

Beech and Bonaparte engineering p.c.

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CALCULATION PACKAGE COVER SHEET

Client: Honeywell Project: Onondaga Lake SCA Final Cover Design Project/Proposal #: GD5497

TITLE OF COMPUTATIONS

SETTLEMENT ANALYSES REEVALUATION (SPRING 2016) FOR SCA FINAL COVER DESIGN

COMPUTATIONS BY:

Signature



04/15/16

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APPROVAL NOTES:

REVISIONS (Number and initial all revisions)

NO.	SHEET	DATE	BY	CHECKED BY	APPROVAL
_____	_____	_____	_____	_____	_____
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A-1

ADDENDUM 2

Settlement Analyses Reevaluation for SCA Final Cover Design

Written by:	<u>Ray Wu / Clinton Carlson</u>	Date:	<u>04/15/2016</u>	Reviewed by:	<u>Ali Ebrahimi / Jay Beech</u>	Date:	<u>04/15/2016</u>
Client:	Honeywell	Project:	Onondaga Lake SCA Final Cover Design	Project/ Proposal No.:	GD5497	Task No.:	03

SETTLEMENT ANALYSES REEVALUATION (SPRING 2016) FOR SCA FINAL COVER DESIGN

PURPOSE

This package was prepared in support of the final cover design for the Sediment Consolidation Area (SCA) as part of the Onondaga Lake remediation project. The purpose of this package is to use the as-built surveys for the SCA leveling layer surface to reevaluate the settlement analyses for the SCA final cover as presented in the NYSDEC approved calculation package titled “*Settlement Analyses for SCA Final Cover Design*” [Beech and Bonaparte, 2015], referred to herein as the Settlement Package.

METHODOLOGY

As discussed in the Settlement Package, the original settlement analyses for the SCA final cover used the SCA survey taken on 7 December 2014 as an initial surface to estimate the post-settlement grades of the top of clay liner and final cover. The assumptions in the original settlement analyses were first reevaluated by comparing the December 2014 and April 2015 SCA surveys, as presented in Addendum 1 of the Settlement Package. In this package, the SCA surveys of the as-built leveling layer surface taken on 1 December 2015 (ground survey) and 17 March 2016 (aerial survey) are used to reevaluate the original settlement analyses.

The December 2015 and March 2016 SCA surveys are shown in Figures 1 and 2, respectively. The December 2015 survey was performed approximately one month after the 2015 leveling layer construction was completed at the SCA (i.e., beginning of SCA winter shutdown conditions) and the March 2016 survey was performed before the start of the 2016 construction season. Therefore, the December 2015 and March 2016 surveys bracket an approximately four month period when no additional construction loading occurred in the SCA. As shown in Figure 3, an isopach (negative values are indicative of settlement) between the two surveys indicates that approximately:

- 57% of the SCA area had a change in elevation between -0.5 and 0.5 ft;
- 34% of the SCA area had a change in elevation between -0.5 and -1 ft;
- 8% of the SCA area had a change in elevation between -1 and -2 ft; and
- 1% of the SCA area had a change in elevation less than -2 or greater than 0.5 ft.

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The accuracy of the March 2016 aerial survey was reported to be ± 0.5 to 1 ft.¹ Therefore, approximately 91% of the areas showing a change in elevation are within the accuracy of the survey.

RESULTS

During the four months between the December 2015 and March 2016 surveys, the functioning settlement cells (i.e., SCs connected to Legs 2 and 3 installed underneath the compacted clay liner, Figure 4) measured minimal settlement on the order of 0.5 to 1 ft, except near the east and west sumps where the measured settlement was on the order of 1.5 to 2 ft, as shown in Figures 5A through 5D. It is noted that the general range of 0.5 to 1 ft of settlement was also generally seen in previous winter shutdown condition periods. Since the settlement measured by the SCs is within the elevation differences between the December 2015 and March 2016 surveys, the following observations are made:

- Based on weekly survey data provided by Parsons during the 2015 leveling layer construction, approximately 317,000 cubic yards of leveling layer material were placed in the SCA. Therefore, the average total leveling layer thickness is approximately 3.9 ft (i.e., 317,000 cubic yards over a plan area of 50 acres). The settlement pattern due to placement of this leveling layer material is consistent with the settlement pattern observed in past years during winter shutdown periods in between geotextile tube filling.
- Back calculated consolidation parameters obtained from using the measured settlements at the time of the March 2016 survey are expected to be similar to the consolidation parameters back calculated from using the measured settlements at the time of the December 2014 survey. In turn, the estimated settlement due to the final cover will not change significantly.

