



July 22, 2016

John A. Hodge, Esq.
John Adams Hodge & Associates, LLC
9367 Two Notch Road
Suite C2B
Columbia, SC 29223

**Subject: Review of Impact of Blasting on Water Levels
 Vulcan Quarry, Cherokee County, South Carolina**

Dear Mr. Hodge:

SCHNABEL ENGINEERING LLC. (Schnabel) has completed a review of water level records from a bedrock well adjacent to the Vulcan Blacksburg Quarry in Cherokee County, SC. The review was completed to determine if there was an observable impact to water levels in the bedrock aquifer correlated to blasting events at the quarry.

PROJECT DESCRIPTION

Water level records were obtained from the SC Department of Natural Resources for well CRK-0074 located on property adjacent to the Vulcan Material Blacksburg Quarry in Cherokee County SC. The well has a reported depth of 265 feet and is completed in the crystalline bedrock aquifer. An automated data recorder collects water level information. The water level is reported daily. Water level data from November 1, 2013 to May 18, 2016 was reviewed. Attached is a copy of the well record for CRK0074 from the SCDNR website and an aerial photograph showing the location of the well based on the reported latitude/longitude coordinates. Well CRK0074 appears to be approximately 4200 feet from the active portion of the quarry.

Vulcan provided blasting records for the quarry covering the dates November 5, 2013 through June 29, 2016. Charts were prepared that graphed depth to water level in CRK0074 versus date for periods of time that included blast dates. Approximately seven to fourteen days of water level data before and after blast events were graphed to provide visual indications of any correlation between blast events and water level changes in CRK0074. Day to day changes in water level averaged a few tenths of a foot up or down.

To determine if there were any blasting effects on water levels I also examined hourly water level records. In most cases I examined the hourly water level changes for a period of at least 24 hours covering the day of a blasting event. This provided an opportunity to observe any overall trend in water levels for approximately 12 hours before and 12 hours after a blast event. Water levels before and after a blast event appeared to be approximately +/- 0.2 feet. No significant water level change was observed associated with a blast event.

Vulcan Blacksburg Water Level Review
Cherokee County, SC

On January 15, 2016 a blast event occurred at 1200. Water levels remained consistent for approximately 4 hours after the blast. Between 1400 and 2000 the water level dropped approximately 23 feet to 98 feet below the assumed datum. The water level remained at 98 feet for approximately 26 hours. The consistency of the water level at 98 feet suggest that the data recorder is set at 98 feet and the water level therefore may be below 98 feet. At 2200 on January 16, 2016, the water level began to recover and continued to recover for more than 24 hours. The shape of the curve of the plotted water levels suggests a classic pumping test recovery curve.

To determine if there may be nearby pumping activity that could influence water levels in CRK0074 I looked at hourly water level data covering periods where there was no blasting event. From midnight July 12, 2015 to midnight July 19, 2015 there were three significant water level declines. The first one started approximately at 1600 July 12 and continued until 1900. The water level declined from approximately 73.18 feet to approximately 93.95 feet. The level then rose steadily until 0600 July 13, 2015. At 1900 on July 15 another significant water level drop occurred. The water level declined approximately seven feet in two hours before beginning to recover over the next six hours. Finally at 1400 on July 17 dropped approximately twenty-five feet in three hours. The water level remained at or below 98 feet for five hours until beginning to recover at 2200 on July 17. Full recovery was apparent by 1800 July 17, 2015. No blast event occurred during this period.

Starting at 1600 on January 7, 2014 the water level declined from 72.3 feet to 95.76 feet over five hours. The water level recovered starting at 2100 and continuing for the next seven hours. There was no blast event during that period. Again the shape of the curve of the plotted water levels as they rose suggests a classic pumping test recovery curve.

CONCLUSION

For the period of record examined we found no relationship between water levels in well CRK0074 and blasting events at the Vulcan Blacksburg Quarry approximately 4200 feet away. There were significant water level declines and recovery over relatively short time periods (hours) not associated with blast events. We attribute these deviations to local ground water pumping and not quarry activities. We appreciate the opportunity to provide our services. Please contact us if you have any questions regarding this review.

