Schultz Land & Water Consulting, Inc.

4859 Townsend Court
PO Box 301
Montague, MI 49437

Phone (231) 893-7177
DavidLSchultz@Charter.net

June 25, 2013

Chip May, Executive Director
Camp Arcadia
3046 Oak Street, P.O. Box 229
Arcadia, MI 49613

Re: SandGrabber Report

Dear Mr. May;

This letter is intended to serve as the final report on the SandGrabber (SG) system placed on your beach over the last two years. Placement of the SG modules was permitted by the State of Michigan as an experimental system, with its removal mandated after a three-year trial. Five surveys were performed to quantify the gains and losses that occurred during the study period. Since then, SandGrabber has changed its name to SandSaver, so any reference to SG is intended to mean either name.

Shore protection at Camp Arcadia beach goes back to at least 1978, when the existing wooden walls and groins were installed. Most of the substantial additions and maintenance took prior to 1987. The continued deterioration of these structures initiated a deliberate search for solutions to their vulnerability, being situated so close to the Lake Michigan shore. Due to the camp's previous shore protection efforts, they are not in a high risk erosion zone. However, immediately north and south of the camp, the state has measured the 60 year recession rates to be 105' and 85' respectively. This amount of beach and bluff recession at Camp Arcadia would result in the loss of their most essential buildings.

After soliciting proposals from a number of consultants and contractors, the camp's beach committee selected SandGrabber, who was willing to install a limited number of SG modules at no cost, in an effort to gain positive data to be used for future marketing. Ledy Design Group (now LSG) performed the initial topographic survey used to facilitate design, layout and permitting efforts. The State of Michigan issued a permit on 11/20/09 and the US Army Corps of Engineers issued a permit on 11/29/10. The extra 1 year to obtain the federal permit created a time crunch that forced removal of the SG modules in April, 2013 after only five surveys, instead of the 7 originally contemplated.

In retrospect, the SG system should have been left in place longer, in order to witness its response to the rising Lake Michigan water levels we are now experiencing. Instead the modules were in place during historically low water levels. This would have given all parties additional information regarding SG performance over a larger range of conditions that can be expected over a standard service life.

Attachments to this report illustrate the changes that occurred, and consist of overlapping survey profiles and a spreadsheet that quantifies these changes into square feet at each cross-section and cubic yards between each section. Additionally, I broke the beach into 4 quadrants to assist in visualizing trends based upon proximity to the SG installation.

The results of the shoreline in response to the SG system are unambiguously positive. Of the 2,567 cubic yards (cy) of beach volume gain from April 2011 to April 2013, 37% of the gain (954 cy) occurred at the SG installation, which constituted only 25% of the surveyed beach length. This equates to a gain of 6.4 cy per foot of beach front at the SG location, compared with a gain of 3.6 cy/ft over the rest of the study area.

Beach volume gains did not just occur behind the SG modules, as some had anticipated. Tangible gains in bottom elevation were witnessed as much as 50' in front of the SG system into the lake. This benefit was also visited upon the beach immediately north of the installation, which is downdrift at this location on Lake Michigan. This portion of the beach gained 6.1 cy/ft, when standard expectations were it would lose profile if the SG system was successful at "grabbing" any sand. This result appears to show that, at the very least, the SandGrabber design does not generate adjacent negative impacts associated with shore-normal and impermeable structures. The SG modules' permeability and placement in a shore-parallel orientation demonstrated no negative impacts to adjacent stretches of beach.

Summary of Monitoring Surveys at Camp Arcadia's Lake Michigan Beach

Quadrant	Location	ΔVol.	Average ΔVol.	
1	Sta 5+00 to 6+75	+329 cy	1.9 cy/ft	
2	Sta 6+75 to 8+25	+522	3.5	
3	Sta 8+25 to 9+75	+954	6.4	← location of SandGrabber system
4	Sta 9+75 to 11+00	+761	6.1	
Total	Sta 5+00 to 11+00	+2567 cy	4.3 cy/ft	

It has been a distinct pleasure to work for you and your colleagues in the interest of protecting Camp Arcadia and preserving its beach. Please feel free to contact me when further discussion or action becomes warranted.

Respectfully,

David L. Schultz, P.E.

cc: Barry Peterman, MDEQ
James Kohlenberg, Sand Saver

YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI. 49307
TELEPHONE 231-510-4216 FAX 231-832-1947

Date: June 16, 2013

To Whom It May Concern:

From: Cliff Youngs, P.E.

Subject: Survey equipment and procedures

To Whom It May Concern::

Please find listed below the information you have requested regarding the hydrographic surveying equipment used by Youngs Consulting:

- Innerspace 455 XPe 200KHZ sounder – put into service in 2006
- 208KHz 3 degree XDCR transducer – put into service in 2006
- Raven Invicta 210 GPS receiver – put into service fall of 2005
- Hypack Max Hydrographic Survey Version 2012a

Please find below the methodology and equipment used by LCM Surveying and Engineering:

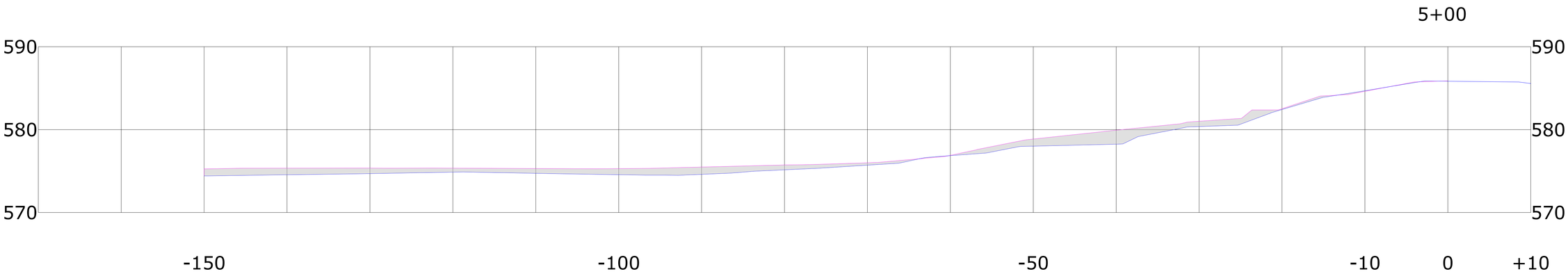
> LCM Surveying & Engineering performed the upland portion of the topographic survey by utilizing Leica System 1200 GNSS GPS Receivers. We used a Base/Rover system referenced to the Michigan CORS GPS Network. We established the baseline, stationing and control for this project by using previous survey control established by LEDY Survey Group, who had previously completed a survey for the Lutheran Camp Association.
>
> This survey control was used to establish reference lines at 25' intervals along the established baseline. Survey data was collected along said reference lines for each monitoring survey. Since data was collected along a common reference line the data could be compared with previous surveys looking for any variations.

Please contact me for any questions.

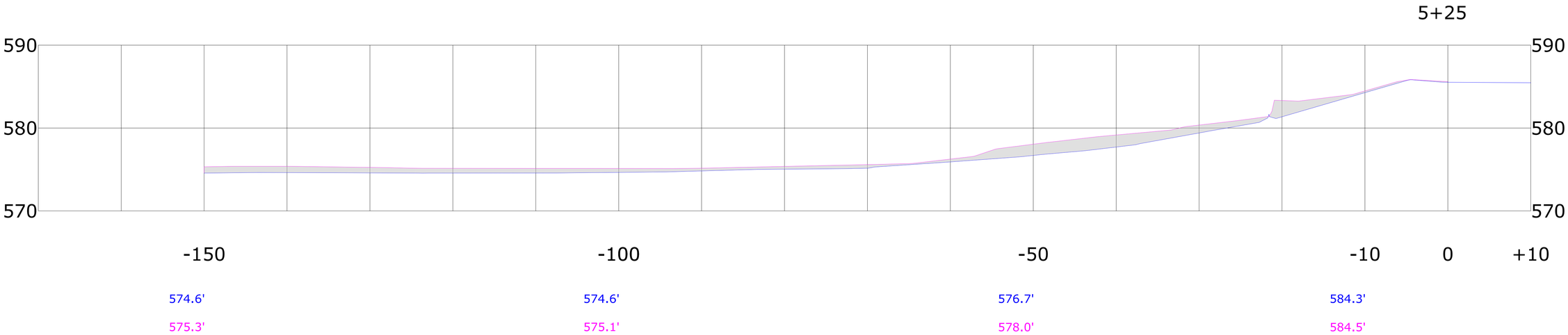
Camp Arcadia Volumetrics

Station	Change, 4/13/11 to 9/1/11 c.s. area change loss (sf)	gain (sf)	volume change (cy)	Change, 9/1/11 to 4/17/12 c.s. area change loss (sf)	gain (sf)	volume change (cy)	Change, 4/17/12 to 9/6/12 c.s. area change loss (sf)	gain (sf)	volume change (cy)	Change, 9/6/12 to 4/12/13 c.s. area change loss (sf)	gain (sf)	volume change (cy)	4/13/11 to 4/12/13 Cum. volume change cubic yards		
5+00	0.7	90.0		70.7	8.8		1.9	151.8		147.0	4.0				
5+25	0.0	98.4	86.9	39.4	10.4	-42.1	4.7	134.9	129.7	104.0	38.0	-96.8	77.7		
5+50	6.2	67.0	73.7	9.9	21.4	-8.1	3.2	119.5	114.1	159.0	12.0	-98.6	81.1		
5+75	9.1	51.2	47.6	15.7	32.8	13.2	1.8	105.6	101.9	125.0	9.0	-121.8	41.0	329.3	5+00 to 6+75
6+25	24.9	4.9	20.5	8.3	64.5	67.9	56.9	24.6	66.2	11.0	37.0	-83.3	71.2	1.88 cy/lf	
6+50	42.8	17.7	-20.9	0.8	75.8	60.7	68.8	22.0	-36.6	22.0	38.0	19.4	22.7		
6+75	42.2	20.6	-21.6	2.0	67.8	65.2	56.2	24.7	-36.3	10.0	55.0	28.2	35.6		
7+00	54.9	19.2	-26.5	5.8	56.1	53.8	47.9	31.8	-22.0	18.0	57.0	38.9	44.1		
7+25	36.3	102.4	14.1	11.4	56.3	44.1	55.8	38.0	-15.7	17.0	49.0	32.9	75.3		
7+50	76.3	27.2	7.9	15.4	67.1	44.7	37.3	34.4	-9.6	8.0	64.0	40.7	83.8	522.4	6+75 to 8+25
7+75	58.6	6.2	-47.0	0.4	95.8	68.1	22.6	38.6	6.1	22.0	41.0	34.7	61.9	3.48 cy/lf	
8+00	20.6	48.4	-11.4	15.6	95.1	81.0	23.5	13.6	2.8	18.0	70.0	32.9	105.3		
8+25	13.8	36.3	23.3	7.2	43.7	53.7	3.0	39.1	12.1	16.0	100.0	63.0	152.1		
8+50	23.5	28.6	12.8	15.0	30.2	23.9	52.4	9.1	-3.3	11.0	114.0	86.6	120.0		
8+75	59.7	34.4	-9.4	9.9	48.7	25.0	0.0	95.5	24.2	50.0	75.0	59.3	99.1		
9+00	32.6	57.9	0.0	20.6	46.8	30.1	8.8	78.2	76.3	19.0	113.0	55.1	161.5		
9+25	67.1	35.1	-3.1	10.6	89.2	48.5	27.3	56.0	45.4	4.0	146.0	109.3	200.1	954.0	8+25 to 9+75
9+50	51.2	28.0	-25.6	7.7	30.3	46.9	18.3	47.6	26.9	0.0	187.0	152.3	200.5	6.36 cy/lf	
9+75	92.1	23.6	-42.5	12.0	52.5	29.2	18.3	51.0	28.7	1.0	154.0	157.4	172.9		
10+00	87.1	20.7	-62.5	15.4	51.9	35.6	34.4	54.1	24.3	0.0	182.0	155.1	152.5		
10+25	64.3	10.2	-55.8	1.1	51.2	40.1	38.9	37.9	8.7	5.0	186.0	168.1	161.0		
10+50	61.7	24.6	-42.2	20.2	49.8	36.9	47.1	45.1	-1.4	8.0	138.0	144.0	137.3	761.2	9+75 to 11+00
10+75	59.0	9.6	-40.0	15.3	78.7	43.1	61.5	34.5	-13.4	1.0	208.0	156.0	145.6	6.09 cy/lf	
11+00	46.7	19.7	-35.4	29.3	32.7	30.9	53.2	40.7	-18.3	4.0	202.0	187.5	164.8		
			-157.0			892.4			510.7			1320.8	2566.9		

Red stations and values are at SandGrabber installation location



		END AREA (SQ FT)	VOLUME (CYD)
5+00.00 EX			
	Excavation	0.7	0
	Fill	90.0	0
5+25.00 EX			
	Excavation	0.0	0
	Fill	98.4	87



LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

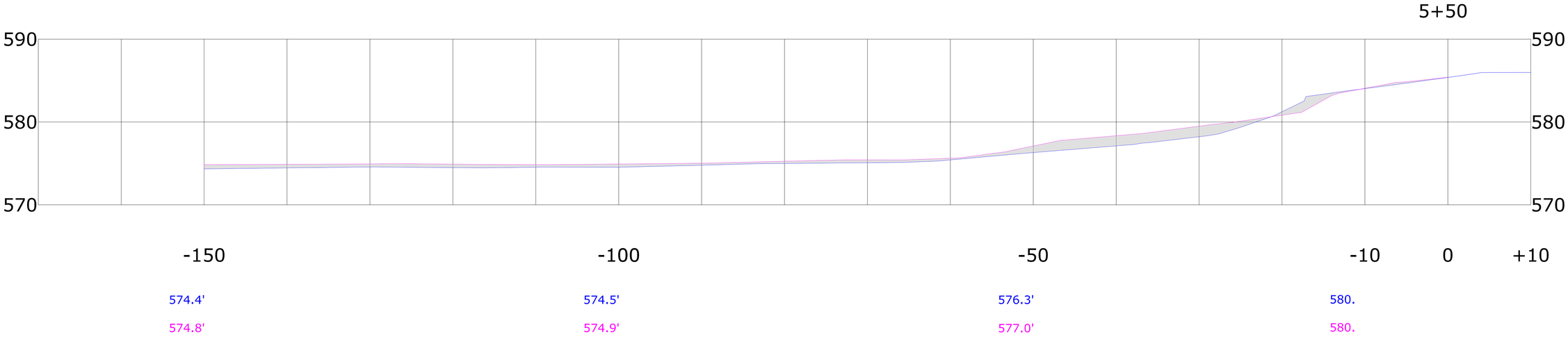
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

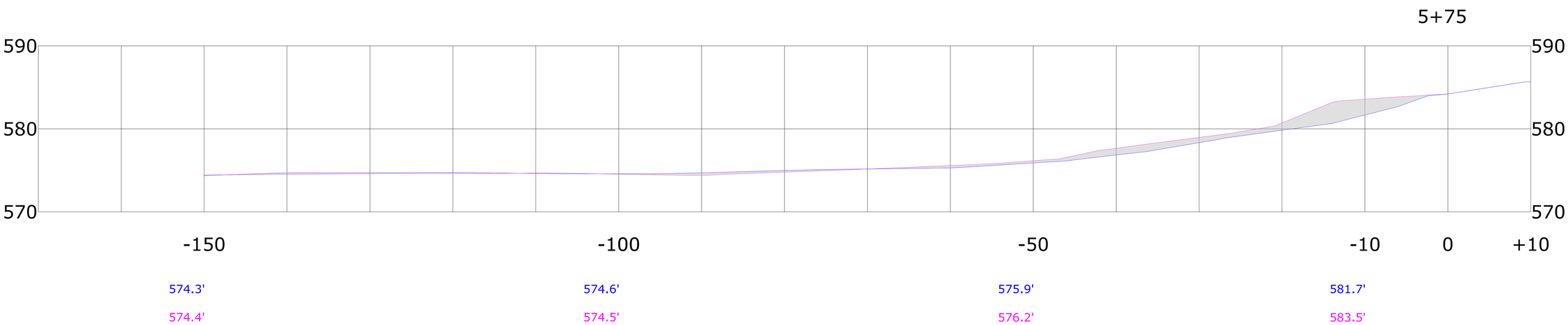
DRN. BY: FTW
CHK'D BY: CCY
DATE: 03-12-2013
FIELD BOOK/PAGE: SEE FILE

JOB NO.: 10046

SHEET NO.: 2 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
5+50.00 EX			
	Excavation	6.2	3
	Fill	67.0	77
5+75.00 EX			
	Excavation	9.1	7
	Fill	51.2	55



LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

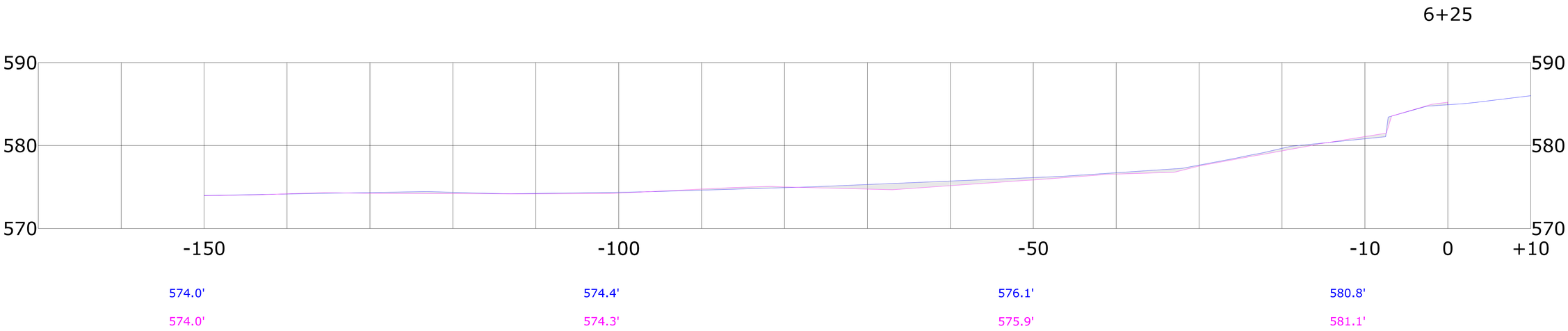
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

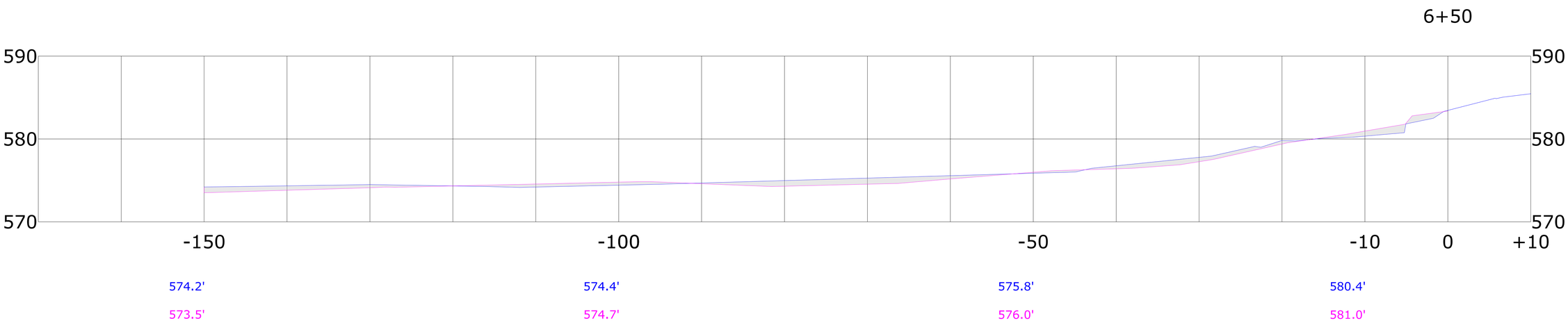
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 3 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
6+25.00 EX			
	Excavation	24.9	31
	Fill	4.9	52
6+50.00 EX			
	Excavation	42.8	31
	Fill	17.7	10



LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

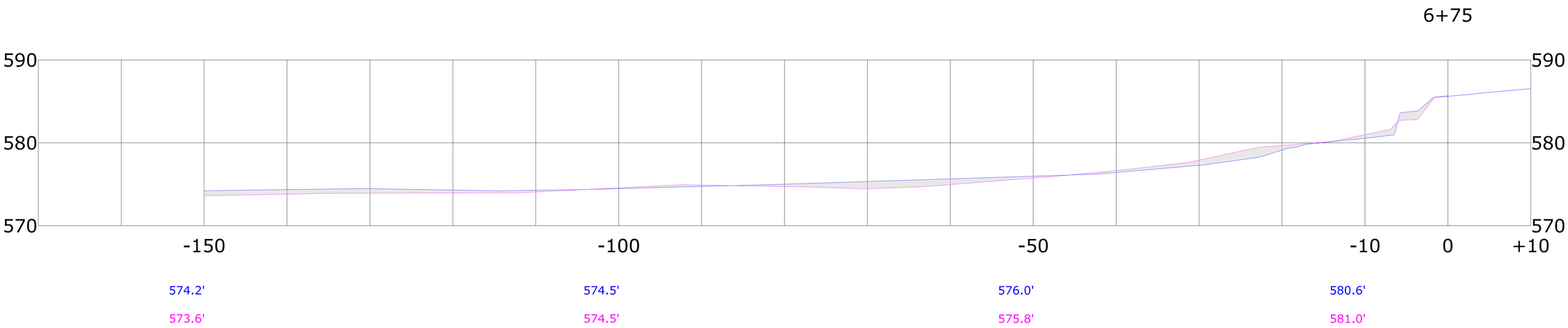
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

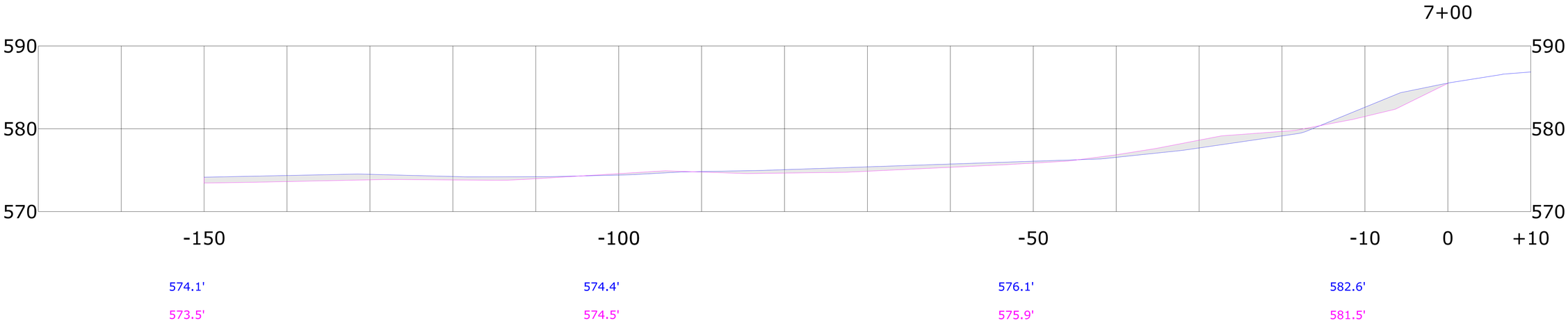
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 4 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
6+75.00 EX			
	Excavation	42.2	39
	Fill	20.6	18
7+00.00 EX			
	Excavation	54.9	45
	Fill	19.2	18



LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

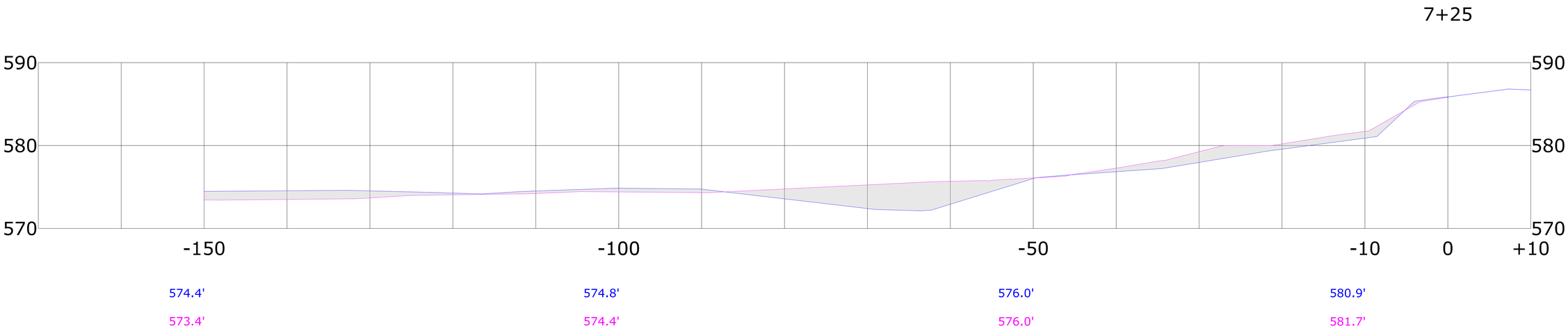
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

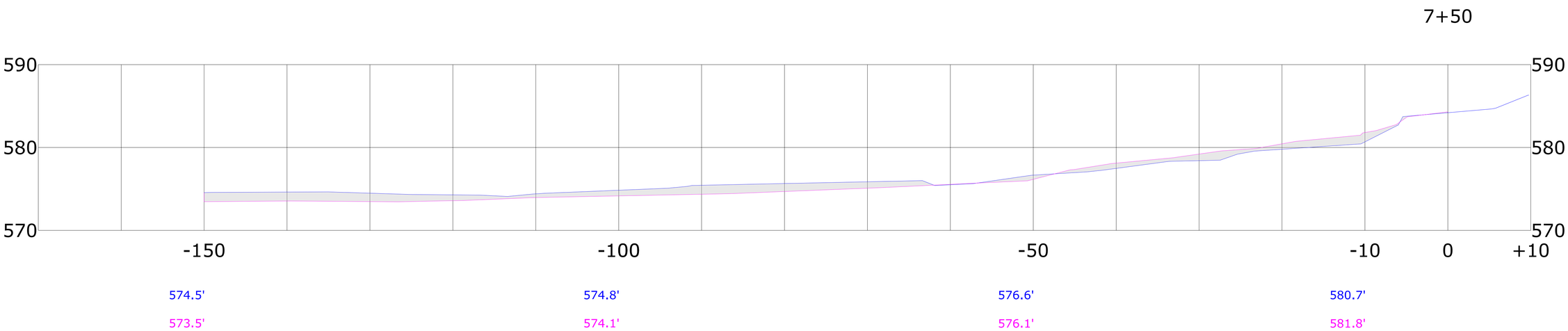
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 5 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
7+25.00 EX			
	Excavation	36.3	42
	Fill	102.4	56
7+50.00 EX			
	Excavation	76.3	52
	Fill	27.2	60



LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

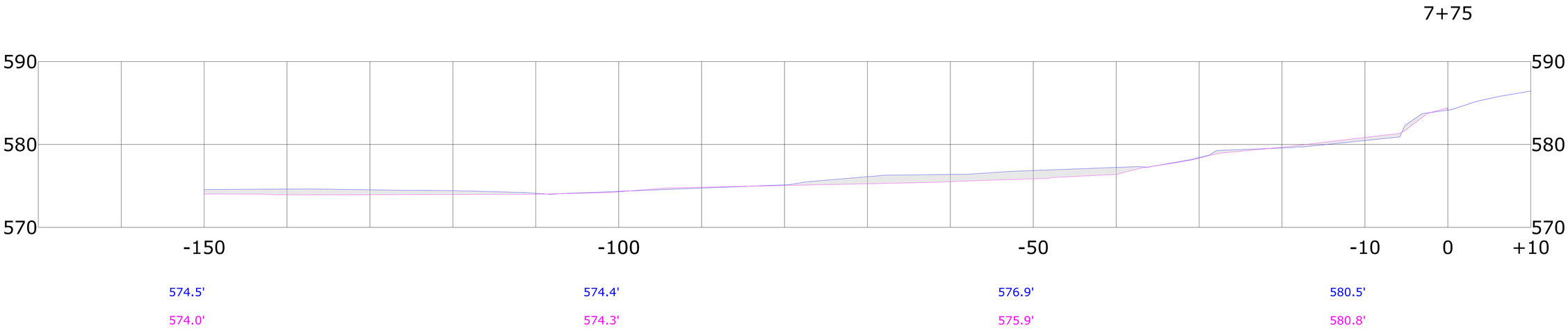
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

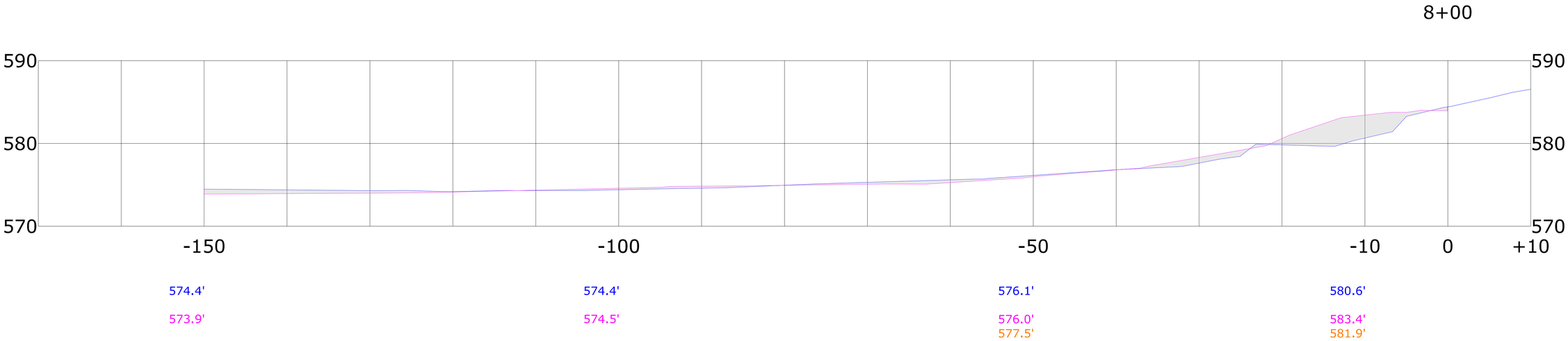
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 6 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
7+75.00 EX			
	Excavation	58.6	62
	Fill	6.2	15
8+00.00 EX			
	Excavation	20.6	37
	Fill	48.4	25



LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

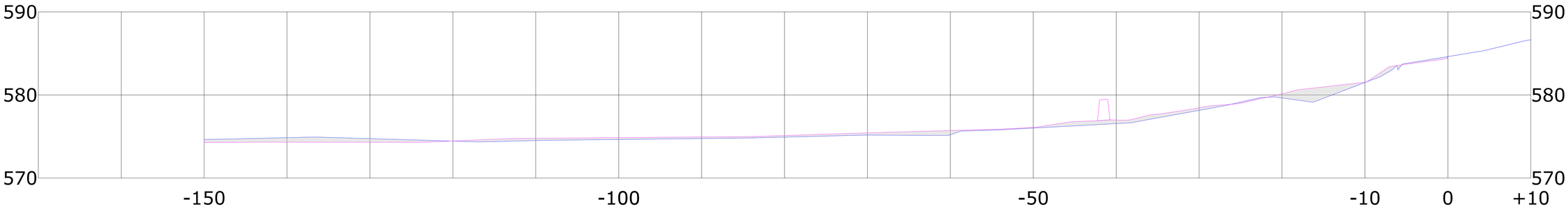
ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 7 OF 13

8+25



574.6'
574.3'

574.6'
574.8'

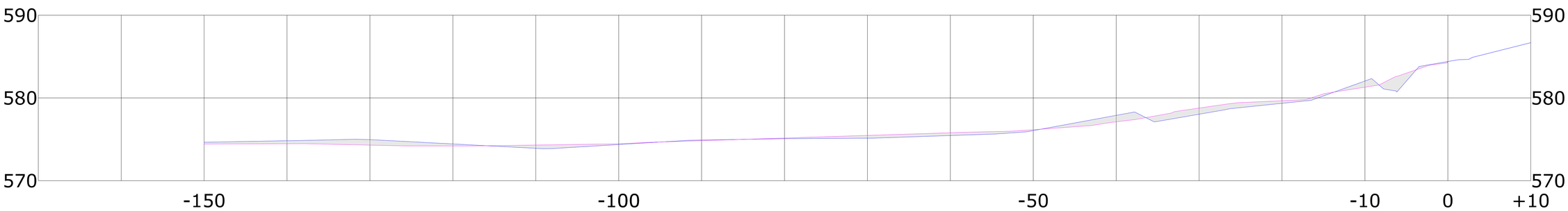
576.0'
576.1'

BASE: W. E.
576.9' 577.0'

581.5'
581.6'

		END AREA (SQ FT)	VOLUME (CYD)
8+25.00 EX			
	Excavation	13.8	16
	Fill	36.3	39
8+50.00 EX			
	Excavation	23.5	17
	Fill	28.6	30

8+50



574.6'
574.4'

574.4'
574.4'

576.0'
576.2'

582.0'
581.3'

LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

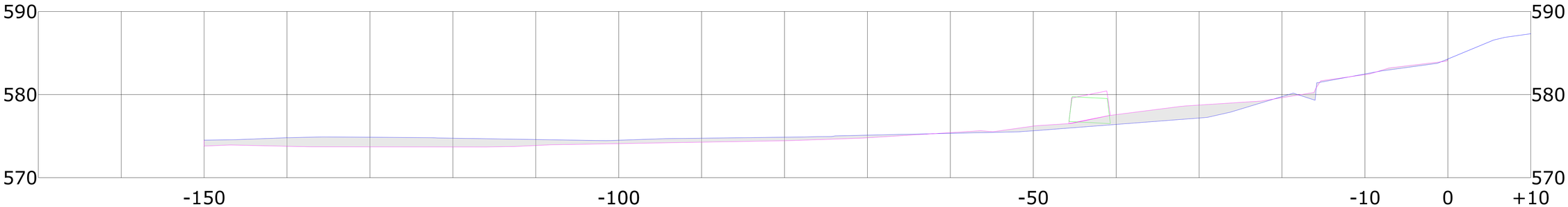
ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 8 OF 13

8+75

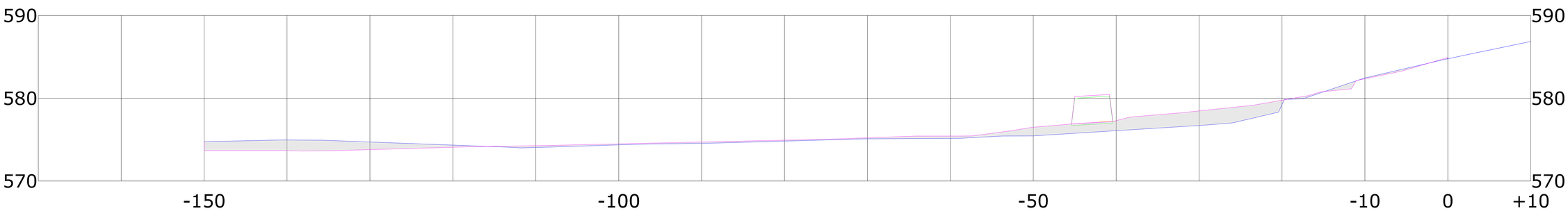


BASE: W. E.

574.5'	574.5'	575.6'	NO DATA	582.5'
573.8'	574.1'	576.2'	576.5' 577.5'	582.4'

		END AREA (SQ FT)	VOLUME (CYD)
8+75.00 EX			
	Excavation	59.7	39
	Fill	34.4	29
9+00.00 EX			
	Excavation	32.6	43
	Fill	57.9	43

9+00



BASE: W. E.

574.7'	574.4'	575.4'	NO DATA	582.4'
573.7'	574.5'	576.5'	576.9' 577.2'	582.3'

LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

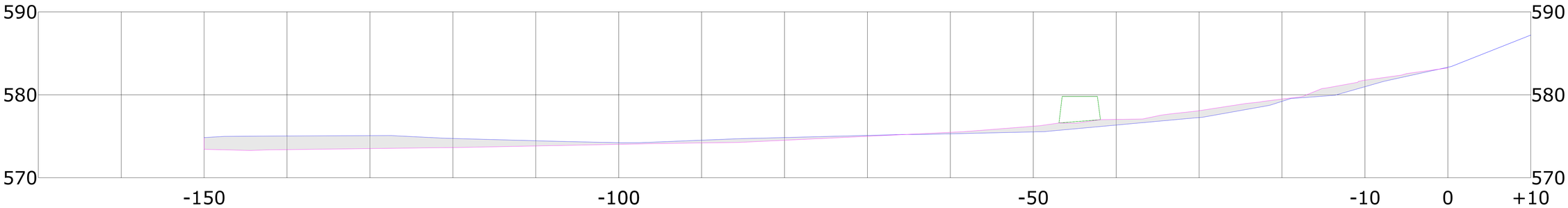
ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 9 OF 13

9+25

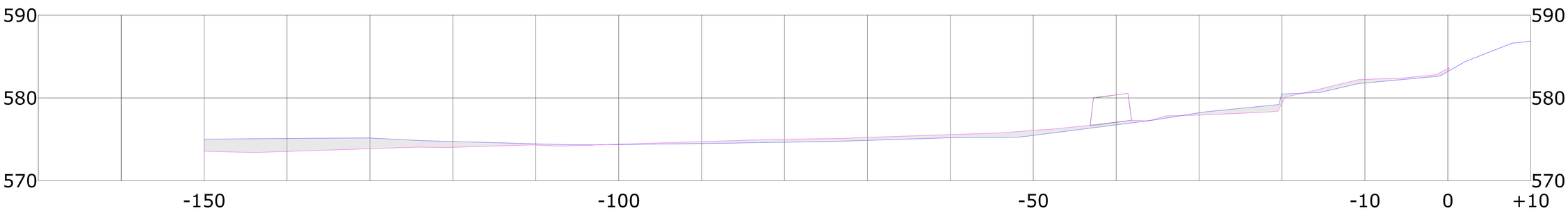


BASE: W. E.

574.8'	574.2'	575.5'	NO DATA		581.0'
573.4'	573.9'	576.2'	576.6'	577.0'	581.7'

		END AREA (SQ FT)	VOLUME (CYD)
9+25.00 EX			
	Excavation	67.1	46
	Fill	35.1	43
9+50.00 EX			
	Excavation	51.2	55
	Fill	28.0	29

9+50



BASE: W. E.

575.0'	574.4'	575.5'	NO DATA		581.8'
573.6'	574.5'	576.1'	576.6'	577.3'	582.3'

LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

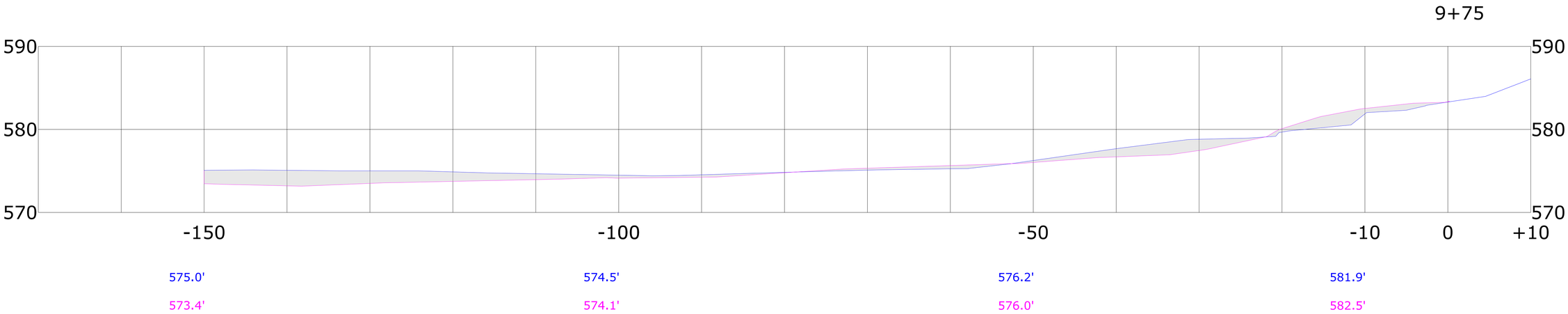
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

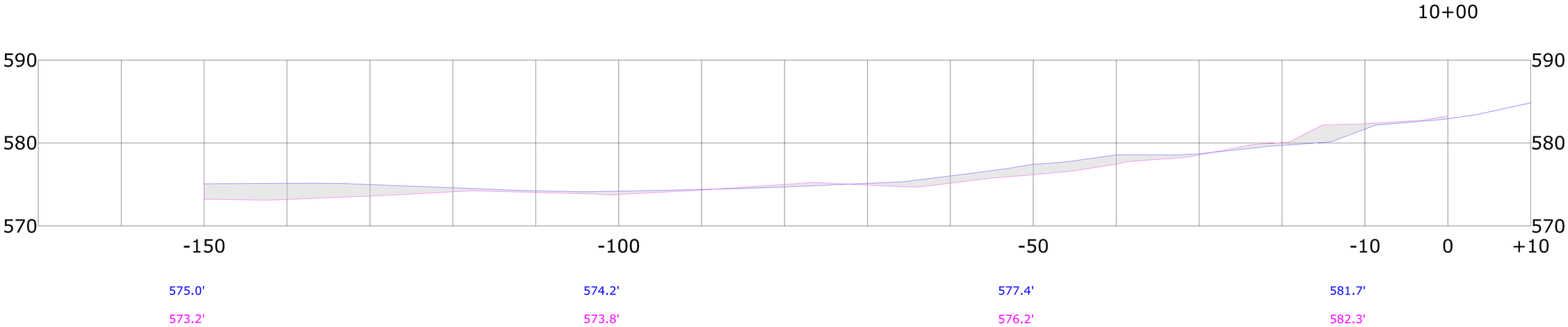
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 10 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
9+75.00 EX			
	Excavation	92.1	66
	Fill	23.6	24
10+00.00 EX			
	Excavation	87.1	83
	Fill	20.7	21



LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

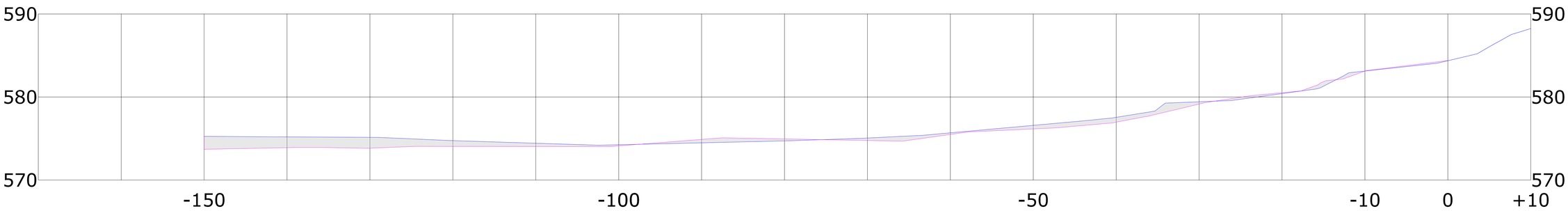
ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY: FTW
CHK'D BY: CCY
DATE: 03-12-2013
FIELD BOOK/PAGE: SEE FILE

JOB NO.: 10046

SHEET NO.: 11 OF 13

10+25

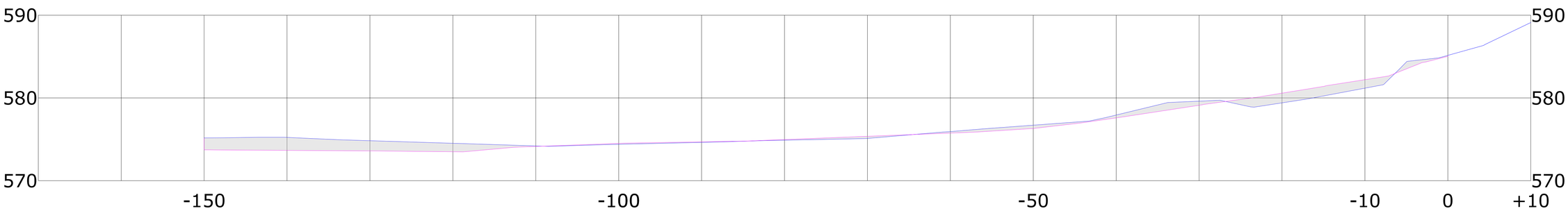


575.2 574.2' 576.6' 583.1'

573.7' 574.1' 576.1' 583.1'

		END AREA (SQ FT)	VOLUME (CYD)
10+25.00 EX			
	Excavation	64.3	70
	Fill	10.2	14
10+50.00 EX			
	Excavation	61.7	58
	Fill	24.6	16

10+50



575.1' 574.4' 576.7' 581.2'

573.7 574.4' 576.3' 582.0'

LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

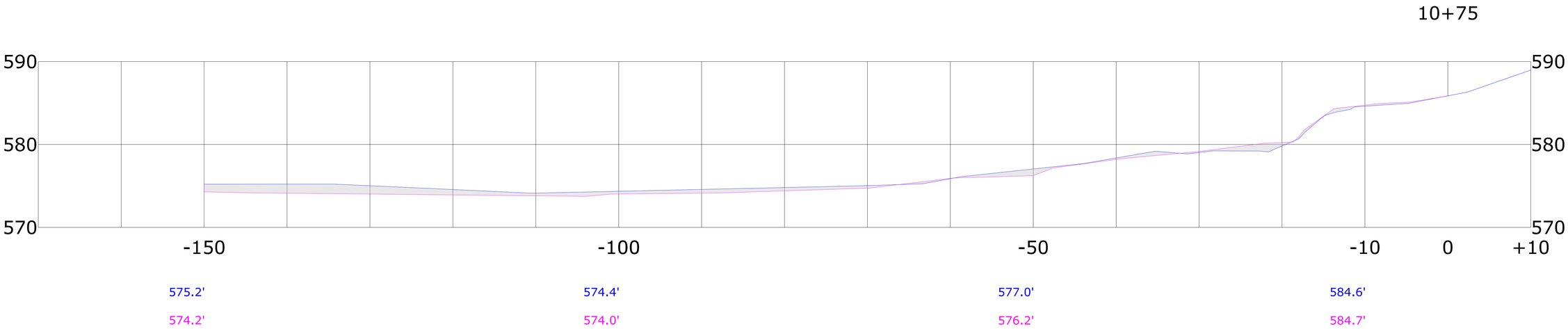
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

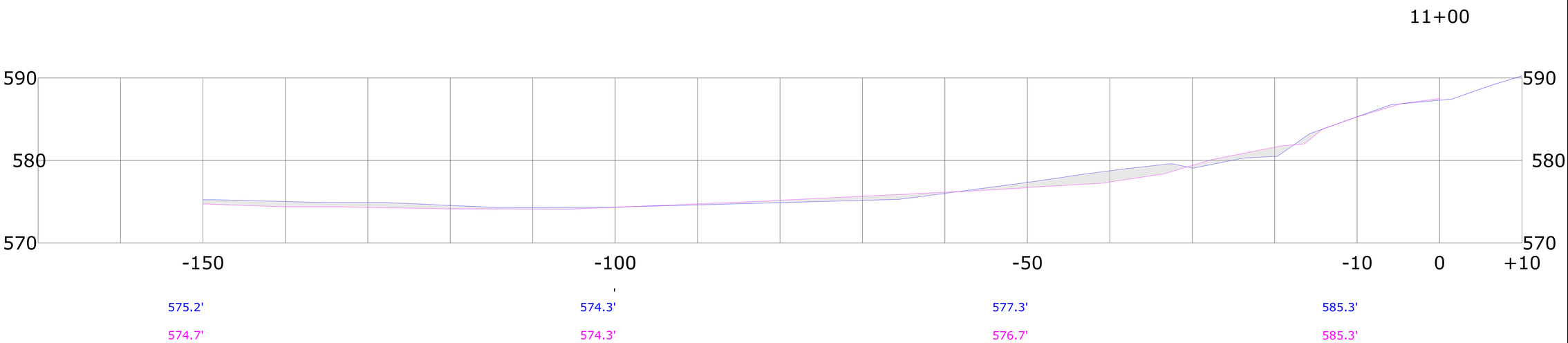
DRN. BY: FTW
CHK'D BY: CCY
DATE: 03-12-2013
FIELD BOOK/PAGE: SEE FILE

JOB NO.: 10046

SHEET NO.: 12 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
10+75.00 EX			
	Excavation	59.0	56
	Fill	9.6	16
11+00.00 EX			
	Excavation	46.7	49
	Fill	19.7	14



LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

SCALE 1"=6'

G R A N D S U M M A R Y

Material Name		Unadjusted Volumes (cu. yd.)
EX		
	Excavation	947
	Fill	791

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

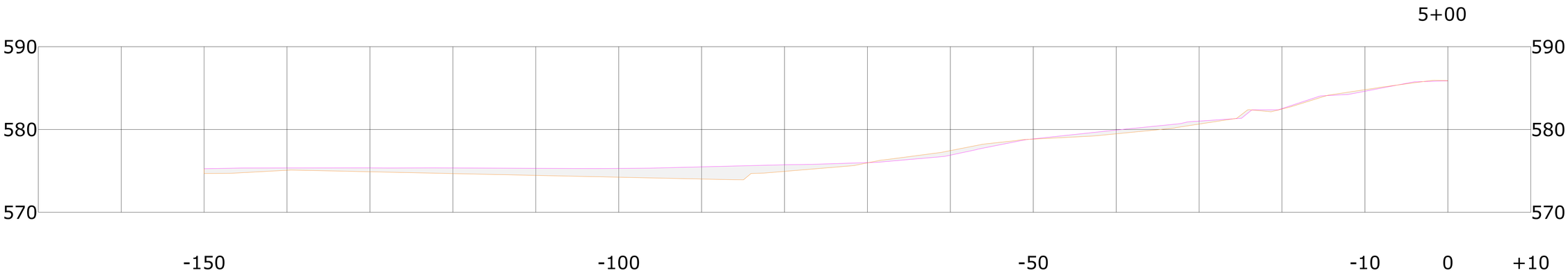
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

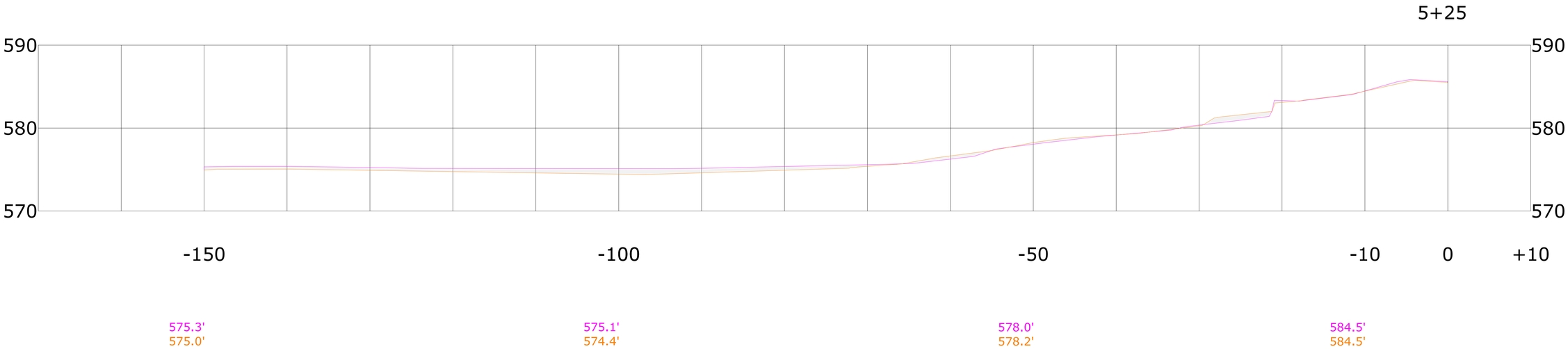
DRN. BY: FTW
CHK'D BY: CCY
DATE: 03-12-2013
FIELD BOOK/PAGE: SEE FILE

JOB NO.: 10046

SHEET NO.: 13 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
5+00.00 EX			
	Excavation	70.7	0
	Fill	8.8	0
5+25.00 EX			
	Excavation	39.4	51
	Fill	10.4	9