CONCLUSIONS

The change in elevations between the December 2015 and March 2016 surveys were generally within the maximum survey accuracy of ± 0.5 to 1 ft and consistent with the settlements measured by the settlement cells over the same time period. Therefore, the assumptions made in the original settlement analyses continue to remain valid and the estimated post-settlement final cover design grades presented in the Settlement Package are still expected to maintain proper drainage slopes on the top of the clay liner and final cover.

¹ Vertical accuracy of the aerial survey is such that 90% of the elevations are reported within 0.5 ft of the true elevation, and the remaining 10% are within 1 ft of the true elevation.

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REFERENCES

Beech and Bonaparte. "Appendix A-1: *Settlement Analyses for SCA Final Cover*," Onondaga Lake SCA Final Cover Design, dated April 2015.

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Figures

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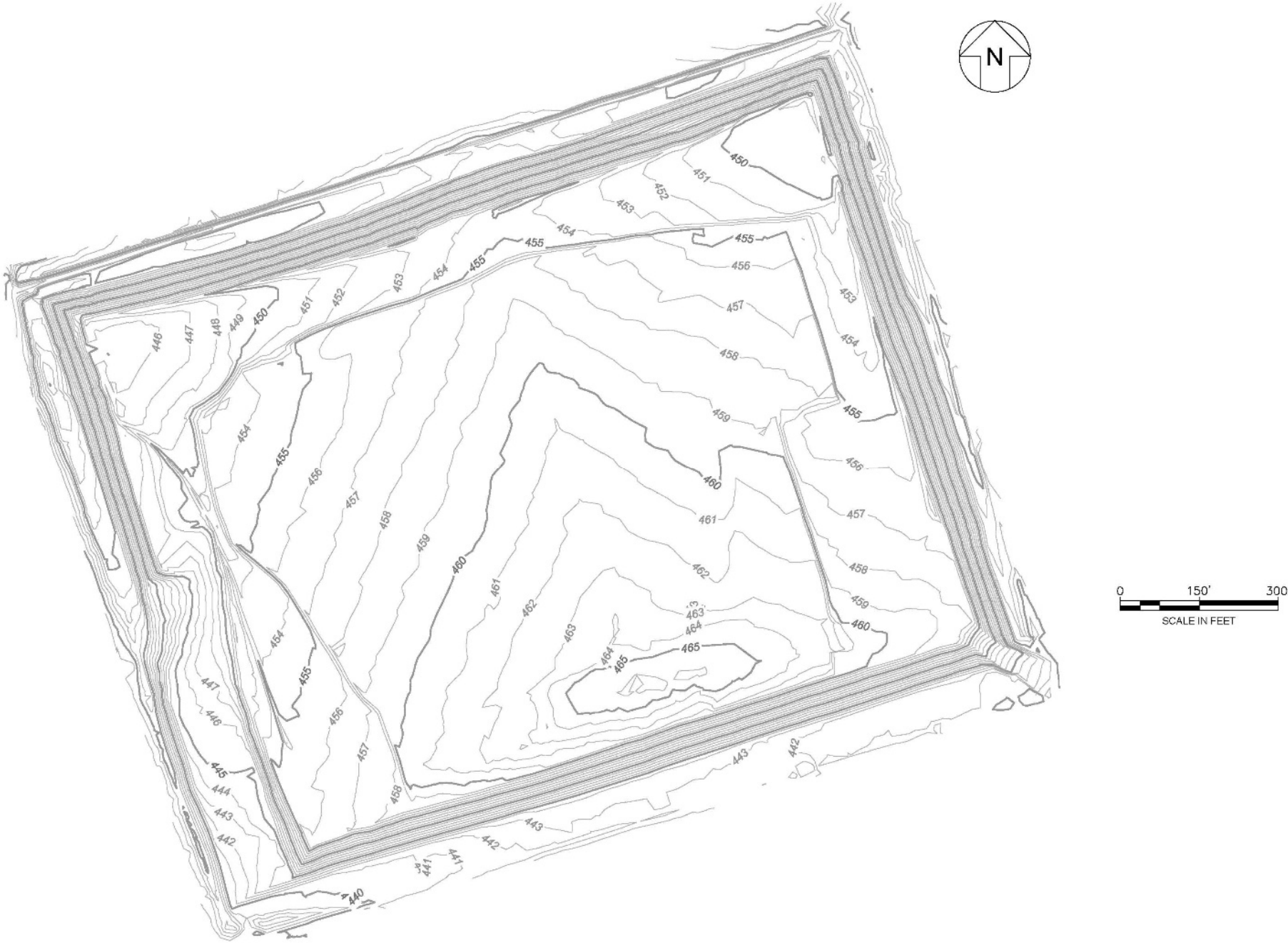


