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April 30, 2008

Mr. William Kutash
Florida Department of Environmental Protection
Waste Management Division
13051 N. Telecom Parkway
Temple Terrace, FL 33637-0926

Re: Groundwater Modeling Interim Report – Hydraulic Containment
Former American Beryllium Company Site
OGC #04-1328
Tallevast, Manatee County, Florida

Dear Mr. Kutash:

GeoTrans is pleased to submit the following Groundwater Flow and Transport Model Hydraulic Containment Interim Report for the former American Beryllium Company Site in Tallevast, Florida. The purpose of this report is to document the progress of groundwater modeling activities being conducted as part of the preparation of the revised Remedial Action Plan (RAP) to be submitted on September 1, 2008.

1. Introduction

To support the preparation of a final Remedial Action Plan (RAP) for the former American Beryllium Company site (**Figure 1**), a three-dimensional computer model of groundwater flow and contaminant mass fate and transport is under development on behalf of Lockheed Martin Corporation (LMC). For development of the final RAP, the model will be used to assess capture and remediation alternatives of the contaminants of concern (COCs) in groundwater and to estimate remediation timeframes. This model will also be used as a tool for performance assessment during implementation of the remedy. The model is described in a report prepared by GeoTrans and submitted to the Florida Department of Environmental Protection (FDEP) in March 2008 (GeoTrans, 2008).

The purpose of this memorandum is to present a summary of the status of model simulations conducted to date to support the evaluation of potential groundwater capture (hydraulic control) scenarios in the surficial and intermediate zone aquifers at the Tallevast site. The objective of this modeling is to develop a *conceptual design* for a plume containment system that is effective in containing contaminated groundwater in excess of groundwater cleanup target levels (GCTLs) and that is also implementable and practical.

Wells and trenches are the only remediation elements being considered for hydraulic capture and the only elements being reported on in this interim documentation. The preliminary distribution of wells and trenches used in the hydraulic containment simulations was based on consideration of the distribution of COCs in each of the hydrostratigraphic units. Extraction wells were placed more densely within zones containing COCs in excess of ten-times their respective GCTLs than in zones containing COCs at lesser concentrations. The objective of this concept was to produce a faster pore-water exchange rate in the more concentrated zones (on the order of one pore-water volume per two years) while maintaining capture in the less concentrated zones.

The work summarized herein is the successor to preliminary work conducted for and included in the Remedial Action Plan that was submitted to the FDEP in 2007 (ARCADIS-BBL, 2007). Those simulations were conducted using a series of independent, two-dimensional groundwater flow models. The new model is fully three-dimensional and reflects more site specific data (collected in the Fall/Winter of 2007/2008), thus capture results predicted by the current model are different from those predicted using the two-dimensional models.

The work reported herein was conducted according to the following set of analysis steps, which are described in the sections of this document (indicated in parentheses):

- The goals and objectives for hydraulic capture and containment were selected, and specific criteria for setting target capture zones and the rate of pore volume exchange were established (Section 1).
- The information and data on geologic layering and hydrogeologic properties was developed into a conceptual model that served as the basis for a numerical groundwater flow model representation (Section 2).
- Groundwater quality data values were used to define the target areas for remediation within the geologic units in which concentrations were above relevant criteria (Section 3).
- The numerical modeling approach was defined, including the methods for simulating extraction wells and trenches, including their hydraulic efficiencies, and for delineating the simulated extent of the capture zones that the remediation pumping systems would create (Section 4).
- A series of scenarios were defined and simulated using the numerical groundwater flow model, including simulated capture zone extents and water balance components of interest (Section 5).
- Conclusions were derived through analysis of the simulation modeling results, and recommendations developed for guiding the ongoing simulation modeling process (Section 6).

Section 7 provides a list of references that were used in performing the hydraulic containment modeling.

2. Representation of Geology in the Numerical Model

The numerical model being used for the hydraulic containment analysis consists of fourteen layers and is summarized in **Figure 2**. The five relatively permeable units (upper surficial aquifer system [USAS], lower shallow aquifer system [LSAS], AF Gravels, S&P Sands, and lower AF Sands) are represented using one to three model layers. The USAS has been divided into two layers, an upper permeable layer and a lower, less-permeable layer, representing the bottom five feet of the unit. Review of multiple site boring logs suggests that there is a distinct difference in permeability between the two zones. The LSAS has been divided into three layers. This was necessary to enable the model to simulate the significant vertical head differentials evident in wells completed at different depths in the LSAS. Model layers 5 and 6 have been assigned different values of hydraulic conductivity than model layer 4, consistent with test measurements in the field. The remaining permeable units (upper AF gravels, S&P sands, and lower AF sands) are each represented by a single model layer.

The Venice Clay, which lies between the overlying LSAS and the underlying Sands and Clay Zone 1, is represented using two layers. This layering is for the benefit of the transport modeling that is to take place later in the program. All of the other lower permeability units are represented by a single model layer.

3. Ground Water Quality and Target Capture Zones

ARCADIS-BBL previously defined the maximum extent of COCs in excess of GCTLs and natural attenuation default concentrations (NADCs) in specific stratigraphic units based on water quality data collected in December 2006 (ARCADIS-BBL, 2007). GCTLs and NADCs were exceeded in the upper surficial aquifer system (USAS), the lower shallow aquifer system (LSAS), the AF gravels (AFG), and the S&P sands. The compounds of concern at the site are as follows:

- 1,4-Dioxane GCTL = 3.2 ug/L
- 1,1-Dichloroethane GCTL = 70 ug/L
- 1,1-Dichloroethene GCTL = 7 ug/L
- Cis-1,2-Dichloroethene GCTL = 70 ug/L
- Tetrachloroethene GCTL = 3 ug/L
- Trichloroethene GCTL = 3 ug/L

ARCADIS conducted a comprehensive groundwater sampling event at the site in January and February 2008 (ARCADIS, 2008). These data have been used to define the extent of COCs in excess of their respective GCTLs in the four hydrostratigraphic units. The areal extent where one or more of the COCs exceed their respective GCTLs in 2006 or 2008 are shown for each of the four units in **Figures 3, 4, 5,** and **6**.

