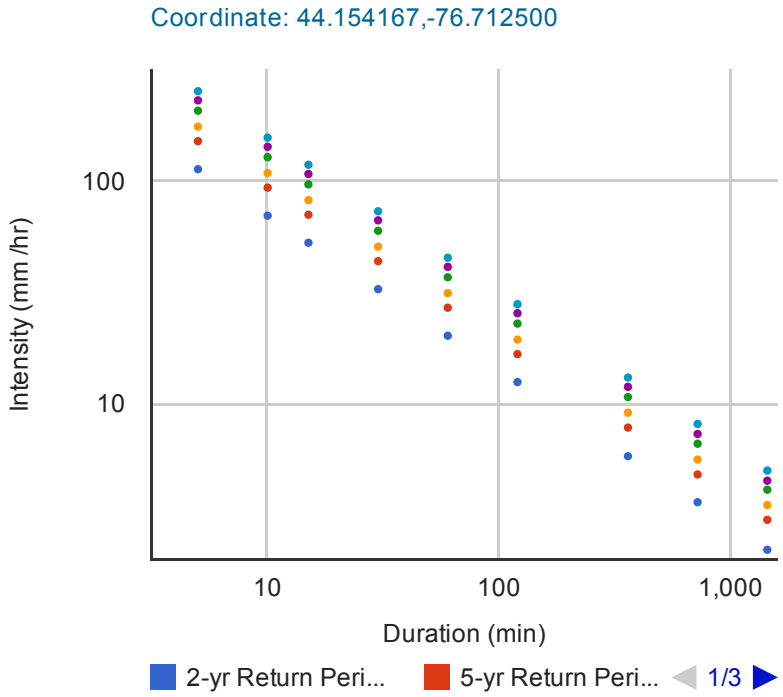
Coordinate summary

These are the coordinates in the selection.

IDF Curve: 44° 9' 15" N, 76° 42' 45" W (44.154167,-76.712500)

Results

An IDF curve was found for this set of coordinates.



Coefficient summary Notes

Click a return period in the table header for more detail.

Return period	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
A	20.2	27.0	31.4	37.0	41.2	45.3
B	-0.694	-0.694	-0.694	-0.694	-0.694	-0.694

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min	10-min	15-min	30-min	1-hr	2-hr	6-hr	12-hr	24-hr
2-yr	113.3	70.0	52.9	32.7	20.2	12.5	5.8	3.6	2.2
5-yr	151.5	93.6	70.7	43.7	27.0	16.7	7.8	4.8	3.0
10-yr	176.1	108.9	82.2	50.8	31.4	19.4	9.1	5.6	3.5
25-yr	207.6	128.3	96.8	59.9	37.0	22.9	10.7	6.6	4.1
50-yr	231.1	142.9	107.8	66.7	41.2	25.5	11.9	7.3	4.5
100-yr	254.1	157.1	118.6	73.3	45.3	28.0	13.1	8.1	5.0

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Active coordinate

44° 9' 15" N, 76° 42' 45" W (44.154167,-76.712500) Modify selection

Retrieved: Thu, 04 Dec 2014 19:53:47 GMT

Map options: Modify selection | Show/hide gauging stations | Re-center selection

Coordinate summary

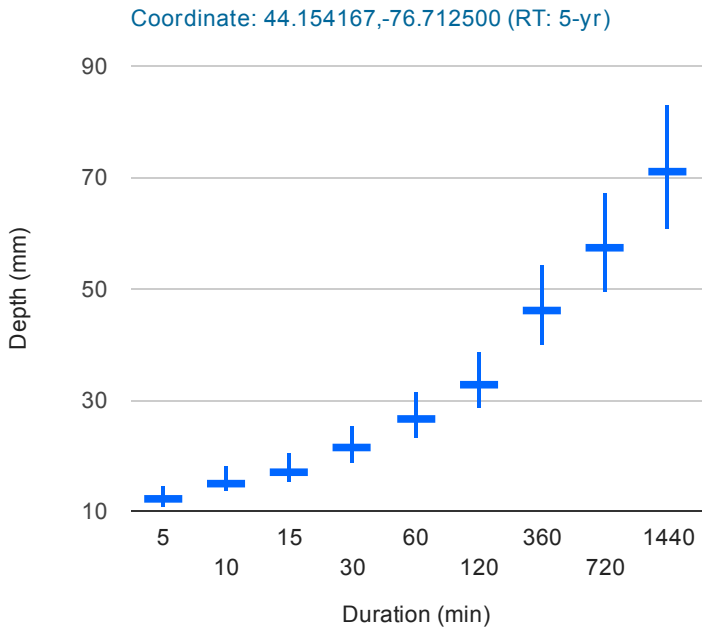
These are the coordinates in the selection.

IDF Curve: 44° 9' 15" N, 76° 42' 45" W (44.154167,-76.712500)

Results

An IDF curve was found for this set of coordinates.

Return period: 5-yr Choose another return period



MTO Switch variable: Intensity or Depth

Coefficient summary Notes

A: 27 (+4.4, -3.9)

B: -0.694 (+0.001, -0.002)

Statistics

Rainfall intensity (mm hr^{-1})

Duration	5-min		10-min		15-min		30-min		1-hr		2-hr		6-hr		12-hr		24-hr	
Intensity (mm hr^{-1})	151.5	+24.2 -21.2	93.6	+15.1 -13.2	70.7	+11.4 -10.0	43.7	+7.1 -6.3	27.0	+4.4 -3.9	16.7	+2.7 -2.4	7.8	+1.3 -1.1	4.8	+0.8 -0.7	3.0	+0.5 -0.4

Rainfall depth (mm)

Duration	5-min		10-min		15-min		30-min		1-hr		2-hr		6-hr		12-hr		24-hr	
Depth (mm)	12.6	+2.0 -1.8	15.6	+2.5 -2.2	17.7	+2.9 -2.5	21.8	+3.5 -3.1	27.0	+4.4 -3.9	33.4	+5.5 -4.9	46.7	+7.7 -6.9	57.8	+9.6 -8.6	71.4	+11.9 -10.7

Terms of Use

Exit

Amherst Island Wind Energy Project - 160960595 - Phase 4
Culvert Sizing - NRCS (SCS) Curve Number Determination

Soil Type	Hydrologic Soil Group
Loam, Sandy Loam	B
Clay	CD

TABLE OF CURVE NUMBERS (CN's)									
Land Use		Hydrologic Soil Type							Source
		A	AB	B	BC	C	CD	D	
Meadow	"Good"	30	44	58	64.5	71	74.5	78	MTO
Woodlot	"Fair"	36	48	60	66.5	73	76	79	MTO
Lawns	"Good"	39	50	61	67.5	74	77	80	USDA
Pasture/Range		58	61.5	65	70.5	76	78.5	81	MTO
Crop		66	70	74	78	82	84	86	MTO
Bare Soil (Fallow)		77	82	86	89	91	93	94	MTO
Impervious		98	98	98	98	98	98	98	MTO

MTO - Ministry of Transportation Ontario Drainage Manual (1997), Design Chart 1.09-Soil/Land Use Curve Numbers
USDA - United States Department of Agriculture (2004), National Engineering Handbook, Part 630 Hydrology, Chapter 9 Hydrologic Soil Cover Compexes

HYDROLOGIC SOIL TYPE (%) - Existing Conditions								
Catchment	Hydrologic Soil Type							TOTAL
	A	AB	B	BC	C	CD	D	
RA 21	0	0	0	0	0	100	0	100

LAND USE (%) - Existing Conditions									
Catchment	Meadow	Woodlot	Lawns	Pasture Range	Crop	Bare Soil	Lakes and Wetlands	Impervious	Total
RA 21		0			98		0	2	100

CURVE NUMBER (CN) - Existing Conditions										
Catchment	Meadow	Woodlot	Lawns	Pasture Range	Crop	Bare Soil	Lakes and Wetlands	Impervious	Weighted CN w/ imp area	Weighted CN w/o imp area
RA 21					82			2	84	84

Notes:

AMC II assumed
Hydrological Soil Groups taken from MTO Drainage Manual

Amherst Island Wind Energy Project - 160960595 - Phase 4
SWMHYMO Parameters

Existing Conditions Airport Method

Catchment Number	SWMHYMO Command	Area (ha)	CN	TIMP (%)	XIMP (%)	Rise (m)	Length (m)	Slope (%)	Tc (hrs)	Tp (hrs)
RA 21	DESIGN NASHYD	22.1	84			4	600	0.7	1.07	0.64

SWMHYMO Parameter Notes:

Time of Concentration calculated using the Airport Method
(For areas less than 100 ha)

$Tc = [3.26 (1.1-C) L^{0.5}] / S^{0.33}$

Where: C = Runoff Coefficient = 0.4 for undeveloped areas
L = Length of Overland Flow (m)
S = Slope (%)

$Tp = 0.6Tc$

```
00001> 2     Metric units
00002> *#*************************************************************************
00003> *#  Project Name: [Amherst Island Wind Energy Project] Project Number:[1609-60595]
00004> *#  Date        : June 30, 2017
00005> *#                Hydrologic Modeling for Access Road Culvert Sizing
00006> *#                and Channel Realignment - CA Permitting
00007> *#  Company     : Stantec Consulting Ltd. (Kitchener)
00008> *#  Modeller    : D. Williams
00009> *#  License #   :  4730904
00010> *#*************************************************************************
00011> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[1]
00012> *%                  ["25mm.4hr"] <--storm filename, one per line for NSTORM time
00013> *%-----------------|-----------------------------------------------------------|
00014> READ STORM          STORM_FILENAME=["STORM.001"]
00015> *#-----------------|-----------------------------------------------------------|
00016>
00017> *#*************************************************************************
00018> *#  RA 21
00019> *#*************************************************************************
00020> DESIGN NASHYD       ID=[1], NHYD=["RA 21"], DT=[1]min, AREA=[22.1](ha),
00021>                     DWF=[0](cms), CN/C=[84], TP=[0.64]hrs,
00022>                     RAINFALL=[ ,  ,  ,  , ](mm/hr), END=-1
00023> *#-----------------|-----------------------------------------------------------|
00024> START               TZERO=[0.0],  METOUT=[2],  NSTORM=[1],  NRUN=[5]
00025> *%                  ["AI5SCS.24h"] <--storm filename, one per line for NSTORM time
00026> *#-----------------|-----------------------------------------------------------|
00027> START               TZERO=[0.0]hrs or date,  METOUT=[2],  NSTORM=[1],  NRUN=[10]
00028> *                   ["AI10SCS.24h"] <--storm filename, one per line for NSTORM tim
00029> *%-----------------|-----------------------------------------------------------|
00030> START               TZERO=[0.0]hrs or date,  METOUT=[2],  NSTORM=[1],  NRUN=[100]
00031> *                   ["AI100SCS.24h"] <--storm filename, one per line for NSTORM ti
00032> *%-----------------|-----------------------------------------------------------|
00033>
00034> FINISH
00035>
00036>
00037>
00038>
00039>
00040>
00041>
00042>
00043>
00044>
00045>
00046>
00047>
00048>
```

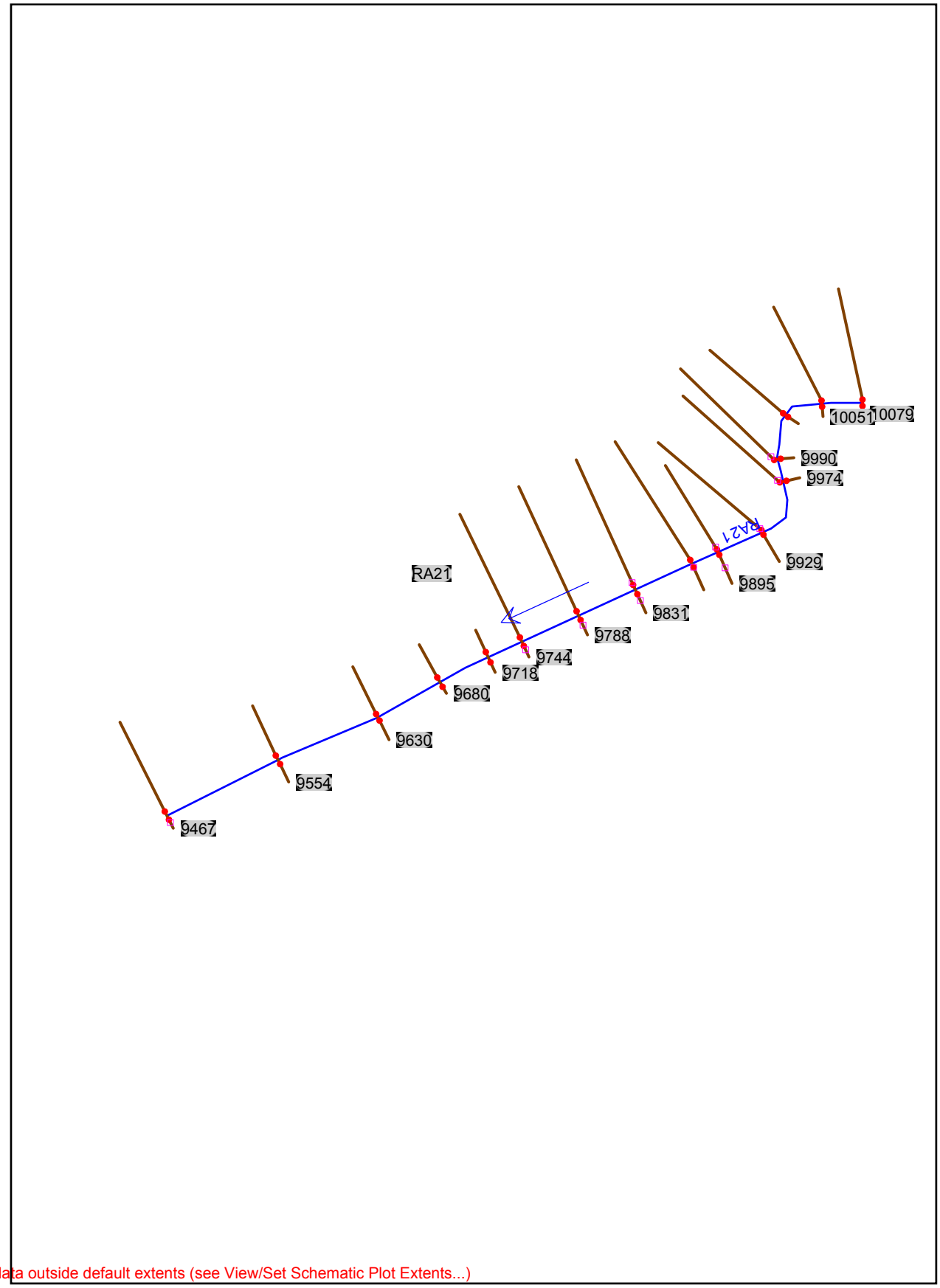
```
00001> ================================================================================
00002>
00003>    SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999    =========
00004>    S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
00005>    SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9   Ver  4.05
00006>        S   W W   M   M  H   H    Y    M   M  O   O       9999   9999   Sept 2011
00007>    SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9    =========
00008>                                                          9   9  9   9   # 4730904
00009>          StormWater Management HYdrologic Model           999    999    =========
00010>
00011>  ********************************************************************************
00012>  ***************************** SWMHYMO Ver/4.05  ********************************
00013>  *********  A single event and continuous hydrologic simulation model  *********
00014>  *********     based on the principles of HYMO and its successors      *********
00015>  *********                  OTTHYMO-83 and OTTHYMO-89.                  *********
00016>  ********************************************************************************
00017>  ********* Distributed by:  J.F. Sabourin and Associates Inc.          *********
00018>  *********                  Ottawa,  Ontario: (613) 836-3884           *********
00019>  *********                  Gatineau, Quebec: (819) 243-6858           *********
00020>  *********                  E-Mail: swmhymo@jfsa.Com                   *********
00021>  ********************************************************************************
00022>
00023>  +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00024>  +++++++++ Licensed user: Stantec Consulting Ltd. (Kitchener)          +++++++++
00025>  +++++++++               Kitchener             SERIAL#:4730904        +++++++++
00026>  +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
00027>
00028>  ********************************************************************************
00029>  *********           ++++++ PROGRAM ARRAY DIMENSIONS ++++++            *********
00030>  *********           Maximum value for ID numbers  :     10           *********
00031>  *********           Max. number of rainfall points: 105408           *********
00032>  *********           Max. number of flow points    : 105408           *********
00033>  ********************************************************************************
00034>
00035>  ***** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) *****
00036>  *****-----------------------------------------------------------------------*****
00037>  *****    ID:  Hydrograph IDentification numbers, (1-10).                  *****
00038>  *****  NHYD:  Hydrograph reference numbers, (6 digits or characters).     *****
00039>  *****  AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).   *****
00040>  ***** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).     *****
00041>  ***** TpeakDate_hh:mm is the date and time of the peak flow.               *****
00042>  *****  R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).        *****
00043>  *****  R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).        *****
00044>  *****     *:  see WARNING or NOTE message printed at end of run.          *****
00045>  *****    **:  see  ERROR  message printed at end of run.                  *****
00046>  ********************************************************************************
00047>  ********************************************************************************
00048>
00049> ::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::
00050>
00051>  ********************************************************************************
00052>
00053>  **********************   S U M M A R Y   O U T P U T   **********************
00054>  ********************************************************************************
00055>  *         DATE: 2017-07-05     TIME: 11:30:19     RUN COUNTER: 001523         *
00056>  ********************************************************************************
00057>  * Input   filename: C:\usr\_AIWEP\AI_21.dat                                    *
00058>  * Output  filename: C:\usr\_AIWEP\AI_21.out                                    *
00059>  * Summary filename: C:\usr\_AIWEP\AI_21.sum                                    *
00060>  * User comments:                                                              *
00061>  * 1:_____________________________________________________________________________*
00062>  * 2:_____________________________________________________________________________*
00063>  * 3:_____________________________________________________________________________*
00064>  ********************************************************************************
00065>
00066>
```

```
00067> #*******************************************************************************
00068> #  Project Name: [Amherst Island Wind Energy Project] Project Number:[1609-6059
00069> #  Date        : June 30, 2017
00070> #                Hydrologic Modeling for Access Road Culvert Sizing
00071> #                and Channel Realignment - CA Permitting
00072> #  Company     : Stantec Consulting Ltd. (Kitchener)
00073> #  Modeller    : D. Williams
00074> #  License #   :  4730904
00075> #*******************************************************************************
00076>  RUN:COMMAND#
00077>  001:0001--------------------------------------------------------------------------
00078>      START
00079>       [TZERO =    .00 hrs on        0]
00080>       [METOUT=   2    (1=imperial, 2=metric output)]
00081>       [NSTORM=   1 ]
00082>       [NRUN  =   1 ]
00083>  001:0002--------------------------------------------------------------------------
00084>      READ STORM
00085>       Filename = STORM.001
00086>       Comment  =
00087>       [SDT= 5.00:SDUR=   4.00:PTOT=  25.00]
00088> #-----------------|-------------------------------------------------------------|
00089> #*******************************************************************************
00090> #  RA 21
00091> #*******************************************************************************
00092>  001:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.
00093>      DESIGN NASHYD      01:RA 21         22.10     .264 No_date    2:23    7.68 .3
00094>       [CN= 84.0: N= 3.00]
00095>       [Tp=  .64:DT= 1.00]
00096> #-----------------|-------------------------------------------------------------|
00097>   ** END OF RUN :   4
00098>
00099> *******************************************************************************
00100>
00101>
00102>
00103>
00104>
00105>  RUN:COMMAND#
00106>  005:0001--------------------------------------------------------------------------
00107>      START
00108>       [TZERO =    .00 hrs on        0]
00109>       [METOUT=   2    (1=imperial, 2=metric output)]
00110>       [NSTORM=   1 ]
00111>       [NRUN  =   5 ]
00112> #*******************************************************************************
00113> #  Project Name: [Amherst Island Wind Energy Project] Project Number:[1609-6059
00114> #  Date        : June 30, 2017
00115> #                Hydrologic Modeling for Access Road Culvert Sizing
00116> #                and Channel Realignment - CA Permitting
00117> #  Company     : Stantec Consulting Ltd. (Kitchener)
00118> #  Modeller    : D. Williams
00119> #  License #   :  4730904
00120> #*******************************************************************************
00121>  005:0002--------------------------------------------------------------------------
00122>      READ STORM
00123>       Filename = STORM.001
00124>       Comment  =
00125>       [SDT=15.00:SDUR=  24.00:PTOT=  71.40]
00126> #-----------------|-------------------------------------------------------------|
00127> #*******************************************************************************
00128> #  RA 21
00129> #*******************************************************************************
00130>  005:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.
00131>      DESIGN NASHYD      01:RA 21         22.10    1.024 No_date   12:34   41.31 .5
00132>       [CN= 84.0: N= 3.00]
```

```
00133>       [Tp=  .64:DT= 1.00]
00134> #-----------------|-------------------------------------------------------------|
00135> #-----------------|-------------------------------------------------------------|
00136>   ** END OF RUN :   9
00137>
00138> ****************************************************************************
00139>
00140>
00141>
00142>
00143>
00144>  RUN:COMMAND#
00145>  010:0001-----------------------------------------------------------------------
00146>      START
00147>       [TZERO =    .00 hrs on        0]
00148>       [METOUT=   2    (1=imperial, 2=metric output)]
00149>       [NSTORM=   1 ]
00150>       [NRUN  =  10 ]
00151> #****************************************************************************
00152> #  Project Name: [Amherst Island Wind Energy Project] Project Number:[1609-6059
00153> #  Date        : June 30, 2017
00154> #                Hydrologic Modeling for Access Road Culvert Sizing
00155> #                and Channel Realignment - CA Permitting
00156> #  Company     : Stantec Consulting Ltd. (Kitchener)
00157> #  Modeller    : D. Williams
00158> #  License #   :  4730904
00159> #****************************************************************************
00160>  010:0002-----------------------------------------------------------------------
00161>      READ STORM
00162>       Filename = STORM.001
00163>       Comment  =
00164>       [SDT=15.00:SDUR=  24.00:PTOT=  83.00]
00165> #-----------------|-------------------------------------------------------------|
00166> #****************************************************************************
00167> #  RA 21
00168> #****************************************************************************
00169>  010:0003---------------ID:NHYD-----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.
00170>      DESIGN NASHYD      01:RA 21         22.10    1.272 No_date   12:33   51.14 .6
00171>       [CN= 84.0: N= 3.00]
00172>       [Tp=  .64:DT= 1.00]
00173> #-----------------|-------------------------------------------------------------|
00174> #-----------------|-------------------------------------------------------------|
00175>   ** END OF RUN :  99
00176>
00177> ****************************************************************************
00178>
00179>
00180>
00181>
00182>
00183>  RUN:COMMAND#
00184>  100:0001-----------------------------------------------------------------------
00185>      START
00186>       [TZERO =    .00 hrs on        0]
00187>       [METOUT=   2    (1=imperial, 2=metric output)]
00188>       [NSTORM=   1 ]
00189>       [NRUN  = 100 ]
00190> #****************************************************************************
00191> #  Project Name: [Amherst Island Wind Energy Project] Project Number:[1609-6059
00192> #  Date        : June 30, 2017
00193> #                Hydrologic Modeling for Access Road Culvert Sizing
00194> #                and Channel Realignment - CA Permitting
00195> #  Company     : Stantec Consulting Ltd. (Kitchener)
00196> #  Modeller    : D. Williams
00197> #  License #   :  4730904
00198> #****************************************************************************
```

```
00199>  100:0002-------------------------------------------------------------------------
00200>      READ STORM
00201>       Filename = STORM.001
00202>       Comment  =
00203>       [SDT=15.00:SDUR=  24.00:PTOT= 119.80]
00204> #-----------------|-----------------------------------------------------------------|
00205> #*********************************************************************************
00206> #  RA 21
00207> #*********************************************************************************
00208>  100:0003--------------ID:NHYD----------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.
00209>      DESIGN NASHYD      01:RA 21         22.10    2.098 No_date   12:33   83.96 .7
00210>       [CN= 84.0: N= 3.00]
00211>       [Tp=  .64:DT= 1.00]
00212> #-----------------|-----------------------------------------------------------------|
00213> #-----------------|-----------------------------------------------------------------|
00214>  100:0002-------------------------------------------------------------------------
00215>       FINISH
00216> ---------------------------------------------------------------------------------
00217> *********************************************************************************
00218>      WARNINGS / ERRORS / NOTES
00219>      ------------------------
00220>    Simulation ended on 2017-07-05     at 11:30:20
00221> =================================================================================
00222>
00223>
```