Figure 1. SCA survey performed 1 December 2015 (survey data provided by Parsons)

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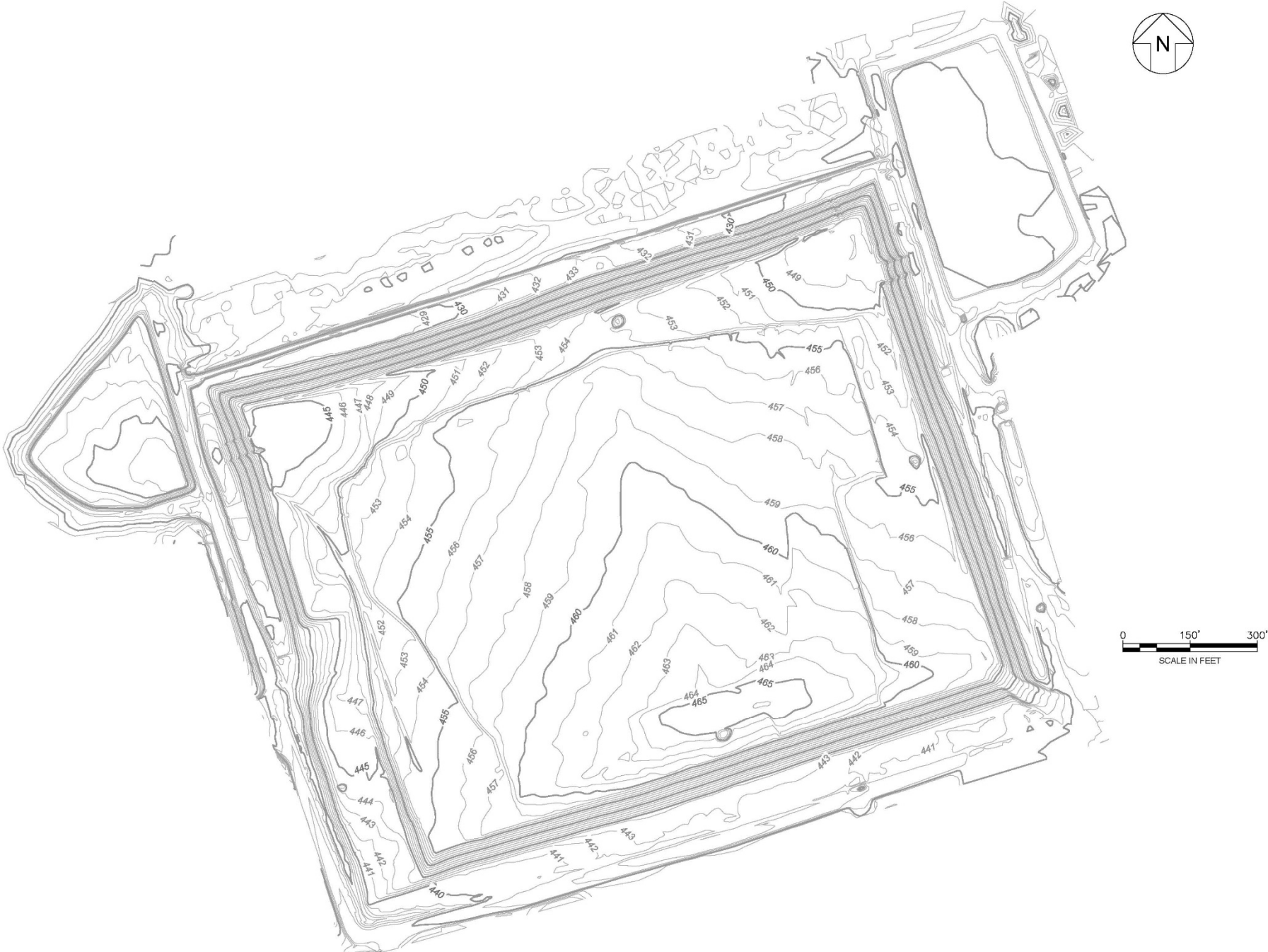