4. Numerical Modeling Approach

Groundwater Flow Model. The hydraulic containment simulations summarized in this document were conducted using the three-dimensional groundwater flow model that is being developed for the site using MODFLOW 2000 (McDonald and Harbaugh, 1988; Harbaugh, et al., 2000a; 200b). This model is a robust representation of the groundwater flow system in the surficial and intermediate aquifer systems that simulates the interaction between hydrostratigraphic units under different pumping conditions, actively represents the interaction between local surface water bodies and the groundwater system, and simulates the potential induction of additional groundwater recharge associated with a reduction in the elevation of the water table (and resulting reduction in evapotranspiration from the water table) due to pumping stresses.

Evaluation of Capture. The results of each hydraulic containment scenario were evaluated using particle tracking analysis. Specifically, particles were first initialized in all grid cells in the model layer(s) representing the individual hydrostratigraphic units. The containment scenario was then simulated under steady-state flow conditions and the associated travel pathways of the particles over a period of time sufficient for a steady-state capture zone to be achieved were determined. The zone of hydraulic containment for each hydrostratigraphic unit was then determined based on the distribution of particles in that unit that were captured by the remediation groundwater extraction systems.

Well and Trench Representation. All extraction wells completed in the USAS and the LSAS, including the wells of the interim remedial action program (IRAP) system, along with the trenches in the USAS (where applicable), were represented using the MODFLOW drain package. This representation is consistent with the planned operational approach for these wells, which will cycle on and off based on water level. Consistent with the guidance provided by the project design engineers, water levels at the USAS extraction wells were fixed at six and one-half feet (6.5 ft) above the base of the USAS (i.e., the bottom of model layer two); water levels at the LSAS extraction wells were fixed at an elevation equal to that of the top of the LSAS (model layer 4). Wells in both units were assumed to have an effective diameter of one foot (1 ft) and an efficiency of 50 percent. All extraction wells completed in the AF Gravels and the S&P Sands were represented as wells, rather than drains, using the MODFLOW well package (i.e., simulating specified flux rates at the pumping wells in those two layers). A pumping rate of one gpm (1 gpm) was assigned to each of these wells, a rate that was determined to be appropriate based on previous testing and model analysis.

Trenches were evaluated as a possible component of the hydraulic containment system in the USAS. The head in these trenches (which is equivalent to the elevation of the drain) was assumed to be six and one-half feet (6.5 ft) above the base of the USAS, the same as the extraction wells in the USAS. The trenches were assumed to have an efficiency of 50 percent.

A summary of the trench and well representation used in these hydraulic containment simulations is presented in **Table 1**.

Conductance Term. The conductance term, C, of each drain cell used to represent a fixed-head well was calculated using the following equation (based on Prickett [1967] and Anderson and Woessner [1992]):

$$C = 2K_e \pi \ b/\ln(\text{delta } x/4.81r_w) \qquad (1)$$

where K_e is the effective hydraulic conductivity at the cell (ft/d), b is the saturated thickness of the cell (ft), delta x is the representative grid spacing (ft), and r_w is the well radius (ft). Where wells were completed in rectangular grid cells, delta x was approximated as the geometric mean of the cell dimensions. For the purposes of these hydraulic containment scenarios, a uniform conductance term of 250 ft^2/d was assigned to grid cells containing trenches. This value is based on a typical cell length of 12.5 feet, a saturated thickness of 10 ft, the hydraulic conductivity of model layer 1 of 7 ft/d, and an average distance across which head-loss occurs of 3.5 ft.

Because the wells and trenches were represented as drains, the extraction rate (Q) achieved is effectively calculated by the model and controlled by the aquifer properties, as described in the equation:

$$Q = C\,(h - d) * \text{efficiency} \qquad (2)$$

where h is the water level in the grid cell (ft) and d is the elevation of the water level in the drain.

5. Simulation of Hydraulic Containment Alternatives

Introduction. This section summarizes the hydraulic containment alternatives that have been evaluated to date. Additional alternatives will be identified based on review of those alternatives summarized herein and on discussions among the affected parties regarding objectives and trade-offs. These alternatives will be evaluated in the near future. As such, it is emphasized that the results presented in this document are only for discussion purposes.

Scenarios Tested. Four basic alternative hydraulic containment scenarios have been identified and tested that demonstrate the range of situations tested to date with respect to hydraulic containment. Scenarios A and B were chosen to maximize pore volume turnover and to provide maximum total capture among the scenarios tested. These scenarios are expected to represent the upper limit with respect to hydraulic recovery rate and number of wells/trenches required. The four basic scenarios are summarized in **Table 2** and described as follows:

1. A scenario in which only wells within the respective GCTL zones of the three lower units (LSAS, AF Gravels, and S&P Sands), together with a trench and well combination for the GCTL zone of the USAS, are used (Scenario A). This scenario is expected to represent the upper limit of the well/trench combination that would be used to achieve shortest cleanup time among the scenarios tested.

2. A scenario in which only wells within the respective GCTL zones of all four of the units, including the USAS, are used (Scenario B). This scenario is expected to represent the upper limit of total wells that would be used to achieve the shortest cleanup time among the scenarios tested.

3. A scenario in which only wells located within the 10-times GCTL zone in each of the four units are used (Scenario C).

4. A scenario in which the number of wells in the USAS and, to a lesser degree the LSAS and AF Gravels, is further reduced from that of Scenario C to reduce the potential impact of pumping on local surface-water bodies (Scenario D).