HEC-RAS MODELING – EXISTING CONDITIONS



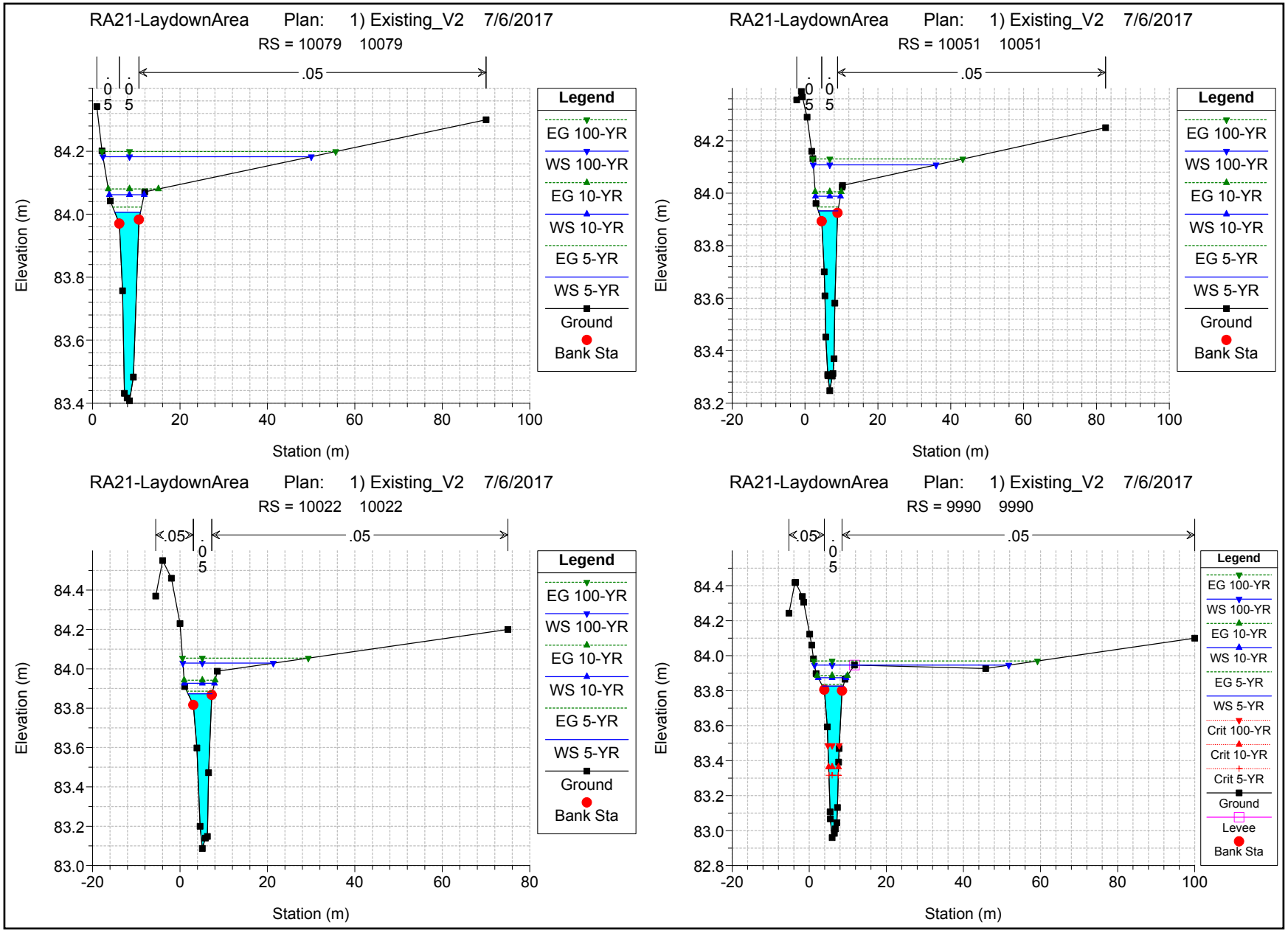
Some schematic data outside default extents (see View/Set Schematic Plot Extents...)

HEC-RAS Plan: Existing River: RA21 Reach: RA21

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	Vel Total	Vel Left	Vel Right
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)	(m/s)	(m/s)
RA21	10079	5-YR	1.02	83.41	84.01		84.02	0.002831	0.56	1.83	5.87	0.28	0.56	0.07	0.05
RA21	10079	10-YR	1.27	83.41	84.06		84.08	0.002771	0.61	2.22	7.97	0.29	0.57	0.14	0.12
RA21	10079	100-YR	2.10	83.41	84.18		84.20	0.002222	0.63	5.42	47.67	0.27	0.39	0.24	0.14
RA21	10051	5-YR	1.02	83.25	83.93		83.95	0.002411	0.54	1.90	5.37	0.26	0.54	0.07	0.02
RA21	10051	10-YR	1.27	83.25	83.99		84.01	0.002442	0.59	2.25	6.87	0.27	0.56	0.15	0.10
RA21	10051	100-YR	2.10	83.25	84.11		84.13	0.002579	0.70	4.17	33.68	0.29	0.50	0.28	0.13
RA21	10022	5-YR	1.02	83.09	83.87		83.89	0.001897	0.50	2.06	5.51	0.23	0.50	0.08	0.02
RA21	10022	10-YR	1.27	83.09	83.93		83.94	0.002022	0.56	2.39	6.89	0.24	0.53	0.14	0.09
RA21	10022	100-YR	2.10	83.09	84.03		84.05	0.002760	0.73	3.42	20.67	0.29	0.61	0.29	0.10
RA21	9990	5-YR	1.02	82.96	83.83	83.32	83.84	0.001266	0.43	2.37	5.40	0.19	0.43	0.03	0.04
RA21	9990	10-YR	1.27	82.96	83.87	83.36	83.89	0.001443	0.49	2.67	7.23	0.21	0.47	0.08	0.08
RA21	9990	100-YR	2.10	82.96	83.95	83.49	83.97	0.002489	0.70	3.70	50.36	0.28	0.57	0.19	0.06
RA21	9974	5-YR	1.02	82.90	83.81	83.25	83.82	0.001005	0.40	2.59	5.63	0.17	0.39	0.02	0.05
RA21	9974	10-YR	1.27	82.90	83.85	83.29	83.86	0.001179	0.45	2.89	7.36	0.19	0.44	0.06	0.09
RA21	9974	100-YR	2.10	82.90	83.93	83.42	83.94	0.001253	0.50	7.67	74.40	0.20	0.27	0.11	0.11
RA21	9929	5-YR	1.02	82.82	83.74	83.27	83.76	0.001773	0.52	2.14	12.30	0.22	0.48	0.07	0.09
RA21	9929	10-YR	1.27	82.82	83.78	83.32	83.80	0.002050	0.58	2.77	27.78	0.24	0.46	0.12	0.05
RA21	9929	100-YR	2.10	82.82	83.84	83.48	83.86	0.002437	0.68	5.70	59.57	0.27	0.37	0.20	0.13
RA21	9895	5-YR	1.02	82.77	83.69	83.23	83.70	0.001665	0.48	2.40	18.09	0.22	0.43	0.07	0.06
RA21	9895	10-YR	1.27	82.77	83.73	83.28	83.74	0.001376	0.46	4.66	58.49	0.20	0.27	0.12	0.08
RA21	9895	100-YR	2.10	82.77	83.80	83.43	83.80	0.001128	0.45	9.10	71.06	0.19	0.23	0.17	0.13
RA21	9875	5-YR	1.02	82.80	83.63	83.25	83.65	0.003677	0.61	1.79	19.09	0.31	0.57		0.05
RA21	9875	10-YR	1.27	82.80	83.68	83.31	83.69	0.003748	0.59	2.93	30.44	0.31	0.43		0.15
RA21	9875	100-YR	2.10	82.80	83.76	83.46	83.77	0.002134	0.49	7.46	64.21	0.24	0.28	0.16	0.19
RA21	9831	5-YR	1.02	82.73	83.49	83.17	83.50	0.002989	0.48	2.17	8.26	0.28	0.47	0.06	0.15
RA21	9831	10-YR	1.27	82.73	83.55	83.22	83.56	0.002588	0.50	2.65	9.23	0.27	0.48	0.12	0.19
RA21	9831	100-YR	2.10	82.73	83.68	83.38	83.69	0.001752	0.50	5.91	40.19	0.23	0.36	0.18	0.15
RA21	9788	5-YR	1.02	82.67	83.45	83.06	83.45	0.000579	0.29	3.71	9.42	0.13	0.27	0.11	0.16
RA21	9788	10-YR	1.27	82.67	83.50	83.09	83.51	0.000628	0.33	4.23	10.69	0.14	0.30	0.13	0.15
RA21	9788	100-YR	2.10	82.67	83.64	83.17	83.64	0.000661	0.39	7.61	38.77	0.15	0.28	0.17	0.10
RA21	9744	5-YR	1.02	82.60	83.44	82.85	83.44	0.000174	0.21	5.57	11.52	0.08	0.18	0.09	0.09
RA21	9744	10-YR	1.27	82.60	83.49	82.88	83.49	0.000210	0.24	6.24	14.27	0.09	0.20	0.10	0.09
RA21	9744	100-YR	2.10	82.60	83.62	82.96	83.62	0.000274	0.30	10.24	41.95	0.10	0.21	0.14	0.08
RA21	9718	5-YR	2.87	82.53	83.41		83.42	0.001174	0.51	6.88	25.29	0.20	0.42	0.20	0.15
RA21	9718	10-YR	3.58	82.53	83.46		83.47	0.001266	0.56	8.12	25.35	0.21	0.44	0.22	0.20
RA21	9718	100-YR	5.90	82.53	83.58		83.60	0.001515	0.68	11.22	25.58	0.24	0.53	0.28	0.32

HEC-RAS Plan: Existing River: RA21 Reach: RA21 (Continued)

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	Vel Total	Vel Left	Vel Right
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)	(m/s)	(m/s)
RA21	9680	5-YR	2.87	82.52	83.36		83.37	0.001582	0.56	5.90	15.47	0.23	0.49	0.23	0.25
RA21	9680	10-YR	3.58	82.52	83.40		83.41	0.001904	0.64	6.52	16.34	0.26	0.55	0.27	0.30
RA21	9680	100-YR	5.90	82.52	83.50		83.53	0.002552	0.82	10.00	34.60	0.31	0.59	0.37	0.30
RA21	9630	5-YR	2.87	82.70	83.30		83.31	0.001021	0.37	10.85	43.49	0.18	0.26	0.18	0.24
RA21	9630	10-YR	3.58	82.70	83.34		83.34	0.001041	0.40	12.40	43.65	0.18	0.29	0.19	0.26
RA21	9630	100-YR	5.90	82.70	83.43		83.44	0.001124	0.47	16.56	44.09	0.19	0.36	0.24	0.33
RA21	9554	5-YR	2.87	82.58	83.17		83.19	0.002750	0.60	7.05	38.18	0.29	0.41	0.20	0.27
RA21	9554	10-YR	3.58	82.58	83.21		83.22	0.002763	0.63	8.38	40.33	0.29	0.43	0.23	0.31
RA21	9554	100-YR	5.90	82.58	83.29		83.31	0.002868	0.72	12.10	45.83	0.31	0.49	0.29	0.39
RA21	9467	5-YR	2.87	82.45	83.04	82.88	83.05	0.001000	0.38	12.41	67.43	0.18	0.23	0.13	0.19
RA21	9467	10-YR	3.58	82.45	83.08	82.91	83.08	0.001000	0.40	14.66	70.68	0.18	0.24	0.16	0.20
RA21	9467	100-YR	5.90	82.45	83.16	82.96	83.17	0.001001	0.44	21.17	79.36	0.18	0.28	0.22	0.24


