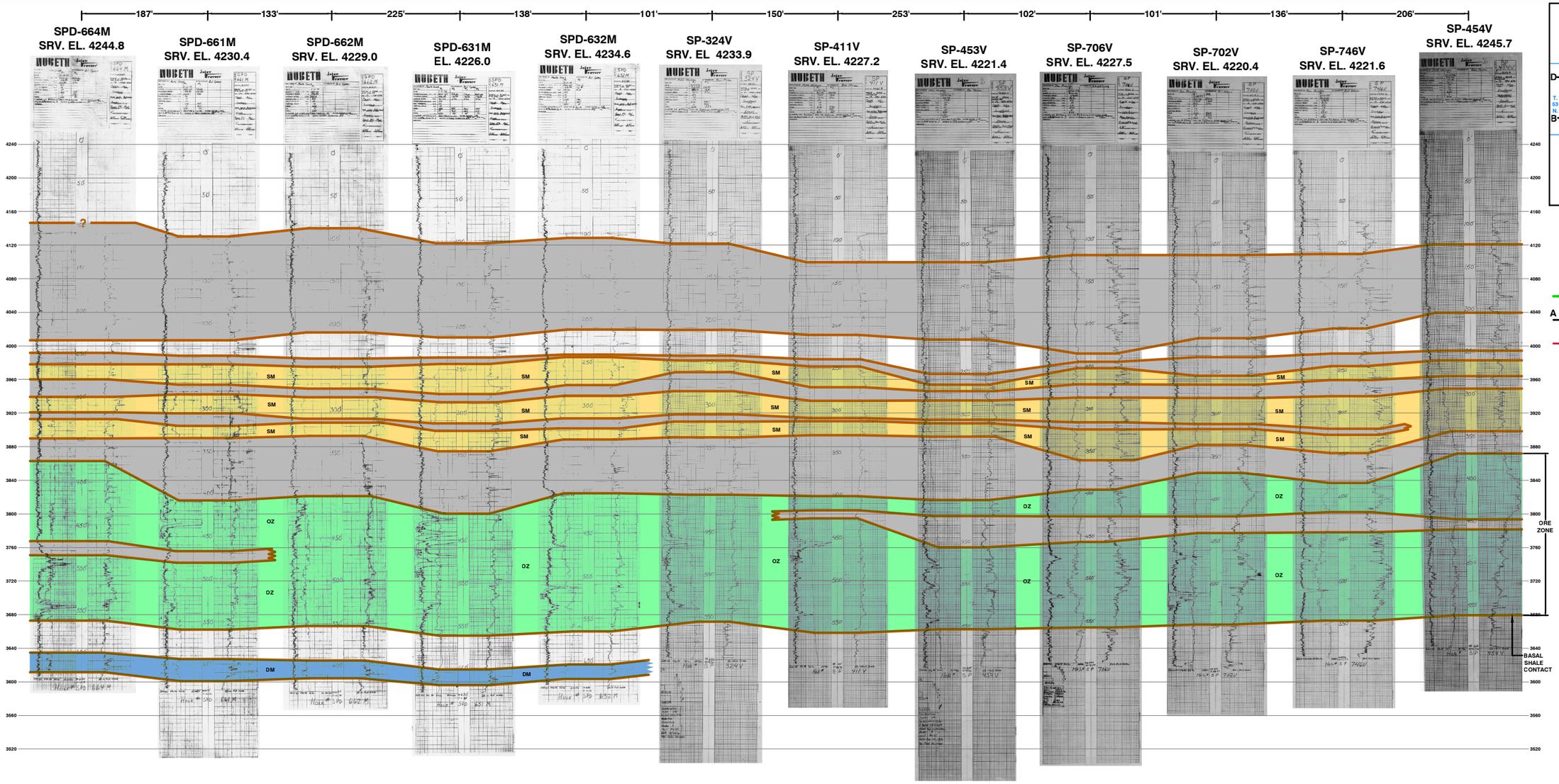

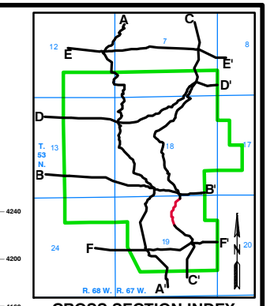

CROSS SECTION INDEX

0 4,000 8,000

GRAPHIC SCALE (FEET)

INDEX KEY

PROPOSED ROSS PERMIT BOUNDARY

A A' CROSS SECTION LOCATION

SEGMENT OF CROSS SECTION SHOWN ON THIS SHEET

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LEGEND

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- SA — SURFICIAL AQUIFER: FLUVIAL SANDSTONE OVERLAYING MUDSTONE AND CLAYSTONE (LA,LB INTERVAL) (SHOWN WHERE PRESENT)
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CERTIFICATE OF GEOLOGIST

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PROFESSIONAL GEOLOGIST
BENJAMIN J. SCHIFFER
PG-3446
WYOMING

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

ADDENDUM 2.6-C
FIGURE 23

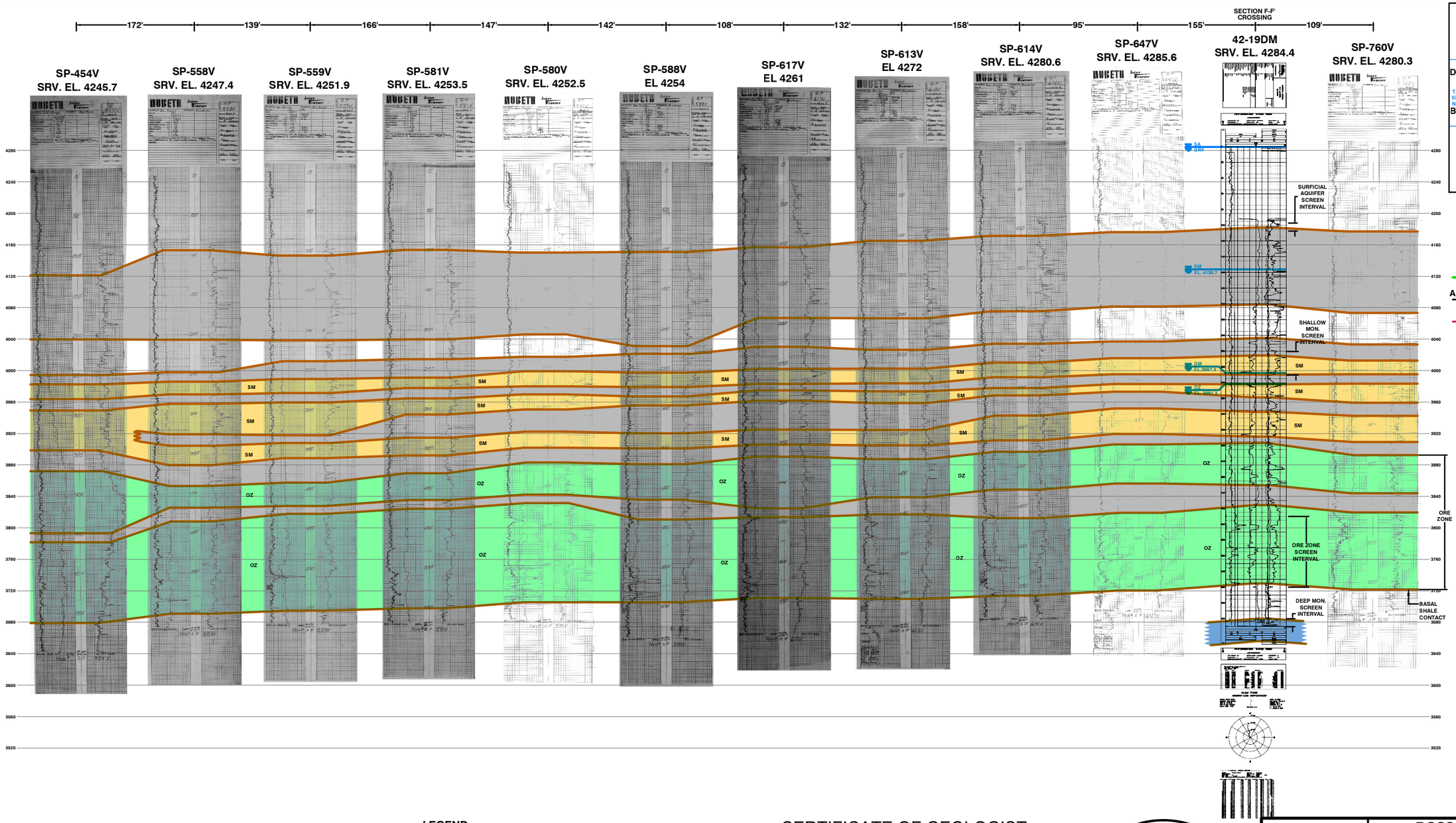
GEOLOGIC CROSS SECTION
C-C'
SEGMENT 7

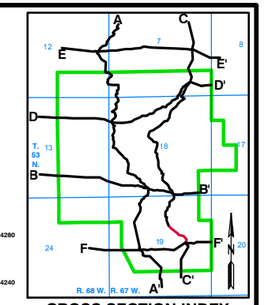
Drawn By: RAM
Checked By: BJS
Date: 10-10

WWC ENGINEERING
www.wwcengineering.com

FILE: ROSS_GEO_XSEC_CC7

K:\Peninsula Minerals\09142\DWGS ROSS GEOXS\ROSS GEO XSEC CC7.dwg, TRA 2.6-C FIGURE 23, 12/2/2010 1:39:58 PM, ramul





CROSS SECTION INDEX

0 4,000 8,000

GRAPHIC SCALE (FEET)

INDEX KEY

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STRATA ENERGY

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P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

ADDENDUM 2.6-C
FIGURE 24

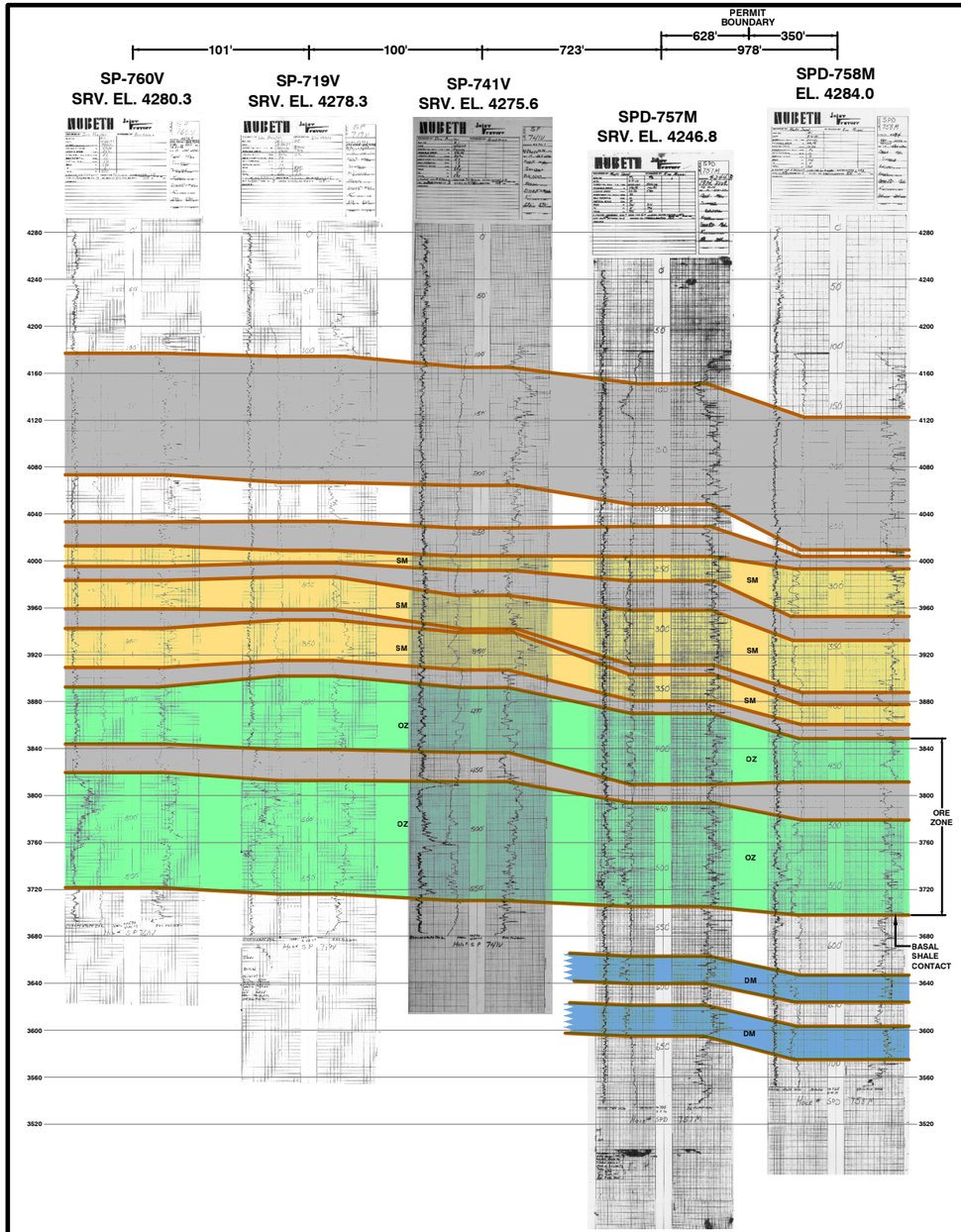
GEOLOGIC CROSS SECTION C-C' SEGMENT 8

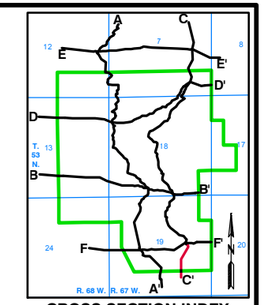
Drawn By: RAM
Checked By: BJS
Date: 10-10

WWC ENGINEERING
www.wwcengineering.com

FILE ROSS_GEO_XSEC_CC8

K:\Peninsula Minerals\09142\DWGS ROSS GEOXS\ROSS GEO XSEC CC8.dwg, TRA 2.6-C FIGURE 24, 12/2/2010 1:42:31 PM, ramul





CROSS SECTION INDEX

0 4,000 8,000
GRAPHIC SCALE (FEET)

INDEX KEY

- PROPOSED ROSS PERMIT BOUNDARY
- A — A' CROSS SECTION LOCATION
- SEGMENT OF CROSS SECTION SHOWN ON THIS SHEET

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WYOMING

STRATA ENERGY

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CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

ADDENDUM 2.6-C
FIGURE 25

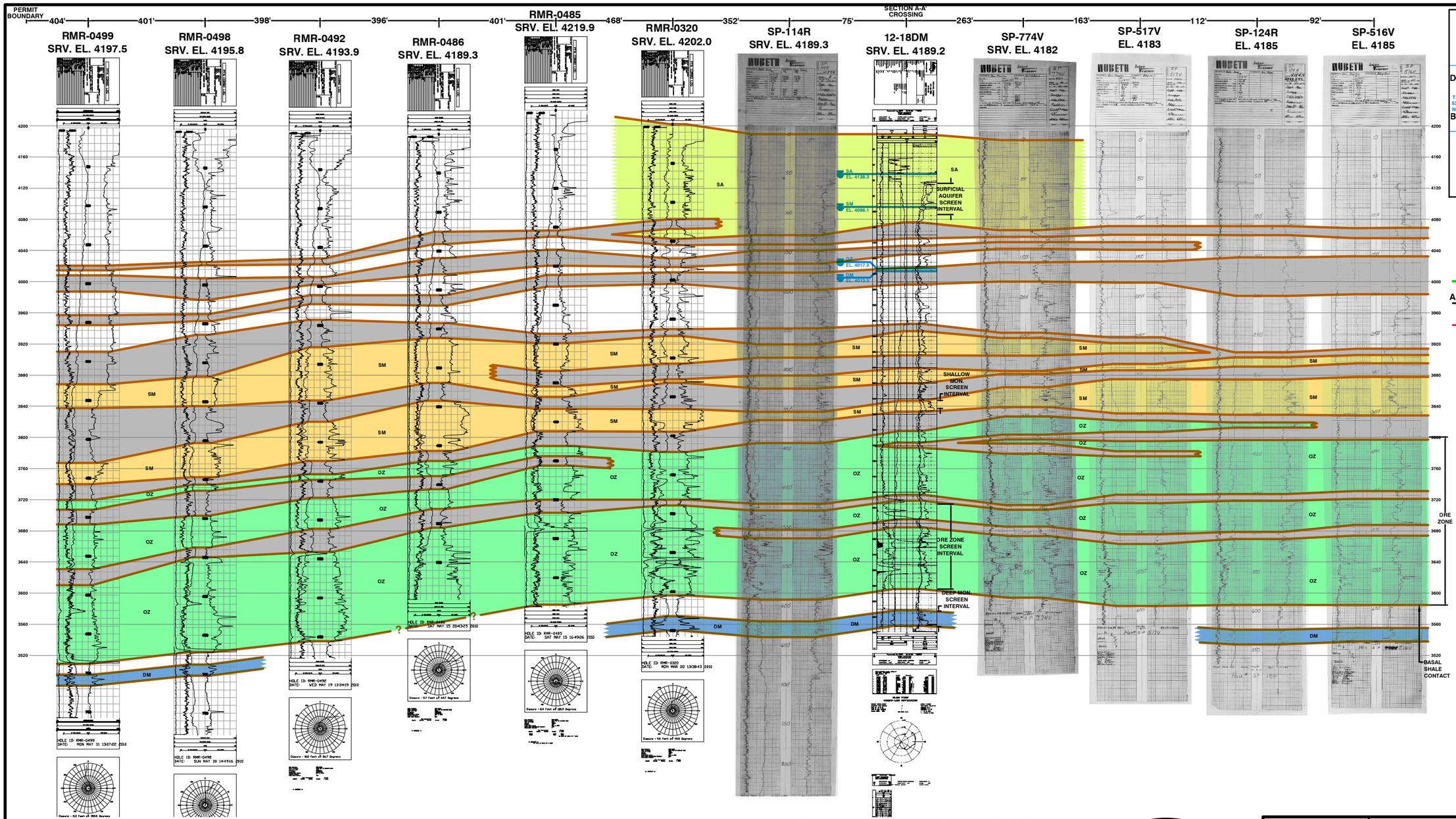
GEOLOGIC CROSS SECTION
C-C'
SEGMENT 9

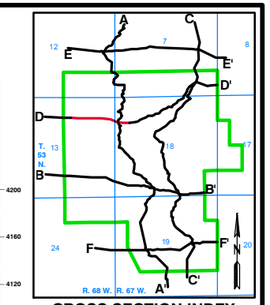
Drawn By: RAM
Checked By: BJS
Date: 10-10

WWC ENGINEERING
www.wwcengineering.com

FILE: ROSS_GEO_XSEC_CC9

K:\Peninsula Minerals\09142\DWGS ROSS GEOXS\ROSS GEO XSEC CC9.dwg, TRA 2.6-C FIGURE 25, 12/2/2010 1:44:42 PM, ramul





CROSS SECTION INDEX

0 4,000 8,000

GRAPHIC SCALE (FEET)

INDEX KEY

PROPOSED ROSS PERMIT BOUNDARY

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STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

ADDENDUM 2.6-C
FIGURE 26

GEOLOGIC CROSS SECTION D-D' SEGMENT 1

Drawn By: RAM
Checked By: BJS
Date: 10-10

FILE: ROSS_GEO_XSEC_DD1

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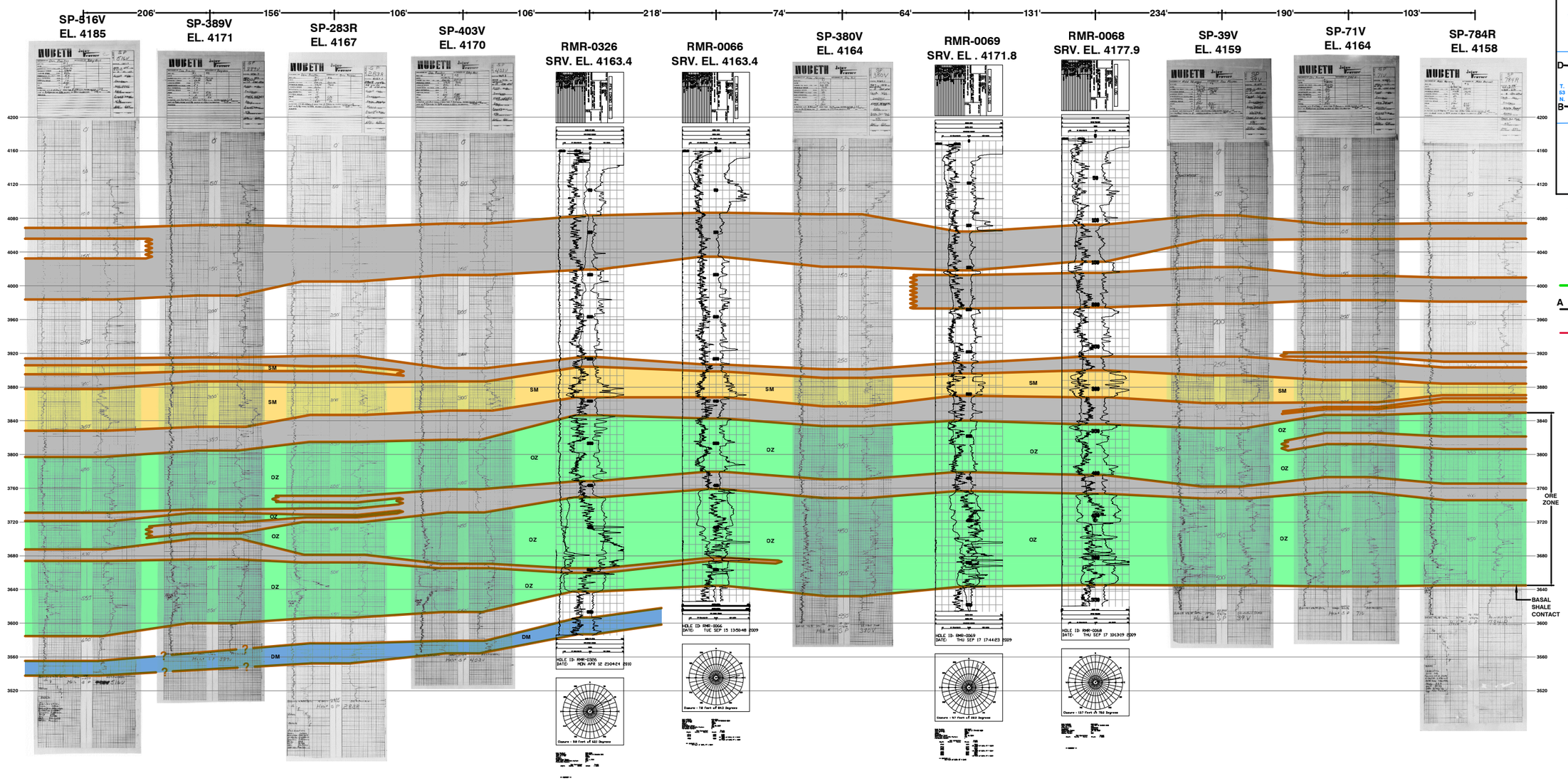
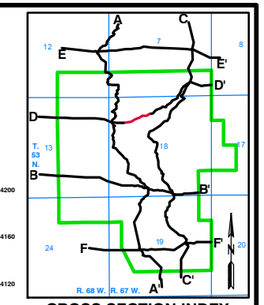
www.wwcengineering.com

K:\Peninsula Minerals\09142\DWGS ROSS GEOXS\ROSS GEO XSEC DD1.dwg, TRA 2.6-C FIGURE 26, 12/2/2010 2:19:39 PM, ramul





CROSS SECTION INDEX

0 4,000 8,000
GRAPHIC SCALE (FEET)

INDEX KEY

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SA	SURFICIAL AQUIFER: FLUVIAL SANDSTONE OVERLAYING MUDSTONE AND CLAYSTONE (LA,LB INTERVAL) (SHOWN WHERE PRESENT)
SM	SHALLOW MONITORING INTERVAL: SATURATED SAND INTERVAL OVERLYING AQUITARDS ABOVE THE UPPERMOST MINERALIZATION (LK, LL, LM INTERVAL)
OZ	ORE ZONE: INTERVAL CONTAINING LOWER LANCE / FOX HILLS SANDSTONE ROLL FRONTS (i.e. A,B,C,D & E WITHIN LT, LTS, FH INTERVAL)
DM	DEEP MONITORING INTERVAL: WATER BEARING UNIT (BFS INTERVAL) BENEATH BASAL SHALE CONTACT WITHIN BFH INTERVAL (SHOWN WHERE PRESENT)
SA EL. SM EL. OZ EL. DM EL.	WATER LEVEL ELEVATIONS IN RESPECTIVE AQUIFER FROM JULY 2010 WATER LEVEL SURVEY (SHOWN WHERE PRESENT)

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STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

ADDENDUM 2.6-C
FIGURE 27

GEOLOGIC CROSS SECTION D-D' SEGMENT 2

Drawn By: RAM
Checked By: BJS
Date: 10-10

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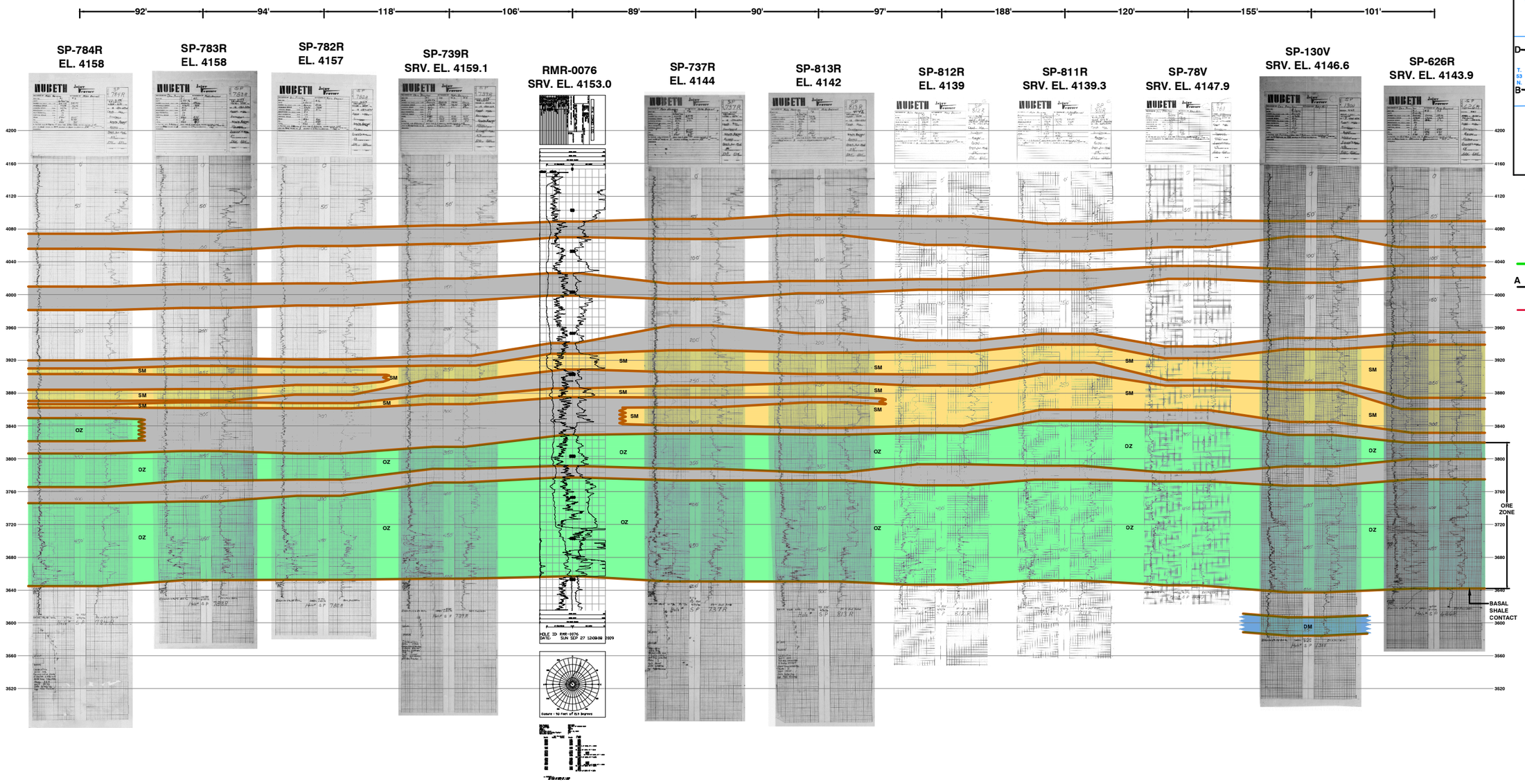
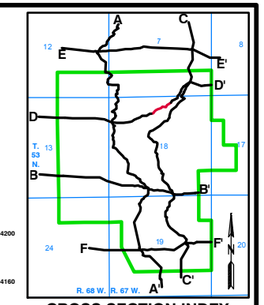
FILE: ROSS GEO XSEC DD2

K:\Peninsula Minerals\09142\DWGS ROSS GEOXS\ROSS GEO XSEC DD2.dwg, TRA 2.6-C FIGURE 27, 12/2/2010 2:22:07 PM, ramul





CROSS SECTION INDEX

0 4,000 8,000

GRAPHIC SCALE (FEET)

INDEX KEY

PROPOSED ROSS PERMIT BOUNDARY

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ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

ADDENDUM 2.6-C
FIGURE 28

GEOLOGIC CROSS SECTION D-D' SEGMENT 3

Drawn By: RAM
Checked By: BJS
Date: 10-10

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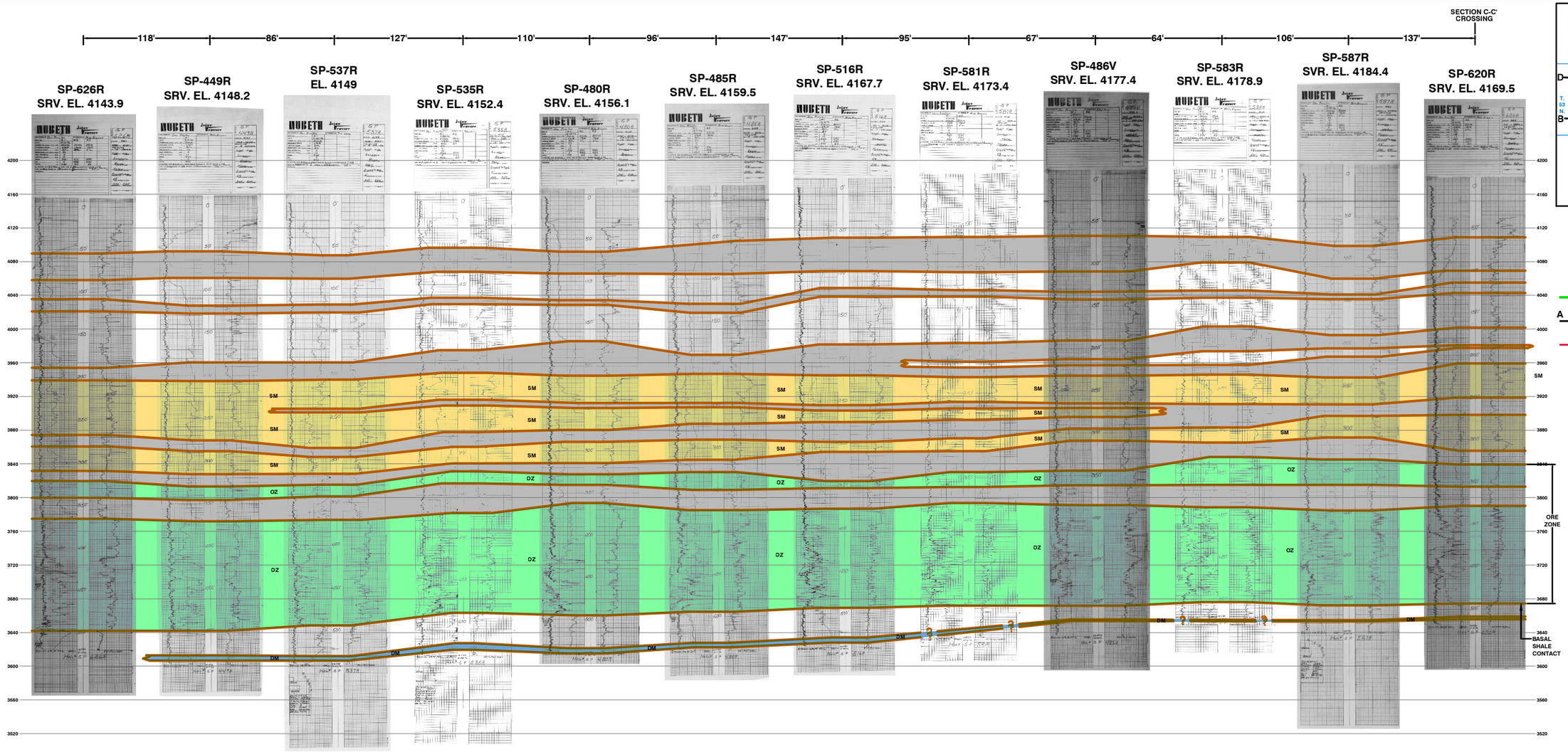
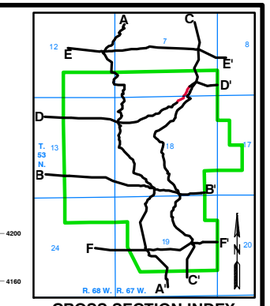
FILE: ROSS_GEO_XSEC_DD3

K:\Peninsula Minerals\09142\DWGS ROSS GEOXS\ROSS GEO XSEC DD3.dwg, TRA 2.6-C FIGURE 28, 12/2/2010 2:24:26 PM, ramul





CROSS SECTION INDEX

0 4,000 8,000

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INDEX KEY

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ROSS ISR PROJECT
CROOK COUNTY, WY
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GILLETTE, WY 82716

REVISIONS

Date	Description

ADDENDUM 2.6-C
FIGURE 29

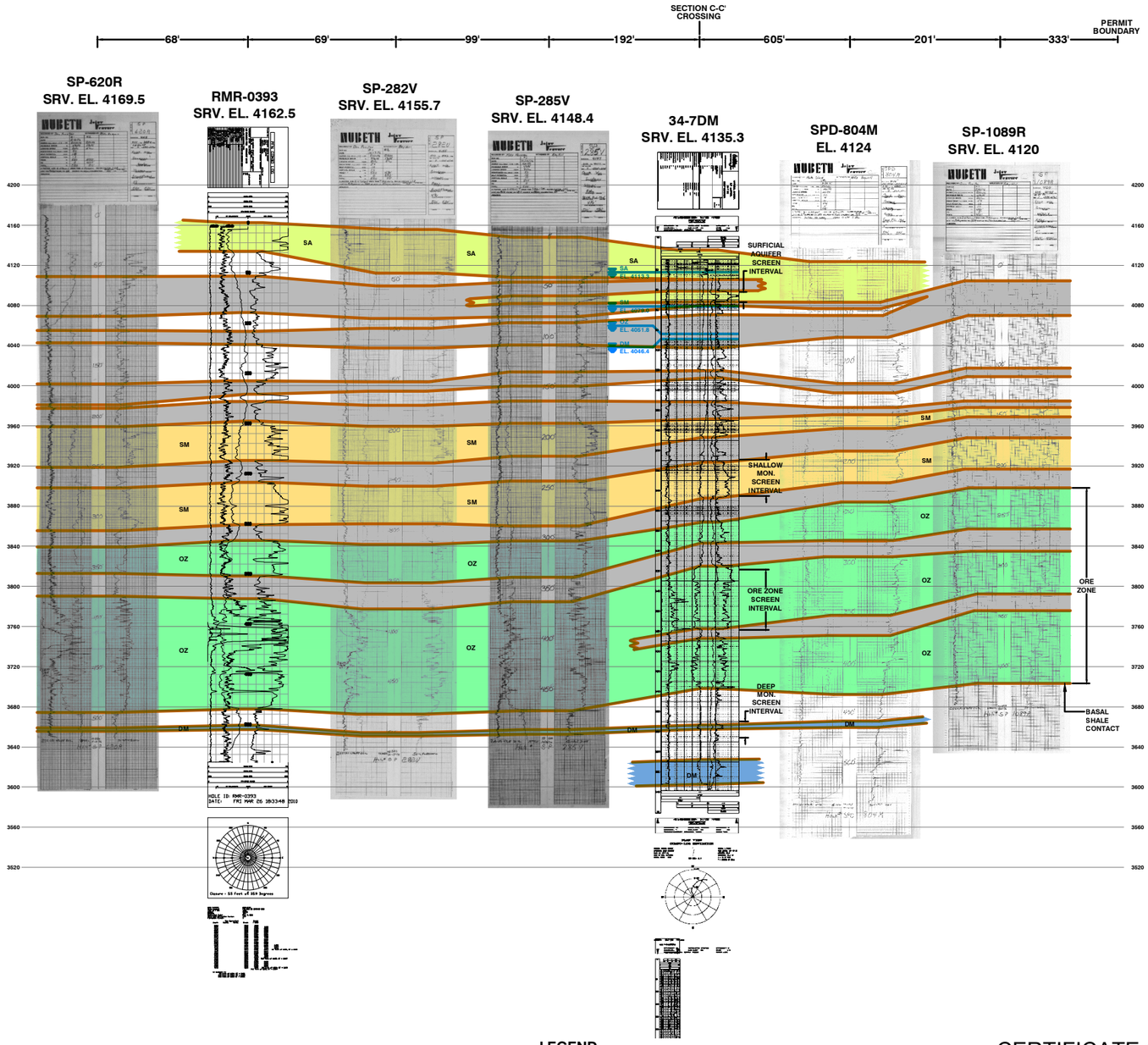
GEOLOGIC CROSS SECTION D-D' SEGMENT 4

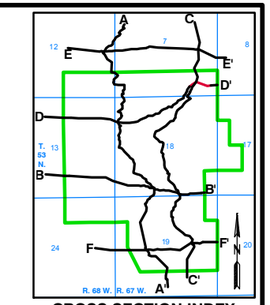
Drawn By: RAM
Checked By: BJS
Date: 10-10

FILE: ROSS_GEO_XSEC_DD4

WWC ENGINEERING
www.wwcengineering.com

K:\Peninsula Minerals\09142\DWGS ROSS GEOXS\ROSS GEO XSEC DD4.dwg, TRA 2.6-C FIGURE 29, 12/2/2010 2:27:23 PM, ramul





CROSS SECTION INDEX

0 4,000 8,000

GRAPHIC SCALE (FEET)

INDEX KEY

- PROPOSED ROSS PERMIT BOUNDARY
- A — A' CROSS SECTION LOCATION
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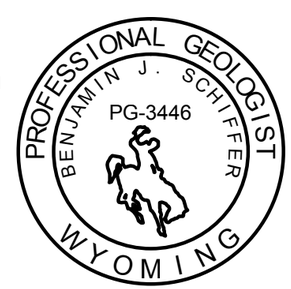

STRATA ENERGY

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CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

ADDENDUM 2.6-C
FIGURE 30

GEOLOGIC CROSS SECTION D-D' SEGMENT 5

Drawn By: RAM
Checked By: BJS
Date: 10-10

FILE: ROSS_GEO_XSEC_DD5

WWC ENGINEERING
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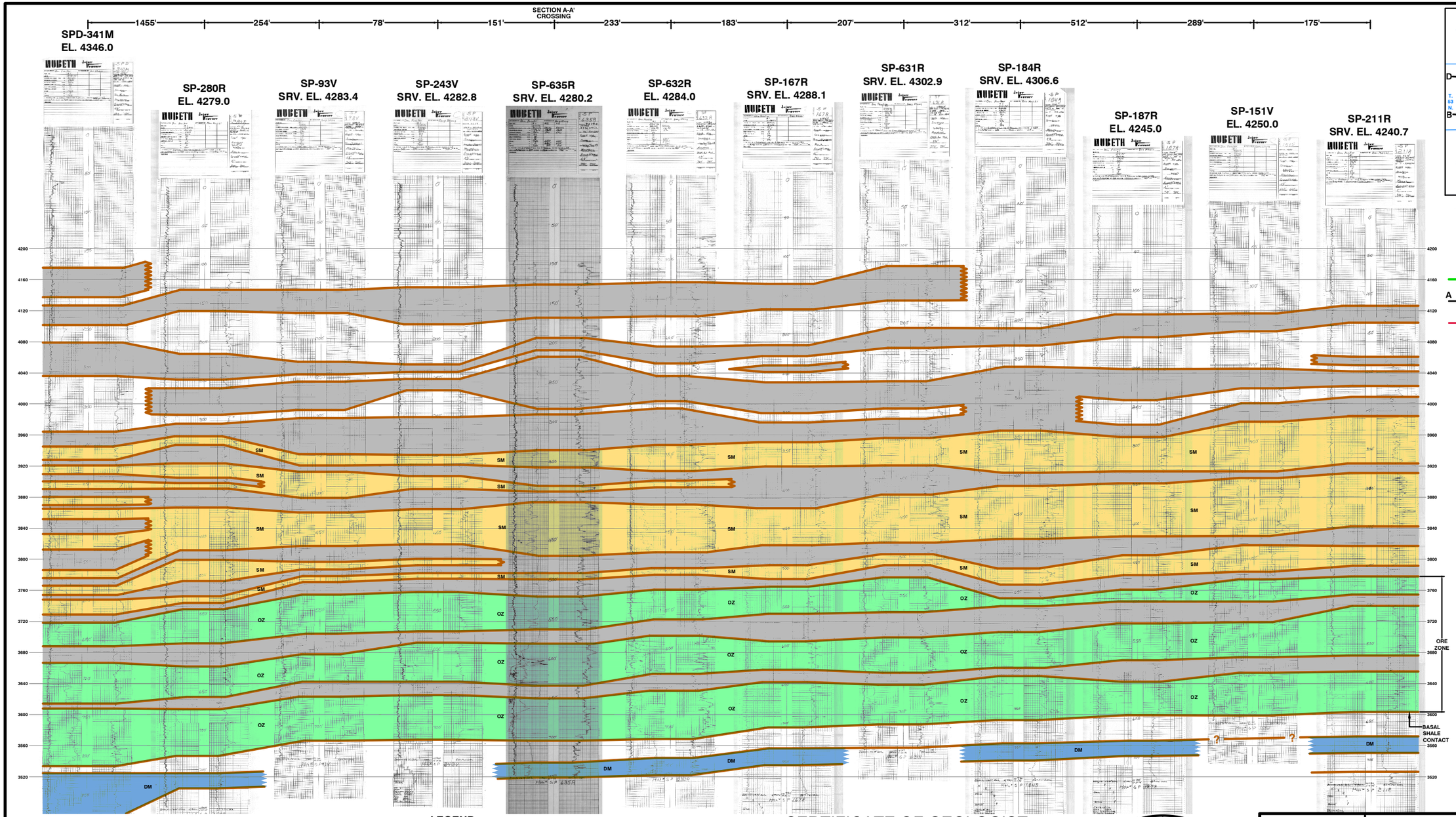
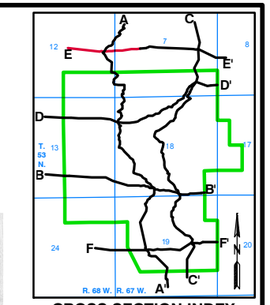
K:\Peninsula Minerals\09142\DWGS ROSS GEOXS\ROSS GEO XSEC DD5.dwg, TRA 2.6-C FIGURE 30, 12/2/2010 2:29:52 PM, ramul





CROSS SECTION INDEX

0 4,000 8,000

GRAPHIC SCALE (FEET)

INDEX KEY

PROPOSED ROSS PERMIT BOUNDARY

A A' CROSS SECTION LOCATION

SEGMENT OF CROSS SECTION SHOWN ON THIS SHEET

NOTES:

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2. STRATIGRAPHIC UNITS (i.e. LA, LB. etc.) ARE FROM TYPE LOG PRESENTED IN FIGURE 2.6-7.

LEGEND

- AQUITARDS: SHALE-RICH, LOW PERMEABILITY INTERVALS.
- SA — SURFICIAL AQUIFER: FLUVIAL SANDSTONE OVERLAYING MUDSTONE AND CLAYSTONE (LA,LB INTERVAL) (SHOWN WHERE PRESENT)
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- SA EL. SM EL. OZ EL. DM EL. — WATER LEVEL ELEVATIONS IN RESPECTIVE AQUIFER FROM JULY 2010 WATER LEVEL SURVEY (SHOWN WHERE PRESENT)

CERTIFICATE OF GEOLOGIST

I, Benjamin J. Schiffer, hereby certify that this drawing was prepared by myself or under my direct supervision and that it correctly represents the geologic conditions described in the accompanying application which is provided to meet the requirements of the Wyoming Environmental Quality Act and its accompanying regulations.