Sincerely,
SCHNABEL ENGINEERING LLC



Raymond L. Knox, PG (SC#311)
Senior Associate

RK:RK

Vulcan Blacksburg Water Level Review
Cherokee County, SC

Attachments:

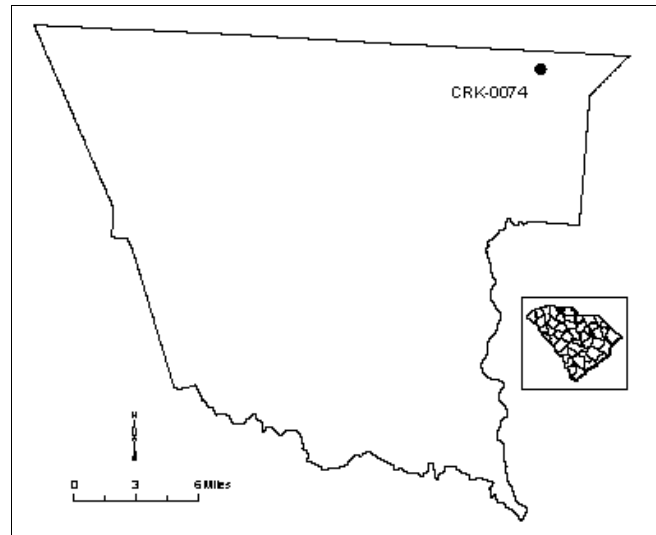
CRK0074 well info

CRK0074 location aerial

Water level graphs

Monitoring Wells in Cherokee County

Click well ID to retrieve daily average groundwater levels



Well ID	Elevation	Latitude	Longitude	Depth	Aquifer	Status
CRK-0074	825	35 09 19	81 26 34	265	Crystalline Rock	ADR

Status column:

ADR: Water level is continuously measured on an hourly basis.**Manual:** Water level is periodically measured on a bi-monthly basis.**Inactive:** Water level is not currently monitored.**Abandoned:** Well has been permanently abandoned and water levels can no longer be measured.

our map.