In addition, in all of these scenarios, the ten existing IRAP wells were simulated in the same manner as the potential new extraction wells; that is, using the drain function, including specifying that the groundwater levels would be maintained at 6.5 feet above the base of the USAS or at the top of the LSAS, depending on the unit in which the well is completed. As such, the simulated production rates at these wells are different from those currently in place (approximately 8.6 gpm) (M. Geffell, personal communication, April 2008).

Scenario Simulation Results. The results of all simulations have been characterized with respect to (a) the predicted zone of hydraulic containment in the USAS and the LSAS (model layers 1 and 4, respectively), and (b) the simulated drawdown in the USAS (model layer 1). In all scenarios, the zone of hydraulic containment in the AF Gravels and the S&P Sands under steady-state conditions effectively extends all the way to the model boundaries, since the principal sources of water for these units are the specified head model boundaries. As such, only the predicted potentiometric surface in each of these units under Scenario A is presented herein, as these are effectively representative of these surfaces under all of the other scenarios. The scenario simulation results for the four basic alternative hydraulic containment scenarios are presented in **Figures 7** through **20**.

A summary of the extraction rates simulated under each of these scenarios is presented in **Table 2**. Total extraction rates range between 151 gpm (Scenario D) and 325 gpm (Scenario B). A summary of how flow into and out of the model domain changes between pre-implementation (no new remediation pumping) and post implementation (new hydraulic containment pumping) conditions is presented in **Table 3**.

Review of the results presented in **Table 3** suggests that a substantial volume of water (ranging between 53 and 122 gpm) is being captured from the local ponds in the area in these scenarios. It is unlikely that such a rate of loss of water from these ponds can actually be sustained.

In order to bracket the possible range of pond-related impacts on the capture predictions, Scenario C and Scenario D were simulated with the fluxes into and out of the area ponds fixed at the rates predicted by the model during pre-implementation conditions. The results of these two scenarios, labeled Scenario C-2 and D-2, respectively, are presented in **Figures 21** through **26**. A substantial reduction in extraction rate is predicted in both instances as a result of the inability of the wells to induce additional inflow from the ponds. This is off set by an expansion of the zone of capture because additional recharge area is needed to supply the remediation pumping.

6. Conclusions

The results of the hydraulic containment scenarios summarized in this interim deliverable report show that a system can be designed that successfully contains and controls COC-impacted groundwater at the former ABC site. The design of a well system for the impacted units in the intermediate aquifer system (LSAS, AF Gravels, and S&P Sands) should be relatively straightforward. Pumping in these units can be relatively aggressive to promote pore-water turnover. However, the success of any alternative with respect to clean-up time will have to be assessed through contaminant mass fate and transport modeling.

In contrast to the intermediate aquifer system, the design of a containment system for the USAS will have to address the potential impacts of pond and wetland dewatering. There are trade-offs between how much water can be pumped and captured and what impacts to surface-water features can be tolerated. Mitigation techniques will likely need to be considered, such as maintaining pond levels via replenishment with treated groundwater or with water pumped from the Floridan aquifer.

The numerical model used to evaluate the scenarios presented herein will continue to undergo refinement, including the development of a contaminant mass fate and transport component. As model development continues, these scenarios will be further refined and additional alternatives will be identified and evaluated. The information presented in this document is preliminary and is not a recommendation of a specific alternative.

7. References

Anderson, M.P. and W.W. Woessner, 1992. Applied groundwater modeling: simulation of flow and advective transport. San Diego: Academic Press, 381 p.

ARCADIS, April 2008. 2008 Groundwater monitoring report, former American Beryllium Site.

ARCADIS-BBL, 2007. Remedial action plan (RAP), former American Beryllium Company site, Tallevast, Florida.

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Harbaugh, A.W., Banta, E.R., Hill M.C., and McDonald, M.G., 2000a. MODFLOW-2000, the US Geological Survey Modular Ground-Water Model – User's Guide to Modularization Concepts and the Ground-Water Flow Process, USGS Open-File Report 00-92, 121 p.

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McDonald, M.G. and A.W. Harbaugh, 1988. A modular, three-dimensional, finite difference ground-water flow model, USGS Techniques of Water Resource Investigations (Book 6).

Prickett, T.A., 1967. Designing pumped well characteristics into electric analog models, Journal of Ground Water, Vol. 17, No. 2, pp. 38-46.

We look forward to meeting with you in May to present and discuss this work.

Sincerely,

Charles R. Faust, P.G., Ph.D.
President
Principal Hydrogeologist

David C. Skipp
Associate
Senior Hydrogeologist

TABLES

Table 1. Summary of trench and well representation used in preliminary hydraulic containment simulations.

	Simulation Model Representation		
	Head	**Flow**	**Description**
USAS trenches	Fixed	Computed	Trench specified in model layer 1; water level in trench fixed at 6.5 feet above base of USAS. High hydraulic conductivity specified in underlying cell in layer 2.
USAS wells	Fixed	Computed	Fully penetrating well. Water level in well fixed at 6.5 feet above base of USAS.
LSAS wells	Fixed	Computed	Fully penetrating well. Water level in well fixed at top of LSAS.
AF Gravels wells	Computed	Fixed	1 gpm per well specified
S&P Sands wells	Computed	Fixed	1 gpm per well specified

Note: gpm: gallon(s) per minute

Table 2. Summary of hydraulic containment scenarios simulated and extraction rate results.