PROFESSIONAL GEOLOGIST
BENJAMIN J. SCHIFFER
PG-3446
WYOMING

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

ADDENDUM 2.6-C
FIGURE 31

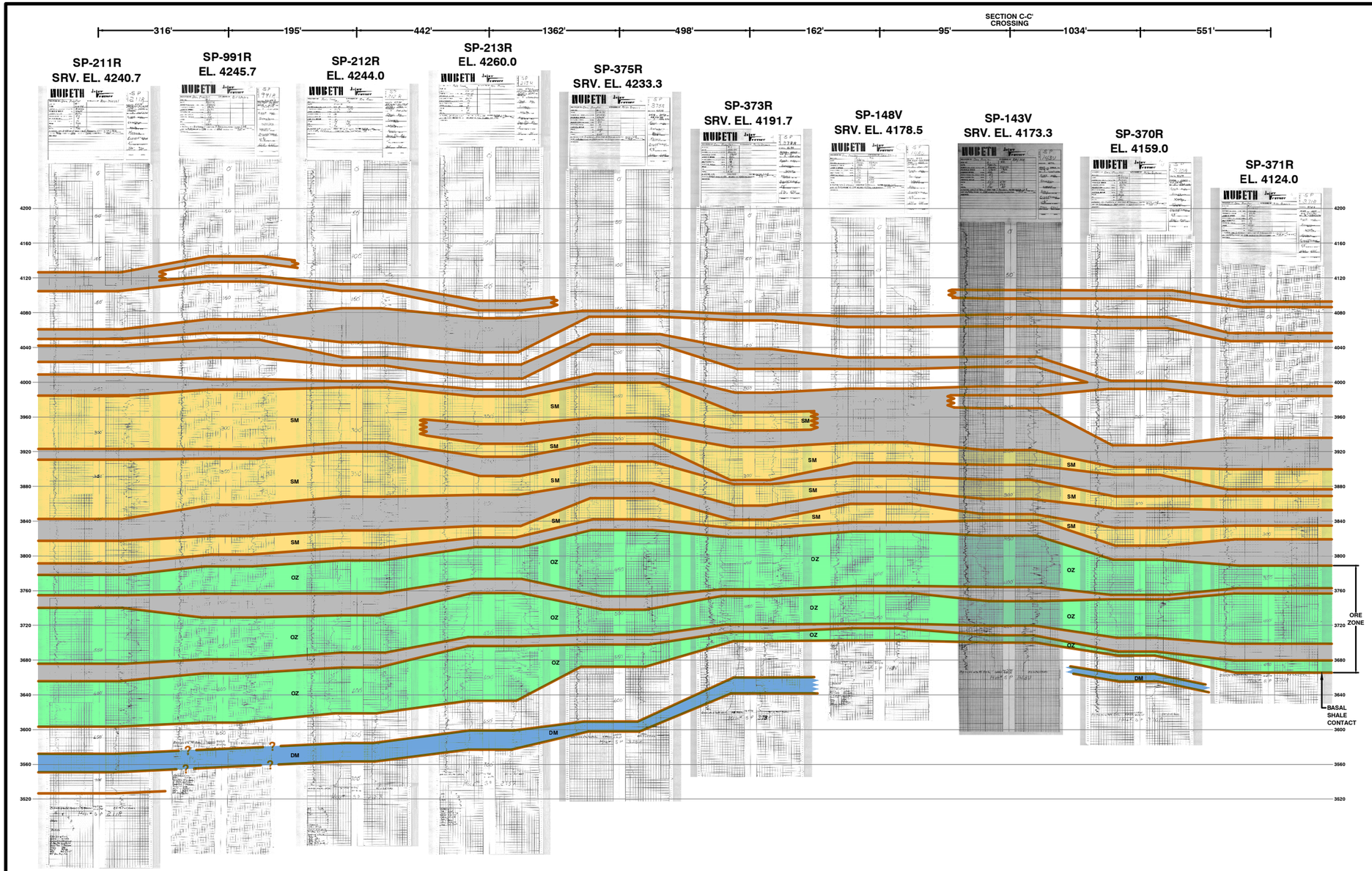
GEOLOGIC CROSS SECTION E-E' SEGMENT 1

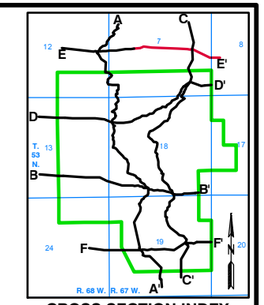
Drawn By: RAM
Checked By: BJS
Date: 10-10

FILE: ROSS GEO XSEC EE1

WWC ENGINEERING
www.wwcengineering.com

K:\Peninsula Minerals\09142\DWGS ROSS GEOXS\ROSS GEO XSEC EE1.dwg, TRA 2.6-C FIGURE 31, 12/2/2010 2:44:56 PM, ramul





CROSS SECTION INDEX

0 4,000 8,000

GRAPHIC SCALE (FEET)

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STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

ADDENDUM 2.6-C
FIGURE 32

GEOLOGIC CROSS SECTION E-E' SEGMENT 2

Drawn By: RAM
Checked By: BJS
Date: 10-10

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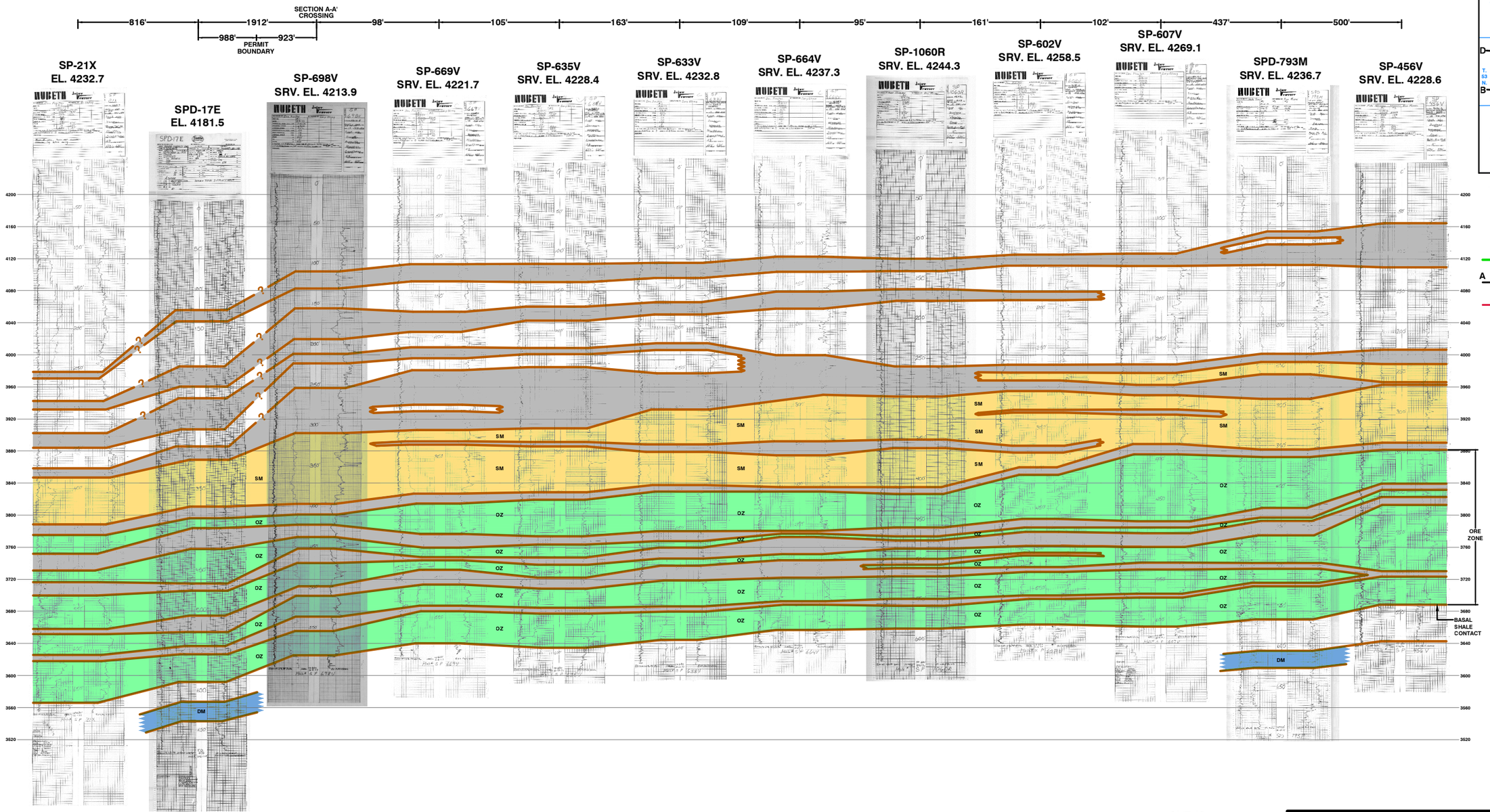
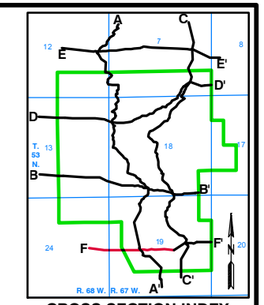
FILE: ROSS_GEO_XSEC_EE2

K:\Peninsula Minerals\09142\DWGS ROSS GEOXS\ROSS GEO XSEC EE2.dwg, TRA 2.6-C FIGURE 32, 12/2/2010 2:51:13 PM, ramul





CROSS SECTION INDEX

0 4,000 8,000
GRAPHIC SCALE (FEET)

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WYOMING

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

ADDENDUM 2.6-C
FIGURE 33

GEOLOGIC CROSS SECTION F-F' SEGMENT 1

Drawn By: RAM
Checked By: BJS
Date: 10-10

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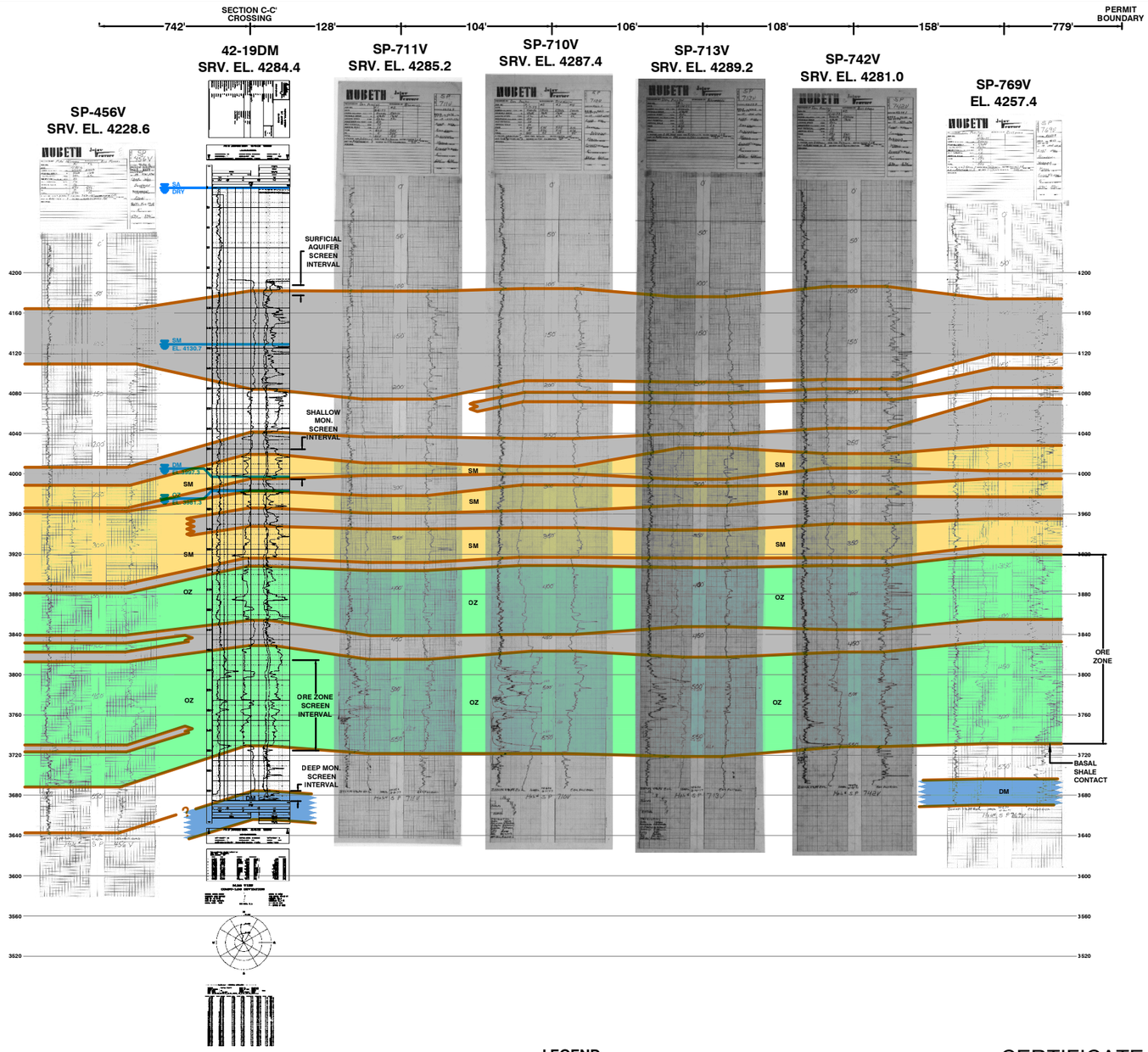
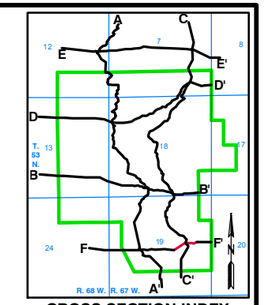
FILE: ROSS_GEO_XSEC_FF1

K:\Peninsula Minerals\09142\DWGS ROSS GEOXS\ROSS GEO XSEC FF1.dwg, TRA 2.6-C FIGURE 33, 12/2/2010 2:54:03 PM, ramul





CROSS SECTION INDEX

0 4,000 8,000

GRAPHIC SCALE (FEET)

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GILLETTE, WY 82716

REVISIONS	
Date	Description

ADDENDUM 2.6-C
FIGURE 34

GEOLOGIC CROSS SECTION
F-F'
SEGMENT 2

Drawn By: RAM
Checked By: BJS
Date: 10-10

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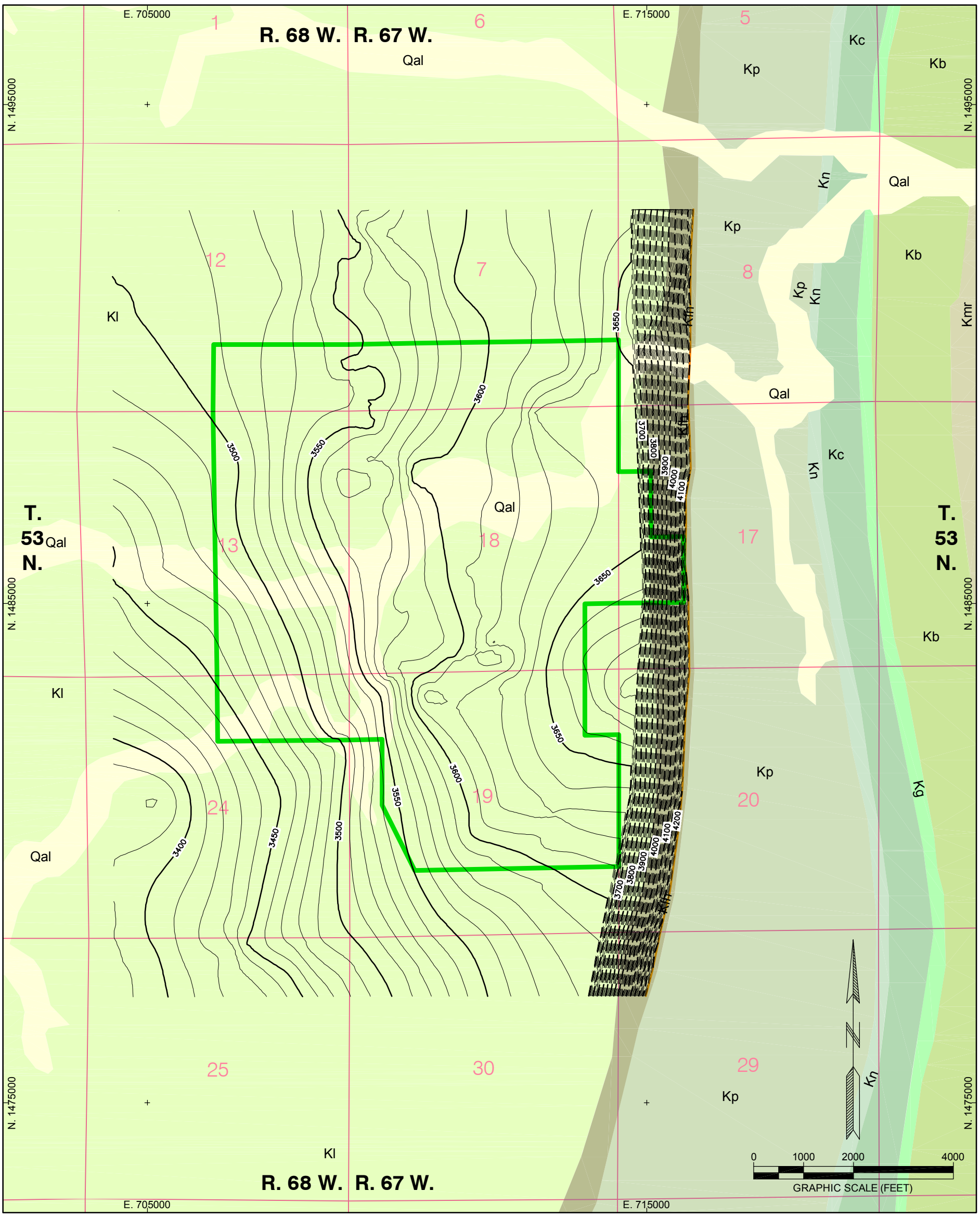
FILE: ROSS GEO XSEC FF2

K:\Peninsula Minerals\09142\DWGS ROSS GEOXS\ROSS GEO XSEC FF2.dwg, TRA 2.6-C FIGURE 34, 12/2/2010 3:38:51 PM, ramul

ADDENDUM 2.6-D

ISOPACHS AND STRUCTURE

CONTOUR MAPS



Drawing Coordinates: WY83EF

LEGEND

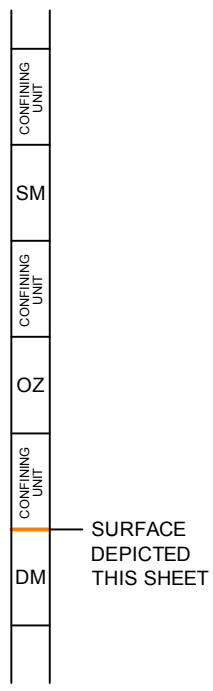
PROPOSED ROSS PERMIT BOUNDARY

3600 — TOP STRUCTURE ELEVATION (10' CONTOUR INTERVAL). CONTOUR LINES ARE DASHED WHERE ELEVATIONS WERE PROJECTED ALONG THE BLACK HILLS MONOCLINE FLEXURE.

PROJECTED TOP OF DEEP MONITORING INTERVAL AT GROUND LEVEL

NOTES:

1. SEE FIGURE D5-4 LEGEND FOR BEDROCK GEOLOGY MAP UNITS. BEDROCK GEOLOGY MAPPING ADAPTED FROM SUTHERLAND (2008).
2. SURFACES SHOWN DERIVED FROM GEMCOM GEMS© SOFTWARE CUSTOMIZED FOR STRATA ENERGY, INC. AND DEVELOPED IN SUPPORT OF SITE SPECIFIC GROUNDWATER MODEL.



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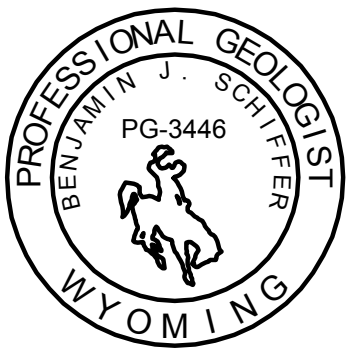

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P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

ADDENDUM 2.6-D
FIGURE 1
STRUCTURE CONTOURS OF TOP OF DEEP MONITORING SURFACE

Drawn By: RAM
Checked By: BJS
Date: 11-10
FILE: ROSS_GEO_SURF_ISO.DWG

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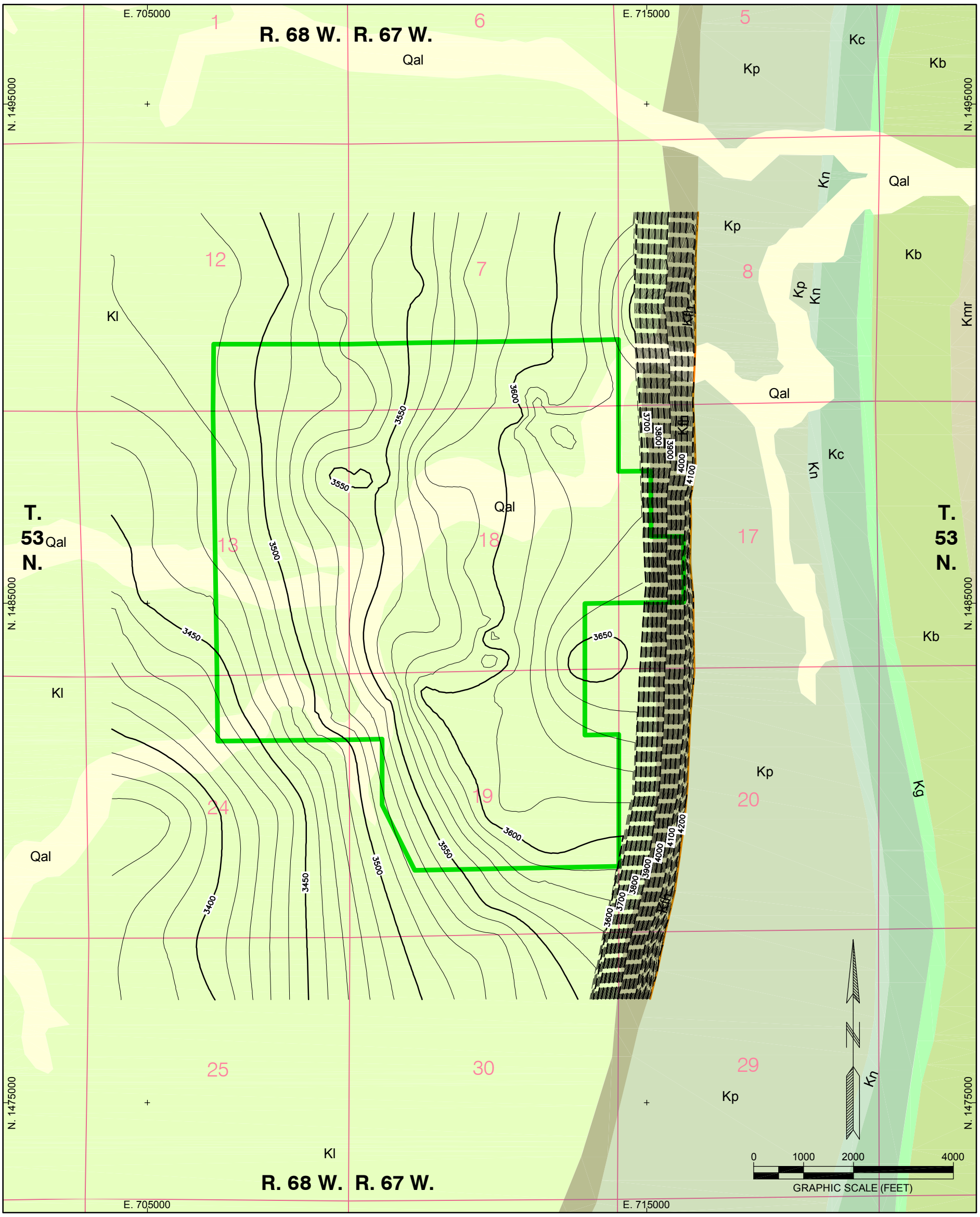

Drawing Coordinates: WY83EF

LEGEND

- PROPOSED ROSS PERMIT BOUNDARY
- 3600 — BOTTOM STRUCTURE ELEVATION (10' CONTOUR INTERVAL). CONTOUR LINES ARE DASHED WHERE ELEVATIONS WERE PROJECTED ALONG THE BLACK HILLS MONOCLINE FLEXURE.
- PROJECTED TOP OF DEEP MONITORING INTERVAL AT GROUND LEVEL

NOTES:

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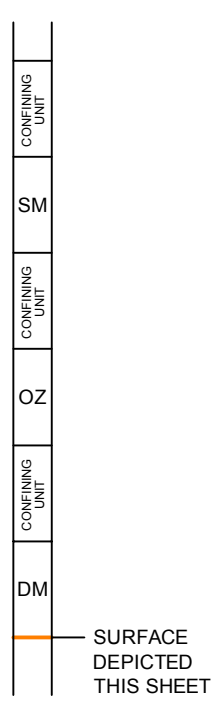

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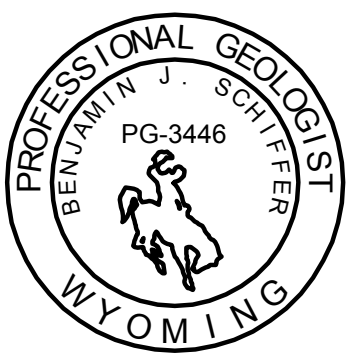

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

ADDENDUM 2.6-D
FIGURE 2
STRUCTURE CONTOURS OF BOTTOM OF DEEP MONITORING SURFACE

Drawn By: RAM
Checked By: BJS
Date: 11-10
FILE: ROSS_GEO_SURF_ISO.DWG

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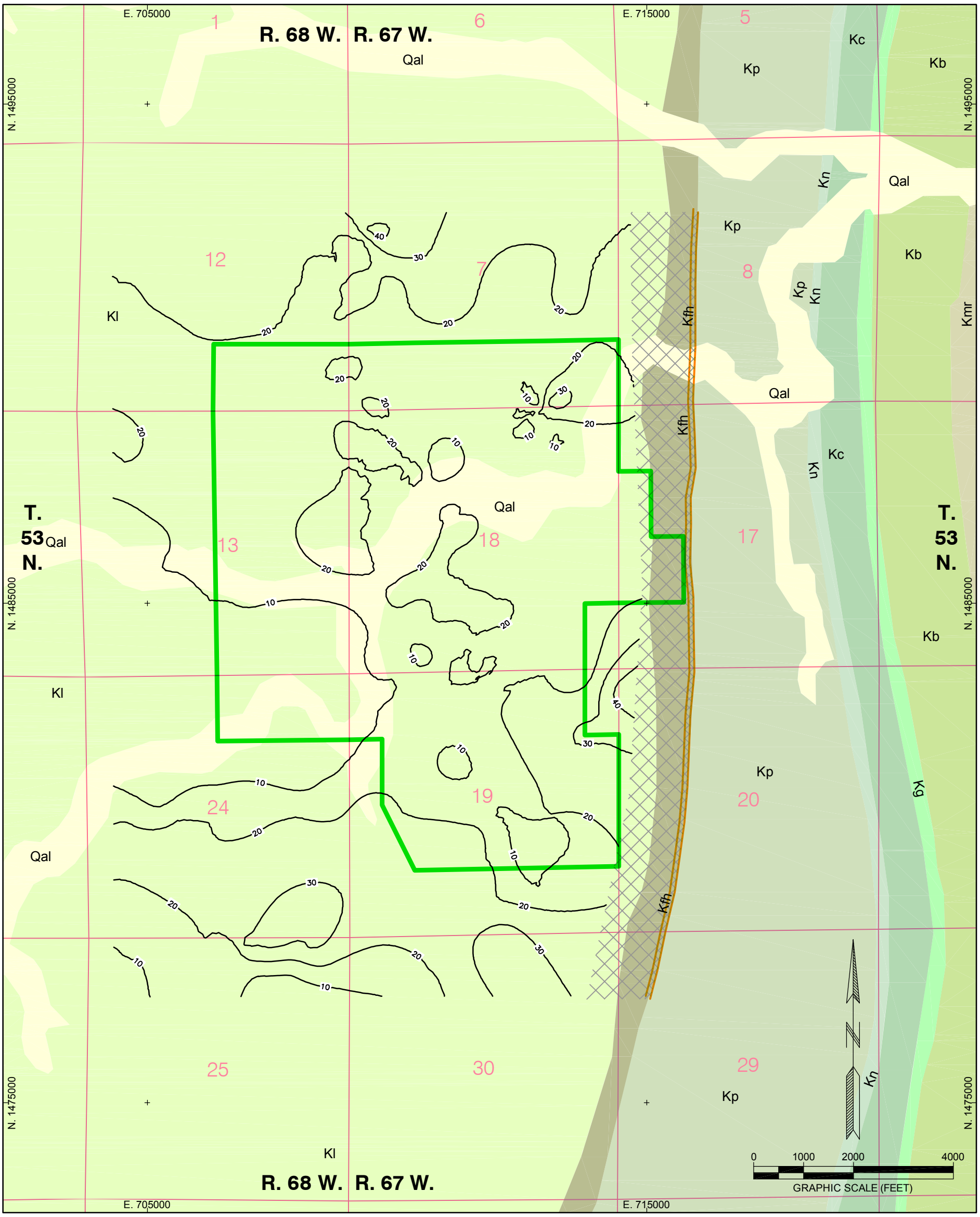


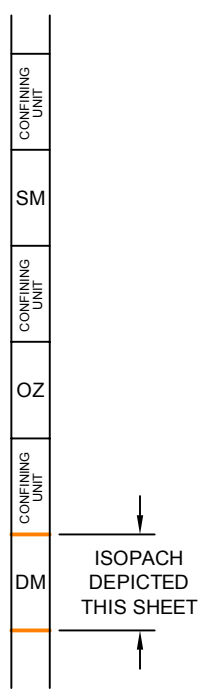
Drawing Coordinates: WY83EF

LEGEND

- PROPOSED ROSS PERMIT BOUNDARY
- 100 — ISOPACH LINE (10' CONTOUR INTERVAL)
- PROJECTED OUTCROP/SUBCROP OF DEEP MONITORING INTERVAL
- THICKNESS OF DEEP MONITORING INTERVAL UNDETERMINED DUE TO STEEPLY DIPPING BEDS

NOTES:

1. SEE FIGURE D5-4 LEGEND FOR BEDROCK GEOLOGY MAP UNITS. BEDROCK GEOLOGY MAPPING ADAPTED FROM SUTHERLAND (2008).
2. SURFACES SHOWN DERIVED FROM GEMCOM GEMS© SOFTWARE CUSTOMIZED FOR STRATA ENERGY, INC. AND DEVELOPED IN SUPPORT OF SITE SPECIFIC GROUNDWATER MODEL.



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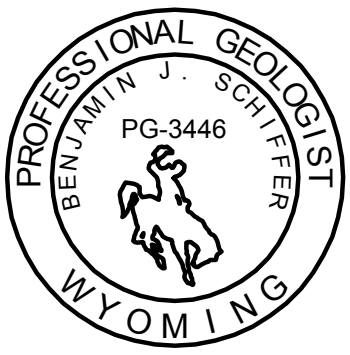

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ADDENDUM 2.6-D
FIGURE 3
ISOPACH OF DEEP MONITORING INTERVAL

Drawn By: RAM
Checked By: BJS
Date: 11-10
FILE: ROSS_GEO_SURF_ISO.DWG

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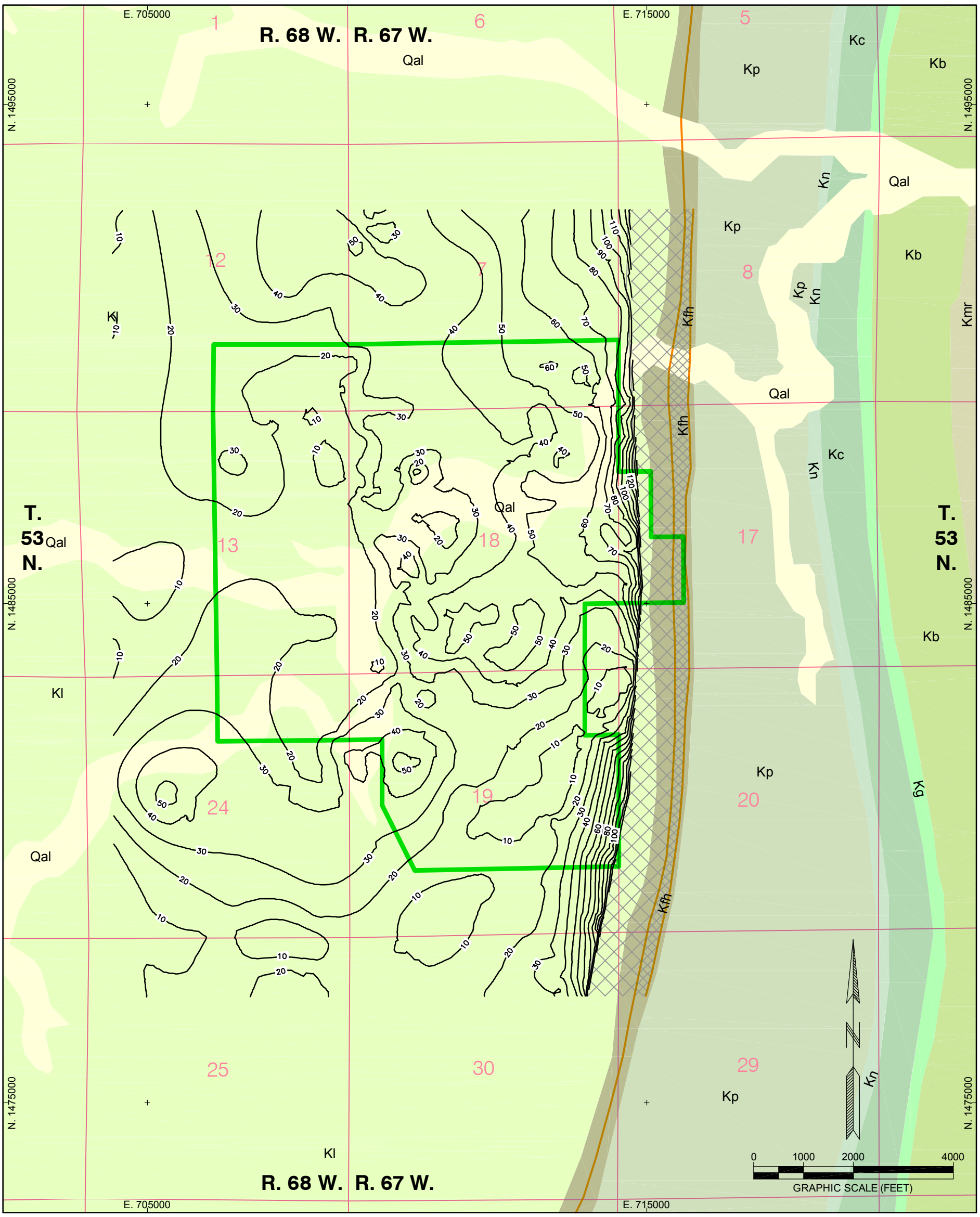

Drawing Coordinates: WY83EF

LEGEND

- PROPOSED ROSS PERMIT BOUNDARY
- 100 — ISOPACH LINE (10' CONTOUR INTERVAL)
- PROJECTED OUTCROP/SUBCROP OF CONFINING UNIT BELOW ORE ZONE
- THICKNESS OF CONFINING UNIT BELOW ORE ZONE UNDETERMINED DUE TO STEEPLY DIPPING BEDS

NOTES:

1. SEE FIGURE D5-4 LEGEND FOR BEDROCK GEOLOGY MAP UNITS. BEDROCK GEOLOGY MAPPING ADAPTED FROM SUTHERLAND (2008).
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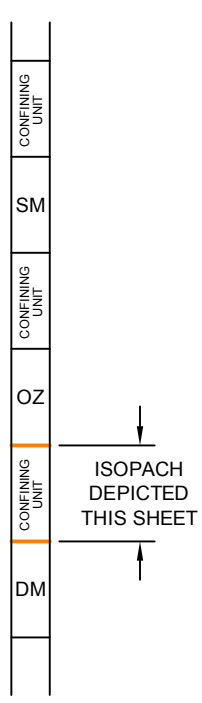

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Date	Description

ADDENDUM 2.6-D
FIGURE 4
ISOPACH OF CONFINING UNIT BELOW ORE ZONE

Drawn By: RAM
Checked By: BJS
Date: 11-10
FILE: ROSS_GEO_SURF_ISO.DWG

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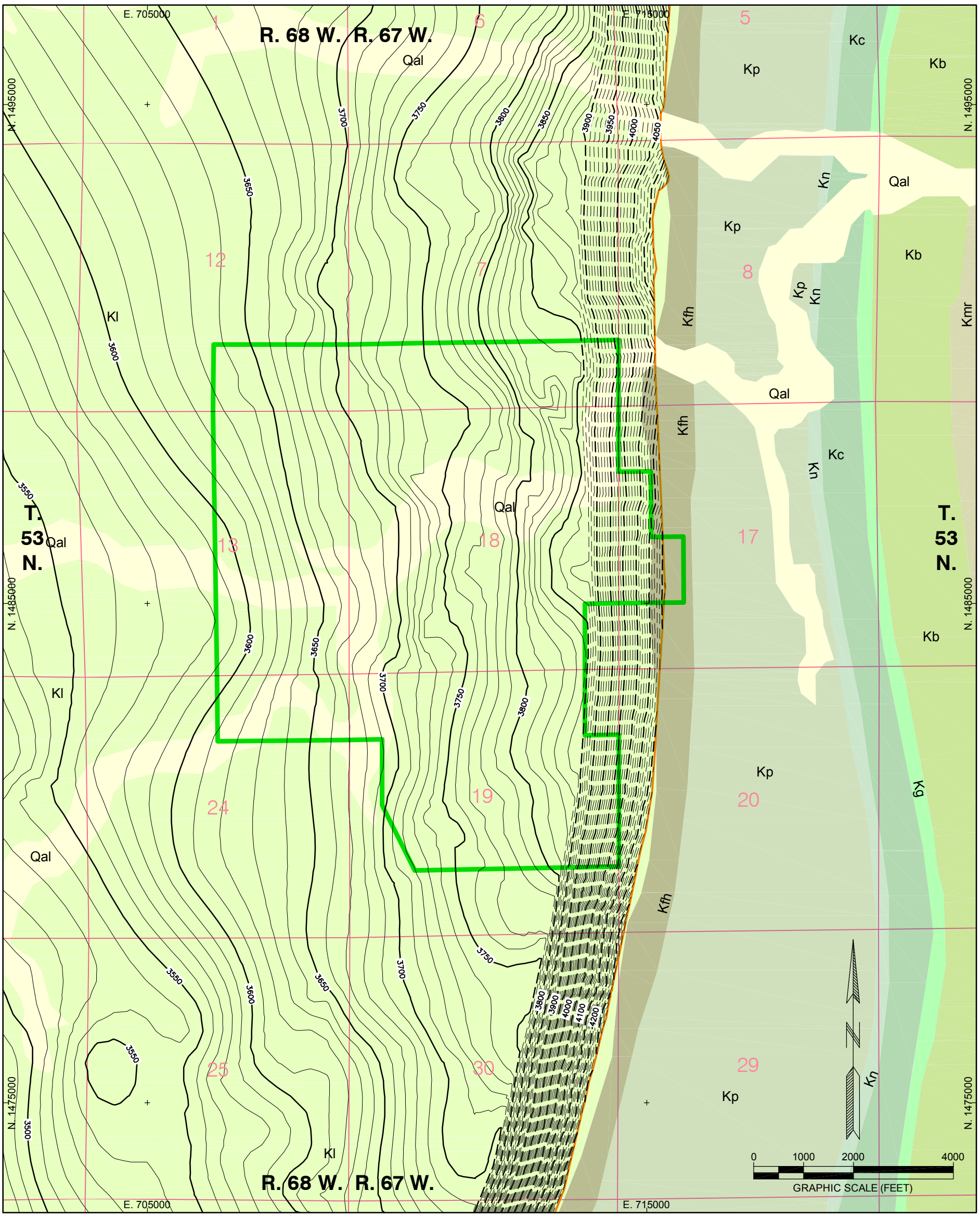

Drawing Coordinates: WY83EF

LEGEND

PROPOSED ROSS PERMIT BOUNDARY

3600 / 3600 — TOP STRUCTURE ELEVATION (10' CONTOUR INTERVAL). CONTOUR LINES ARE DASHED WHERE ELEVATIONS WERE PROJECTED ALONG THE BLACK HILLS MONOCLINE FLEXURE.

PROJECTED TOP OF ORE ZONE AT GROUND LEVEL

NOTES:

1. SEE FIGURE D5-4 LEGEND FOR BEDROCK GEOLOGY MAP UNITS. BEDROCK GEOLOGY MAPPING ADAPTED FROM SUTHERLAND (2008).
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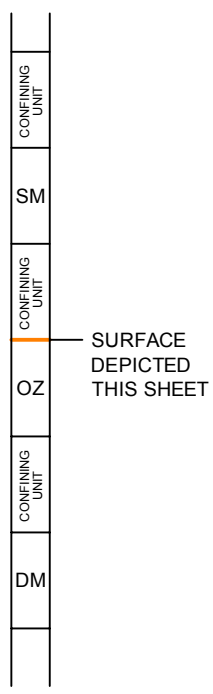

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ADDENDUM 2.6-D
FIGURE 5
STRUCTURE CONTOURS OF TOP OF ORE ZONE SURFACE

Drawn By: RAM
Checked By: BJS
Date: 11-10
FILE: ROSS_GEO_SURF_ISO.DWG

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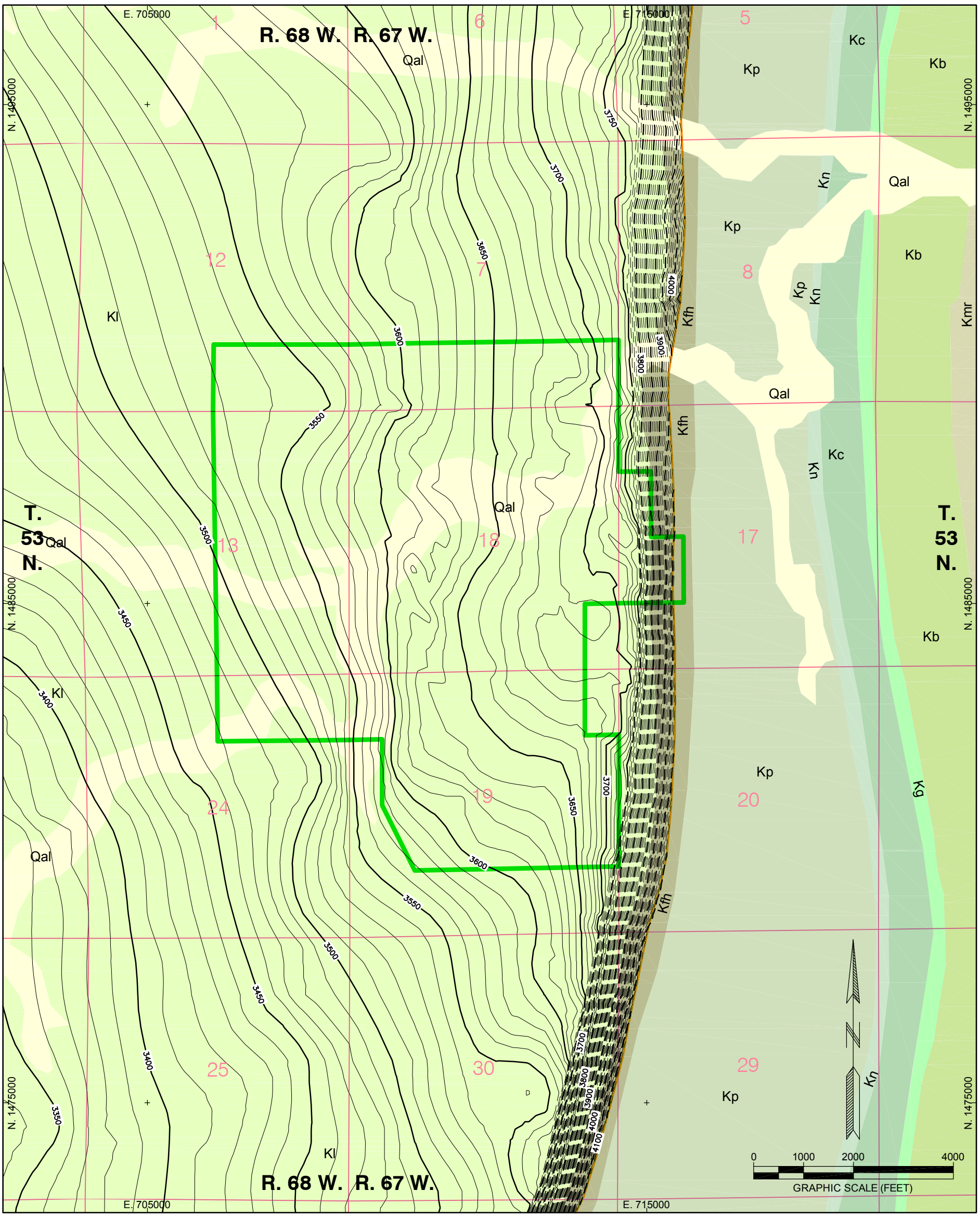

Drawing Coordinates: WY83EF

LEGEND

- PROPOSED ROSS PERMIT BOUNDARY
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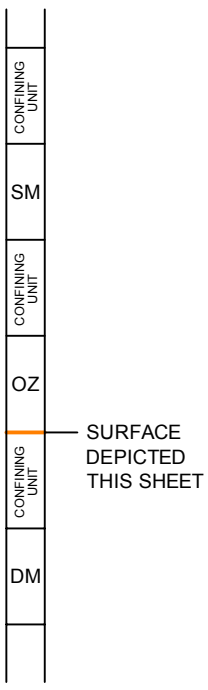
- PROJECTED BOTTOM OF ORE ZONE AT GROUND LEVEL

NOTES:

1. SEE FIGURE D5-4 LEGEND FOR BEDROCK GEOLOGY MAP UNITS. BEDROCK GEOLOGY MAPPING ADAPTED FROM SUTHERLAND (2008).
2. SURFACES SHOWN DERIVED FROM GEMCOM GEMS© SOFTWARE CUSTOMIZED FOR STRATA ENERGY, INC. AND DEVELOPED IN SUPPORT OF SITE SPECIFIC GROUNDWATER MODEL.