Elm Rd

Belton Dr

2278

Frontage Rd

Caveny Rd

S-11-60

CRK 0074

Mill Creek Rd

State Rd S-11-21

arrigan Dr

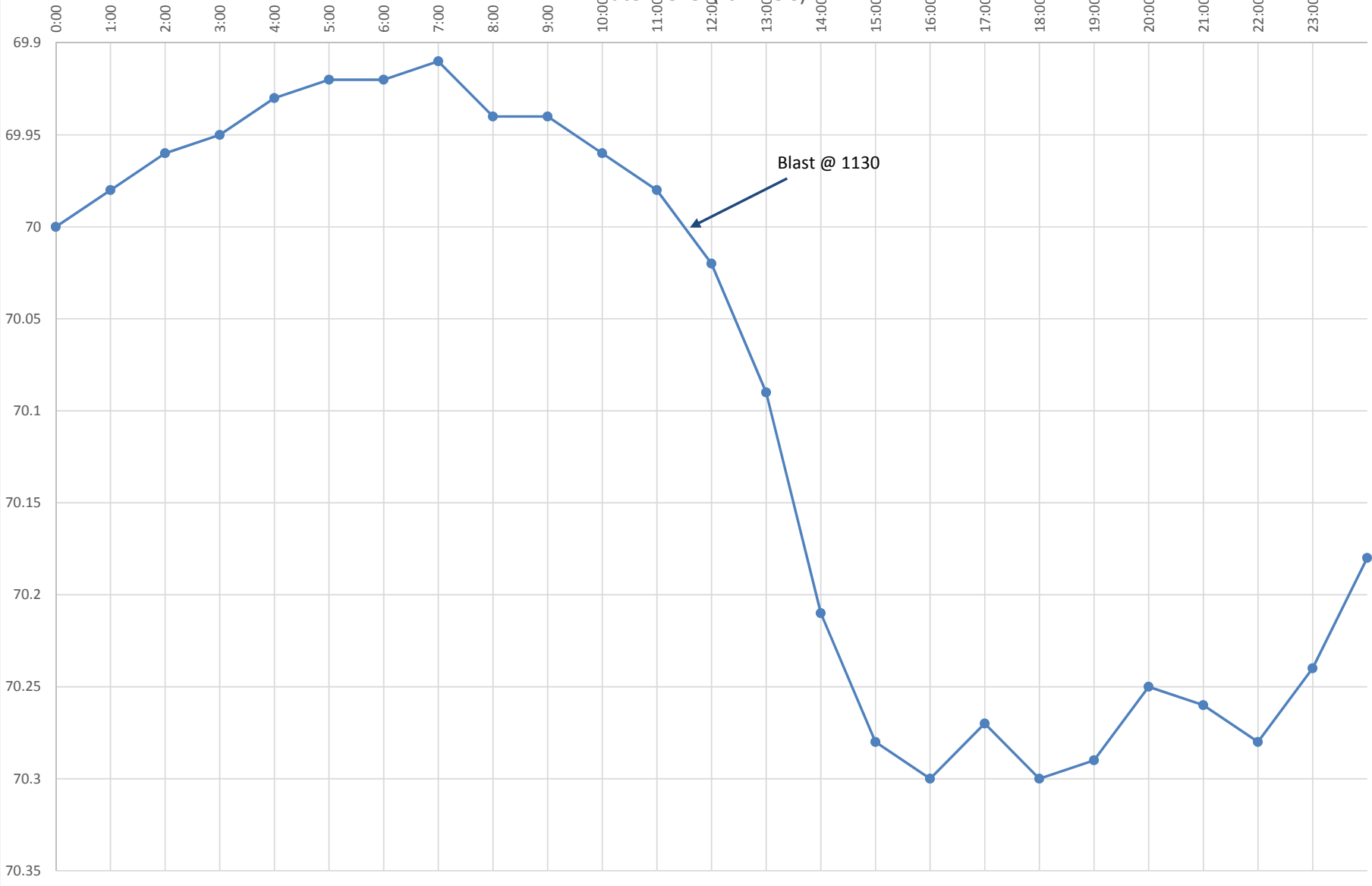
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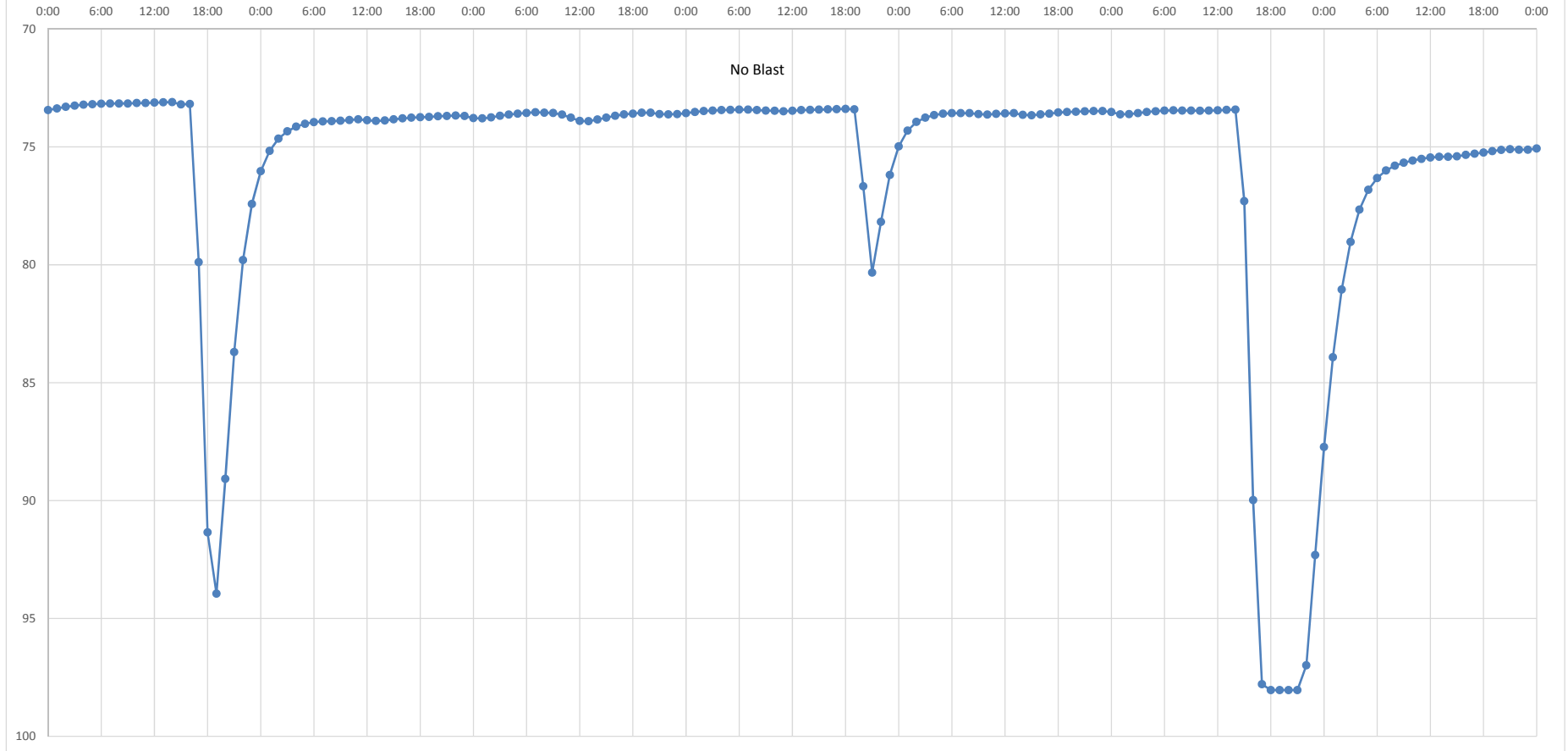
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- The Inn
- WilcoHe
- William