	Preliminary Hydraulic Containment Scenarios											
	Scenario A		*Scenario B*		*Scenario C*		*Scenario D*		*Scenario C-2*		*Scenario D-2*	
Unit	*Number of wells*	*Extraction Rate (gpm)*	*Number of wells*	*Extraction Rate (gpm)*	*Number of wells*	*Extraction Rate (gpm)*	*Number of wells*	*Extraction Rate (gpm)*	*Number of wells*	*Extraction Rate (gpm)*	*Number of wells*	*Extraction Rate (gpm)*
USAS	63	190	103	205	61	145	27	78	61	96	27	64
LSAS	105	52	105	51	87	56	67	51	87	49	67	47
AF Gravels	60	60	60	60	23	23	21	21	23	23	21	21
S&P Sands	9	9	9	9	1	1	1	1	1	1	1	1
Totals:	**237**	**311**	**277**	**325**	**172**	**225**	**116**	**151**	**172**	**170**	**116**	**132**

Extraction System	*Scenario A*	*Scenario B*	*Scenario C*	*Scenario D*	*Scenario C-2*	*Scenario D-2*
Wells in full GCTL area	**Yes**	**Yes**	**No**	**No**	**No**	**No**
Wells only in 10x GCTL area	**No**	**No**	**Yes**	**No**	**Yes**	**No**
Trenches	**Yes**	**No**	**No**	**No**	**No**	**No**

Note: gpm: gallons per minute

Extraction rate = total for all remediation systems, including IRAP extraction wells and preliminary concept new extraction wells and trenches.

GCTL: groundwater cleanup target levels

10X GCTL: ten-times the GCTL

The numerical model used to evaluate the scenarios presented herein will continue to undergo refinement, including the development of a contaminant mass fate and transport component. As model development continues, these scenarios will be further refined and additional alternatives will be identified and evaluated. The information presented in this document is preliminary and is not a recommendation of a specific alternative.

Table 3. Summary of predicted changes in inflow and outflow between pre-implementation and post-implementation conditions.

	Change in Simulated Flow Rates (gpm)					
Water Balance Term	**Scenario A**	**Scenario B**	**Scenario C**	**Scenario D**	**Scenario C-2**	**Scenario D-2**
Evapotranspiration	121	123	92	69	111	87
Lateral Model Boundary	59	59	26	22	29	24
Ponds and Rivers	111	122	93	53	-16	-16
Drainage Ditches	21	21	15	7.6	46	38
Remediation Trenches	-51	NS	NS	NS	NS	NS
Remediation Wells	-260	-325	-225	-152	-170	-132

Note: All values represent changes in groundwater flow model simulated flow rates in gallons per minute (gpm).
Positive values indicate an increase in the net inflow to the groundwater flow system (or a decrease in the net outflow).
Negative values indicate an increase in the net outflow from the groundwater flow system (or a decrease in the net inflow)
NS: not simulated.
Scenarios C-2 and D-2 include ponds with their rates of recharge to groundwater held fixed at the values simulated in the baseline, pre-implementation conditions scenario.

FIGURES

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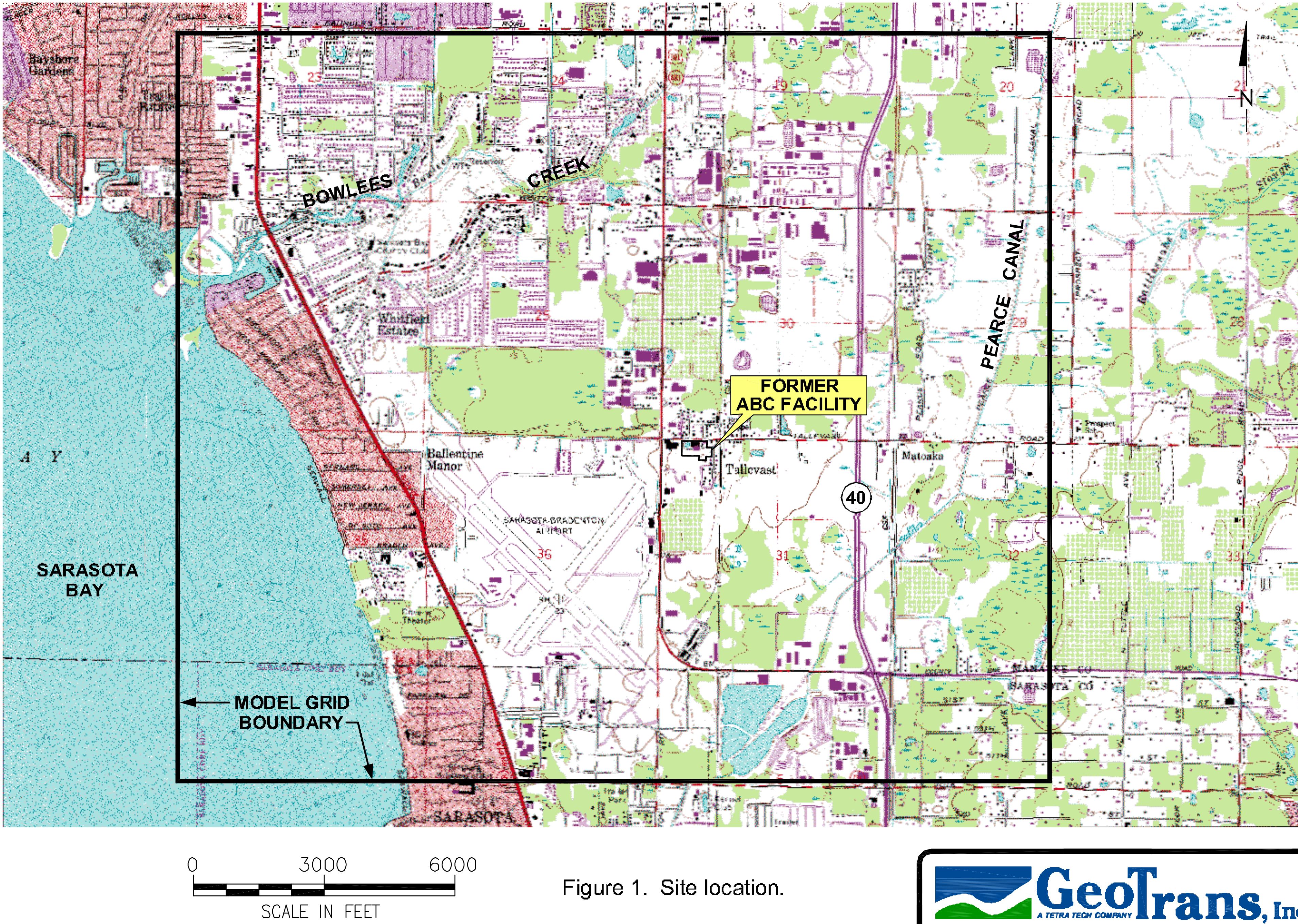

Figure 1. Site location.