RA21-LaydownArea Plan: 1) Existing_V2 7/6/2017
RS = 10079 10079
.05
.05
.05
Elevation (m)
Station (m)
Legend
EG 100-YR
WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Ground
Bank Sta
RA21-LaydownArea Plan: 1) Existing_V2 7/6/2017
RS = 10051 10051
.05
.05
.05
Elevation (m)
Station (m)
Legend
EG 100-YR
WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Ground
Bank Sta
RA21-LaydownArea Plan: 1) Existing_V2 7/6/2017
RS = 10022 10022
.05
.05
.05
Elevation (m)
Station (m)
Legend
EG 100-YR
WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Ground
Bank Sta
RA21-LaydownArea Plan: 1) Existing_V2 7/6/2017
RS = 9990 9990
.05
.05
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Elevation (m)
Station (m)
Legend
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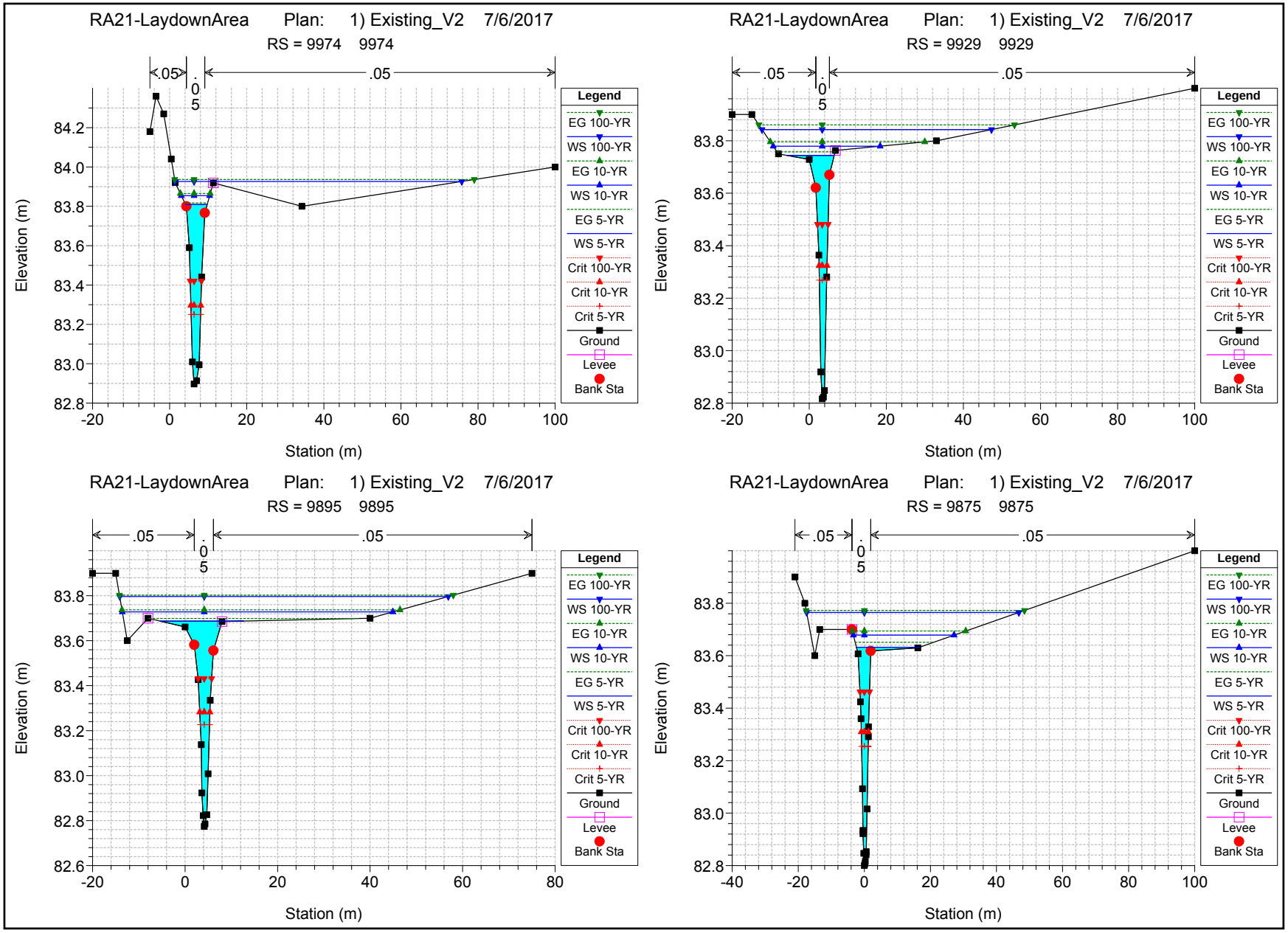
Crit 10-YR
Crit 5-YR
Ground
Levee
Bank Sta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Elevation (m)
Station (m)
Legend
EG 100-YR
WS 100-YR
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Crit 100-YR
Crit 10-YR
Crit 5-YR
Ground
Levee
Bank Sta
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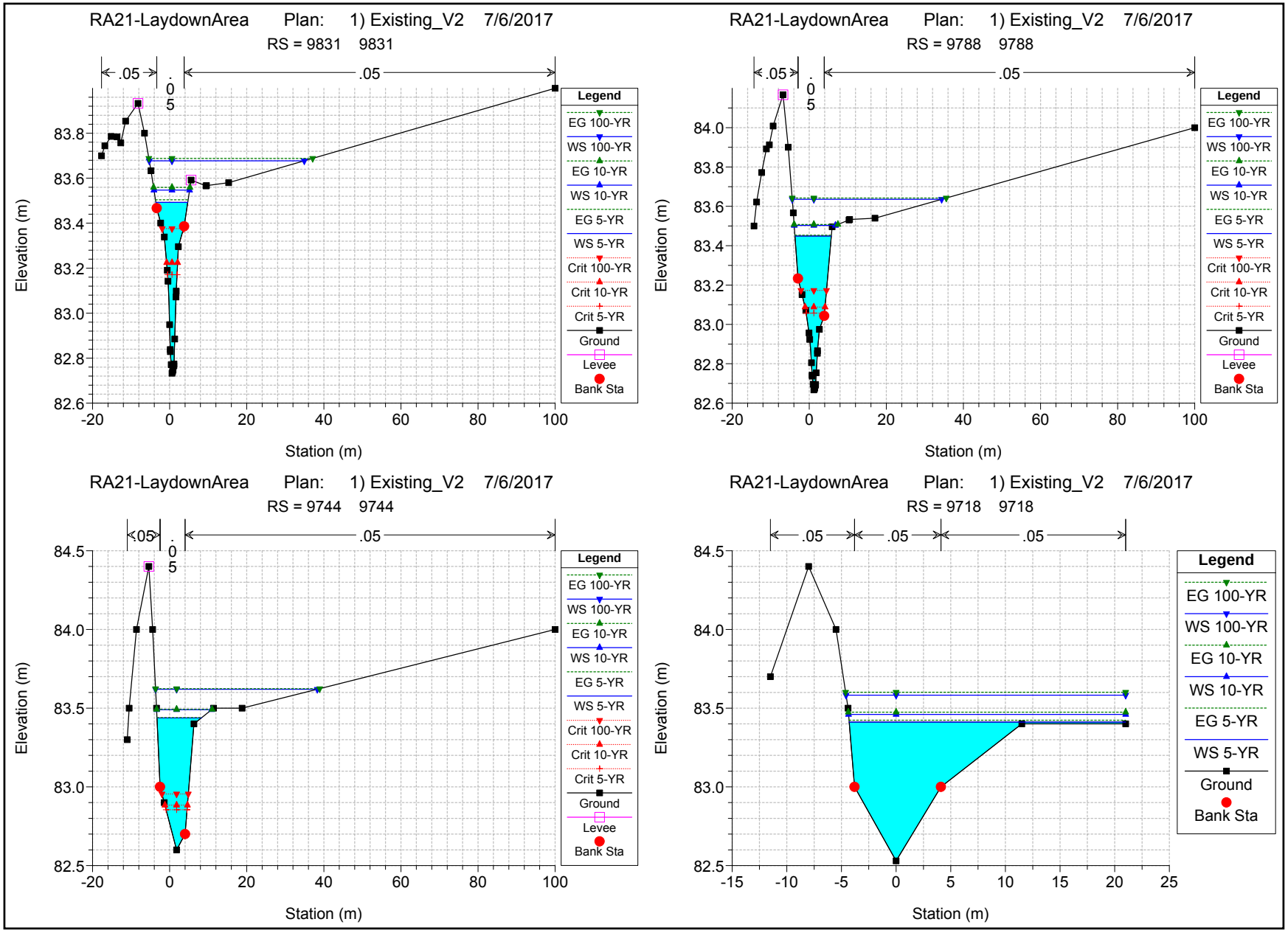
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Station (m)
Legend
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WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Crit 100-YR
Crit 10-YR
Crit 5-YR
Ground
Levee
Bank Sta
RA21-LaydownArea Plan: 1) Existing_V2 7/6/2017
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Elevation (m)
Station (m)
Legend
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WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Crit 100-YR
Crit 10-YR
Crit 5-YR
Ground
Levee
Bank Sta
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Elevation (m)
Station (m)
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WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Crit 100-YR
Crit 10-YR
Crit 5-YR
Ground
Levee
Bank Sta
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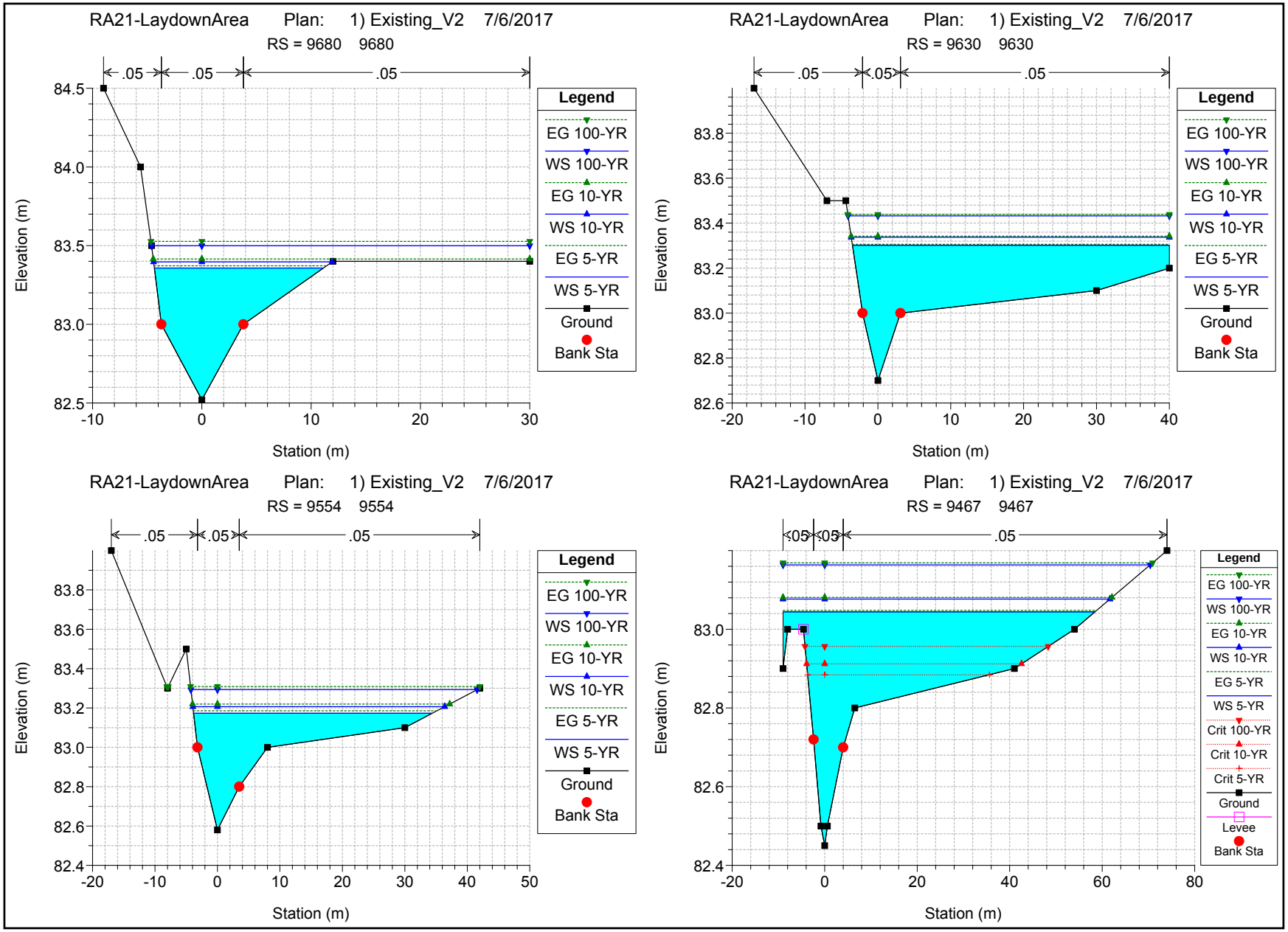
WS 10-YR
EG 5-YR
WS 5-YR
Ground
Bank Sta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Station (m)
Legend
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EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Ground
Bank Sta
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Station (m)
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WS 5-YR
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Bank Sta
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Station (m)
Legend
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EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Ground
Bank Sta
RA21-LaydownArea Plan: 1) Existing_V2 7/6/2017
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Elevation (m)
Station (m)
Legend
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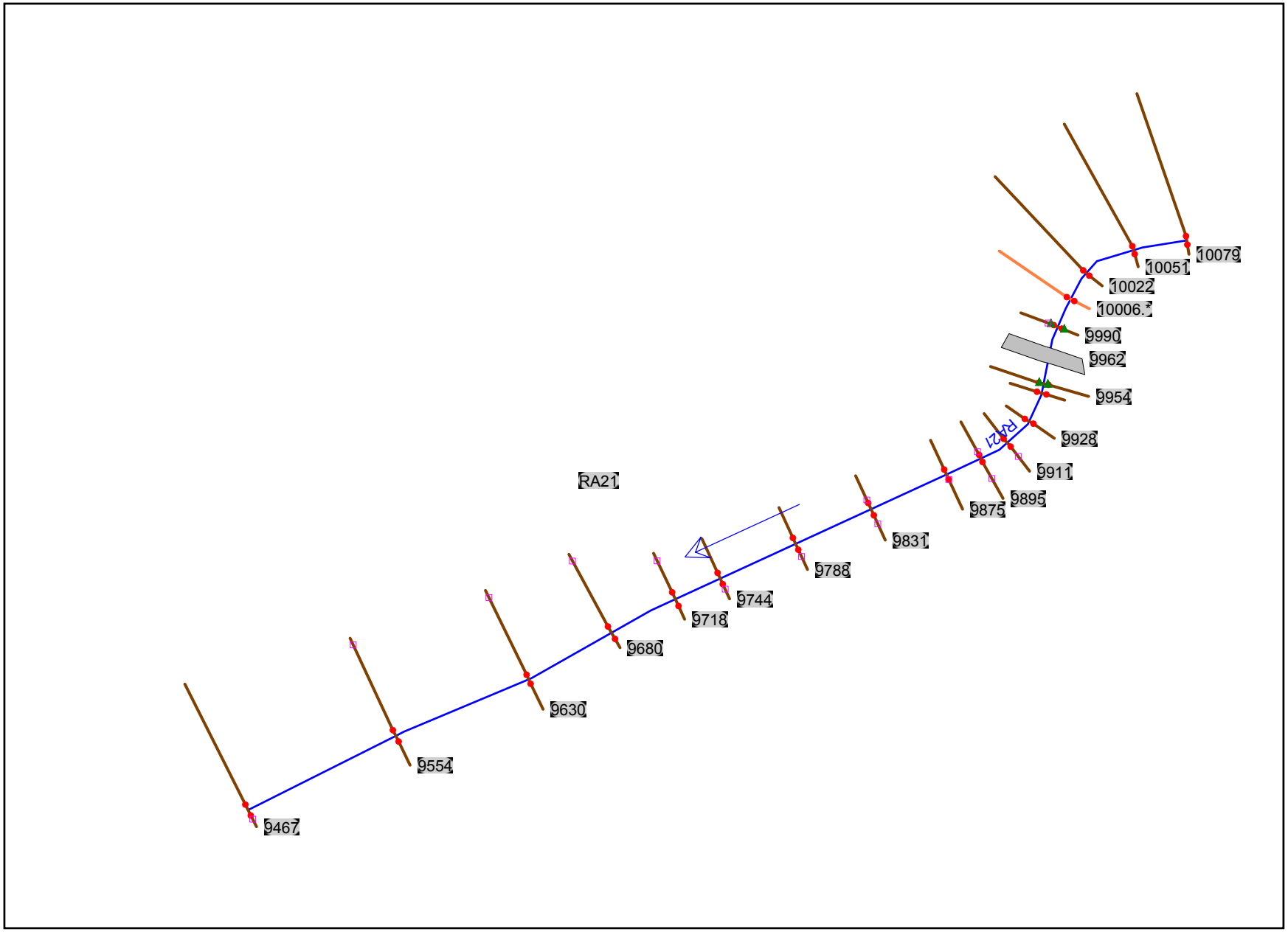
WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Crit 100-YR
Crit 10-YR
Crit 5-YR
Ground
Levee
Bank Sta

HEC-RAS MODELING - PROPOSED CONDITIONS WITH CSA SWM CONTROLS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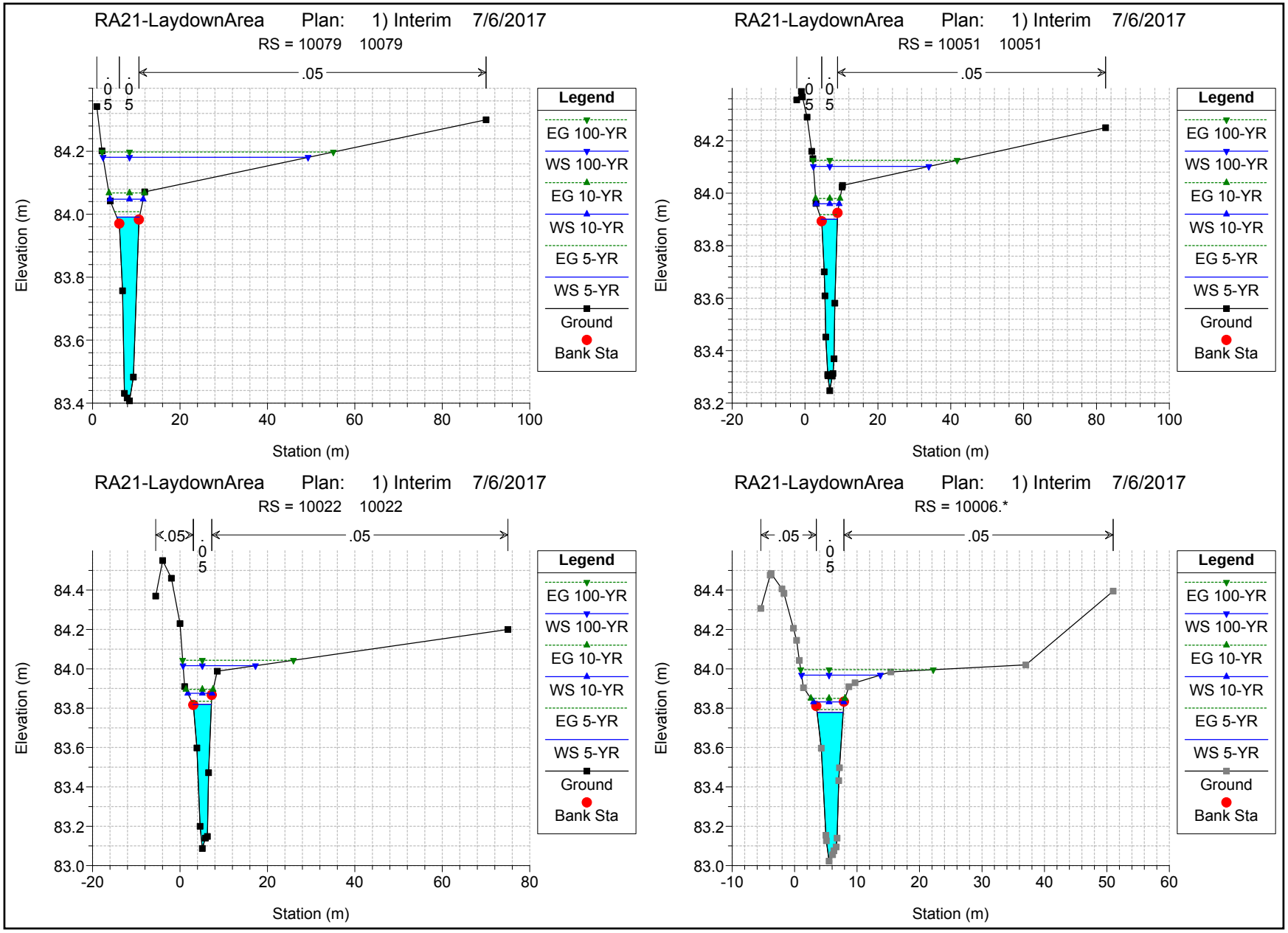
9680
9630
9554
9467
RA21
RA21

HEC-RAS Plan: Interim_New River: RA21 Reach: RA21

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	Vel Total	Vel Left	Vel Right
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)	(m/s)	(m/s)
RA21	10079	5-YR	1.02	83.41	83.99		84.01	0.003241	0.59	1.75	5.18	0.30	0.58	0.05	0.03
RA21	10079	10-YR	1.27	83.41	84.05		84.07	0.003111	0.63	2.11	7.59	0.30	0.60	0.13	0.11
RA21	10079	100-YR	2.10	83.41	84.18		84.20	0.002280	0.64	5.33	46.97	0.27	0.39	0.24	0.14
RA21	10051	5-YR	1.02	83.25	83.90		83.92	0.003062	0.58	1.75	4.47	0.29	0.58	0.03	
RA21	10051	10-YR	1.27	83.25	83.96		83.98	0.003028	0.63	2.06	6.36	0.30	0.62	0.11	0.07
RA21	10051	100-YR	2.10	83.25	84.10		84.13	0.002729	0.72	3.98	31.78	0.29	0.53	0.29	0.12
RA21	10022	5-YR	1.02	83.09	83.82		83.84	0.002761	0.57	1.80	4.18	0.28	0.57	0.01	
RA21	10022	10-YR	1.27	83.09	83.88		83.90	0.002884	0.62	2.07	5.59	0.29	0.61	0.10	0.03
RA21	10022	100-YR	2.10	83.09	84.02		84.04	0.003017	0.75	3.20	16.81	0.31	0.66	0.29	0.09
RA21	10006.*	5-YR	1.02	83.02	83.78		83.79	0.002401	0.54	1.88	4.18	0.26	0.54		
RA21	10006.*	10-YR	1.27	83.02	83.83		83.85	0.002711	0.60	2.12	4.88	0.28	0.60	0.05	
RA21	10006.*	100-YR	2.10	83.02	83.97		84.00	0.002957	0.74	3.17	12.76	0.30	0.66	0.24	0.12
RA21	9990	5-YR	1.02	82.96	83.74	83.32	83.76	0.002009	0.51	2.00	4.25	0.24	0.51		
RA21	9990	10-YR	1.27	82.96	83.79	83.36	83.81	0.002430	0.58	2.21	4.54	0.26	0.58		
RA21	9990	100-YR	2.10	82.96	83.92	83.49	83.95	0.002908	0.73	3.03	9.44	0.30	0.69	0.21	0.18
RA21	9962		Culvert												
RA21	9954	5-YR	1.02	82.89	83.73		83.74	0.000760	0.37	2.73	17.25	0.15	0.37		
RA21	9954	10-YR	1.27	82.89	83.77		83.78	0.000945	0.44	2.92	28.70	0.17	0.44		
RA21	9954	100-YR	2.10	82.89	83.86		83.88	0.001707	0.64	3.30	40.64	0.24	0.64		
RA21	9944	5-YR	1.02	82.88	83.73		83.74	0.000785	0.36	2.99	11.58	0.15	0.34	0.05	0.05
RA21	9944	10-YR	1.27	82.88	83.77		83.78	0.000913	0.40	3.57	16.84	0.17	0.36	0.08	0.08
RA21	9944	100-YR	2.10	82.88	83.85		83.87	0.001256	0.52	5.33	22.73	0.20	0.39	0.14	0.17
RA21	9928	5-YR	1.02	82.85	83.72		83.72	0.000699	0.34	3.11	12.86	0.15	0.33	0.04	0.04
RA21	9928	10-YR	1.27	82.85	83.76		83.76	0.000821	0.39	3.73	17.71	0.16	0.34	0.07	0.08
RA21	9928	100-YR	2.10	82.85	83.83		83.85	0.001195	0.51	5.40	23.38	0.20	0.39	0.13	0.17
RA21	9911	5-YR	1.02	82.81	83.71	83.18	83.71	0.000607	0.32	3.56	22.50	0.14	0.29	0.03	0.05
RA21	9911	10-YR	1.27	82.81	83.75	83.22	83.75	0.000674	0.35	4.59	30.29	0.15	0.28	0.05	0.08
RA21	9911	100-YR	2.10	82.81	83.82	83.31	83.83	0.000869	0.44	6.94	31.36	0.17	0.30	0.13	0.16
RA21	9895	5-YR	1.02	82.77	83.69	83.23	83.70	0.001575	0.47	2.77	29.39	0.21	0.37	0.07	0.07
RA21	9895	10-YR	1.27	82.77	83.73	83.28	83.74	0.001285	0.45	4.51	37.82	0.19	0.28	0.12	0.12
RA21	9895	100-YR	2.10	82.77	83.81	83.43	83.81	0.001153	0.46	7.49	38.69	0.19	0.28	0.18	0.19
RA21	9875	5-YR	1.02	82.80	83.63	83.26	83.65	0.003675	0.61	1.80	19.21	0.31	0.57		0.05
RA21	9875	10-YR	1.27	82.80	83.68	83.31	83.69	0.003783	0.59	2.72	20.31	0.31	0.47		0.18
RA21	9875	100-YR	2.10	82.80	83.77	83.46	83.78	0.002515	0.54	5.68	34.86	0.26	0.37	0.18	0.27
RA21	9831	5-YR	1.02	82.73	83.49	83.17	83.50	0.002992	0.48	2.17	8.26	0.28	0.47	0.06	0.15
RA21	9831	10-YR	1.27	82.73	83.55	83.22	83.56	0.002598	0.50	2.64	9.22	0.27	0.48	0.12	0.19

HEC-RAS Plan: Interim_New River: RA21 Reach: RA21 (Continued)