CERTIFICATE OF GEOLOGIST

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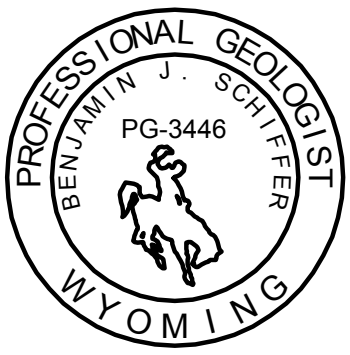

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CROOK COUNTY, WY
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REVISIONS

Date	Description

ADDENDUM 2.6-D
FIGURE 6
STRUCTURE CONTOURS OF BOTTOM OF ORE ZONE SURFACE

Drawn By: RAM
Checked By: BJS
Date: 11-10
FILE: ROSS_GEO_SURF_ISO.DWG

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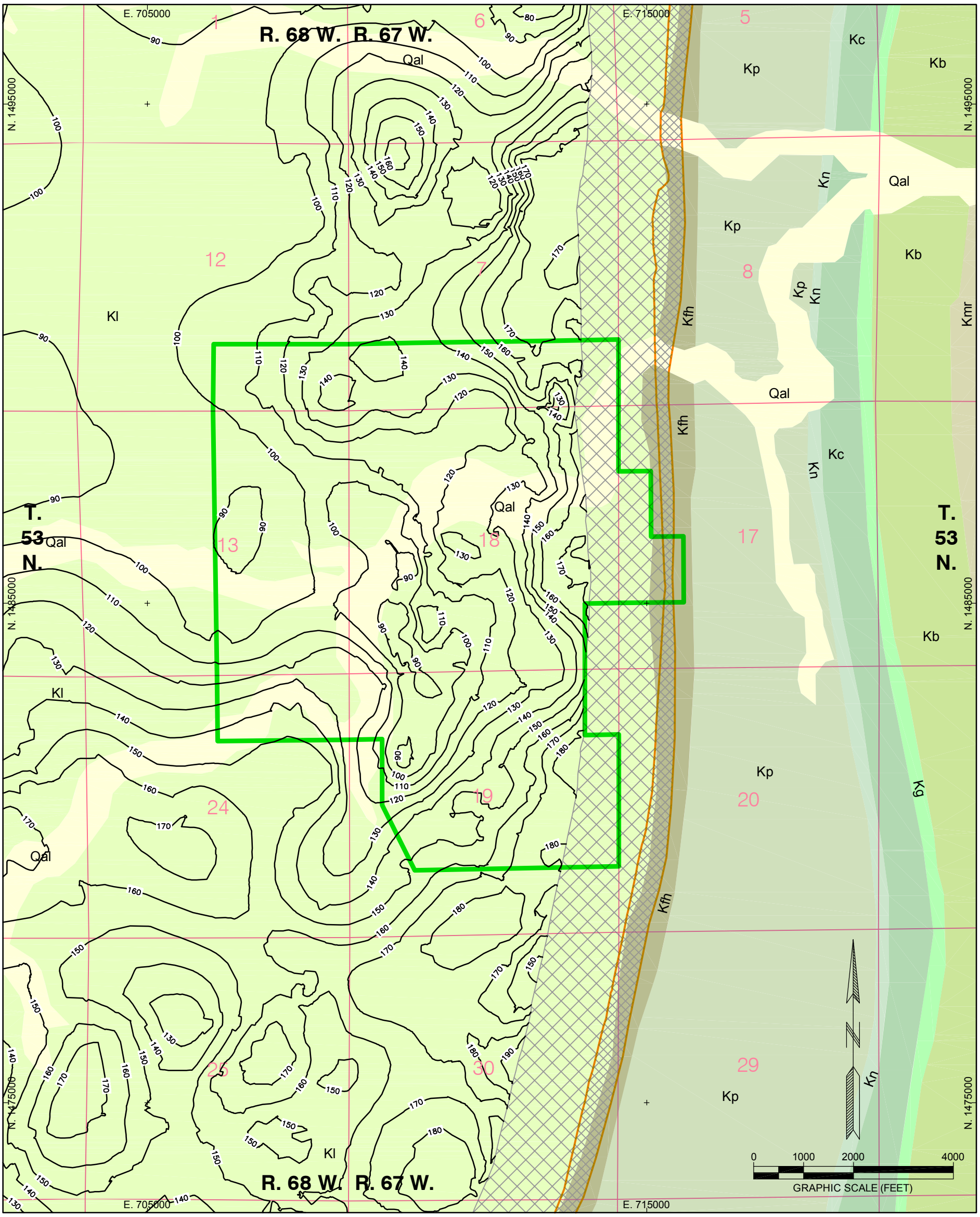


Drawing Coordinates: WY83EF

LEGEND

PROPOSED ROSS PERMIT BOUNDARY

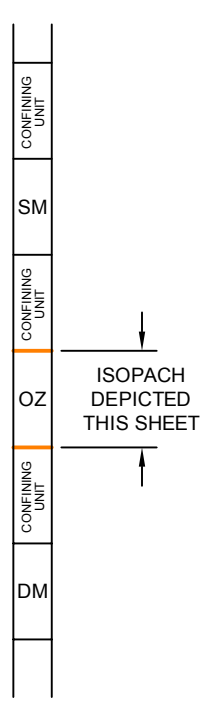
100 ISOPACH LINE (10' CONTOUR INTERVAL)

PROJECTED OUTCROP/SUBCROP OF ORE ZONE

THICKNESS OF ORE ZONE UNDETERMINED DUE TO STEEPLY DIPPING BEDS

NOTES:

1. SEE FIGURE D5-4 LEGEND FOR BEDROCK GEOLOGY MAP UNITS. BEDROCK GEOLOGY MAPPING ADAPTED FROM SUTHERLAND (2008).
2. SURFACES SHOWN DERIVED FROM GEMCOM GEMS© SOFTWARE CUSTOMIZED FOR STRATA ENERGY, INC. AND DEVELOPED IN SUPPORT OF SITE SPECIFIC GROUNDWATER MODEL.



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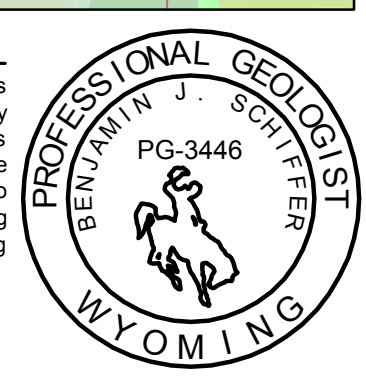

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Date	Description

ADDENDUM 2.6-D
FIGURE 7

ISOPACH OF ORE ZONE

Drawn By: RAM
Checked By: BJS
Date: 11-10

FILE: ROSS_GEO_SURF_ISO.DWG

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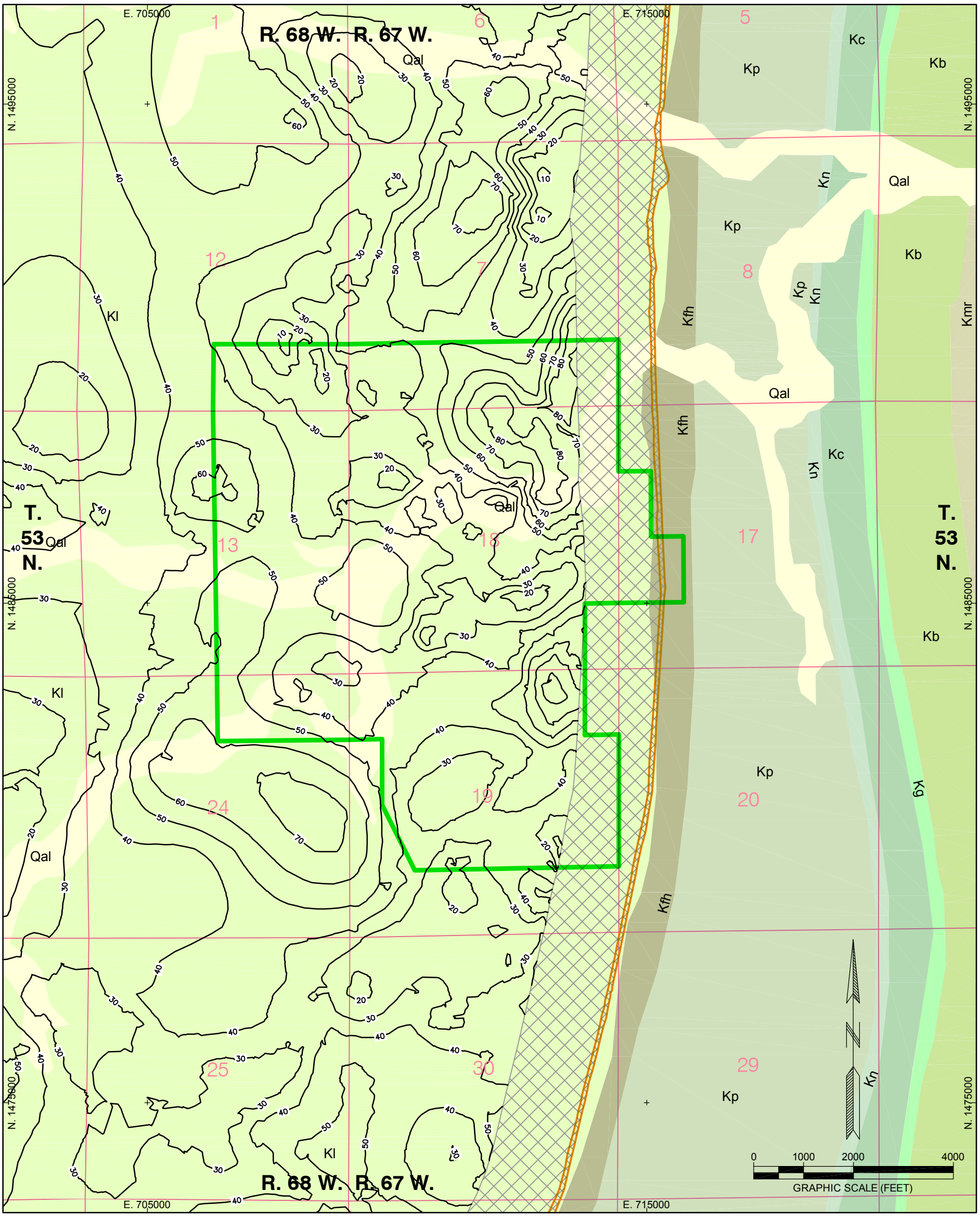
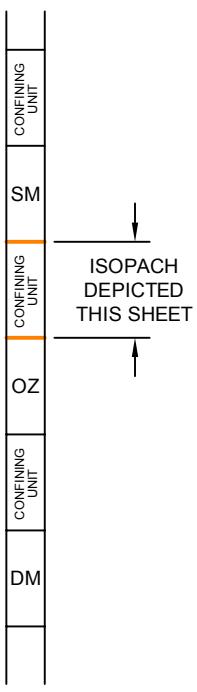


Drawing Coordinates: WY83EF

LEGEND

- PROPOSED ROSS PERMIT BOUNDARY
- 100 — ISOPACH LINE (10' CONTOUR INTERVAL)
- PROJECTED OUTCROP/SUBCROP OF CONFINING UNIT ABOVE ORE ZONE
- THICKNESS OF CONFINING UNIT ABOVE ORE ZONE UNDETERMINED DUE TO STEEPLY DIPPING BEDS



NOTES:

1. SEE FIGURE D5-4 LEGEND FOR BEDROCK GEOLOGY MAP UNITS. BEDROCK GEOLOGY MAPPING ADAPTED FROM SUTHERLAND (2008).
2. SURFACES SHOWN DERIVED FROM GEMCOM GEMS© SOFTWARE CUSTOMIZED FOR STRATA ENERGY, INC. AND DEVELOPED IN SUPPORT OF SITE SPECIFIC GROUNDWATER MODEL.

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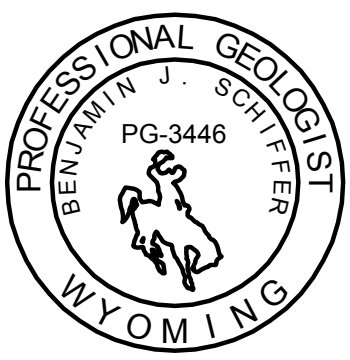

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REVISIONS

Date	Description

ADDENDUM 2.6-D
FIGURE 8

ISOPACH OF CONFINING UNIT ABOVE ORE ZONE

Drawn By: RAM
Checked By: BJS
Date: 11-10
FILE: ROSS_GEO_SURF_ISO.DWG

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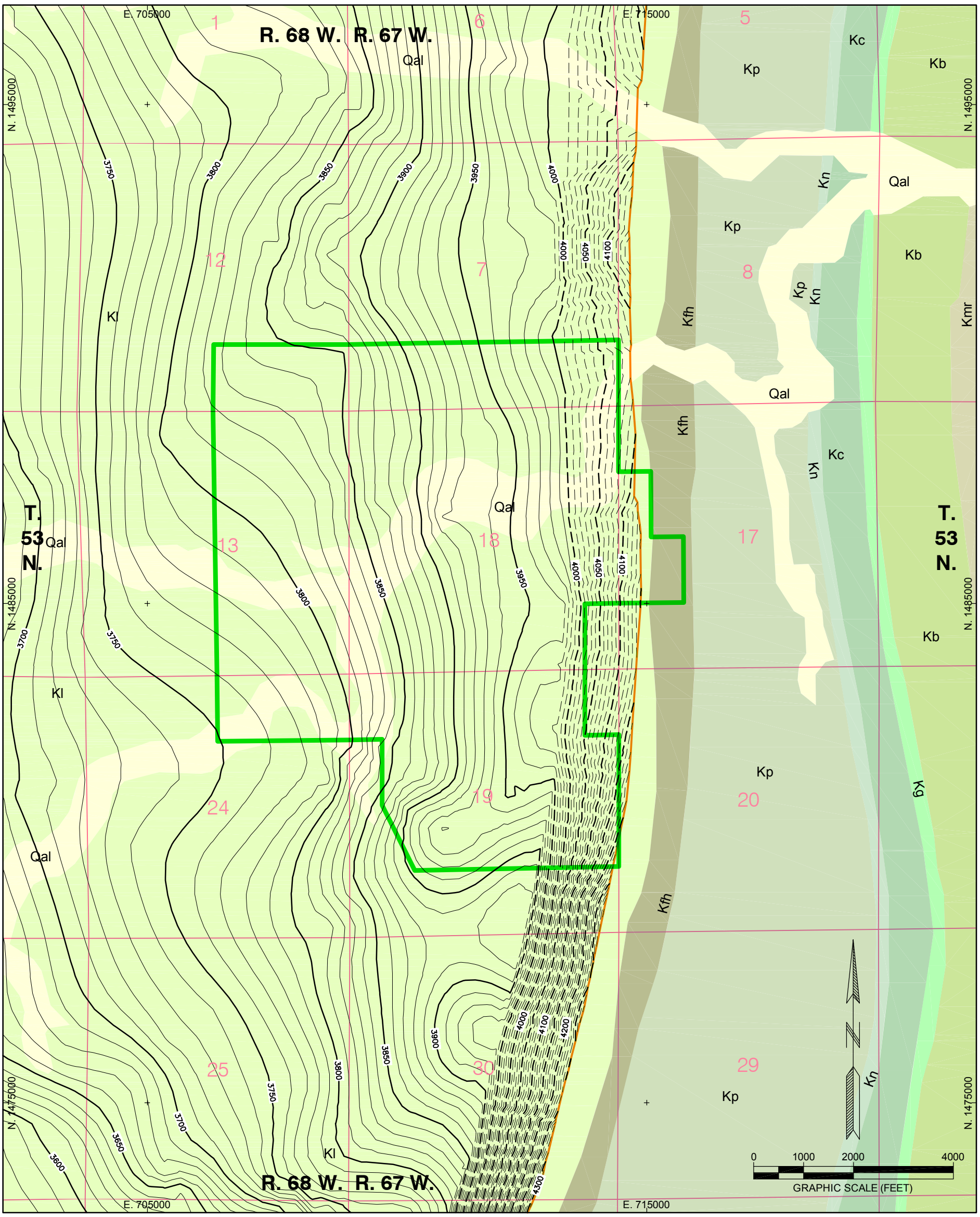


Drawing Coordinates: WY83EF

LEGEND

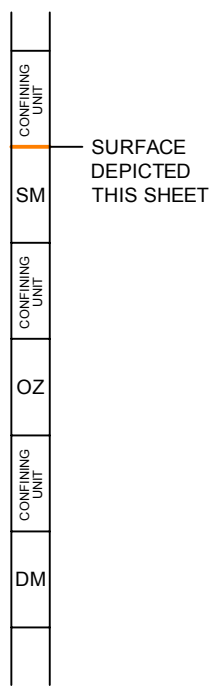
PROPOSED ROSS PERMIT BOUNDARY

3600 / 3600 — TOP STRUCTURE ELEVATION (10' CONTOUR INTERVAL). CONTOUR LINES ARE DASHED WHERE ELEVATIONS WERE PROJECTED ALONG THE BLACK HILLS MONOCLINE FLEXURE.

PROJECTED TOP OF SHALLOW MONITORING INTERVAL AT GROUND LEVEL

NOTES:

1. SEE FIGURE D5-4 LEGEND FOR BEDROCK GEOLOGY MAP UNITS. BEDROCK GEOLOGY MAPPING ADAPTED FROM SUTHERLAND (2008).
2. SURFACES SHOWN DERIVED FROM GEMCOM GEMS© SOFTWARE CUSTOMIZED FOR STRATA ENERGY, INC. AND DEVELOPED IN SUPPORT OF SITE SPECIFIC GROUNDWATER MODEL.



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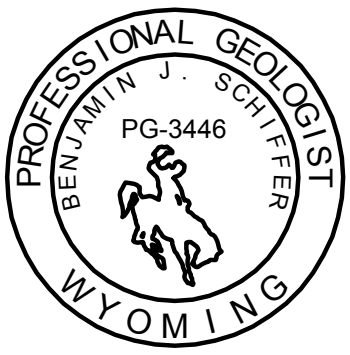

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REVISIONS

Date	Description

ADDENDUM 2.6-D
FIGURE 9
STRUCTURE CONTOURS OF TOP OF SHALLOW MONITORING INTERVAL

Drawn By: RAM
Checked By: BJS
Date: 11-10

FILE: ROSS_GEO_SURF_ISO.DWG

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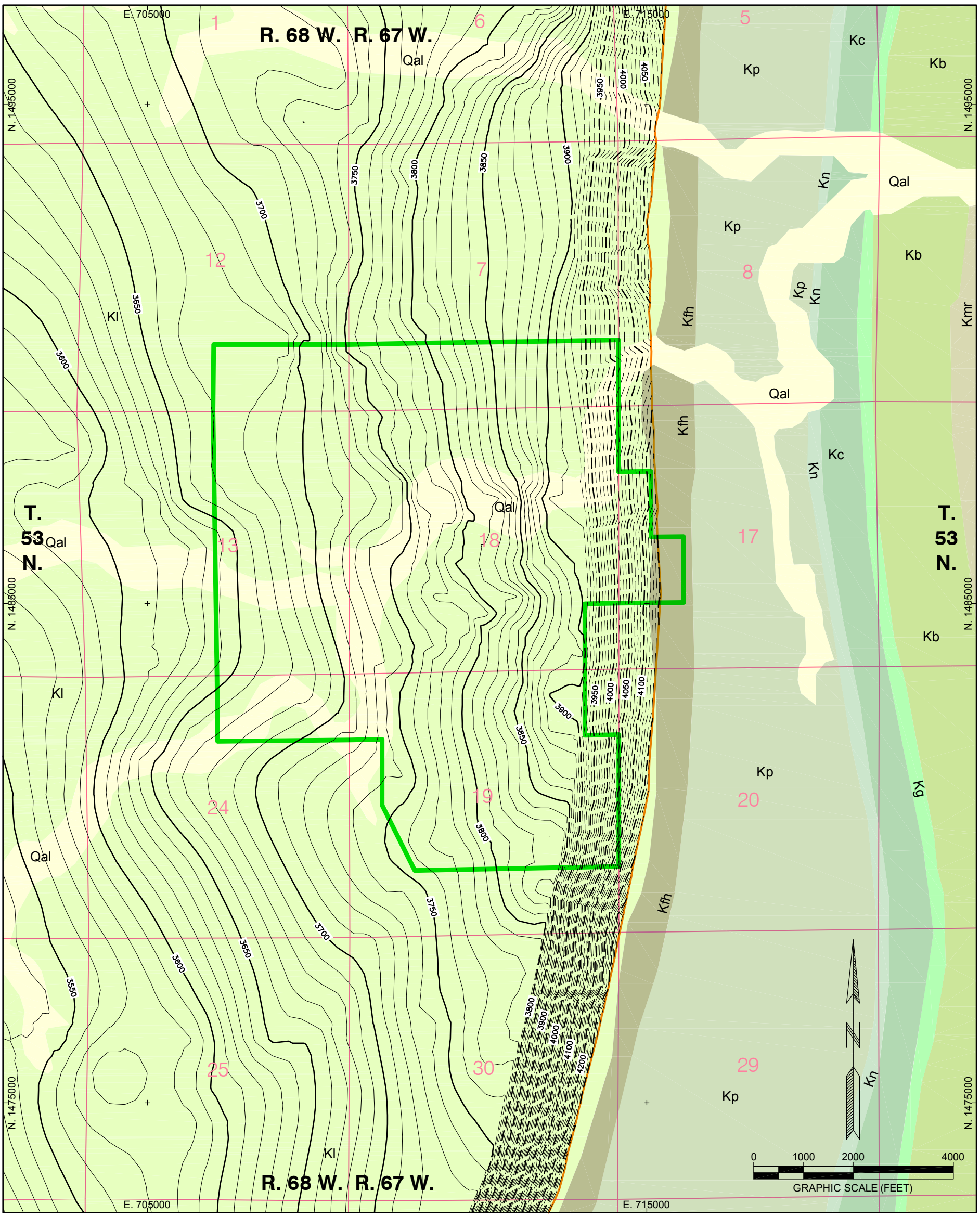


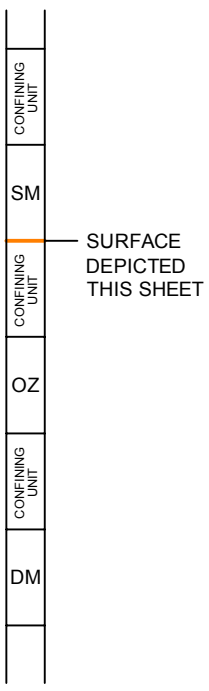
Drawing Coordinates: WY83EF

LEGEND

- PROPOSED ROSS PERMIT BOUNDARY
- 3600 — BOTTOM STRUCTURE ELEVATION (10' CONTOUR INTERVAL). CONTOUR LINES ARE DASHED WHERE ELEVATIONS WERE PROJECTED ALONG THE BLACK HILLS MONOCLINE FLEXURE.
- PROJECTED BOTTOM OF SHALLOW MONITORING INTERVAL AT GROUND LEVEL

NOTES:

1. SEE FIGURE D5-4 LEGEND FOR BEDROCK GEOLOGY MAP UNITS. BEDROCK GEOLOGY MAPPING ADAPTED FROM SUTHERLAND (2008).
2. SURFACES SHOWN DERIVED FROM GEMCOM GEMS© SOFTWARE CUSTOMIZED FOR STRATA ENERGY, INC. AND DEVELOPED IN SUPPORT OF SITE SPECIFIC GROUNDWATER MODEL.



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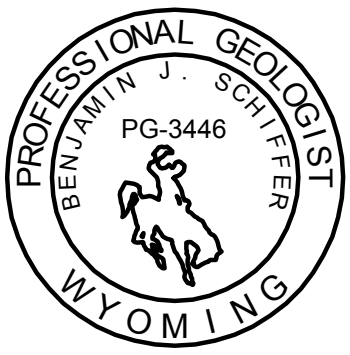

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Date	Description

ADDENDUM 2.6-D
FIGURE 10
STRUCTURE CONTOURS OF BOTTOM OF SHALLOW MONITORING INTERVAL

Drawn By: RAM
Checked By: BJS
Date: 11-10
FILE: ROSS_GEO_SURF_ISO.DWG

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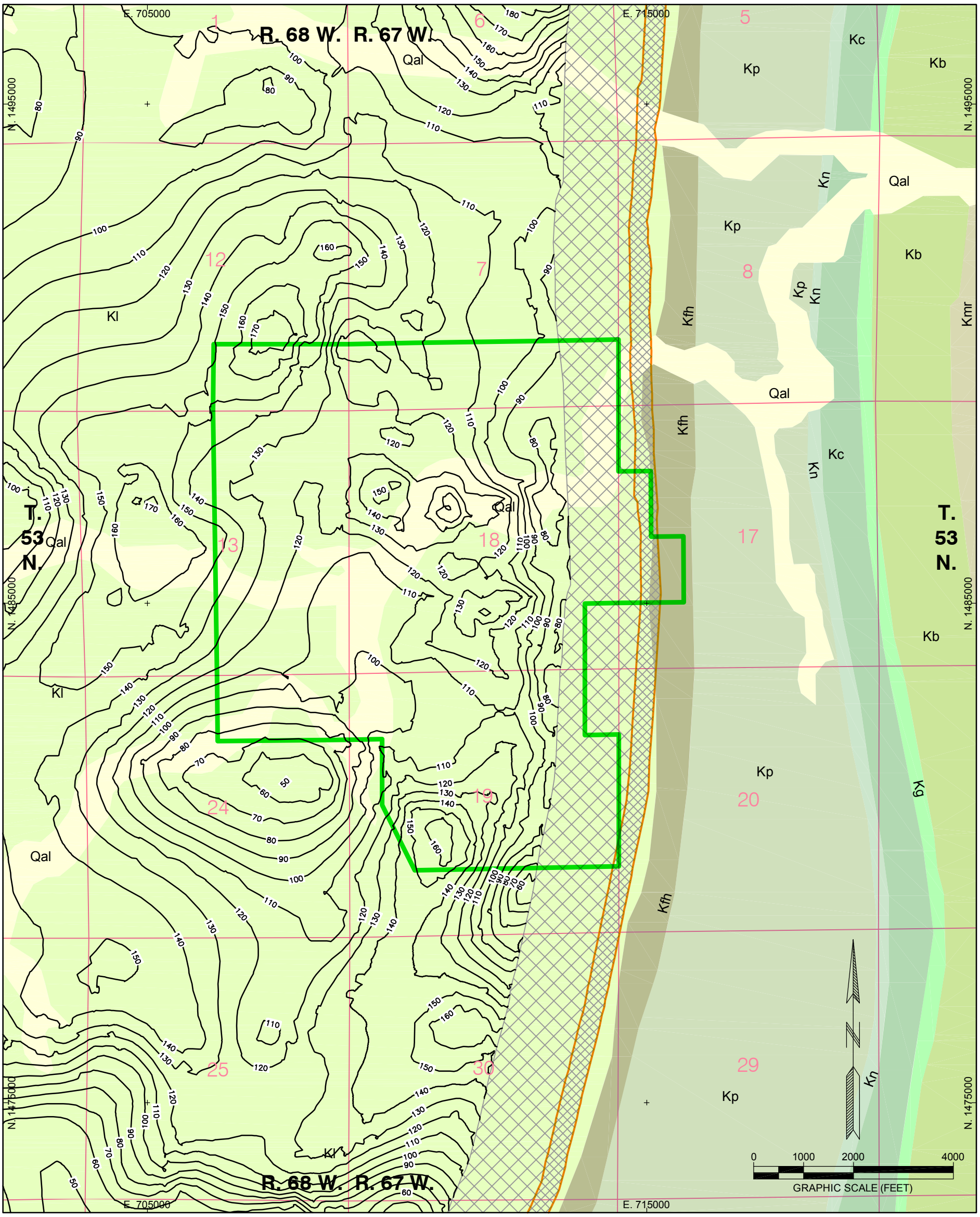


Drawing Coordinates: WY83EF

LEGEND

PROPOSED ROSS PERMIT BOUNDARY

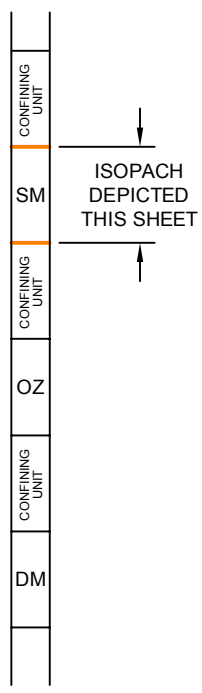
100 ISOPACH LINE (10' CONTOUR INTERVAL)

PROJECTED OUTCROP/SUBCROP OF SHALLOW MONITORING INTERVAL

THICKNESS OF SHALLOW MONITORING INTERVAL UNDETERMINED DUE TO STEEPLY DIPPING BEDS

NOTES:

1. SEE FIGURE D5-4 LEGEND FOR BEDROCK GEOLOGY MAP UNITS. BEDROCK GEOLOGY MAPPING ADAPTED FROM SUTHERLAND (2008).
2. SURFACES SHOWN DERIVED FROM GEMCOM GEMS© SOFTWARE CUSTOMIZED FOR STRATA ENERGY, INC. AND DEVELOPED IN SUPPORT OF SITE SPECIFIC GROUNDWATER MODEL.



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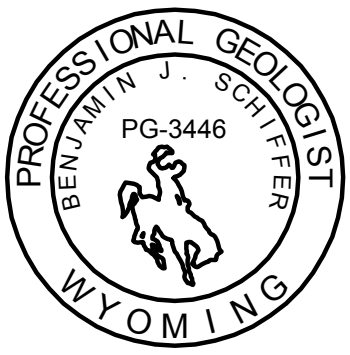

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Date	Description

ADDENDUM 2.6-D
FIGURE 11

ISOPACH OF SHALLOW MONITORING INTERVAL

Drawn By: RAM
Checked By: BJS
Date: 11-10

FILE: ROSS_GEO_SURF_ISO.DWG

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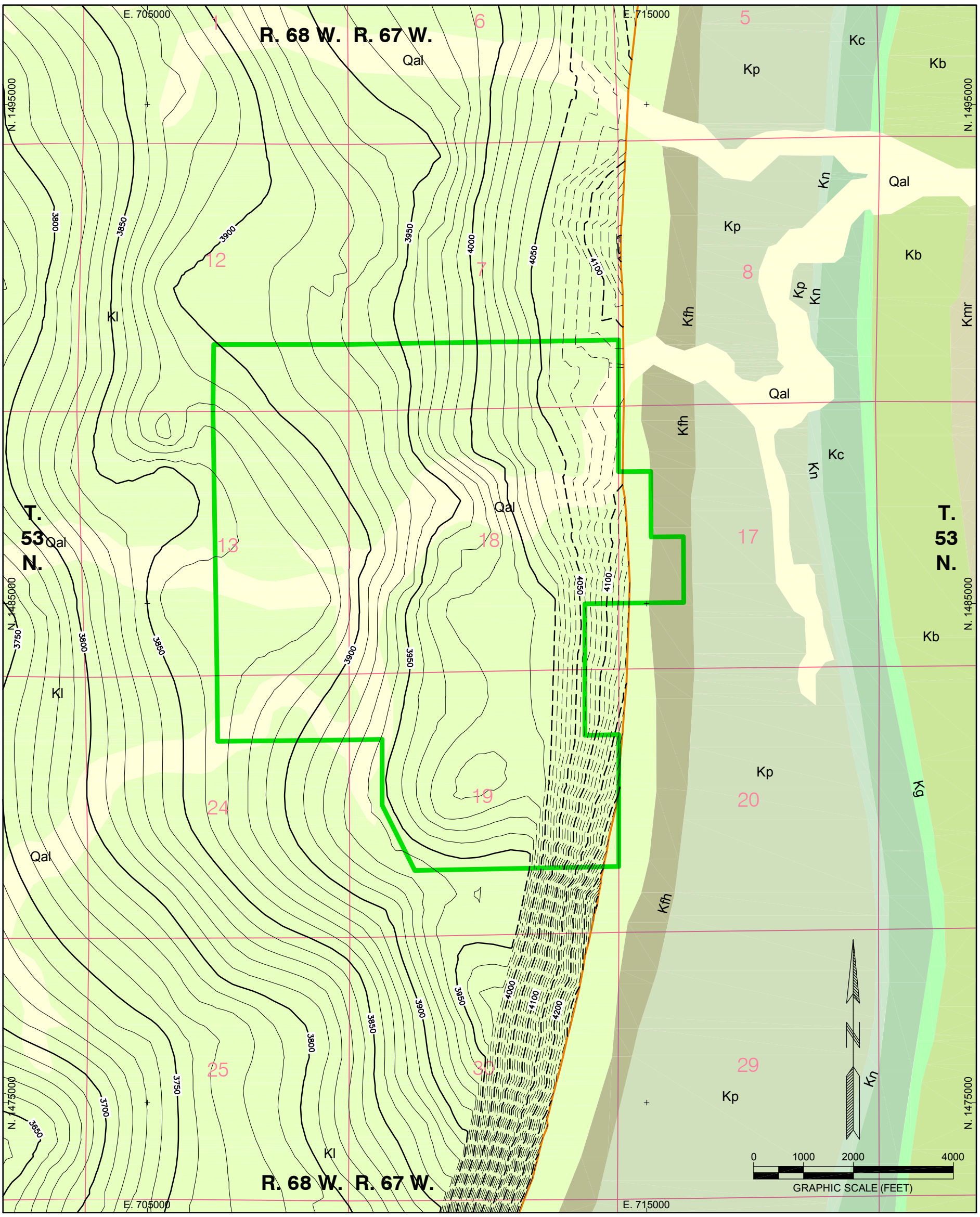

Drawing Coordinates: WY83EF

LEGEND

PROPOSED ROSS PERMIT BOUNDARY

3600 / 3600 — TOP STRUCTURE ELEVATION (10' CONTOUR INTERVAL). CONTOUR LINES ARE DASHED WHERE ELEVATIONS WERE PROJECTED ALONG THE BLACK HILLS MONOCLINE FLEXURE.

PROJECTED TOP OF CONFINING UNIT ABOVE SHALLOW MONITORING INTERVAL AT GROUND LEVEL

NOTES:

1. SEE FIGURE D5-4 LEGEND FOR BEDROCK GEOLOGY MAP UNITS. BEDROCK GEOLOGY MAPPING ADAPTED FROM SUTHERLAND (2008).
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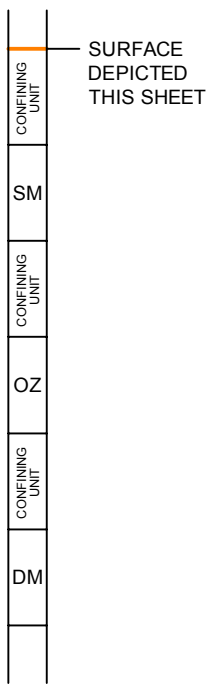

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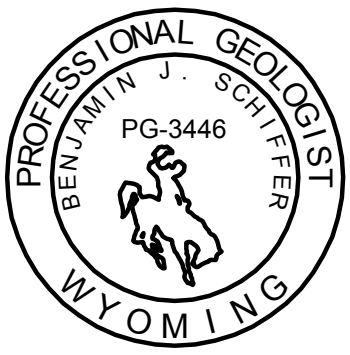

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ADDENDUM 2.6-D
FIGURE 12
STRUCTURE CONTOURS OF TOP OF CONFINING UNIT ABOVE SHALLOW MONITORING INTERVAL

Drawn By: RAM
Checked By: BJS
Date: 11-10
FILE: ROSS_GEO_SURF_ISO.DWG

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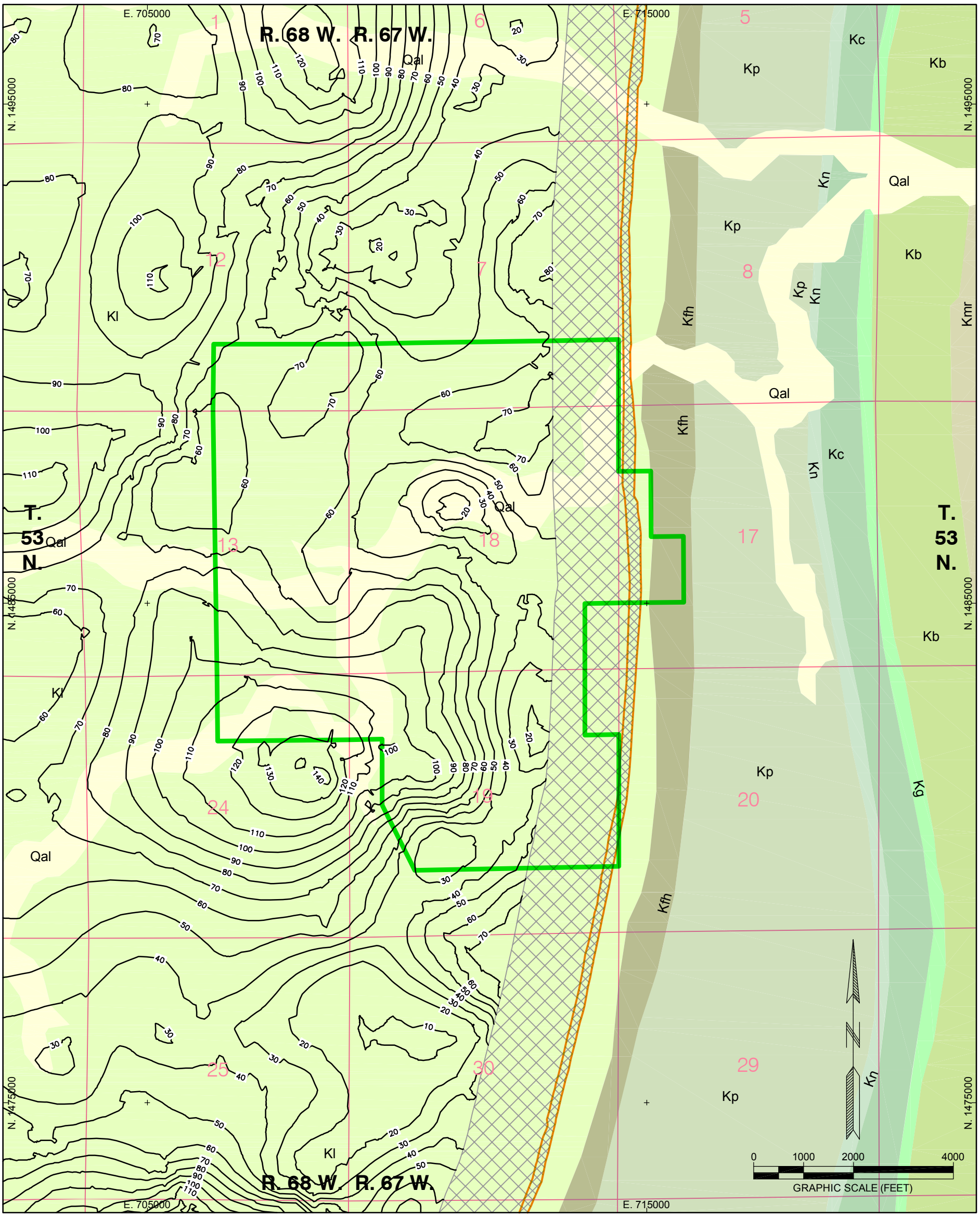


Drawing Coordinates: WY83EF

LEGEND

PROPOSED ROSS PERMIT BOUNDARY

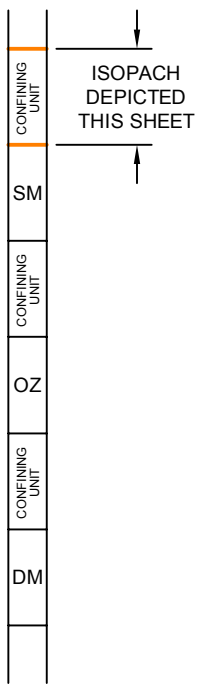
100 ISOPACH LINE (10' CONTOUR INTERVAL)

PROJECTED OUTCROP/SUBCROP OF CONFINING UNIT ABOVE SHALLOW MONITORING INTERVAL

THICKNESS OF CONFINING UNIT ABOVE SHALLOW MONITORING INTERVAL UNDETERMINED DUE TO STEEPLY DIPPING BEDS

NOTES:

1. SEE FIGURE D5-4 LEGEND FOR BEDROCK GEOLOGY MAP UNITS. BEDROCK GEOLOGY MAPPING ADAPTED FROM SUTHERLAND (2008).
2. SURFACES SHOWN DERIVED FROM GEMCOM GEMS© SOFTWARE CUSTOMIZED FOR STRATA ENERGY, INC. AND DEVELOPED IN SUPPORT OF SITE SPECIFIC GROUNDWATER MODEL.



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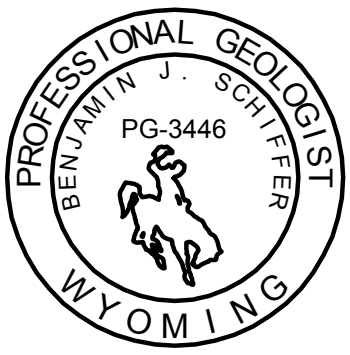

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Date	Description

ADDENDUM 2.6-D
FIGURE 13

ISOPACH OF CONFINING UNIT ABOVE SHALLOW MONITORING INTERVAL

Drawn By: RAM
Checked By: BJS
Date: 11-10
FILE: ROSS_GEO_SURF_ISO.DWG

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ADDENDUM 2.6-E

PLUGGING OF DRILL HOLES AND REPAIR, AND ABANDONMENT OF WELLS

Addendum 2.6 – E

Plugging of Drill Holes and Repair and Abandonment of Wells

Introduction

This addendum discusses the final disposition of boreholes and wells within the project area, and includes boreholes and wells installed by previous mineral owners at the Ross Property and the boreholes and wells installed by Strata. Historical and recent boreholes are tabulated in Addendum 2.6-B. Borehole locations are depicted on Exhibit 1 of this Addendum. Hole plugging and sealing and well abandonment and repair will be conducted in accordance with Chapter 11 of the Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD) Rules and Regulations.

Borehole Abandonment

The Ross Project area was extensively explored in the 1970's by the Nubeth Joint Venture. Based on Strata's drill hole inventory, some 1,682 holes were drilled by Nubeth on and within ½ mile of the Ross Permit Boundary (Table 1). Details on the Nubeth boreholes are tabulated in Appendix A of this Addendum. Documentation on the abandonment practices of the majority of the Nubeth boreholes was not available. It is Strata's intent to locate each of the Nubeth boreholes within the proposed Ross Permit Boundary and plug them from bottom to top, in accordance with WDEQ/LQD Chapter 11 Section 6, part (c).

Hole plugging procedures include locating the hole, entering the drill hole with bit and drill pipe, which is washed to bottom, then Type I cement (14.8 to 15.0 lb/gal with 2% bentonite) is pumped through the drill pipe as the pipe is removed from the hole. The hole is topped off with cement and a metal ID tag is placed at the surface. As discussed in Addendum 2.7 F. (Aquifer Test Report), some 55 holes in the vicinity of the 12-18 well cluster were located, re-entered and plugged in this fashion. It is Strata's intent to locate the remainder of the Nubeth boreholes and abandon them in a similar fashion.

Strata began confirmation and exploration drilling for the Ross ISR Project in September 2008. As of October 2010, Strata had completed 540 delineation holes on or within a ½-mile radius of the proposed permit area (Table 1). Of the 540 drill holes completed by Strata, 333 holes were plugged with cement while 208 were sealed with plug gel. Strata continues exploration drilling and the ultimate number of holes will be based on the number needed to define the ore body. Plugging/abandonment procedures will follow those described above.

Table 1. Drill Hole Survey Summary

Statistic	Number Within Permit Area	Within 1/2 Mile Buffer	Total
Total Number of Holes Drilled[1]	1,952	270	2,222
Number of Nubeth Exploration Holes	1,483	199	1682
Number of Nubeth Exploratory Holes Found	625	134	759
Number of Nubeth Exploratory Holes to be Found	858	65	923
Number of Delineation Holes (Strata)	467	73	540
Number of Holes Plugged with Cement (Strata & Nubeth)	341	57	398
Number of Holes Plugged with Plug Gel (Strata & Nubeth)	192	16	208
Number of Holes Plugged Unknown (All Nubeth)	1,419	197	1,616

[1] Includes Exploration and Delineation Holes Note: Statistics are based on information as of October 2010

Well Abandonment

Nubeth installed 47 wells during the course of its R&D activities at the Ross Site. Details on these wells are presented in TR Table 2.6-2. The Nubeth well locations are depicted on Exhibit 1. Figures 1, 2, and 3 provide detail on the various Nubeth hydrologic test sites. TR Table 2.6-12 provides well-specific information, included the well's name, purpose (i.e., pumping or monitor), location and depth. The ownership of three wells was transferred from Nubeth, and two wells were converted to source wells for oil field water flood operations and are still in operation. The third well was transferred to a local rancher. The remaining 44 Nubeth wells were plugged and abandoned in accordance with standard practices of the day.

Wells installed by Strata for recovery and monitoring will be properly abandoned to ensure that the exempted aquifer remains isolated from aquifers above and below. After wells have been taken out of service, plugging and abandonment will be conducted in accordance with WDEQ/LQD Chapter 11, Section 6, Using the steps outlined below.