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Hydrostratigraphic Unit	Formation	Unit	Thickness (ft)	Model Layer	Baseline model Kh (ft/day)	Arithmetic mean Kh (ft/d)	Geometric mean Kh (ft/d)	Baseline model Kv (ft/day)
Surficial Aquifer System	*Undifferentiated Surficial Deposits (USD)*	*upper surficial aquifer system*	15 - 50	1	7.0	9.70	2.20	0.7
			5	2	0.7			7.0E-2
Intermediate Aquifer System	*Peace River Formation*	hard streak	1	3	1.0E-3, 5.0E-5	NA	NA	1.0E-3, 5.0E-5
		lower shallow aquifer system	5 - 35	4	5.0	4.3	2.16	2.0E-3, 5.0E-4
				5	0.01 - 8.0			5.0E-3, 2.0E-5
				6				
		Venice clay	5 - 35	7	0.01	0.64	0.019	3.0E-2, 1.0E-4
				8				
	Undifferentiated Arcadia Formation	sand & clay zone 1	15 - 50	9	0.1	0.13	0.013	4.0E-3, 3.0E-4
		upper AF gravels	5 - 15	10	3.1	19.2	0.51	3.1E-1
		sand & clay zone 2	10 - 55	11	0.20	0.30	0.025	2.0E-3, 1.0E-4
		S & P sands	5 - 15	12	2.0	1.5	0.20	0.2
		sand & clay zone 3, 4	100 - 150	13	0.10	0.88	0.087	1.0E-1, 1.0E-4
		lower AF sands	1 - 15	14	0.50	0.70	0.076	0.05

NOTES:

K_h: horizontal hydraulic conductivity

K_v: vertical hydraulic conductivity

Some units are divided into two zones with different values of K_h and/or K_v. In these units, two values of K_h and/or K_v are shown.

K_h in Layer 4 has four zones ranging from 0.01 to 8 ft/d.

Figure 2. Summary of site stratigraphy, model layering, and model parameter values.

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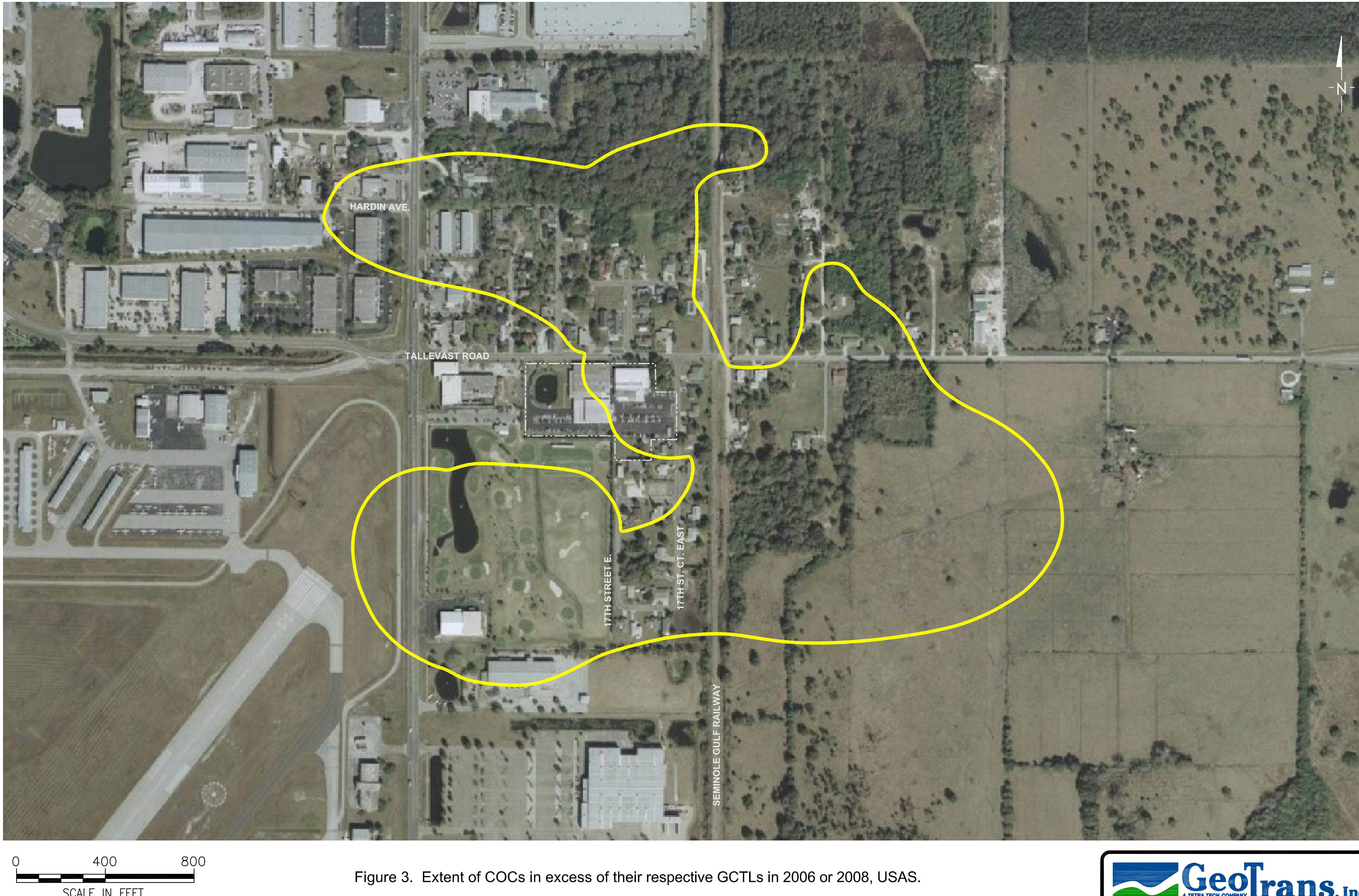

Figure 3. Extent of COCs in excess of their respective GCTLs in 2006 or 2008, USAS.