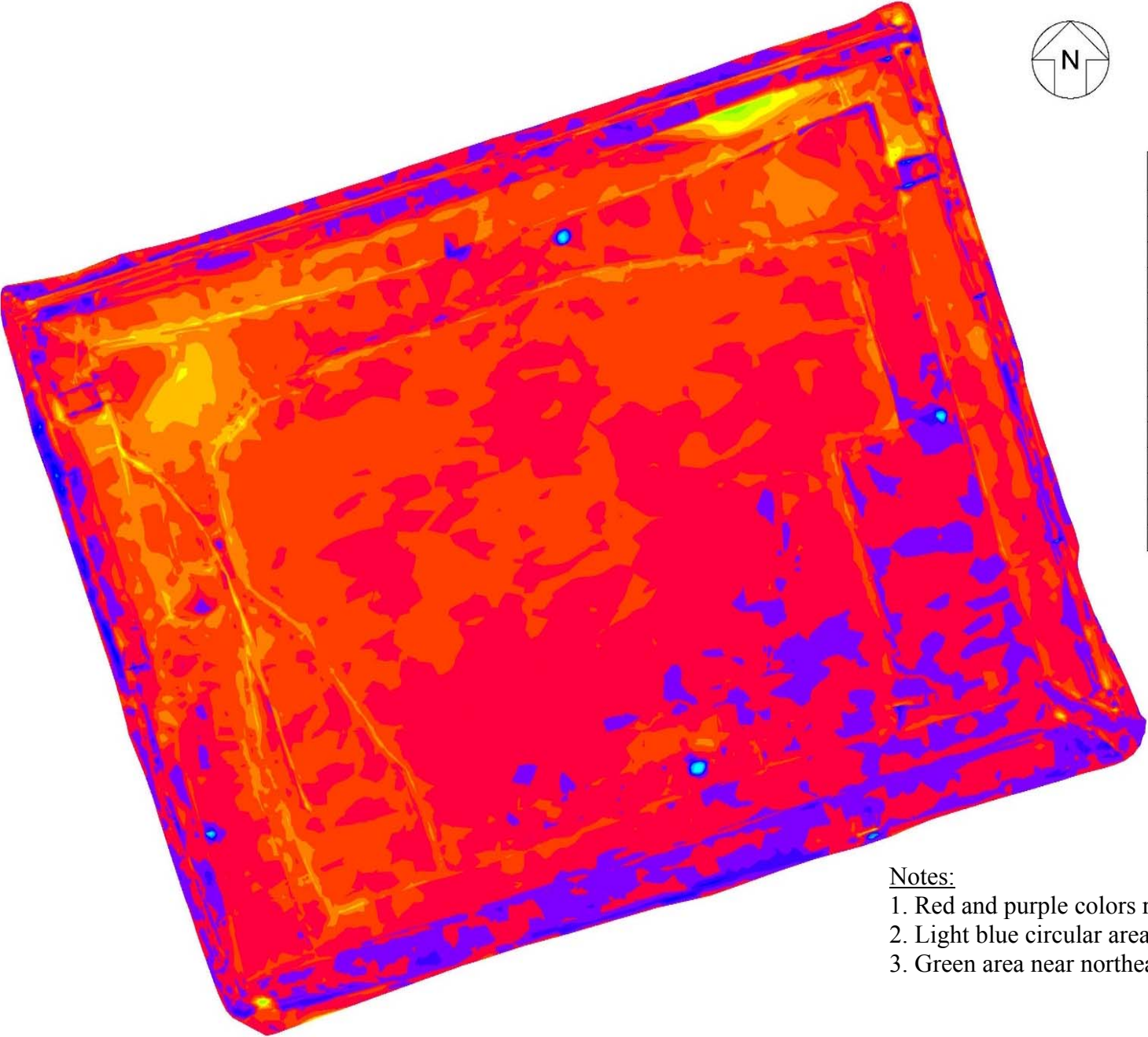
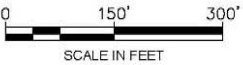


Figure 2. SCA survey performed 17 March 2016 (survey data provided by Parsons)