4000

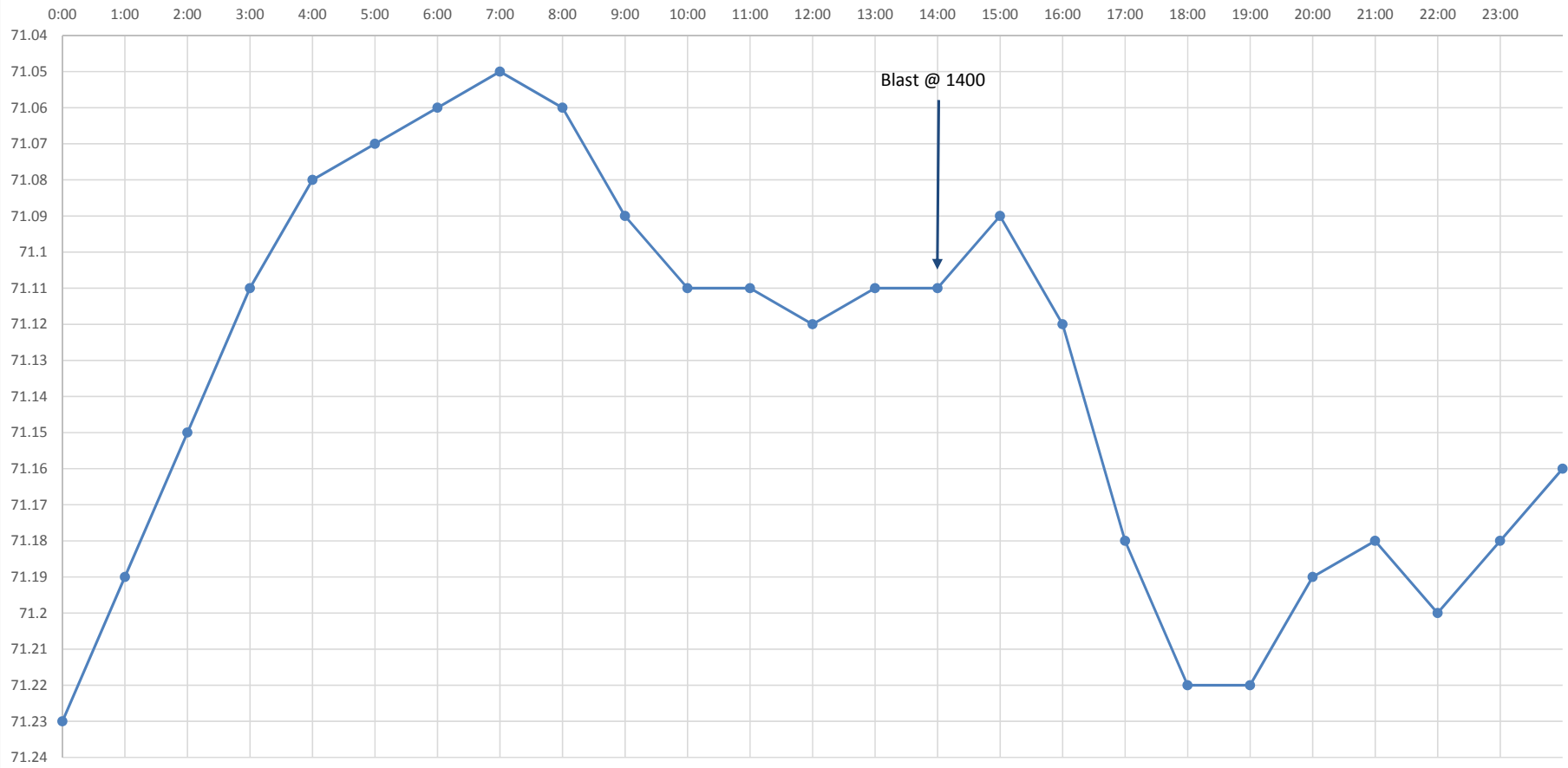
CRK0074
08/13/14
Water Level (ft. BTOC)