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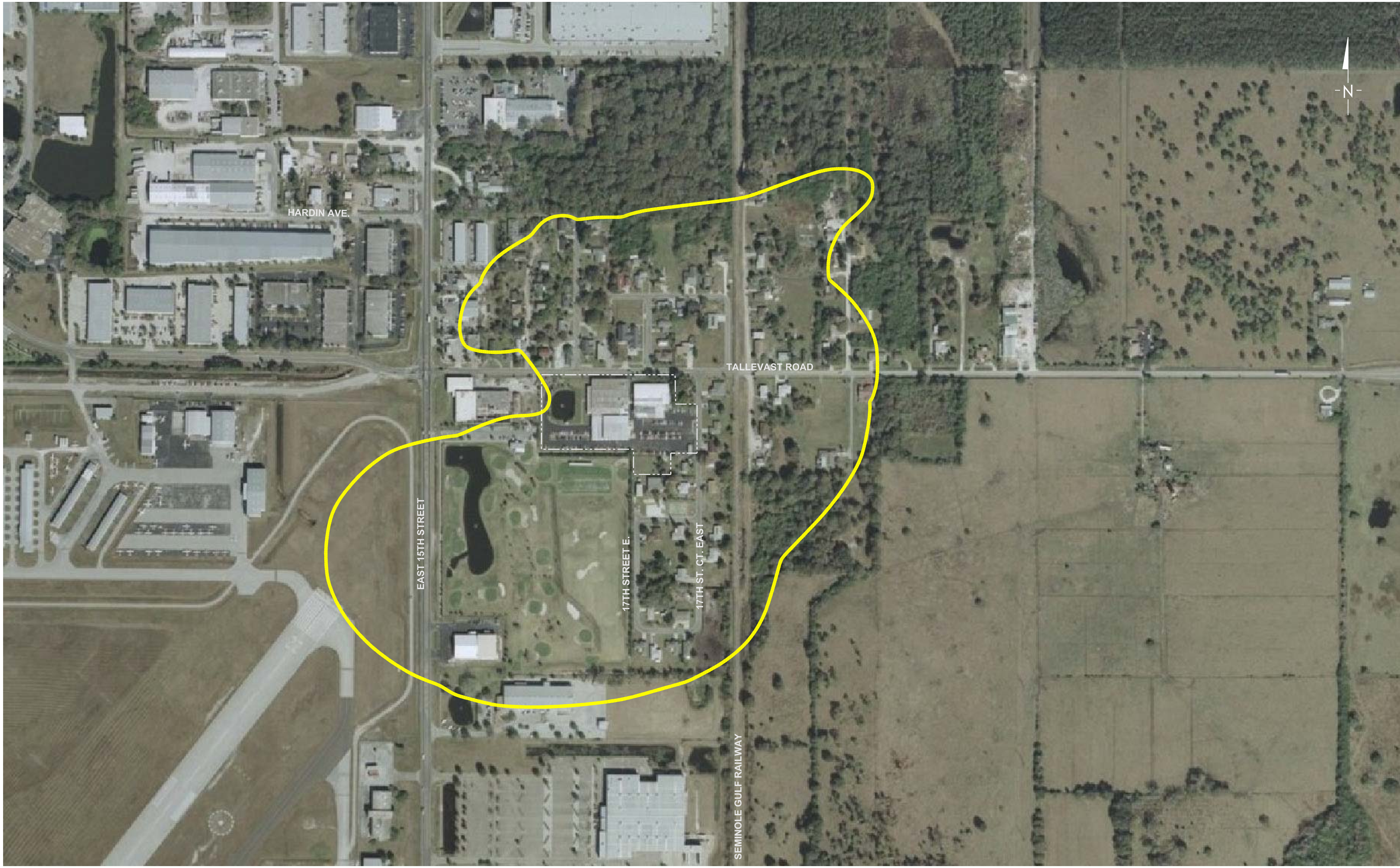

0 400 800
SCALE IN FEET

Figure 4. Extent of COCs in excess of their respective GCTLs in 2006 or 2008, LSAS.