LAKE MICHIGAN

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011
(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

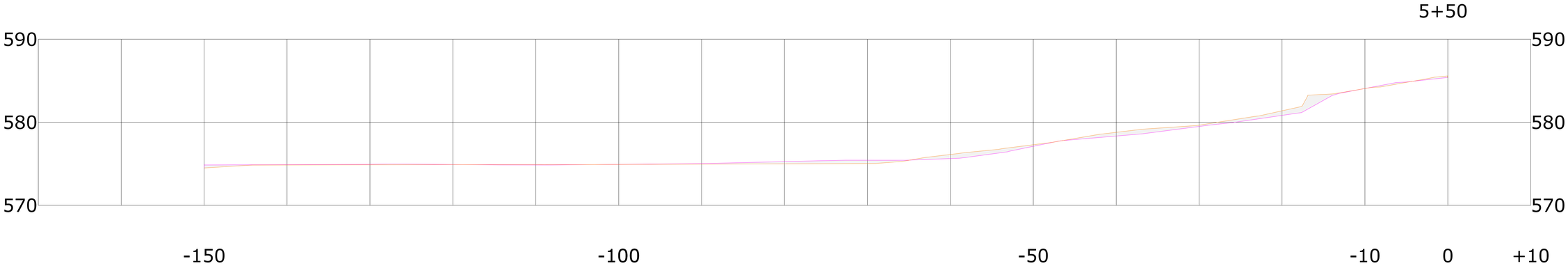
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

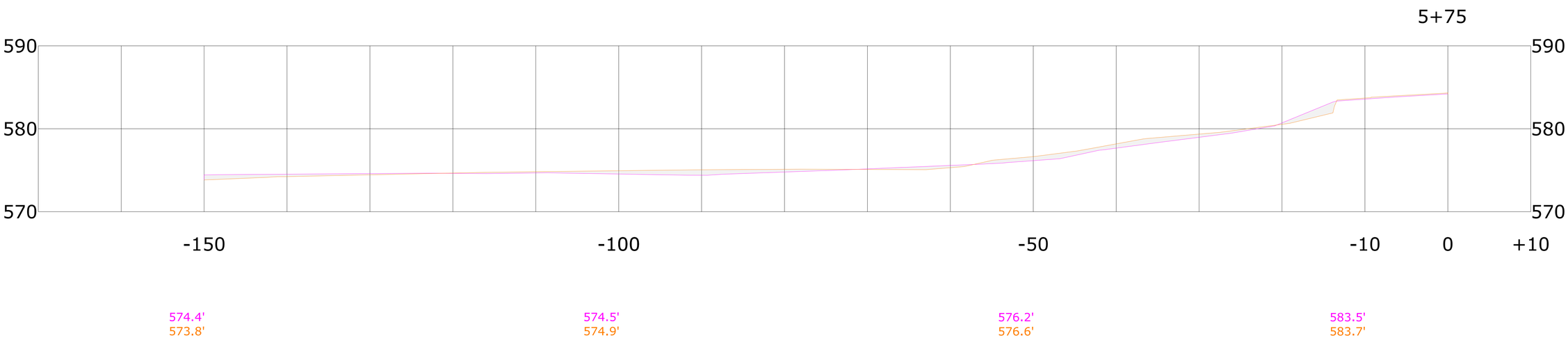
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 2 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
5+50.00 EX			
	Excavation	9.9	23
	Fill	21.4	15
5+75.00 EX			
	Excavation	15.7	12
	Fill	32.8	25



LAKE MICHIGAN

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

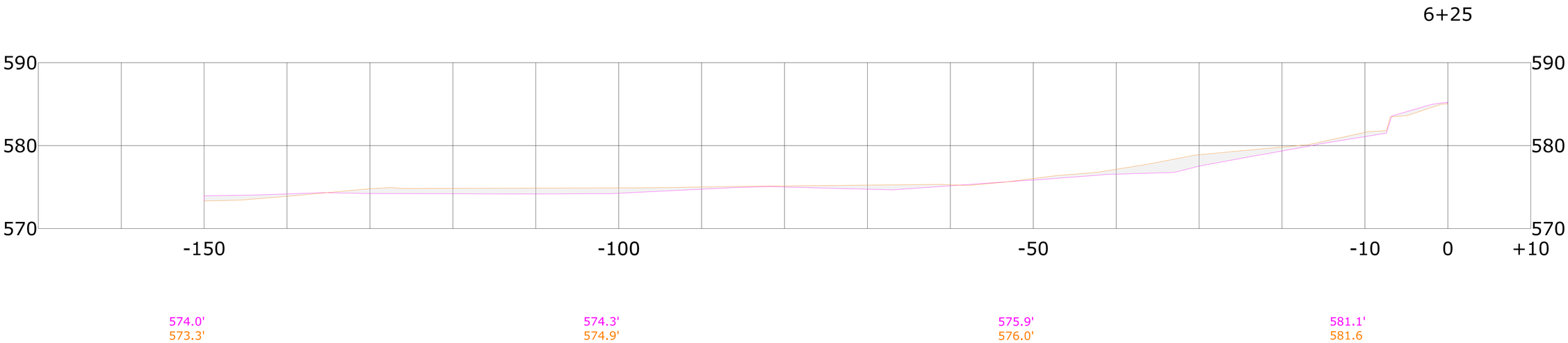
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

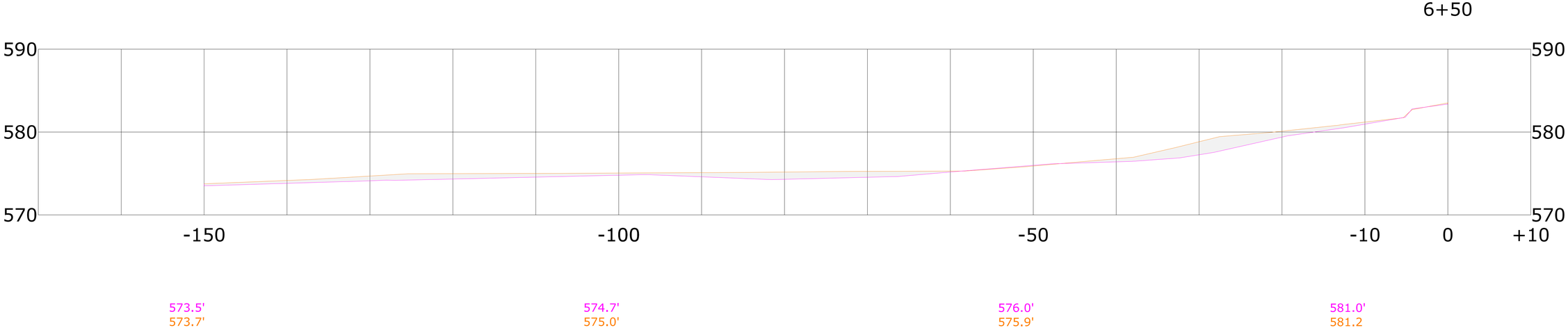
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 3 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
6+25.00 EX			
	Excavation	8.3	22
	Fill	64.5	90
6+50.00 EX			
	Excavation	0.8	4
	Fill	75.8	65



LAKE MICHIGAN

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011
(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

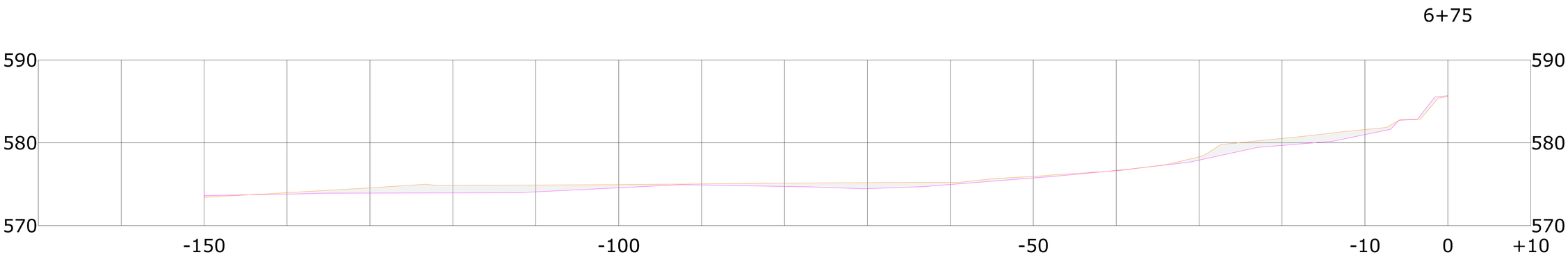
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

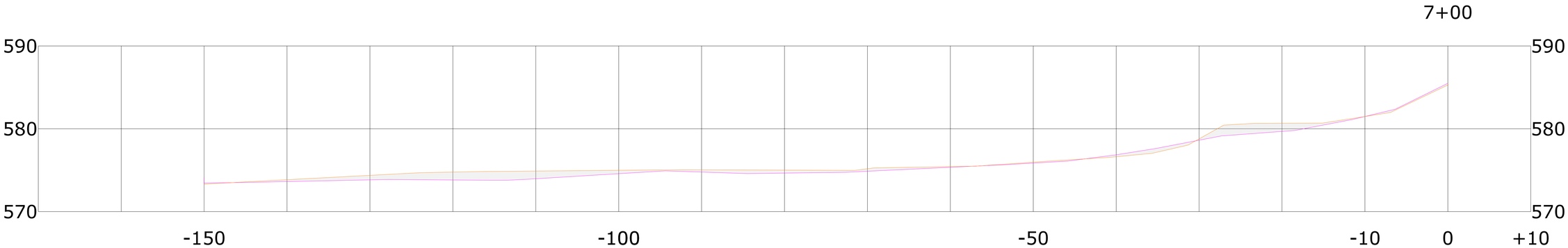
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 4 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
6+75.00 EX			
	Excavation	2.0	1
	Fill	67.8	66
7+00.00 EX			
	Excavation	5.8	4
	Fill	56.1	57



LAKE MICHIGAN

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

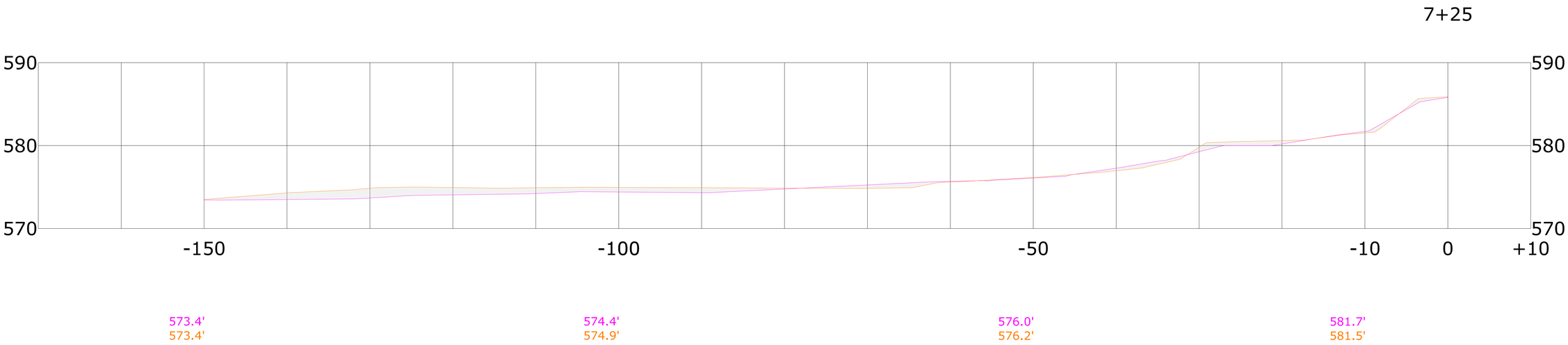
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

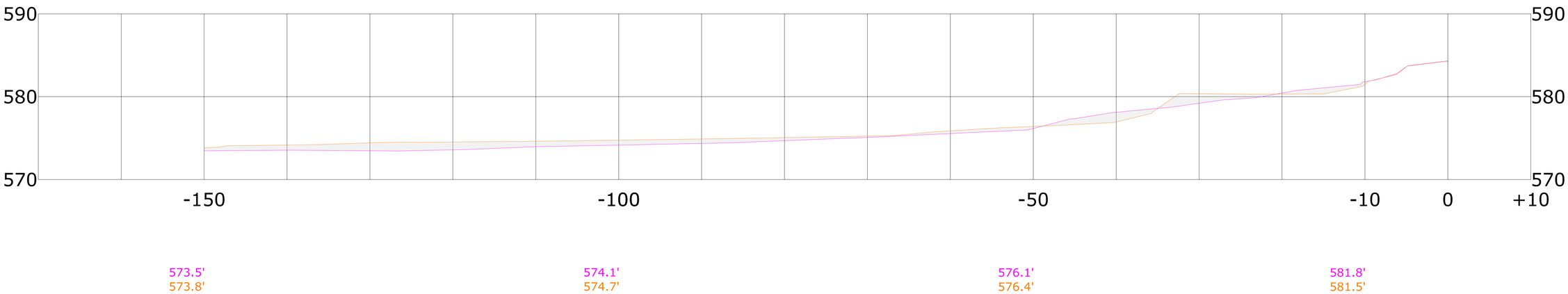
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 5 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
7+25.00 EX			
	Excavation	11.4	8
	Fill	56.3	52
7+50.00 EX			
	Excavation	15.4	12
	Fill	67.1	57



LAKE MICHIGAN

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

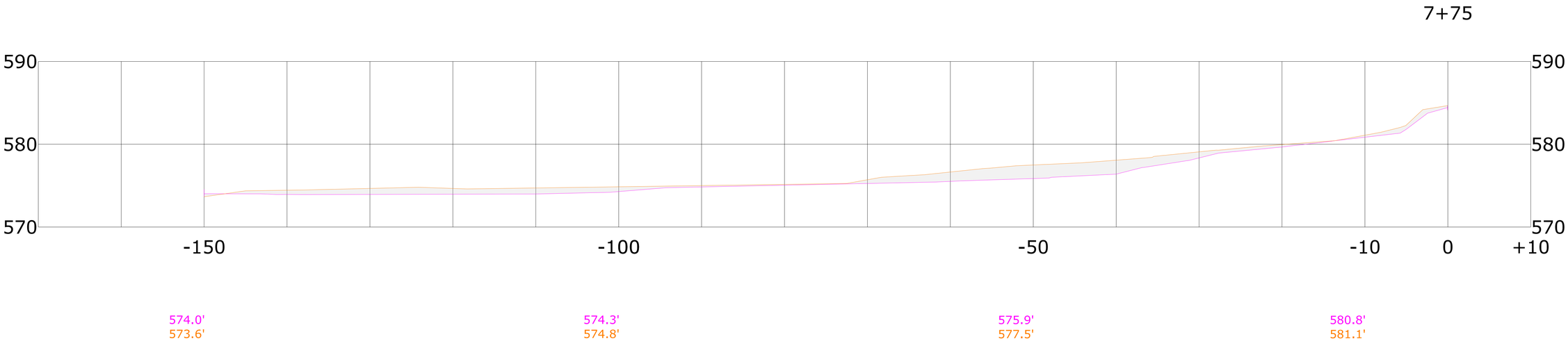
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

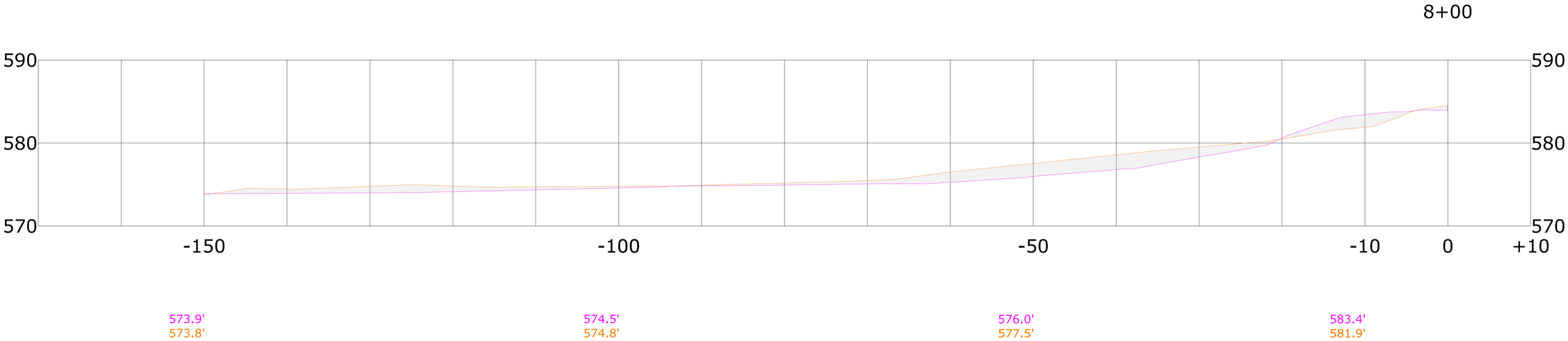
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 6 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
7+75.00 EX			
	Excavation	0.4	7
	Fill	95.8	75
8+00.00 EX			
	Excavation	15.6	7
	Fill	95.1	88



LAKE MICHIGAN

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011
(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

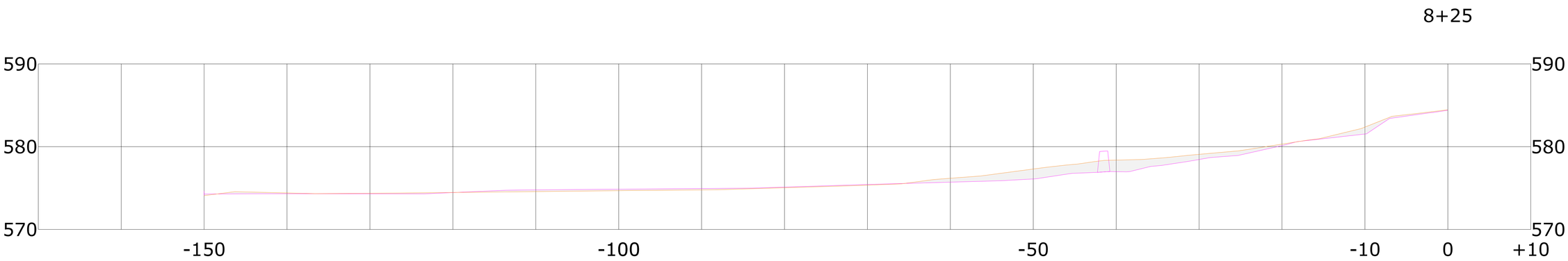
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

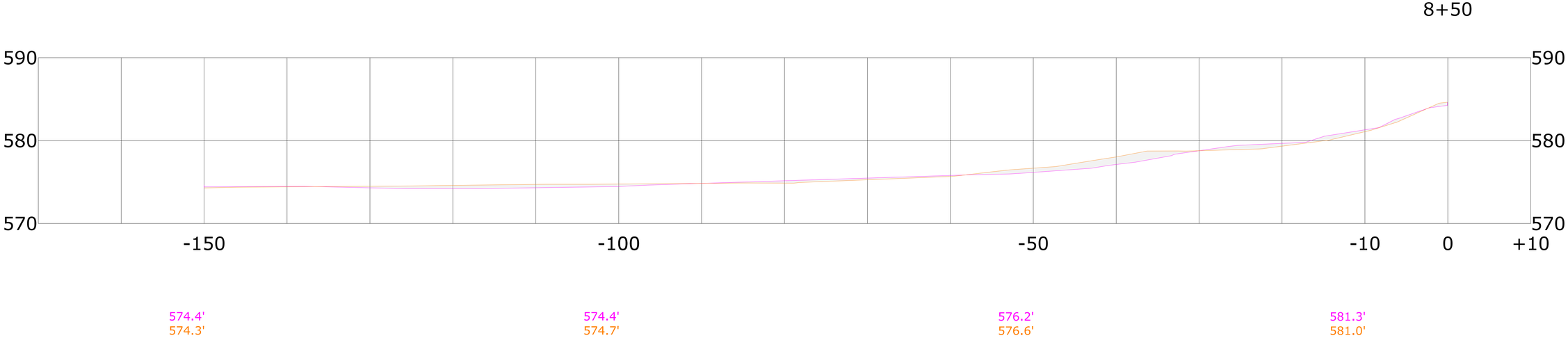
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 7 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
8+25.00 EX			
	Excavation	7.2	11
	Fill	43.7	64
8+50.00 EX			
	Excavation	15.0	10
	Fill	30.2	34



LAKE MICHIGAN

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

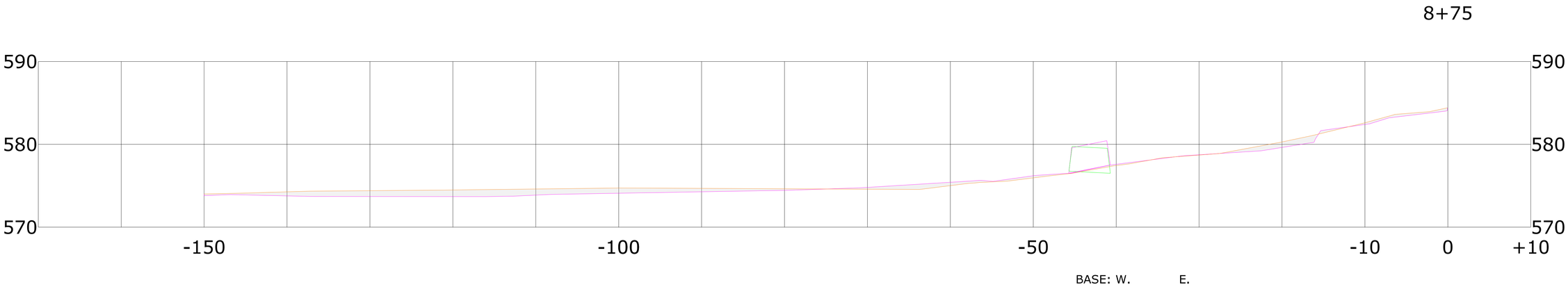
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

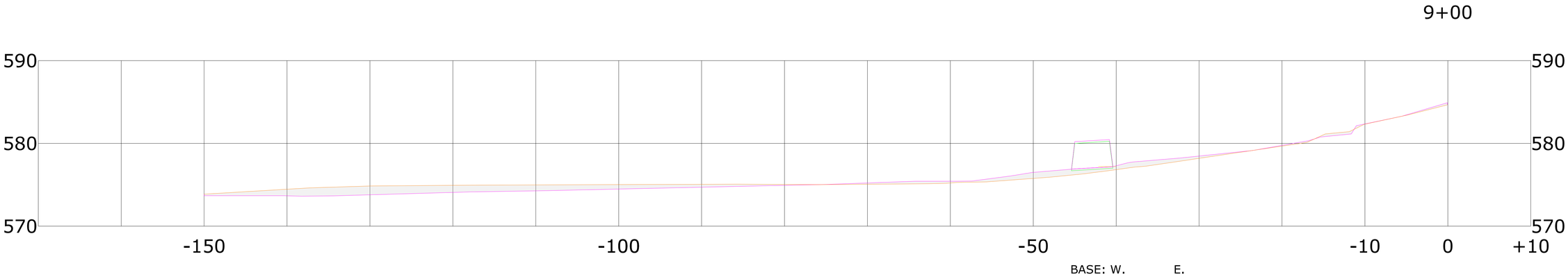
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 8 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
8+75.00 EX			
	Excavation	9.9	12
	Fill	48.7	37
9+00.00 EX			
	Excavation	20.6	14
	Fill	46.8	44



LAKE MICHIGAN

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

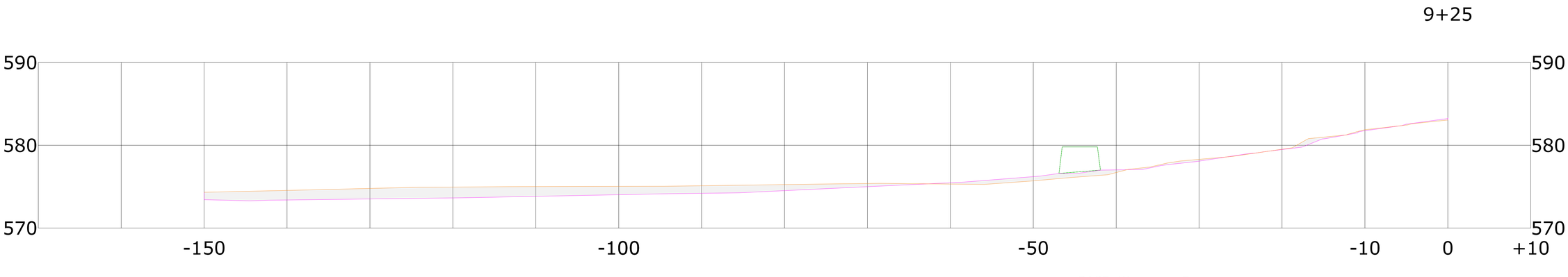
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

