-----Original Message-----

From: **Gates, Bill (Efdsouth) [mailto:GatesWH@EFDSOUTH.NAVFAC.NAVY.mil]**
Sent: Wednesday, March 06, 2002 9:08 AM
To: Ramanauskas Peter (E-mail)
Cc: Basinski Ralph (E-mail); Brent Tom (E-mail)
Subject: Dye Burial Grounds Phase II Ground Water Monitoring

Dye Burial Ground Tech Memo on... | Figure 1 DBG Positive Detectio... | Figure 2 DBG Upper Pennsylvani... | Figure 3 DBG Lower Pennsylvani... | Figure 4 DBG Golconda Haney Co.. | Figure 5 DBG Beech Creek Conto...

Pete,

The attached Tech Memo with figures provides an evaluation of the necessity of performing a second round of ground water investigation at the Dye Burial Grounds. Request your review and comments.

Thanks,
Bill

<<Dye Burial Ground Tech Memo on Phase II GW SA_1_.doc>>
<<Figure 1 DBG Positive Detections of Inorganics in DBG Ground Water.pdf.pdf>> <<Figure 2 DBG Upper Pennsylvanian Contours.pdf>> <<Figure 3 DBG Lower Pennsylvanian Aquifers.pdf.pdf>> <<Figure 4 DBG Golconda Haney Contours.pdf>> <<Figure 5 DBG Beech Creek Contours.pdf>>

ADDITIONAL INVESTIGATION OF THE DYE BURIAL GROUND NSWC, CRANE

OVERVIEW

This technical memorandum was developed to evaluate the necessity of performing a second round of ground water investigation at the Dye Burial Ground located at NSWC Crane, as detailed in the RFI Work Plan dated May 2001. The potential second round of investigation includes the sampling of additional existing monitoring wells and the installation of new monitoring wells, and was intended to be contingent on the results of the initial sampling round. The initial sampling round has been performed, and is summarized in this document, as well as a recommendation not to conduct additional sampling this site.

The RFI Work Plan included the following statements in the second paragraph of section 5.5.2.2, regarding additional activities:

> "If dyes are not detected and if detected inorganic concentrations do not exceed upgradient concentrations, the second round of ground water sampling will not be conducted and the conclusion will be made that contamination is not migrating from the disposal areas. If dyes are detected or if detected inorganic concentrations exceed upgradient concentrations, the second round of ground water sampling will be conducted to evaluate the nature and extent of ground water contamination."

The RFI Work Plan further states in the third paragraph of Section 5.5.2.2 that:

> "An additional well cluster (02T01, 02T01P2, 02T01P3) may be installed at a location northeast of the site, if it is determined that ground water in the Pennsylvanian aquifer at the northeastern portion of the site flows in that direction".

NATURE AND EXTENT OF CONTAMINATION

Military dyes are the primary constituent of concern at the DBG. All of the military dyes disposed at the DBG were organic compounds. Dyes disposed at the DBG did not contain metals. Ground water samples were collected from the Upper Pennsylvania aquifer because this aquifer is in direct contact with the dye burial trenches. As noted below, the Upper Pennsylvanian aquifer is of limited areal extent and Upper Pennsylvania ground waters not discharging as seeps would infiltrate into the Lower Pennsylvanian aquifer. Therefore, ground water samples were also collected from the Lower Pennsylvania aquifer.