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ELEVATIONS TABLE				
NUMBER	MINIMUM ELEVATION CHANGE	MAXIMUM ELEVATION CHANGE	COLOR	AREA (AC)
1	-3.50	-3.00		0.01
2	-3.00	-2.50		0.04
3	-2.50	-2.00		0.12
4	-2.00	-1.50		0.70
5	-1.50	-1.00		3.60
6	-1.00	-0.50		17.93
7	-0.50	0.00		24.24
8	0.00	0.50		5.84
9	0.50	1.00		0.44
10	1.00	1.50		0.06
11	1.50	2.00		0.01
12	2.00	2.50		0.01
13	2.50	3.00		0.01



- Notes:
- 1. Red and purple colors represent change in elevation between ± 0.5 ft.
 - 2. Light blue circular areas represent rock piles placed after the December 2015 ground survey.
 - 3. Green area near northeast corner represents large erosion rill.

Figure 3. Isopach between SCA surveys performed 1 December 2015 and 17 March 2016 (survey data provided by Parsons)

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Figure 4. Location of Settlement Cells (SCs) in SCA

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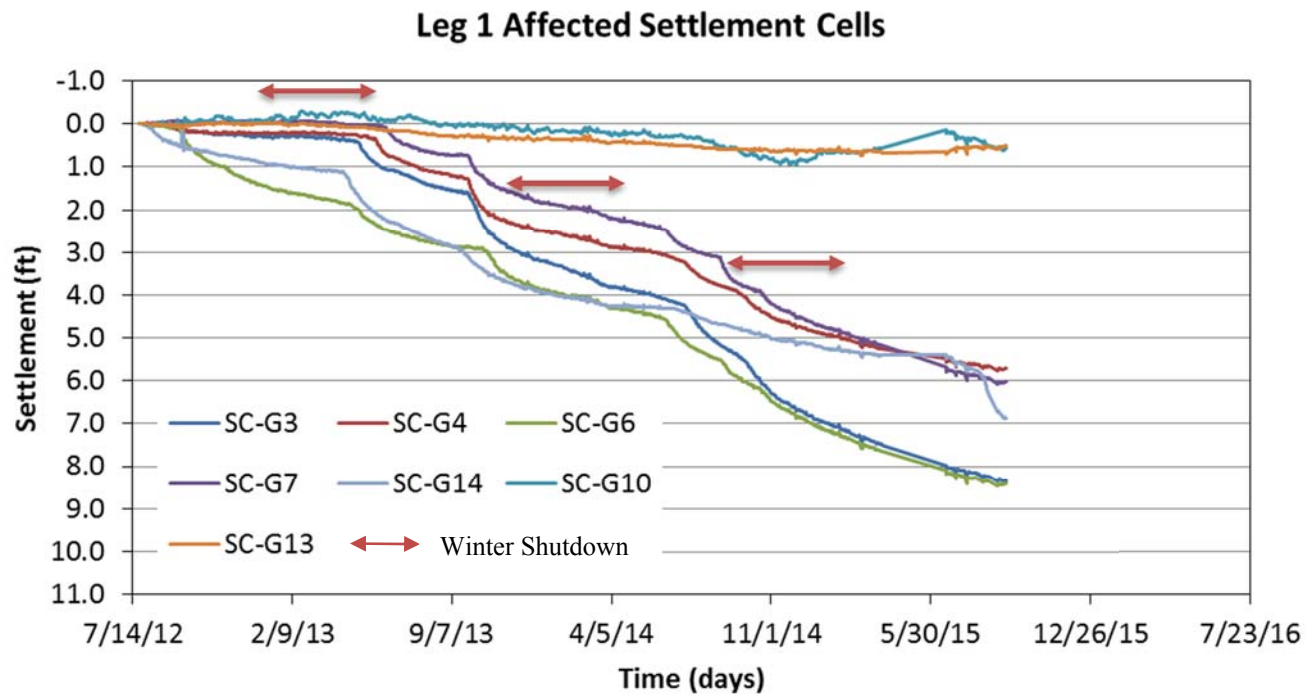


Figure 5A. Leg 1 Settlement Cell Data between 31 January 2012 and 6 April 2016
Note: Leg 1 was abandoned on 17 September 2015 due to an unrepairable leak within the SCA.
[Red arrows indicate approximate winter shutdown conditions]