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	Vel Total	Vel Left	Vel Right
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)	(m/s)	(m/s)
RA21	9831	100-YR	2.10	82.73	83.67	83.38	83.69	0.001848	0.52	5.15	23.16	0.24	0.41	0.19	0.20
RA21	9788	5-YR	1.02	82.67	83.45	83.06	83.45	0.000580	0.29	3.71	9.41	0.13	0.27	0.11	0.16
RA21	9788	10-YR	1.27	82.67	83.50	83.09	83.51	0.000629	0.33	4.23	10.63	0.14	0.30	0.13	0.15
RA21	9788	100-YR	2.10	82.67	83.63	83.17	83.64	0.000673	0.39	6.93	23.90	0.15	0.30	0.17	0.14
RA21	9744	5-YR	1.02	82.60	83.44	82.85	83.44	0.000174	0.21	5.57	11.51	0.08	0.18	0.09	0.09
RA21	9744	10-YR	1.27	82.60	83.49	82.88	83.49	0.000210	0.24	6.24	14.25	0.09	0.20	0.10	0.09
RA21	9744	100-YR	2.10	82.60	83.62	82.96	83.62	0.000275	0.30	9.25	24.90	0.10	0.23	0.14	0.11
RA21	9718	5-YR	2.87	82.53	83.41	83.00	83.42	0.001162	0.51	6.87	23.54	0.20	0.42	0.20	0.16
RA21	9718	10-YR	3.58	82.53	83.46	83.04	83.47	0.001273	0.56	8.00	23.78	0.21	0.45	0.22	0.21
RA21	9718	100-YR	5.90	82.53	83.58	83.16	83.60	0.001604	0.69	10.82	24.46	0.25	0.55	0.28	0.33
RA21	9680	5-YR	2.87	82.52	83.36	83.01	83.37	0.001579	0.56	5.91	15.47	0.23	0.49	0.23	0.25
RA21	9680	10-YR	3.58	82.52	83.40	83.05	83.41	0.001918	0.64	6.51	16.31	0.26	0.55	0.27	0.30
RA21	9680	100-YR	5.90	82.52	83.49	83.17	83.52	0.002512	0.81	10.75	44.53	0.30	0.55	0.36	0.27
RA21	9630	5-YR	2.87	82.70	83.30	83.13	83.31	0.001023	0.38	11.26	48.54	0.18	0.25	0.18	0.22
RA21	9630	10-YR	3.58	82.70	83.34	83.15	83.34	0.001030	0.40	12.96	48.83	0.18	0.28	0.19	0.25
RA21	9630	100-YR	5.90	82.70	83.43	83.20	83.44	0.001078	0.45	17.52	49.63	0.19	0.34	0.23	0.31
RA21	9554	5-YR	2.87	82.58	83.17	83.00	83.19	0.002747	0.60	7.05	38.18	0.29	0.41	0.20	0.27
RA21	9554	10-YR	3.58	82.58	83.21	83.00	83.22	0.002768	0.63	8.37	40.32	0.30	0.43	0.23	0.31
RA21	9554	100-YR	5.90	82.58	83.29	83.15	83.31	0.002874	0.72	12.09	45.82	0.31	0.49	0.29	0.39
RA21	9467	5-YR	2.87	82.45	83.04	82.88	83.05	0.001000	0.38	12.43	67.66	0.18	0.23	0.13	0.19
RA21	9467	10-YR	3.58	82.45	83.08	82.91	83.08	0.001000	0.40	14.69	71.09	0.18	0.24	0.16	0.20
RA21	9467	100-YR	5.90	82.45	83.16	82.96	83.17	0.001002	0.44	21.25	80.20	0.18	0.28	0.22	0.24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Bank Sta
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Ground
Bank Sta
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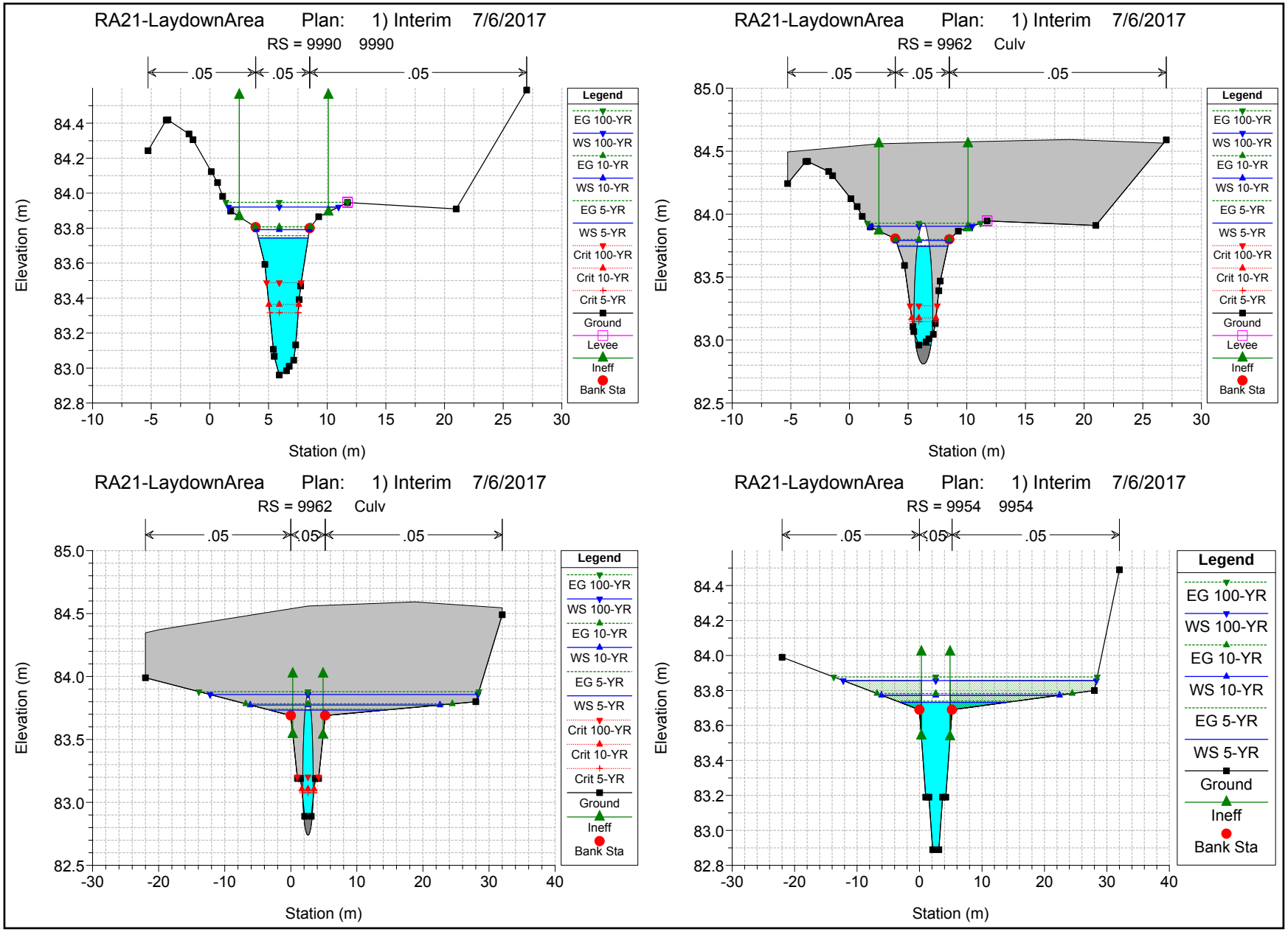
Ground
Bank Sta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WS 5-YR
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Crit 10-YR
Crit 5-YR
Ground
Levee
Ineff
Bank Sta
RA21-LaydownArea Plan: 1) Interim 7/6/2017
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Elevation (m)
Station (m)
Legend
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WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Crit 100-YR
Crit 10-YR
Crit 5-YR
Ground
Levee
Ineff
Bank Sta
RA21-LaydownArea Plan: 1) Interim 7/6/2017
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Station (m)
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Crit 5-YR
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Bank Sta
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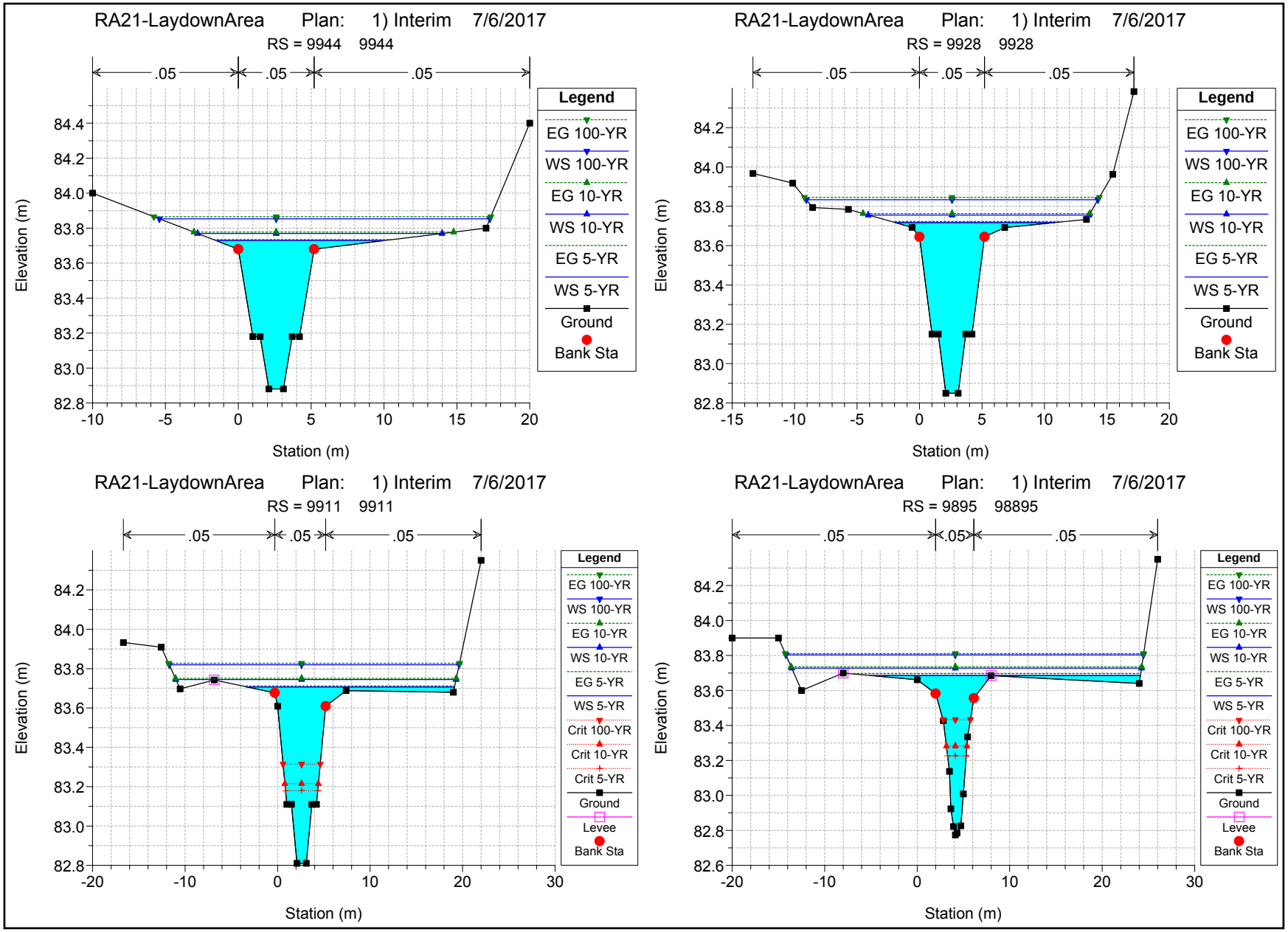
Bank Sta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WS 5-YR
Ground
Bank Sta
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EG 5-YR
WS 5-YR
Ground
Bank Sta
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Elevation (m)
Station (m)
Legend
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EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Crit 100-YR
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Ground
Levee
Bank Sta
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Station (m)
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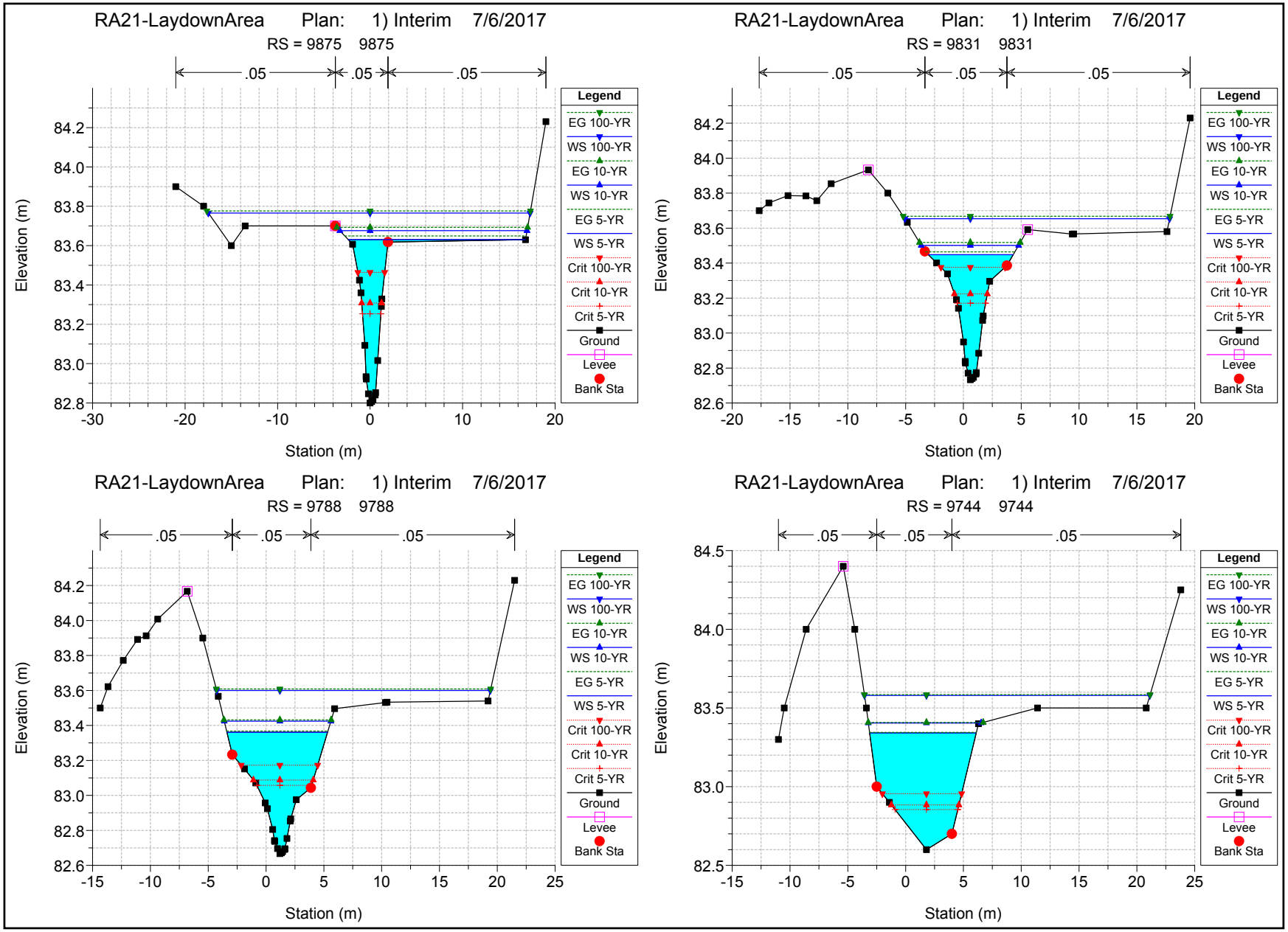
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Station (m)
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Ground
Levee
Bank Sta
RA21-LaydownArea Plan: 1) Interim 7/6/2017
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Elevation (m)
Station (m)
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WS 100-YR
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Crit 100-YR
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Crit 5-YR
Ground
Levee
Bank Sta
RA21-LaydownArea Plan: 1) Interim 7/6/2017
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Levee
Bank Sta
RA21-LaydownArea Plan: 1) Interim 7/6/2017
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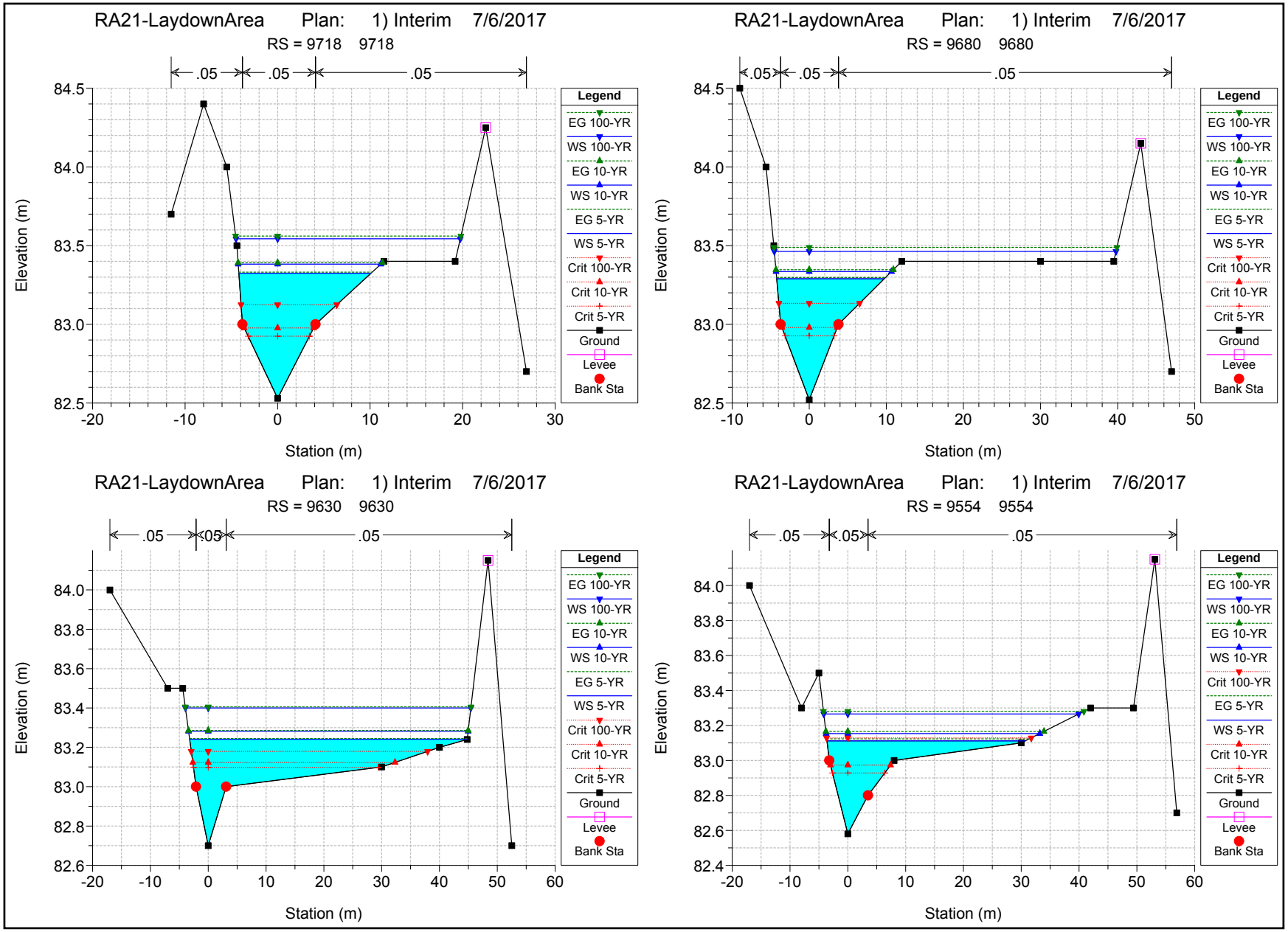
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RS = 9718 9718
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Elevation (m)
Station (m)
Legend
EG 100-YR
WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Crit 100-YR
Crit 10-YR
Crit 5-YR
Ground
Levee
Bank Sta
RA21-LaydownArea Plan: 1) Interim 7/6/2017
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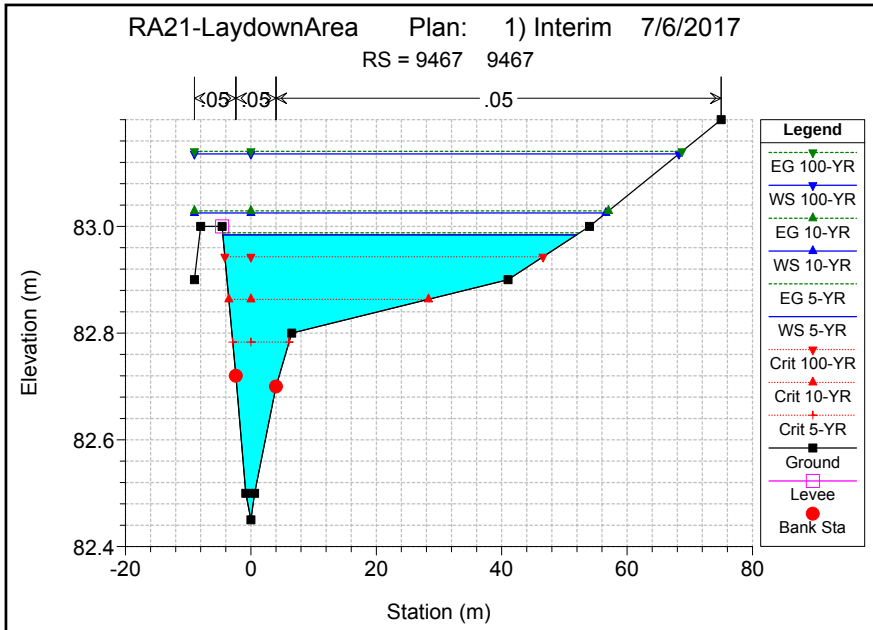
.05
.05
Elevation (m)
Station (m)
Legend
EG 100-YR
WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Crit 100-YR
Crit 10-YR
Crit 5-YR
Ground
Levee
Bank Sta
RA21-LaydownArea Plan: 1) Interim 7/6/2017
RS = 9630 9630
.05
.05
.05
Elevation (m)
Station (m)
Legend
EG 100-YR
WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Crit 100-YR
Crit 10-YR
Crit 5-YR
Ground
Levee
Bank Sta
RA21-LaydownArea Plan: 1) Interim 7/6/2017
RS = 9554 9554
.05
.05
.05
Elevation (m)
Station (m)
Legend
EG 100-YR
WS 100-YR
EG 10-YR
WS 10-YR
Crit 100-YR
EG 5-YR
WS 5-YR
Crit 10-YR
Crit 5-YR
Ground
Levee
Bank Sta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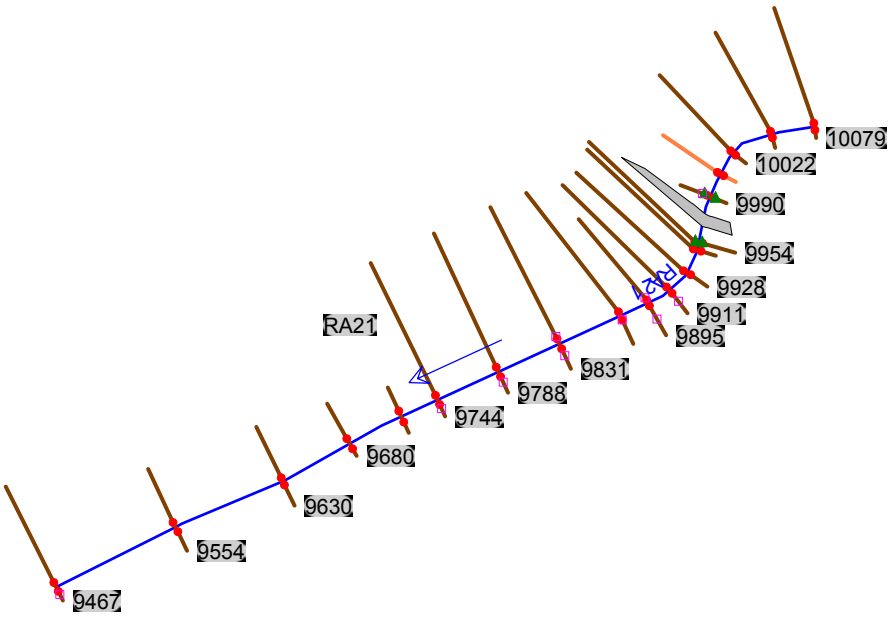
82.8
82.6
82.4
-20
0
20
40
60
80
Station (m)
Legend
EG 100-YR
WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Crit 100-YR
Crit 10-YR
Crit 5-YR
Ground
Levee
Bank Sta