Dyes were not detected in any of the ground water samples collected from the Upper Pennsylvanian or the Lower Pennsylvania aquifers during Phase 1 sampling. Metals were detected in both Upper Pennsylvanian and Lower Pennsylvanian ground water samples. Figure 1 is a tag map showing metals in concentrations above detection limits for each monitoring well that was sampled. Concentrations of metals were higher in downgradient Lower Pennsylvanian wells than upgradient wells. The highest metals concentrations were observed in MW02C11P3. In this well, two metals (beryllium and cadmium) were detected in excess of MCLs, and beryllium was the only detection of this compound in all of the wells sampled. The measured pH at this well of 3.68 was much more acidic than the measured pH of any other well. This could account for the high metals concentrations because the solubility of most metals increases in waters with acidity. This acidic pH is not attributable to the dyes disposed at the DBG. Measured pHs at the other motoring wells ranging from 5.22 to 6.23 were much less acidic. The metals concentrations also were lower. If the acidic pH was due to the dyes disposed at the DBG than acidic pHs should also have been observed at other DBG wells. The Pennsylvanian aquifer is known to contain discontinuous coal seams. Ground water which has been in contact with coal would be more acidic and would be expected to have higher metals concentrations.

The lack of any detection of dyes in any ground water sample demonstrates that dyes are not migrating from the DBG in ground water. The presence of metals in downgradient wells cannot be attributed to the composition of dyes disposed at the DBG. Metals are naturally present in ground waters and fluctuate in concentration. It is necessary to determine the nature and extent of contamination that is attributable to disposal operations at the DBG. It is not necessary to determine the nature and extent of contamination that is not attributable to the DBG. Because the metals in the ground water cannot be attributed to DBG disposal operations, it is not necessary to conduct Phase II ground water sampling to determine nature and extent of metals contamination.

The ultimate use of ground water analytical data is for the assessment of risk to human health. These risk assessments are conducted using data from the most concentrated portion of any ground water plume. In the case of the DBG, the human health risk assessment will be conducted using the data from the wells with the highest metals concentrations. The metals data for the ground water samples collected in the Phase I DBG sampling was compared to historical ground water metals data contained in section 5.4 of the Work Plan. The Phase I data is comparable to historical data. Therefore, additional ground water samples are not likely to provide useful data for human health risk assessment purposes.

UNDERSTANDING OF GROUND WATER FLOW DIRECTION

The DBG lies along the crest of north – northwest trending ridge that separates Sulphur Creek to the northeast from Little Sulphur Creek to the southwest. The elevation at the site is approximately 740 feet above msl and slopes in all directions except to the northeast, where the land surface rises to meet the highest point of the ridge at an elevation of approximately 770 above msl. Principal drainage from the site area is to the south and southwest toward Little Sulphur Creek.