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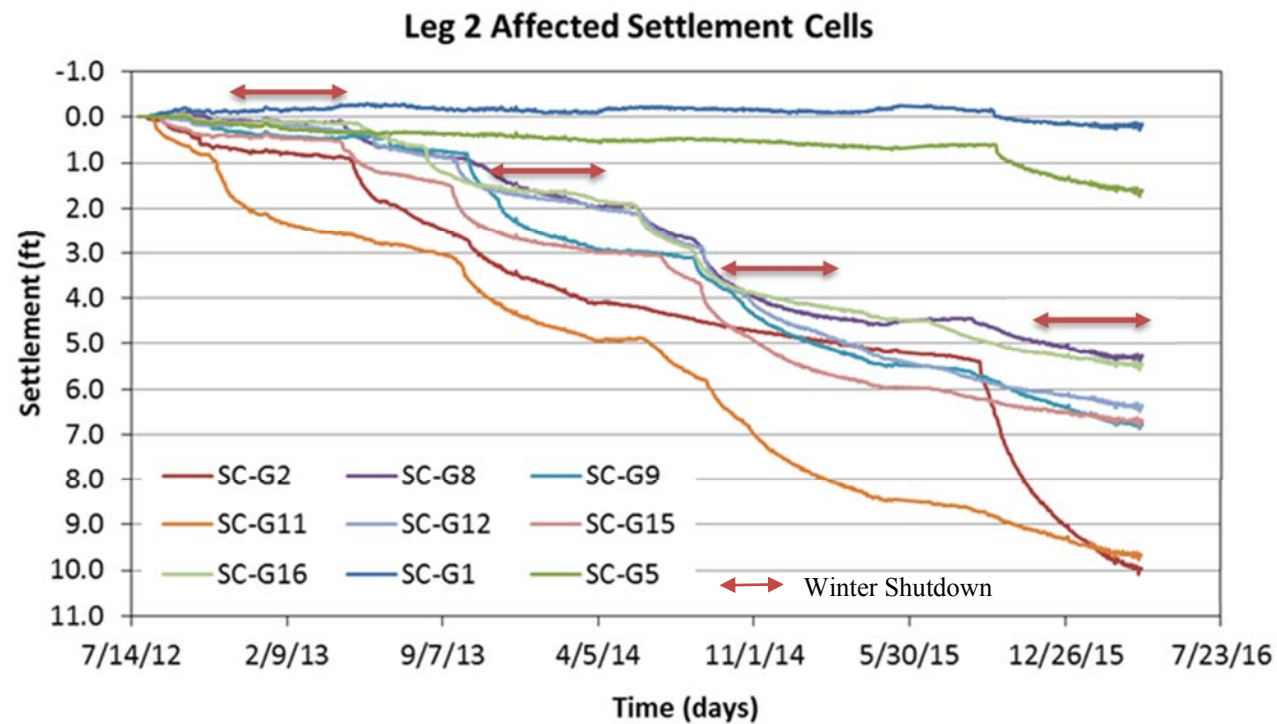


Figure 5B. Leg 2 Settlement Cell Data between 31 January 2012 and 6 April 2016
[Red arrows indicate approximate winter shutdown conditions]

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Leg 3 Affected Settlement Cells