1. Mobilize to well with a drill rig or service unit.

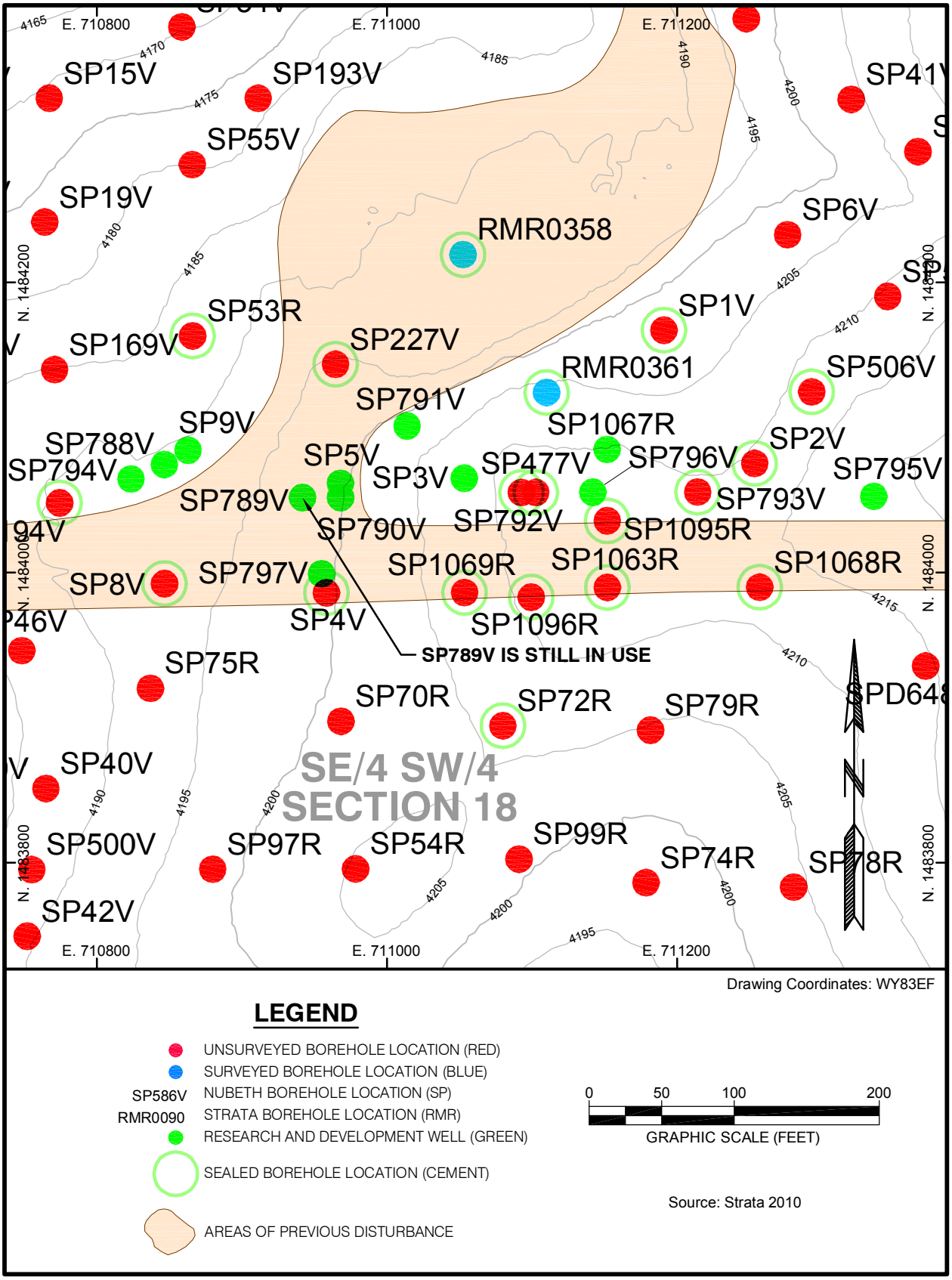

Figure 1. Hydrologic Test Area

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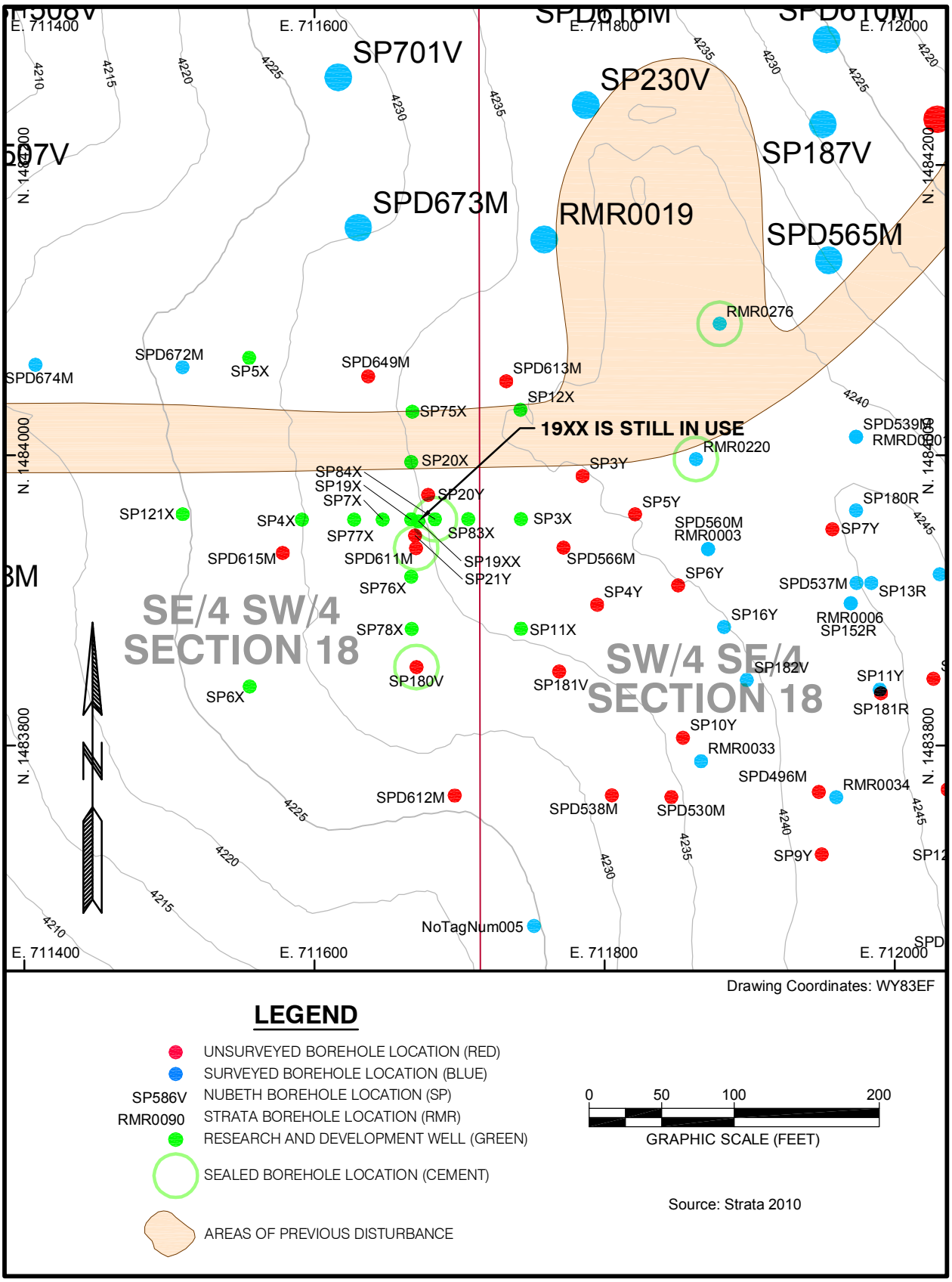

Figure 2. Phase I Research and Development Area

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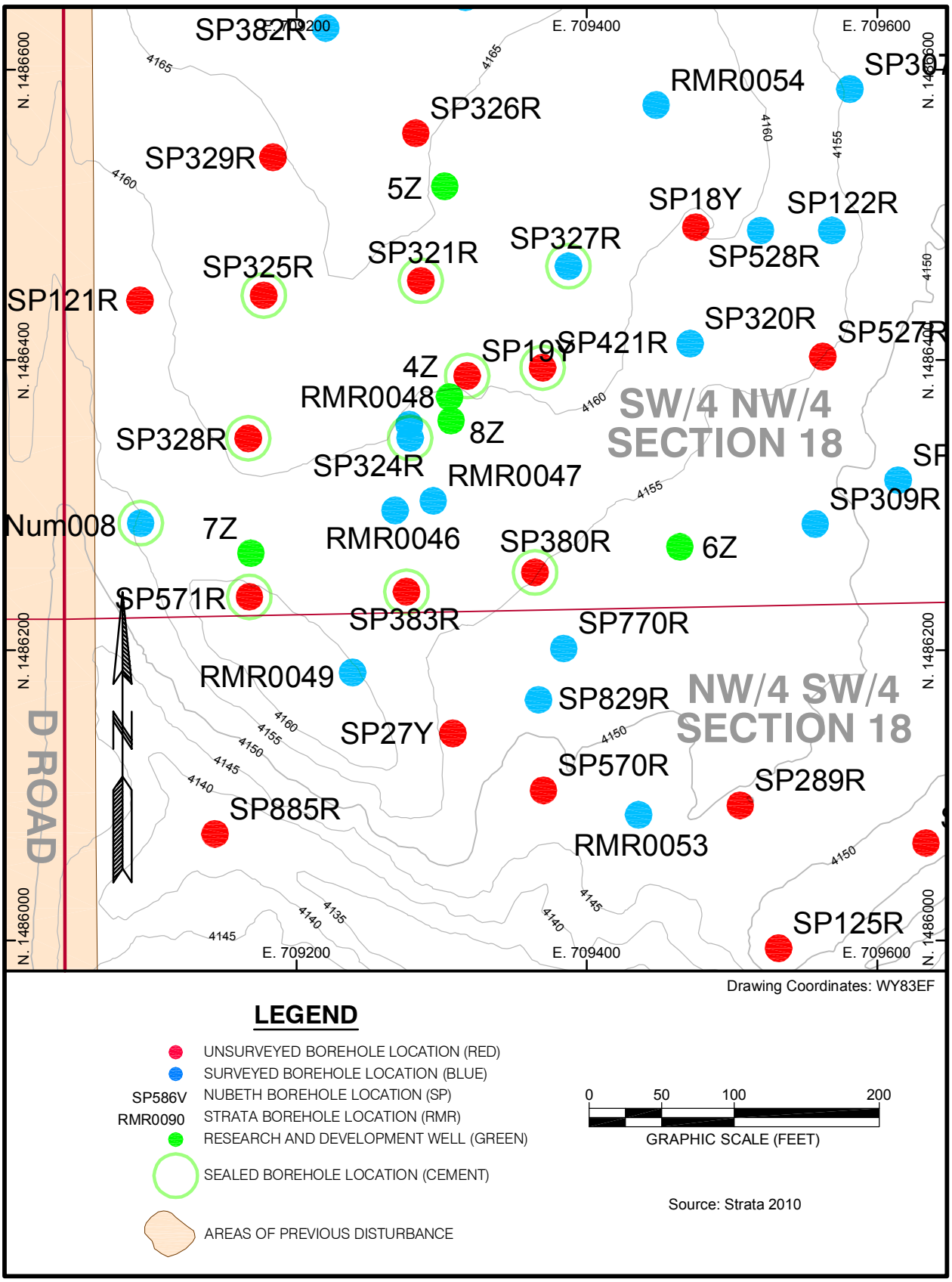


Figure 3. Phase II Research and Development Area

K:\Peninsula_Minerals\09142\DWGS_WY83E\ROSS_TR_GEO_EXPLOR.dwg, TRA_2.6-E_FIGURE_3, 12/18/2010 1:22:26 PM

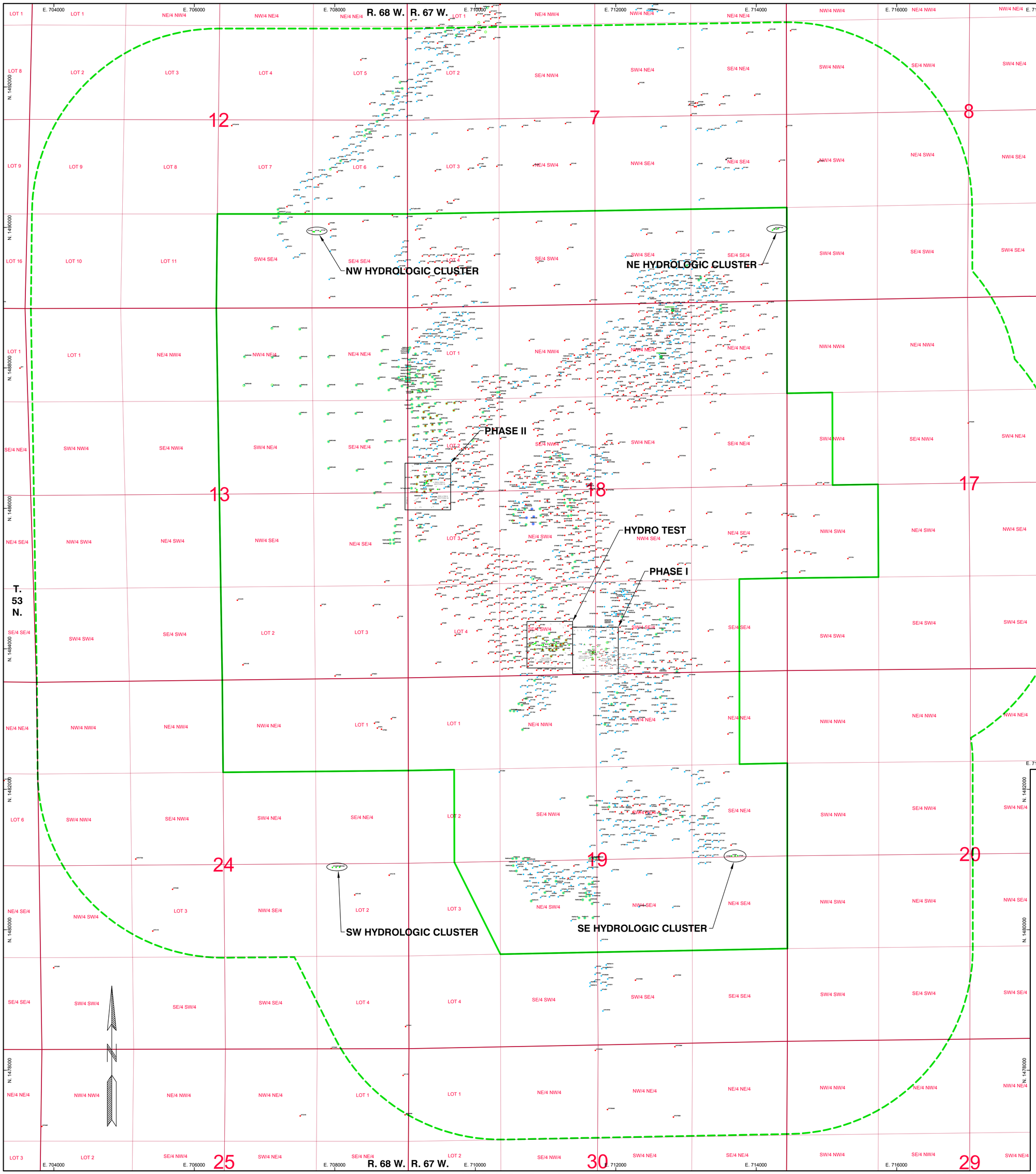
2. Remove tubing, packers and surface equipment.
3. Run tubing to total depth (under reamed wells) or to top of screened interval in screened wells.
4. Pump Type 1 15 lb/gallon cement from the total depth of the well (or from the top of the screened interval) to the surface.
5. Cut casing a minimum of two feet below ground surface, and embed a metal identification tag in the cement. The identification tag will include the well's permit number, well identification number, and date of plugging. All marking devices shall be installed at a minimum depth of two feet below the land surface. Abandonment records including the volume of cement placed in the well will be furnished to LQD in annual reports.
6. To the extent possible, the vegetative cover will be reestablished by seeding, planting, transplanting, or by other adequate methods in a manner consistent with Chapter 3, Section 2(d), Land Quality Rules and Regulations

Well Repair

The need for well repairs will be based on the results of routine mechanical integrity testing (MIT). Mechanical integrity testing will be conducted in accordance with WDEQ/LQD Chapter 11, Section 7(a). In the event a well fails an integrity test, it will immediately be taken out of service, WDEQ/LQD notified, and remediation attempted using the following procedure.

1. The initial step in troubleshooting will consist of isolating the site of the failure in the wellbore. This can be accomplished in one of several way, depending on the situation. Investigative methods could include wireline logging (including camera logging) and packer testing,
2. After isolating the portion of the well requiring repair, the decision will be made to repair, or if the repair appears infeasible, to abandon the well.
3. Repair techniques will be specific to the mode of failure, although the most likely problem would be casing failure. Depending on the situation, a number repair techniques could be applicable, including:
    a. Recementing the annulus between the casing and wellbore (commonly referred to as a squeeze job);
    b. Installing a liner in portion of the failed casing;
    c. Under reaming and cementing the failed casing (See Section X.X for a discussion of under reaming); and
    d. If the problem area is close to the surface, it may be possible to excavate to the depth of failure and make the repair from above.

Following repair, retesting of the well, in accordance with the requirements of Section 7(a)(ii) of Chapter 11, would be completed within 120 days after the repair is completed. The well undergoing repair would remain out of service until receipt of notification from WDEQ/LQD that the mechanical integrity of the well has been restored.



ROSS PROJECT AREA

0 250 500 1000
GRAPHIC SCALE (FEET)

DRAWING COORDINATES: WY83EF

LEGEND

- PROPOSED ROSS PERMIT BOUNDARY
- HALF MILE BUFFER FROM PROPOSED PERMIT BOUNDARY
- UNSURVEYED BOREHOLE LOCATION (RED)
- SURVEYED BOREHOLE LOCATION (BLUE)
- NUBETH BOREHOLE LOCATION (SP)
- STRATA BOREHOLE LOCATION (RMR)
- SEALED BOREHOLE LOCATION (GEL)
- SEALED BOREHOLE LOCATION (CEMENT)
- CORING HOLE LOCATION
- RESEARCH AND DEVELOPMENT WELL (GREEN)

Source: Strata 2010

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

ADDENDUM 2.6-E
EXHIBIT 1

RESEARCH AND DEVELOPMENT EXPLORATORY / DELINEATION BOREHOLES OCTOBER, 2010

Drawn By: MBM
Checked By: SMM
Date: 11/9/10

WWC ENGINEERING
www.wwcengineering.com

FILE: ROSS_TR_GEO_EXPLOR

ADDENDUM 2.7-A

HEC-HMS SURFACE WATER

HYDROLOGIC MODEL

HEC-HMS RESULTS

2yr 24hr

Hydraulic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (acre-ft)
B2	3.52	234.6	11May2010, 01:13	70.7
B1	2.18	189.7	11May2010, 01:07	51.7
J1	5.7	423	11May2010, 01:13	122.4
R1	5.7	420.3	11May2010, 01:49	122.6
B3	2.07	164.2	11May2010, 00:49	38.1
B7	0.19	9.1	11May2010, 00:13	1.7
J2	7.96	501.7	11May2010, 01:43	162.4
R2	7.96	500.6	11May2010, 01:49	162.4
B4	3.53	180.3	11May2010, 01:37	65
B5	2.14	116.6	11May2010, 01:01	32.8
J3	5.67	273.7	11May2010, 01:19	97.8
R3	5.67	273.1	11May2010, 01:31	97.8
B6	0.56	15.3	11May2010, 00:55	5.1
B8	0.08	13.4	11May2010, 00:19	1.7
J4	14.27	775.2	11May2010, 01:43	267.1
R4	14.27	770.4	11May2010, 01:49	266.9
B9	0.9	21.9	11May2010, 01:07	8.2
B10	0.01	2	11May2010, 00:13	0.2
J5	15.18	787.3	11May2010, 01:49	275.3
R5	15.18	762.7	11May2010, 02:07	274.7
B11	0.4	8.3	11May2010, 01:07	3.2
Oshoto R.	15.58	408.4	11May2010, 03:43	277.7
R6	15.58	408.2	11May2010, 03:49	277.7
B13	1.65	101.6	11May2010, 01:25	33.1
B12	0.04	9	11May2010, 00:19	1.2
J6	17.27	445.3	11May2010, 03:43	312
R7	17.27	444.9	11May2010, 03:49	312
B14	0.44	50.1	11May2010, 00:31	8.8
B15	0.16	16.8	11May2010, 00:19	2.5
J7	0.6	63.1	11May2010, 00:25	11.3
R8	0.6	62.8	11May2010, 00:37	11.3
B16	0.16	4.3	11May2010, 00:37	1.3
B17	0.02	5.4	11May2010, 00:13	0.6
J8	18.05	455.8	11May2010, 03:43	325.2
R9	18.05	455.6	11May2010, 03:49	325.2
B18	0.13	3.2	11May2010, 00:25	0.9
B19	0.01	0.6	11May2010, 00:13	0.1
J9	18.19	456.6	11May2010, 03:49	326.2
R10	18.19	456.5	11May2010, 03:49	326.2
B20	0.01	3.3	11May2010, 00:07	0.3
J10	18.2	456.7	11May2010, 03:49	326.5

HEC-HMS RESULTS

5yr 24hr

Hydraulic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (acre-ft)
B2	3.52	507.2	11May2010, 01:13	135.9
B1	2.18	384	11May2010, 01:07	95.4
J1	5.7	890.3	11May2010, 01:07	231.3
R1	5.7	884.7	11May2010, 01:37	231.5
B3	2.07	374.8	11May2010, 00:43	74.9
B7	0.19	34.1	11May2010, 00:13	4.1
J2	7.96	1072.5	11May2010, 01:31	310.5
R2	7.96	1069.3	11May2010, 01:37	310.5
B4	3.53	401.5	11May2010, 01:31	127.7
B5	2.14	288.1	11May2010, 00:55	67.7
J3	5.67	631.9	11May2010, 01:13	195.4
R3	5.67	630.9	11May2010, 01:19	195.4
B6	0.56	51.4	11May2010, 00:43	12.2
B8	0.08	28.4	11May2010, 00:13	3.3
J4	14.27	1714.5	11May2010, 01:31	521.4
R4	14.27	1700.7	11May2010, 01:31	521.2
B9	0.9	71.7	11May2010, 00:55	19.6
B10	0.01	4.1	11May2010, 00:13	0.4
J5	15.18	1754.1	11May2010, 01:31	541.2
R5	15.18	1699.5	11May2010, 01:49	539.5
B11	0.4	29.4	11May2010, 00:55	8
Oshoto R.	15.58	1093.5	11May2010, 02:55	547.3
R6	15.58	1092.1	11May2010, 02:55	547.3
B13	1.65	219.2	11May2010, 01:19	63.7
B12	0.04	16.7	11May2010, 00:19	2.1
J6	17.27	1190.5	11May2010, 02:49	613.1
R7	17.27	1190.3	11May2010, 02:55	613.1
B14	0.44	109.4	11May2010, 00:25	17
B15	0.16	43.4	11May2010, 00:13	5.1
J7	0.6	142.8	11May2010, 00:25	22
R8	0.6	142	11May2010, 00:31	22
B16	0.16	16.7	11May2010, 00:31	3.2
B17	0.02	9.9	11May2010, 00:13	1
J8	18.05	1213.1	11May2010, 02:55	639.4
R9	18.05	1212.3	11May2010, 02:55	639.4
B18	0.13	14.7	11May2010, 00:19	2.4
B19	0.01	2	11May2010, 00:13	0.2
J9	18.19	1214.8	11May2010, 02:55	642
R10	18.19	1213.8	11May2010, 02:55	642
B20	0.01	6.1	11May2010, 00:07	0.5
J10	18.2	1214.2	11May2010, 02:55	642.5

HEC-HMS RESULTS

10yr 24hr

Hydraulic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (acre-ft)
B2	3.52	721.3	11May2010, 01:07	185.6
B1	2.18	531.5	11May2010, 01:01	128.1
J1	5.7	1251.7	11May2010, 01:07	313.7
R1	5.7	1243.7	11May2010, 01:31	313.9
B3	2.07	541	11May2010, 00:43	103.2
B7	0.19	56	11May2010, 00:13	6.1
J2	7.96	1520.9	11May2010, 01:25	423.3
R2	7.96	1517.7	11May2010, 01:31	423.3
B4	3.53	576.8	11May2010, 01:25	176
B5	2.14	428	11May2010, 00:55	95
J3	5.67	923.8	11May2010, 01:07	271
R3	5.67	919.6	11May2010, 01:19	271
B6	0.56	85	11May2010, 00:43	18.1
B8	0.08	39.9	11May2010, 00:13	4.5
J4	14.27	2469.3	11May2010, 01:25	716.8
R4	14.27	2449.9	11May2010, 01:25	716.5
B9	0.9	118	11May2010, 00:55	29.1
B10	0.01	5.8	11May2010, 00:07	0.6
J5	15.18	2539.3	11May2010, 01:25	746.2
R5	15.18	2463.6	11May2010, 01:43	743.9
B11	0.4	49.3	11May2010, 00:55	12.1
Oshoto R.	15.58	1946.7	11May2010, 02:25	755.9
R6	15.58	1941.1	11May2010, 02:25	755.8
B13	1.65	311.3	11May2010, 01:19	87
B12	0.04	22.3	11May2010, 00:19	2.7
J6	17.27	2117.5	11May2010, 02:25	845.6
R7	17.27	2110.1	11May2010, 02:25	845.6
B14	0.44	156.2	11May2010, 00:25	23.2
B15	0.16	64.8	11May2010, 00:13	7.1
J7	0.6	204.7	11May2010, 00:19	30.3
R8	0.6	204	11May2010, 00:31	30.3
B16	0.16	28.7	11May2010, 00:25	4.8
B17	0.02	13.2	11May2010, 00:13	1.4
J8	18.05	2146.8	11May2010, 02:25	882.1
R9	18.05	2140.4	11May2010, 02:31	882
B18	0.13	25.9	11May2010, 00:19	3.6
B19	0.01	3.2	11May2010, 00:13	0.3
J9	18.19	2144.2	11May2010, 02:31	886
R10	18.19	2142.8	11May2010, 02:31	886.1
B20	0.01	8.2	11May2010, 00:07	0.7
J10	18.2	2143.2	11May2010, 02:31	886.7

HEC-HMS RESULTS

25yr 24hr

Hydraulic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (acre-ft)
B2	3.52	1073.8	11May2010, 01:07	266.9
B1	2.18	771.2	11May2010, 01:01	181.1
J1	5.7	1839.8	11May2010, 01:07	448
R1	5.7	1824.6	11May2010, 01:25	448.1
B3	2.07	814.2	11May2010, 00:43	149.8
B7	0.19	96.7	11May2010, 00:07	9.6
J2	7.96	2261.9	11May2010, 01:19	607.5
R2	7.96	2254	11May2010, 01:25	607.5
B4	3.53	870.5	11May2010, 01:25	255.4
B5	2.14	667.5	11May2010, 00:49	140.6
J3	5.67	1413.2	11May2010, 01:07	396
R3	5.67	1408.4	11May2010, 01:13	396
B6	0.56	145.3	11May2010, 00:43	28.3
B8	0.08	58.6	11May2010, 00:13	6.4
J4	14.27	3732.3	11May2010, 01:19	1038.1
R4	14.27	3702.1	11May2010, 01:19	1037.7
B9	0.9	201	11May2010, 00:55	45.5
B10	0.01	8.5	11May2010, 00:07	0.8
J5	15.18	3861.3	11May2010, 01:19	1083.9
R5	15.18	3745.2	11May2010, 01:31	1080.9
B11	0.4	86.4	11May2010, 00:49	19.1
Oshoto R.	15.58	3359.3	11May2010, 02:01	1099.7
R6	15.58	3342.6	11May2010, 02:07	1099.6
B13	1.65	462.3	11May2010, 01:19	125.1
B12	0.04	31.2	11May2010, 00:19	3.8
J6	17.27	3670.3	11May2010, 02:01	1228.5
R7	17.27	3657.2	11May2010, 02:07	1228.6
B14	0.44	232.7	11May2010, 00:25	33.4
B15	0.16	100.4	11May2010, 00:13	10.5
J7	0.6	309.4	11May2010, 00:19	43.9
R8	0.6	304.7	11May2010, 00:25	43.9
B16	0.16	50.7	11May2010, 00:25	7.6
B17	0.02	18.4	11May2010, 00:13	1.9
J8	18.05	3719	11May2010, 02:01	1282
R9	18.05	3713.8	11May2010, 02:07	1282
B18	0.13	46.3	11May2010, 00:19	5.9
B19	0.01	5.2	11May2010, 00:13	0.5
J9	18.19	3720.4	11May2010, 02:07	1288.3
R10	18.19	3718.1	11May2010, 02:07	1288.4
B20	0.01	11.4	11May2010, 00:07	0.9
J10	18.2	3718.7	11May2010, 02:07	1289.3

HEC-HMS RESULTS

50yr 24hr

Hydraulic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (acre-ft)
B2	3.52	1323.1	11May2010, 01:07	324.6
B1	2.18	939	11May2010, 01:01	218.3
J1	5.7	2253.9	11May2010, 01:07	542.9
R1	5.7	2242.7	11May2010, 01:25	542.9
B3	2.07	1007.9	11May2010, 00:43	182.9
B7	0.19	127.2	11May2010, 00:07	12.1
J2	7.96	2788.7	11May2010, 01:19	738
R2	7.96	2776.4	11May2010, 01:19	738
B4	3.53	1079.7	11May2010, 01:25	312
B5	2.14	839.9	11May2010, 00:49	173.3
J3	5.67	1763.3	11May2010, 01:07	485.3
R3	5.67	1757.1	11May2010, 01:13	485.3
B6	0.56	190.2	11May2010, 00:43	35.8
B8	0.08	71.6	11May2010, 00:13	7.7
J4	14.27	4632.5	11May2010, 01:19	1266.8
R4	14.27	4608.2	11May2010, 01:19	1266.3
B9	0.9	263.4	11May2010, 00:49	57.5
B10	0.01	10.3	11May2010, 00:07	1
J5	15.18	4812.3	11May2010, 01:19	1324.7
R5	15.18	4673.1	11May2010, 01:31	1321.3
B11	0.4	114.6	11May2010, 00:49	24.3
Oshoto R.	15.58	4338	11May2010, 01:55	1345.3
R6	15.58	4328.8	11May2010, 01:55	1345.3
B13	1.65	569.5	11May2010, 01:13	152.1
B12	0.04	37.3	11May2010, 00:19	4.5
J6	17.27	4766.4	11May2010, 01:55	1502
R7	17.27	4762	11May2010, 01:55	1502.1
B14	0.44	286.6	11May2010, 00:25	40.6
B15	0.16	125.8	11May2010, 00:13	13
J7	0.6	383.7	11May2010, 00:19	53.5
R8	0.6	379	11May2010, 00:25	53.6
B16	0.16	67.2	11May2010, 00:25	9.7
B17	0.02	22	11May2010, 00:13	2.3
J8	18.05	4843.2	11May2010, 01:55	1567.6
R9	18.05	4831.6	11May2010, 01:55	1567.5
B18	0.13	62.2	11May2010, 00:13	7.5
B19	0.01	6.7	11May2010, 00:07	0.7
J9	18.19	4840.4	11May2010, 01:55	1575.7
R10	18.19	4830.6	11May2010, 01:55	1575.8
B20	0.01	13.6	11May2010, 00:07	1.1
J10	18.2	4831.5	11May2010, 01:55	1576.8

HEC-HMS RESULTS

100yr 24hr

Hydraulic Element	Drainage Area (mi^2)	Peak Discharge (cfs)	Time of Peak	Volume (acre-ft)
B2	3.52	1580.9	11May2010, 01:07	384.4
B1	2.18	1111.5	11May2010, 01:01	256.7
J1	5.7	2680.8	11May2010, 01:07	641.1
R1	5.7	2669.8	11May2010, 01:25	641.1
B3	2.07	1210	11May2010, 00:37	217.4
B7	0.19	159.5	11May2010, 00:07	14.8
J2	7.96	3333.4	11May2010, 01:13	873.4
R2	7.96	3329.4	11May2010, 01:19	873.4
B4	3.53	1296.9	11May2010, 01:25	370.8
B5	2.14	1019.9	11May2010, 00:49	207.5
J3	5.67	2127.8	11May2010, 01:07	578.3
R3	5.67	2121	11May2010, 01:13	578.3
B6	0.56	239	11May2010, 00:37	43.8
B8	0.08	85.1	11May2010, 00:13	9.1
J4	14.27	5582.5	11May2010, 01:13	1504.6
R4	14.27	5546.4	11May2010, 01:19	1504
B9	0.9	330.9	11May2010, 00:49	70.3
B10	0.01	12.3	11May2010, 00:07	1.1
J5	15.18	5808.6	11May2010, 01:13	1575.5
R5	15.18	5631.1	11May2010, 01:25	1572.4
B11	0.4	144.7	11May2010, 00:49	29.8
Oshoto R.	15.58	5341.1	11May2010, 01:49	1602
R6	15.58	5331.6	11May2010, 01:49	1601.9
B13	1.65	681.1	11May2010, 01:13	180.2
B12	0.04	43.5	11May2010, 00:19	5.2
J6	17.27	5890.3	11May2010, 01:49	1787.3
R7	17.27	5883.5	11May2010, 01:49	1787.4
B14	0.44	342.3	11May2010, 00:25	48
B15	0.16	152.3	11May2010, 00:13	15.5
J7	0.6	460.7	11May2010, 00:19	63.6
R8	0.6	456.6	11May2010, 00:25	63.6
B16	0.16	84.9	11May2010, 00:25	11.9
B17	0.02	25.6	11May2010, 00:13	2.6
J8	18.05	5985.4	11May2010, 01:49	1865.5
R9	18.05	5973.9	11May2010, 01:49	1865.4
B18	0.13	79.6	11May2010, 00:13	9.2
B19	0.01	8.4	11May2010, 00:07	0.8
J9	18.19	5984.9	11May2010, 01:49	1875.5
R10	18.19	5974	11May2010, 01:49	1875.6
B20	0.01	15.9	11May2010, 00:07	1.3
J10	18.2	5975.1	11May2010, 01:49	1876.8

HEC-HMS INPUT FILE

Basin: Basin 1
    Description: AMC II
    Last Modified Date: 8 September 2010
    Last Modified Time: 22:48:39
    Version: 3.4
    Unit System: English
    Missing Flow To Zero: No
    Enable Flow Ratio: No
    Allow Blending: No
    Compute Local Flow At Junctions: No

    Enable Sediment Routing: No

    Enable Quality Routing: No
End:

Subbasin: B2
    Canvas X: -7897.077509529859
    Canvas Y: -3551.4612452350684
    Area: 3.52
    Downstream: J1

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 78

    Transform: SCS
    Lag: 68
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: B1
    Canvas X: -7770.012706480304
    Canvas Y: 3271.918678526048
    Area: 2.18
    Downstream: J1

    Canopy: None

    Surface: None

    LossRate: SCS

```
    Percent Impervious Area: 0.0
    Curve Number: 80

    Transform: SCS
    Lag: 64
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Junction: J1
    Canvas X: -6880.559085133416
    Canvas Y: 400.254129606099
    Label X: -48.0
    Label Y: 2.0
    Downstream: R1
End:

Reach: R1
    Canvas X: -5196.95044472681
    Canvas Y: 387.5476493011438
    From Canvas X: -6880.559085133416
    From Canvas Y: 400.254129606099
    Label X: -26.0
    Label Y: 10.0
    Downstream: J2

    Route: Muskingum Cunge
    Channel: Trapezoid
    Length: 15558
    Energy Slope: 0.0051
    Width: 45
    Side Slope: 3
    Mannings n: 0.030
    Use Variable Time Step: No
    Channel Loss: None
End:

Subbasin: B3
    Canvas X: -5978.398983481575
    Canvas Y: 3144.853875476493
    Area: 2.07
    Downstream: J2

    Canopy: None

    Surface: None
```

```
    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 77

    Transform: SCS
    Lag: 44
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: B7
    Canvas X: -5578.144853875476
    Canvas Y: -1467.598475222363
    Area: 0.19
    Downstream: J2

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 70

    Transform: SCS
    Lag: 14
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Junction: J2
    Canvas X: -5196.95044472681
    Canvas Y: 387.5476493011438
    Label X: -12.0
    Label Y: 20.0
    Downstream: R2
End:

Reach: R2
    Canvas X: -3462.51588310038
    Canvas Y: 387.5476493011438
    From Canvas X: -5196.95044472681
    From Canvas Y: 387.5476493011438
    Label X: -16.0
    Label Y: 11.0
    Downstream: J4
```

```
    Route: Muskingum Cunge
    Channel: Trapezoid
    Length: 2924
    Energy Slope: 0.0055
    Width: 35
    Side Slope: 3
    Mannings n: 0.030
    Use Variable Time Step: No
    Channel Loss: None
End:

Subbasin: B4
    Canvas X: -5476.493011435832
    Canvas Y: -3614.9936467598473
    Area: 3.53
    Downstream: J3

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 77

    Transform: SCS
    Lag: 84
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: B5
    Canvas X: -2770.0127064803046
    Canvas Y: -3386.277001270648
    Area: 2.14
    Downstream: J3

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 75

    Transform: SCS
```

```
    Lag: 52
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Junction: J3
    Canvas X: -4161.3722998729345
    Canvas Y: -1200.762388818297
    Downstream: R3
End:

Reach: R3
    Canvas X: -3462.51588310038
    Canvas Y: 387.5476493011438
    From Canvas X: -4161.3722998729345
    From Canvas Y: -1200.762388818297
    Label X: -10.0
    Label Y: -14.0
    Downstream: J4

    Route: Muskingum Cunge
    Channel: Trapezoid
    Length: 4514
    Energy Slope: 0.0044
    Width: 30
    Side Slope: 3
    Mannings n: 0.030
    Use Variable Time Step: No
    Channel Loss: None
End:

Subbasin: B6
    Canvas X: -2903.4307496823367
    Canvas Y: -1594.663278271918
    Area: 0.56
    Downstream: J4

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 70

    Transform: SCS
    Lag: 42
```

```
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: B8
    Canvas X: -4351.969504447266
    Canvas Y: 3017.789072426938
    Area: 0.08
    Downstream: J4

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 79

    Transform: SCS
    Lag: 20
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Junction: J4
    Canvas X: -3462.51588310038
    Canvas Y: 387.5476493011438
    Label X: -11.0
    Label Y: 22.0
    Downstream: R4
End:

Reach: R4
    Canvas X: -1747.1410419313843
    Canvas Y: 362.13468869123244
    From Canvas X: -3462.51588310038
    From Canvas Y: 387.5476493011438
    Label X: -20.0
    Label Y: 11.0
    Downstream: J5

    Route: Muskingum Cunge
    Channel: Trapezoid
    Length: 773
    Energy Slope: 0.001
    Width: 30
```

```
    Side Slope: 3
    Mannings n: 0.03
    Use Variable Time Step: No
    Channel Loss: None
End:

Subbasin: B9
    Canvas X: -2509.5298602287157
    Canvas Y: 2903.430749682338
    Area: 0.9
    Downstream: J5

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 70

    Transform: SCS
    Lag: 52
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: B10
    Canvas X: -1728.081321473951
    Canvas Y: -1124.523506988564
    Area: 0.01
    Downstream: J5

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 79

    Transform: SCS
    Lag: 15
    Unitgraph Type: STANDARD

    Baseflow: None
End:
```

```
Junction: J5
    Canvas X: -1747.1410419313843
    Canvas Y: 362.13468869123244
    Label X: -11.0
    Label Y: 22.0
    Downstream: R5
End:

Reach: R5
    Canvas X: -273.18932655654316
    Canvas Y: 349.4282083862772
    From Canvas X: -1747.1410419313843
    From Canvas Y: 362.13468869123244
    Label X: -18.0
    Label Y: 12.0
    Downstream: Oshoto R.

    Route: Muskingum Cunge
    Channel: Trapezoid
    Length: 4947
    Energy Slope: 0.001
    Width: 30
    Side Slope: 3
    Mannings n: 0.03
    Use Variable Time Step: No
    Channel Loss: None
End:

Subbasin: B11
    Canvas X: -387.5476493011429
    Canvas Y: -1086.4040660736973
    Area: 0.4
    Downstream: Oshoto R.

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 69

    Transform: SCS
    Lag: 49
    Unitgraph Type: STANDARD

    Baseflow: None
End:
```

```
Reservoir: Oshoto R.
    Canvas X: -273.18932655654316
    Canvas Y: 349.4282083862772
    Label X: -38.0
    Label Y: 20.0
    Downstream: R6

    Route: Controlled Outflow
    Routing Curve: Elevation-Area
    Initial Elevation: 4134
    Elevation-Area Table: Oshoto
    Adaptive Control: On
    Main Tailwater Condition: None
    Auxiliary Tailwater Condition: None

    Spillway: Broad-Crested Spillway
    Spillway Outlet: Main
    Spillway Crest Length: 45
    Spillway Crest Elevation: 4134
    Spillway Coefficient: 2.63
    End Spillway:

    Spillway: Broad-Crested Spillway
    Spillway Outlet: Main
    Spillway Crest Length: 50
    Spillway Crest Elevation: 4135.5
    Spillway Coefficient: 2.63
    End Spillway:

    Dam Top: Level Dam
    Dam Top Outlet: Main
    Overflow Coefficient: 2.63
    Top Length: 415
    Top Elevation: 4137.5
    End Dam Top:

    Evaporation Method: Zero Evaporation
    End Evaporation:
End:

Reach: R6
    Canvas X: 1416.7725540025422
    Canvas Y: 374.84116899618857
    From Canvas X: -273.18932655654316
    From Canvas Y: 349.4282083862772
    Label X: -23.0
    Label Y: 10.0
```

```
    Downstream: J6

    Route: Muskingum Cunge
    Channel: Trapezoid
    Length: 1919
    Energy Slope: 0.0031
    Width: 30
    Side Slope: 3
    Mannings n: 0.03
    Use Variable Time Step: No
    Channel Loss: None
End:

Subbasin: B13
    Canvas X: 1035.5781448538764
    Canvas Y: -1048.2846251588307
    Area: 1.65
    Downstream: J6

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 78

    Transform: SCS
    Lag: 76
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: B12
    Canvas X: 635.3240152477756
    Canvas Y: 2077.509529860229
    Area: 0.04
    Downstream: J6

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 83
```

```
    Transform: SCS
    Lag: 25
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Junction: J6
    Canvas X: 1416.7725540025422
    Canvas Y: 374.84116899618857
    Label X: -12.0
    Label Y: 21.0
    Downstream: R7
End:

Reach: R7
    Canvas X: 3017.789072426938
    Canvas Y: 374.84116899618857
    From Canvas X: 1416.7725540025422
    From Canvas Y: 374.84116899618857
    Label X: -22.0
    Label Y: 10.0
    Downstream: J8

    Route: Muskingum Cunge
    Channel: Trapezoid
    Length: 1602
    Energy Slope: 0.005
    Width: 30
    Side Slope: 3
    Mannings n: 0.03
    Use Variable Time Step: No
    Channel Loss: None
End:

Subbasin: B14
    Canvas X: 1048.2846251588326
    Canvas Y: 3424.396442185515
    Area: 0.44
    Downstream: J7

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 78
```

```
    Transform: SCS
    Lag: 31
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: B15
    Canvas X: 2928.843710292249
    Canvas Y: 3500.635324015248
    Area: 0.16
    Downstream: J7

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 75

    Transform: SCS
    Lag: 18
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Junction: J7
    Canvas X: 2445.9974587039396
    Canvas Y: 1925.0317662007628
    Downstream: R8
End:

Reach: R8
    Canvas X: 3017.789072426938
    Canvas Y: 374.84116899618857
    From Canvas X: 2445.9974587039396
    From Canvas Y: 1925.0317662007628
    Label X: -10.0
    Label Y: 9.0
    Downstream: J8

    Route: Muskingum Cunge
    Channel: Trapezoid
    Length: 3568
    Energy Slope: 0.0106
```

```
    Width: 30
    Side Slope: 3
    Mannings n: 0.03
    Use Variable Time Step: No
    Channel Loss: None
End:

Subbasin: B16
    Canvas X: 3703.9390088945365
    Canvas Y: 1950.4447268106737
    Area: 0.16
    Downstream: J8

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 69

    Transform: SCS
    Lag: 28
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Subbasin: B17
    Canvas X: 2585.76874205845
    Canvas Y: -1111.8170266836078
    Area: 0.02
    Downstream: J8

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 83

    Transform: SCS
    Lag: 19
    Unitgraph Type: STANDARD

    Baseflow: None
End:
```

Junction: J8
    Canvas X: 3017.789072426938
    Canvas Y: 374.84116899618857
    Label X: -10.0
    Label Y: -13.0
    Downstream: R9
End:

Reach: R9
    Canvas X: 4974.58703939009
    Canvas Y: 387.5476493011438
    From Canvas X: 3017.789072426938
    From Canvas Y: 374.84116899618857
    Label X: -21.0
    Label Y: 11.0
    Downstream: J9

    Route: Muskingum Cunge
    Channel: Trapezoid
    Length: 599
    Energy Slope: 0.0017
    Width: 30
    Side Slope: 3
    Mannings n: 0.03
    Use Variable Time Step: No
    Channel Loss: None
End:

Subbasin: B18
    Canvas X: 4758.576874205846
    Canvas Y: 1886.9123252858963
    Area: 0.13
    Downstream: J9

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 68

    Transform: SCS
    Lag: 20
    Unitgraph Type: STANDARD

    Baseflow: None

```
End:

Subbasin: B19
    Canvas X: 4682.337992376113
    Canvas Y: -1200.762388818297
    Area: 0.01
    Downstream: J9

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 71

    Transform: SCS
    Lag: 15
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Junction: J9
    Canvas X: 4974.58703939009
    Canvas Y: 387.5476493011438
    Label X: -8.0
    Label Y: 20.0
    Downstream: R10
End:

Reach: R10
    Canvas X: 7058.449809402795
    Canvas Y: 412.96060991105514
    From Canvas X: 4974.58703939009
    From Canvas Y: 387.5476493011438
    Label X: -30.0
    Label Y: 19.0
    Downstream: J10

    Route: Muskingum Cunge
    Channel: Trapezoid
    Length: 635
    Energy Slope: 0.0031
    Width: 30
    Side Slope: 3
    Mannings n: 0.03
    Use Variable Time Step: No
```

```
    Channel Loss: None
End:

Subbasin: B20
    Canvas X: 6842.439644218552
    Canvas Y: 1785.2604828462518
    Area: 0.01
    Downstream: J10

    Canopy: None

    Surface: None

    LossRate: SCS
    Percent Impervious Area: 0.0
    Curve Number: 82

    Transform: SCS
    Lag: 11
    Unitgraph Type: STANDARD

    Baseflow: None
End:

Junction: J10
    Canvas X: 7058.449809402795
    Canvas Y: 412.96060991105514
End:

Basin Schematic Properties:
    Last View N: 5000.0
    Last View S: -5000.0
    Last View W: -5000.0
    Last View E: 5000.0
    Maximum View N: 5000.0
    Maximum View S: -5000.0
    Maximum View W: -5000.0
    Maximum View E: 5000.0
    Extent Method: Elements
    Buffer: 0
    Draw Icons: Yes
    Draw Icon Labels: Yes
    Draw Map Objects: No
    Draw Gridlines: No
    Draw Flow Direction: No
    Fix Element Locations: No
    Fix Hydrologic Order: No
End:
```

ADDENDUM 2.7-B

MILLER PEAK FLOW ESTIMATES

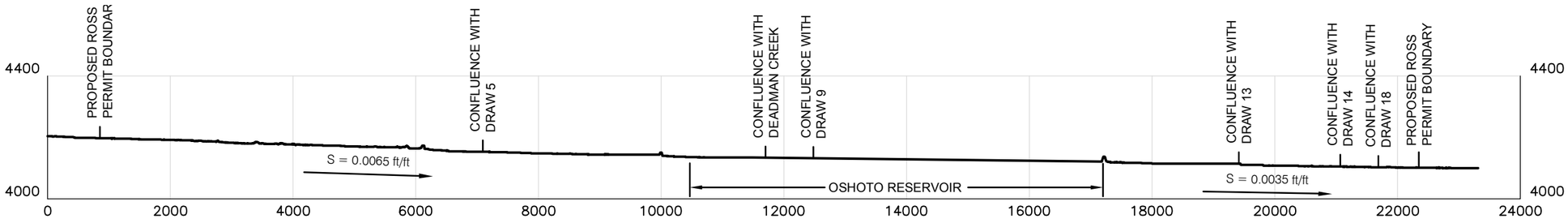
Miller Peak Flow Estimates

Equation	Junction	Area (mi^2)	Peak Discharge (cfs)
$Q_2 = 29.9(Area^{0.475})$	10	18.2	112
$Q_5 = 80.9(Area^{0.455})$	10	18.2	303
$Q_{10} = 134(Area^{0.447})$	10	18.2	490
$Q_{25} = 225(Area^{0.439})$	10	18.2	804
$Q_{50} = 311(Area^{0.434})$	10	18.2	1096
$Q_{100} = 415(Area^{0.430})$	10	18.2	1445

Note: Equations for the estimation of peak flows use Hydrologic Region 2 from Miller, 2003.