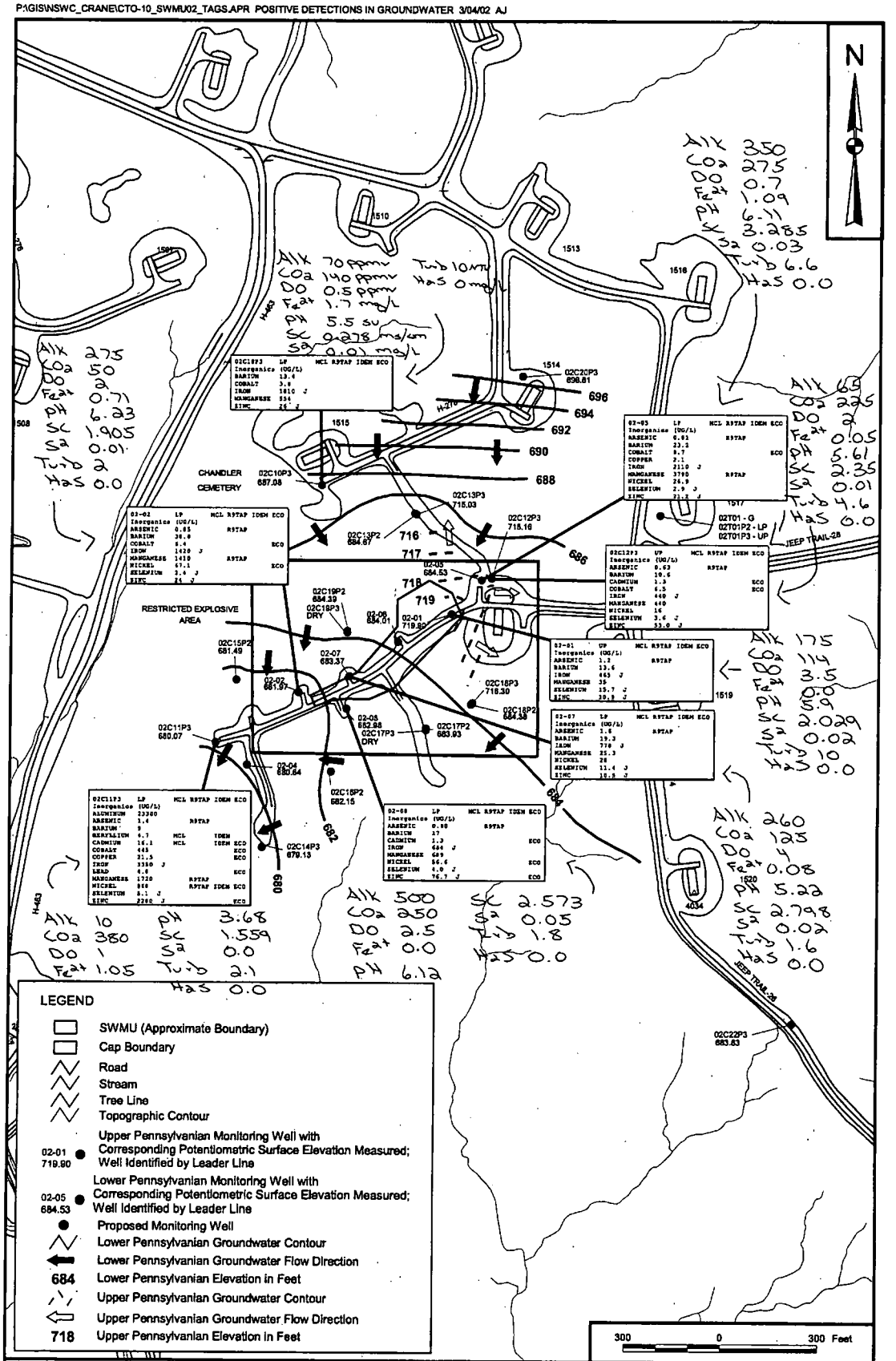
The shallowest ground water beneath the Dye Burial Ground exists in the Upper Pennsylvanian aquifer. Ground water in the upper Pennsylvanian aquifer is reported by the USACE to be perched and limited in extent (U.S.ACE, 1994). Both the physical and saturated extent of the Upper Pennsylvanian aquifer has been identified by the USACE, and is depicted as the Upper "B" sand unit as shown on Figure 2. The boundary of the upper Pennsylvanian aquifer is identified where the ground surface slopes downward intersecting and exposing the unit in outcrops. Ground water in the upper Pennsylvanian aquifer flows toward the north and southeast, based on the most recent water level measurements taken by TtNUS in the fall of 2001. The relatively small lateral extent of the upper Pennsylvanian aquifer limits ground water flow, and it is expected that ground water in this unit drains vertically into the underlying lower Pennsylvanian aquifer. Upper Pennsylvanian ground water does not appear to discharge to the surface, because no visible seeps exist in outcrops along the slopes of the hills bordering the site. The potentiometric surface contours depict ground water in the Upper Pennsylvanian aquifer to flow toward the north and southeast and not toward the northeast in the direction of the proposed monitoring well cluster.

Ground water in the underlying aquifers, (Lower Pennsylvanian, Golconda, and Beech Creek aquifers, Figures 3, 4, and 5) all depict ground water flow to the south – southwest toward Little Sulphur Creek.