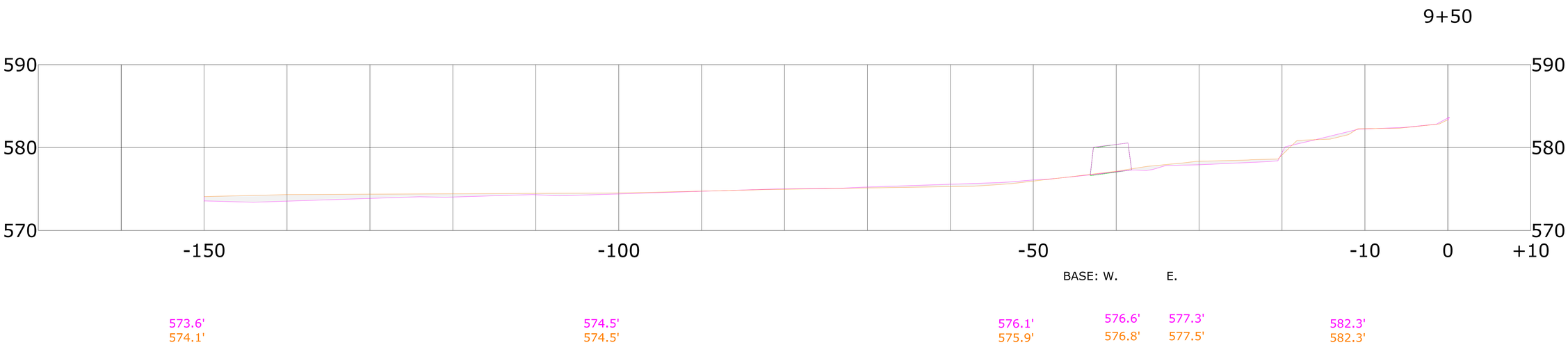
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 9 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
9+25.00 EX			
	Excavation	10.6	14
	Fill	89.2	63
9+50.00 EX			
	Excavation	7.7	8
	Fill	30.3	55



LAKE MICHIGAN

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

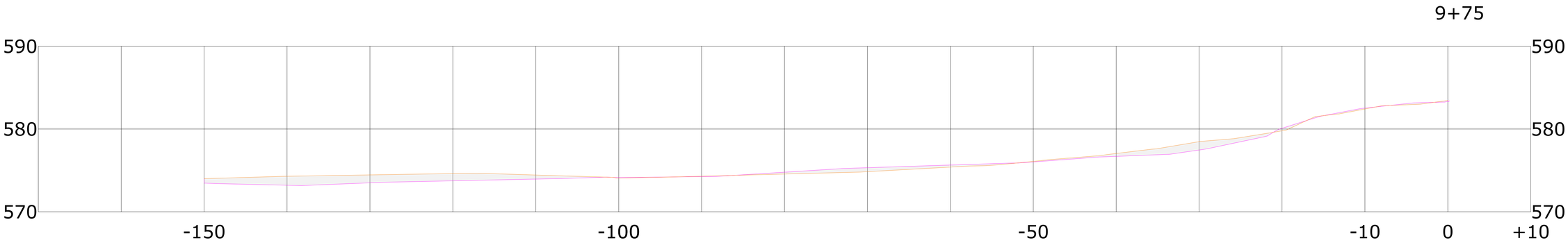
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

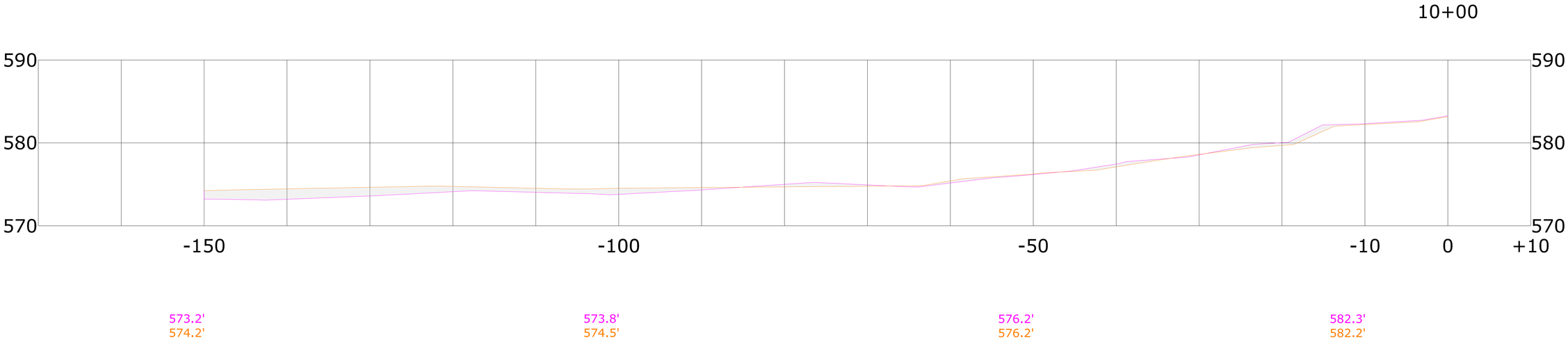
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 10 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
9+75.00 EX			
	Excavation	12.0	9
	Fill	52.5	38
10+00.00 EX			
	Excavation	15.4	13
	Fill	51.9	48



LAKE MICHIGAN

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011
(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

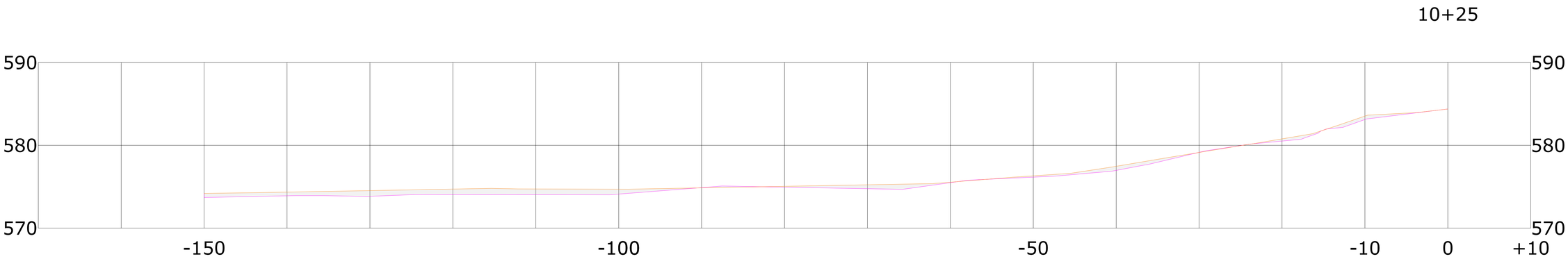
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

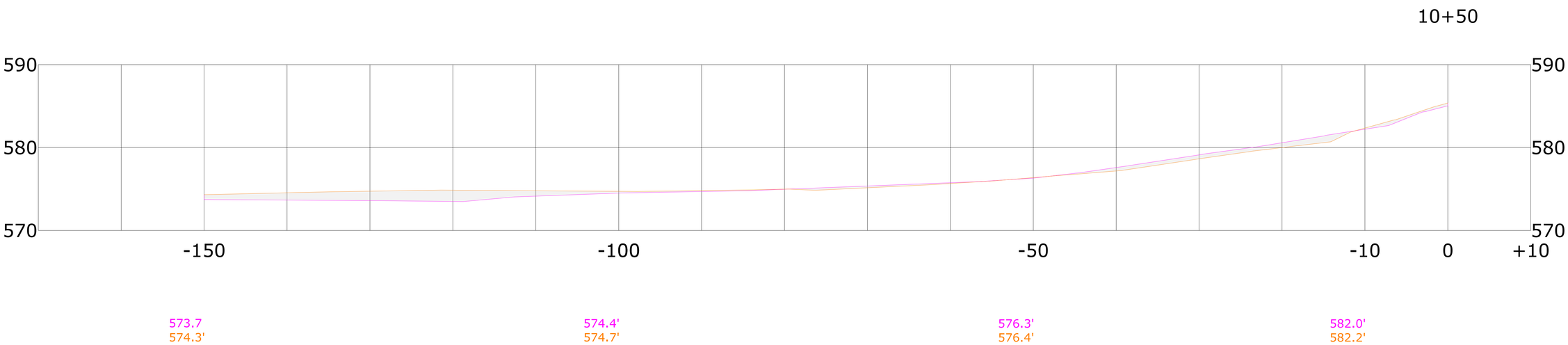
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 11 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
10+25.00 EX			
	Excavation	1.1	8
	Fill	51.2	48
10+50.00 EX			
	Excavation	20.2	10
	Fill	49.8	47



LAKE MICHIGAN

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

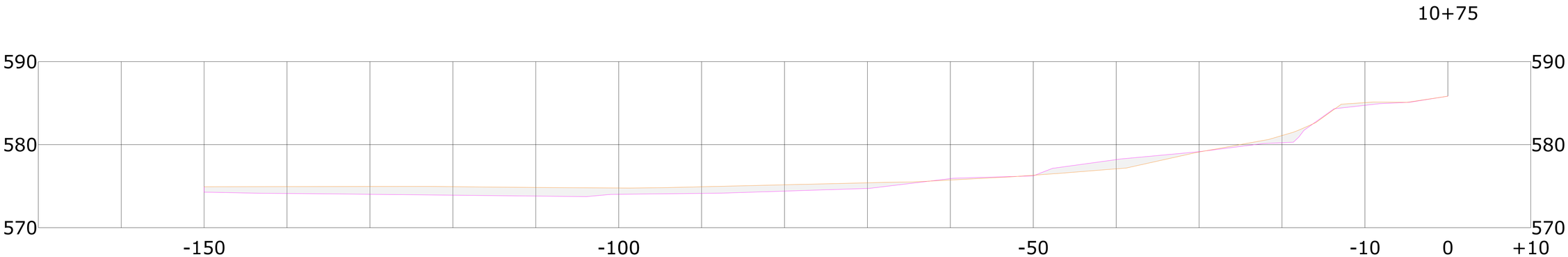
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

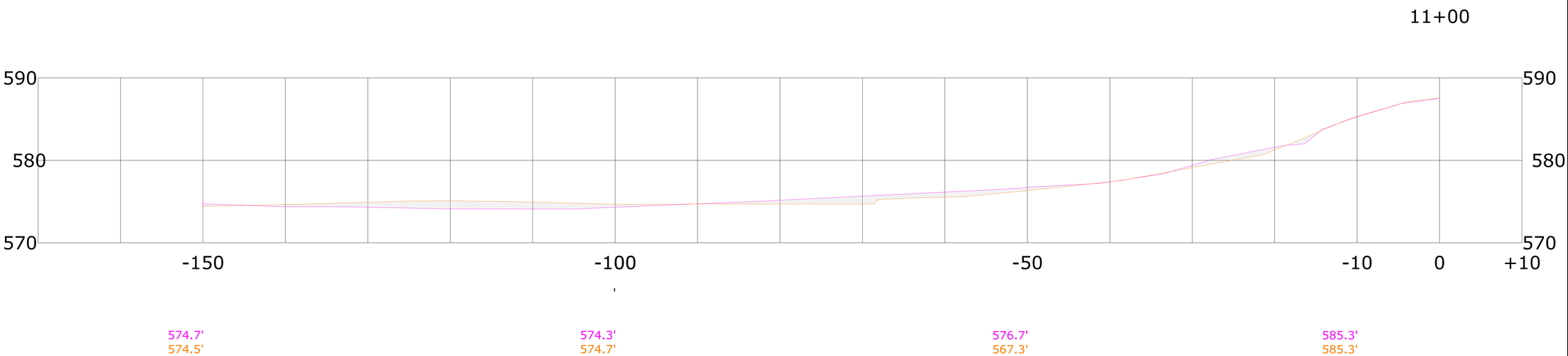
DRN. BY: FTW
CHK'D BY: CCY
DATE: 03-12-2013
FIELD BOOK/PAGE: SEE FILE

JOB NO.: 10046

SHEET NO.: 12 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
10+75.00 EX			
	Excavation	15.3	16
	Fill	78.7	59
11+00.00 EX			
	Excavation	29.3	21
	Fill	32.7	52



LAKE MICHIGAN

(WATER ELEV:577.9'±, SEPTEMBER 01, 2011) 09-01-2011

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

SCALE 1"=6'

G R A N D S U M M A R Y

Material Name	Unadjusted Volumes (cu. yd.)
Excavation	297
Fill	1188

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

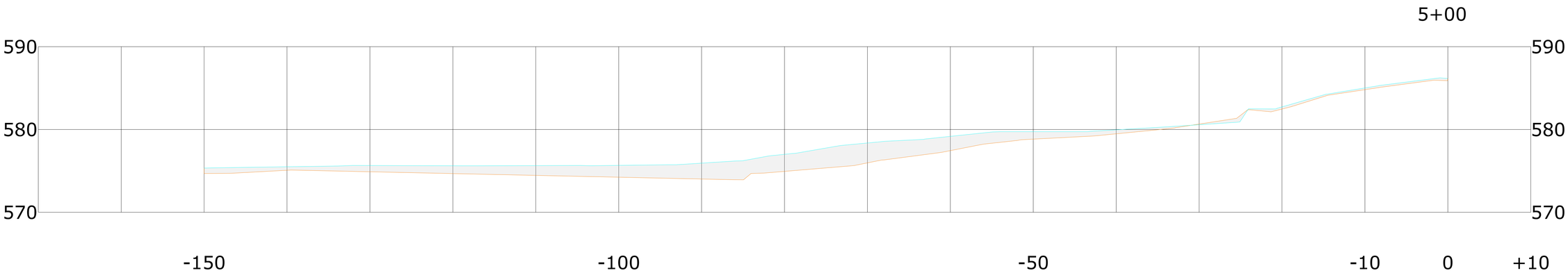
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

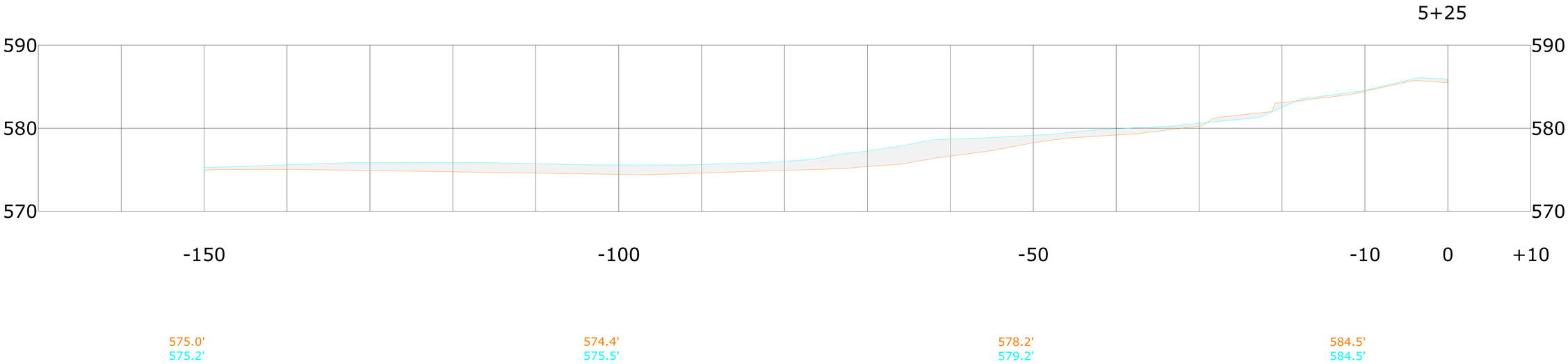
DRN. BY: FTW
CHK'D BY: CCY
DATE: 03-12-2013
FIELD BOOK/PAGE: SEE FILE

JOB NO.: 10046

SHEET NO.: 13 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
5+00.00 EX			
	Excavation	1.9	0
	Fill	151.8	0
5+25.00 EX			
	Excavation	4.7	3
	Fill	134.9	133



LAKE MICHIGAN

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012
(WATER ELEV:577.0'±, SEPTEMBER 6, 2012) 09-06-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

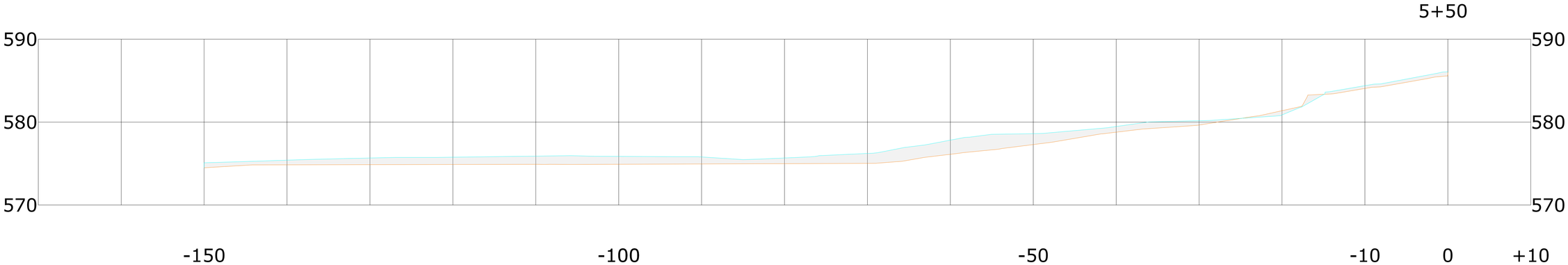
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

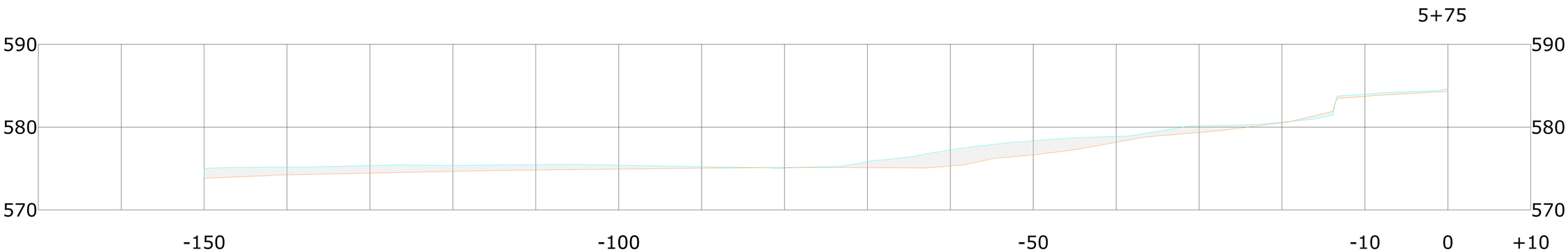
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 2 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
5+50.00 EX			
	Excavation	3.2	4
	Fill	119.5	118
5+75.00 EX			
	Excavation	1.8	2
	Fill	105.6	104



LAKE MICHIGAN

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

(WATER ELEV:577.0'±, SEPTEMBER 6, 2012) 09-06-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

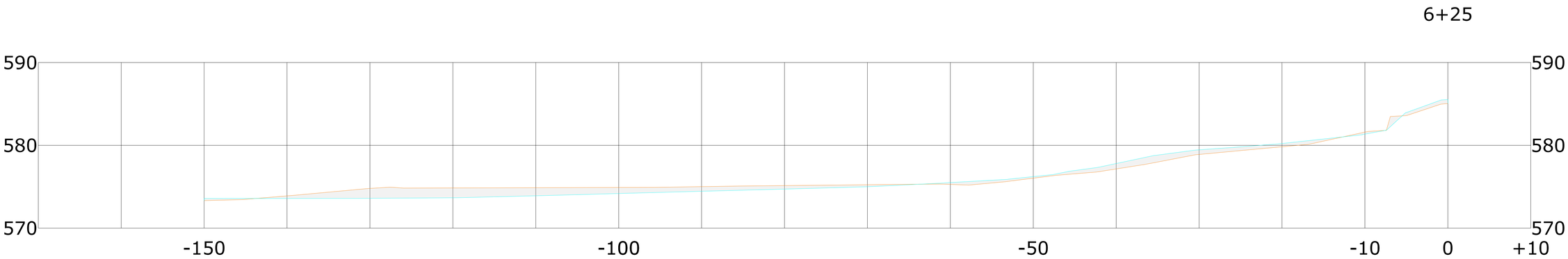
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

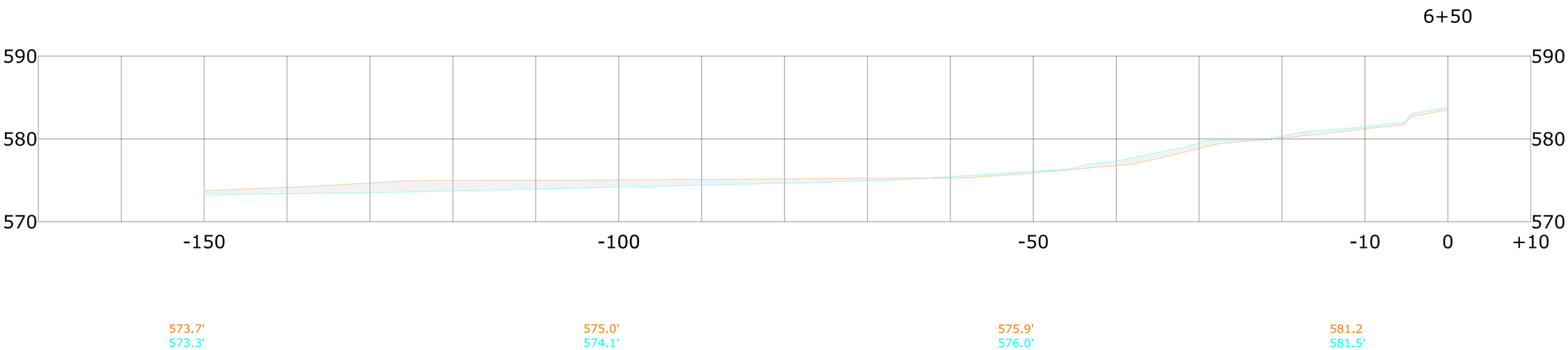
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 3 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
6+25.00 EX			
	Excavation	56.9	54
	Fill	24.6	121
6+50.00 EX			
	Excavation	68.8	58
	Fill	22.0	22



(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012
(WATER ELEV:577.0'±, SEPTEMBER 6, 2012) 09-06-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

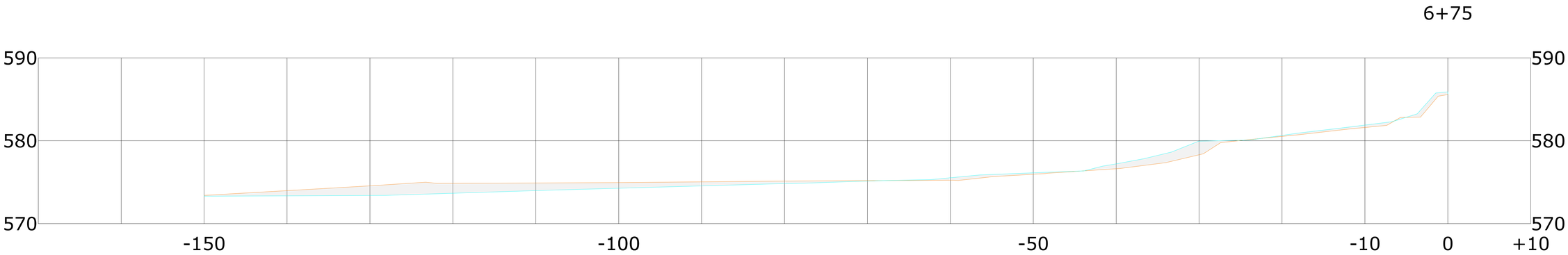
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 4 OF 13



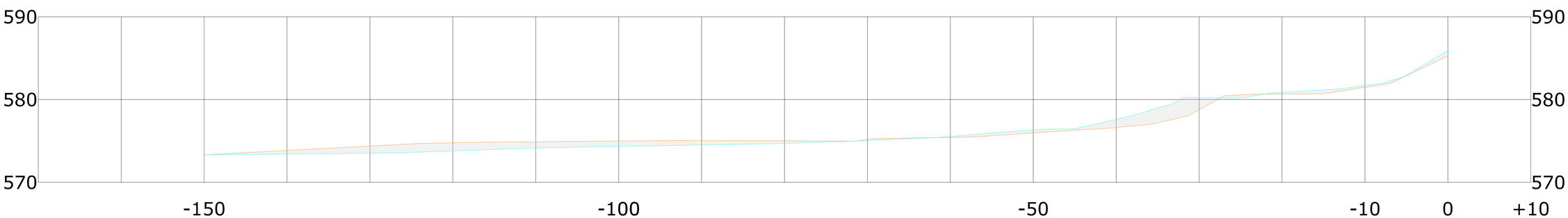
573.4'
573.3'

574.9'
574.4'

575.9'
576.1'

581.6'
581.9'

		END AREA (SQ FT)	VOLUME (CYD)
6+75.00 EX			
	Excavation	56.2	58
	Fill	24.7	22
7+00.00 EX			
	Excavation	47.9	48
	Fill	31.8	26



573.3'
573.3'
575.2'

575.0'
574.4'

575.9'
576.3'

581.5'
581.7'

LAKE MICHIGAN

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012
(WATER ELEV:577.0'±, SEPTEMBER 6, 2012) 09-06-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

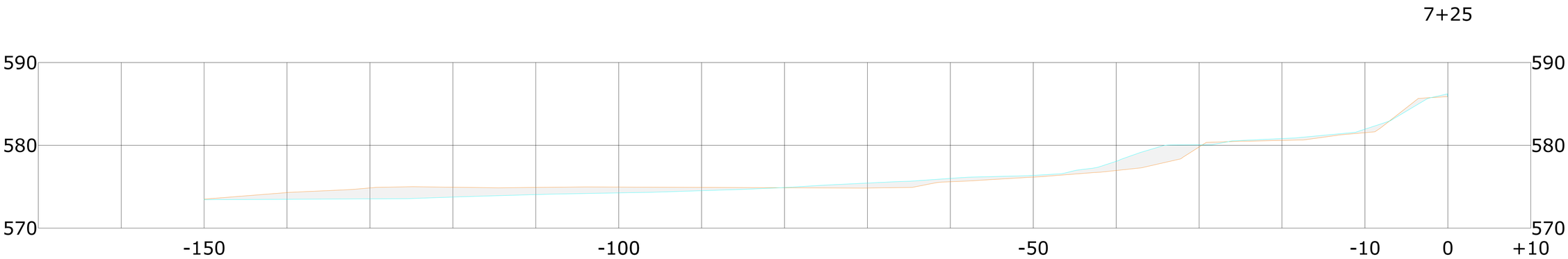
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