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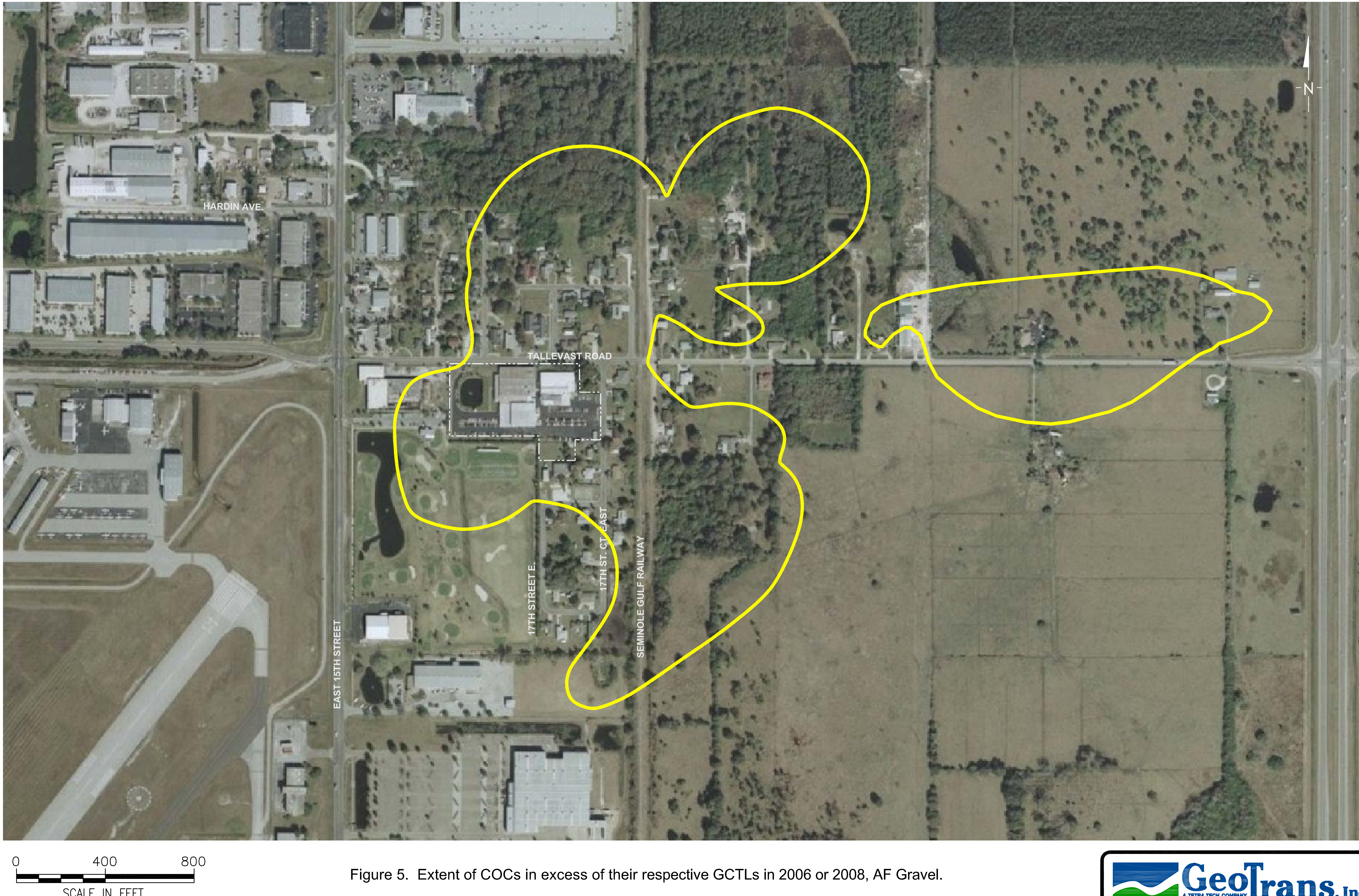

Figure 5. Extent of COCs in excess of their respective GCTLs in 2006 or 2008, AF Gravel.

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SCALE IN FEET

Figure 6. Extent of COCs in excess of their respective GCTLs in 2006 or 2008, S&P Sands.

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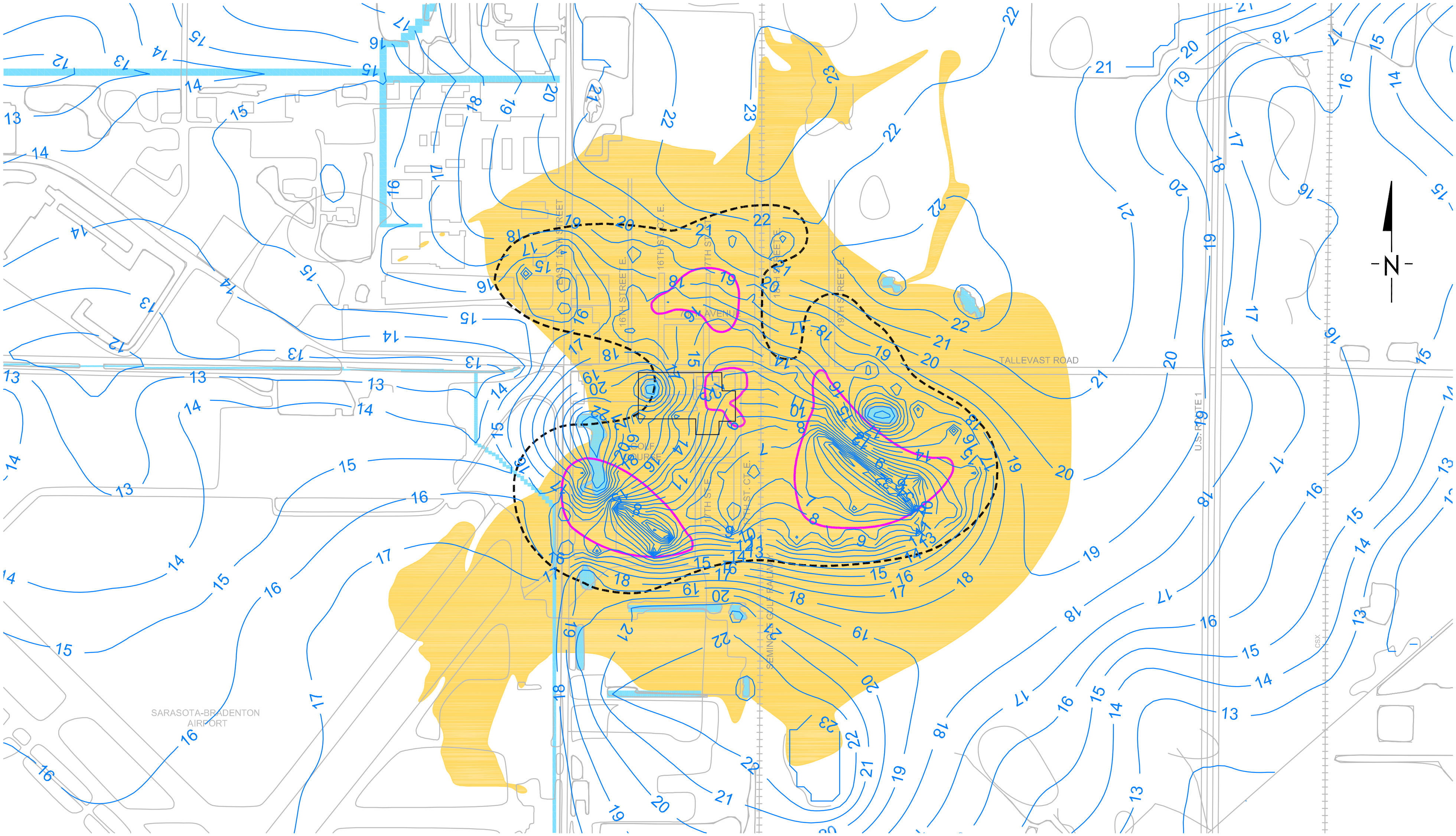