CONCLUSION

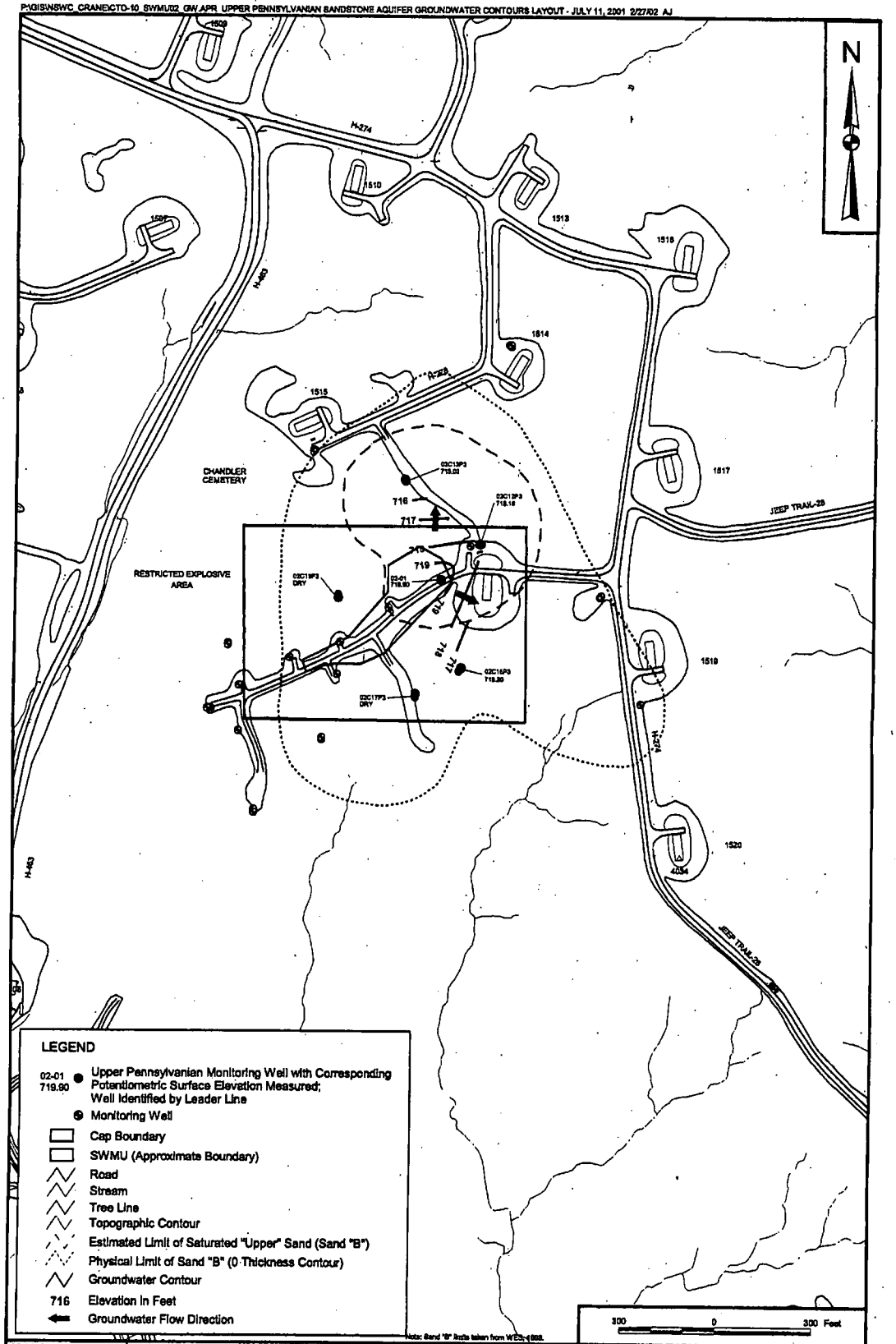
Given the current understanding of ground water flow directions, the potential for ground water in the Pennsylvanian aquifers or underlying aquifers to flow toward the northeast is low. Consequently additional monitoring well installation is not necessary. Additional ground water sampling is also not needed since the Phase I ground water samples adequately defined the nature and extent of contamination.