HEC-RAS MODELING - PROPOSED ULTIMATE CONDITIONS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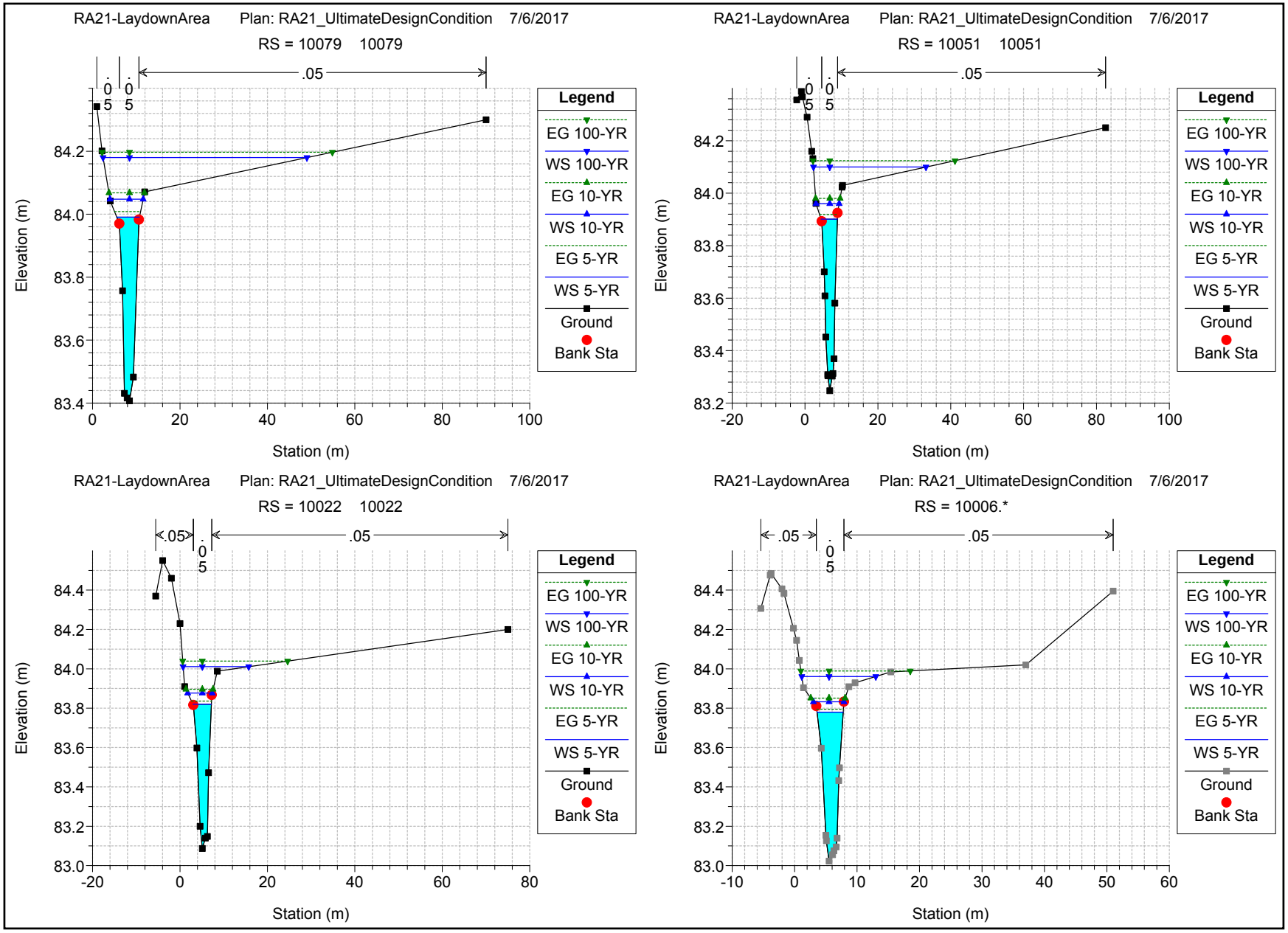
10022
9990
9954
9928
9911
9895
9831
9788
9744
9680
9630
9554
9467
RA21

HEC-RAS Plan: Ultimate River: RA21 Reach: RA21

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	Vel Total	Vel Left	Vel Right
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(m/s)	(m/s)	(m/s)
RA21	10079	5-YR	1.02	83.41	83.99		84.01	0.003234	0.59	1.75	5.19	0.30	0.58	0.05	0.03
RA21	10079	10-YR	1.27	83.41	84.05		84.07	0.003108	0.63	2.11	7.59	0.30	0.60	0.13	0.11
RA21	10079	100-YR	2.10	83.41	84.18		84.20	0.002307	0.64	5.28	46.64	0.27	0.40	0.24	0.14
RA21	10051	5-YR	1.02	83.25	83.90		83.92	0.003050	0.58	1.75	4.49	0.29	0.58	0.03	
RA21	10051	10-YR	1.27	83.25	83.96		83.98	0.003024	0.63	2.07	6.36	0.30	0.61	0.11	0.07
RA21	10051	100-YR	2.10	83.25	84.10		84.12	0.002801	0.72	3.90	30.88	0.30	0.54	0.29	0.12
RA21	10022	5-YR	1.02	83.09	83.82		83.84	0.002742	0.57	1.80	4.21	0.27	0.57	0.02	
RA21	10022	10-YR	1.27	83.09	83.88		83.90	0.002876	0.62	2.08	5.61	0.29	0.61	0.10	0.03
RA21	10022	100-YR	2.10	83.09	84.01		84.04	0.003140	0.76	3.11	15.00	0.31	0.68	0.29	0.09
RA21	10006.*	5-YR	1.02	83.02	83.78		83.79	0.002384	0.54	1.88	4.18	0.26	0.54		
RA21	10006.*	10-YR	1.27	83.02	83.83		83.85	0.002702	0.60	2.12	4.89	0.28	0.60	0.05	
RA21	10006.*	100-YR	2.10	83.02	83.96		83.99	0.003130	0.76	3.07	11.85	0.31	0.68	0.23	0.11
RA21	9990	5-YR	1.02	82.96	83.75	83.32	83.76	0.001992	0.51	2.00	4.26	0.24	0.51		
RA21	9990	10-YR	1.27	82.96	83.79	83.36	83.81	0.002422	0.57	2.21	4.54	0.26	0.57		
RA21	9990	100-YR	2.10	82.96	83.91	83.49	83.94	0.003129	0.75	2.94	8.99	0.31	0.71	0.20	0.16
RA21	9962		Culvert												
RA21	9954	5-YR	1.02	82.89	83.73		83.74	0.000754	0.37	2.74	17.69	0.15	0.37		
RA21	9954	10-YR	1.27	82.89	83.77		83.78	0.000941	0.43	2.92	28.89	0.17	0.43		
RA21	9954	100-YR	2.10	82.89	83.85		83.87	0.001790	0.64	3.26	56.72	0.24	0.64		
RA21	9944	5-YR	1.02	82.88	83.73		83.74	0.000776	0.36	3.01	11.79	0.15	0.34	0.05	0.05
RA21	9944	10-YR	1.27	82.88	83.77		83.78	0.000908	0.40	3.58	16.93	0.17	0.35	0.08	0.08
RA21	9944	100-YR	2.10	82.88	83.84		83.86	0.001417	0.54	5.46	40.16	0.21	0.38	0.14	0.11
RA21	9928	5-YR	1.02	82.85	83.72		83.73	0.000691	0.34	3.14	13.24	0.15	0.33	0.04	0.04
RA21	9928	10-YR	1.27	82.85	83.76		83.76	0.000822	0.39	3.83	25.21	0.16	0.33	0.07	0.06
RA21	9928	100-YR	2.10	82.85	83.82		83.84	0.001208	0.51	6.43	51.72	0.20	0.33	0.12	0.11
RA21	9911	5-YR	1.02	82.81	83.71	83.18	83.71	0.000595	0.32	3.71	30.02	0.14	0.27	0.03	0.04
RA21	9911	10-YR	1.27	82.81	83.75	83.22	83.75	0.000643	0.35	5.17	46.81	0.14	0.25	0.05	0.07
RA21	9911	100-YR	2.10	82.81	83.81	83.31	83.82	0.000809	0.42	8.77	63.90	0.16	0.24	0.12	0.11
RA21	9895	5-YR	1.02	82.77	83.69	83.23	83.70	0.001665	0.48	2.40	18.09	0.22	0.43	0.07	0.06
RA21	9895	10-YR	1.27	82.77	83.73	83.28	83.74	0.001376	0.46	4.66	58.49	0.20	0.27	0.12	0.08
RA21	9895	100-YR	2.10	82.77	83.80	83.43	83.80	0.001128	0.45	9.10	71.06	0.19	0.23	0.17	0.13
RA21	9875	5-YR	1.02	82.80	83.63	83.25	83.65	0.003677	0.61	1.79	19.09	0.31	0.57		0.05
RA21	9875	10-YR	1.27	82.80	83.68	83.31	83.69	0.003747	0.59	2.93	30.44	0.31	0.43		0.15
RA21	9875	100-YR	2.10	82.80	83.76	83.46	83.77	0.002133	0.49	7.46	64.21	0.24	0.28	0.16	0.19
RA21	9831	5-YR	1.02	82.73	83.49	83.17	83.50	0.002989	0.48	2.17	8.26	0.28	0.47	0.06	0.15
RA21	9831	10-YR	1.27	82.73	83.55	83.22	83.56	0.002588	0.50	2.65	9.23	0.27	0.48	0.12	0.19
RA21	9831	100-YR	2.10	82.73	83.68	83.38	83.69	0.001751	0.50	5.91	40.20	0.23	0.36	0.18	0.15
RA21	9788	5-YR	1.02	82.67	83.45	83.06	83.45	0.000579	0.29	3.71	9.42	0.13	0.27	0.11	0.16
RA21	9788	10-YR	1.27	82.67	83.50	83.09	83.51	0.000628	0.33	4.23	10.69	0.14	0.30	0.13	0.15
RA21	9788	100-YR	2.10	82.67	83.64	83.17	83.64	0.000661	0.39	7.61	38.78	0.15	0.28	0.17	0.10
RA21	9744	5-YR	1.02	82.60	83.44	82.85	83.44	0.000174	0.21	5.57	11.52	0.08	0.18	0.09	0.09
RA21	9744	10-YR	1.27	82.60	83.49	82.88	83.49	0.000210	0.24	6.24	14.27	0.09	0.20	0.10	0.09
RA21	9744	100-YR	2.10	82.60	83.62	82.96	83.62	0.000274	0.30	10.25	41.96	0.10	0.20	0.14	0.08
RA21	9718	5-YR	2.87	82.53	83.41		83.42	0.001174	0.51	6.88	25.29	0.20	0.42	0.20	0.15
RA21	9718	10-YR	3.58	82.53	83.46		83.47	0.001266	0.56	8.12	25.35	0.21	0.44	0.22	0.20
RA21	9718	100-YR	5.90	82.53	83.58		83.60	0.001514	0.68	11.23	25.58	0.24	0.53	0.28	0.32
RA21	9680	5-YR	2.87	82.52	83.36		83.37	0.001582	0.56	5.90	15.47	0.23	0.49	0.23	0.25
RA21	9680	10-YR	3.58	82.52	83.40		83.41	0.001905	0.64	6.52	16.34	0.26	0.55	0.27	0.30
RA21	9680	100-YR	5.90	82.52	83.50		83.53	0.002549	0.82	10.01	34.60	0.30	0.59	0.37	0.30
RA21	9630	5-YR	2.87	82.70	83.30		83.31	0.001021	0.37	10.85	43.49	0.18	0.26	0.18	0.24
RA21	9630	10-YR	3.58	82.70	83.34		83.34	0.001042	0.40	12.40	43.65	0.18	0.29	0.19	0.26
RA21	9630	100-YR	5.90	82.70	83.43		83.44	0.001121	0.47	16.57	44.09	0.19	0.36	0.24	0.33
RA21	9554	5-YR	2.87	82.58	83.17		83.19	0.002750	0.60	7.05	38.18	0.29	0.41	0.20	0.27
RA21	9554	10-YR	3.58	82.58	83.21		83.22	0.002772	0.63	8.37	40.31	0.30	0.43	0.23	0.31
RA21	9554	100-YR	5.90	82.58	83.29		83.31	0.002831	0.72	12.16	45.91	0.31	0.49	0.29	0.38
RA21	9467	5-YR	2.87	82.45	83.04	82.88	83.05	0.001000	0.38	12.41	67.43	0.18	0.23	0.13	0.19
RA21	9467	10-YR	3.58	82.45	83.08	82.91	83.08	0.001000	0.40	14.66	70.68	0.18	0.24	0.16	0.20
RA21	9467	100-YR	5.90	82.45	83.16	82.96	83.17	0.001001	0.44	21.17	79.36	0.18	0.28	0.22	0.24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Elevation (m)
Station (m)
Legend
EG 100-YR
WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Ground
Bank Sta
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.05
Elevation (m)
Station (m)
Legend
EG 100-YR
WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Ground
Bank Sta
RA21-LaydownArea Plan: RA21_UltimateDesignCondition 7/6/2017
RS = 10022 10022
.05
.05
.05
Elevation (m)
Station (m)
Legend
EG 100-YR
WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Ground
Bank Sta
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Elevation (m)
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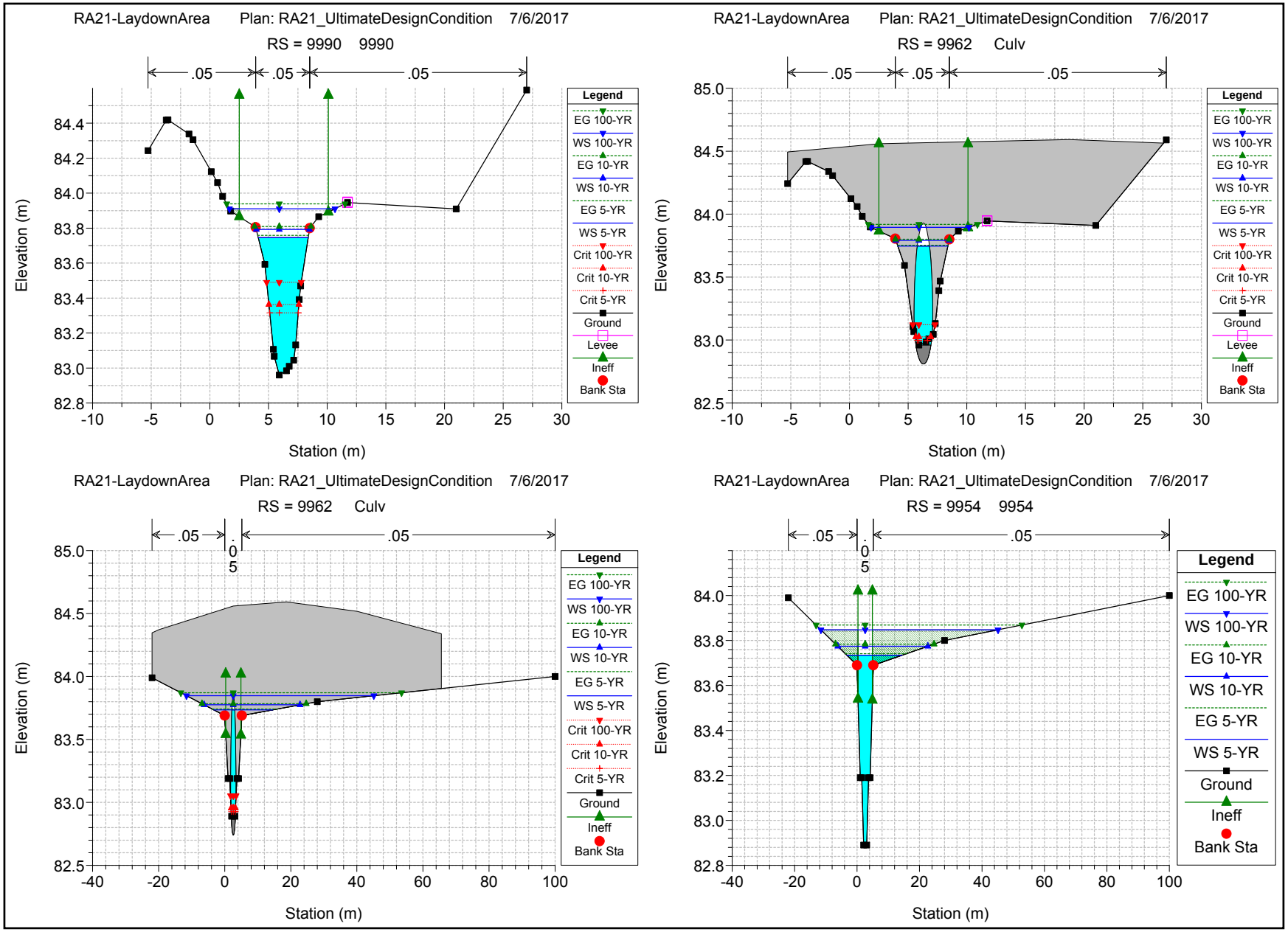
WS 5-YR
Ground
Bank Sta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Elevation (m)
Station (m)
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WS 100-YR
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WS 10-YR
EG 5-YR
WS 5-YR
Crit 100-YR
Crit 10-YR
Crit 5-YR
Ground
Levee
Ineff
Bank Sta
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Crit 100-YR
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Elevation (m)
Station (m)
Legend
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EG 10-YR
WS 10-YR
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WS 5-YR
Crit 100-YR
Crit 10-YR
Crit 5-YR
Ground
Ineff
Bank Sta
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.05
.05
Elevation (m)
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Legend
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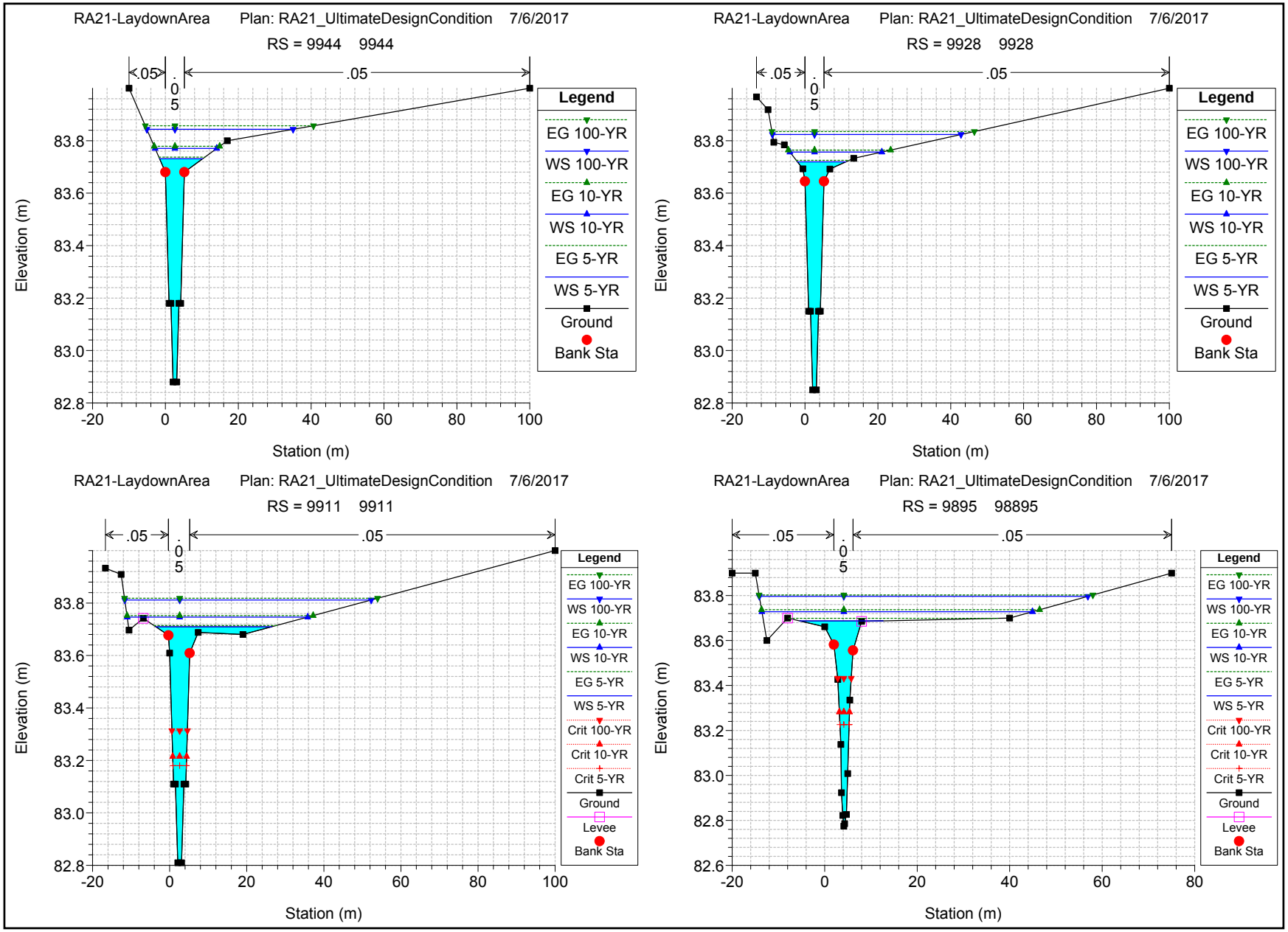
Ground
Ineff
Bank Sta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RA21-LaydownArea Plan: RA21_UltimateDesignCondition 7/6/2017
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Elevation (m)
Station (m)
Legend
EG 100-YR
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Crit 10-YR
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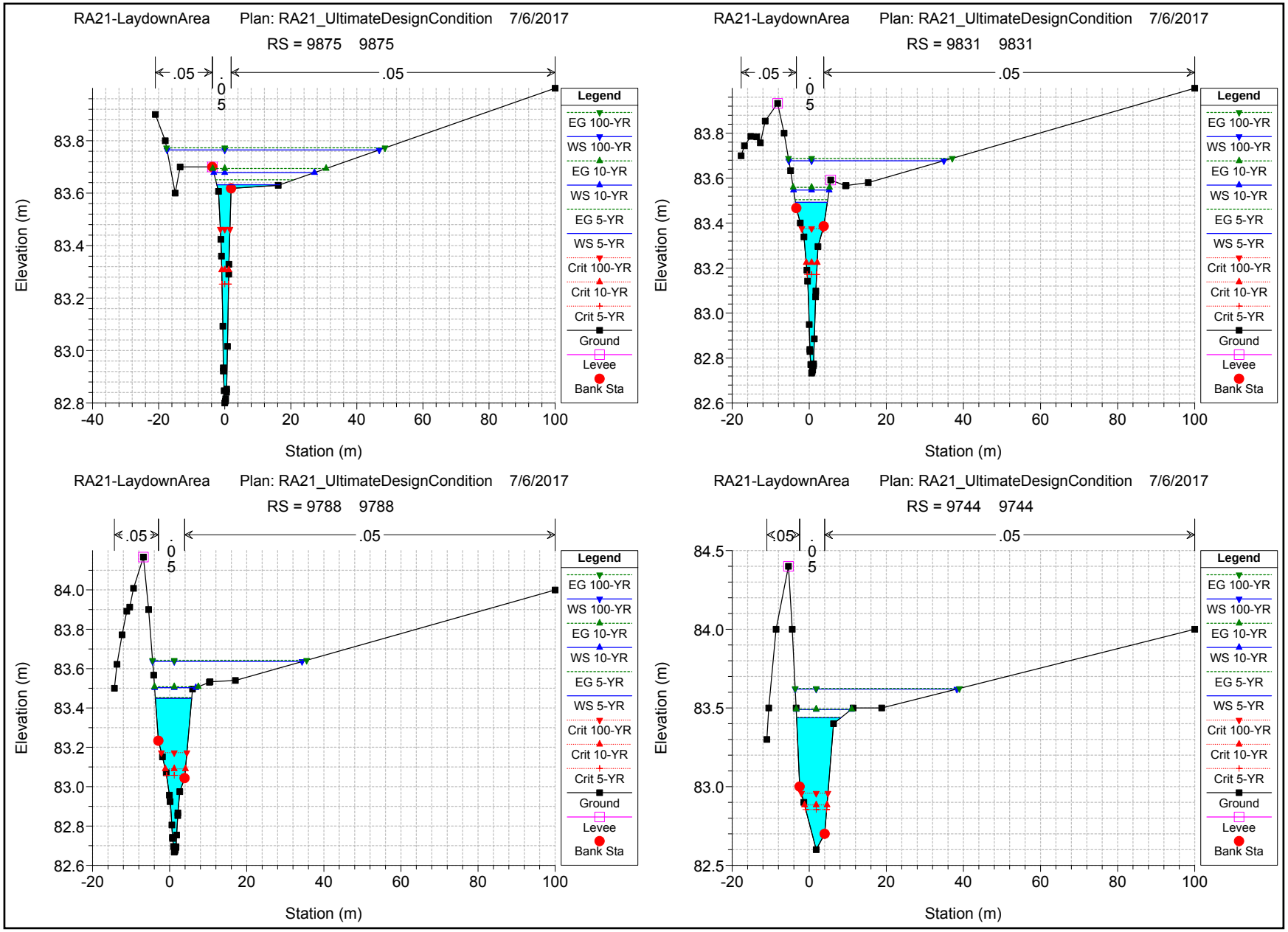
Ground
Levee
Bank Sta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Legend
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WS 5-YR
Crit 100-YR
Crit 10-YR
Crit 5-YR
Ground
Levee
Bank Sta
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Elevation (m)
Station (m)
Legend
EG 100-YR
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WS 10-YR
EG 5-YR
WS 5-YR
Crit 100-YR
Crit 10-YR
Crit 5-YR
Ground
Levee
Bank Sta
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Elevation (m)
Station (m)
Legend
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Crit 10-YR
Crit 5-YR
Ground
Levee
Bank Sta
RA21-LaydownArea Plan: RA21_UltimateDesignCondition 7/6/2017
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Elevation (m)
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Legend
EG 100-YR
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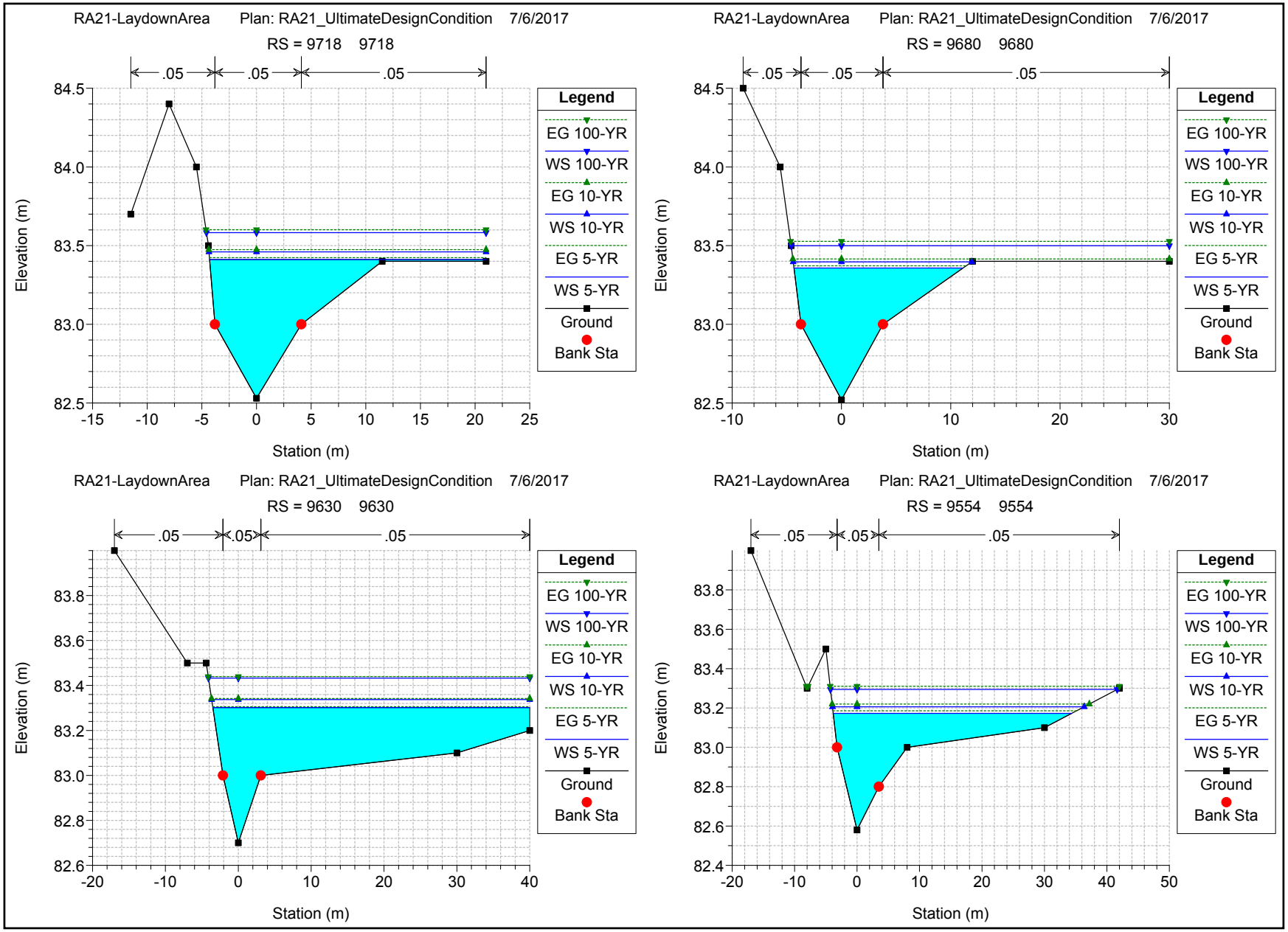
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Station (m)
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EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Ground
Bank Sta
RA21-LaydownArea Plan: RA21_UltimateDesignCondition 7/6/2017
RS = 9680 9680
.05 .05 .05
Elevation (m)
Station (m)
Legend
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WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Ground
Bank Sta
RA21-LaydownArea Plan: RA21_UltimateDesignCondition 7/6/2017
RS = 9630 9630
.05 .05 .05
Elevation (m)
Station (m)
Legend
EG 100-YR
WS 100-YR
EG 10-YR
WS 10-YR
EG 5-YR
WS 5-YR
Ground
Bank Sta
RA21-LaydownArea Plan: RA21_UltimateDesignCondition 7/6/2017
RS = 9554 9554
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Elevation (m)
Station (m)
Legend
EG 100-YR
WS 100-YR
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EG 5-YR
WS 5-YR
Ground
Bank Sta