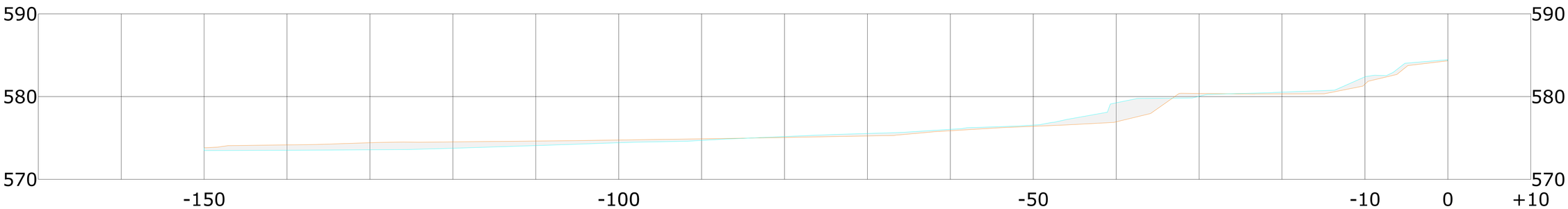
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 5 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
7+25.00 EX			
	Excavation	55.8	48
	Fill	38.0	32
7+50.00 EX			
	Excavation	37.3	43
	Fill	34.4	34



LAKE MICHIGAN

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012
(WATER ELEV:577.0'±, SEPTEMBER 6, 2012) 09-06-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

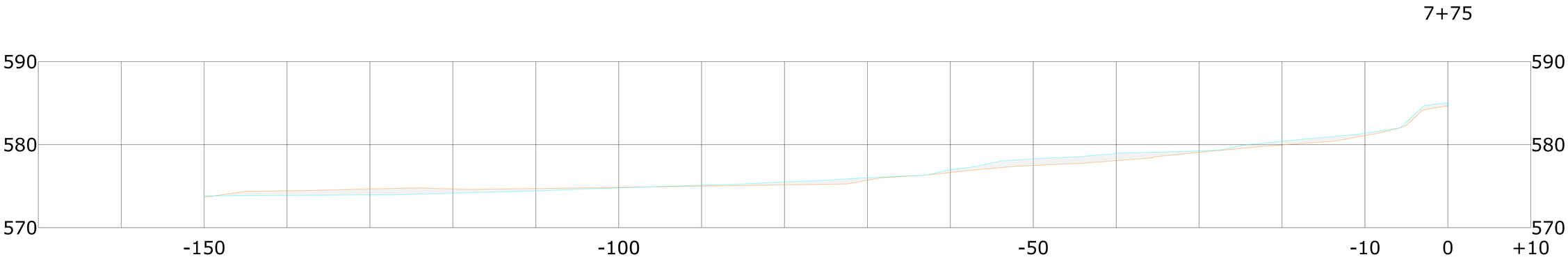
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

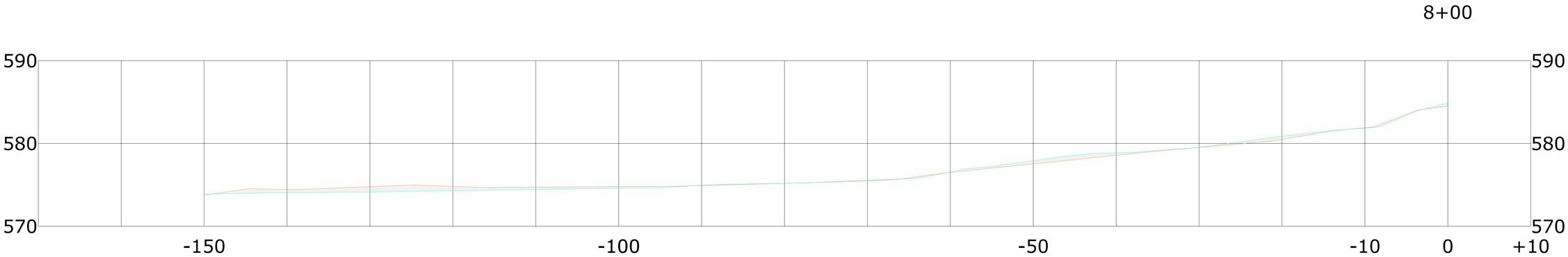
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 6 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
7+75.00 EX			
	Excavation	22.6	28
	Fill	38.6	34
8+00.00 EX			
	Excavation	23.5	21
	Fill	13.6	24



LAKE MICHIGAN

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

(WATER ELEV:577.0'±, SEPTEMBER 6, 2012) 09-06-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

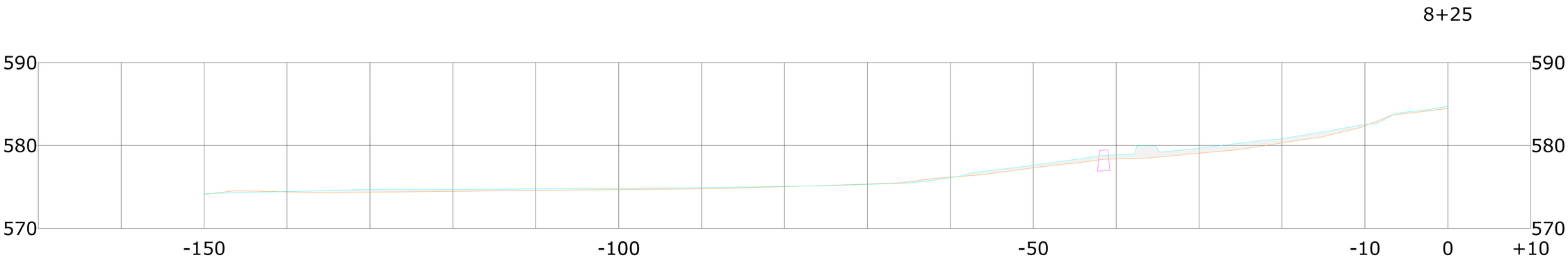
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

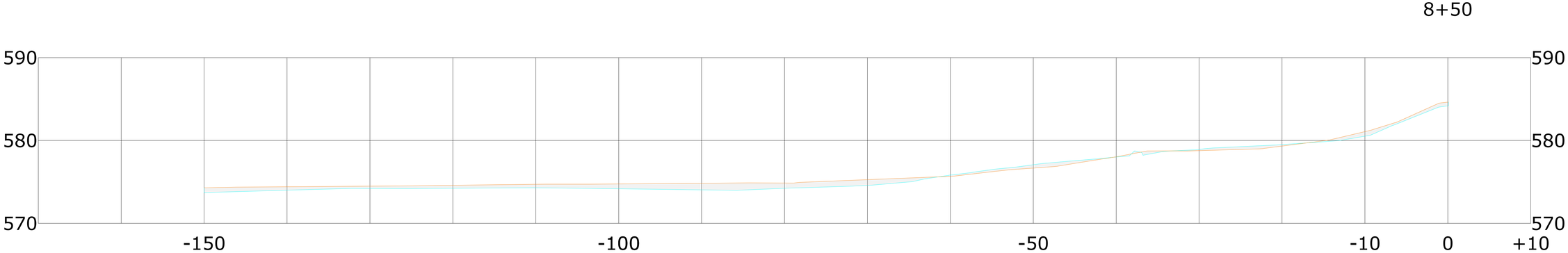
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 7 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
8+25.00 EX			
	Excavation	3.0	12
	Fill	39.1	24
8+50.00 EX			
	Excavation	52.4	26
	Fill	9.1	22



LAKE MICHIGAN

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012
(WATER ELEV:577.0'±, SEPTEMBER 6, 2012) 09-06-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

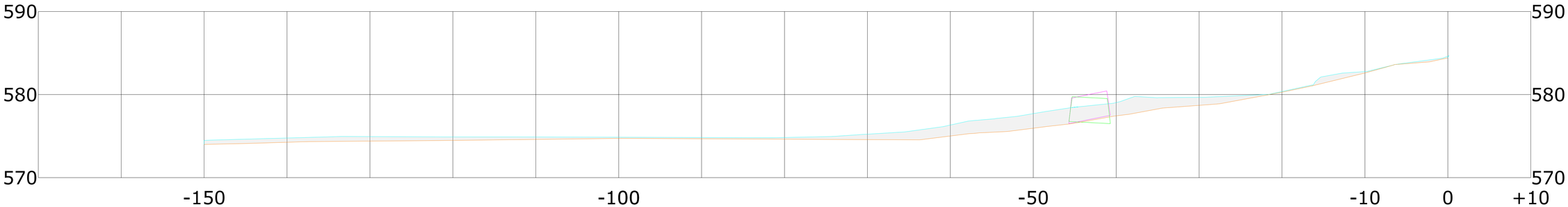
ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 8 OF 13

8+75



BASE: W. E.

574.0'
574.4'

574.7'
574.9'

576.0'
577.7'

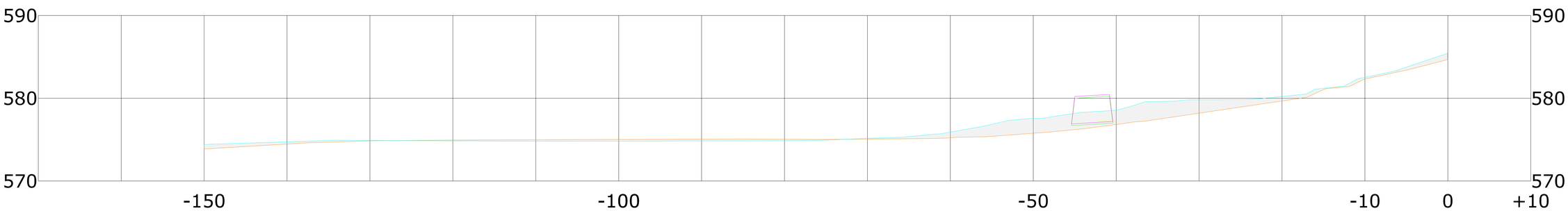
576.5'
578.7'

577.4'
578.8'

582.6'
582.8'

		END AREA (SQ FT)	VOLUME (CYD)
8+75.00 EX			
	Excavation	0.0	24
	Fill	95.5	48
9+00.00 EX			
	Excavation	8.8	4
	Fill	78.2	80

9+00



BASE: W. E.

573.8'
574.4'
575.2'

575.0'
574.8'

575.8'
577.6'

576.6'
578.2'

577.1'
578.5'

582.3'
582.4'

LAKE MICHIGAN

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012
(WATER ELEV:577.0'±, SEPTEMBER 6, 2012) 09-06-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

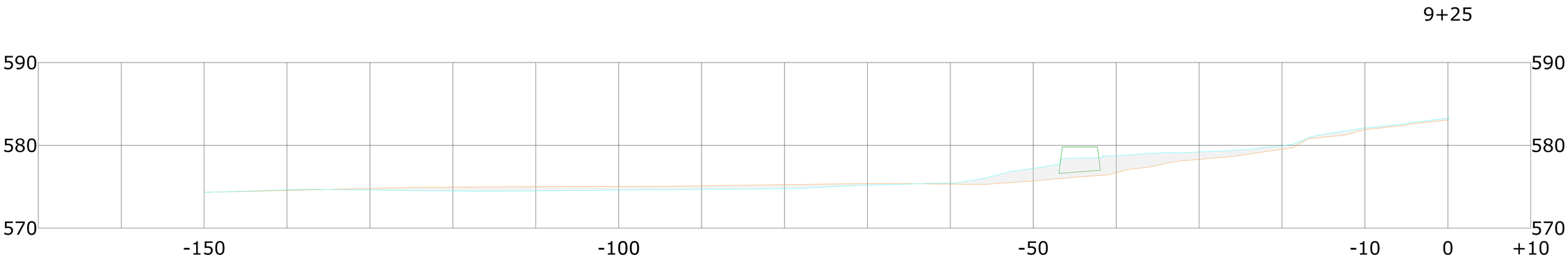
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

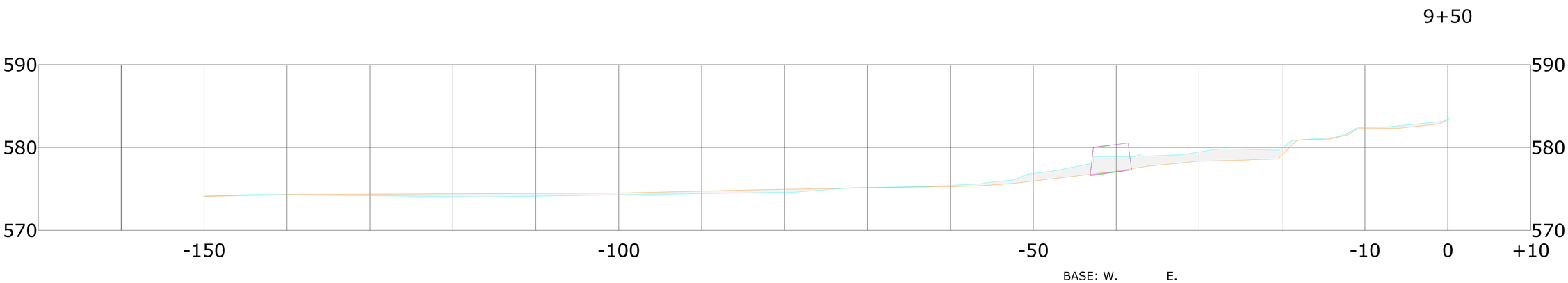
DRN. BY: FTW
CHK'D BY: CCY
DATE: 03-12-2013
FIELD BOOK/PAGE: SEE FILE

JOB NO.: 10046

SHEET NO.: 9 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
9+25.00 EX			
	Excavation	27.3	17
	Fill	56.0	62
9+50.00 EX			
	Excavation	18.3	21
	Fill	47.6	48



LAKE MICHIGAN

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012
(WATER ELEV:577.0'±, SEPTEMBER 6, 2012) 09-06-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

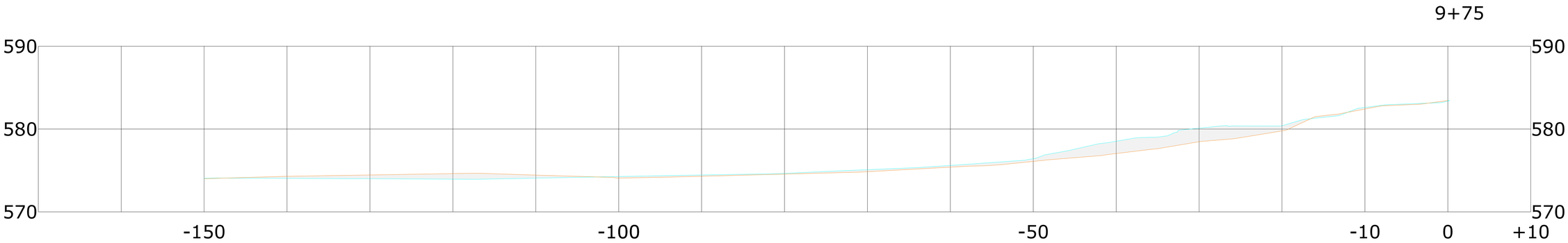
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

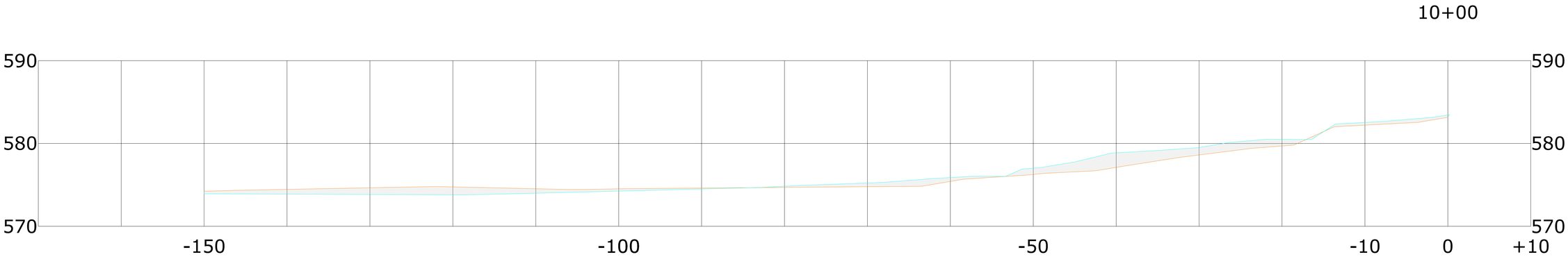
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 10 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
9+75.00 EX			
	Excavation	18.3	17
	Fill	51.0	46
10+00.00 EX			
	Excavation	34.4	24
	Fill	54.1	49



LAKE MICHIGAN

(WATER ELEV:577.5'±, APRIL 17, 2012)
(WATER ELEV:577.0'±, SEPTEMBER 6, 2012)

SCALE 1"=6'

04-17-2012
09-06-2012

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

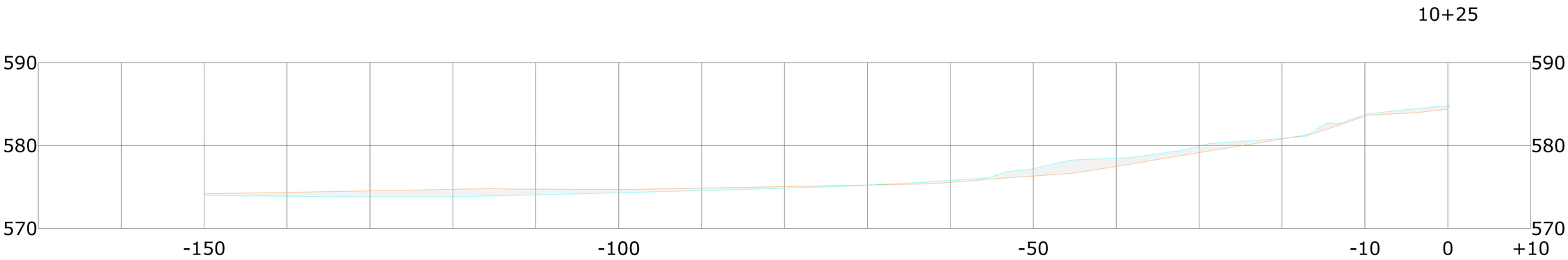
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

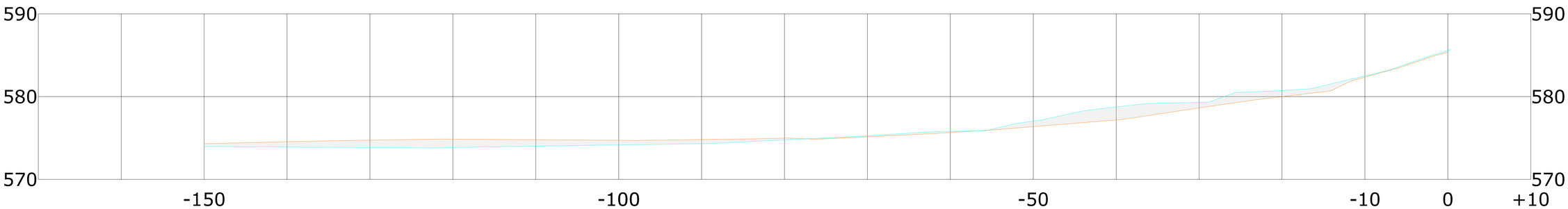
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 11 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
10+25.00 EX			
	Excavation	38.9	34
	Fill	37.9	43
10+50.00 EX			
	Excavation	47.1	40
	Fill	45.1	38



LAKE MICHIGAN

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012
(WATER ELEV:577.0'±, SEPTEMBER 6, 2012) 09-06-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

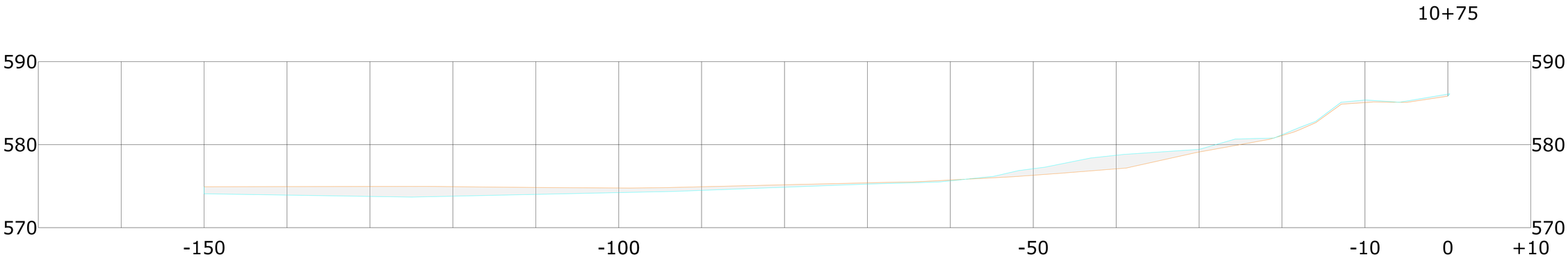
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

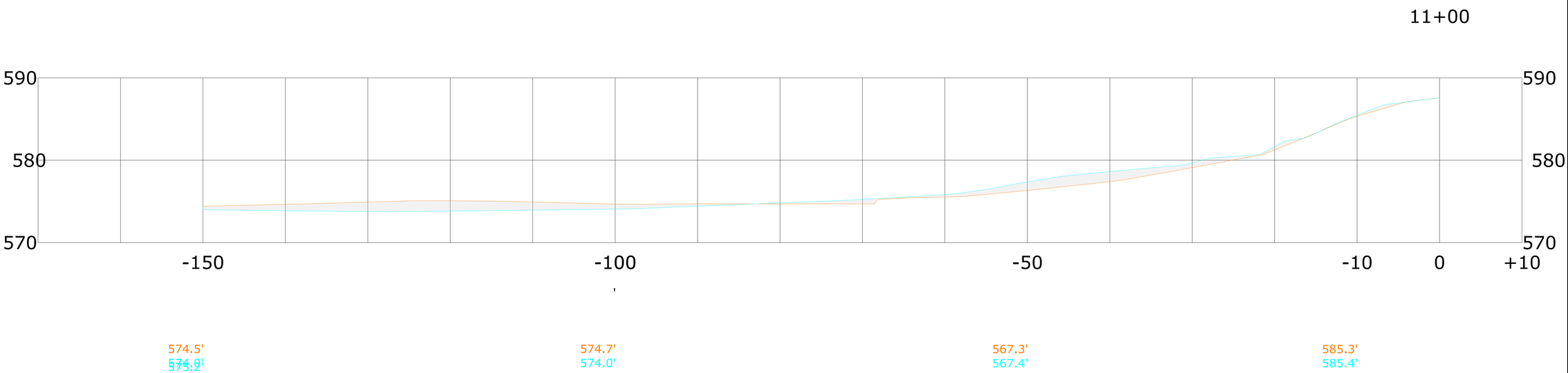
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 12 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
10+75.00 EX			
	Excavation	61.5	50
	Fill	34.5	37
11+00.00 EX			
	Excavation	53.2	53
	Fill	40.7	35



LAKE MICHIGAN

G R A N D S U M M A R Y

Material Name	Unadjusted Volumes (cu. yd.)
Excavation	689
Fill	1202

(WATER ELEV:577.5'±, APRIL 17, 2012) 04-17-2012

(WATER ELEV:577.0'±, SEPTEMBER 6, 2012) 09-06-2012

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

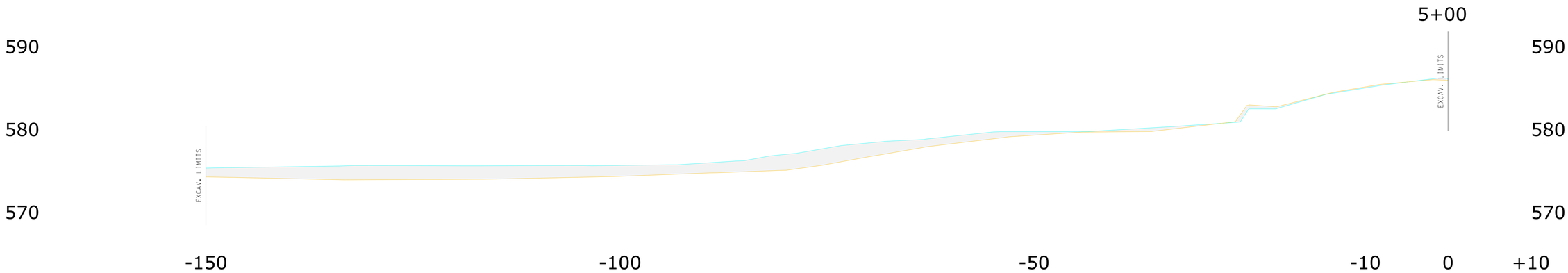
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

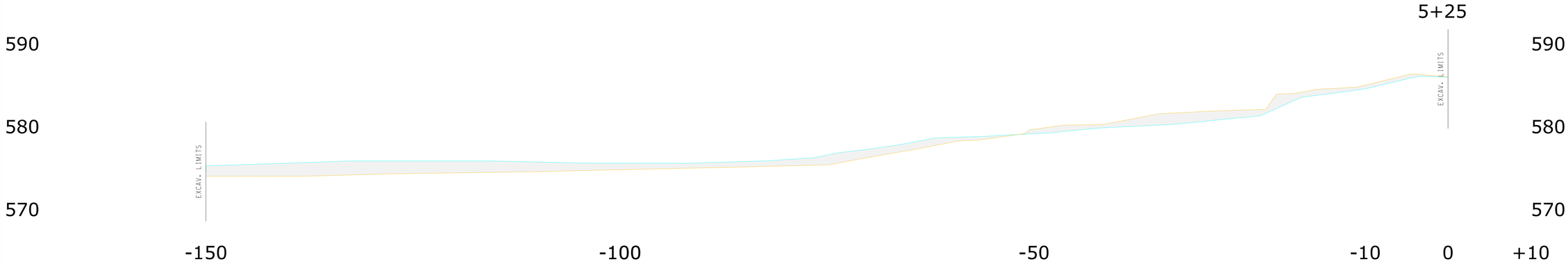
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 13 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
5+00.00 EX			
	Excavation	147	0
	Fill	4	0
5+25.00 EX			
	Excavation	104	116
	Fill	38	19



LAKE MICHIGAN

(WATER ELEV:577.0'±, SEPTEMBER 6, 2012)
(WATER ELEV:576.1'±, APRIL 12, 2013)
SCALE 1"=6'