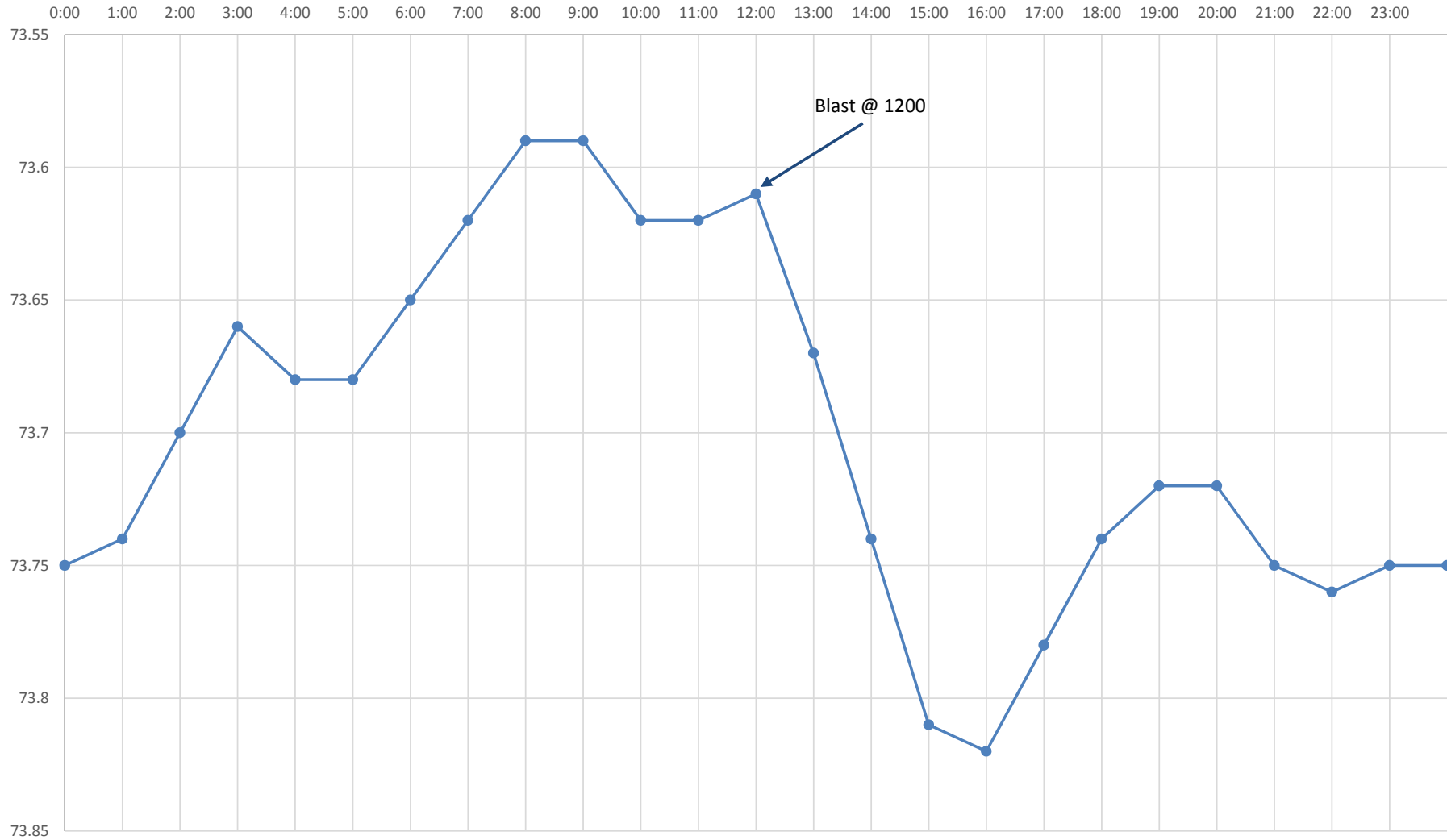
CRK0074
7/12/15
Water Level (ft. BTOC)