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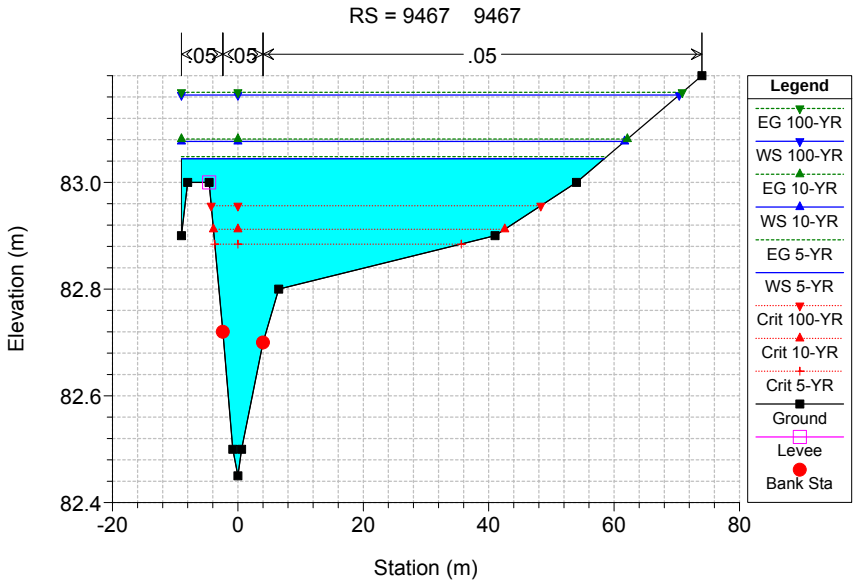


RA21 – DITCH REALIGNMENT DRAWINGS

Stantec

PENNECON HEAVY CIVIL

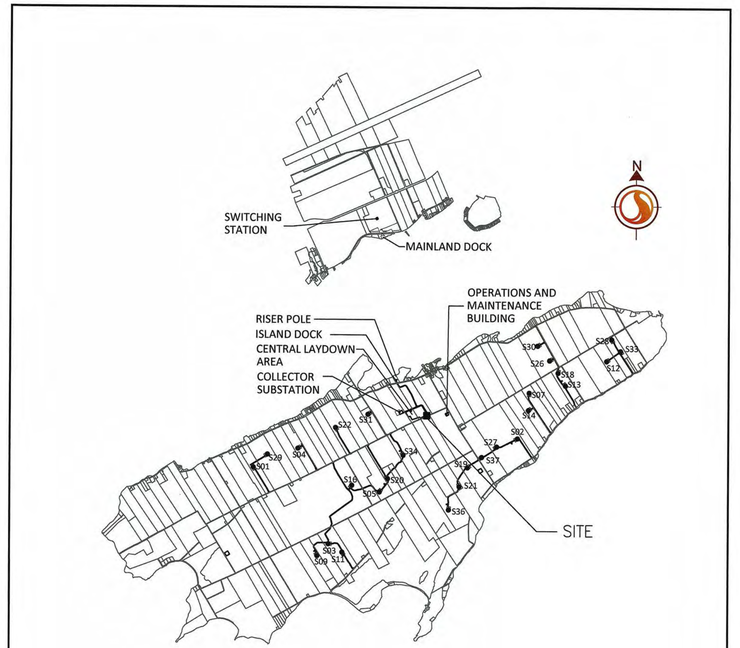
ISO 9001:2008 QUASAR REGISTERED

AMHERST ISLAND, LOYALIST TOWNSHIP, ONTARIO

AMHERST ISLAND WIND PROJECT 75MW WIND FARM

JUNE 2017

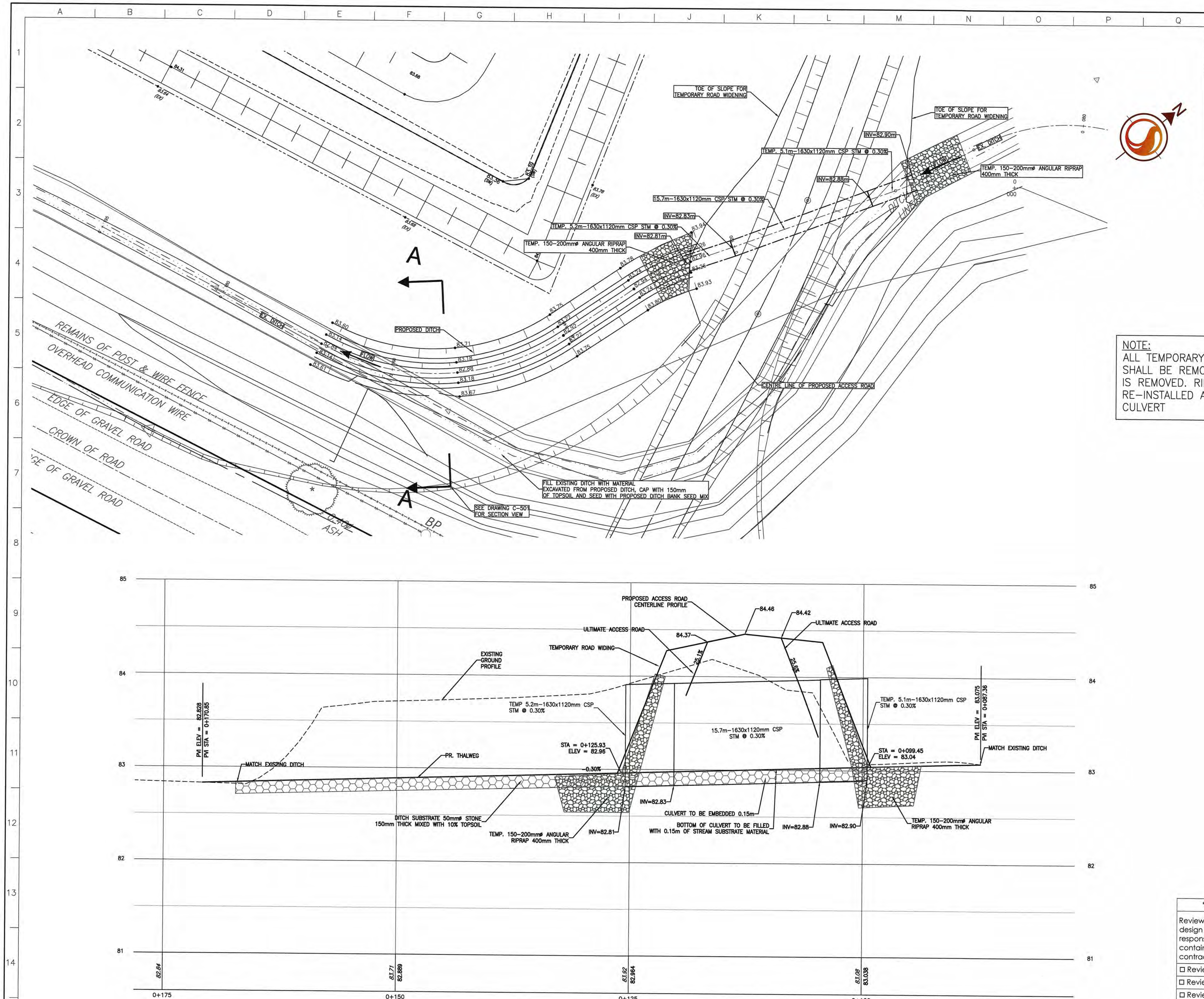
Project Number: 160960595



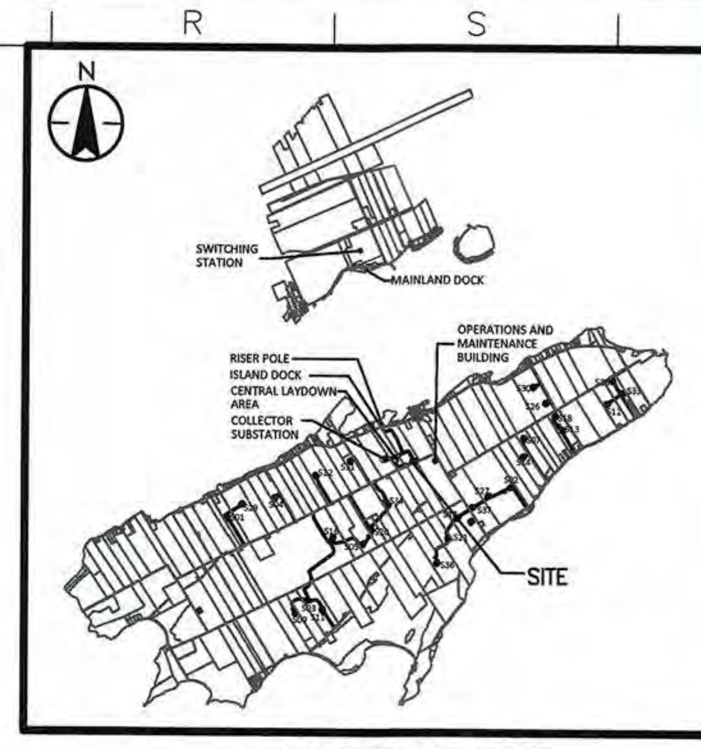
KEY PLAN
NTS

INDEX

SHEET NO.	DESCRIPTION
C-400	GRADING PLAN
C-500	DETAILS
C-501	TYPICAL CROSS-SECTIONS AND DETAILS



NOTE:
ALL TEMPORARY CULVERTS AND RIPRAP SHALL BE REMOVED WHEN ROAD WIDENING IS REMOVED. RIPRAP SHALL BE RE–INSTALLED AROUND THE END ON THE CULVERT



KEY PLAN
N.T.S

Stantec

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Waterloo ON Canada
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Notes

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Legend

		By	Appd.	YY.MM.DD
2	REVISED ENTRANCE	RJB	SC	17.07.07
1	ISSUED FOR CONSTRUCTION	RJB	SC	17.07.05
0	ISSUED FOR CLIENT REVIEW	RJB	SC	17.06.30