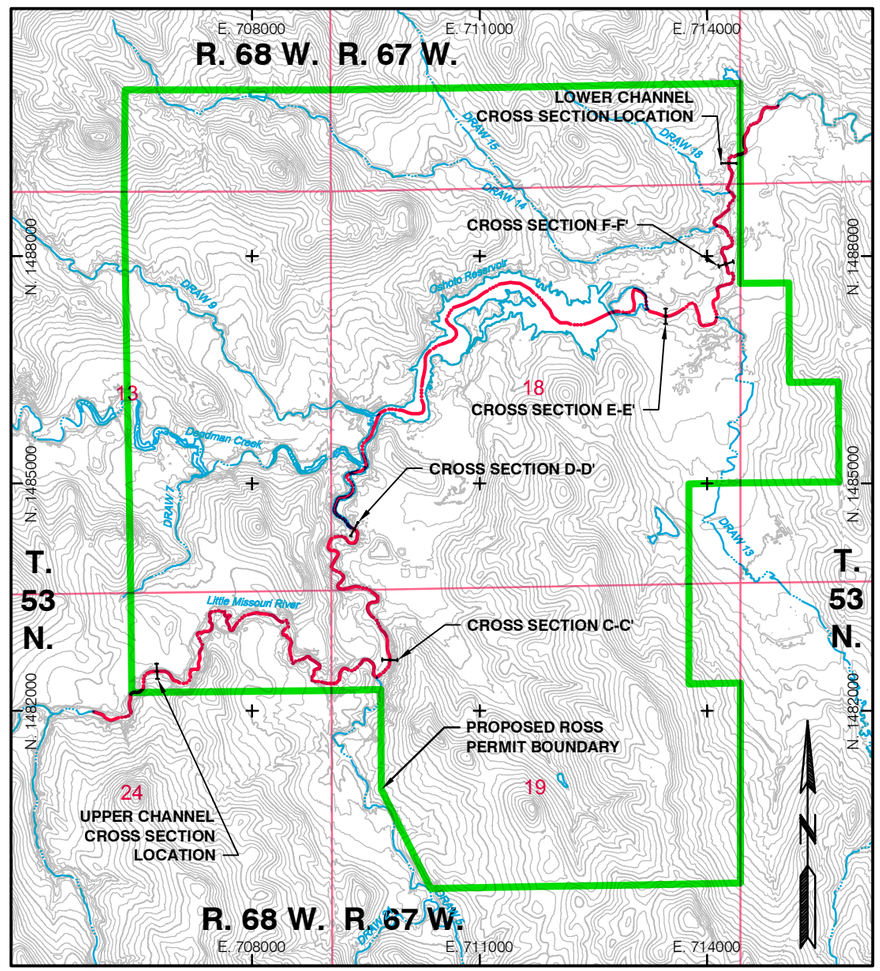
ADDENDUM 2.7-C

FLOOD INUNDATION STUDY



LITTLE MISSOURI RIVER CHANNEL PROFILE

EXAGGERATION 5H:1V (FT)



Basemap: 5' Contours from May 2010 Flight

Drawing Coordinates: WY83EF

ROSS PROJECT AREA

0 1000 2000 4000

GRAPHIC SCALE (FEET)

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY

P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

ADDENDUM 2.7-C
FIGURE 1 SHEET 1 OF 2

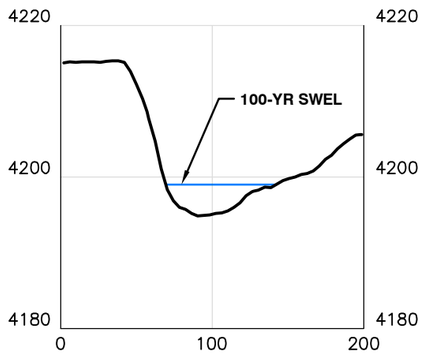
LITTLE MISSOURI RIVER CHANNEL PROFILE AND CROSS SECTIONS

Drawn By: DCJ
Checked By: DEB
Date: 11/24/10

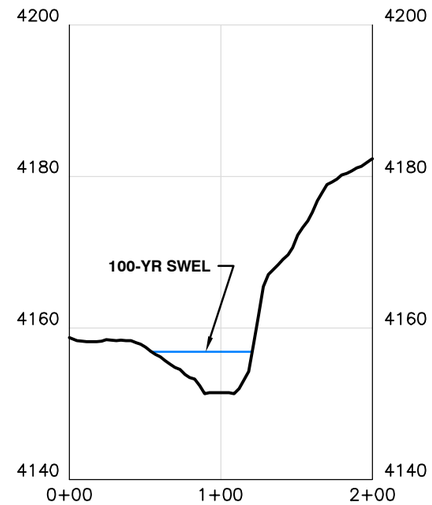
WWC ENGINEERING
www.wwcengineering.com

FILE: ROSS_ER_HYD_PRO_LMR

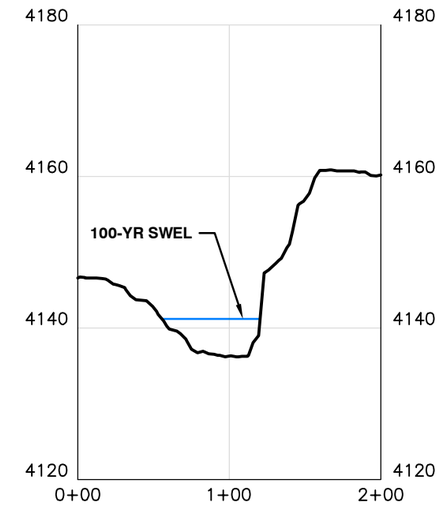
K:\Peninsula_Minerals\09142\DWGS_WY83E\ROSS_ER_HYD_PRO_LMR.dwg, TRA_2.7-C_FIGURE_1_SH1, 12/18/2010 1:57:42 PM



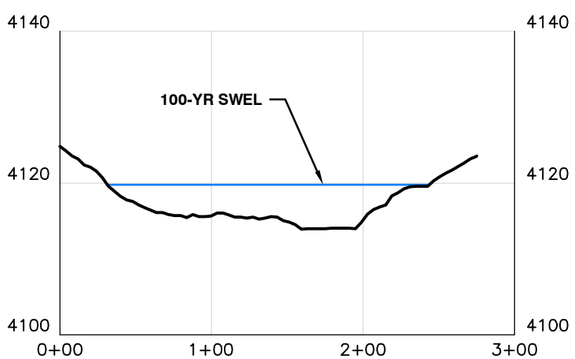
LITTLE MISSOURI RIVER
UPPER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



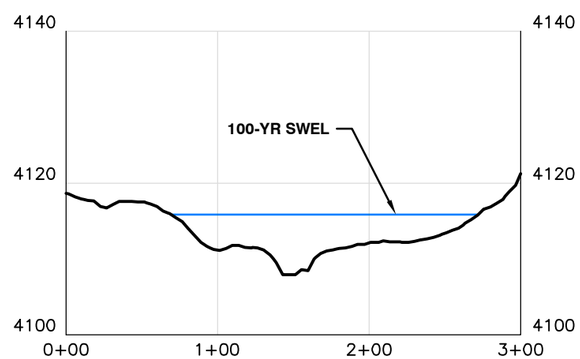
LITTLE MISSOURI RIVER
CHANNEL CROSS SECTION C-C'
EXAGGERATION 5H:1V (FT)



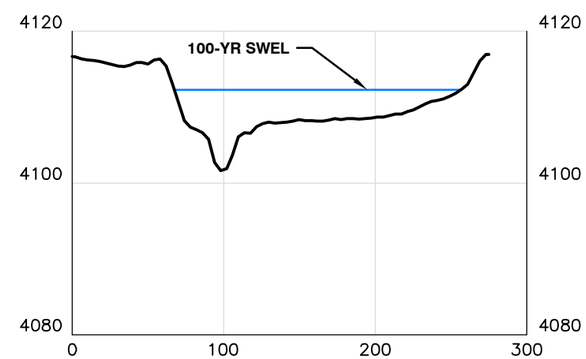
LITTLE MISSOURI RIVER
CHANNEL CROSS SECTION D-D'
EXAGGERATION 5H:1V (FT)



LITTLE MISSOURI RIVER
CHANNEL CROSS SECTION E-E'
EXAGGERATION 5H:1V (FT)



LITTLE MISSOURI RIVER
CHANNEL CROSS SECTION F-F'
EXAGGERATION 5H:1V (FT)



LITTLE MISSOURI RIVER
LOWER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

ADDENDUM 2.7-C
FIGURE 1 **SHEET 2 OF 2**

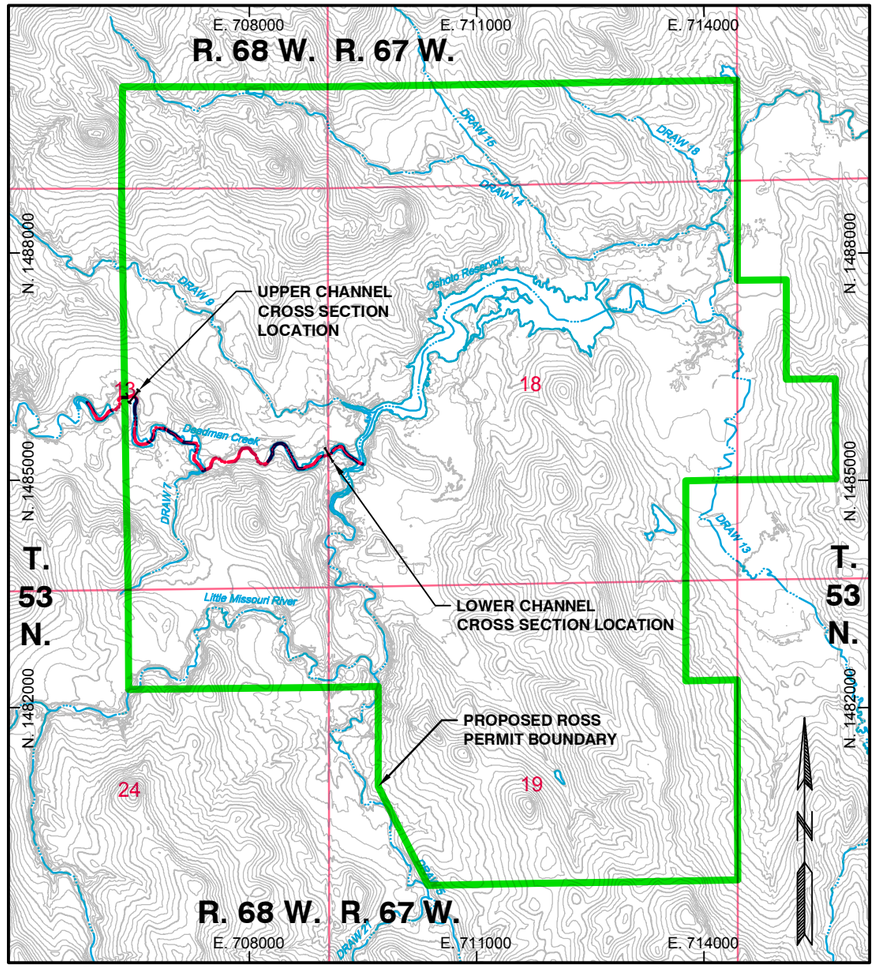
LITTLE MISSOURI RIVER CHANNEL PROFILE AND CROSS SECTIONS

Drawn By: DCJ
Checked By: DEB
Date: 11/24/10

WWC ENGINEERING
www.wwcengineering.com

FILE: ROSS_ER_HYD_PRO_LMR

K:\Peninsula_Minerals\09142\DWGS_WY83E\ROSS_ER_HYD_PRO_LMR.dwg, TRA_2.7-C_FIGURE_1_SH2, 12/18/2010 1:57:51 PM



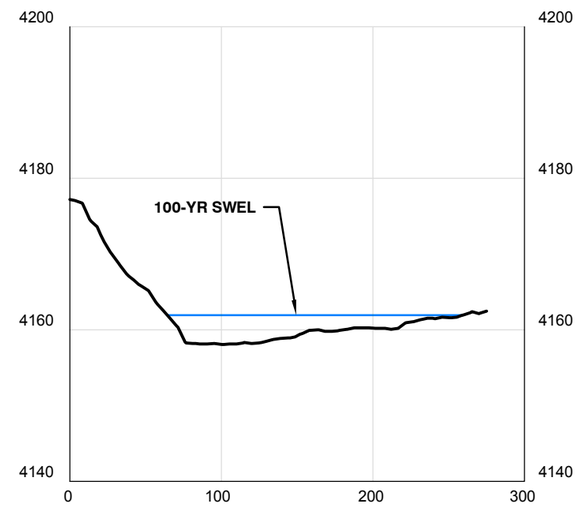
Basemap: 5' Contours from May 2010 Flight

Drawing Coordinates: WY83EF

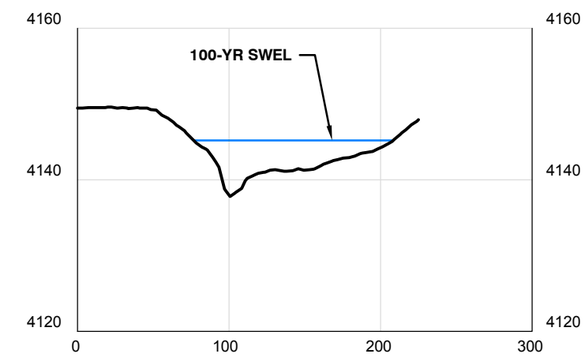
ROSS PROJECT AREA

0 1000 2000 4000

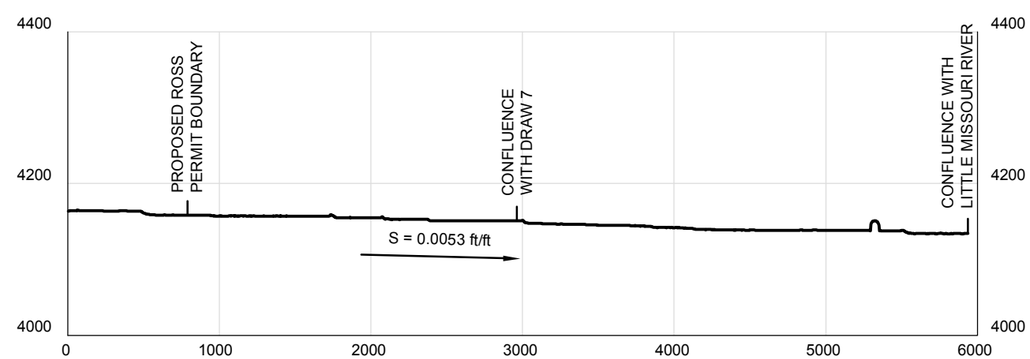
GRAPHIC SCALE (FEET)



DEADMAN CREEK
UPPER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DEADMAN CREEK
LOWER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DEADMAN CREEK
CHANNEL PROFILE
EXAGGERATION 5H:1V (FT)

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

ADDENDUM 2.7-C
FIGURE 2

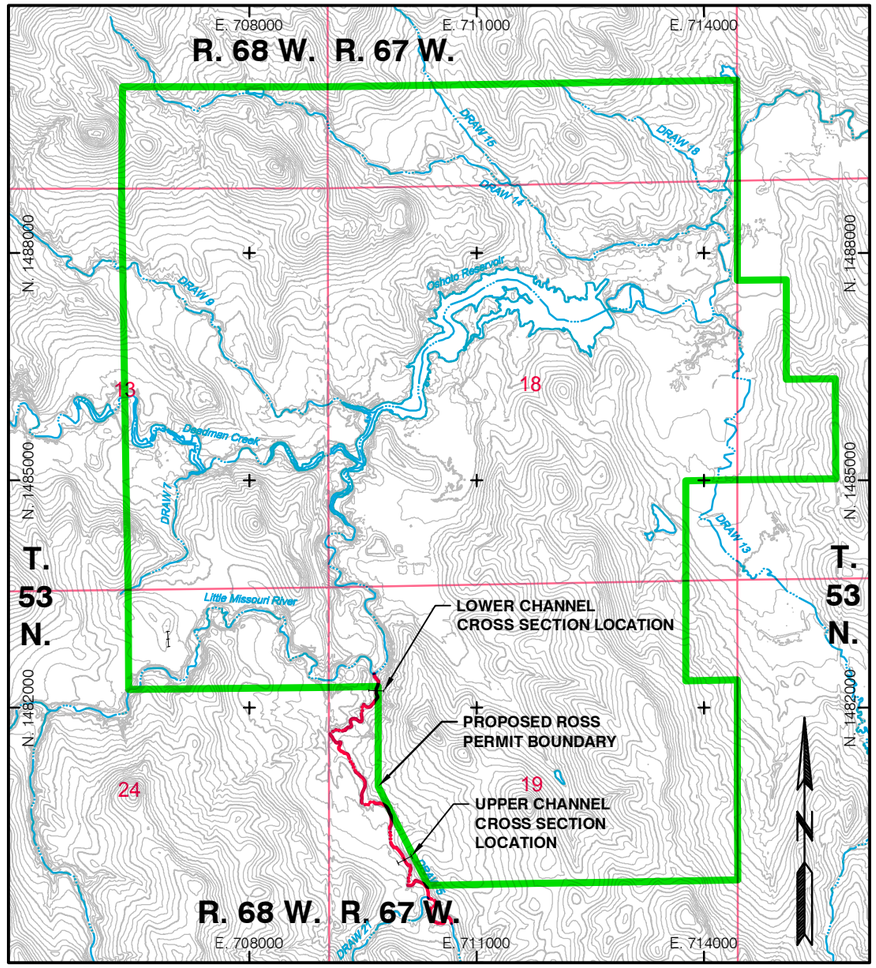
DEADMAN CREEK CHANNEL PROFILE AND CROSS SECTIONS

Drawn By: DCJ
Checked By: DEB
Date: 11/24/10

WWC ENGINEERING
www.wwcengineering.com

FILE: ROSS_ER_HYD_PRO_DEADMAN

K:\Peninsula_Minerals\09142\DWGS_WY83E\ROSS_ER_HYD_PRO_DEADMAN.dwg, TRA_2.7-C_FIGURE_2, 12/18/2010 1:41:45 PM



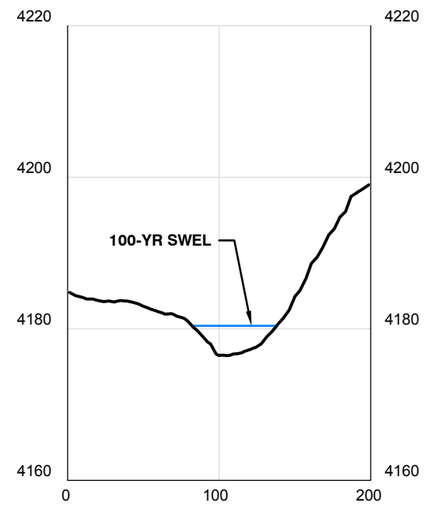
Basemap: 5' Contours from May 2010 Flight

Drawing Coordinates: WY83EF

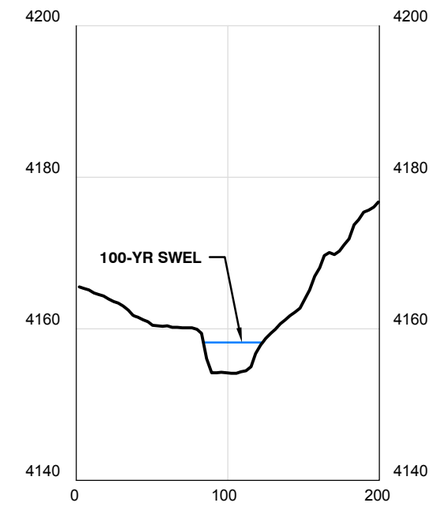
ROSS PROJECT AREA

0 1000 2000 4000

GRAPHIC SCALE (FEET)



DRAW 5
UPPER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



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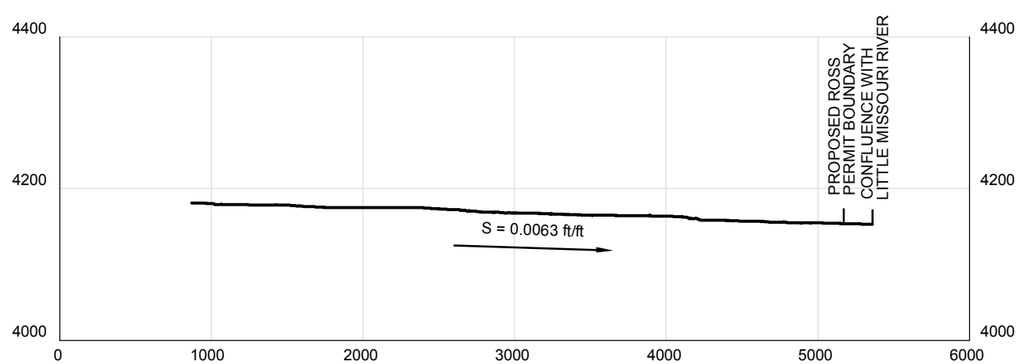
LOWER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DRAW 5
CHANNEL PROFILE
EXAGGERATION 5H:1V (FT)

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

ADDENDUM 2.7-C
FIGURE 3

DRAW 5 CHANNEL PROFILE AND CROSS SECTIONS

Drawn By: DCJ
Checked By: DEB
Date: 11/24/10

FILE: ROSS_ER_HYD_PRO_DRAW_5

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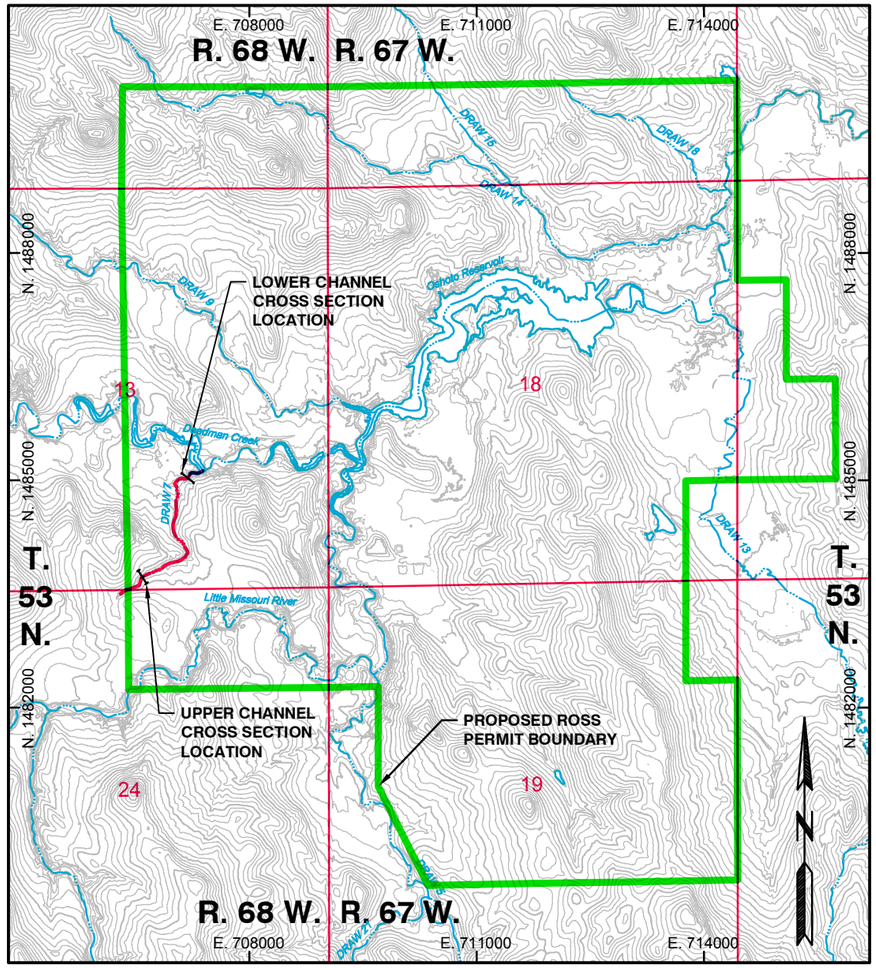
K:\Peninsula_Minerals\09142\DWGS_WY83E\ROSS_ER_HYD_PRO_DRAW_5.dwg, TRA_2.7-C_FIGURE_3, 12/18/2010 1:42:55 PM



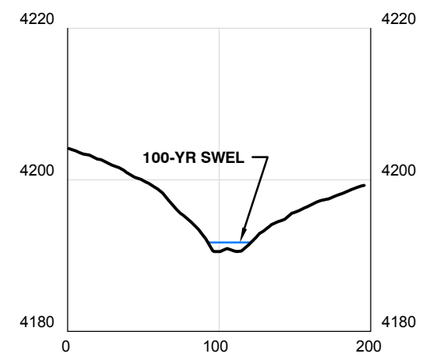
Basemap: 5' Contours from May 2010 Flight

Drawing Coordinates: WY83EF

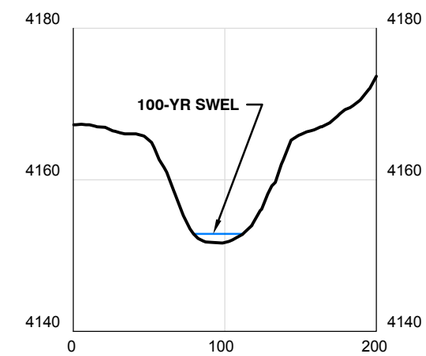
ROSS PROJECT AREA

0 1000 2000 4000

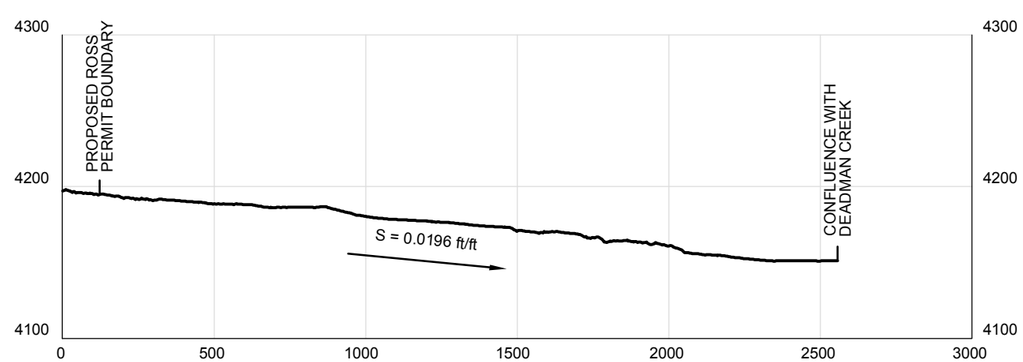
GRAPHIC SCALE (FEET)



DRAW 7
UPPER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DRAW 7
LOWER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DRAW 7
CHANNEL PROFILE
EXAGGERATION 5H:1V (FT)

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

ADDENDUM 2.7-C
FIGURE 4

DRAW 7
CHANNEL PROFILE AND CROSS SECTIONS

Drawn By: DCJ
Checked By: DEB
Date: 11/24/10

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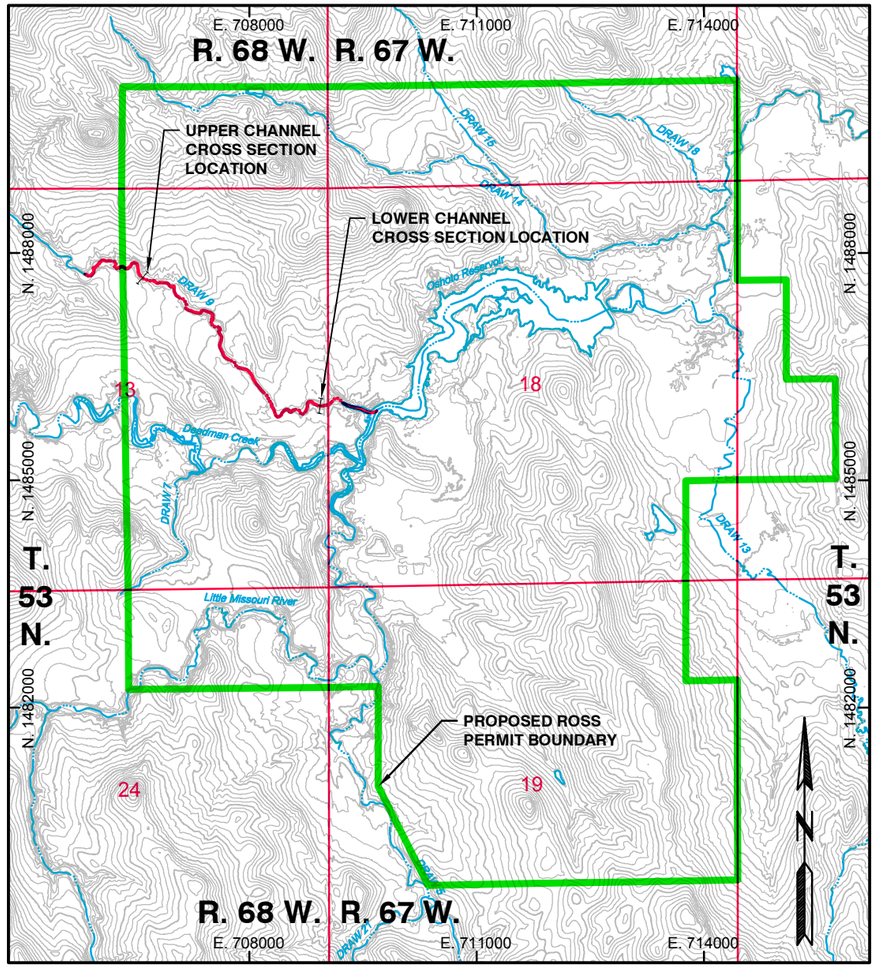
FILE: ROSS_ER_HYD_PRO_DRAW_7

K:\Peninsula_Minerals\09142\DWGS_WY83E\ROSS_ER_HYD_PRO_DRAW_7.dwg, TRA_2.7-C_FIGURE_4, 12/18/2010 1:44:20 PM



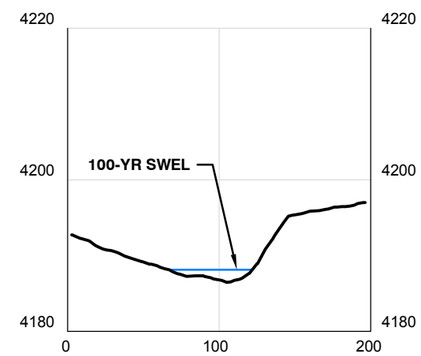
Basemap: 5' Contours from May 2010 Flight

Drawing Coordinates: WY83EF

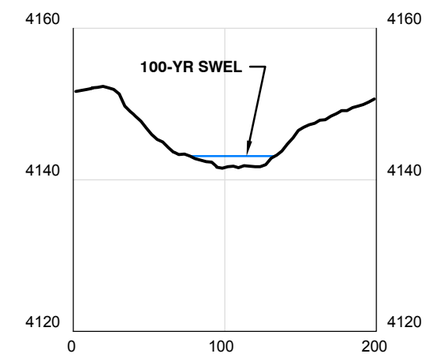
ROSS PROJECT AREA

0 1000 2000 4000

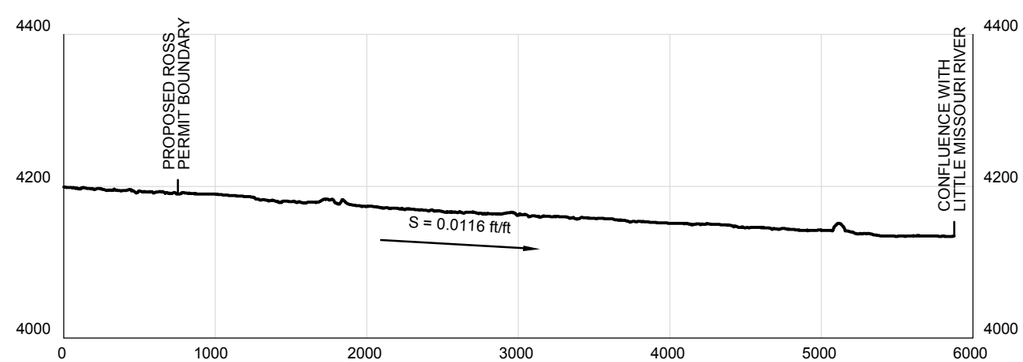
GRAPHIC SCALE (FEET)



DRAW 9
UPPER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DRAW 9
LOWER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DRAW 9
CHANNEL PROFILE
EXAGGERATION 5H:1V (FT)

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

ADDENDUM 2.7-C
FIGURE 5

DRAW 9
CHANNEL PROFILE AND CROSS SECTIONS

Drawn By: DCJ
Checked By: DEB
Date: 11/24/10

WWC ENGINEERING
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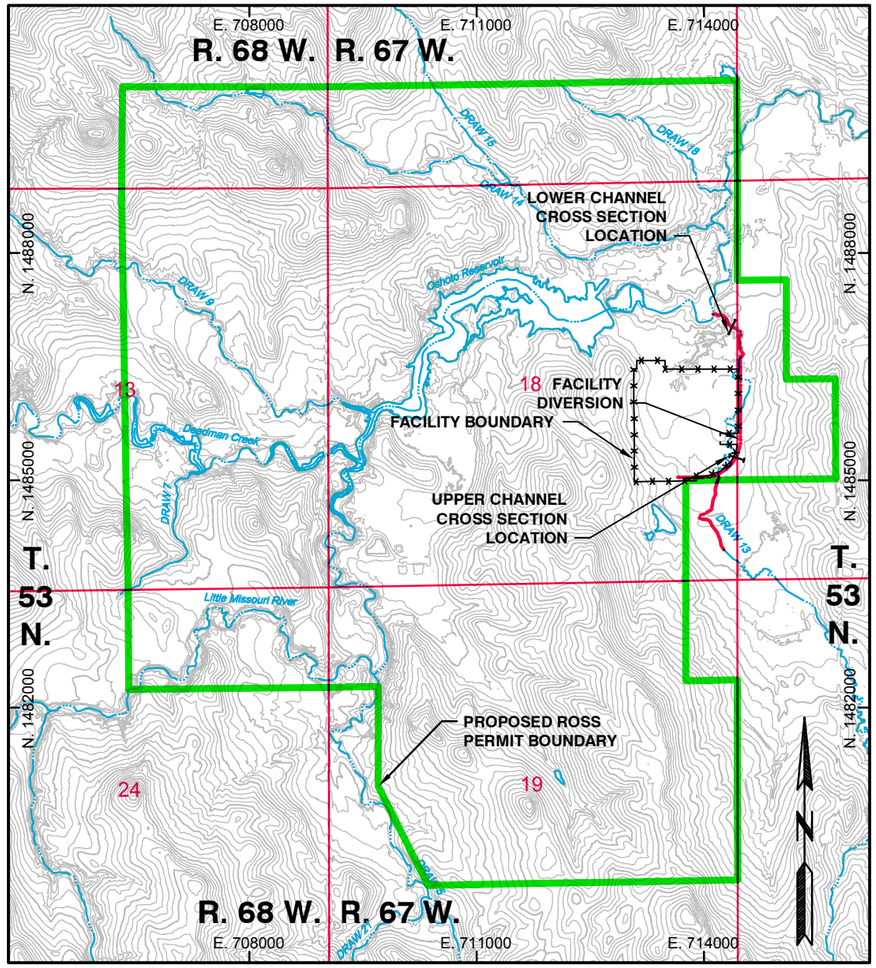
FILE: ROSS_ER_HYD_PRO_DRAW_9

K:\Peninsula_Minerals\09142\DWGS_WY83E\ROSS_ER_HYD_PRO_DRAW_9.dwg, TRA_2.7-C_FIGURE_5, 12/18/2010 1:48:44 PM



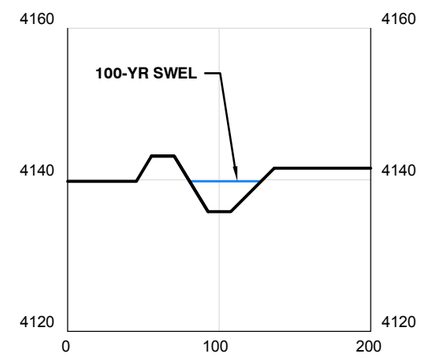
Basemap: 5' Contours from May 2010 Flight

Drawing Coordinates: WY83EF

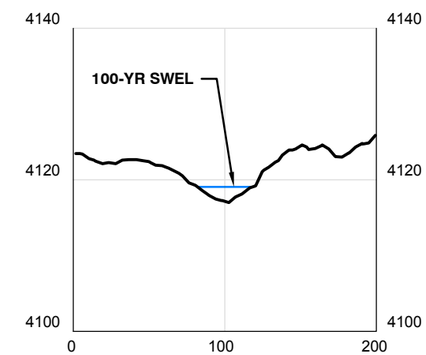
ROSS PROJECT AREA

0 1000 2000 4000

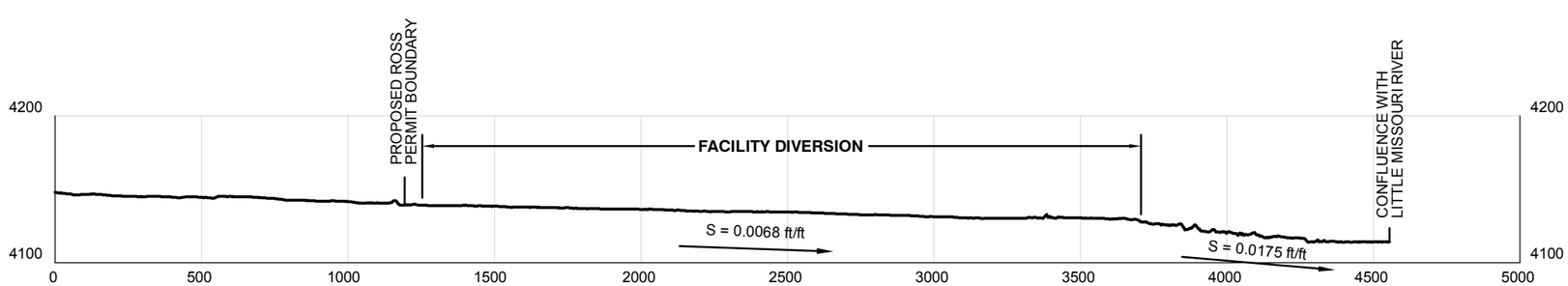
GRAPHIC SCALE (FEET)



DRAW 13
DIVERSION CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DRAW 13
LOWER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DRAW 13
CHANNEL PROFILE
EXAGGERATION 5H:1V (FT)

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

ADDENDUM 2.6-C
FIGURE 6

DRAW 13 CHANNEL PROFILE AND CROSS SECTIONS

Drawn By: DCJ
Checked By: DEB
Date: 11/24/10

WWC ENGINEERING
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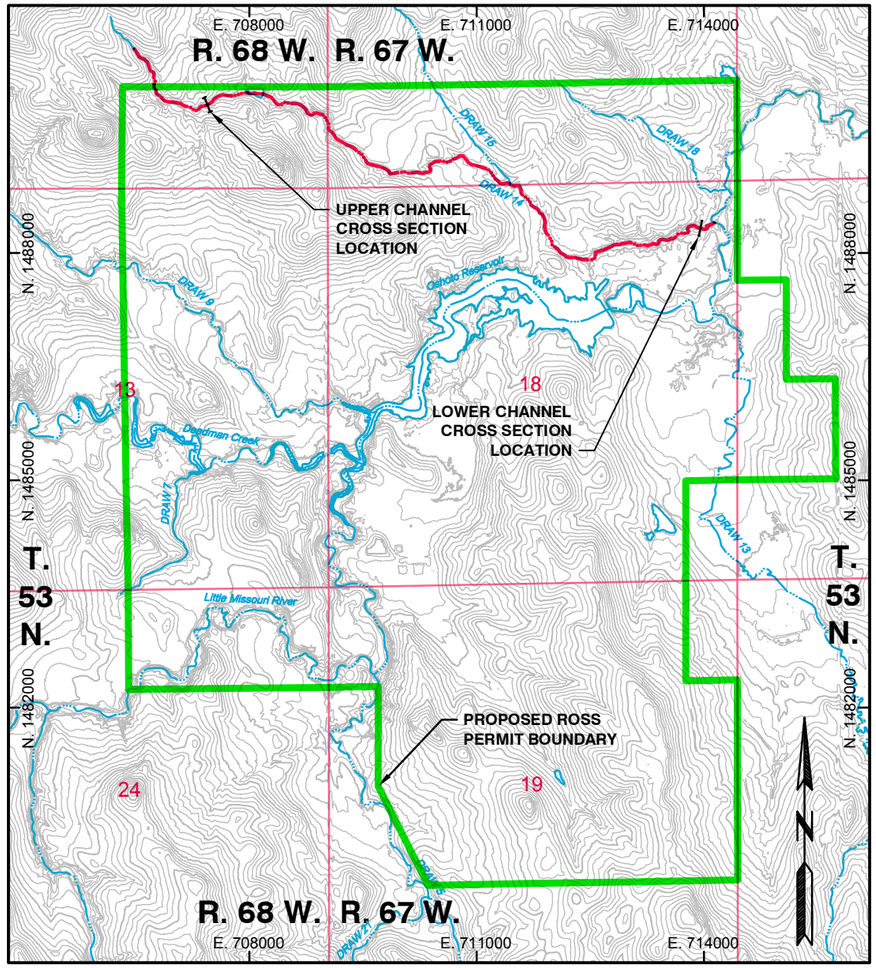
FILE: ROSS_ER_HYD_PRO_DRAW_13

K:\Peninsula_Minerals\09142\DWGS_WY83E\ROSS_ER_HYD_PRO_DRAW_13.dwg, TRA_2.7-C_FIGURE_6, 12/18/2010 1:49:43 PM



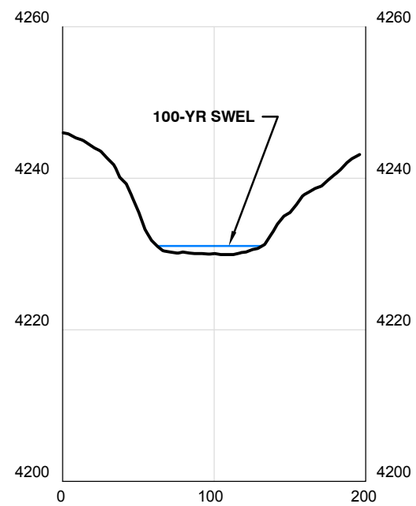
Basemap: 5' Contours from May 2010 Flight

Drawing Coordinates: WY83EF

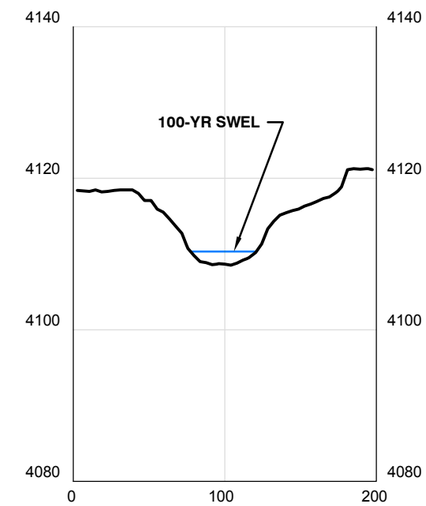
ROSS PROJECT AREA

0 1000 2000 4000

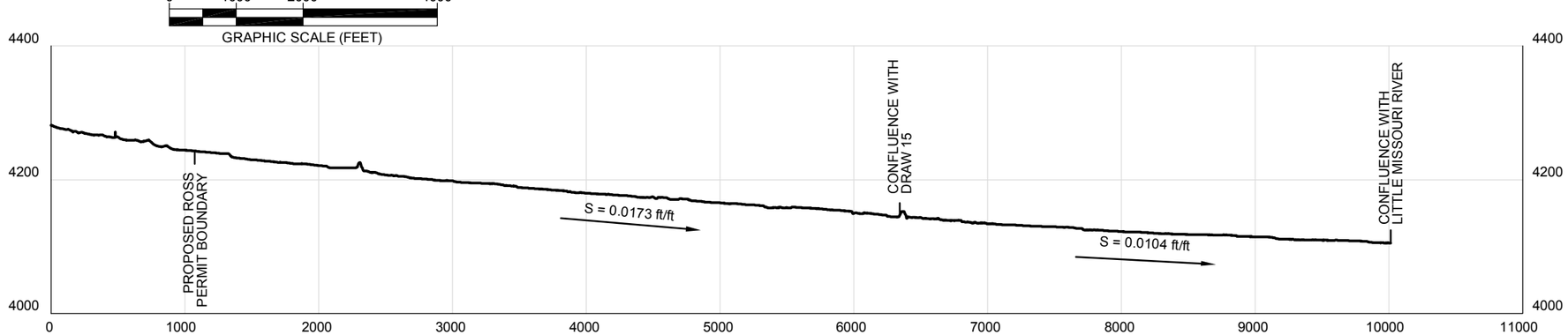
GRAPHIC SCALE (FEET)



DRAW 14
UPPER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DRAW 14
LOWER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DRAW 14
CHANNEL PROFILE
EXAGGERATION 5H:1V (FT)

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

ADDENDUM 2.7-C
FIGURE 7

DRAW 14
CHANNEL PROFILE AND CROSS SECTIONS

Drawn By: DCJ
Checked By: DEB
Date: 11/24/10

FILE: ROSS_ER_HYD_PRO_DRAW_14

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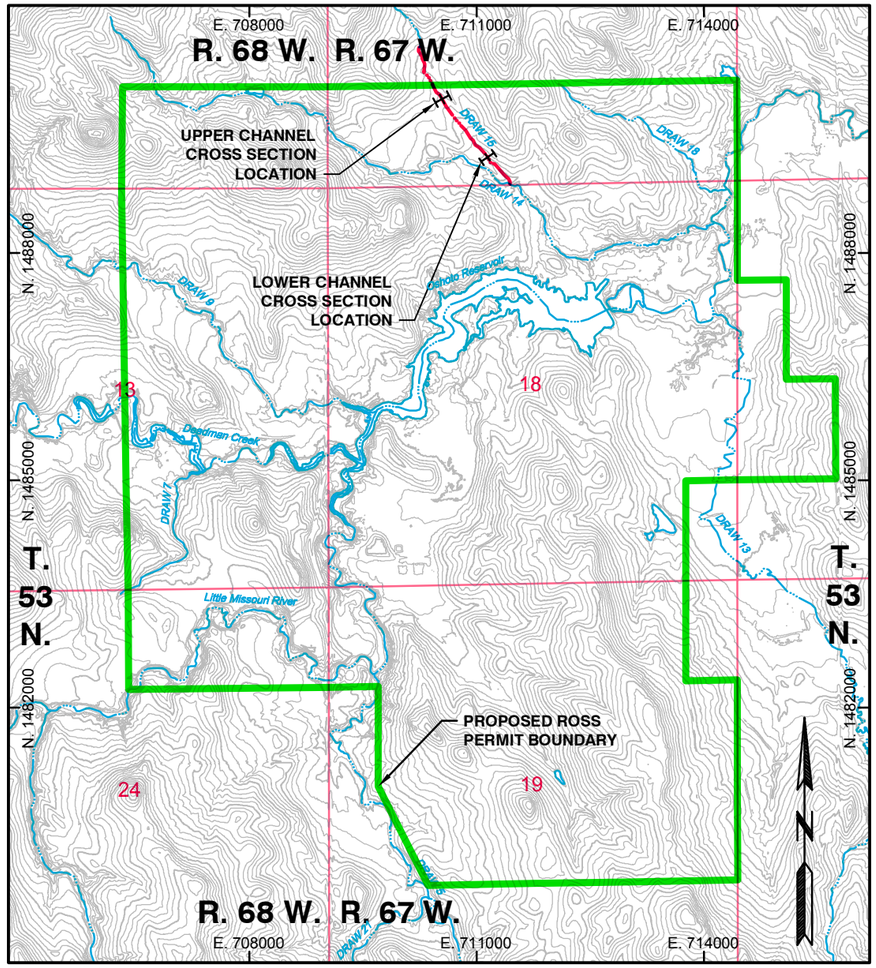
K:\Peninsula_Minerals\09142\DWGS_WY83E\ROSS_ER_HYD_PRO_DRAW_14.dwg, TRA_2.7-C_FIGURE_7, 12/18/2010 1:51:43 PM