P:\GIS\NSWC_CRANE\CTO-10_SWMU02_TAGS.APR POSITIVE DETECTIONS IN GROUNDWATER 3/04/02 AJ



DRAWN BY	DATE	Tetra Tech NUS, Inc.	CONTRACT NUMBER	OWNER NUMBER
J. LAMEY	1/29/02		7141	CTO 0010
CHECKED BY	DATE	POSITIVE DETECTIONS OF INORGANICS, ORGANICS, AND SELECT MISCELLANEOUS PARAMETERS IN GROUNDWATER SWMU 2 - DYE BURIAL GROUNDS NSWC CRANE, INDIANA	APPROVED BY	DATE
COST/SCHEDULE-AREA			APPROVED BY	DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1	REV 0

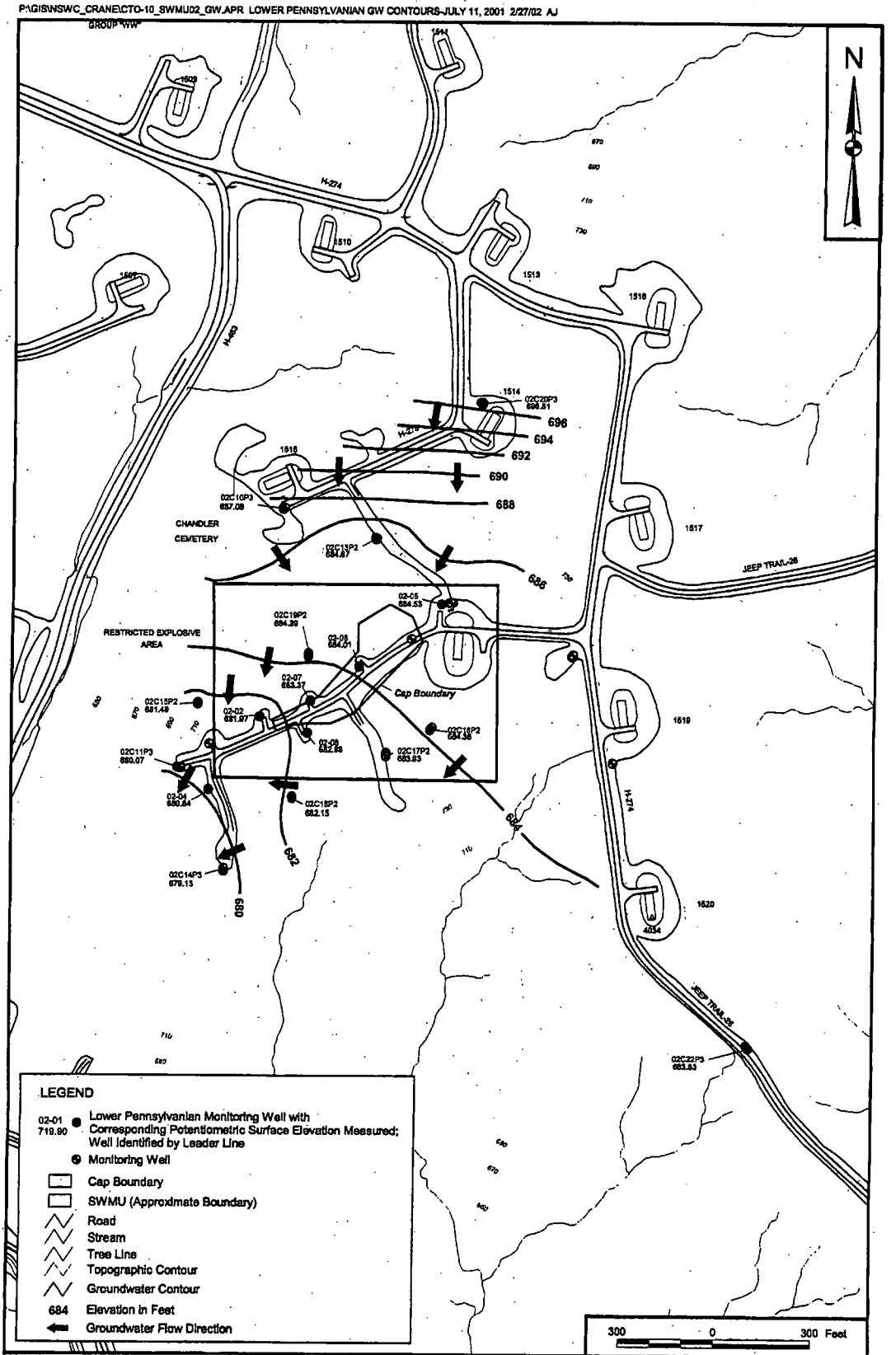
P:\GIS\NSWC_CRANE\CTO-10_SWMU\02_GW_APR_UPPER PENNSYLVANIAN SANDSTONE AQUIFER GROUNDWATER CONTOURS LAYOUT - JULY 11, 2001 2/27/02 AJ