Revision

File Name: 160960595_C-200ST.dwg	Dwn.	Chkd.	Dsgn.	YY.MM.DD
	RJB	SC	SC	17.06.07

Permit-Seal

PROFESSIONAL GEOSCIENTISTS ONTARIO — SCOTT J.E. COWAN, PRACTISING MEMBER 2751

LICENSED PROFESSIONAL ENGINEER — H.E. AMIRAULT 100116290 — PROVINCE OF ONTARIO

*****For PHCL and Windlectric Use Only*****

Review and/or accepted does not constitute approval of design details, calculations or methods. It is the responsibility of the consultant to ensure all information contained within the drawings are in full compliance with contractual obligations

☐ Reviewed - Accepted and no comments
☐ Reviewed - Incorporate comments and resubmit
☐ Reviewed - Not accepted

Reviewed By	Date (dd-mmm-yyyy)
Project Manager - PHCL	Date (dd-mmm-yyyy)
Project Manager - Windlectric	Date (dd-mmm-yyyy)
Owner:	

Client/Project

PENNECON HEAVY CIVIL

AMHERST ISLAND WIND PROJECT
75MW WIND FARM
Amherst Island, Loyalist Township, Ontario

Title

PLAN AND PROFILE 0+080 TO 0+180

Project No. 160960595
Scale 1:200H 1:20V
Drawing No. C-400
Sheet 1 of 3
Revision 2

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2017/07/06 4:38 PM By: Brock, Randy

ORIGINAL SHEET - ARCH D

GENERAL NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH THE PLAN AND PROFILE DRAWINGS (C-400) & THE DETAIL DRAWING (C-501) PREPARED BY STANTEC CONSULTING.
2. THESE PLANS FOR CONSTRUCTION ONLY WHEN APPROVED BY THE PENNECON AND SEALED BY THE ENGINEER.
3. THE CONTRACTOR MUST CHECK AND VERIFY DIMENSIONS, GRADES, AND EXISTING CONDITIONS, OBTAIN ALL UTILITY LOCATES, OBTAIN ALL REQUIRED PERMITS/LICENSES AND VERIFY ELEVATIONS OF EXISTING SERVICES BEFORE PROCEEDING WITH ANY WORK AND REPORT ANY DISCREPANCIES TO THE ENGINEER.
4. ANY PROPOSED CHANGES SHALL BE APPROVED BY THE CONTRACT ADMINISTRATOR AND THE PENNECON.
5. ALL UNDERGROUND SERVICING TO BE INSPECTED BY STANTEC CONSULTING LTD. AND CERTIFIED FOR THE PENNECON. CONTRACTOR SHALL COORDINATE WITH STANTEC AND SHALL CONTACT SAME AT LEAST 48 HOURS PRIOR TO INSTALLATION OF SERVICES.
6. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONSFOR CONSTRUCTION PROJECTS (LATEST EDITION), ONTARIO TRAFFIC MANUAL (OTM) BOOK 7 (LATEST EDITION).
7. ALL TRAFFIC CONTROL PLANS SHALL BE APPROVED BY THE PENNECON AND A COPY MAINTAINED ON SITE AT ALL TIMES.
8. EMERGENCY SERVICE VEHICLES CAN ENTER THE SITE AT ANY ACCESS (EXISTING OR PROPOSED)
9. IF, FOR UNFORESEEN REASONS, THE CONTRACTOR AND/OR HIS/HER REPRESENTATIVE MUST ENCROACH ONTO PRIVATE LANDS TO UNDERTAKE ANY WORKS, HE/SHE MUST OBTAIN WRITTEN PERMISSION FROM THE ADJACENT PROPERTY OWNERS PRIOR TO ENTERING UPON THE PRIVATE PROPERTY TO PERFORM ANY WORKS. COPIES OF THESE LETTERS OF CONSENT MUST BE SUBMITTED TO PENNECON, PRIOR TO ANY WORK BEING PERFORMED. FAILURE TO COMPLY WITH THE ABOVE IS AT CONTRACTORS' RISK.

NOTES FOR WORKING NEAR WATER

1. EROSION AND SEDIMENT CONTROL (ESC) MEASURES WILL BE IMPLEMENTED PRIOR TO, AND MAINTAINED DURING THE CONSTRUCTION PHASES, TO PREVENT ENTRY OF SEDIMENT INTO THE WATER.
2. ALL ACTIVITIES, INCLUDING MAINTENANCE PROCEDURES, WILL BE CONTROLLED TO PREVENT THE ENTRY OF PETROLEUM PRODUCTS, DEBRIS, RUBBLE, CONCRETE OR OTHER DELETERIOUS SUBSTANCES INTO THE WATER. VEHICULAR REFUELING AND MAINTENANCE WILL BE CONDUCTED A MINIMUM OF 30 METRES FROM ANY AQUATIC RESOURCES TO AVOID POTENTIAL IMPACTS, IN THE EVENT THAT AN ACCIDENTAL SPILL OCCURS.
3. ALL DEWATERING/UNWATERING SHALL BE LOCATED AT LEAST 30 METRES FROM THE WATERCOURSE TO A FILTER BAG OR SPLASH PAD. NO DEWATERING SHALL BE SENT DIRECTLY TO ANY WATERCOURSE. THESE CONTROL MEASURES SHALL BE MONITORED FOR EFFECTIVENESS AND MAINTAINED OR REVISED TO MEET THE OBJECTIVE OF PREVENTING SEDIMENT FROM ENTERING THE WATERCOURSE.
4. ALL DISTURBED AREAS WILL BE STABILIZED AND RESTORED WITH NON-INVASIVE SPECIES IMMEDIATELY UPON COMPLETION OF GRADING WORK. ALL SEEDING AND PLANTING SHALL BE COMPLETED BEFORE OCTOBER OF THE CONSTRUCTION YEAR. FINAL SURFACE RESTORATION SHALL BE INITIATED AS SOON AS BACKFILLING AND GRADING ACTIVITIES HAVE BEEN COMPLETED.
5. DISTURBANCE AREAS WITHIN THE STREAM SHOULD BE LIMITED TO AN AREA THAT CAN BE COMPLETED AND STABILIZED WITHIN ONE WORKING DAY.
6. ALL NEAR-WATER WORK WILL BE CONDUCTED WITH APPROPRIATE EROSION AND SEDIMENT CONTROLS. IN-WATER WORKS SHALL NOT BE PERMITTED. THE CONTRACTOR SHALL MONITOR THE WEATHER SEVERAL DAYS IN ADVANCE TO ENSURE THAT WORKS ARE CONDUCTED DURING FAVORABLE WEATHER CONDITIONS. SHOULD AN UNEXPECTED STORM ARISE, THE CONTRACTOR SHALL IMPLEMENT A CONTINGENCY PLAN THAT HAS BEEN PRE-APPROVED BY THE CONTRACT ADMINISTRATOR AND PENNECON. THE CONTINGENCY PLAN SHALL INCLUDE REMOVAL OF ALL ITEMS FROM THE FLOODPLAIN THAT WOULD HAVE THE CAPACITY TO CAUSE AN OBSTRUCTION TO FLOW OR A SPILL (E.G., FUEL TANKS, UNFIXED EQUIPMENT, ETC.).
7. SITE ACCESS AND STAGING WILL MINIMIZE DISTURBANCE TO ALL WATERCOURSES AND THE NATURAL AREA. ANY MATERIAL STOCKPILED ON SITE WILL BE KEPT A SAFE DISTANCE FROM ANY SENSITIVE NATURAL FEATURES. AREAS CONTAINING EXPOSED SOILS OR STOCKPILED MATERIALS WILL BE ISOLATED USING SILT FENCING TO PREVENT THE ENTRY OF SEDIMENT INTO THE WATER. ADDITIONAL ESC SUPPLIES SHALL BE STOCKPILED ON SITE IN ORDER TO UPGRADE ESCS AS NECESSARY.
8. THE EROSION AND SEDIMENT CONTROL STRATEGIES OUTLINED ON THESE PLANS ARE NOT STATIC AND MAY NEED TO BE UPGRADED/AMENDED AS SITE CONDITIONS CHANGE TO MINIMIZE SEDIMENT LADEN RUNOFF FROM LEAVING THE WORK AREAS. IF PRESCRIBED MEASURES ON THE PLANS ARE NOT EFFECTIVE IN PREVENTING THE RELEASE OF A DELETERIOUS SUBSTANCE, ALTERNATIVE MEASURES SHALL BE IMPLEMENTED IMMEDIATELY TO MINIMIZE POTENTIAL ECOLOGICAL IMPACTS, AND THE CONTRACTOR SHALL CONTACT THE CATARAQUI REGION CONSERVATION AUTHORITY ENFORCEMENT OFFICER IMMEDIATELY.
9. CONTRACTOR SHALL PROVIDE CATARAQUI REGION CONSERVATION AUTHORITY WITH 48 HOURS ADVANCE NOTICE PRIOR TO CONSTRUCTION START.

STREAM CONSTRUCTION

1. TIMING RESTRICTIONS FOR IN-WATER WORK ALLOW CONSTRUCTION FROM JULY 1 TO MARCH 15.
2. WORKS TO BE COMPLETED DURING LOW FLOW CONDITIONS.
3. STREAM CONSTRUCTION TO TAKE PLACE FROM UPSTREAM TO DOWNSTREAM
4. A FISH RESCUE BY QUALIFIED STAFF WILL TAKE PLACE PRIOR TO AND DURING DEWATERING IF FLOW IS PRESENT IN THE DITCH
5. IN-WATER WORK TO BE COMPLETED IN THE DRY BY ISOLATING THE WORK AREA USING PUMP AROUND TECHNIQUES.
6. COFFERDAMS ARE TO BE COMPOSED OF SANDBAGS AND A PLASTIC LINER, MATERIAL USED TO FILL BAGS TO BE CLEAN AND FREE OF FINES.
7. EXISTING FLOWS WILL BE MAINTAINED DOWNSTREAM OF THE DE-WATERED WORK AREA.
8. FLOW DISSIPATERS, FILTER BAGS OR OTHER APPROPRIATE MEASURES WILL BE USED AT ANY PUMP DISCHARGE LOCATION TO PREVENT EROSION AND THE DEPOSITION OF DELETERIOUS SUBSTANCES INTO THE WATERCOURSE.
9. SILT OR DEBRIS THAT HAS ACCUMULATED AROUND THE TEMPORARY COFFERDAMS WILL BE REMOVED PRIOR TO THEIR WITHDRAWAL.
10. REFUELING OF EQUIPMENT WILL BE CARRIED OUT A MINIMUM OF 30 M AWAY FROM ANY AQUATIC RESOURCES TO AVOID POTENTIAL IMPACTS, IN THE EVENT THAT AN ACCIDENTAL SPILL OCCURS.
11. ALL EXPOSED SOIL AREAS WILL BE STABILIZED AND RE-VEGETATED WITH SEED MIX.
12. ALL MATERIAL USED IN THE CONSTRUCTION OF THE NEW STREAM WILL BE NATIVE MATERIAL OR WILL BE WASHED PRIOR TO ARRIVAL ON SITE TO PREVENT THE INTRODUCTION OF DELETERIOUS SUBSTANCES TO THE WATERCOURSE.
13. EXCESS TRAPPED SEDIMENTS AND CONTROLS ARE TO BE REMOVED ONLY AFTER THE SOILS OF THE CONSTRUCTION AREA HAVE BEEN STABILIZED AND ADEQUATELY RE-VEGETATED.

SUBSTRATE

1. SUBSTRATE WILL BE USED TO LINE THE BOTTOM OF THE DITCH AND WILL BE COMPRISED OF A 150mm LAYER OF 50mm MINUS STONE MIXED WITH TOPSOIL.

CULVERT OPENING EROSION PROTECTION

1. CULVERTS WILL BE CONSTRUCTED WITH A RIP-RAP APRON INSTALLED AT BOTH THE ENTRANCE AND EXIT OF THE STRUCTURE. THE APRON WILL BE CONSTRUCTED OF 150 – 200 mm ANGULAR RIP-RAP WITH A MINIMUM DEPTH OF 400 mm.

SEQUENCE OF EROSION AND SEDIMENT CONTROL INSTALLATION

1. INSTALL EROSION AND SEDIMENT CONTROL MEASURES AS SHOWN.
2. REMOVE ANY FISH FROM STANDING WATER FOLLOWING WORK AREA ISOLATION.
3. ESTABLISH PUMP AROUND DIVERSION.
4. COMPLETE PROPOSED STREAM REALIGNMENT AND IN-STREAM FEATURES AS DETAILED ON DRAWING SHEETS C-400 AND C-501.
5. STABILIZE SLOPES AND DISTURBED AREAS AND IMPLEMENT PLANTING PLAN.

MONITORING

SITE MONITORING WILL BE CARRIED OUT AT VARIOUS MILESTONES BY THE OWNER'S REPRESENTATIVE. (NUMBERED BELOW):

1. ONCE ALL EROSION AND SEDIMENT CONTROL MEASURES INSTALLED;
2. DURING INSTALLATION OF DIVERSION PUMPING;
3. DURING ANY FISH RESCUE;
4. DURING INSTALLATION OF SUBSTRATE AND IN-STREAM FEATURES OF THE PROPOSED STREAM; AND
5. PRIOR TO EROSION AND SEDIMENT CONTROL MEASURE REMOVAL.

STREAM CONSTRUCTION SEQUENCING PLAN

FOLLOWING RECEIPT OF ALL REQUIRED PERMITS, IN-WATER WORK MAY TAKE PLACE BETWEEN JULY 1ST AND MARCH 15TH. NO IN-WATER WORK SHALL TAKE PLACE WITHOUT NOTIFYING THE CONTRACT ADMINISTRATOR AND THE CATARAQUI REGION CONSERVATION AUTHORITY .

1. INSTALL SILT FENCE ALONG WATERCOURSE TO PROTECT EXISTING WATERCOURSE FROM CONSTRUCTION TRAFFIC AND AROUND STAGING AREA(S).
2. INSTALL SILT FENCING AND COFFER DAMS TO ISOLATE WORK AREA, PUMP STREAM FLOWS AROUND WORK AREA ACCORDING TO PERMIT TO TAKE WATER CONDITIONS.
3. IMPLEMENT FISH RESCUE PLAN IN ISOLATED WORK AREA.
4. DE-WATER WORK AREA BY PUMPING.
5. COMMENCE CONSTRUCTION OF PROPOSED DITCH, COMMENCING WORKS AT THE UPSTREAM END.
6. TOPSOIL SHALL BE STRIPPED AND SET ASIDE, THEN REPLACED ON BANKS AND BACKFILLED AREAS AS APPROPRIATE AS WORK MOVES DOWNSTREAM.
7. A QUALIFIED ENGINEER OR FLUVIAL GEOMORPHOLOGIST OR REPRESENTATIVE THEREOF SHALL BE PRESENT DURING THE CONSTRUCTION OF THE DITCH WORKS.
8. COMPLETED AREAS OF STREAM CONSTRUCTION SHALL BE STABILIZED WITH COIR MATTING AND SEEDED ACCORDING TO THE APPROVED PLANTING PLAN AS WORK PROCEEDS DOWNSTREAM.

NOTES

- WATER INTAKES OR OUTLET PIPES TO BE SCREENED TO PREVENT ENTRAINMENT OR IMPINGEMENT OF FISH.
- WATER PUMPED DURING DE-WATERING ACTIVITIES MUST BE DISCHARGED IN SUCH A MANNER AS TO MINIMIZE IN-STREAM EROSION AND SEDIMENTATION. POSSIBLE ALTERNATIVE INCLUDE USING A FILTER BAG, DISCHARGING INTO A VEGETATED AREA AT LEAST 30 M FROM THE DITCH OR DISCHARGING INTO AN APPROPRIATELY SIZED SETTLING BASIN, ETC.

EROSION CONTROL NOTES

1. EROSION CONTROL FENCE TO BE PLACED AROUND THE BASE OF ALL STOCKPILES. ALL STOCKPILES TO BE KEPT A MINIMUM OF 2.5 M FROM ALL PROPERTY LINES.
2. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED AS SITE WORKS PROGRESSES. THE CONTRACTOR TO PROVIDE ALL ADDITIONAL EROSION CONTROL STRUCTURES.
3. EROSION AND SEDIMENT CONTROLS WILL BE MONITORED ON A DAILY BASIS, AFTER PRECIPITATION AND RAIN EVENTS, AND ANY NECESSARY REPAIRS WILL BE COMPLETED WITHIN 48 HOURS. SHOULD THE CONTROLS NOT SERVE THEIR INTENDED PURPOSE THEY WILL BE CORRECTED OR REPLACED.
4. SEDIMENTS TO BE REMOVED WHEN ACCUMULATIONS REACH A MAXIMUM OF ONE THIRD (1/3) THE HEIGHT OF THE SILT FENCE. THE CONTRACTOR SHALL REMOVE AND DISPOSE OFF-SITE ACCUMULATED SEDIMENT FROM ALL BARRIERS TO THE LEVEL OF EXISTING GRADE, IN A MANNER THAT AVOIDS SEDIMENT ESCAPE TO THE DOWNSTREAM SIDE OF DEVICE. ALL BARRIERS SHALL REMAIN IN PLACE UNTIL AFTER THE SURROUNDING GROUND HAS BEEN RESTORED.
5. ALL EROSION CONTROL STRUCTURES TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND SURFACES HAVE BEEN RE-STABILIZED EITHER BY PAVING OR RESTORATION OF VEGETATIVE GROUND COVER.
6. NO ALTERNATIVE METHODS OF EROSION CONTROL PROTECTION SHALL BE PERMITTED UNLESS APPROVED BY THE CONTRACT ADMINISTRATOR.
7. THE CONTRACTOR IS RESPONSIBLE FOR REMOVING SEDIMENTS FROM ROADS AND SIDEWALKS AT THE END OF EACH WORK DAY.
8. STOCKPILING OF MATERIALS FOR CONSTRUCTION WILL OCCUR AT THE NEARBY CENTRAL STAGING AREA. EROSION AND SEDIMENT CONTROL AND STORMWATER MANAGEMENT DETAILS FOR STOCKPILING WITHIN THE CENTRAL STAGING AREA ARE INCLUDED IN THE PHASE 2 SWM REPORT WHICH WAS APPROVED ON MARCH 13, 2017 BY THE MOECC AND ON APRIL 19, 2017 BY THE CRCA.

NOTE: IN ADDITION TO BEING RESPONSIBLE FOR ENSURING THAT THE PRESCRIBED MEASURES ARE INSTITUTED AND FUNCTIONING AS INTENDED, THE CONTRACTOR IS ALSO RESPONSIBLE FOR IMPLEMENTING ANY INTERIM OR EMERGENCY MEASURES AS NECESSARY, TO ENSURE THAT NO SEDIMENT IS DISCHARGED TO THE WATERCOURSE. THE FOLLOWING EXTRA EQUIPMENT/MATERIALS ARE TO BE KEPT ON SITE AS A CONTINGENCY, IN CASE THE PROPOSED CONTROL MEASURES ARE BREACHED:

- SILT FENCE
- FILTER CLOTH
- FILTER BAGS (AT LEAST 1 PER INSTALLED BAG)
- PUMPS (AT LEAST 1 PER INSTALLED PUMP)
- CLEAN RIP-RAP (FREE OF FINES) FOR ROCK CHECK DAMS
- SAND BAGS AND CLEAN GRAVEL (FREE OF FINES)
- ANY ADDITIONAL MATERIAL DEEMED NECESSARY TO REPAIR/REMEDIATE PROPOSED MEASURES, OR TO ADEQUATELY DEAL WITH UNEXPECTED HIGH FLOWS.

SEEDING NOTES:

1. ALL AREAS THAT HAVE BEEN DISTURBED BY CONSTRUCTION SHALL BE SEEDED BY THE CONTRACTOR UNLESS OTHERWISE NOTED. REMOVE ALL DEBRIS INCLUDING ALL GRANULAR STONE, WOOD AND METAL. SCARIFY ALL DISTURBED AREAS TO ELIMINATE COMPACTION OF TOPSOIL. TO PREPARE AREAS FOR SEEDING, SPREAD, LOOSEN AND FINE GRADE TOPSOIL.

2. SEEDING OPERATIONS SHALL BE COMPLETED BETWEEN SPRING THAW AND JUNE 15TH FOR SPRING WORK, OR BETWEEN AUGUST 15TH AND OCTOBER 15TH FOR FALL WORK.

3. ENSURE ADEQUATE MOISTURE IS AVAILABLE FOR INITIAL SEEDING APPLICATION AND MAINTAIN SEED BY WATERING DURING GERMINATION AND ESTABLISHMENT.

4. INSTALL SEED OVER MIN. 150MM DEPTH OF TOPSOIL. TOPSOIL TO BE PLACED ON DITCH BANKS AND BACKFILLED DITCH.

5. CONTRACTOR TO ENSURE ADEQUATE SEED MIX CATCH. SEEDED AREAS WILL BE ACCEPTED PROVIDED THAT A SUFFICIENT AMOUNT OF THE SEED HAS GERMINATED AND BECOME ESTABLISHED IN THE OPINION OF THE LANDSCAPE ARCHITECT.

6. MAINTENANCE FOR SEEDED AREAS SHALL BEGIN IMMEDIATELY AFTER INSTALLATION AND SHALL CONTINUE UNTIL ACCEPTANCE BY THE CONTRACT ADMINISTRATOR.