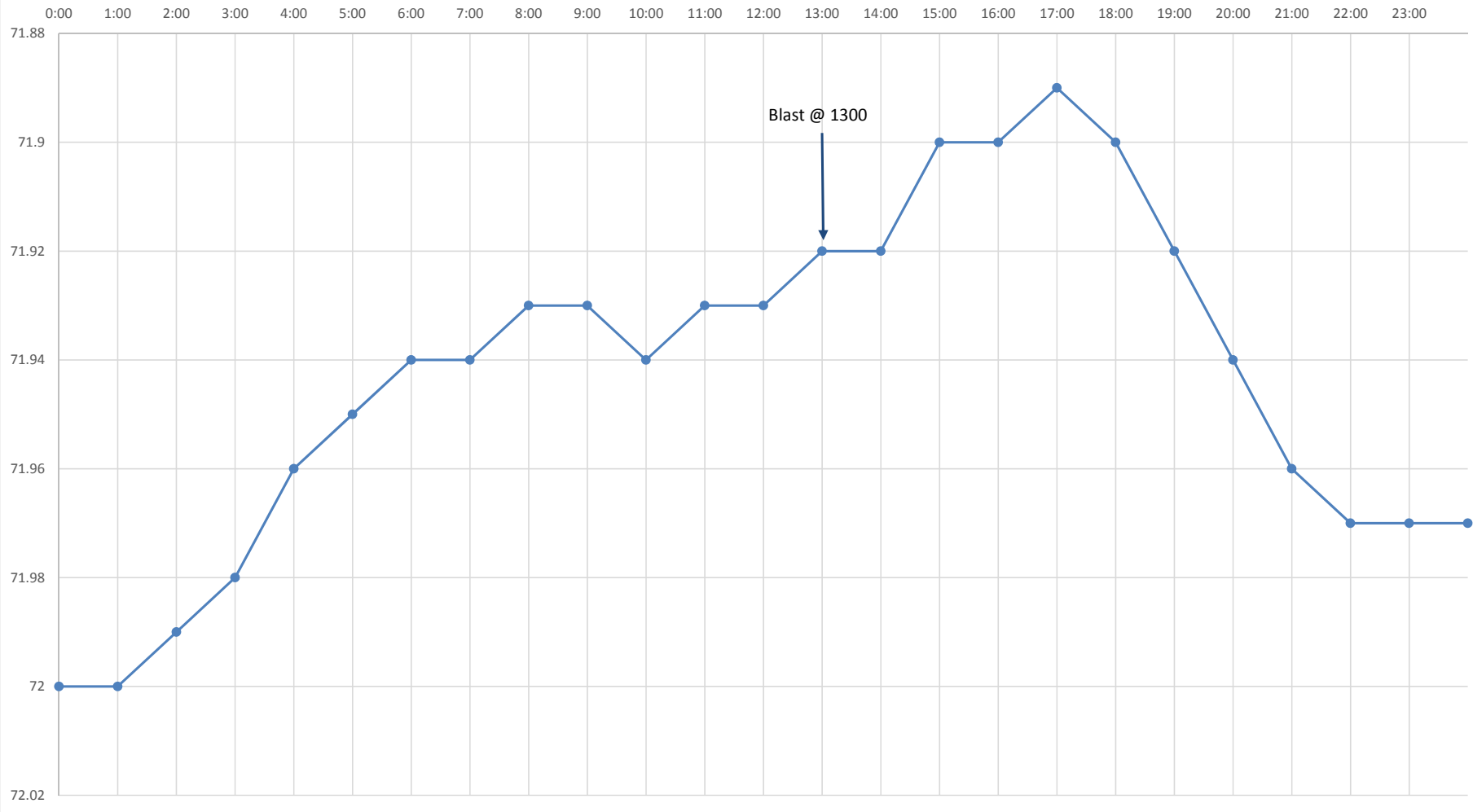
CRK0074
02/18/14
Water Level (ft. BTOC)