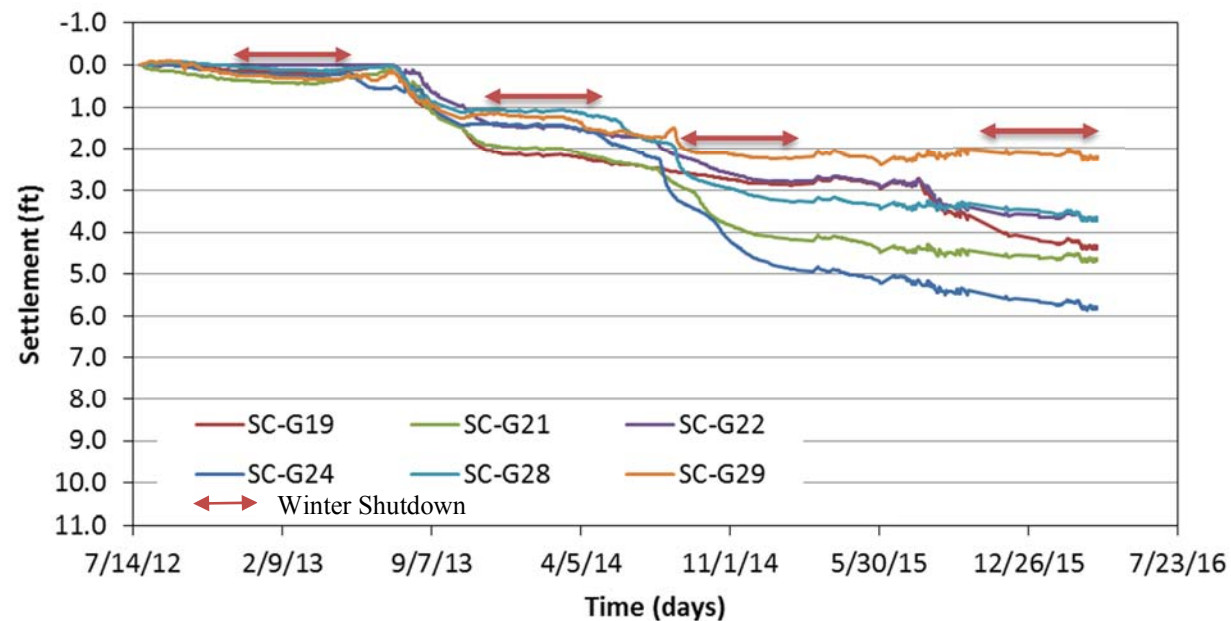


Figure 5C. Leg 3 Settlement Cell Data between 31 January 2012 and 6 April 2016
[Red arrows indicate approximate winter shutdown conditions]

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Leg 4 Affected Settlement Cells

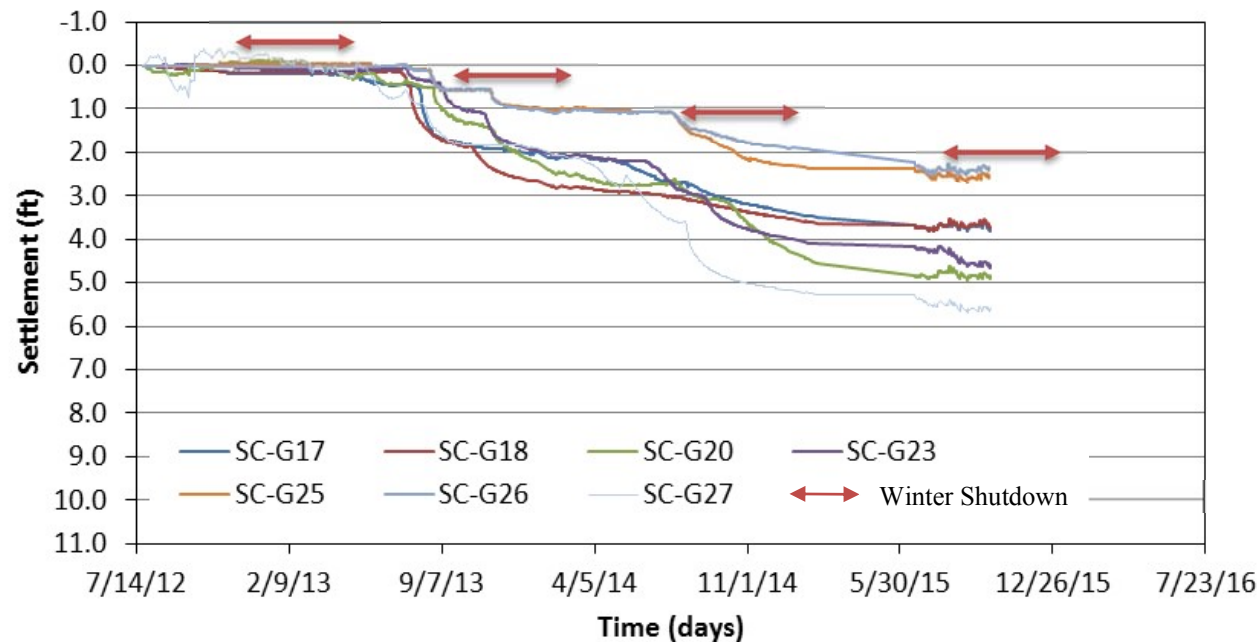


Figure 5D. Leg 4 Settlement Cell Data between 31 January 2012 and 6 April 2016

Note: Leg 4 data collection was interrupted as of 7 December 2015 due to a suspected leak in the hydraulic line.

[Red arrows indicate approximate winter shutdown conditions]