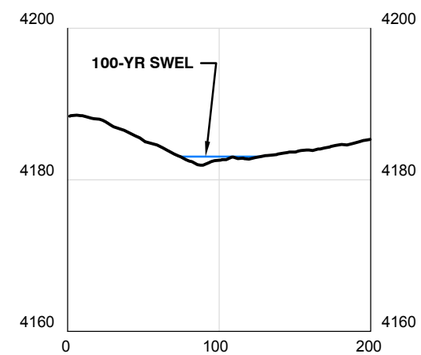
Basemap: 5' Contours from May 2010 Flight

Drawing Coordinates: WY83EF

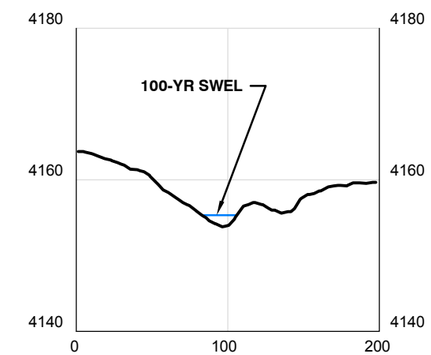
ROSS PROJECT AREA

0 1000 2000 4000

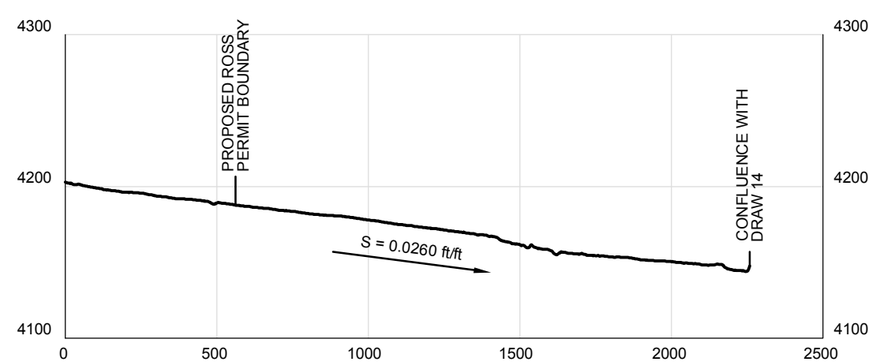
GRAPHIC SCALE (FEET)



DRAW 15
UPPER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DRAW 15
LOWER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DRAW 15
CHANNEL PROFILE
EXAGGERATION 5H:1V (FT)

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS

Date	Description

ADDENDUM 2.7-C
FIGURE 8

DRAW 15
CHANNEL PROFILE AND CROSS SECTIONS

Drawn By: DCJ
Checked By: DEB
Date: 11/24/10

FILE: ROSS_ER_HYD_PRO_DRAW_15

WWC ENGINEERING
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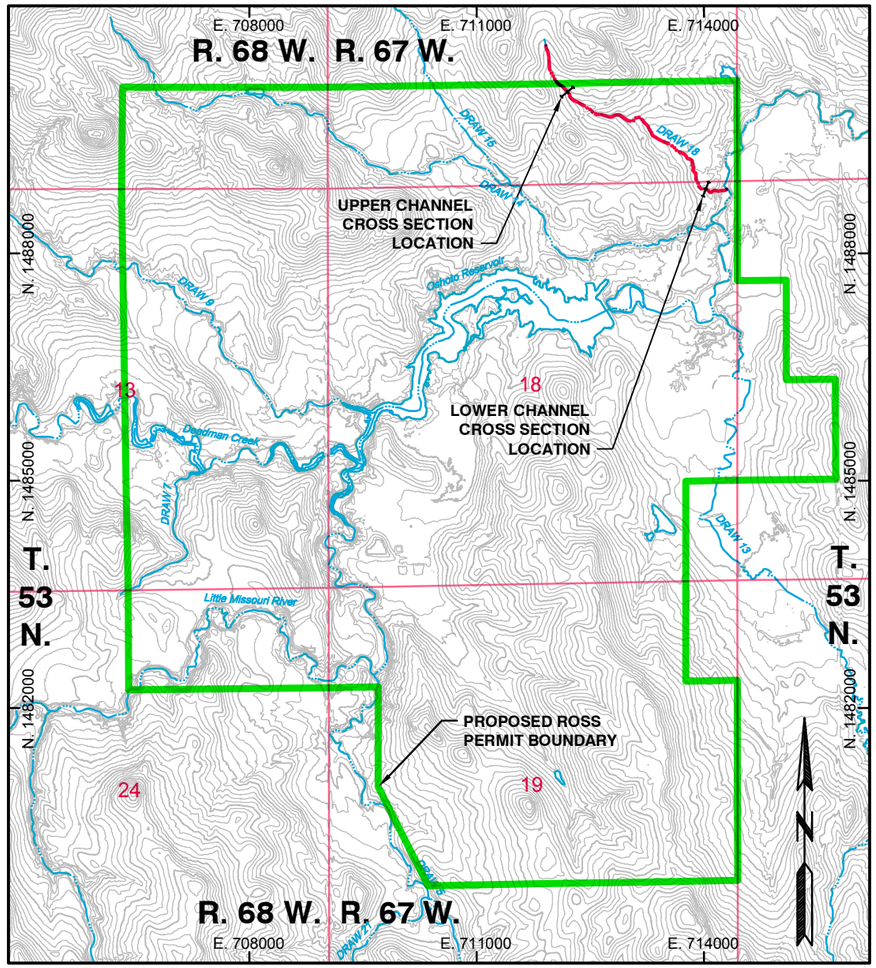
K:\Peninsula_Minerals\09142\DWGS_WY83E\ROSS_ER_HYD_PRO_DRAW_15.dwg, TRA_2.7-C_FIGURE_8, 12/18/2010 1:53:35 PM



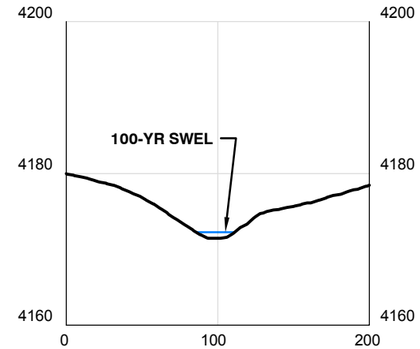
Basemap: 5' Contours from May 2010 Flight

Drawing Coordinates: WY83EF

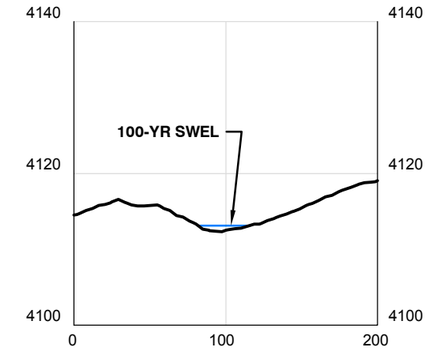
ROSS PROJECT AREA

0 1000 2000 4000

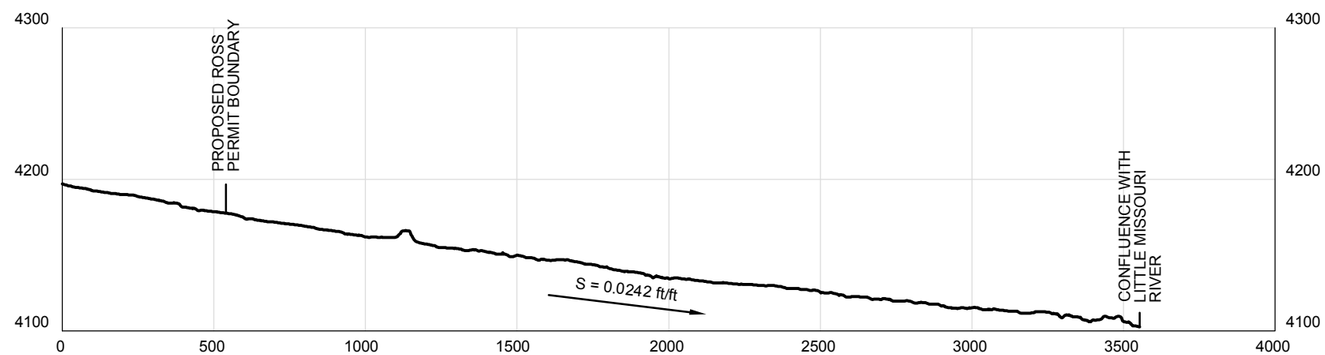
GRAPHIC SCALE (FEET)



DRAW 18
UPPER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DRAW 18
LOWER CHANNEL CROSS SECTION
EXAGGERATION 5H:1V (FT)



DRAW 18
CHANNEL PROFILE
EXAGGERATION 5H:1V (FT)

STRATA ENERGY

ROSS ISR PROJECT
CROOK COUNTY, WY
P.O. BOX 2318
GILLETTE, WY 82716

REVISIONS	
Date	Description

ADDENDUM 2.7-C
FIGURE 9

DRAW 18 CHANNEL PROFILE AND CROSS SECTIONS

Drawn By: DCJ
Checked By: DEB
Date: 11/24/10

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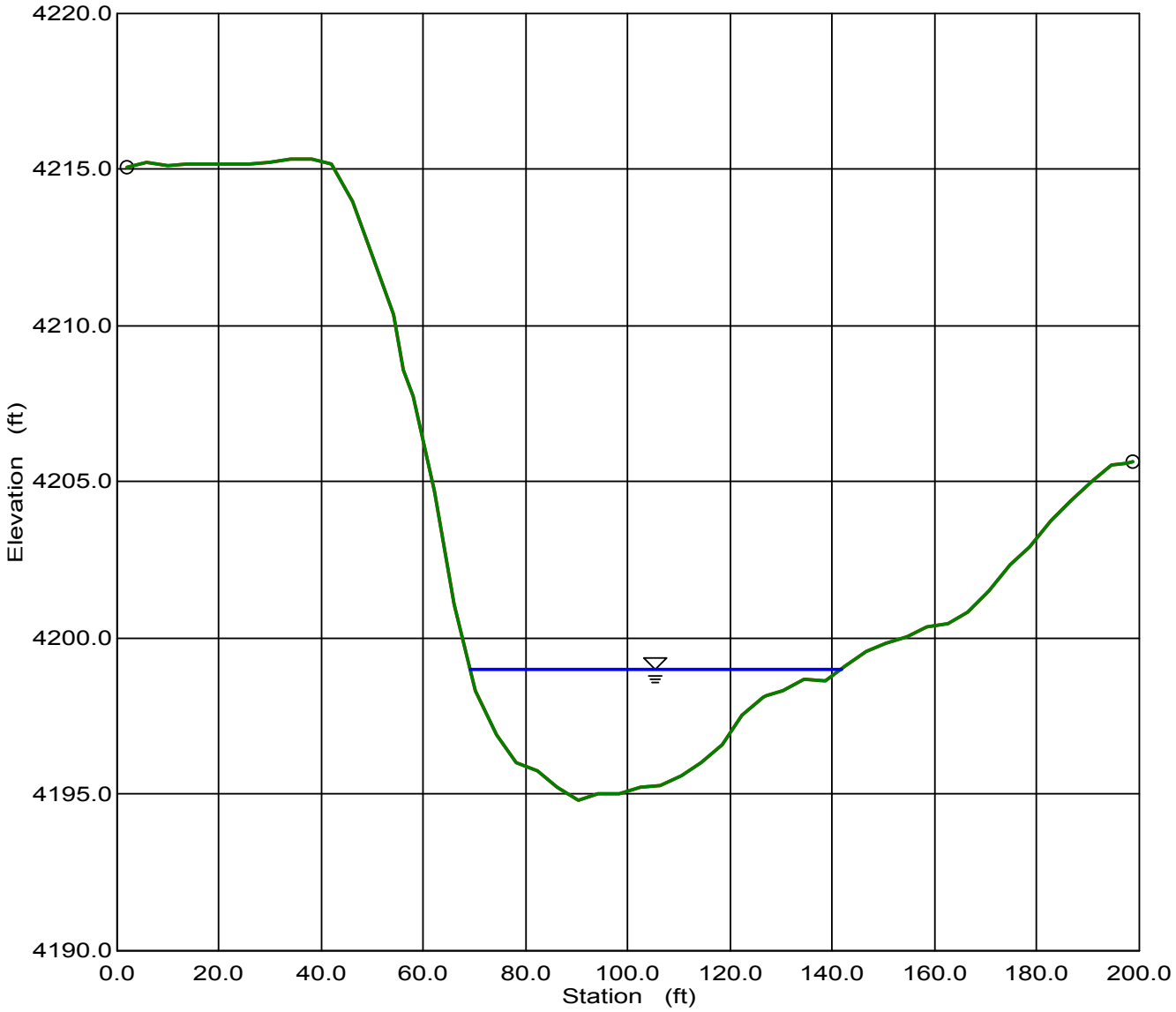
FILE: ROSS_ER_HYD_PRO_DRAW_18

K:\Peninsula_Minerals\09142\DWGS_WY83E\ROSS_ER_HYD_PRO_DRAW_18.dwg, TRA_2.7-C_FIGURE_9, 12/18/2010 1:54:57 PM

Little Missouri R. Upper Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	LMR_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.006500	ft/ft
Water Surface Elevation	4,198.98	ft
Discharge	1,297.00	cfs



Little Missouri R. Upper Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	LMR_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.006500 ft/ft

Elevation range: 4,194.80 ft to 4,215.34 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
1.94	4,215.07	1.94	198.83	0.030
5.96	4,215.20			
9.98	4,215.10			
13.99	4,215.14			
18.01	4,215.17			
22.03	4,215.17			
26.05	4,215.16			
30.07	4,215.23			
34.09	4,215.30			
38.10	4,215.34			
42.12	4,215.15			
46.14	4,213.96			
50.16	4,212.20			
54.18	4,210.35			
56.19	4,208.58			
58.19	4,207.74			
62.21	4,204.71			
66.23	4,201.08			
70.25	4,198.32			
74.27	4,196.88			
78.29	4,195.99			
82.30	4,195.71			
86.32	4,195.20			
90.34	4,194.80			
94.36	4,195.00			
98.38	4,195.00			
102.40	4,195.20			
106.41	4,195.28			
110.43	4,195.57			
114.45	4,196.01			
118.47	4,196.59			
122.49	4,197.52			
126.50	4,198.10			
127.28	4,198.14			
130.52	4,198.30			
134.54	4,198.67			
138.56	4,198.60			
142.58	4,199.07			

Little Missouri R. Upper Cross Section
Worksheet for Irregular Channel

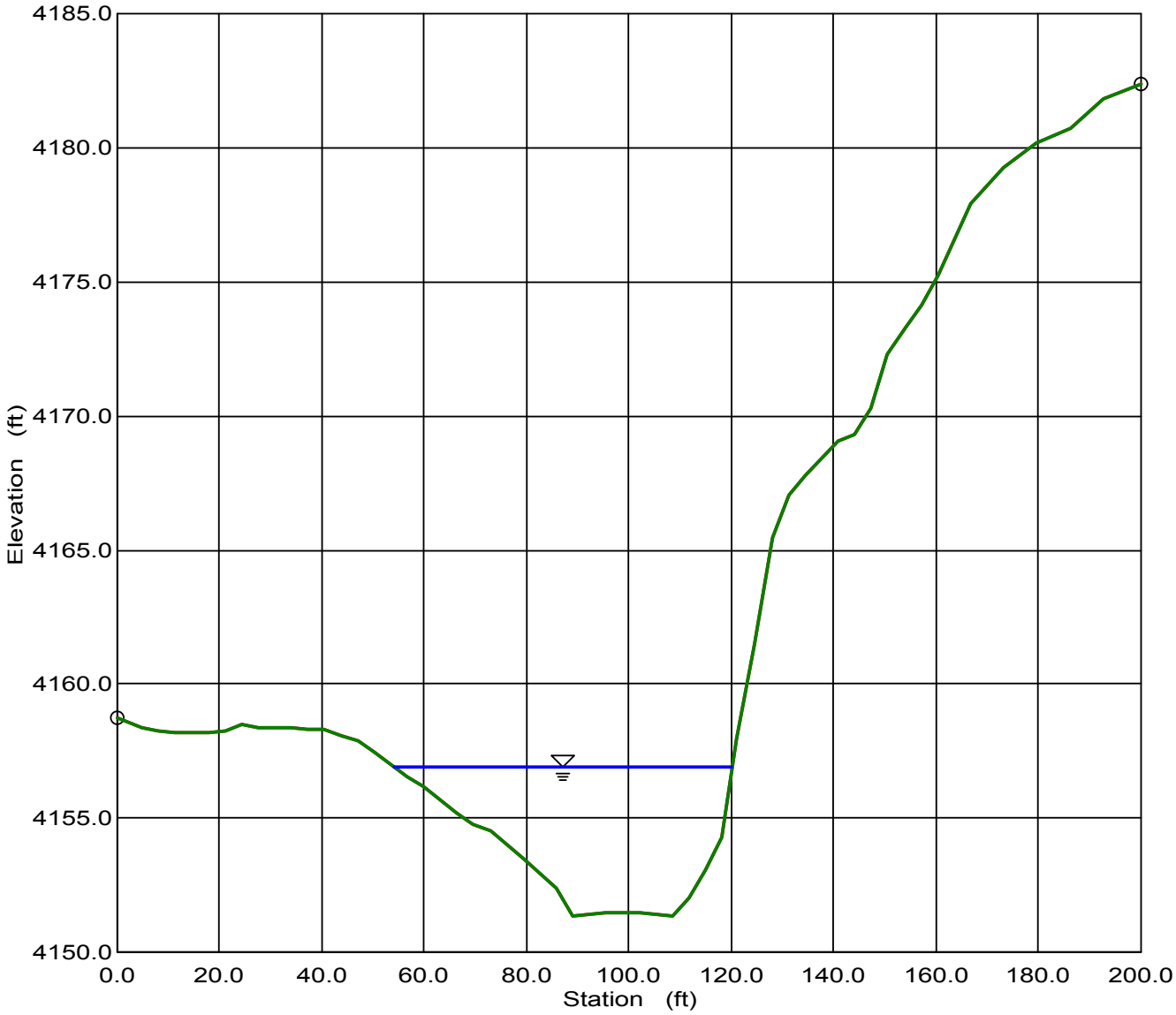
146.60	4,199.53	
150.61	4,199.83	
154.63	4,200.02	
158.65	4,200.32	
162.69	4,200.46	
166.69	4,200.83	
170.71	4,201.48	
174.72	4,202.35	
178.74	4,202.89	
182.76	4,203.72	
186.78	4,204.39	
190.80	4,205.02	
194.81	4,205.51	
197.64	4,205.58	
198.83	4,205.61	
Discharge	1,297.00	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,198.98	ft
Flow Area	179.16	ft²
Wetted Perimeter	73.40	ft
Top Width	72.51	ft
Height	4.18	ft
Critical Depth	4,198.54	ft
Critical Slope	0.010008	ft/ft
Velocity	7.24	ft/s
Velocity Head	0.81	ft
Specific Energy	4,199.79	ft
Froude Number	0.81	
Flow is subcritical.		

Little Missouri R. C-C' Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	LMR_C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.006500	ft/ft
Water Surface Elevation	4,156.90	ft
Discharge	2,127.80	cfs



Little Missouri R. C-C' Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	LMR_C
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.006500 ft/ft

Elevation range: 4,151.37 ft to 4,182.35 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	4,158.76	0.00	200.00	0.030
1.80	4,158.60			
5.00	4,158.40			
8.24	4,158.25			
11.48	4,158.18			
14.72	4,158.20			
17.96	4,158.20			
21.19	4,158.24			
24.43	4,158.47			
27.67	4,158.37			
30.91	4,158.38			
34.14	4,158.38			
37.38	4,158.34			
40.62	4,158.31			
43.85	4,158.09			
47.09	4,157.86			
50.33	4,157.45			
56.80	4,156.55			
60.00	4,156.18			
66.52	4,155.20			
69.75	4,154.79			
72.99	4,154.55			
79.46	4,153.50			
85.94	4,152.39			
89.18	4,151.37			
95.65	4,151.44			
98.89	4,151.47			
102.13	4,151.50			
108.60	4,151.37			
111.84	4,151.99			
115.07	4,153.08			
118.31	4,154.29			
121.00	4,157.97			
124.79	4,161.49			
128.02	4,165.44			
131.26	4,167.06			
134.50	4,167.75			
140.97	4,169.09			

Little Missouri R. C-C' Cross Section
Worksheet for Irregular Channel

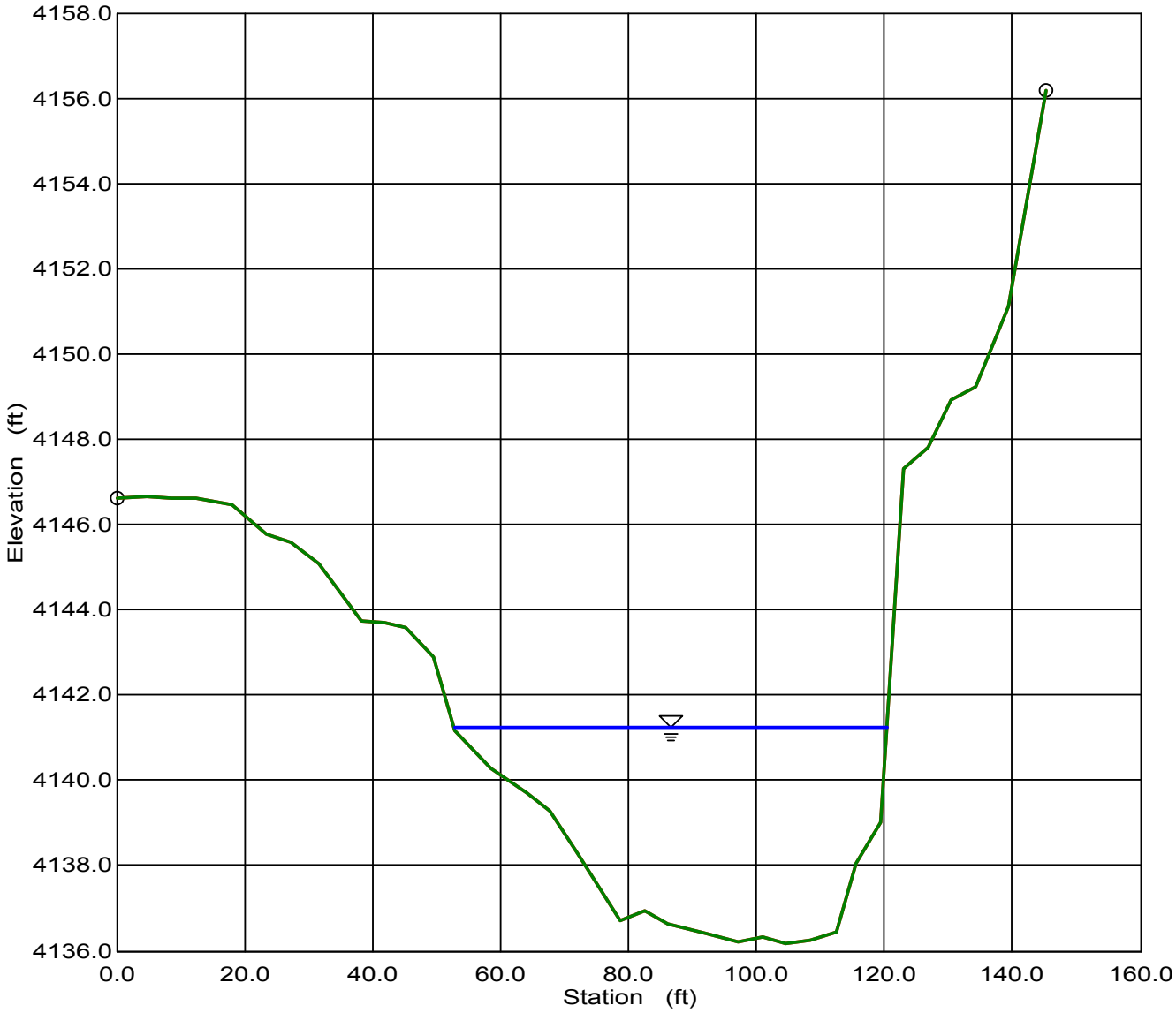
144.21	4,169.28	
147.45	4,170.28	
150.69	4,172.28	
153.92	4,173.28	
157.16	4,174.12	
160.40	4,175.24	
166.87	4,177.92	
173.35	4,179.24	
179.82	4,180.19	
186.30	4,180.71	
192.77	4,181.80	
200.00	4,182.35	
Discharge	2,127.80	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,156.90	ft
Flow Area	234.20	ft²
Wetted Perimeter	68.24	ft
Top Width	65.97	ft
Height	5.53	ft
Critical Depth	4,156.47	ft
Critical Slope	0.009187	ft/ft
Velocity	9.09	ft/s
Velocity Head	1.28	ft
Specific Energy	4,158.19	ft
Froude Number	0.85	
Flow is subcritical.		

Little Missouri R. D-D' Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	LMR_D
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.006500	ft/ft
Water Surface Elevation	4,141.22	ft
Discharge	2,127.80	cfs



Little Missouri R. D-D' Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	LMR_D
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data

Channel Slope 0.006500 ft/ft

Elevation range: 4,136.19 ft to 4,156.18 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	4,146.60	0.00	145.22	0.030
4.69	4,146.64			
8.69	4,146.63			
12.38	4,146.61			
18.17	4,146.48			
23.45	4,145.77			
27.14	4,145.59			
31.65	4,145.08			
38.39	4,143.73			
41.90	4,143.70			
45.13	4,143.59			
49.59	4,142.89			
52.97	4,141.18			
58.61	4,140.29			
64.04	4,139.70			
67.73	4,139.27			
72.09	4,138.30			
78.80	4,136.70			
82.49	4,136.95			
86.18	4,136.64			
92.30	4,136.40			
97.25	4,136.21			
100.94	4,136.32			
104.63	4,136.19			
108.32	4,136.26			
112.52	4,136.43			
115.70	4,138.06			
119.39	4,139.01			
123.08	4,147.29			
126.77	4,147.79			
130.46	4,148.93			
134.15	4,149.22			
139.48	4,151.10			
145.22	4,156.18			
Discharge	2,127.80 cfs			

Results

Little Missouri R. D-D' Cross Section
Worksheet for Irregular Channel

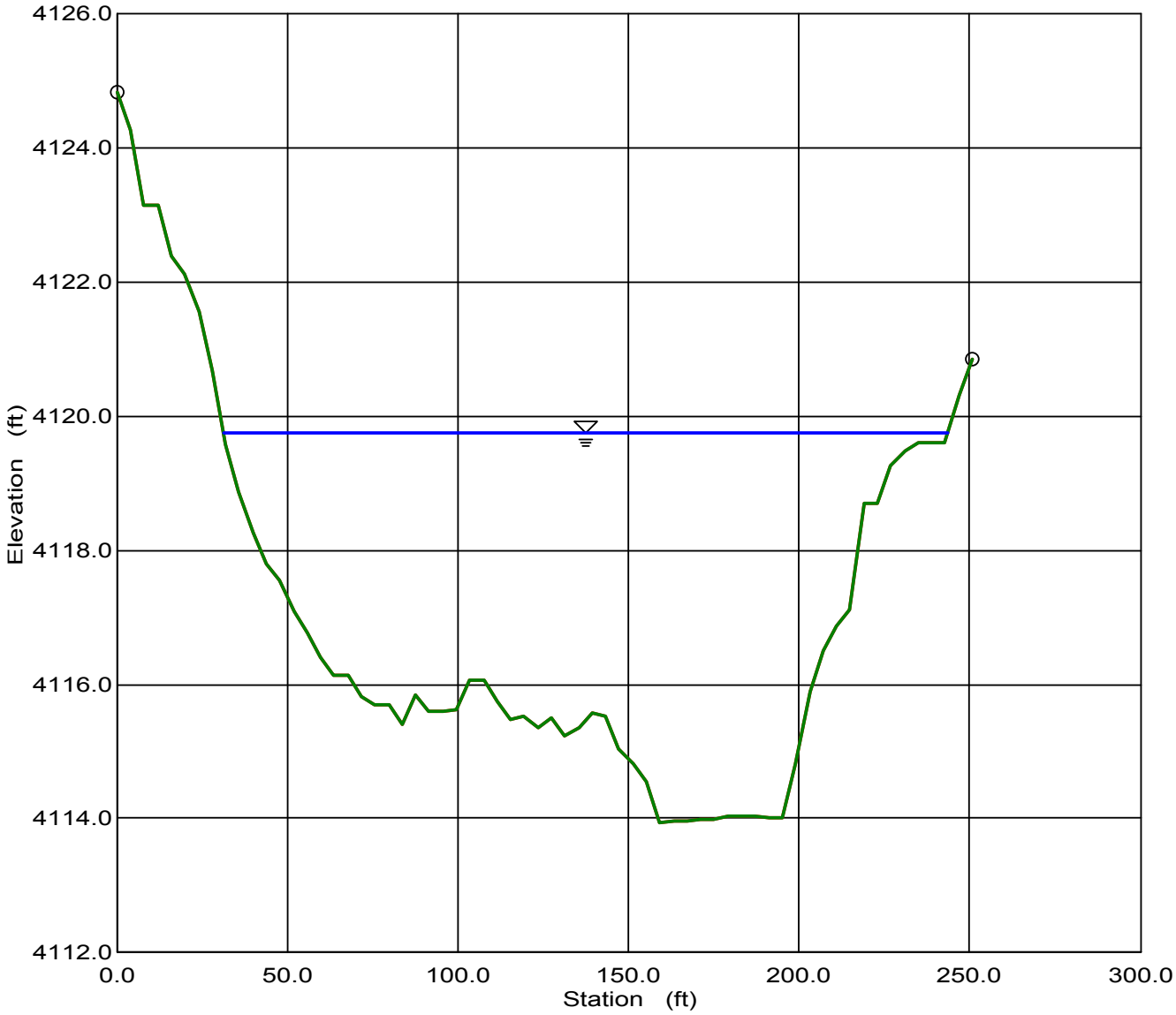
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,141.22	ft
Flow Area	236.48	ft²
Wetted Perimeter	69.92	ft
Top Width	67.50	ft
Height	5.03	ft
Critical Depth	4,140.81	ft
Critical Slope	0.009267	ft/ft
Velocity	9.00	ft/s
Velocity Head	1.26	ft
Specific Energy	4,142.48	ft
Froude Number	0.85	

Flow is subcritical.

Little Missouri R. E-E' Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	LMR_E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.003500	ft/ft
Water Surface Elevation	4,119.74	ft
Discharge	5,331.60	cfs



Little Missouri R. E-E' Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	LMR_E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.003500 ft/ft

Elevation range: 4,113.94 ft to 4,124.84 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	4,124.84	0.00	250.77	0.030
4.17	4,124.27			
8.14	4,123.15			
12.12	4,123.15			
16.10	4,122.39			
20.08	4,122.12			
24.05	4,121.57			
28.03	4,120.69			
32.01	4,119.57			
35.99	4,118.88			
39.96	4,118.26			
43.94	4,117.80			
47.92	4,117.55			
51.90	4,117.09			
55.87	4,116.78			
59.85	4,116.41			
63.83	4,116.13			
67.81	4,116.13			
71.78	4,115.82			
75.76	4,115.69			
79.74	4,115.70			
83.71	4,115.41			
87.69	4,115.85			
91.67	4,115.60			
95.65	4,115.60			
99.62	4,115.63			
103.60	4,116.06			
107.58	4,116.07			
111.56	4,115.75			
115.53	4,115.48			
119.51	4,115.52			
123.49	4,115.35			
127.47	4,115.51			
131.44	4,115.24			
135.42	4,115.36			
139.40	4,115.57			
143.38	4,115.53			
147.35	4,115.03			

Little Missouri R. E-E' Cross Section
Worksheet for Irregular Channel

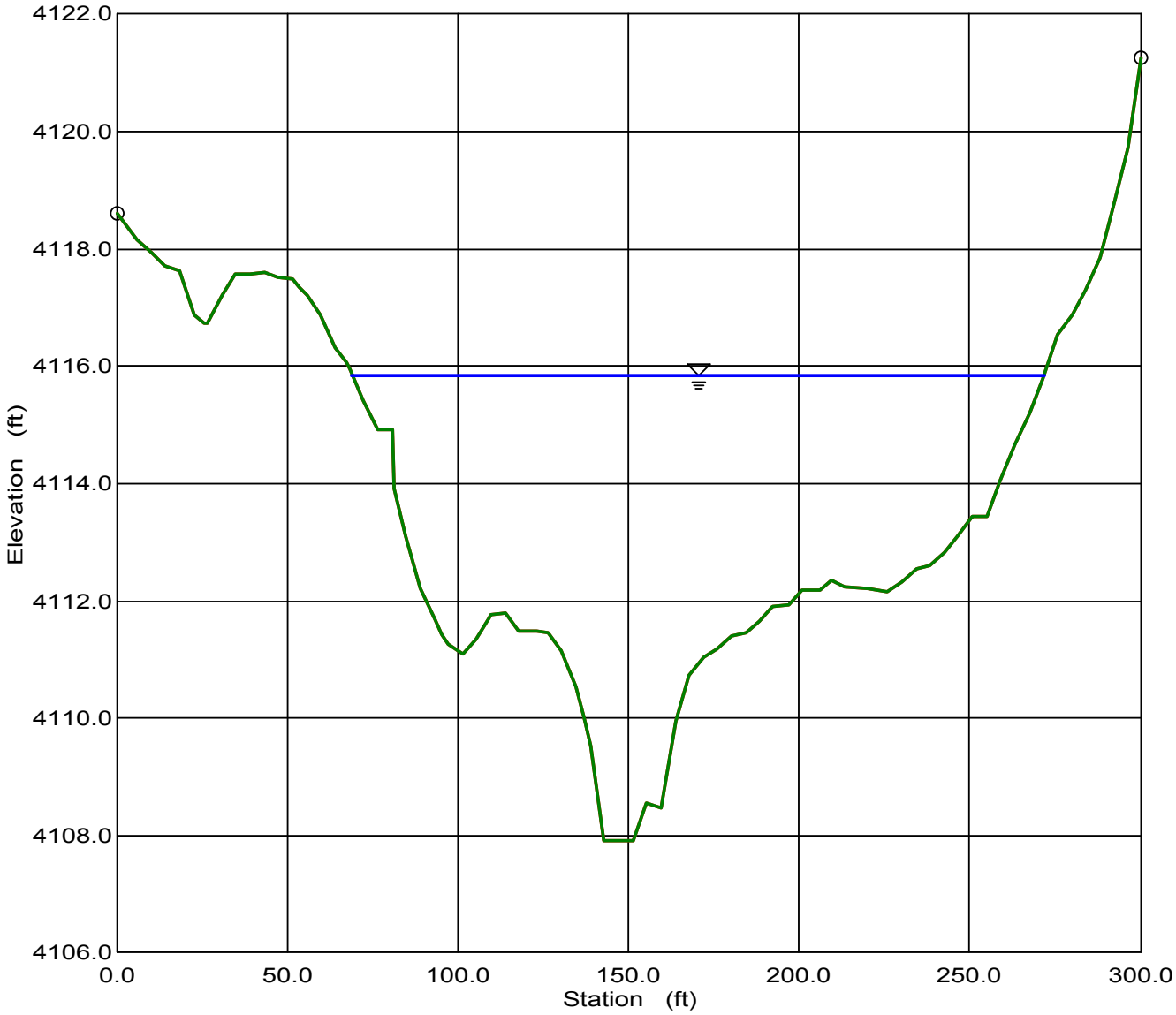
151.33	4,114.82	
155.31	4,114.54	
159.29	4,113.94	
163.26	4,113.96	
167.24	4,113.97	
171.22	4,113.98	
175.19	4,113.98	
179.17	4,114.04	
183.15	4,114.03	
187.13	4,114.03	
191.10	4,114.02	
195.08	4,114.00	
199.06	4,114.81	
203.04	4,115.88	
207.01	4,116.51	
210.99	4,116.87	
214.97	4,117.12	
218.95	4,118.71	
222.92	4,118.71	
226.90	4,119.25	
230.88	4,119.49	
234.86	4,119.60	
238.83	4,119.60	
242.81	4,119.60	
246.79	4,120.32	
250.77	4,120.85	
Discharge	5,331.60	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,119.74	ft
Flow Area	771.91	ft²
Wetted Perimeter	213.30	ft
Top Width	212.19	ft
Height	5.80	ft
Critical Depth	4,118.55	ft
Critical Slope	0.009150	ft/ft
Velocity	6.91	ft/s
Velocity Head	0.74	ft
Specific Energy	4,120.48	ft
Froude Number	0.64	
Flow is subcritical.		

Little Missouri R. F-F' Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	LMR_F
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.003500	ft/ft
Water Surface Elevation	4,115.85	ft
Discharge	5,883.50	cfs



Little Missouri R. F-F' Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	LMR_F
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.003500 ft/ft

Elevation range: 4,107.92 ft to 4,121.25 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	4,118.61	0.00	300.00	0.030
5.96	4,118.15			
10.12	4,117.92			
14.27	4,117.72			
18.42	4,117.63			
22.57	4,116.87			
25.54	4,116.74			
26.72	4,116.73			
30.87	4,117.20			
35.02	4,117.58			
39.17	4,117.57			
43.32	4,117.60			
47.47	4,117.52			
51.62	4,117.50			
53.36	4,117.35			
55.77	4,117.21			
59.92	4,116.87			
64.07	4,116.32			
67.26	4,116.05			
68.23	4,115.95			
72.38	4,115.43			
76.53	4,114.91			
80.68	4,114.91			
81.17	4,113.91			
84.83	4,113.11			
88.98	4,112.20			
93.13	4,111.67			
95.08	4,111.43			
97.28	4,111.27			
101.43	4,111.09			
105.58	4,111.35			
108.99	4,111.71			
109.73	4,111.77			
113.88	4,111.78			
118.03	4,111.48			
122.19	4,111.47			
122.89	4,111.48			
126.34	4,111.46			

Little Missouri R. F-F' Cross Section
Worksheet for Irregular Channel

130.49	4,111.14	
134.64	4,110.54	
136.80	4,110.01	
138.79	4,109.52	
142.94	4,107.92	
147.09	4,107.92	
150.71	4,107.92	
151.24	4,107.92	
155.39	4,108.56	
159.54	4,108.46	
163.69	4,109.94	
167.84	4,110.72	
171.99	4,111.03	
176.15	4,111.19	
180.30	4,111.39	
184.45	4,111.46	
188.60	4,111.65	
192.43	4,111.90	
196.90	4,111.93	
201.05	4,112.19	
206.35	4,112.19	
209.35	4,112.35	
213.50	4,112.25	
220.25	4,112.21	
225.95	4,112.15	
230.10	4,112.32	
234.26	4,112.54	
238.41	4,112.61	
242.56	4,112.82	
246.71	4,113.10	
250.86	4,113.43	
255.01	4,113.43	
259.16	4,114.04	
263.31	4,114.68	
267.46	4,115.20	
271.61	4,115.79	
275.88	4,116.55	
279.91	4,116.86	
284.06	4,117.29	
288.22	4,117.86	
292.37	4,118.83	
296.52	4,119.71	
300.00	4,121.25	
Discharge	5,883.50	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,115.85	ft
Flow Area	805.90	ft²
Wetted Perimeter	204.93	ft
Top Width	202.85	ft
Height	7.93	ft

Little Missouri R. F-F' Cross Section
Worksheet for Irregular Channel

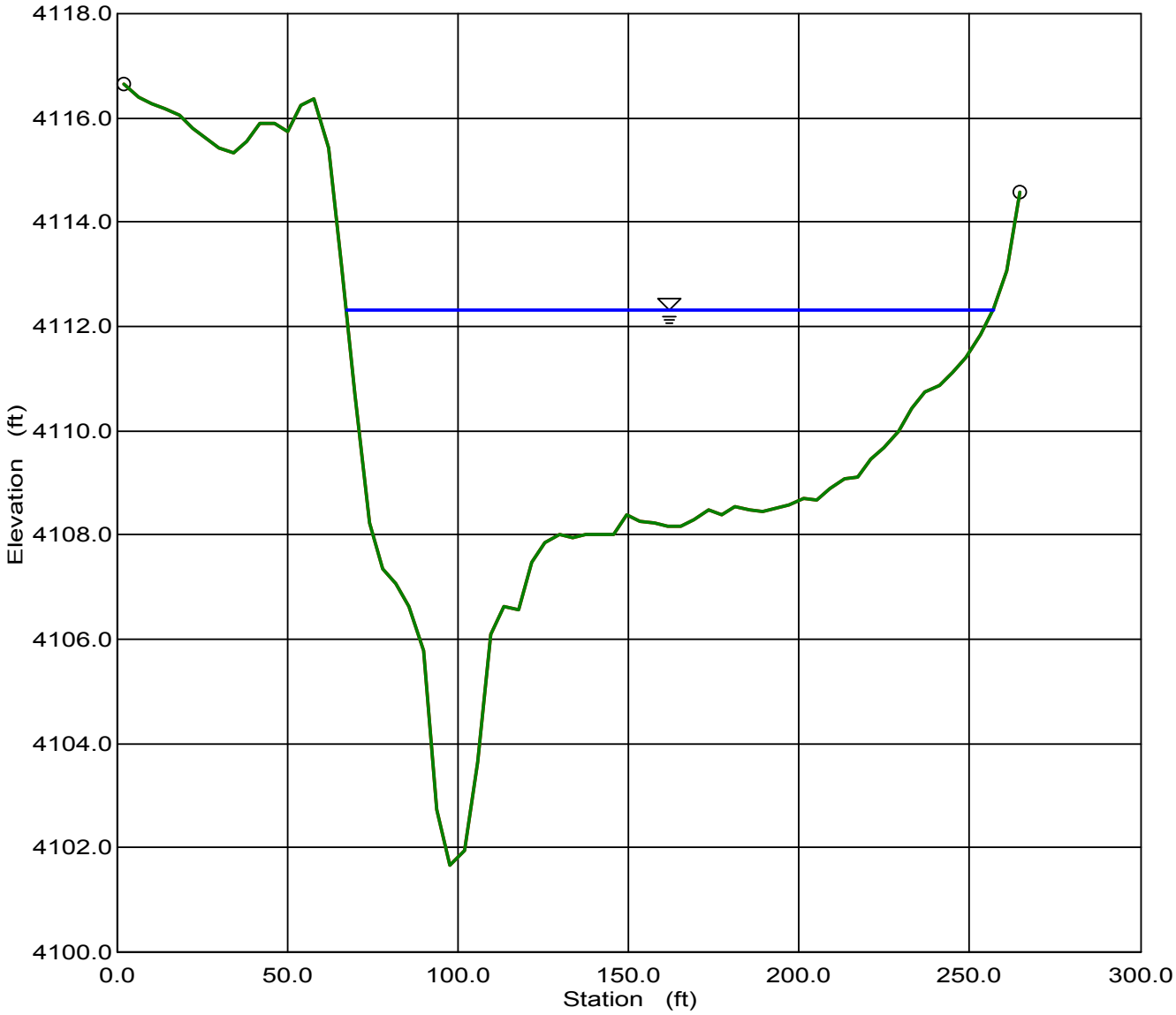
Critical Depth	4,114.68	ft
Critical Slope	0.009032	ft/ft
Velocity	7.30	ft/s
Velocity Head	0.83	ft
Specific Energy	4,116.67	ft
Froude Number	0.65	

Flow is subcritical.