09-06-2012
04-12-2013

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

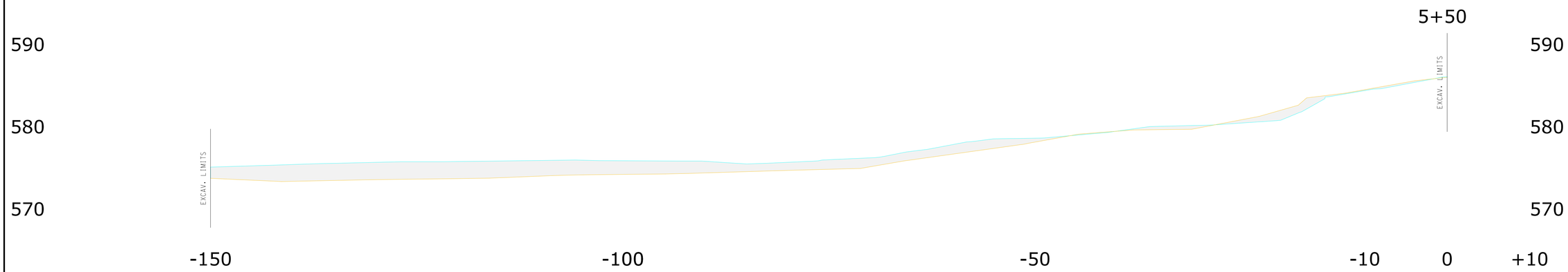
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

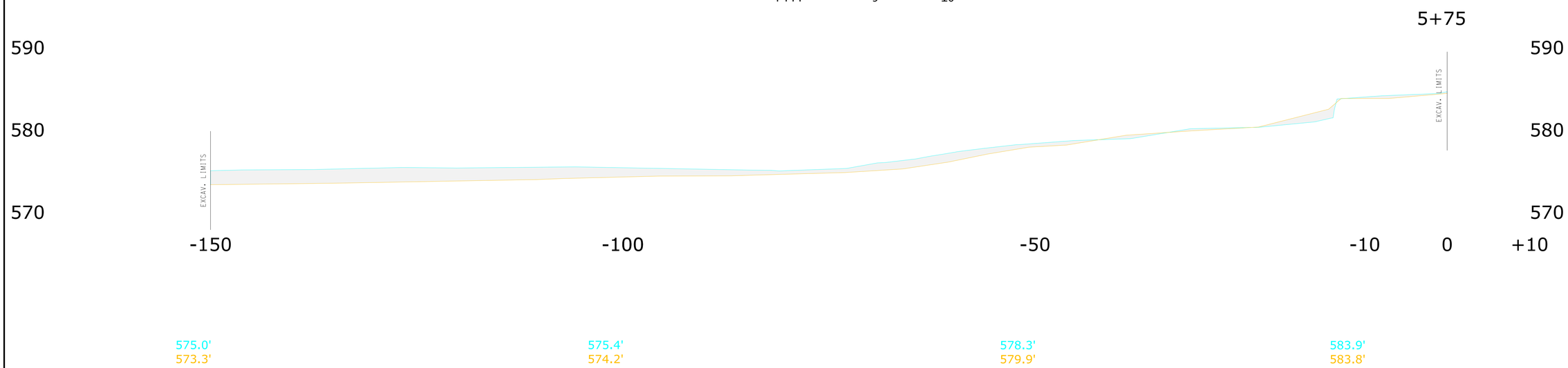
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 2 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
5+50.00 EX			
	Excavation	159	122
	Fill	12	23
5+75.00 EX			
	Excavation	125	131
	Fill	9	10



LAKE MICHIGAN

(WATER ELEV:577.0'±, SEPTEMBER 6, 2012) 09-06-2012
(WATER ELEV:576.1'±, APRIL 12, 2013) 04-12-2013
SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

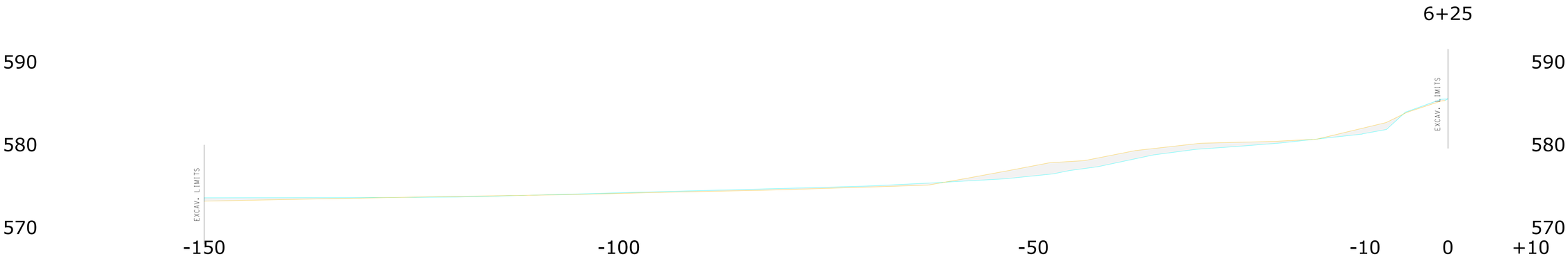
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM: YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

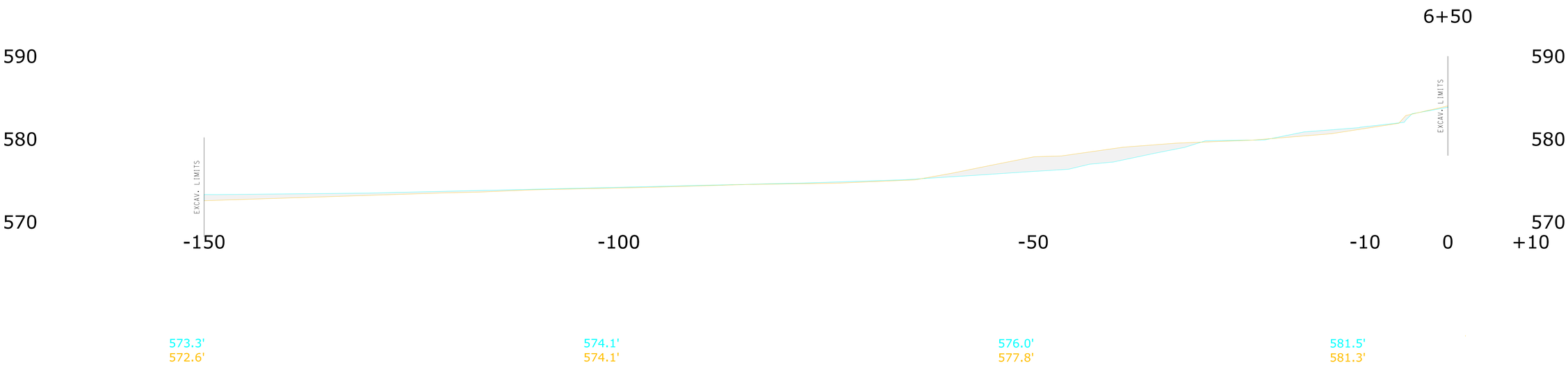
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 3 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
6+25.00 EX			
	Excavation	11	126
	Fill	37	43
6+50.00 EX			
	Excavation	22	15
	Fill	38	35



LAKE MICHIGAN

(WATER ELEV:577.0'±, SEPTEMBER 6, 2012)
(WATER ELEV:576.1'±, APRIL 12, 2013)
SCALE 1"=6'

09-06-2012
04-12-2013

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

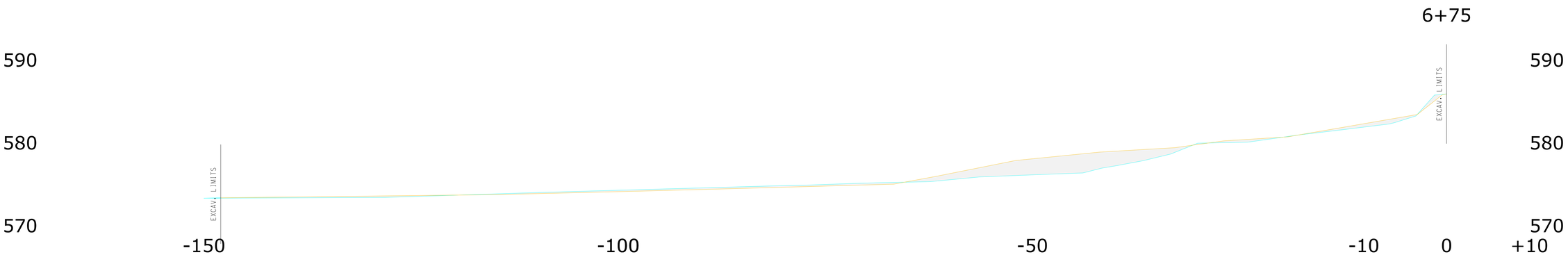
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

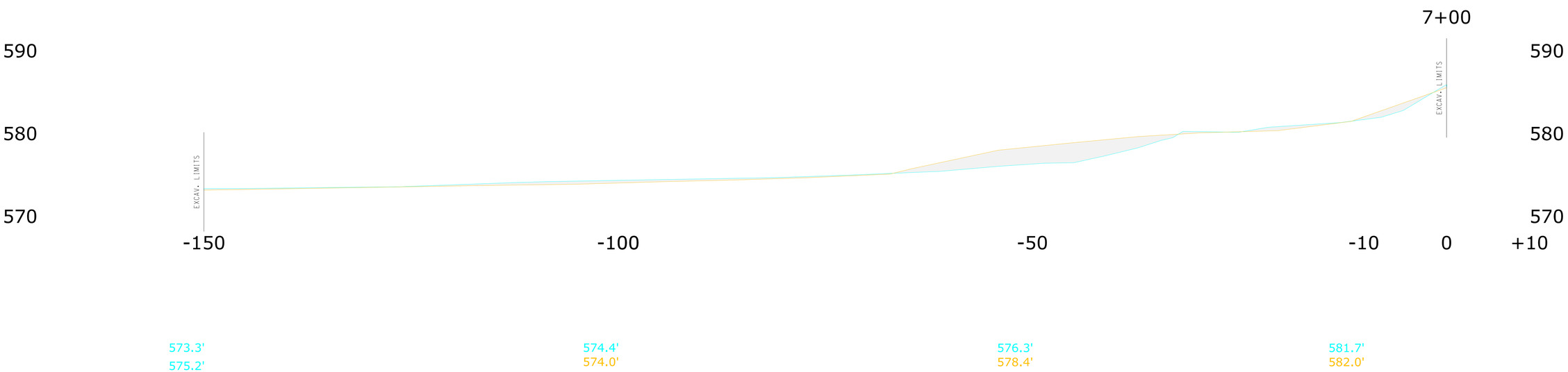
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 4 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
6+75.00 EX			
	Excavation	10	15
	Fill	55	43
7+00.00 EX			
	Excavation	18	13
	Fill	57	52



(WATER ELEV:577.0'±, SEPTEMBER 6, 2012) 09-06-2012

(WATER ELEV:576.1'±, APRIL 12, 2013) 04-12-2013

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

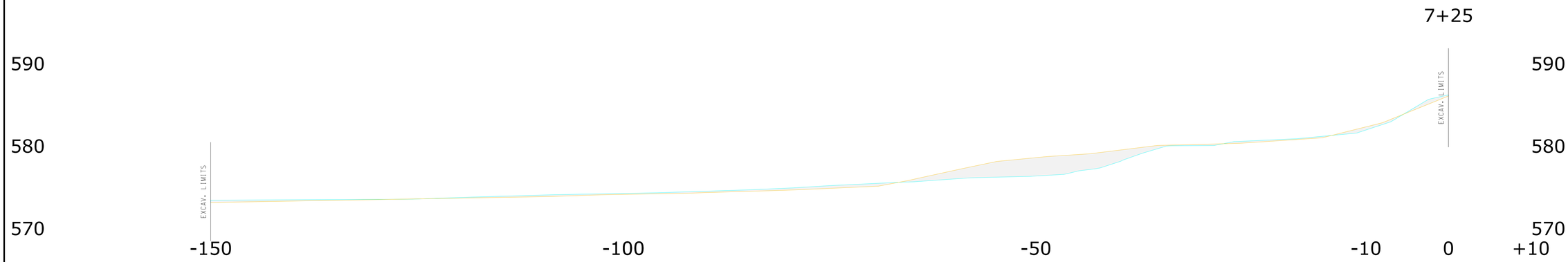
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

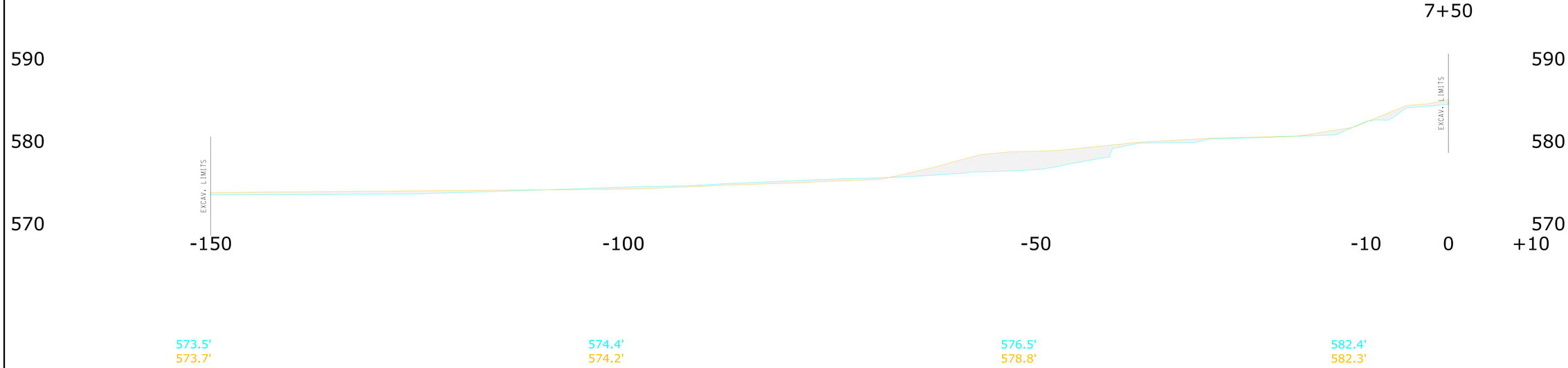
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 5 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
7+25.00 EX			
	Excavation	17	16
	Fill	49	49
7+50.00 EX			
	Excavation	8	12
	Fill	64	52



LAKE MICHIGAN

(WATER ELEV:577.0'±, SEPTEMBER 6, 2012)
(WATER ELEV:576.1'±, APRIL 12, 2013)
SCALE 1"=6'

09-06-2012
04-12-2013

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

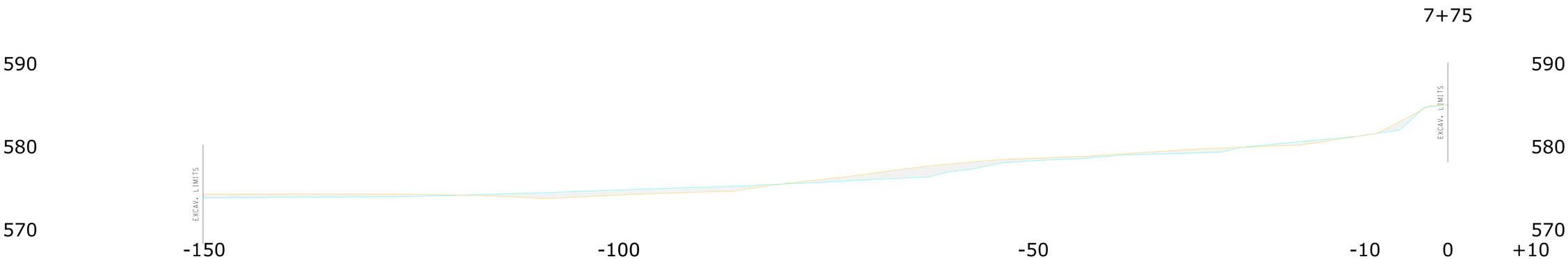
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

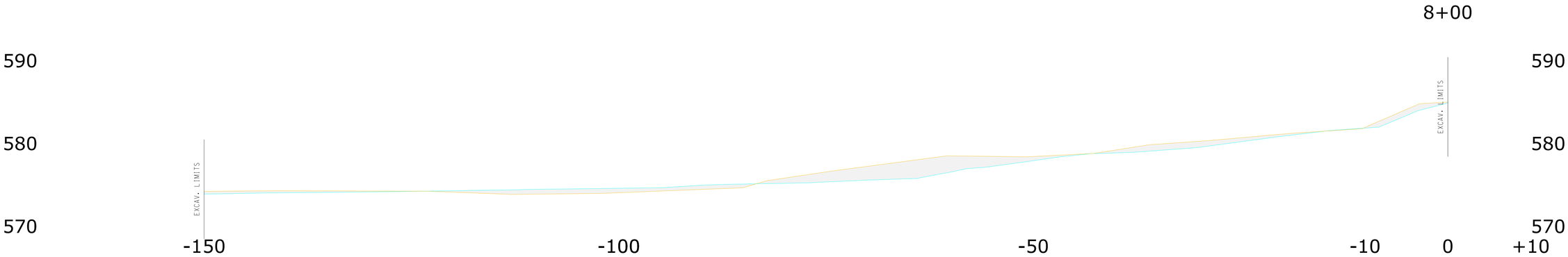
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 6 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
7+75.00 EX			
	Excavation	22	14
	Fill	41	49
8+00.00 EX			
	Excavation	18	19
	Fill	70	51



LAKE MICHIGAN

(WATER ELEV:577.0'±, SEPTEMBER 6, 2012)
(WATER ELEV:576.1'±, APRIL 12, 2013)
SCALE 1"=6'

09-06-2012
04-12-2013

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

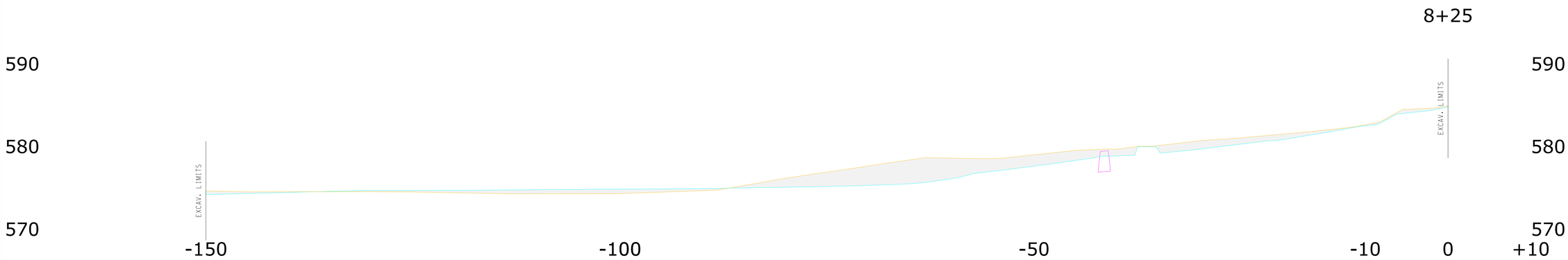
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 7 OF 13



BASE: W. E.

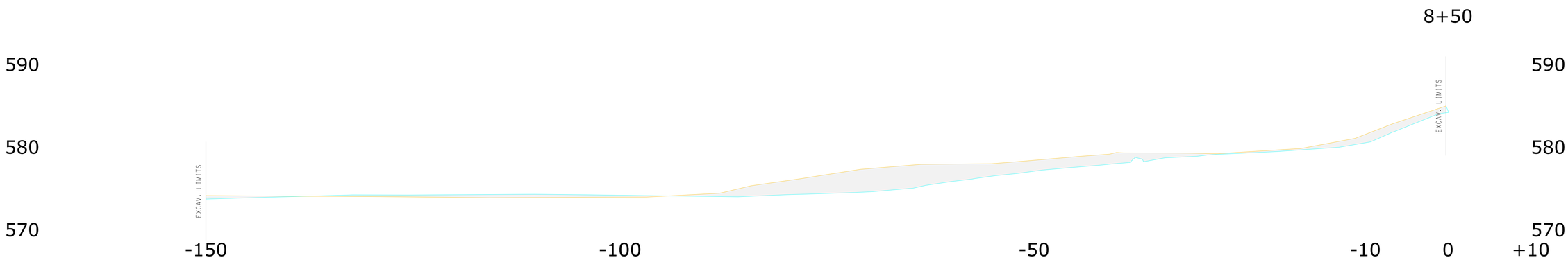
574.2'
574.6'

574.8'
574.3'

578.0'

582.5'
582.6'

		END AREA (SQ FT)	VOLUME (CYD)
8+25.00 EX			
	Excavation	16	16
	Fill	100	79
8+50.00 EX			
	Excavation	11	13
	Fill	114	99



574.4'
574.1'

574.8'
573.9'

577.9'
578.4'

581.2'
581.5'

LAKE MICHIGAN

(WATER ELEV:577.0'±, SEPTEMBER 6, 2012)
(WATER ELEV:576.1'±, APRIL 12, 2013)
SCALE 1"=6'

09-06-2012
04-12-2013

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

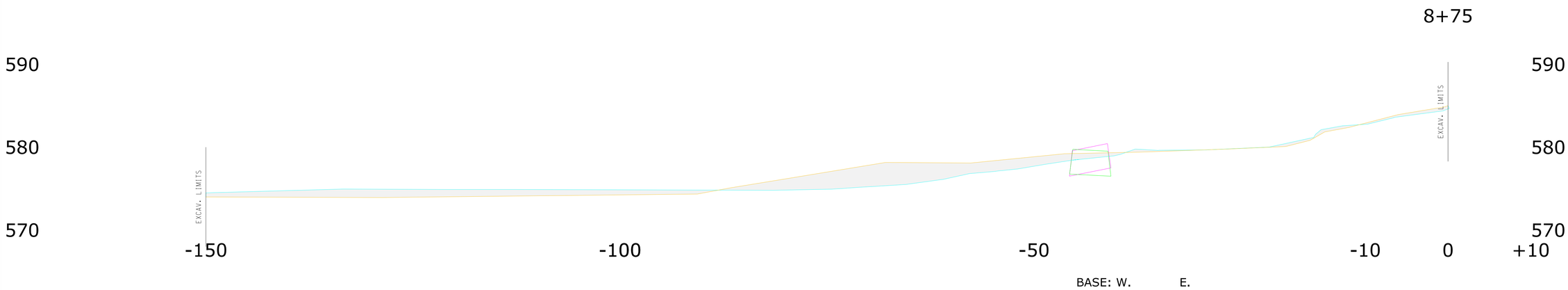
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

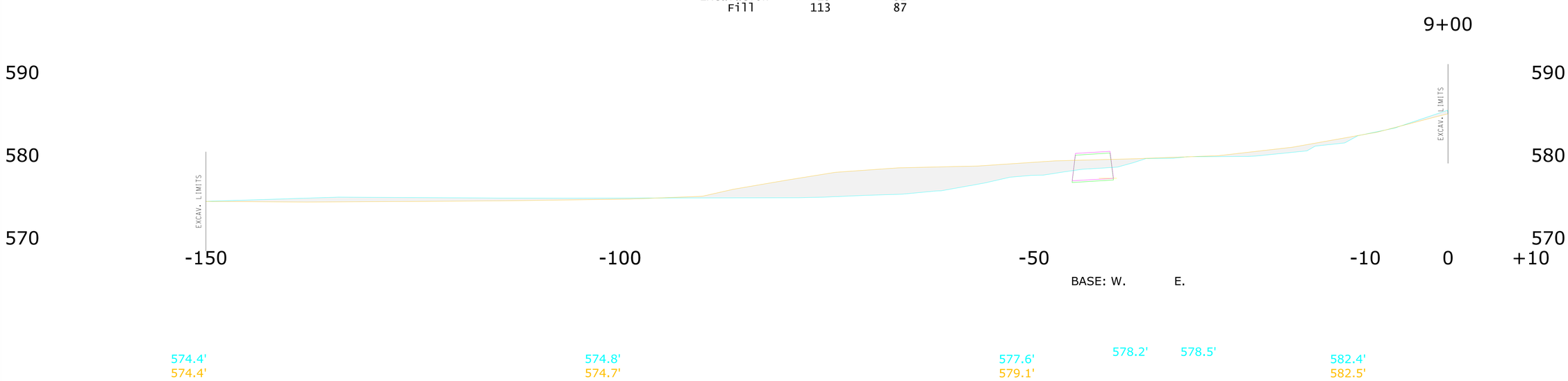
DRN. BY: FTW
CHK'D BY: CCY
DATE: 06-14-2013
FIELD BOOK/PAGE: SEE FILE

JOB NO.: 10046

SHEET NO.: 8 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
8+75.00 EX			
	Excavation	50	28
	Fill	75	87
9+00.00 EX			
	Excavation	19	32
	Fill	113	87



(WATER ELEV:577.0'±, SEPTEMBER 6, 2012)
(WATER ELEV:576.1'±, APRIL 12, 2013)
SCALE 1"=6'

09-06-2012
04-12-2013

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

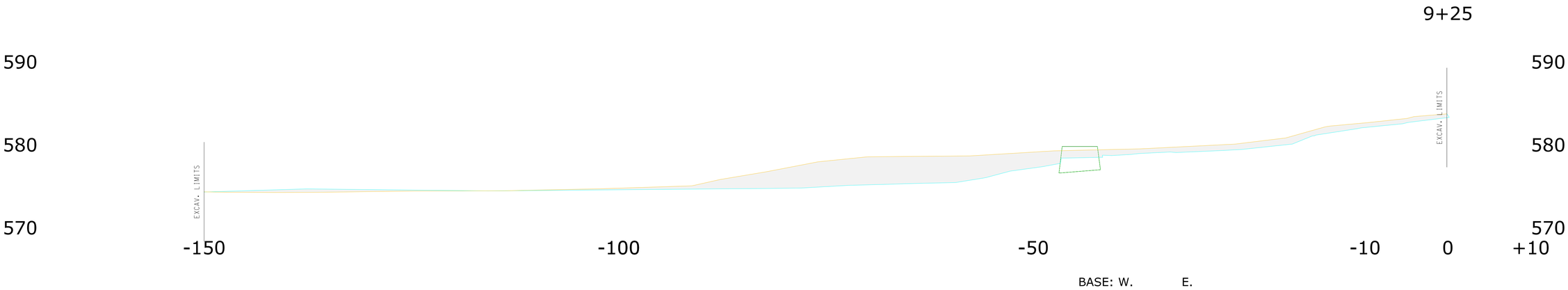
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