Note: Sand "B" limits taken from WES-1998.

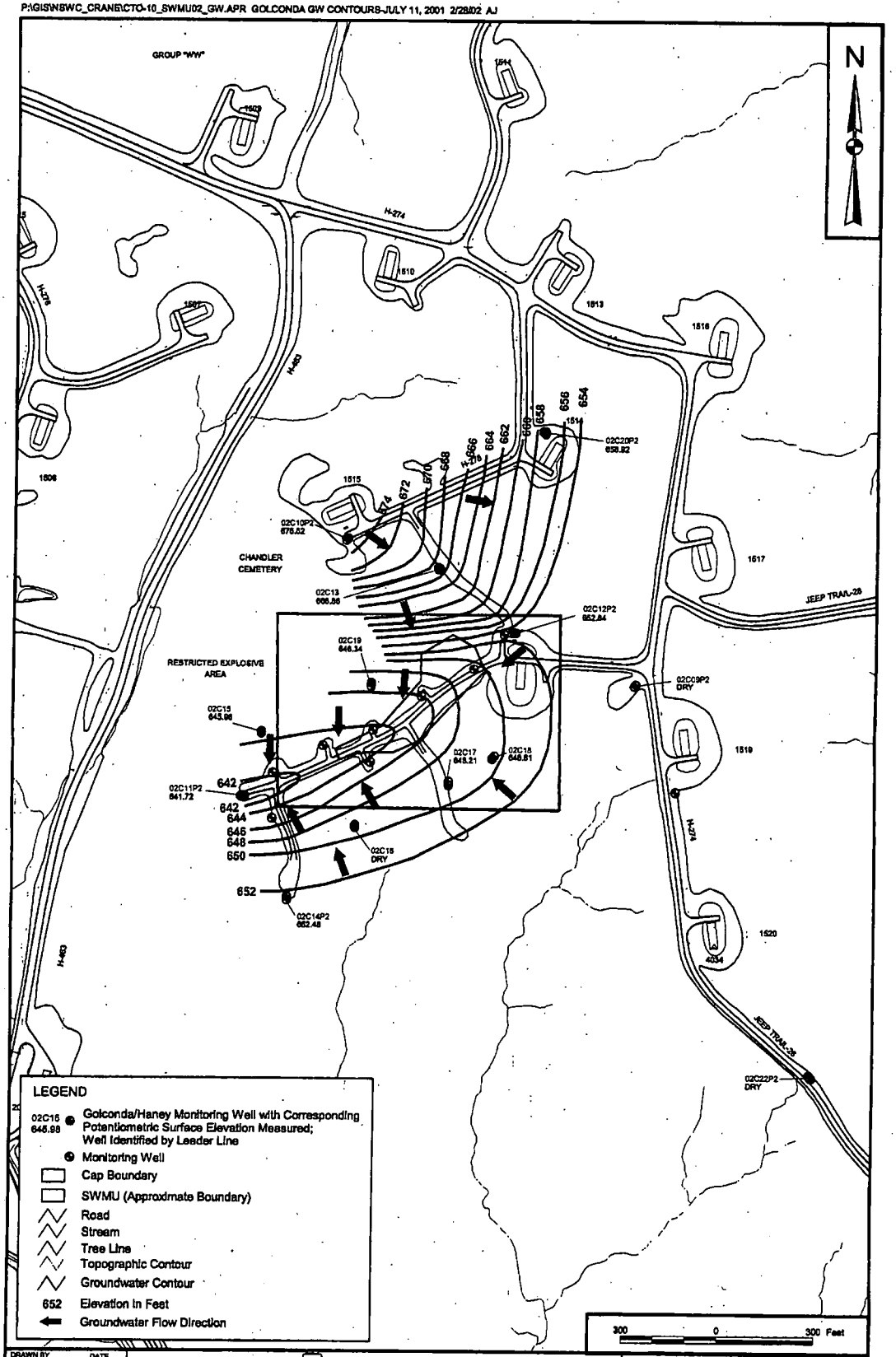
DRAWN BY J. LAMEY	DATE 7/25/01	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7141 / OWNER NUMBER CTO 0010
CHECKED BY M. COCHRAN	DATE 2/27/02	UPPER PENNSYLVANIAN SANDSTONE AQUIFER GROUNDWATER CONTOURS JULY 11, 2001 SWMU 2 - DYE BURIAL GROUNDS NSWC CRANE, INDIANA	APPROVED BY — / DATE —
COST/SCHEDULE-AREA			APPROVED BY — / DATE —
SCALE AS NOTED			DRAWING NO. FIGURE 2 / REV 0