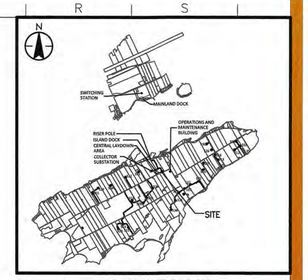
7. SEEDING ON NEWLY CONSTRUCTED DITCH BANKS AND FLOODPLAIN SHALL BE DONE AT THE END OF EACH DAY OF CONSTRUCTION TO ENSURE RAPID STABILIZATION.

TABLE 1 - PROPOSED DITCH BANK SEED MIXTURE (OSC SEED MIX #8210) (OR APPROVED EQUIVALENT)

QUANTITY (%)	BOTANICAL NAME	COMMON NAME	APPLICATION
30	ANDROPOGON GERRARDI	BIG BLUESTEM	RATE OF APPLICATION: 22-25 KG/HA WITH A NURSE CROP OF ANNUAL OAT GRASS, SEEDED AT 22 KG/HA. TO BE APPLIED ON TOPSOIL PLACED ON CONSTRUCTED DITCH BANKS AND 2 M BEYOND THE TOP OF DITCH BANK
6	RUDECKIA HIRTA	BLACK EYED SUSAN	
5	ELYMUS HYSTRIX	BOTTLEBRUSH GRASS	
30	PAA PALUSTRIS	FOWL BLUEGRASS / FOWL MEADOWGRASS	
2	GLYCERIA STRIATA	FOWL MANNAGRASS	
25	CAREX VULPINOIDEA	FOX SEDGE	
2	ASTER NOVAE-ANGLAIE	NEW ENGLAND ASTER	

TABLE 2 - NATIVE PRAIRIE LOW GROW GRASS MIXTURE (OSC SEED MIX #8125) (OR APPROVED EQUIVALENT)

QUANTITY (%)	BOTANICAL NAME	COMMON NAME	APPLICATION
30	ELYMUS CANADENSIS	CANADA WILD RYE	RATE OF APPLICATION: 25 KG/HA WITH A NURSE CROP OF ANNUAL OAT GRASS, SEEDED AT 22 KG/ HECTARE. TO BE APPLIED ON TOPSOIL PLACED ON BACKFILLED DITCH
25	PAO PALUSTRIS	FOWL BLUEGRASS	
15	SCHIZACHYRIUM SCOPARIUM	LITTLE BLUESTEM	
30	SPOROBOLUS CRYTANDRUS	SAND DROPSEED	



KEY PLAN

N.T.S

Stantec

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Notes

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6. THE CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ALL DAMAGED AND/OR DISTURBED PROPERTY WITHIN THE MUNICIPAL RIGHT-OF-WAY TO THE CURRENT MUNICIPAL STANDARDS AND SHALL CONFORM TO ROAD USE AGREEMENT.
7. THE CONTRACTOR IS TO BE RESPONSIBLE FOR ALL DRAINAGE AND MEASURES TO CONTROL WATER. THE SITE IS TO BE FINE GRADED/LEVELED LEAVING THE SITE IN A NEAT APPEARANCE SUCH THAT POSITIVE DRAINAGE IS ACHIEVED.
8. CONSTRUCTION TURNING RADIUS LIMITS IDENTIFY AREAS WHERE ADDITIONAL ROAD WIDTH IS REQUIRED TO ALLOW FOR ADEQUATE CLEARANCE FOR CONSTRUCTION VEHICLES.
9. ALL DISTURBED AREAS WITHIN THE PROPOSED WORKS ARE TO BE RE-VEGETATED USING NATIVE TOPSOIL AND SEED AS PER REA. MIX AND APPLICATION RATE/METHOD TO BE APPROVED PRIOR TO IMPLEMENTATION.
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13. ALL CULVERTS TO BE CONSTRUCTED IN ACCORDANCE WITH OPSS 421 AND AS PER OPSD 802.010.

Legend

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		Dwn.	Chkd.	Dsgn. YY.MM.DD

Permit-Seal

PROFESSIONAL GEOSCIENTIST — SCOTT J.E. COWAN — PRACTISING MEMBER — 2751 — ONTARIO

LICENSED PROFESSIONAL ENGINEER — H.E. AMIRAULT — 100116290 — Jul 6/17 — PROVINCE OF ONTARIO

Client/Project

PENNECON HEAVY CIVIL

AMHERST ISLAND WIND PROJECT
75MW WIND FARM

Amherst Island, Loyalist Township, Ontario

Title

DETAILS

Project No. 160960595	Scale	
Drawing No. C-500	Sheet 2 of 3	Revision 2

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Review and/or accepted does not constitute approval o design details, calculations or methods. It is the responsibility of the consultant to ensure all information contained within the drawings are in full compliance with contractual obligations

☐ Reviewed - Accepted and no comments
☐ Reviewed - Incorporate comments and resubmit
☐ Reviewed - Not accepted

Reviewed By	Date (dd-mmm-yyyy)
Project Manager - PHCL	Date (dd-mmm-yyyy)
Project Manager - Windlectric	Date (dd-mmm-yyyy)
Owner:	

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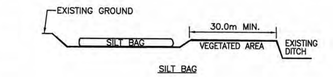
ORIGINAL SHEET - ARCH D

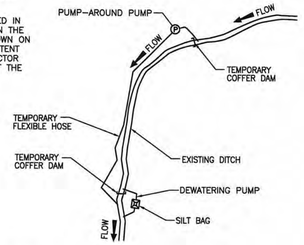
SEQUENCE OF CONSTRUCTION FOR TYPICAL WORK AREA

1. INSTALL SILT BAGS AS REQUIRED.
2. INSTALL UPSTREAM PUMP AND TEMPORARY FLEXIBLE HOSE.
3. PLACE UPSTREAM COFFER DAM AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION OR AS OUTLINED IN THE APPROVED WATER MANAGEMENT PLAN
4. PLACE DOWNSTREAM COFFER DAM AND PUMPING APPARATUS. DEWATER ENTRAPPED AREA. AREA TO BE DEWATERED SHALL BE EQUAL TO ONE DAY'S WORK OR AS OUTLINED IN THE APPROVED WATER MANAGEMENT PLAN.
5. PERFORM DITCH REALIGNMENT WORK IN ACCORDANCE WITH THE PLANS.
6. EXCAVATE ANY ACCUMULATED SILT AND DEWATER BEFORE REMOVAL OF COFFER DAMS. REMOVE COFFER DAMS, PUMPS, AND TEMPORARY FLEXIBLE HOSE. (DOWNSTREAM COFFER DAMS FIRST).
7. ALL GRADING AND STABILIZATION MUST BE COMPLETED IN ONE DAY WITHIN THE PUMP AROUND AREAS BETWEEN THE COFFER DAMS. THE COFFER DAM LOCATIONS AS SHOWN ON THIS SHEET ONLY SHOW THE UPPER AND LOWER EXTENT OF WORK FOR EACH DITCH SEGMENT. THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE LOCATION OF THE COFFER DAM(S) FOR EACH DAY'S WORK.
8. REMOVE SILT BAGS AND STABILIZE BASE AREA.
9. STABILIZE DISTURBED AREA WITH SEED AND MULCH.



SILT BAG

NOTE:
PROVIDE STABILIZED OUTLET



PUMP AROUND OPERATION
N.T.S

NOTES:
ALL EXCAVATION SHALL BE PERFORMED IN ONLY DRY OR ISOLATED SECTIONS OF DITCH.

COFFER DAMS ARE TO BE USED TO ISOLATE WORK FROM DITCH FLOW WHEN NECESSARY.

ALL GRADED AREAS SHALL BE STABILIZED WITHIN 24 HOURS.

MAINTENANCE OF DITCH FLOW OPERATIONS SHALL BE INCIDENTAL TO THE WORK. THIS INCLUDES POLYETHYLENE SHEETING, DIVERSION PIPES, PUMPS AND HOSES.

PUMPS AND HOSES SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA. IN ACCORDANCE WITH THE PERMIT TO TAKE WATER

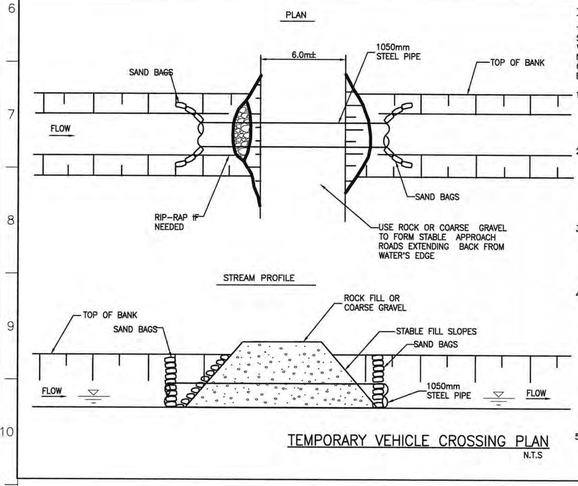
SIDE SLOPES OF RESTORED DITCH SHALL BE MATTED PRIOR TO TURNING WATER INTO CHANNEL. SEE TYPICAL MATTING LOCATION DETAIL.

CONTRACTOR IS RESPONSIBLE FOR DETERMINING & ACQUIRING THE PROPER SIZED PUMP.

ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ONSITE CONSTRUCTION MANAGER.

IF OVERNIGHT PUMPING IS REQUIRED NOISE BY-LAWS MUST BE OBSERVED.

FISH BARRIER NETS MUST BE ERECTED AND MAINTAINED TO PREVENT FISH FROM ENTERING THE WORKING AREA OF THE DITCH.



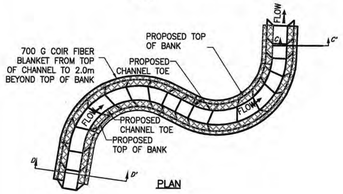
TEMPORARY VEHICLE CROSSING PLAN
N.T.S

TEMPORARY VEHICLE CROSSING

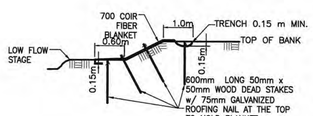
THERE WILL BE NO FORDING OF A FLOWING STREAM DURING CONSTRUCTION. TEMPORARY VEHICLE CROSSING WILL BE INSTALLED AS NECESSARY. THE FOLLOWING SEQUENCE OF CONSTRUCTION AND MITIGATION MEASURES WILL BE FOLLOWED AT ALL TEMPORARY BRIDGES:

1. INSTALL THE CROSSING IN A MANNER THAT WILL MINIMIZE SEDIMENT ENTERING THE WATER. FILL FOR THE TEMPORARY ROAD IS TO BE COARSE GRANULAR OR ROCK FILL MATERIAL.
2. THE ROAD APPROACH LEADING TO THE TEMPORARY CROSSING MUST BE RAISED AND STABLE. EROSION AND SEDIMENT CONTROL MEASURES ARE TO BE INSTALLED TO KEEP SEDIMENT ON LAND (E.G. CHECK DAMS, FILTER CLOTH, ANGULAR RIP RAP, SEED AND MULCH, SEDIMENT TRAPS, ETC.).
3. WHILE THE TEMPORARY CROSSING IN USE, ANY BUILD-UP OF MUD ON THE ROAD SURFACE OR APPROACHES THAT IS AFFECTING WATER QUALITY IS TO BE SCRAPED OFF AND DISPOSED OF IN AN APPROVED LOCATION.
4. WHEN THE TEMPORARY CROSSING IS NO LONGER REQUIRED, IT IS TO BE REMOVED AS QUICKLY AS POSSIBLE. REMOVAL SHALL NOT OCCUR OUTSIDE CONSTRUCTION WINDOWS AS IDENTIFIED ON THE WORK PERMIT WITHOUT PRIOR WRITTEN APPROVAL FROM DFO. SURPLUS GRAVEL IS TO BE REMOVED FROM THE CROSSING AREA AND DISPOSED OF IN A LOCATION APPROVED BY THE CLIENT AND DFO. THE CREEK BANKS ARE TO BE RESTORED TO A STABLE ANGLE AND PROTECTED WITH EROSION RESISTANT MATERIAL PER PLANTING PLAN AND DETAIL C-501-2 (TYPICAL MATTING DETAIL).
5. ALTERNATE METHODS OF CROSSING MAY BE CONSIDERED WITH PRIOR APPROVAL FROM THE ENGINEER.

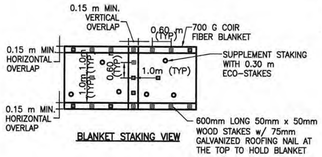
* BEFORE INSTALLING COIR FIBER BLANKET, TILL UPPER 150 mm OF SOIL TO HELP VEGETATION TO ESTABLISH. RAKE SOIL LEVEL AND ADD SEED AND MULCH BEFORE INSTALLING COIR FIBER BLANKET. SEED WITH NATIVE PRAIRIE LOW GROW GRASS SEED MIX.



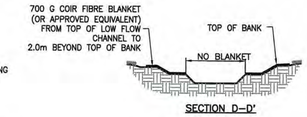
PLAN



SECTION C-C'



BLANKET STAKING VIEW



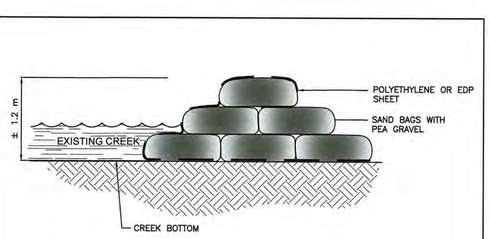
SECTION D-D'

NOTE:
ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ONSITE CONSTRUCTION MANAGER.

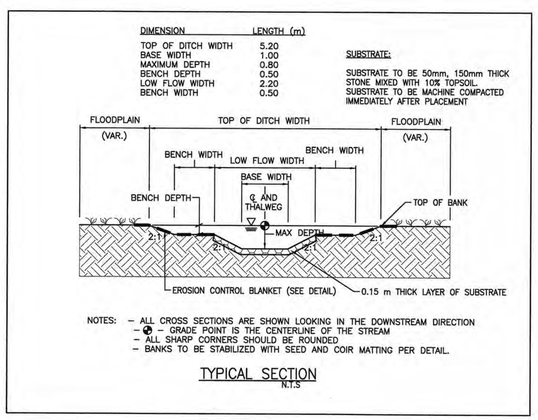
NOTE:

SECURE BLANKET BY STAKING AND OVERLAPPING AT THE SEAMS WITH A SHINGLE-TYPE METHOD. ADDITIONAL STAKING SHALL BE APPLIED AT NO ADDITIONAL COST IF THE BLANKET SEPARATES FROM THE SOIL MORE THAN 0.05m UNDER A REASONABLE PULL.

DETAIL - TYPICAL EROSION CONTROL BLANKET
NOT TO SCALE

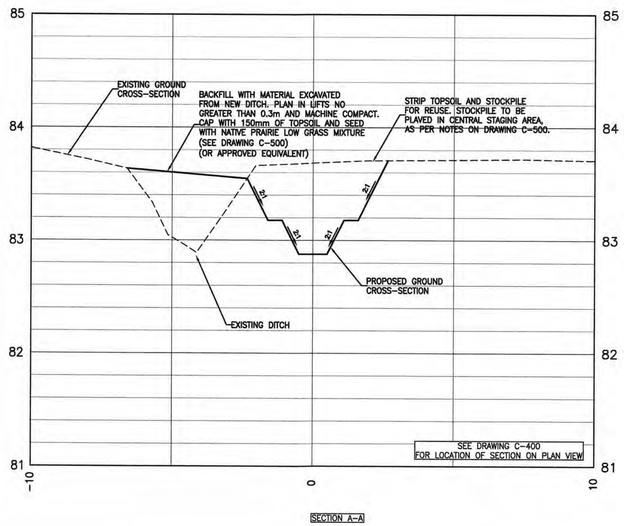


COFFER DAM WITH IMPERMEABLE LINER
N.T.S

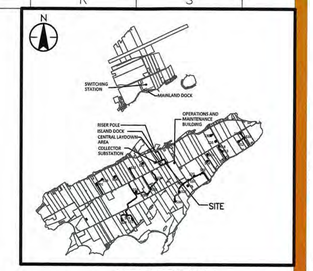


NOTES:
- ALL CROSS SECTIONS ARE SHOWN LOOKING IN THE DOWNSTREAM DIRECTION
- ℄ - GRADE POINT IS THE CENTERLINE OF THE STREAM
- ALL SHARP CORNERS SHOULD BE ROUNDED
- BANKS TO BE STABILIZED WITH SEED AND COIR MATTING PER DETAIL.

TYPICAL SECTION
N.T.S



SECTION A-A



KEY PLAN
N.T.S

Notes

1. TOPOGRAPHIC SURVEY COMPLETED BY McINTOSH PERRY CONSULTING ENGINEERS DATED 2015 (UTM ZONE 18 NAD83 (CRSR)1997.0). GEOTECHNICAL INFORMATION PROVIDED BY STANTEC MEMO, DATED JUNE 2015.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS IN THIS SET PREPARED BY STANTEC CONSULTING LTD.
3. THE CONTRACTOR MUST CHECK AND VERIFY DIMENSIONS; OBTAIN ALL UTILITY LOCATES AND OBTAIN ALL REQUIRED PERMITS/LICENSES AND VERIFY ELEVATIONS OF EXISTING SERVICES BEFORE PROCEEDING WITH ANY WORK.
4. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS (LATEST EDITION).
5. ENCROACHMENT ON NON-PARTICIPATING PROPERTIES IS STRICTLY PROHIBITED. THE CONTRACTOR AND/OR THEIR REPRESENTATIVES ARE TO BE AWARE OF ALL PARTICIPATING LAND OWNERS ON THE PROJECT AND THE PROJECTS CONSTRUCTIBLE LIMITS. ALL CONSTRUCTION ACTIVITY BEYOND THE CONSTRUCTIBLE LIMITS IS STRICTLY PROHIBITED.
6. THE CONTRACTOR IS RESPONSIBLE FOR RESTORATION OF ALL DAMAGED AND/OR DISTURBED PROPERTY WITHIN THE MUNICIPAL RIGHT-OF-WAY TO THE CURRENT MUNICIPAL STANDARDS AND SHALL CONFORM TO ROAD USE AGREEMENT.
7. THE CONTRACTOR IS TO BE RESPONSIBLE FOR ALL DRAINAGE AND MEASURES TO CONTROL WATER. THE SITE IS TO BE FINE GRADED/LEVELED LEAVING THE SITE IN A NEAT APPEARANCE SUCH THAT POSITIVE DRAINAGE IS ACHIEVED.
8. CONSTRUCTION TURNING RADIUS LIMITS IDENTIFY AREAS WHERE ADDITIONAL ROAD WIDTH IS REQUIRED TO ALLOW FOR ADEQUATE CLEARANCE FOR CONSTRUCTION VEHICLES.
9. ALL DISTURBED AREAS WITHIN THE PROPOSED WORKS ARE TO BE RE-VEGETATED USING NATIVE TOPSOIL AND SEED AS PER REA. MIX AND APPLICATION RATE/METHOD TO BE APPROVED PRIOR TO IMPLEMENTATION.
10. CLEARING AND GRUBBING AND REMOVALS TO BE COMPLETED IN ACCORDANCE WITH OPSS 201. TEMPORARY EROSION CONTROL TO BE COMPLETED IN ACCORDANCE WITH OPSS 577.
11. GRADING TO BE COMPLETED IN ACCORDANCE WITH OPSS 206.
12. GRANULAR MATERIAL TO BE USED IN ACCORDANCE WITH OPSS 1010.
13. ALL CULVERTS TO BE CONSTRUCTED IN ACCORDANCE WITH OPSS 421 AND AS PER OPSD 802.010.

Legend

*******For PHCL and Windlectric Use Only*******

Review and/or accepted does not constitute approval o design details, calculations or methods. It is the responsibility of the consultant to ensure all information contained within the drawings are in full compliance with contractual obligations

☐ Reviewed - Accepted and no comments

☐ Reviewed - Incorporate comments and resubmit

☐ Reviewed - Not accepted

Reviewed By	Date (dd-mmm-yyyy)
Project Manager - PHCL	Date (dd-mmm-yyyy)
Project Manager - Windlectric	Date (dd-mmm-yyyy)

Owner:

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	Revision	By	Appd.	YY.MM.DD
2	REVISED ENTRANCE	RJB	SC	17.07.07
1	ISSUED FOR CONSTRUCTION	RJB	SC	17.07.05
0	ISSUED FOR CLIENT REVIEW	RJB	SC	17.06.30
File Name: 160960595_C-500DT.dwg		Dwn. RJB	Chkd. SC	Dsgn. SC 17.06.07

Permit-Seal

PROFESSIONAL GEOSCIENTIST — SCOTT J.E. COWAN — PRACTISING MEMBER — 2751 — ONTARIO — July 6 17

LICENSED PROFESSIONAL ENGINEER — H.E. AMIRAULT — 100116290 — Jul 6/17 — PROVINCE OF ONTARIO

Client/Project

PENNECON HEAVY CIVIL

AMHERST ISLAND WIND PROJECT
75MW WIND FARM
Amherst Island, Loyalist Township, Ontario

Title

EROSION CONTROL AND TYPICAL DETAILS PLAN

Project No.	Scale	Drawing No.	Sheet	Revision
160960595	1:100H 0 1 3 5m; 1:25V 0 0.25 0.75 1.25m	C-501	3 of 3	2