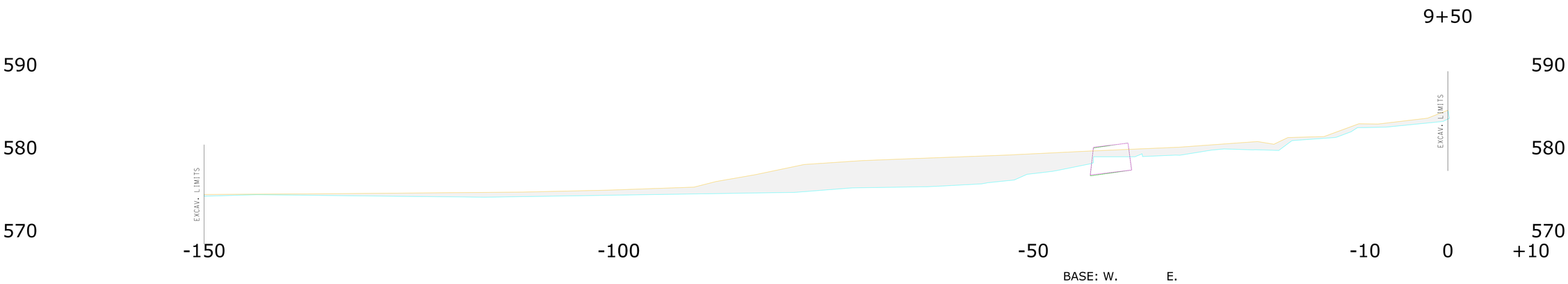
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 9 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
9+50.00 EX	Excavation	7	12
	Fill	146	120
	Excavation	0	3
	Fill	187	154



LAKE MICHIGAN

(WATER ELEV:577.0'±, SEPTEMBER 6, 2012)
(WATER ELEV:576.1'±, APRIL 12, 2013)
SCALE 1"=6'

09-06-2012
04-12-2013

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

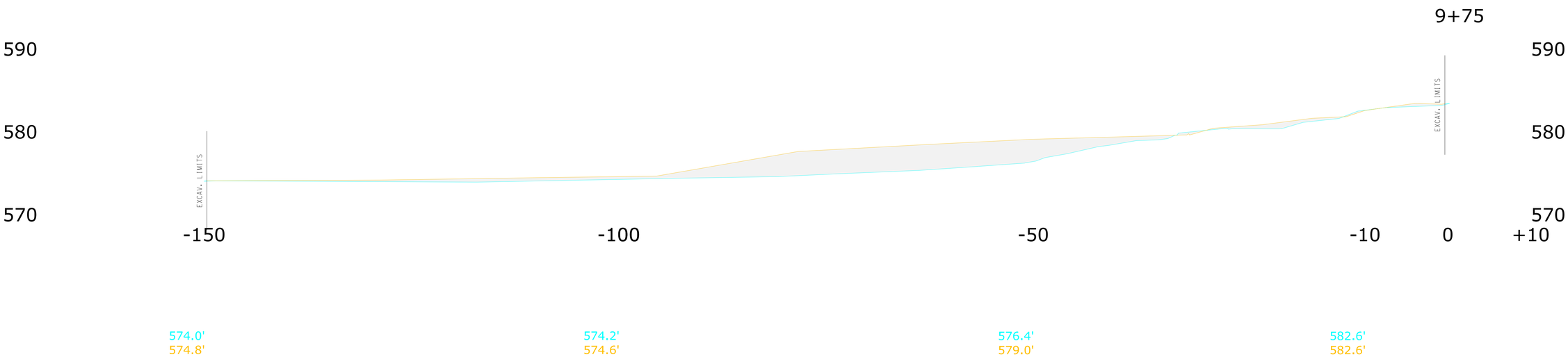
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

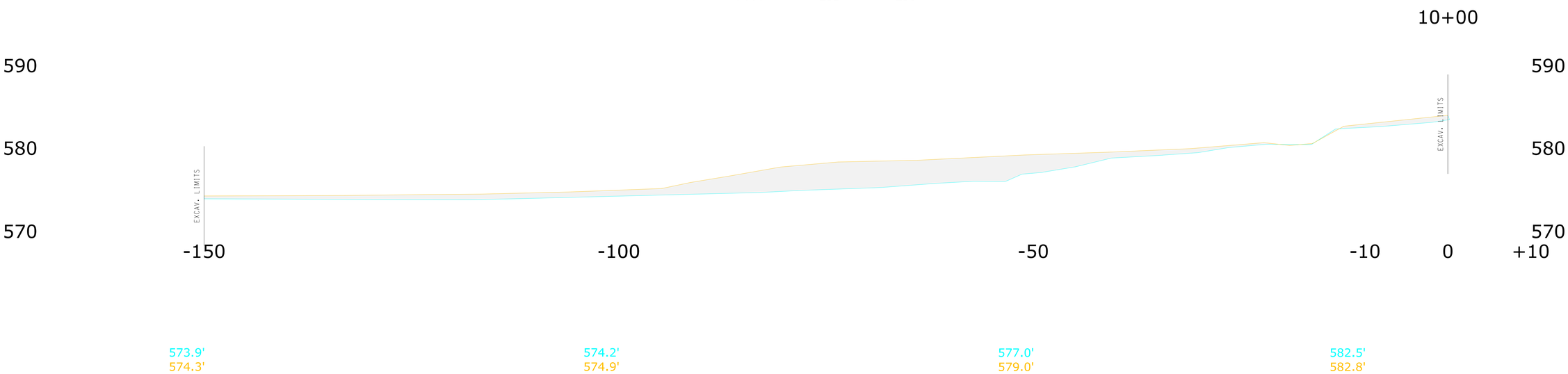
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 10 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
9+75.00 EX			
	Excavation	1	0
	Fill	154	158
10+00.00 EX			
	Excavation	0	0
	Fill	182	156



(WATER ELEV:577.0'±, SEPTEMBER 6, 2012)
(WATER ELEV:576.1'±, APRIL 12, 2013)
SCALE 1"=6'

09-06-2012
04-12-2013

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

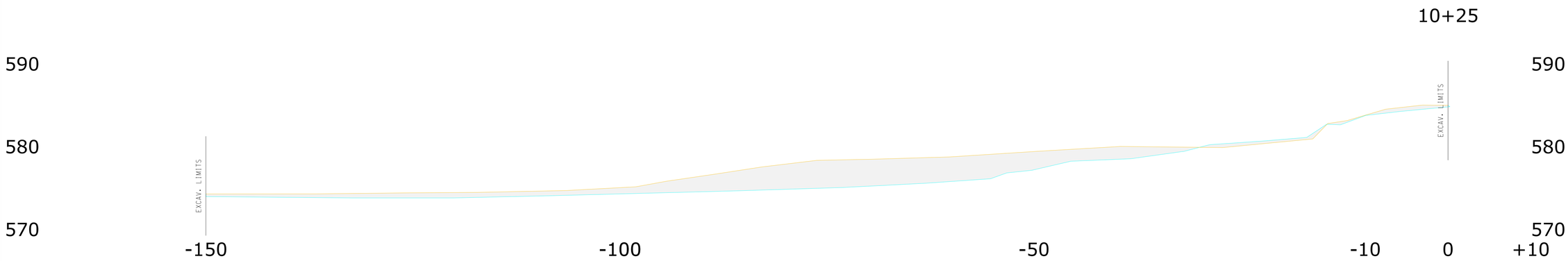
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 11 OF 13



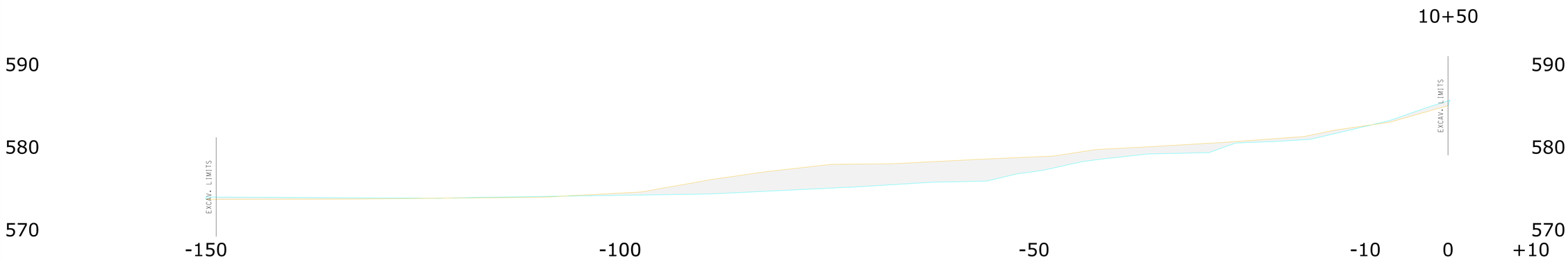
574.1'
574.3'

574.3'
575.0'

577.2'
579.4'

583.7'
583.8'

		END AREA (SQ FT)	VOLUME (CYD)
10+25.00 EX			
	Excavation	5	2
	Fill	186	170
10+50.00 EX			
	Excavation	8	6
	Fill	138	150



573.9'
573.6'

574.1'
574.4'

577.0'
578.8'

582.5'
582.6'

LAKE MICHIGAN

(WATER ELEV:577.0'±, SEPTEMBER 6, 2012)
(WATER ELEV:576.1'±, APRIL 12, 2013)
SCALE 1"=6'

09-06-2012
04-12-2013

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: **MONITORING BEACH TOPOGRAPHY**

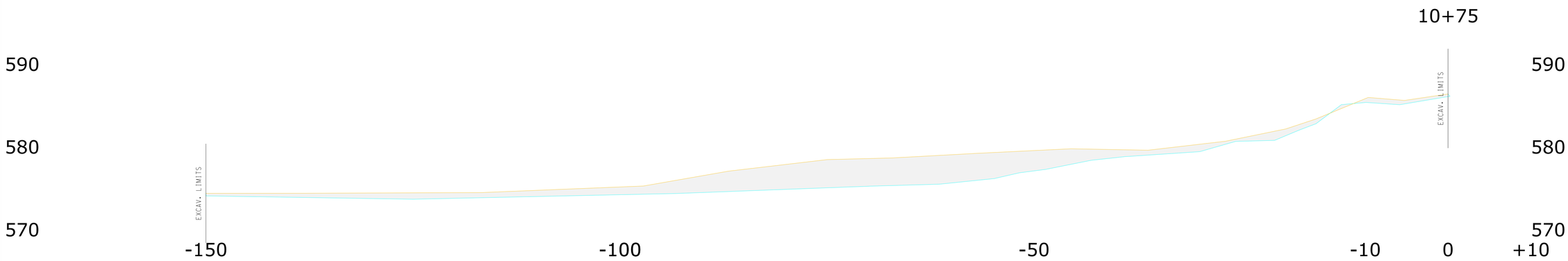
LOCATION: **PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.**

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

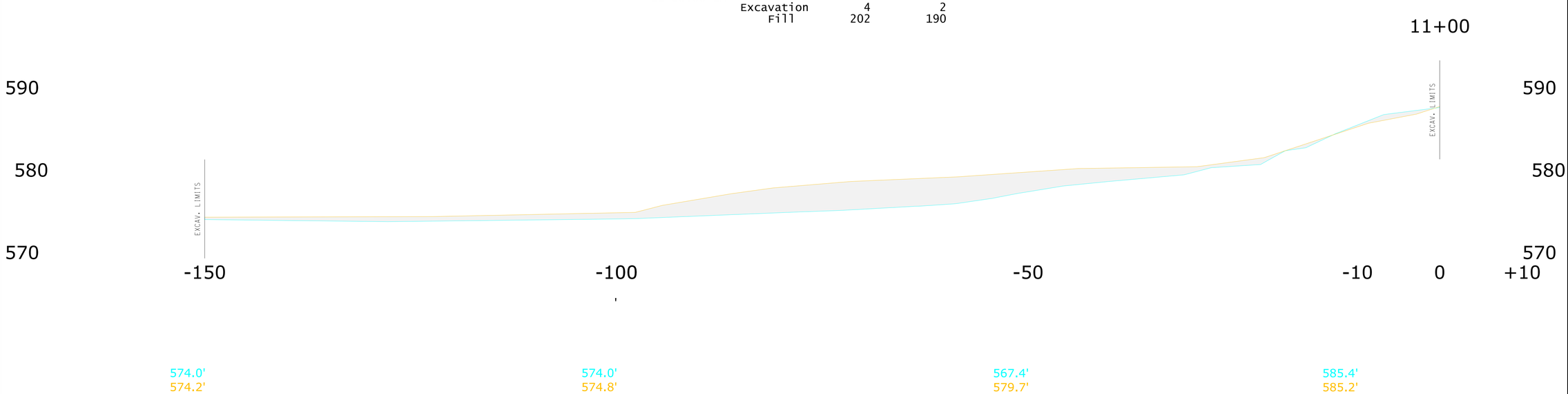
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 12 OF 13



	END AREA (SQ FT)	VOLUME (CYD)
10+75.00 EX		
Excavation	1	4
Fill	208	160
11+00.00 EX		
Excavation	4	2
Fill	202	190



LAKE MICHIGAN

G R A N D S U M M A R Y T O T A L S

Material Name	Unadjusted Volumes (cu. yd.)	Adjusted Volumes (cu. yd.)	Mult Factor
EX			
Excavation	717	717	1.00
Fill	2036	2036	1.00

(WATER ELEV:577.0'±, SEPTEMBER 6, 2012) 09-06-2012

(WATER ELEV:576.1'±, APRIL 12, 2013) 04-12-2013

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

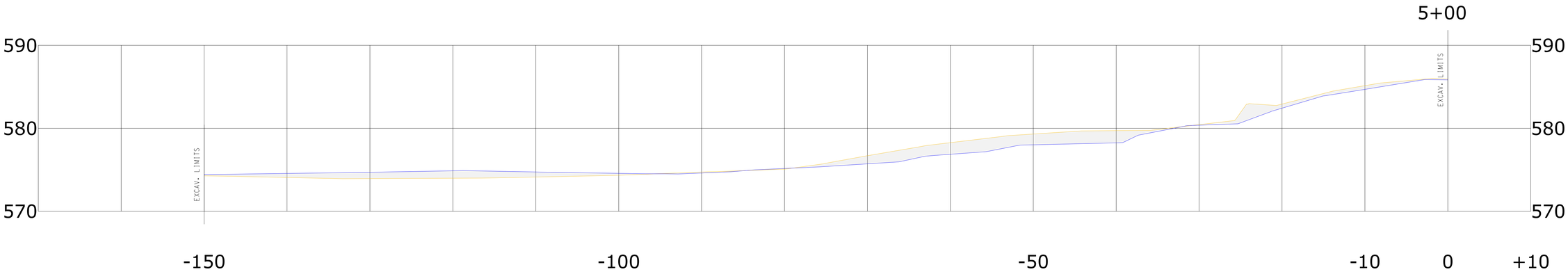
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM: YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

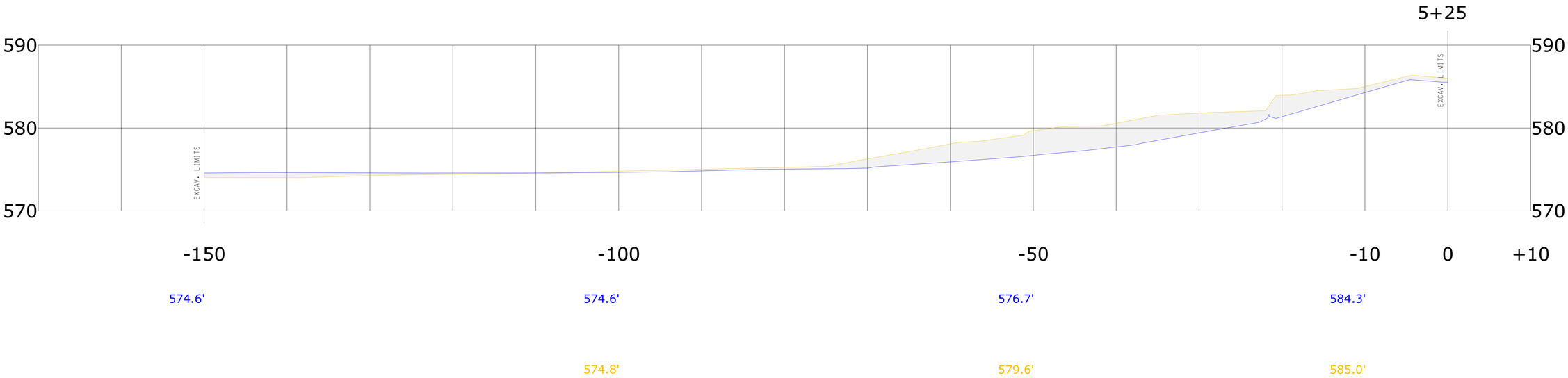
DRN. BY: FTW
CHK'D BY: CCY
DATE: 06-14-2013
FIELD BOOK/PAGE: SEE FILE

JOB NO.: 10046

SHEET NO.: 13 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
5+00.00 EX			
	Excavation	31	0
	Fill	65	0
5+25.00 EX			
	Excavation	14	21
	Fill	148	99



LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:576.1'±, APRIL 12, 2013) 04-12-2013

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

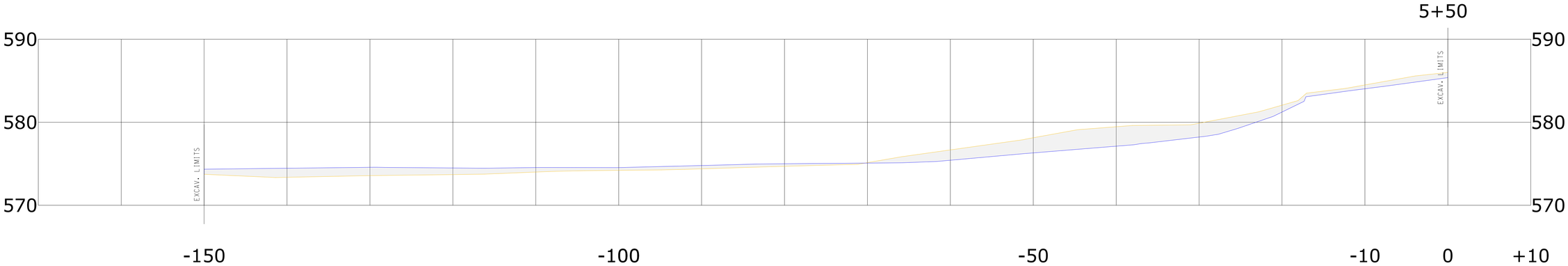
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

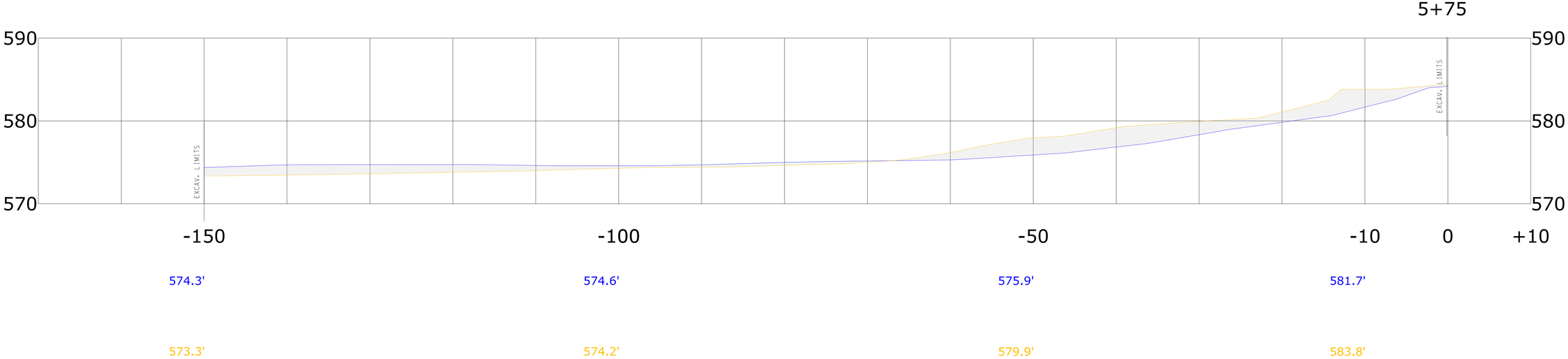
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	03-12-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 2 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
5+50.00 EX			
	Excavation	48	29
	Fill	92	111
5+75.00 EX			
	Excavation	55	48
	Fill	102	90



LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:576.1'±, APRIL 12, 2013) 04-12-2013

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

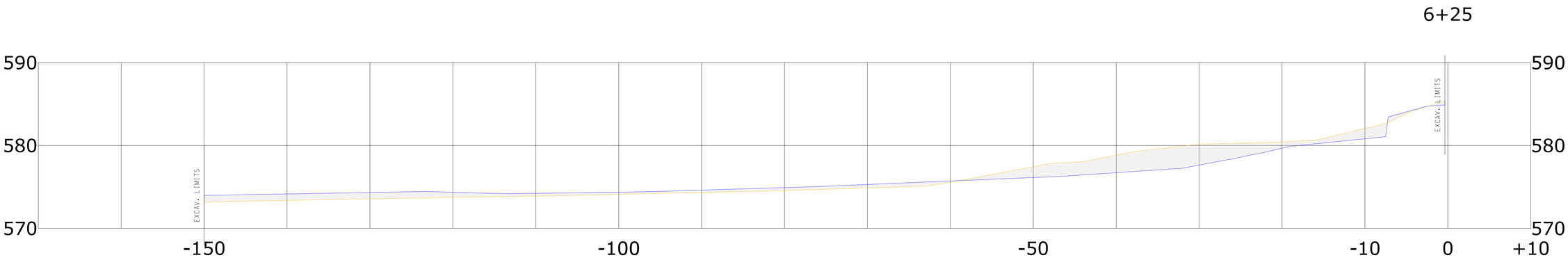
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM: YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

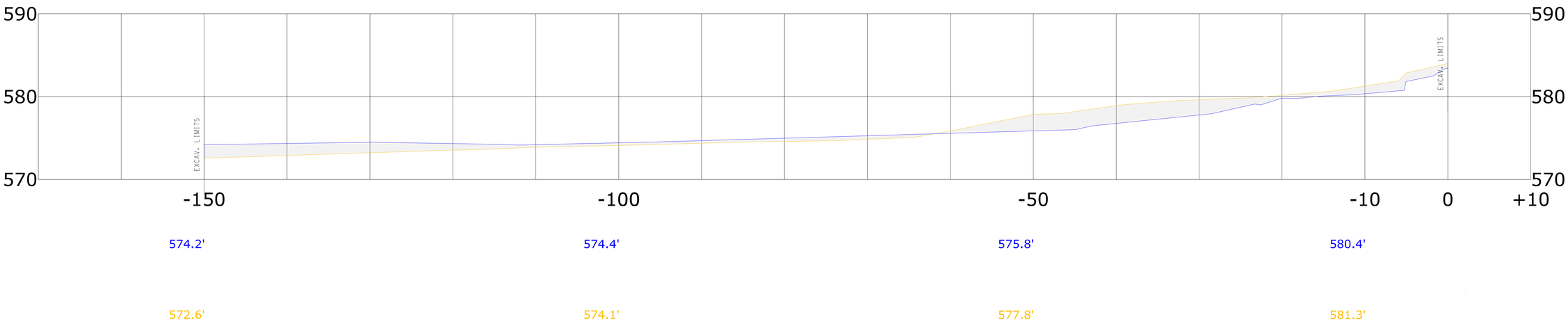
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 3 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
6+25.00 EX			
	Excavation	46	94
	Fill	75	164
6+50.00 EX			
	Excavation	62	50
	Fill	81	72



LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:576.1'±, APRIL 12, 2013) 04-12-2013

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

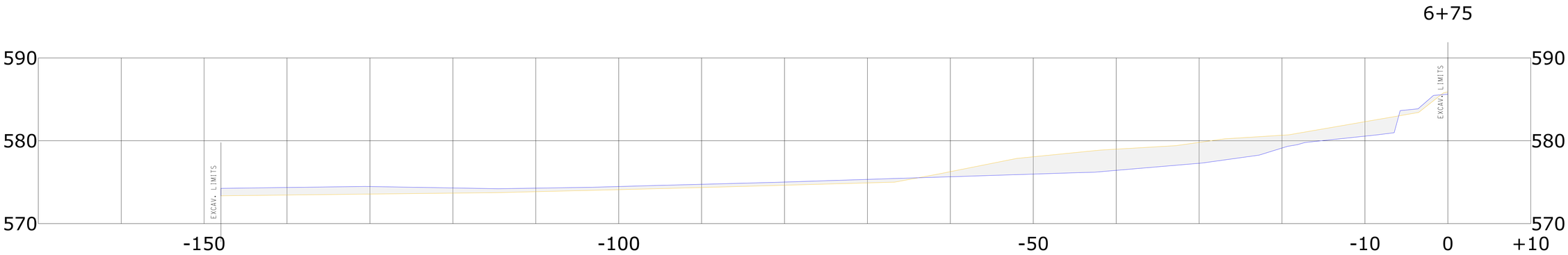
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