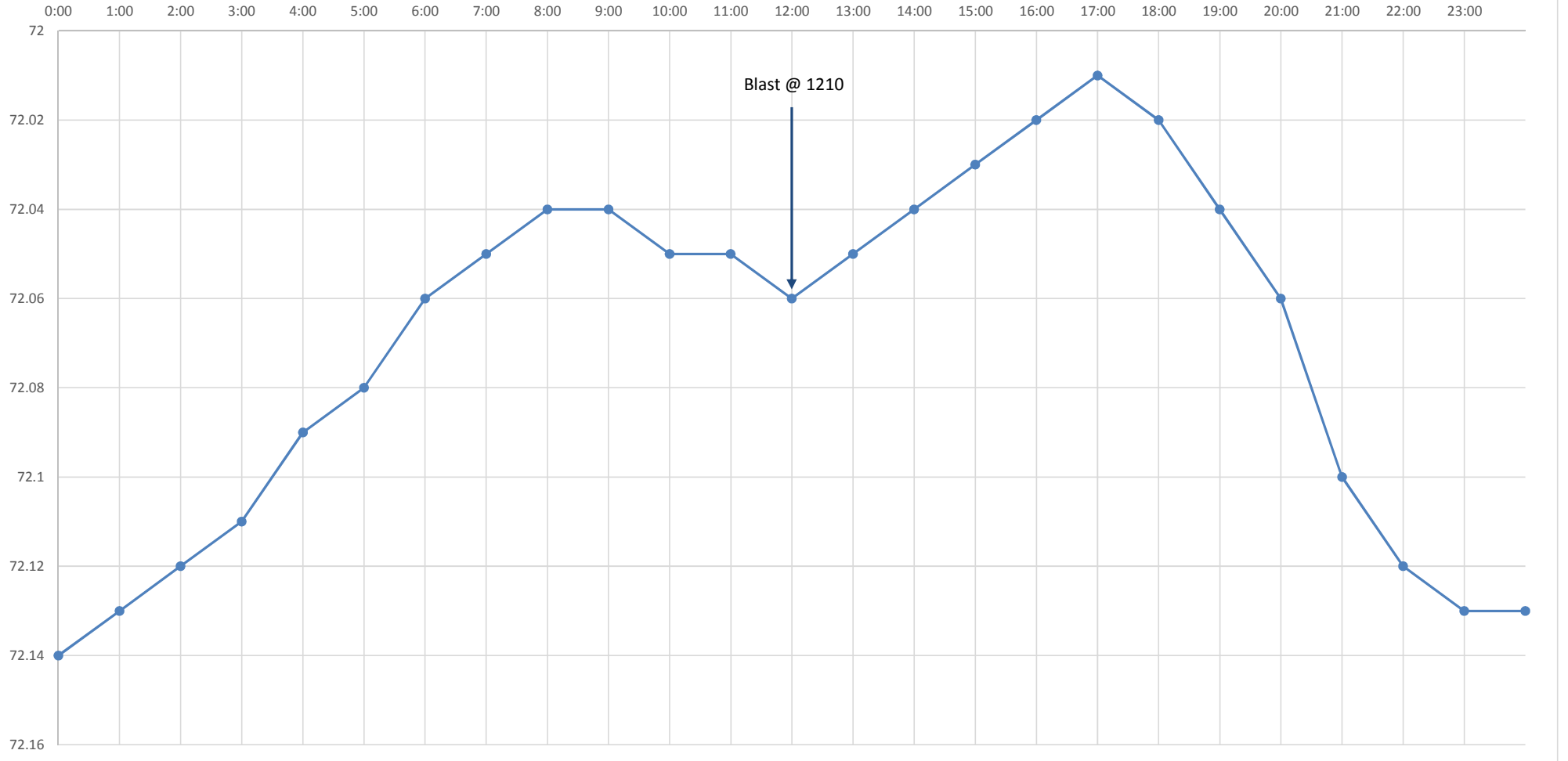
CRK0074
01/20/15
Water Level (ft. BTOC)



CRK0074
11/14/13
Water Level (ft.BTOC)



CRK0074
11/05/13
Water Level (ft. BTOC)



CRK00744

01/15/16

Water Level (ft. BTOC)