P:\GIS\NSWC_CRANE\CTO-10_SWMU02_GW.APR LOWER PENNSYLVANIAN GW CONTOURS-JULY 11, 2001 2/27/02 AJ



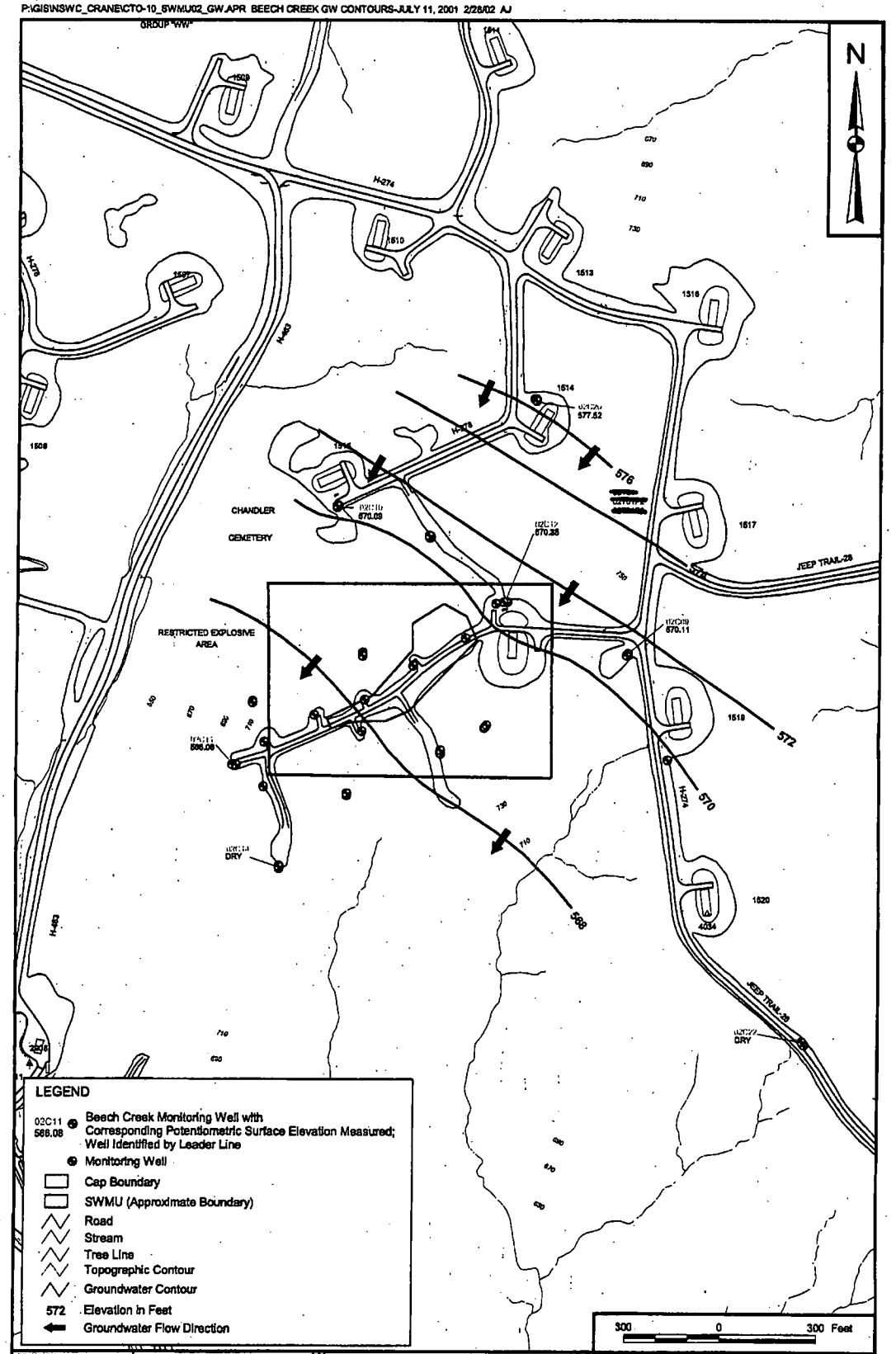
DRAWN BY J. LAMEY	DATE 7/25/01	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7141 / OWNER NUMBER CTO 0010
CHECKED BY M. DOCHRAN	DATE 2/27/02	LOWER PENNSYLVANIAN SANDSTONE AQUIFER GROUNDWATER CONTOURS JULY 11, 2001 SWMU 2 - DYE BURIAL GROUNDS NSWC CRANE, INDIANA	APPROVED BY / DATE
COST/SCHEDULE-AREA			APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 3 / REV 0

P:\GIS\NSWC_CRANE\CTO-10_SWMU02_GW.APR GOLCONDA GW CONTOURS-JULY 11, 2001 2/28/02 AJ



DRAWN BY J. LANEY	DATE 7/25/01	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7141 / OWNER NUMBER CTO 0010
CHECKED BY M. COCHRAN	DATE 2/28/02	GOLCONDA/HANEY LIMESTONE AQUIFER GROUNDWATER CONTOURS JULY 11, 2001 SWMU 2 - DYE BURIAL GROUNDS NSWC CRANE, INDIANA	APPROVED BY / DATE
COST/SCHEDULE-AREA			APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 4 / REV 0

P:\GIS\NSWC_CRANE\CTO-10_SWMU\02_GW.APR BEECH CREEK GW CONTOURS-JULY 11, 2001 2/28/02 AJ



DRAWN BY J. LAMBY DATE 7/25/01	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7141	OWNER NUMBER CTO 0010
CHECKED BY M. COCHRAN DATE 2/28/02	BEECH CREEK LIMESTONE AQUIFER GROUNDWATER CONTOURS JULY 11, 2001 SWMU 2 - DYE BURIAL GROUNDS NSWC CRANE, INDIANA	APPROVED BY — DATE —	
COST/SCHEDULE-AREA		APPROVED BY — DATE —	
SCALE AS NOTED		DRAWING NO. FIGURE 5	REV 0