Little Missouri R. Lower Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	LMR_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.003500	ft/ft
Water Surface Elevation	4,112.32	ft
Discharge	5,975.00	cfs



Little Missouri R. Lower Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	LMR_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.003500 ft/ft

Elevation range: 4,101.66 ft to 4,116.63 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
2.38	4,116.63	2.38	264.89	0.030
6.36	4,116.40			
10.34	4,116.26			
14.31	4,116.18			
18.29	4,116.05			
22.27	4,115.81			
26.24	4,115.60			
30.22	4,115.42			
34.20	4,115.34			
38.18	4,115.56			
42.15	4,115.90			
46.13	4,115.89			
50.11	4,115.73			
54.09	4,116.22			
58.06	4,116.37			
62.04	4,115.41			
66.02	4,113.14			
69.99	4,110.71			
73.97	4,108.22			
77.95	4,107.34			
81.93	4,107.06			
85.91	4,106.63			
89.88	4,105.77			
93.84	4,102.72			
97.84	4,101.66			
101.81	4,101.94			
105.79	4,103.65			
109.77	4,106.09			
113.75	4,106.62			
117.72	4,106.57			
121.70	4,107.46			
125.68	4,107.84			
129.66	4,108.01			
133.63	4,107.93			
137.61	4,108.00			
141.59	4,108.02			
145.57	4,108.02			
149.54	4,108.37			

Little Missouri R. Lower Cross Section
Worksheet for Irregular Channel

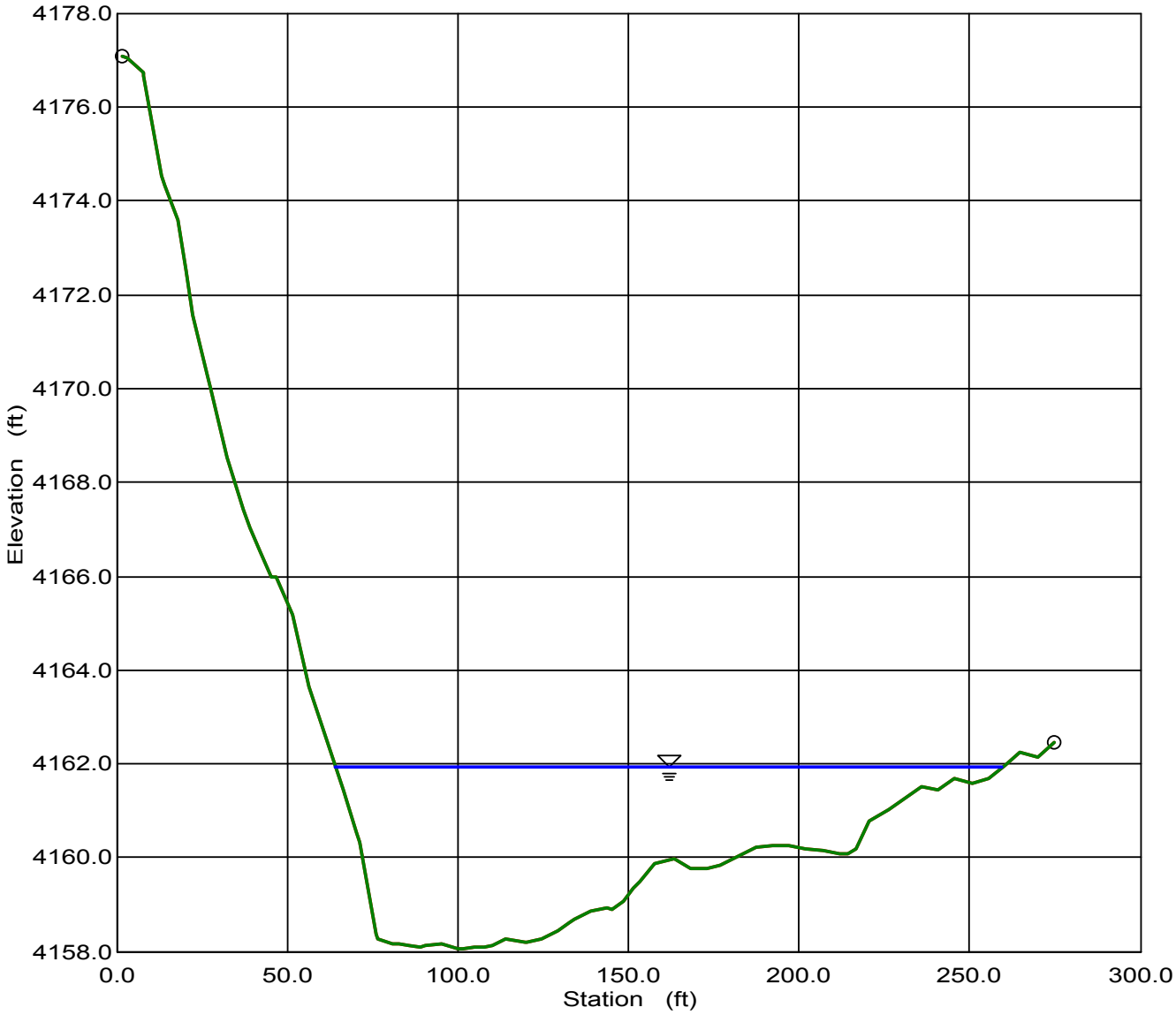
153.52	4,108.27	
157.50	4,108.23	
161.48	4,108.16	
165.45	4,108.15	
169.43	4,108.30	
173.41	4,108.49	
177.39	4,108.38	
181.36	4,108.53	
185.34	4,108.48	
189.32	4,108.45	
193.29	4,108.51	
197.27	4,108.57	
201.25	4,108.69	
205.23	4,108.67	
209.20	4,108.89	
213.18	4,109.08	
217.16	4,109.10	
221.14	4,109.45	
225.11	4,109.66	
229.09	4,110.00	
233.07	4,110.43	
237.05	4,110.75	
241.02	4,110.87	
245.00	4,111.13	
248.98	4,111.41	
252.96	4,111.84	
256.93	4,112.34	
260.91	4,113.05	
264.89	4,114.57	
Discharge	5,975.00	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,112.32	ft
Flow Area	794.78	ft²
Wetted Perimeter	193.41	ft
Top Width	189.45	ft
Height	10.66	ft
Critical Depth	4,111.15	ft
Critical Slope	0.009052	ft/ft
Velocity	7.52	ft/s
Velocity Head	0.88	ft
Specific Energy	4,113.20	ft
Froude Number	0.65	
Flow is subcritical.		

Deadman Creek Lower Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Deadman_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.005300	ft/ft
Water Surface Elevation	4,161.92	ft
Discharge	2,670.00	cfs



Deadman Creek Upper Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Deadman_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.005300 ft/ft

Elevation range: 4,158.07 ft to 4,177.09 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
1.50	4,177.09	1.50	275.00	0.030
3.26	4,177.05			
7.75	4,176.73			
8.11	4,176.66			
12.96	4,174.55			
14.01	4,174.34			
17.81	4,173.60			
20.27	4,172.51			
22.27	4,171.57			
26.52	4,170.28			
27.51	4,169.99			
32.36	4,168.52			
37.21	4,167.41			
39.04	4,167.03			
42.06	4,166.56			
45.29	4,165.98			
46.90	4,165.99			
51.55	4,165.18			
56.60	4,163.66			
57.81	4,163.32			
61.45	4,162.50			
64.06	4,161.97			
66.30	4,161.45			
70.32	4,160.53			
71.15	4,160.34			
75.99	4,158.38			
76.58	4,158.26			
80.85	4,158.17			
82.83	4,158.17			
85.70	4,158.12			
89.09	4,158.10			
90.55	4,158.12			
95.35	4,158.17			
100.25	4,158.07			
101.60	4,158.08			
105.09	4,158.09			
107.86	4,158.09			
109.94	4,158.13			

Deadman Creek Upper Cross Section
Worksheet for Irregular Channel

114.11	4,158.27	
119.64	4,158.21	
120.37	4,158.21	
124.49	4,158.26	
126.63	4,158.33	
129.34	4,158.46	
132.88	4,158.63	
134.19	4,158.70	
139.04	4,158.86	
143.89	4,158.92	
145.40	4,158.91	
148.74	4,159.07	
151.65	4,159.35	
153.58	4,159.50	
157.91	4,159.89	
163.28	4,159.97	
168.12	4,159.77	
172.98	4,159.77	
176.68	4,159.85	
182.68	4,160.04	
187.53	4,160.24	
192.38	4,160.27	
195.45	4,160.26	
197.23	4,160.27	
201.71	4,160.18	
206.92	4,160.17	
211.77	4,160.07	
214.22	4,160.09	
216.62	4,160.18	
220.48	4,160.77	
226.32	4,161.02	
231.17	4,161.28	
236.02	4,161.53	
240.87	4,161.46	
245.72	4,161.68	
250.57	4,161.59	
255.42	4,161.68	
258.02	4,161.84	
260.26	4,161.96	
264.73	4,162.26	
269.96	4,162.15	
275.00	4,162.48	
Discharge	2,670.00	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,161.92	ft
Flow Area	435.18	ft²
Wetted Perimeter	196.08	ft
Top Width	195.35	ft
Height	3.85	ft
Critical Depth	4,161.36	ft

Deadman Creek Upper Cross Section
Worksheet for Irregular Channel

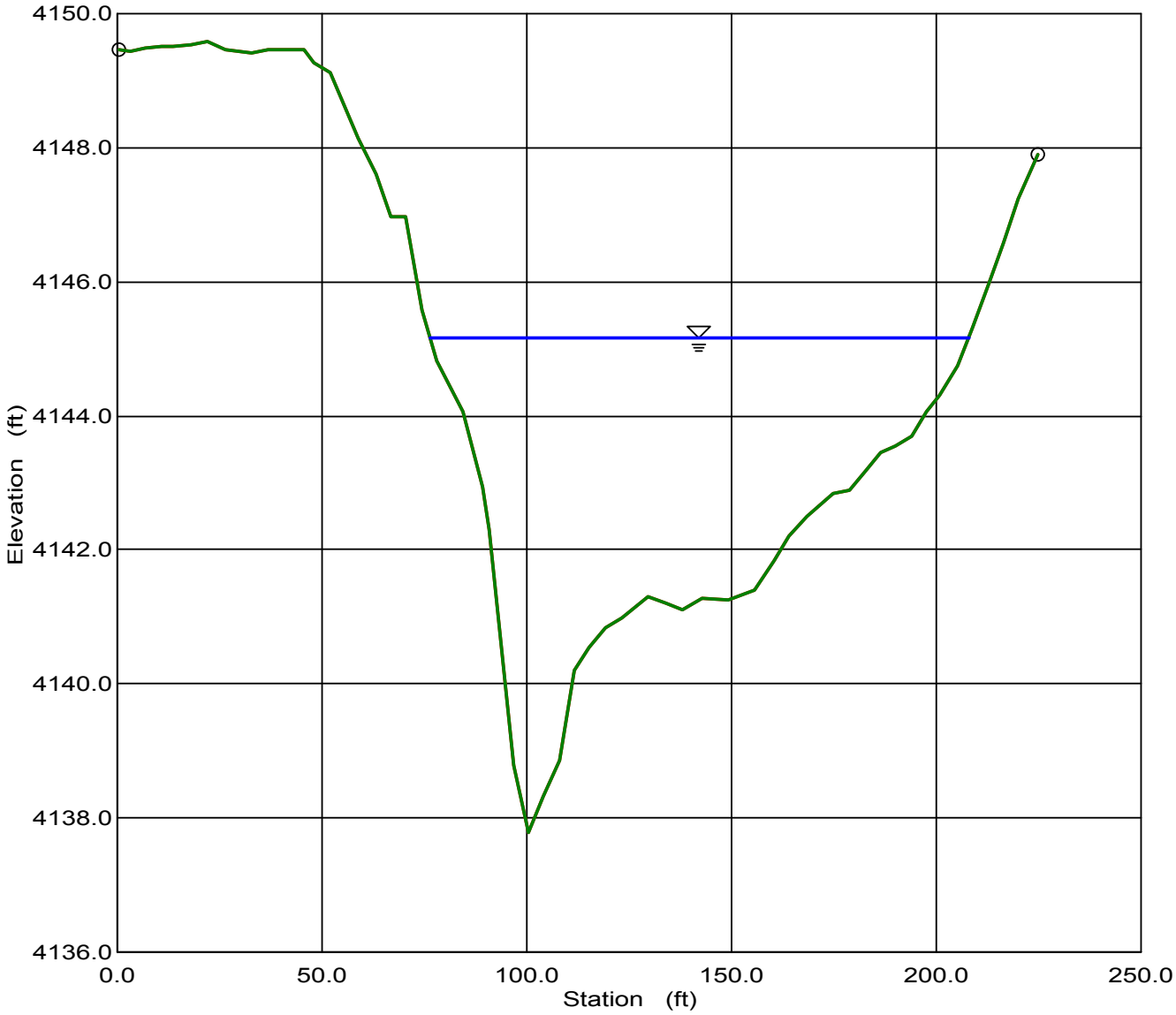
Critical Slope	0.010457	ft/ft
Velocity	6.14	ft/s
Velocity Head	0.58	ft
Specific Energy	4,162.51	ft
Froude Number	0.72	

Flow is subcritical.

Deadman Creek Lower Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Deadman_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.005300	ft/ft
Water Surface Elevation	4,145.17	ft
Discharge	3,329.00	cfs



Deadman Creek Lower Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Deadman_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.005300 ft/ft

Elevation range: 4,137.79 ft to 4,149.58 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.68	4,149.45	0.68	225.00	0.030
3.40	4,149.44			
7.14	4,149.48			
10.88	4,149.52			
13.60	4,149.52			
18.36	4,149.53			
22.10	4,149.58			
26.53	4,149.45			
32.99	4,149.42			
37.06	4,149.47			
40.80	4,149.46			
45.91	4,149.47			
48.28	4,149.27			
52.37	4,149.13			
58.84	4,148.15			
63.24	4,147.60			
66.98	4,146.97			
70.72	4,146.97			
74.46	4,145.57			
78.22	4,144.82			
84.68	4,144.06			
89.41	4,142.94			
91.14	4,142.30			
96.89	4,138.79			
100.63	4,137.79			
104.37	4,138.31			
108.11	4,138.86			
111.85	4,140.19			
115.59	4,140.55			
119.33	4,140.84			
123.45	4,140.99			
129.91	4,141.30			
134.29	4,141.20			
138.03	4,141.11			
142.84	4,141.27			
149.25	4,141.24			
155.76	4,141.39			
160.47	4,141.83			

Deadman Creek Lower Cross Section
Worksheet for Irregular Channel

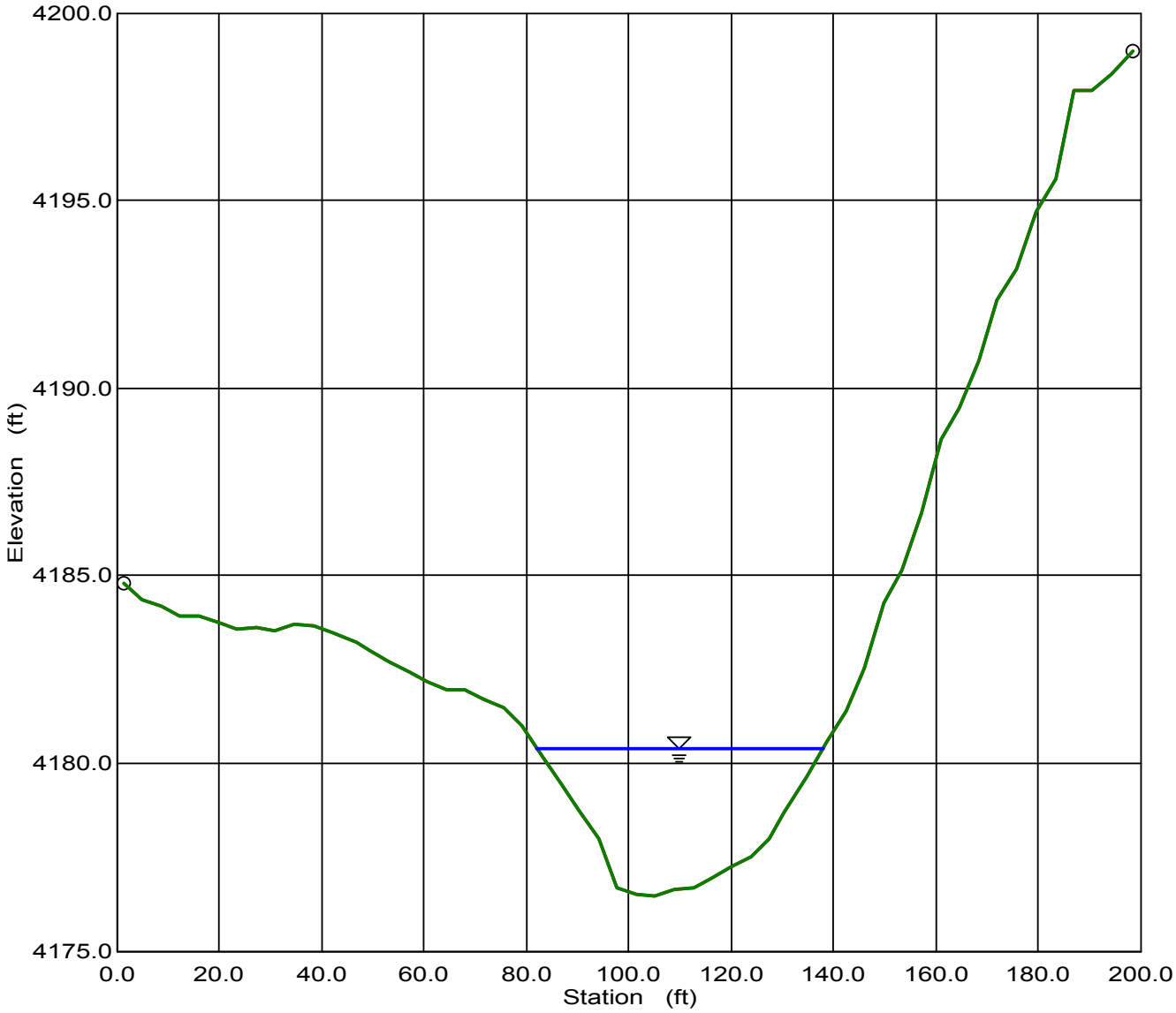
164.21	4,142.21	
168.68	4,142.49	
175.15	4,142.84	
179.17	4,142.89	
182.91	4,143.18	
186.64	4,143.46	
190.38	4,143.56	
194.12	4,143.70	
197.86	4,144.06	
200.99	4,144.29	
205.34	4,144.75	
209.08	4,145.32	
212.82	4,145.96	
216.56	4,146.58	
220.30	4,147.23	
225.00	4,147.90	
Discharge	3,329.00	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,145.17	ft
Flow Area	426.02	ft²
Wetted Perimeter	133.54	ft
Top Width	131.58	ft
Height	7.38	ft
Critical Depth	4,144.56	ft
Critical Slope	0.009457	ft/ft
Velocity	7.81	ft/s
Velocity Head	0.95	ft
Specific Energy	4,146.11	ft
Froude Number	0.77	
Flow is subcritical.		

Draw 5 Upper Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw5_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.006300	ft/ft
Water Surface Elevation	4,180.38	ft
Discharge	1,020.00	cfs



Draw 5 Upper Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw5_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.006300 ft/ft

Elevation range: 4,176.47 ft to 4,198.98 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
1.28	4,184.79	1.28	198.63	0.030
5.00	4,184.38			
8.90	4,184.18			
12.43	4,183.91			
16.14	4,183.91			
19.85	4,183.74			
23.57	4,183.57			
27.28	4,183.63			
31.00	4,183.53			
34.71	4,183.70			
38.42	4,183.66			
42.14	4,183.48			
46.85	4,183.24			
49.57	4,183.00			
53.28	4,182.69			
56.99	4,182.43			
60.71	4,182.17			
64.42	4,181.94			
68.13	4,181.98			
71.85	4,181.68			
75.56	4,181.46			
79.28	4,181.00			
82.99	4,180.21			
86.70	4,179.50			
90.42	4,178.72			
94.13	4,177.99			
97.85	4,176.66			
101.56	4,176.50			
105.27	4,176.47			
108.99	4,176.62			
112.70	4,176.69			
116.42	4,176.96			
120.13	4,177.23			
123.84	4,177.53			
127.56	4,178.01			
130.32	4,178.68			
134.99	4,179.63			
138.70	4,180.58			

Draw 5 Upper Cross Section
Worksheet for Irregular Channel

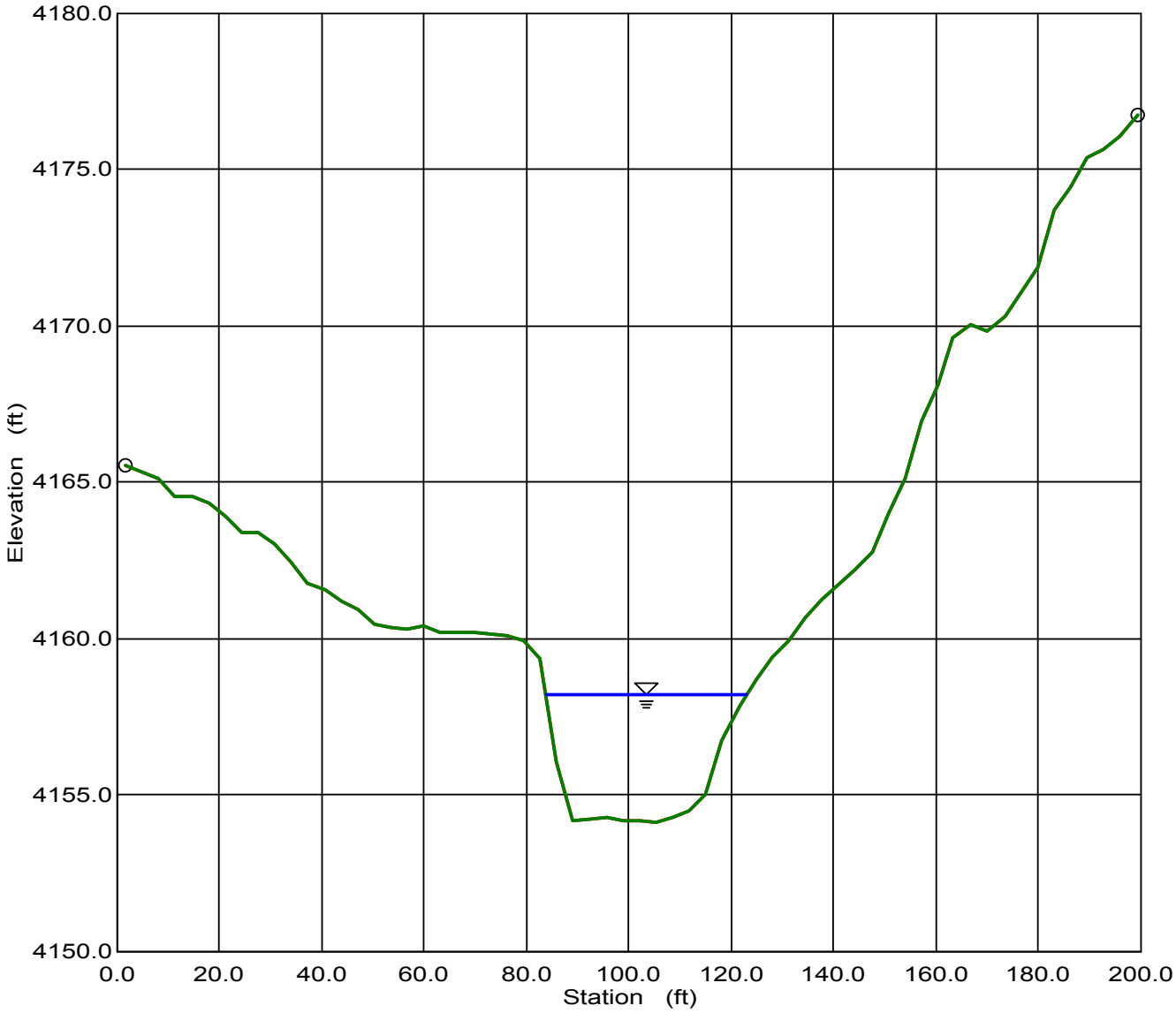
142.41	4,181.39	
146.13	4,182.53	
149.84	4,184.26	
153.55	4,185.16	
157.27	4,186.65	
160.98	4,188.66	
164.70	4,189.46	
168.41	4,190.73	
172.12	4,192.35	
175.86	4,193.17	
179.55	4,194.70	
183.45	4,195.56	
186.98	4,197.92	
190.69	4,197.92	
194.41	4,198.35	
198.63	4,198.98	
Discharge	1,020.00	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,180.38	ft
Flow Area	141.06	ft²
Wetted Perimeter	56.55	ft
Top Width	55.74	ft
Height	3.91	ft
Critical Depth	4,179.97	ft
Critical Slope	0.010141	ft/ft
Velocity	7.23	ft/s
Velocity Head	0.81	ft
Specific Energy	4,181.19	ft
Froude Number	0.80	
Flow is subcritical.		

Draw 5 Lower Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw5_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.006300	ft/ft
Water Surface Elevation	4,158.18	ft
Discharge	1,020.00	cfs



Draw 5 Lower Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw5_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.006300 ft/ft

Elevation range: 4,154.08 ft to 4,176.73 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
1.79	4,165.52	1.79	199.37	0.030
5.03	4,165.30			
8.27	4,165.09			
11.51	4,164.54			
14.75	4,164.54			
17.98	4,164.31			
21.22	4,163.90			
24.46	4,163.40			
27.70	4,163.40			
30.94	4,162.99			
34.18	4,162.45			
37.42	4,161.77			
40.66	4,161.54			
43.90	4,161.18			
47.14	4,160.92			
50.38	4,160.43			
53.61	4,160.35			
56.85	4,160.31			
60.09	4,160.38			
63.33	4,160.21			
66.57	4,160.18			
69.81	4,160.18			
73.05	4,160.13			
76.29	4,160.09			
79.53	4,159.94			
82.77	4,159.36			
86.00	4,156.05			
89.24	4,154.16			
92.48	4,154.21			
95.72	4,154.28			
98.96	4,154.17			
102.20	4,154.14			
105.44	4,154.08			
108.68	4,154.29			
111.92	4,154.48			
115.16	4,154.98			
118.39	4,156.71			
121.63	4,157.83			

Draw 5 Lower Cross Section
Worksheet for Irregular Channel

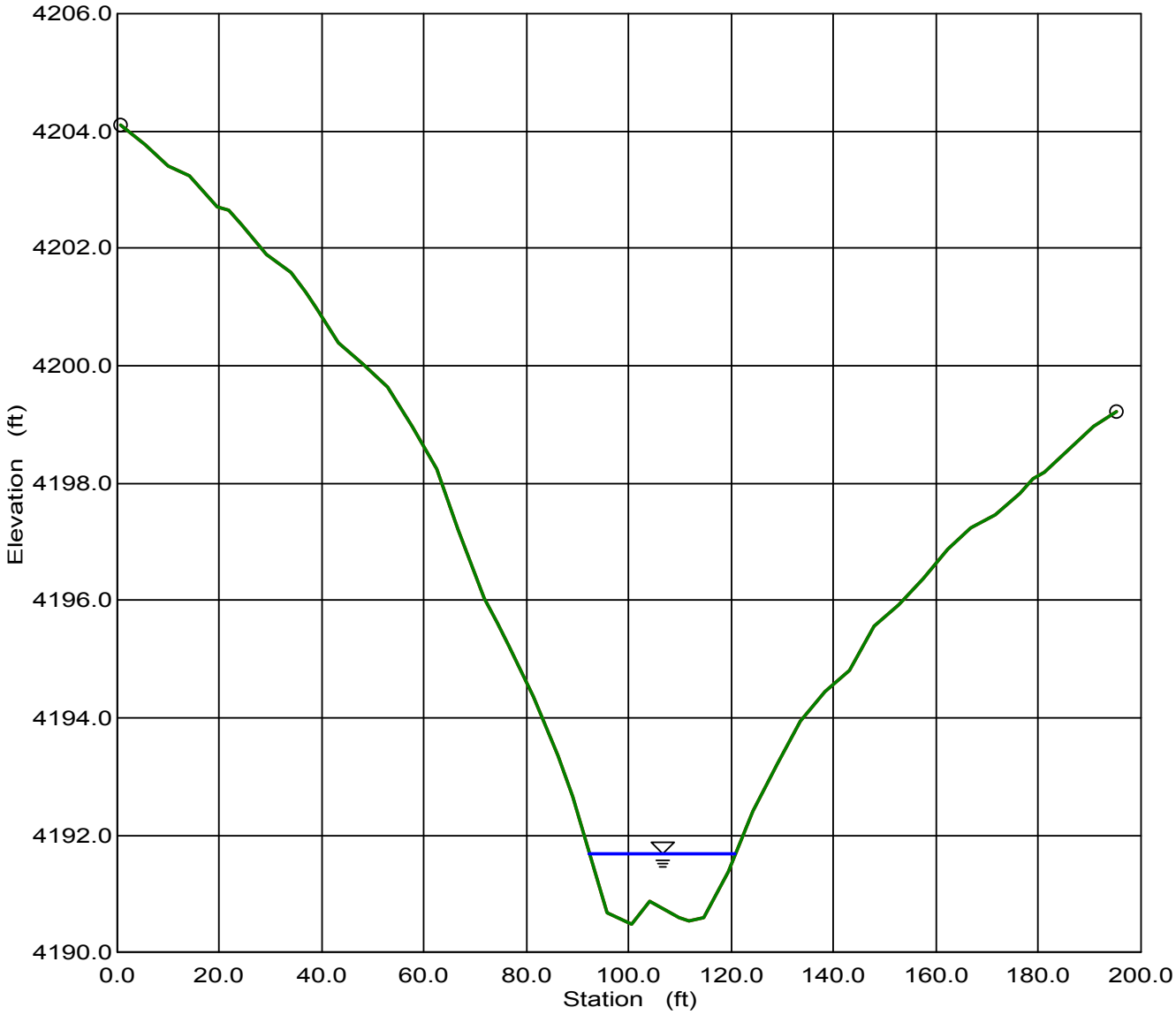
124.87	4,158.69	
128.11	4,159.40	
131.35	4,159.91	
134.59	4,160.67	
137.83	4,161.21	
141.07	4,161.68	
144.31	4,162.17	
147.55	4,162.72	
150.79	4,163.99	
154.03	4,165.11	
157.26	4,166.93	
160.50	4,168.06	
163.50	4,169.62	
166.98	4,170.04	
170.22	4,169.81	
173.46	4,170.27	
176.70	4,171.06	
179.94	4,171.84	
183.18	4,173.68	
186.42	4,174.41	
189.66	4,175.38	
192.89	4,175.63	
196.13	4,176.04	
199.37	4,176.73	
Discharge	1,020.00	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,158.18	ft
Flow Area	124.26	ft²
Wetted Perimeter	41.19	ft
Top Width	39.06	ft
Height	4.10	ft
Critical Depth	4,157.70	ft
Critical Slope	0.009849	ft/ft
Velocity	8.21	ft/s
Velocity Head	1.05	ft
Specific Energy	4,159.23	ft
Froude Number	0.81	
Flow is subcritical.		

Draw 7 Upper Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw7_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.019600	ft/ft
Water Surface Elevation	4,191.68	ft
Discharge	159.50	cfs



Draw 7 Upper Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw7_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.019600 ft/ft

Elevation range: 4,190.48 ft to 4,204.12 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.72	4,204.12	0.72	195.52	0.030
5.47	4,203.76			
10.22	4,203.40			
14.39	4,203.24			
19.72	4,202.72			
21.88	4,202.64			
24.47	4,202.41			
29.36	4,201.91			
33.98	4,201.60			
36.85	4,201.27			
38.73	4,201.00			
43.48	4,200.40			
48.23	4,200.03			
52.98	4,199.64			
57.73	4,198.98			
62.48	4,198.25			
66.80	4,197.21			
71.99	4,196.04			
74.29	4,195.61			
76.74	4,195.21			
81.49	4,194.36			
86.24	4,193.36			
89.26	4,192.64			
95.74	4,190.66			
100.49	4,190.48			
104.24	4,190.86			
110.00	4,190.58			
111.73	4,190.54			
114.75	4,190.60			
119.50	4,191.38			
124.25	4,192.40			
129.00	4,193.21			
133.75	4,193.95			
138.50	4,194.45			
143.25	4,194.81			
148.00	4,195.55			
152.75	4,195.92			
157.51	4,196.38			

Draw 7 Upper Cross Section
Worksheet for Irregular Channel

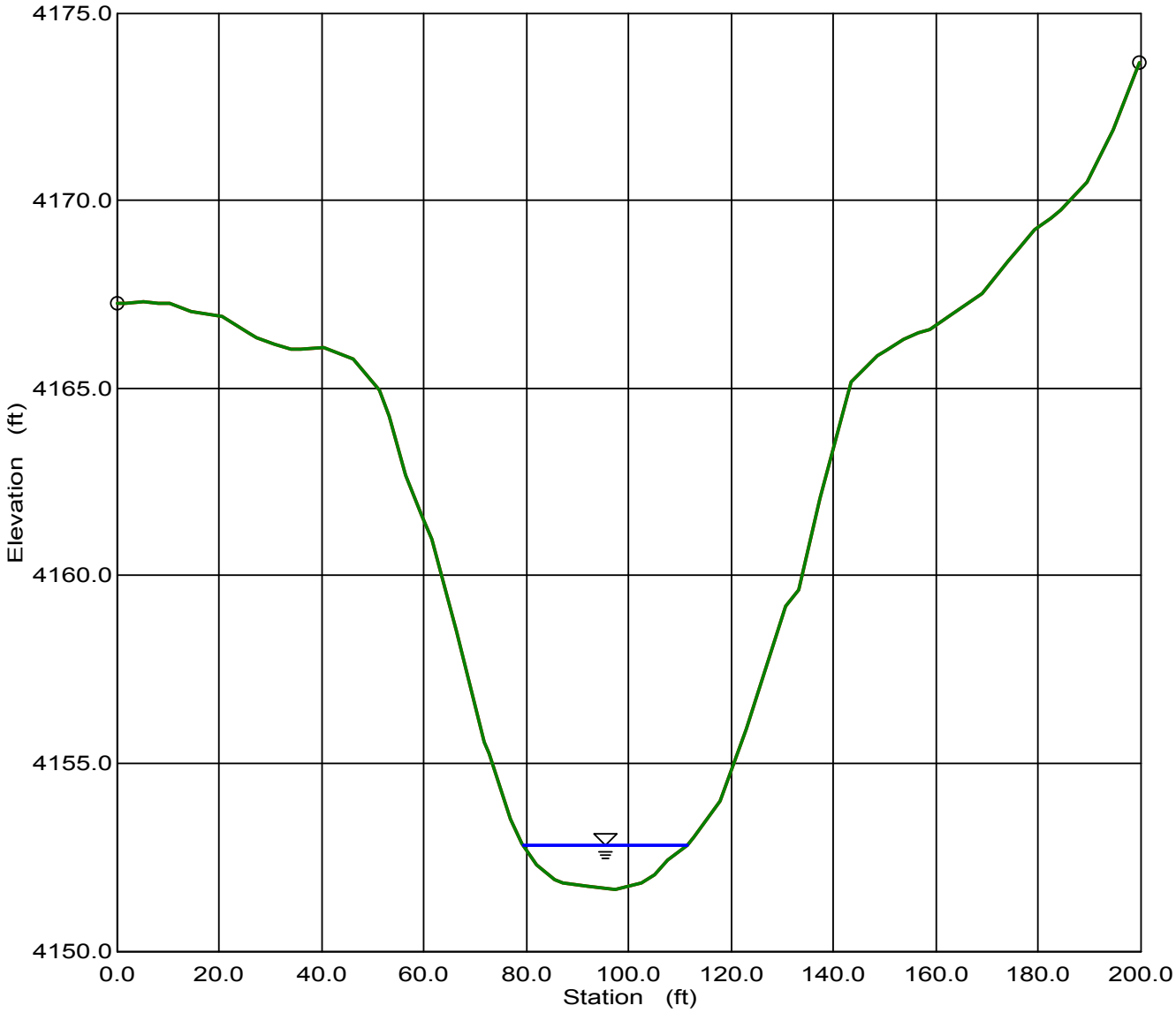
162.26	4,196.88	
167.01	4,197.25	
171.76	4,197.45	
176.51	4,197.82	
179.12	4,198.06	
181.26	4,198.17	
186.01	4,198.58	
190.76	4,198.96	
195.52	4,199.23	
Discharge	159.50	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,191.68	ft
Flow Area	25.17	ft²
Wetted Perimeter	28.80	ft
Top Width	28.52	ft
Height	1.20	ft
Critical Depth	4,191.80	ft
Critical Slope	0.013435	ft/ft
Velocity	6.34	ft/s
Velocity Head	0.62	ft
Specific Energy	4,192.31	ft
Froude Number	1.19	
Flow is supercritical.		

Draw 7 Lower Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw7_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.019600	ft/ft
Water Surface Elevation	4,152.82	ft
Discharge	159.50	cfs



Draw 7 Lower Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw7_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.019600 ft/ft

Elevation range: 4,151.62 ft to 4,173.68 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.30	4,167.25	0.30	199.89	0.030
1.66	4,167.25			
5.42	4,167.29			
8.12	4,167.27			
10.53	4,167.24			
14.58	4,167.06			
20.77	4,166.90			
25.89	4,166.47			
27.50	4,166.36			
31.00	4,166.15			
33.96	4,166.04			
36.12	4,166.04			
40.42	4,166.07			
46.36	4,165.79			
51.48	4,164.94			
53.34	4,164.25			
56.59	4,162.67			
59.80	4,161.57			
61.71	4,160.99			
66.26	4,158.52			
71.95	4,155.57			
72.72	4,155.24			
77.06	4,153.51			
79.18	4,152.88			
82.18	4,152.27			
85.64	4,151.89			
87.30	4,151.80			
92.10	4,151.72			
97.54	4,151.62			
102.65	4,151.82			
105.03	4,152.05			
107.77	4,152.41			
111.49	4,152.80			
112.89	4,153.02			
117.95	4,154.01			
123.13	4,155.92			
128.24	4,158.10			
130.87	4,159.19			

Draw 7 Lower Cross Section
Worksheet for Irregular Channel

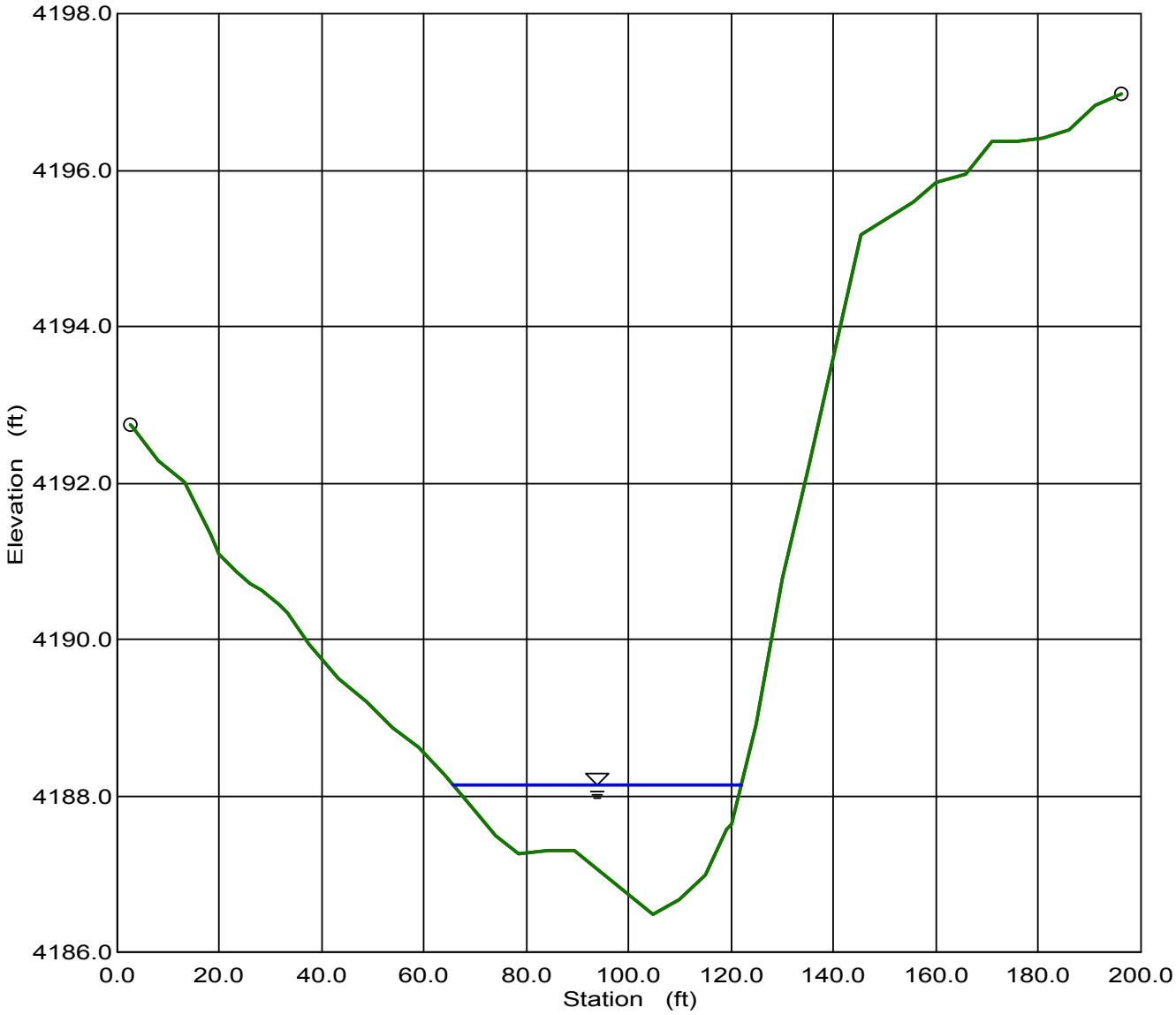
133.36	4,159.62	
137.33	4,162.06	
143.60	4,165.16	
148.72	4,165.86	
150.25	4,165.99	
153.83	4,166.30	
156.71	4,166.47	
158.95	4,166.56	
163.17	4,166.95	
169.19	4,167.51	
174.30	4,168.38	
176.09	4,168.70	
179.42	4,169.23	
182.55	4,169.54	
184.54	4,169.75	
189.66	4,170.48	
194.78	4,171.89	
199.89	4,173.68	
Discharge	159.50	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,152.82	ft
Flow Area	26.34	ft²
Wetted Perimeter	32.28	ft
Top Width	32.14	ft
Height	1.20	ft
Critical Depth	4,152.92	ft
Critical Slope	0.013697	ft/ft
Velocity	6.05	ft/s
Velocity Head	0.57	ft
Specific Energy	4,153.39	ft
Froude Number	1.18	
Flow is supercritical.		

Draw 9 Upper Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw9_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.016600	ft/ft
Water Surface Elevation	4,188.14	ft
Discharge	330.90	cfs



Draw 9 Upper Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw9_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.016600 ft/ft

Elevation range: 4,186.48 ft to 4,196.97 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
2.64	4,192.74	2.64	196.33	0.030
3.01	4,192.71			
8.10	4,192.28			
13.19	4,192.00			
18.27	4,191.34			
20.13	4,191.09			
23.36	4,190.86			
25.96	4,190.71			
28.45	4,190.63			
31.79	4,190.44			
33.54	4,190.34			
37.62	4,189.93			
43.44	4,189.49			
48.80	4,189.19			
53.89	4,188.88			
58.97	4,188.61			
64.06	4,188.26			
69.15	4,187.87			
74.23	4,187.48			
78.41	4,187.25			
84.24	4,187.31			
89.50	4,187.30			
94.58	4,187.04			
99.67	4,186.76			
104.76	4,186.48			
109.85	4,186.68			
114.93	4,186.99			
119.21	4,187.57			
120.02	4,187.64			
125.04	4,188.91			
130.20	4,190.77			
135.28	4,192.20			
140.37	4,193.69			
145.46	4,195.17			
150.55	4,195.38			
155.63	4,195.60			
160.01	4,195.85			
165.81	4,195.94			

Draw 9 Upper Cross Section
Worksheet for Irregular Channel

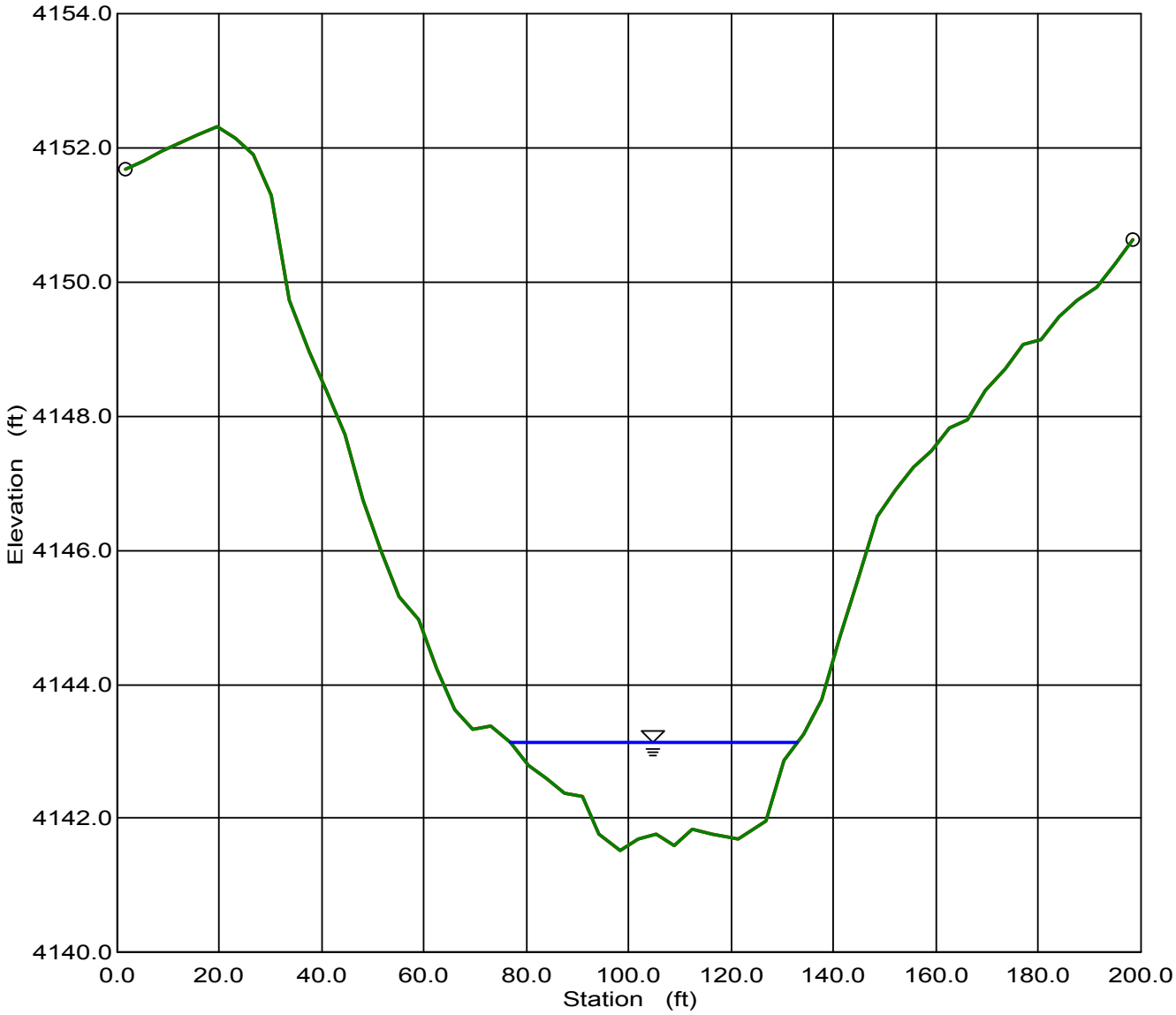
170.90	4,196.36	
175.98	4,196.36	
181.07	4,196.41	
186.16	4,196.52	
191.25	4,196.82	
196.33	4,196.97	
Discharge	330.90	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,188.14	ft
Flow Area	53.68	ft²
Wetted Perimeter	56.56	ft
Top Width	56.38	ft
Height	1.67	ft
Critical Depth	4,188.22	ft
Critical Slope	0.013138	ft/ft
Velocity	6.16	ft/s
Velocity Head	0.59	ft
Specific Energy	4,188.73	ft
Froude Number	1.11	
Flow is supercritical.		