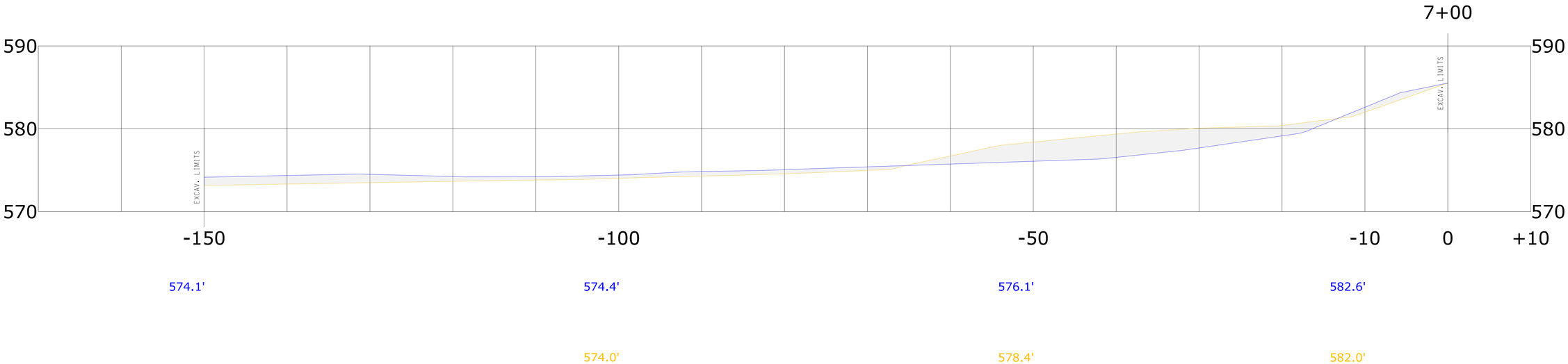
DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 4 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
6+75.00 EX			
	Excavation	49	51
	Fill	109	88
7+00.00 EX			
	Excavation	60	50
	Fill	97	95



LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:576.1'±, APRIL 12, 2013) 04-12-2013

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

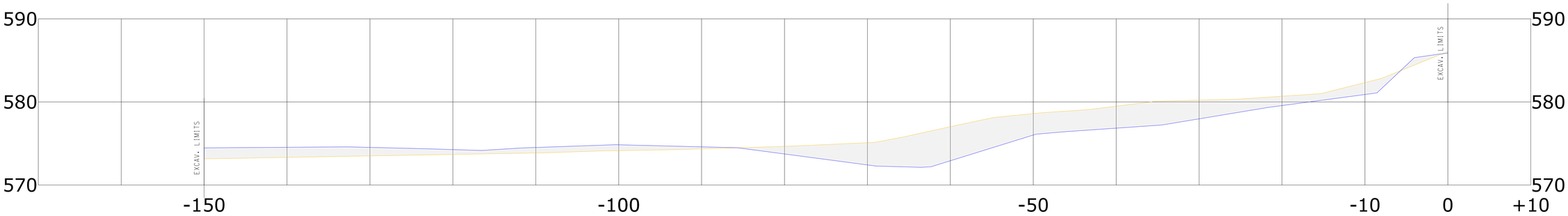
ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 5 OF 13

7+25

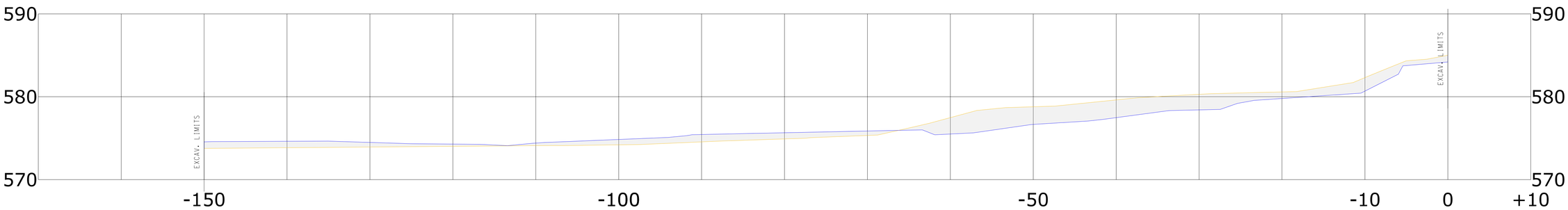


574.4' 574.8' 576.0' 580.9'

573.1' 574.1' 578.5' 582.3'

		END AREA (SQ FT)	VOLUME (CYD)
7+25.00 EX			
	Excavation	52	52
	Fill	175	126
7+50.00 EX			
	Excavation	49	47
	Fill	104	129

7+50



574.5' 574.8' 576.6' 580.7'

573.7' 574.2' 578.8' 582.3'

LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:576.1'±, APRIL 12, 2013) 04-12-2013

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

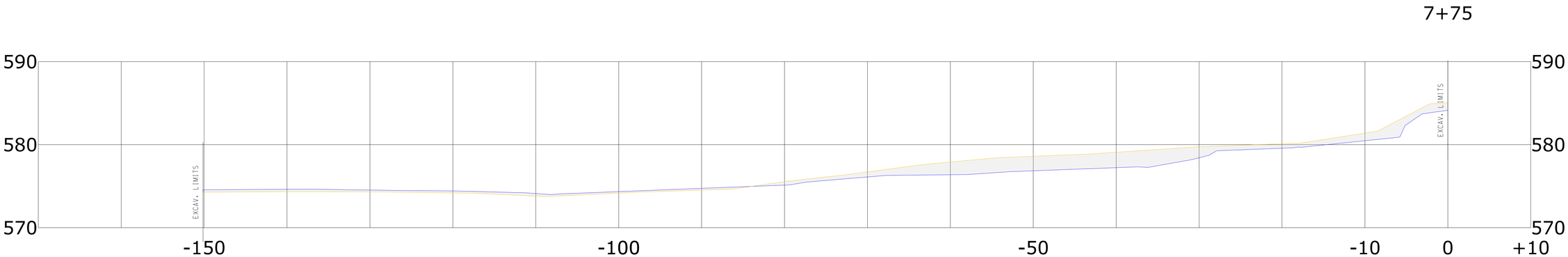
LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

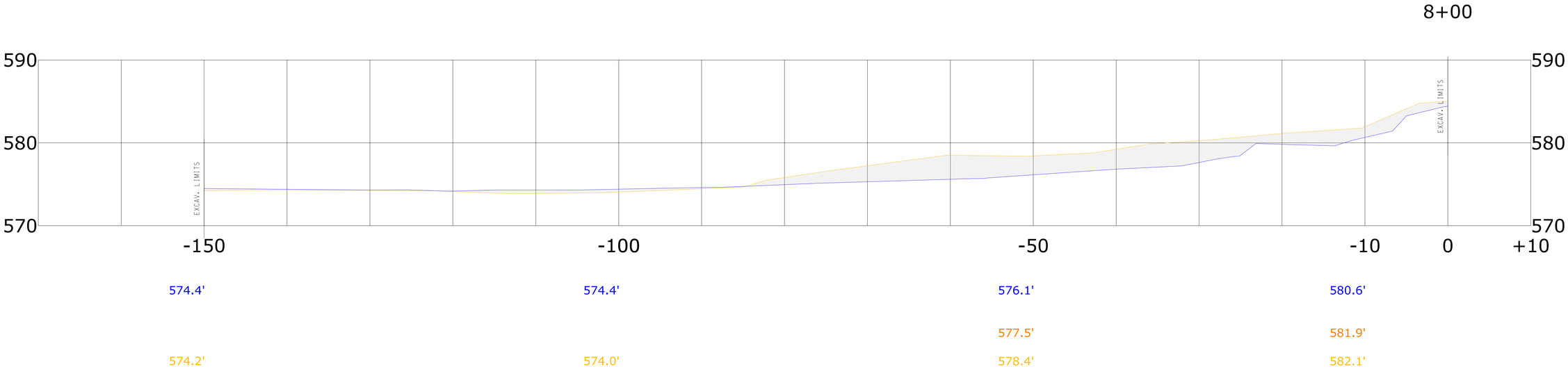
DRN. BY: FTW
CHK'D BY: CCY
DATE: 06-14-2013
FIELD BOOK/PAGE: SEE FILE

JOB NO.: 10046

SHEET NO.: 6 OF 13



		END AREA (SQ FT)	VOLUME (CYD)
7+75.00 EX			
	Excavation	16	30
	Fill	94	92
8+00.00 EX			
	Excavation	13	13
	Fill	163	119



SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

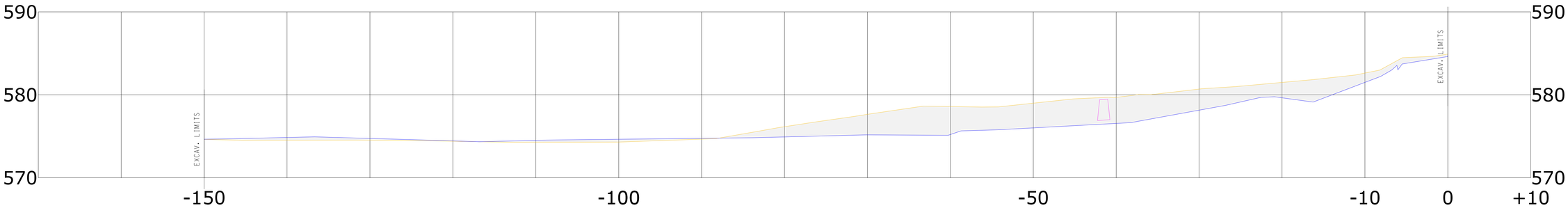
ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 7 OF 13

8+25



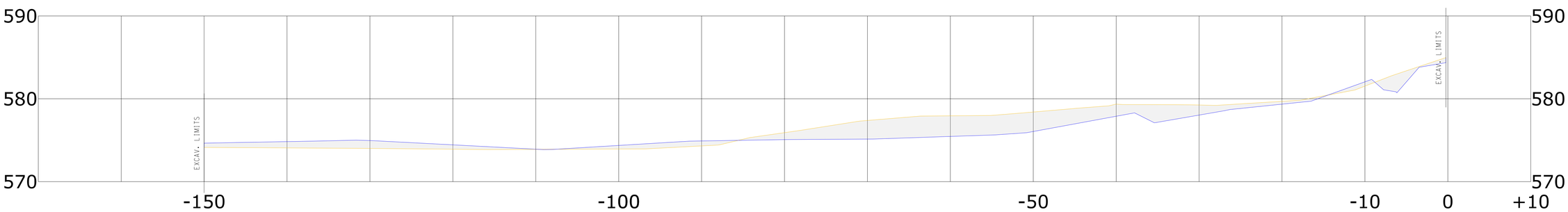
574.6' 574.6' 576.0' 581.5'

BASE: W. E.

574.6' 574.3' 578.0' 582.6'

		END AREA (SQ FT)	VOLUME (CYD)
8+25.00 EX			
	Excavation	12	12
	Fill	191	164
8+50.00 EX			
	Excavation	37	23
	Fill	117	143

8+50



574.6' 574.4' 576.0' 582.0'

574.1' 573.9' 578.4' 581.5'

LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:576.1'±, APRIL 12, 2013) 04-12-2013

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

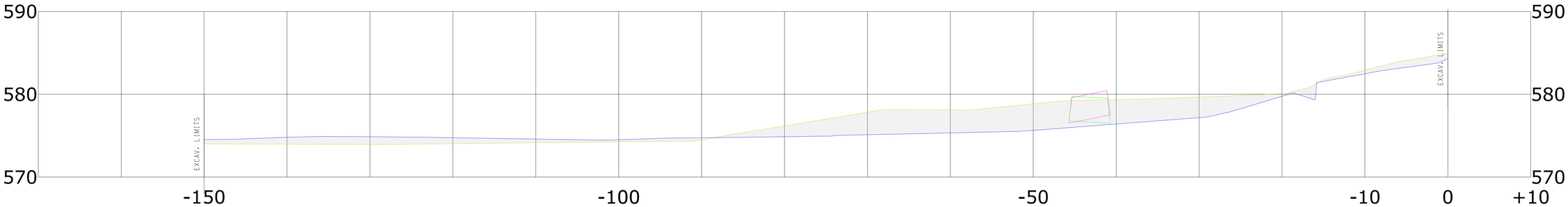
ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 8 OF 13

8+75

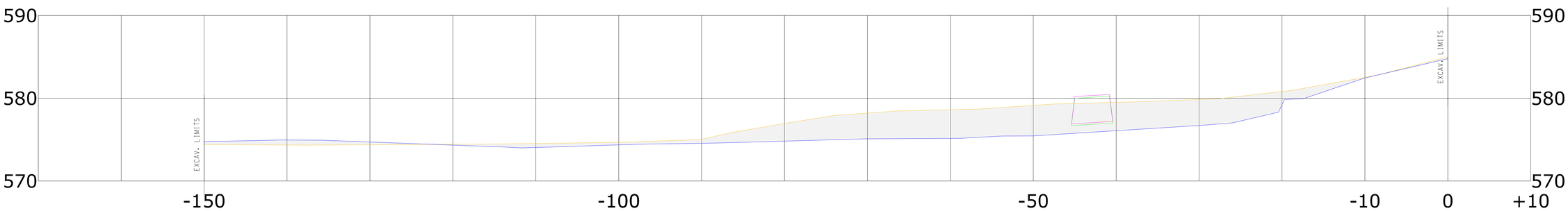


BASE: W. E.
NO DATA

574.5'	574.5'	575.6'	582.5'
574.0'	574.3'	578.8'	582.9'

		END AREA (SQ FT)	VOLUME (CYD)
8+75.00 EX			
	Excavation	37	34
	Fill	170	133
9+00.00 EX			
	Excavation	11	22
	Fill	227	184

9+00



BASE: W. E.
NO DATA

574.7'	574.4'	575.4'	582.4'
574.4'	574.7'	579.1'	582.5'

LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:576.1'±, APRIL 12, 2013) 04-12-2013

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

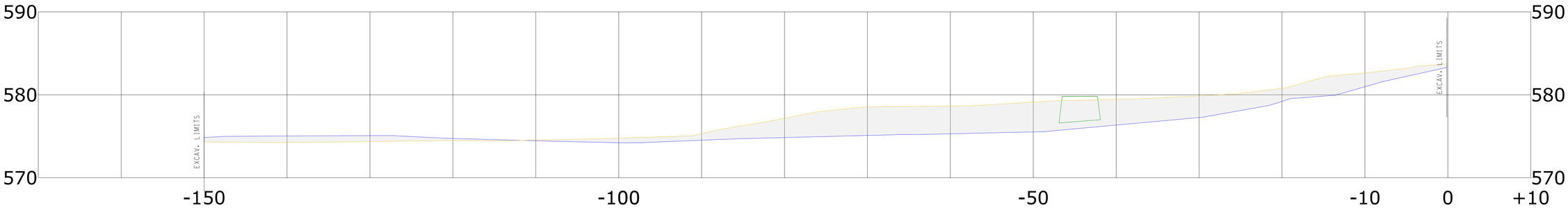
ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 9 OF 13

9+25



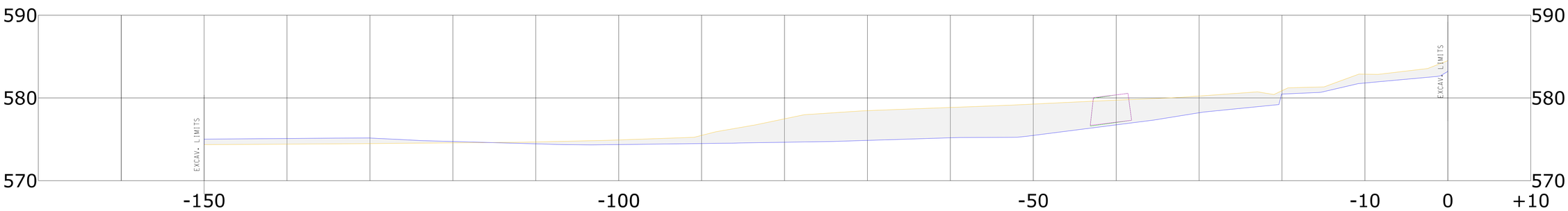
BASE: W. E.
NO DATA

574.8' 574.2' 575.5' 581.0'

574.3' 574.7' 579.1' 582.6'

		END AREA (SQ FT)	VOLUME (CYD)
	Excavation	21	15
	Fill	236	214
9+50.00 EX			
	Excavation	18	18
	Fill	233	217

9+50



BASE: W. E.
NO DATA

575.0' 574.4' 575.5' 581.8'

574.3' 574.9' 579.2' 582.8'

LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:576.1'±, APRIL 12, 2013) 04-12-2013

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

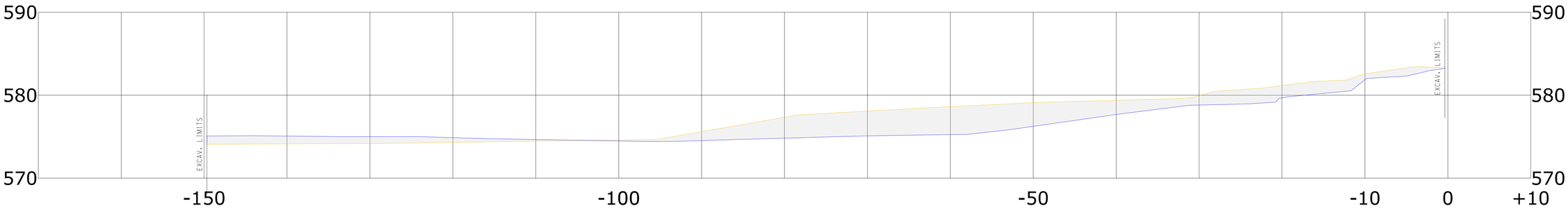
ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 10 OF 13

9+75

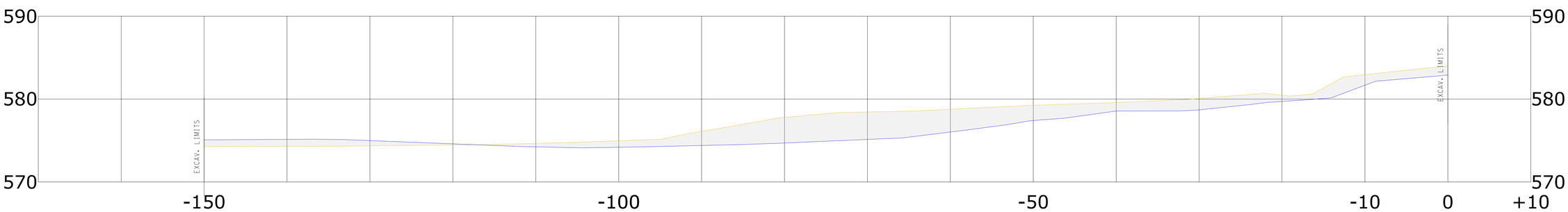


575.0' 574.5' 576.2' 581.9'

574.8' 574.6' 579.0' 582.6'

		END AREA (SQ FT)	VOLUME (CYD)
9+75.00 EX			
	Excavation	30	22
	Fill	188	195
10+00.00 EX			
	Excavation	20	23
	Fill	191	175

10+00



575.0' 574.2' 577.4' 581.7'

574.3' 574.9' 579.0' 582.8'

LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:576.1'±, APRIL 12, 2013) 04-12-2013

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

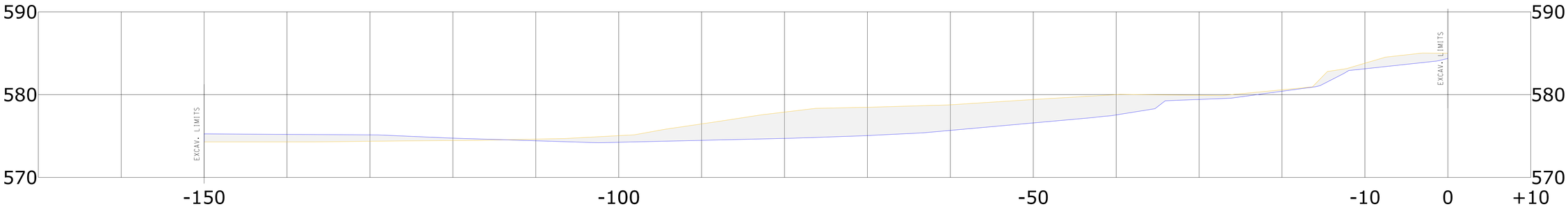
ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY: FTW
CHK'D BY: CCY
DATE: 06-14-2013
FIELD BOOK/PAGE: SEE FILE

JOB NO.: 10046

SHEET NO.: 11 OF 13

10+25

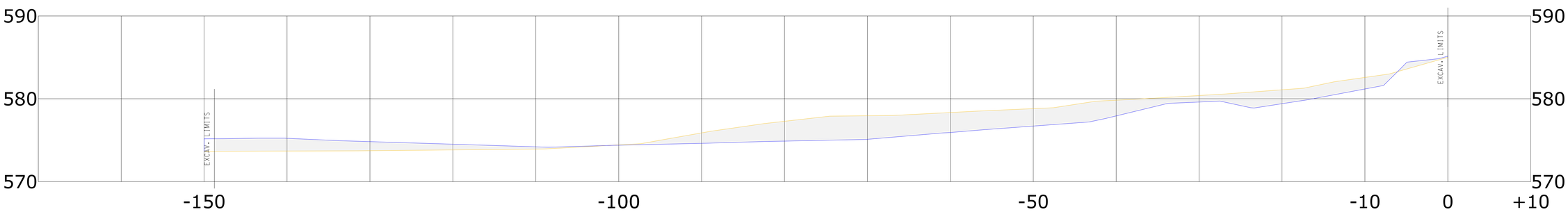


575.2 574.2' 576.6' 583.1'

574.3' 575.0' 579.4' 583.8'

		END AREA (SQ FT)	VOLUME (CYD)
10+25.00 EX			
	Excavation	24	20
	Fill	200	181
10+50.00 EX			
	Excavation	44	31
	Fill	166	169

10+50



575.1' 574.4' 576.7' 581.2'

573.6' 574.4' 578.8' 582.6'

LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:576.1'±, APRIL 12, 2013) 04-12-2013

SCALE 1"=6'

LCM Surveying & Engineering
• Surveying
• Civil Engineering

225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

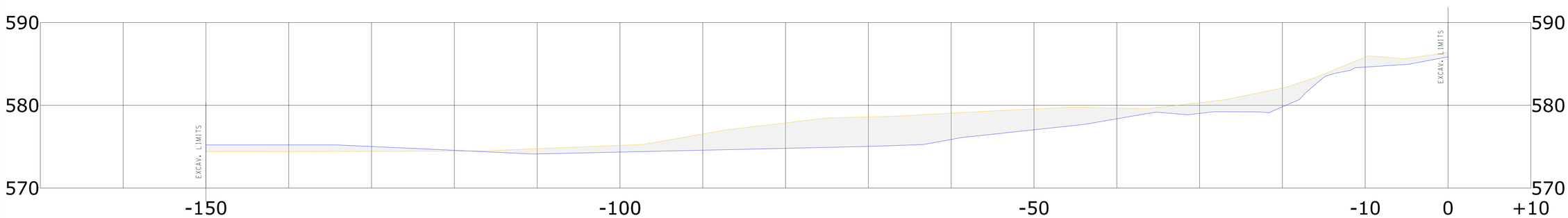
ENGINEERING FIRM:
YOUNGS CONSULTING
14154 RUBY LANE
BIG RAPIDS, MI 49307

DRN. BY:	CHK'D BY:	DATE:	FIELD BOOK/PAGE:
FTW	CCY	06-14-2013	SEE FILE

JOB NO.: 10046

SHEET NO.: 12 OF 13

10+75

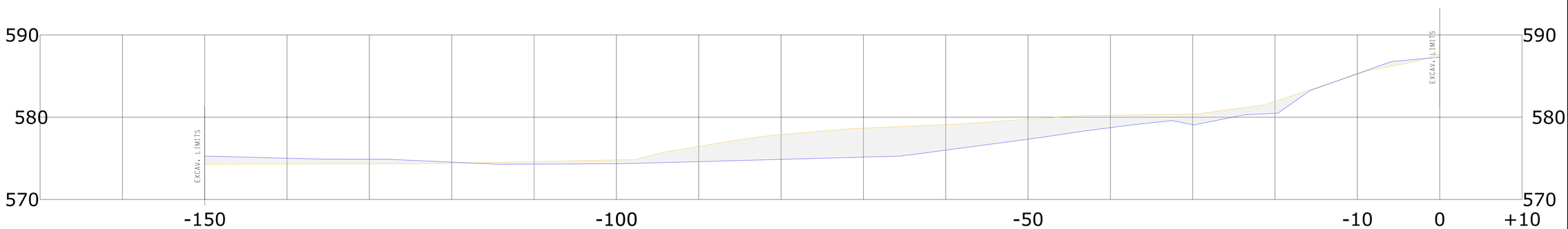


575.2' 574.4' 577.0' 584.6'

574.3' 575.2' 579.5' 585.9'

		END AREA (SQ FT)	VOLUME (CYD)
10+75.00 EX			
	Excavation	19	29
	Fill	214	176
11+00.00 EX			
	Excavation	21	19
	Fill	182	183

11+00



575.2' 574.3' 577.3' 585.3'

574.2' 574.8' 579.7' 585.2'

LAKE MICHIGAN

(WATER ELEV:576.9'±, APRIL 13, 2011) 04-13-2011

(WATER ELEV:576.1'±, APRIL 12, 2013) 04-12-2013

SCALE 1"=6'

G R A N D S U M M A R Y T O T A L S

Material Name		Unadjusted Volumes (cu. yd.)	Adjusted Volumes (cu. yd.)	Mult Factor
EX				
	Excavation	753	753	1.00
	Fill	3319	3319	1.00

LCM Surveying & Engineering
• Surveying
• Civil Engineering
225 EAST MAIN ST.
MARION, MI 49665
Phone: (231) 743-3000
Fax: (231) 743-3001

PROJECT: MONITORING BEACH TOPOGRAPHY

LOCATION: PART OF THE SECTION 10, T24N, R16W, ARCADIA TWP., MANISTEE CO., MICHIGAN.

ENGINEERING FIRM: YOUNGS CONSULTING 14154 RUBY LANE BIG RAPIDS, MI 49307

DRN. BY: FTW
CHK'D BY: CCY
DATE: 06-14-2013
FIELD BOOK/PAGE: SEE FILE

JOB NO.: 10046

SHEET NO.: 13 OF 13