Draw 9 Lower Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw9_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.011600	ft/ft
Water Surface Elevation	4,143.13	ft
Discharge	330.90	cfs



Draw 9 Lower Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw9_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.011600 ft/ft

Elevation range: 4,141.51 ft to 4,152.31 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
1.64	4,151.68	1.64	198.55	0.030
5.22	4,151.81			
8.80	4,151.95			
12.20	4,152.08			
15.96	4,152.21			
19.54	4,152.31			
23.12	4,152.14			
26.70	4,151.90			
30.28	4,151.28			
33.86	4,149.72			
37.44	4,148.98			
41.03	4,148.37			
44.61	4,147.72			
48.19	4,146.76			
51.77	4,145.99			
55.35	4,145.30			
58.93	4,144.97			
62.51	4,144.23			
66.08	4,143.63			
69.67	4,143.34			
73.25	4,143.39			
76.83	4,143.13			
80.41	4,142.79			
83.99	4,142.59			
87.57	4,142.39			
91.15	4,142.32			
94.13	4,141.76			
98.31	4,141.51			
101.89	4,141.70			
105.47	4,141.76			
109.05	4,141.58			
112.63	4,141.83			
116.21	4,141.75			
119.79	4,141.70			
121.44	4,141.68			
126.95	4,141.96			
130.53	4,142.87			
134.11	4,143.25			

Draw 9 Lower Cross Section
Worksheet for Irregular Channel

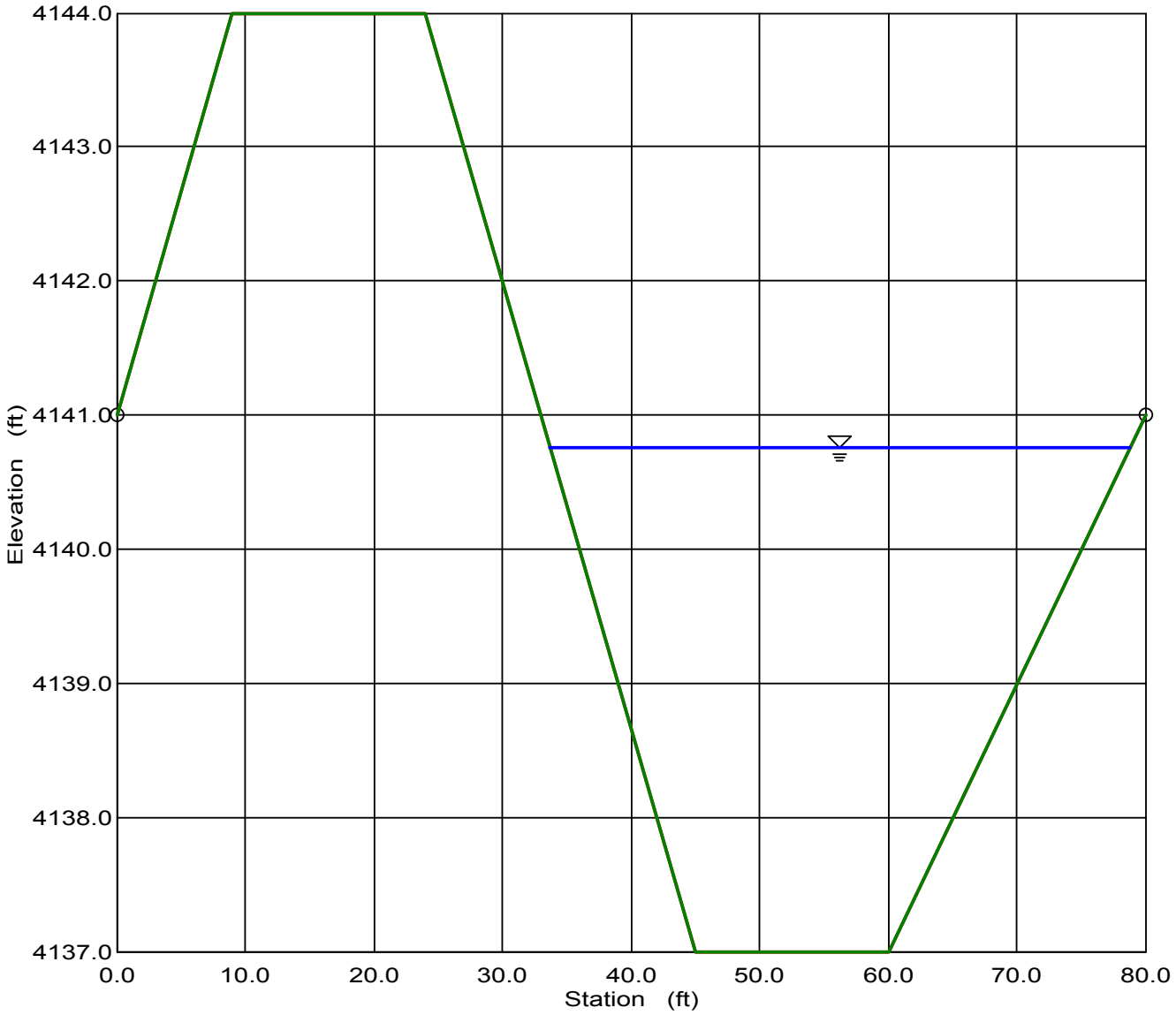
137.69	4,143.76	
141.27	4,144.69	
144.85	4,145.55	
148.75	4,146.51	
152.01	4,146.89	
155.59	4,147.23	
159.17	4,147.47	
162.75	4,147.83	
166.33	4,147.95	
169.91	4,148.39	
173.49	4,148.70	
177.07	4,149.08	
180.65	4,149.14	
184.23	4,149.49	
187.81	4,149.74	
191.39	4,149.91	
194.97	4,150.26	
198.55	4,150.64	
Discharge	330.90	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,143.13	ft
Flow Area	59.70	ft²
Wetted Perimeter	56.37	ft
Top Width	56.13	ft
Height	1.62	ft
Critical Depth	4,143.08	ft
Critical Slope	0.013032	ft/ft
Velocity	5.54	ft/s
Velocity Head	0.48	ft
Specific Energy	4,143.60	ft
Froude Number	0.95	
Flow is subcritical.		

Draw 13 Diversion Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw13_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.004500	ft/ft
Water Surface Elevation	4,140.76	ft
Discharge	681.10	cfs



Draw 13 Diversion Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw13_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

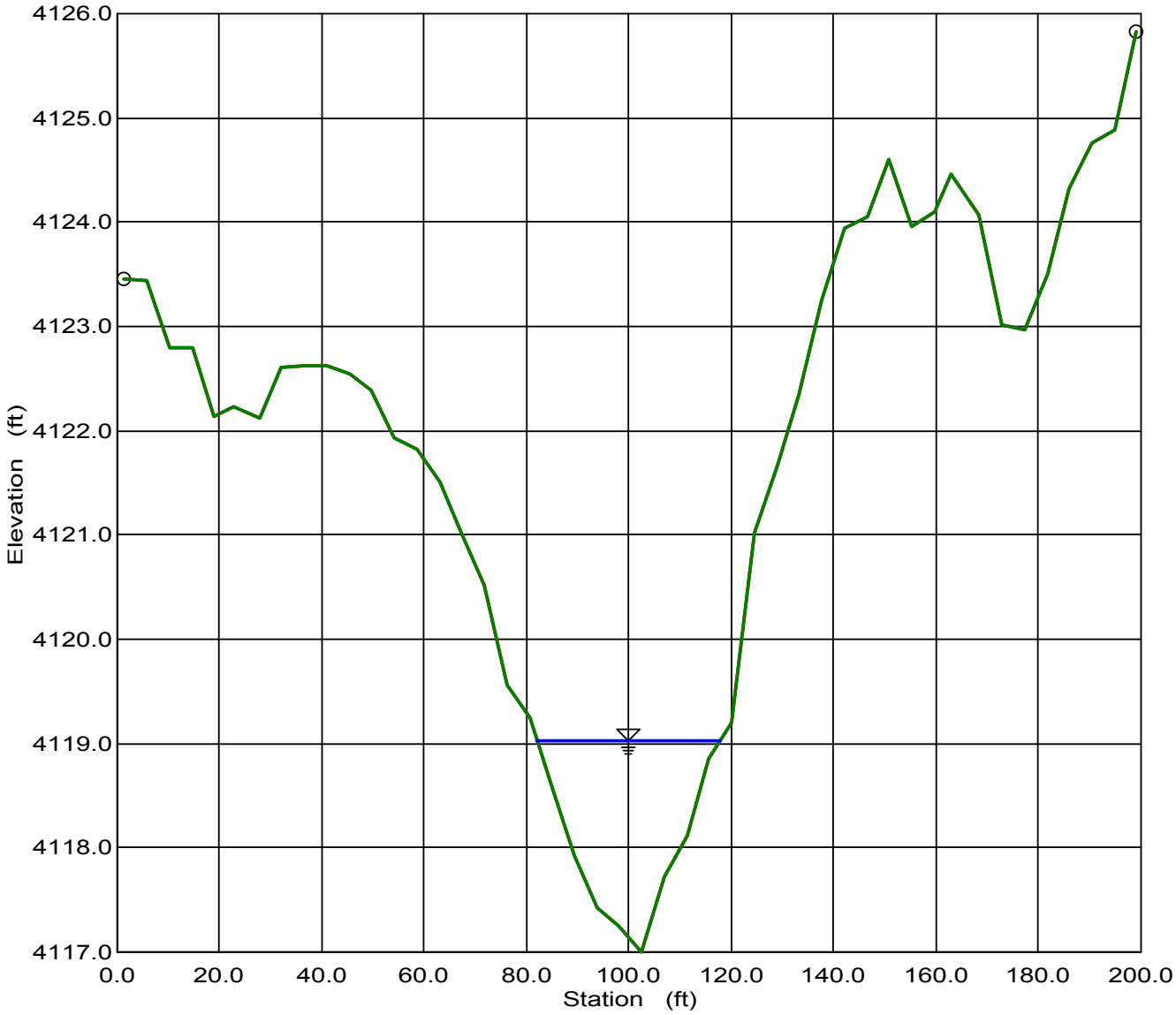
Input Data				
Channel Slope	0.004500 ft/ft			
Elevation range: 4,137.00 ft to 4,144.00 ft.				
Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	4,141.00	0.00	80.00	0.030
9.00	4,144.00			
24.00	4,144.00			
45.00	4,137.00			
60.00	4,137.00			
80.00	4,141.00			
Discharge	681.10 cfs			

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,140.76	ft
Flow Area	112.79	ft²
Wetted Perimeter	46.03	ft
Top Width	45.05	ft
Height	3.76	ft
Critical Depth	4,140.05	ft
Critical Slope	0.010513	ft/ft
Velocity	6.04	ft/s
Velocity Head	0.57	ft
Specific Energy	4,141.32	ft
Froude Number	0.67	
Flow is subcritical.		

Draw 13 Lower Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw13_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.100000	ft/ft
Water Surface Elevation	4,119.02	ft
Discharge	681.10	cfs



Draw 13 Lower Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw13_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.100000 ft/ft

Elevation range: 4,117.00 ft to 4,125.82 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
1.54	4,123.45	1.54	199.32	0.030
5.93	4,123.44			
10.33	4,122.79			
14.72	4,122.79			
19.12	4,122.13			
22.96	4,122.23			
27.91	4,122.13			
32.30	4,122.60			
36.70	4,122.62			
41.09	4,122.62			
45.49	4,122.54			
49.88	4,122.39			
54.28	4,121.92			
58.68	4,121.82			
63.07	4,121.51			
67.47	4,121.02			
71.86	4,120.52			
76.26	4,119.55			
80.65	4,119.25			
85.05	4,118.61			
89.44	4,117.93			
93.84	4,117.42			
98.23	4,117.25			
102.63	4,117.00			
107.07	4,117.72			
111.42	4,118.11			
115.81	4,118.85			
120.21	4,119.20			
124.60	4,121.01			
129.00	4,121.66			
133.39	4,122.34			
137.79	4,123.24			
142.19	4,123.94			
146.58	4,124.05			
150.98	4,124.60			
155.37	4,123.95			
159.77	4,124.10			
163.15	4,124.46			

Draw 13 Lower Cross Section
Worksheet for Irregular Channel

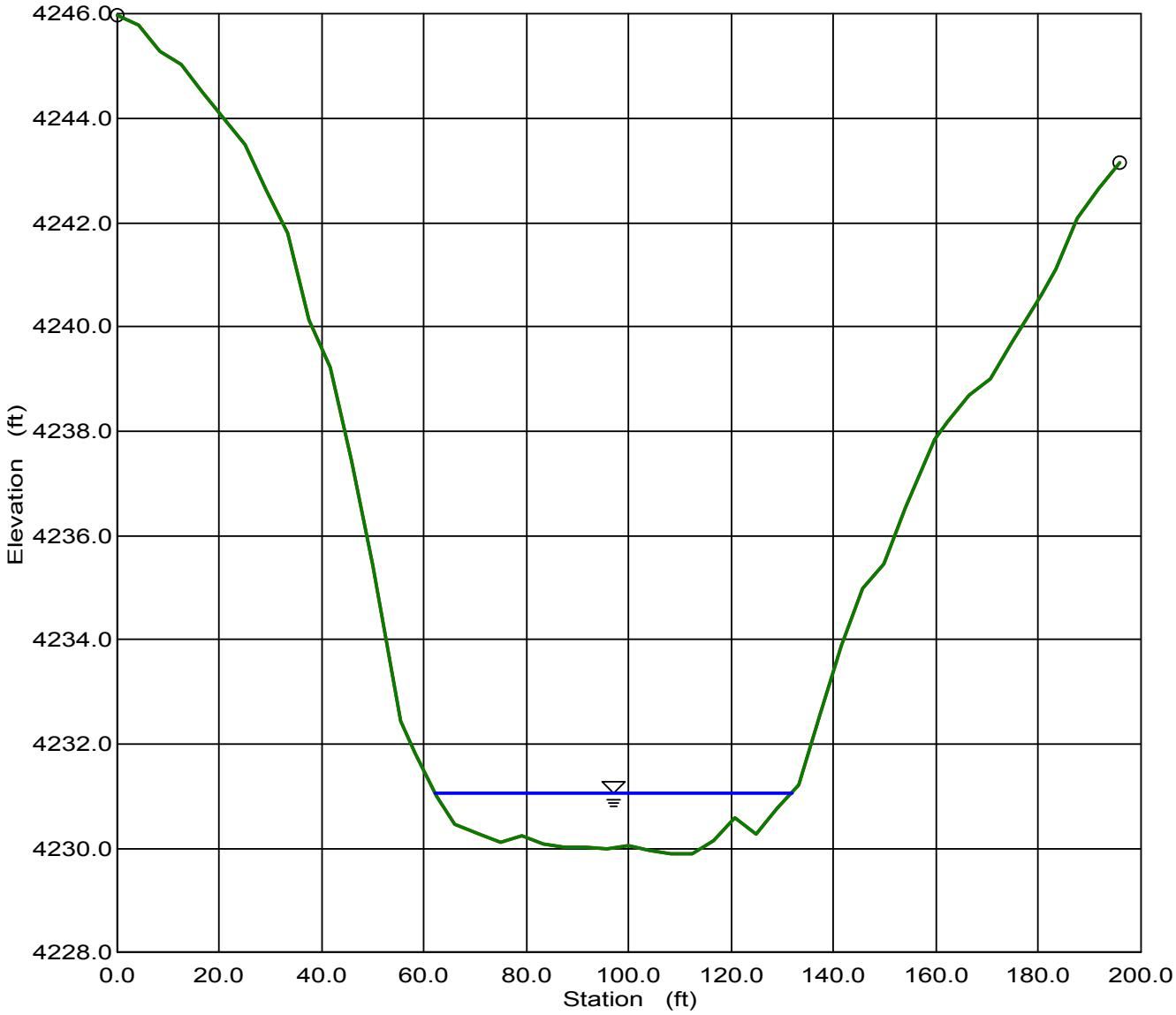
168.56	4,124.07	
172.95	4,123.02	
177.35	4,122.97	
181.84	4,123.50	
186.14	4,124.32	
190.53	4,124.75	
194.93	4,124.88	
199.32	4,125.82	
Discharge	681.10	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,119.02	ft
Flow Area	40.35	ft²
Wetted Perimeter	36.07	ft
Top Width	35.80	ft
Height	2.02	ft
Critical Depth	4,120.13	ft
Critical Slope	0.010900	ft/ft
Velocity	16.88	ft/s
Velocity Head	4.43	ft
Specific Energy	4,123.45	ft
Froude Number	2.80	
Flow is supercritical.		

Draw 14 Upper Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw14_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.016200	ft/ft
Water Surface Elevation	4,231.06	ft
Discharge	342.30	cfs



Draw 14 Upper Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw14_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.016200 ft/ft

Elevation range: 4,229.89 ft to 4,245.98 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.24	4,245.98	0.24	195.85	0.030
4.41	4,245.80			
8.57	4,245.29			
12.73	4,245.04			
16.89	4,244.50			
21.05	4,243.99			
25.21	4,243.50			
29.38	4,242.63			
33.54	4,241.79			
37.70	4,240.12			
41.86	4,239.23			
46.02	4,237.43			
50.18	4,235.43			
55.59	4,232.43			
58.51	4,231.79			
62.67	4,230.99			
66.00	4,230.44			
70.99	4,230.26			
75.15	4,230.10			
79.32	4,230.23			
83.48	4,230.09			
87.64	4,230.02			
91.80	4,230.03			
95.96	4,229.97			
100.13	4,230.05			
104.29	4,229.94			
108.45	4,229.89			
112.61	4,229.90			
116.77	4,230.14			
120.94	4,230.57			
125.10	4,230.25			
129.26	4,230.77			
133.42	4,231.22			
137.58	4,232.57			
141.74	4,233.89			
145.91	4,234.99			
150.07	4,235.45			
154.23	4,236.52			

Draw 14 Upper Cross Section
Worksheet for Irregular Channel

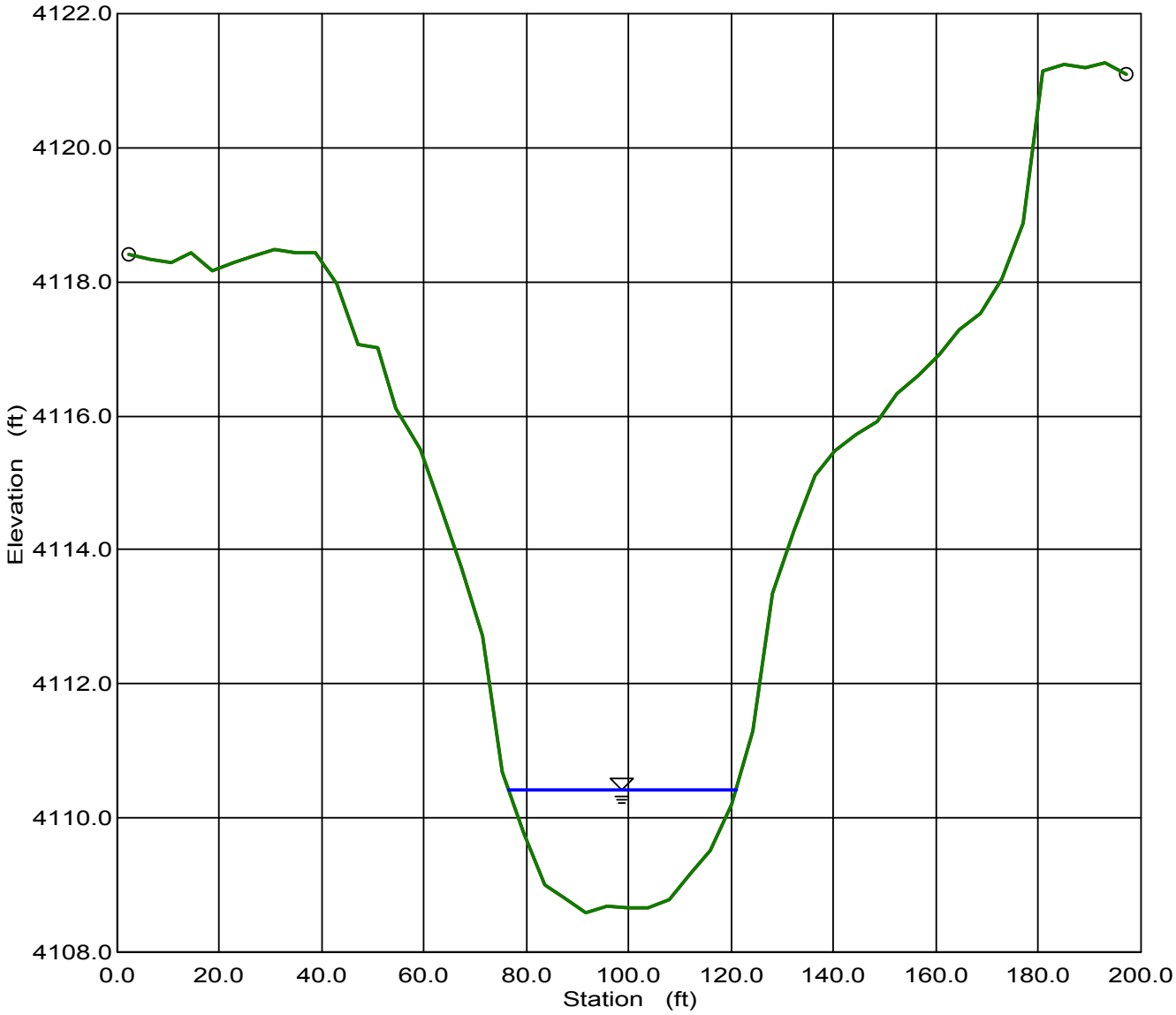
159.70	4,237.84	
162.55	4,238.19	
166.71	4,238.67	
170.88	4,239.01	
175.04	4,239.70	
180.52	4,240.62	
183.36	4,241.10	
187.52	4,242.07	
191.69	4,242.66	
195.85	4,243.14	
Discharge	342.30	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,231.06	ft
Flow Area	60.04	ft²
Wetted Perimeter	69.83	ft
Top Width	69.67	ft
Height	1.18	ft
Critical Depth	4,231.11	ft
Critical Slope	0.013613	ft/ft
Velocity	5.70	ft/s
Velocity Head	0.51	ft
Specific Energy	4,231.57	ft
Froude Number	1.08	
Flow is supercritical.		

Draw 14 Lower Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw14_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.016200	ft/ft
Water Surface Elevation	4,110.43	ft
Discharge	456.60	cfs



Draw 14 Lower Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw14_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.016200 ft/ft

Elevation range: 4,108.57 ft to 4,121.27 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
2.45	4,118.40	2.45	197.25	0.030
6.51	4,118.34			
10.57	4,118.28			
14.55	4,118.43			
18.69	4,118.16			
22.75	4,118.28			
26.80	4,118.39			
30.86	4,118.47			
34.92	4,118.44			
38.98	4,118.44			
43.04	4,117.97			
47.10	4,117.07			
51.15	4,117.01			
54.58	4,116.11			
59.27	4,115.51			
63.33	4,114.68			
67.39	4,113.74			
71.45	4,112.72			
75.50	4,110.70			
79.56	4,109.77			
83.62	4,109.01			
87.68	4,108.81			
91.74	4,108.57			
95.80	4,108.68			
99.85	4,108.66			
103.91	4,108.66			
107.97	4,108.77			
112.03	4,109.17			
116.09	4,109.51			
120.14	4,110.19			
124.20	4,111.31			
128.26	4,113.35			
132.32	4,114.28			
136.38	4,115.10			
140.44	4,115.47			
144.44	4,115.71			
148.55	4,115.92			
152.61	4,116.32			

Draw 14 Lower Cross Section
Worksheet for Irregular Channel

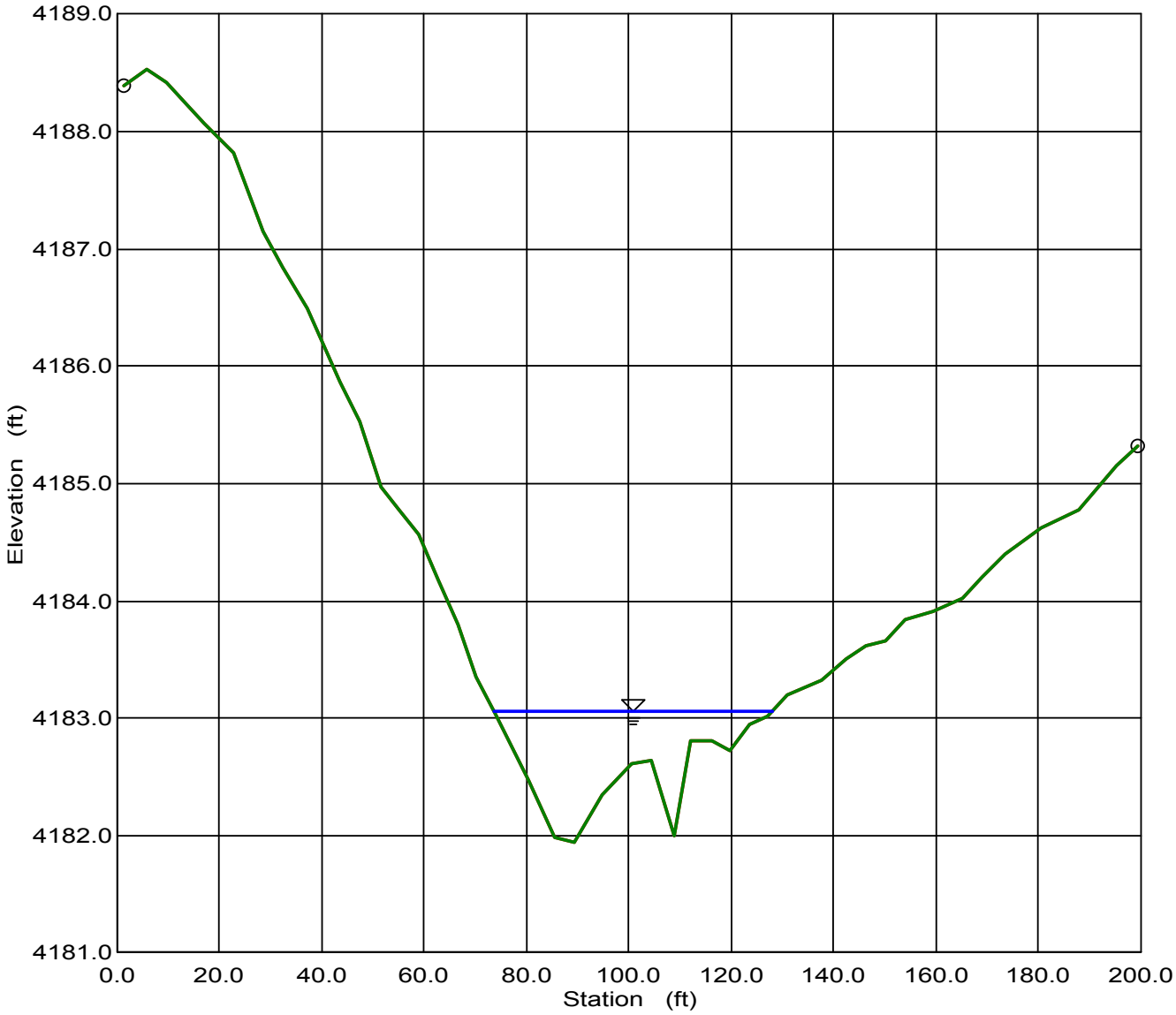
156.67	4,116.60	
160.73	4,116.91	
164.79	4,117.29	
168.85	4,117.52	
172.90	4,118.05	
176.96	4,118.87	
181.02	4,121.14	
185.08	4,121.25	
189.14	4,121.20	
193.20	4,121.27	
197.25	4,121.09	
Discharge	456.60	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,110.43	ft
Flow Area	59.66	ft²
Wetted Perimeter	44.61	ft
Top Width	44.33	ft
Height	1.85	ft
Critical Depth	4,110.58	ft
Critical Slope	0.011665	ft/ft
Velocity	7.65	ft/s
Velocity Head	0.91	ft
Specific Energy	4,111.34	ft
Froude Number	1.16	
Flow is supercritical.		

Draw 15 Upper Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw15_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.026000	ft/ft
Water Surface Elevation	4,183.06	ft
Discharge	152.30	cfs



Draw 15 Upper Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw15_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.026000 ft/ft

Elevation range: 4,181.94 ft to 4,188.53 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
1.37	4,188.40	1.37	199.50	0.030
5.81	4,188.53			
9.61	4,188.42			
13.41	4,188.25			
17.21	4,188.07			
22.91	4,187.83			
28.60	4,187.16			
32.40	4,186.84			
37.28	4,186.49			
43.79	4,185.87			
47.59	4,185.54			
51.64	4,184.98			
55.19	4,184.77			
58.98	4,184.56			
62.78	4,184.18			
66.58	4,183.79			
70.38	4,183.35			
74.17	4,183.03			
80.37	4,182.47			
85.57	4,181.99			
89.37	4,181.94			
94.74	4,182.35			
100.76	4,182.61			
104.56	4,182.63			
109.10	4,182.00			
112.15	4,182.81			
116.29	4,182.80			
119.75	4,182.72			
123.55	4,182.94			
127.35	4,183.02			
131.14	4,183.20			
137.83	4,183.32			
142.54	4,183.51			
146.33	4,183.62			
150.13	4,183.66			
153.93	4,183.83			
159.38	4,183.92			
165.32	4,184.02			

Draw 15 Upper Cross Section
Worksheet for Irregular Channel

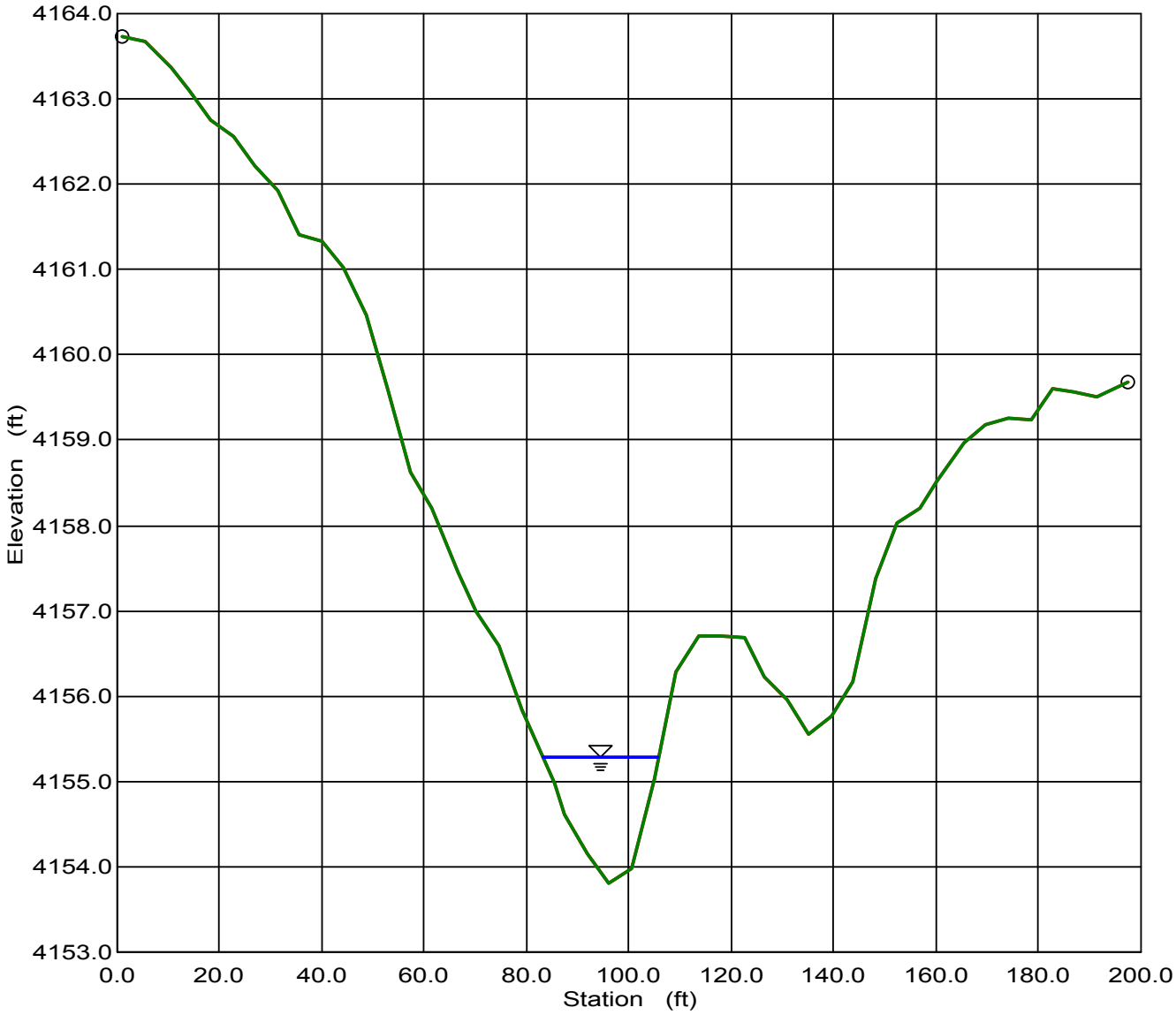
169.12	4,184.20	
173.75	4,184.39	
180.51	4,184.62	
188.11	4,184.77	
195.29	4,185.15	
199.50	4,185.32	
Discharge	152.30	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,183.06	ft
Flow Area	29.01	ft²
Wetted Perimeter	54.43	ft
Top Width	54.20	ft
Height	1.11	ft
Critical Depth	4,183.16	ft
Critical Slope	0.015615	ft/ft
Velocity	5.25	ft/s
Velocity Head	0.43	ft
Specific Energy	4,183.49	ft
Froude Number	1.27	
Flow is supercritical.		

Draw 15 Lower Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw15_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.026000	ft/ft
Water Surface Elevation	4,155.28	ft
Discharge	152.30	cfs



Draw 15 Lower Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw15_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.026000 ft/ft

Elevation range: 4,153.80 ft to 4,163.73 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
1.21	4,163.73	1.21	197.45	0.030
5.54	4,163.68			
10.84	4,163.36			
14.18	4,163.10			
18.50	4,162.75			
22.83	4,162.55			
27.15	4,162.22			
31.47	4,161.92			
35.80	4,161.40			
40.19	4,161.33			
44.44	4,161.03			
48.76	4,160.47			
53.09	4,159.60			
57.41	4,158.63			
61.73	4,158.20			
66.82	4,157.45			
70.38	4,157.00			
74.70	4,156.58			
79.26	4,155.84			
85.48	4,154.97			
87.67	4,154.61			
91.99	4,154.15			
96.31	4,153.80			
100.64	4,153.98			
104.96	4,155.04			
109.28	4,156.28			
113.61	4,156.71			
117.93	4,156.71			
122.80	4,156.69			
126.57	4,156.23			
130.90	4,155.96			
135.24	4,155.55			
139.54	4,155.76			
143.86	4,156.16			
148.19	4,157.38			
152.51	4,158.03			
156.83	4,158.20			
160.12	4,158.51			

Draw 15 Lower Cross Section
Worksheet for Irregular Channel

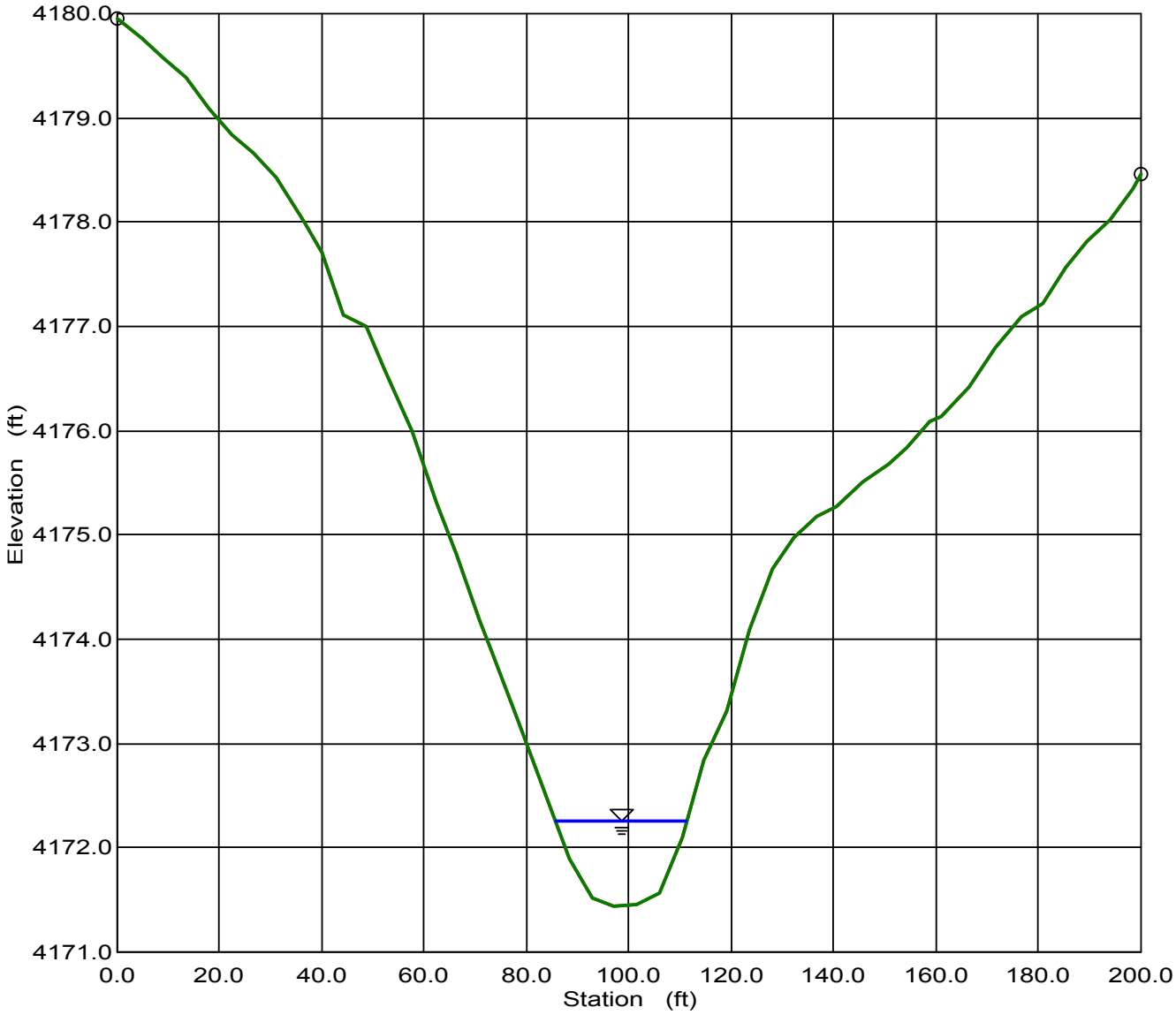
165.48	4,158.96	
169.80	4,159.19	
174.12	4,159.27	
178.79	4,159.24	
182.77	4,159.60	
187.09	4,159.57	
191.41	4,159.51	
197.45	4,159.68	
Discharge	152.30	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,155.28	ft
Flow Area	20.49	ft²
Wetted Perimeter	22.83	ft
Top Width	22.57	ft
Height	1.48	ft
Critical Depth	4,155.53	ft
Critical Slope	0.013137	ft/ft
Velocity	7.43	ft/s
Velocity Head	0.86	ft
Specific Energy	4,156.14	ft
Froude Number	1.38	
Flow is supercritical.		

Draw 18 Upper Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw18_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.024200	ft/ft
Water Surface Elevation	4,172.25	ft
Discharge	79.60	cfs



Draw 18 Upper Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw18_A
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.024200 ft/ft

Elevation range: 4,171.44 ft to 4,179.95 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	4,179.95	0.00	200.00	0.030
4.81	4,179.76			
9.21	4,179.57			
13.61	4,179.38			
18.01	4,179.09			
22.41	4,178.84			
26.82	4,178.67			
31.22	4,178.43			
36.66	4,178.00			
40.02	4,177.71			
44.42	4,177.11			
48.82	4,176.99			
52.23	4,176.59			
57.63	4,175.99			
62.62	4,175.30			
66.43	4,174.82			
70.83	4,174.18			
73.00	4,173.90			
78.19	4,173.25			
83.38	4,172.57			
88.44	4,171.90			
92.84	4,171.52			
97.24	4,171.44			
101.64	4,171.45			
106.05	4,171.57			
110.45	4,172.10			
114.85	4,172.83			
119.25	4,173.30			
123.65	4,174.09			
128.05	4,174.68			
132.46	4,174.97			
136.86	4,175.17			
140.49	4,175.27			
145.66	4,175.51			
150.87	4,175.68			
154.46	4,175.84			
158.87	4,176.09			
161.26	4,176.14			

Draw 18 Upper Cross Section
Worksheet for Irregular Channel

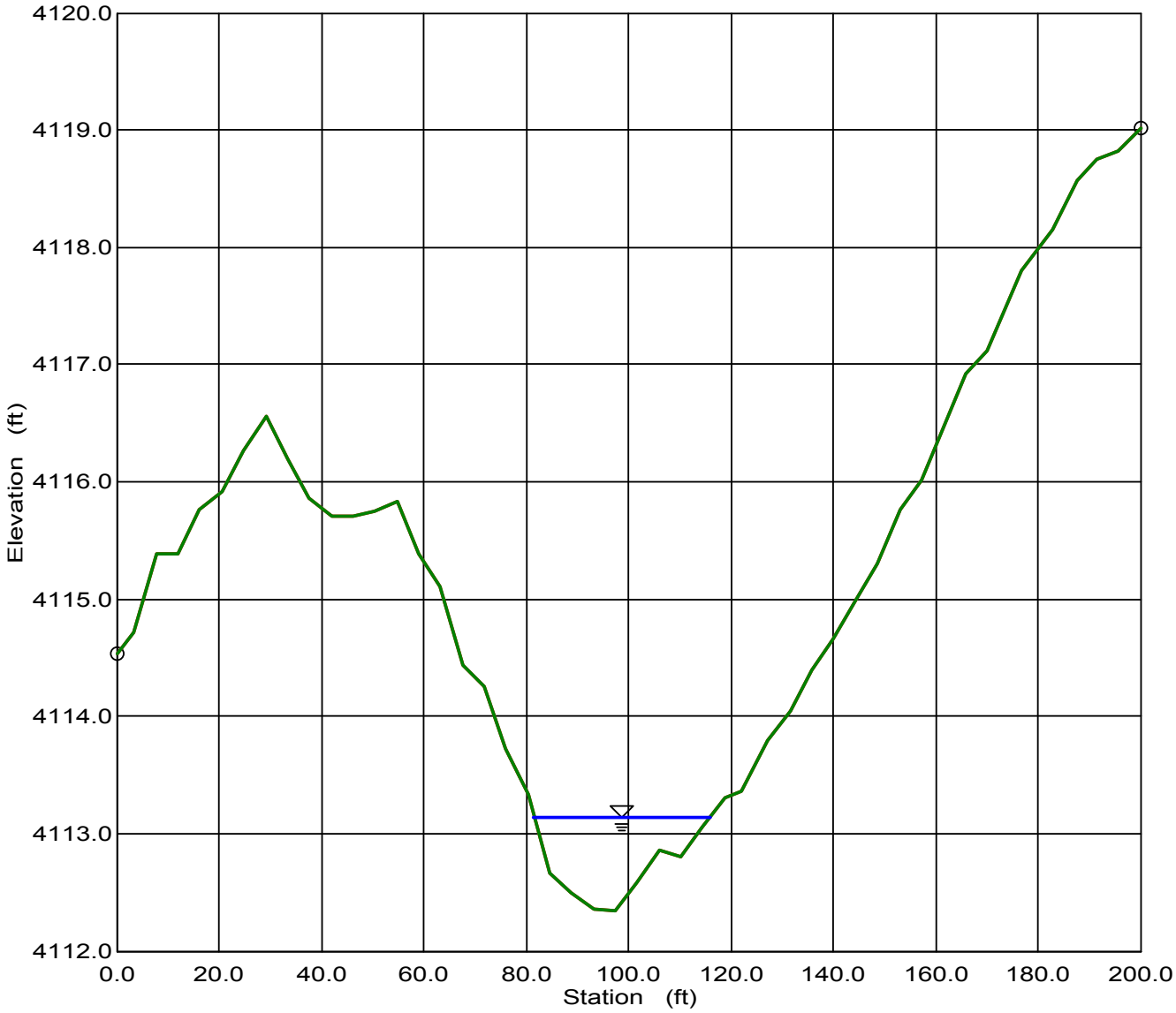
166.45	4,176.42	
171.64	4,176.79	
176.83	4,177.09	
180.87	4,177.21	
185.28	4,177.57	
189.68	4,177.82	
194.08	4,178.02	
198.48	4,178.32	
200.00	4,178.46	
Discharge	79.60	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,172.25	ft
Flow Area	14.85	ft²
Wetted Perimeter	25.60	ft
Top Width	25.52	ft
Height	0.81	ft
Critical Depth	4,172.35	ft
Critical Slope	0.015224	ft/ft
Velocity	5.36	ft/s
Velocity Head	0.45	ft
Specific Energy	4,172.69	ft
Froude Number	1.24	
Flow is supercritical.		

Draw 18 Lower Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw18_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Section Data		
Wtd. Mannings Coefficient	0.030	
Channel Slope	0.024200	ft/ft
Water Surface Elevation	4,113.14	ft
Discharge	79.60	cfs



Draw 18 Lower Cross Section
Worksheet for Irregular Channel

Project Description	
Project File	k:\common\clint_a\flowmaster\strata.fm2
Worksheet	Draw18_B
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Water Elevation

Input Data	
Channel Slope	0.024200 ft/ft

Elevation range: 4,112.34 ft to 4,119.01 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
0.00	4,114.53	0.00	200.00	0.030
3.50	4,114.72			
7.77	4,115.38			
12.04	4,115.38			
16.31	4,115.76			
20.59	4,115.91			
24.86	4,116.27			
29.13	4,116.56			
33.40	4,116.20			
37.67	4,115.86			
41.94	4,115.70			
46.21	4,115.71			
50.48	4,115.75			
54.74	4,115.83			
59.02	4,115.39			
63.29	4,115.10			
67.56	4,114.43			
71.83	4,114.26			
76.10	4,113.72			
80.37	4,113.34			
84.64	4,112.66			
88.91	4,112.49			
93.18	4,112.35			
97.45	4,112.34			
101.72	4,112.58			
105.99	4,112.86			
110.26	4,112.80			
114.53	4,113.06			
118.80	4,113.30			
122.07	4,113.36			
127.34	4,113.79			
131.61	4,114.04			
135.88	4,114.39			
140.15	4,114.66			
144.42	4,114.99			
148.69	4,115.30			
152.96	4,115.76			
157.23	4,116.01			

Draw 18 Lower Cross Section
Worksheet for Irregular Channel

165.77	4,116.92	
170.04	4,117.12	
176.73	4,117.80	
182.85	4,118.15	
187.66	4,118.57	
191.39	4,118.75	
195.66	4,118.82	
200.00	4,119.01	
Discharge	79.60	cfs

Results		
Wtd. Mannings Coefficient	0.030	
Water Surface Elevation	4,113.14	ft
Flow Area	16.74	ft²
Wetted Perimeter	34.51	ft
Top Width	34.44	ft
Height	0.80	ft
Critical Depth	4,113.22	ft
Critical Slope	0.016230	ft/ft
Velocity	4.76	ft/s
Velocity Head	0.35	ft
Specific Energy	4,113.50	ft
Froude Number	1.20	
Flow is supercritical.		