LEGEND

COMPOSITE 10X GCTL

TARGET CAPTURE ZONE INCLUDING 100 FT BUFFER

ZONE OF HYDRAULIC CONTAINMENT

0 1000 2000

SCALE IN FEET

CONCEPTUAL HYDRAULIC CONTAINMENT SCENARIO FOR DISCUSSION PURPOSES ONLY

Figure 7. Predicted zone of hydraulic containment in the USAS (model Layer 1) under Scenario A.

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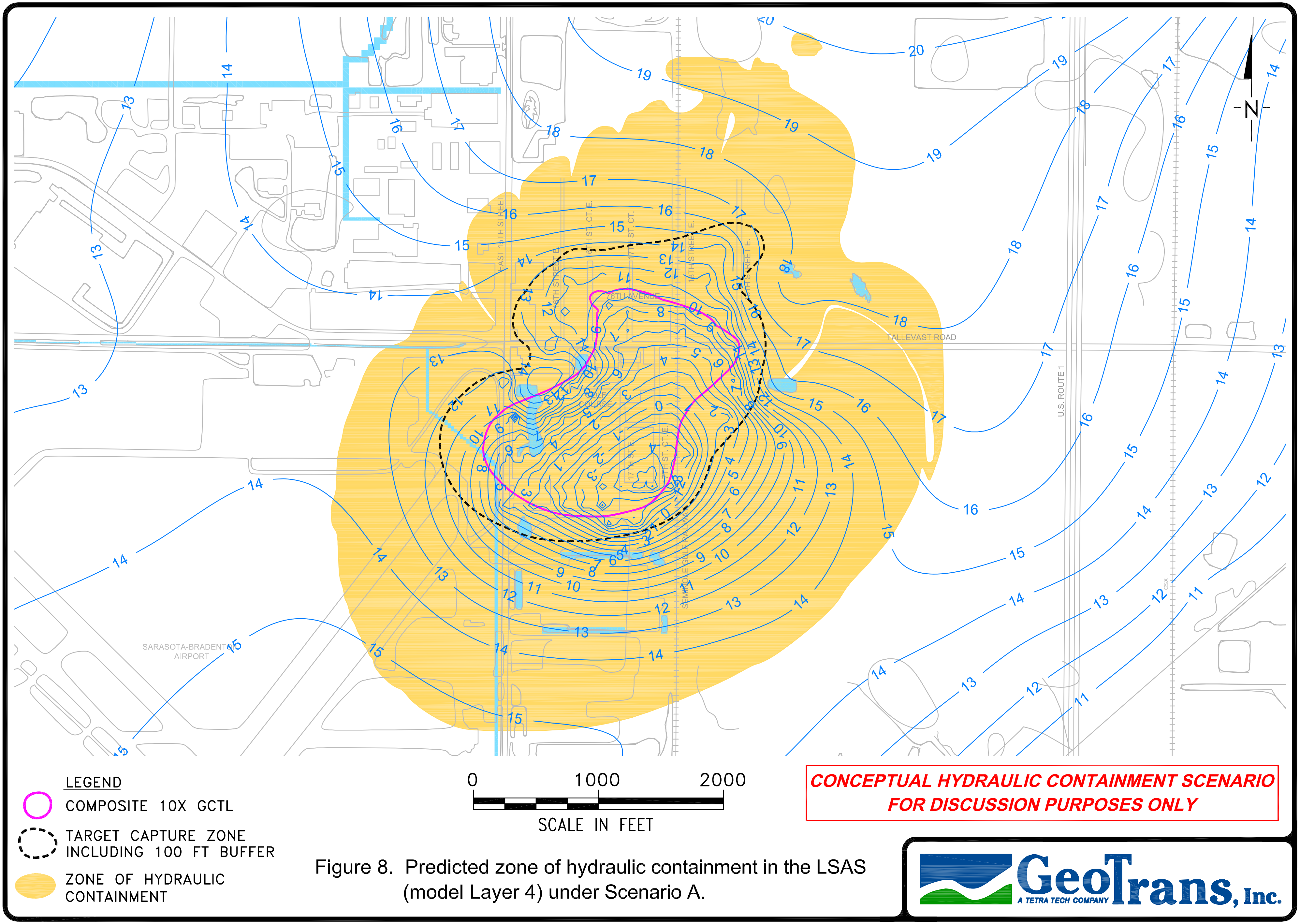

Figure 8. Predicted zone of hydraulic containment in the LSAS (model Layer 4) under Scenario A.

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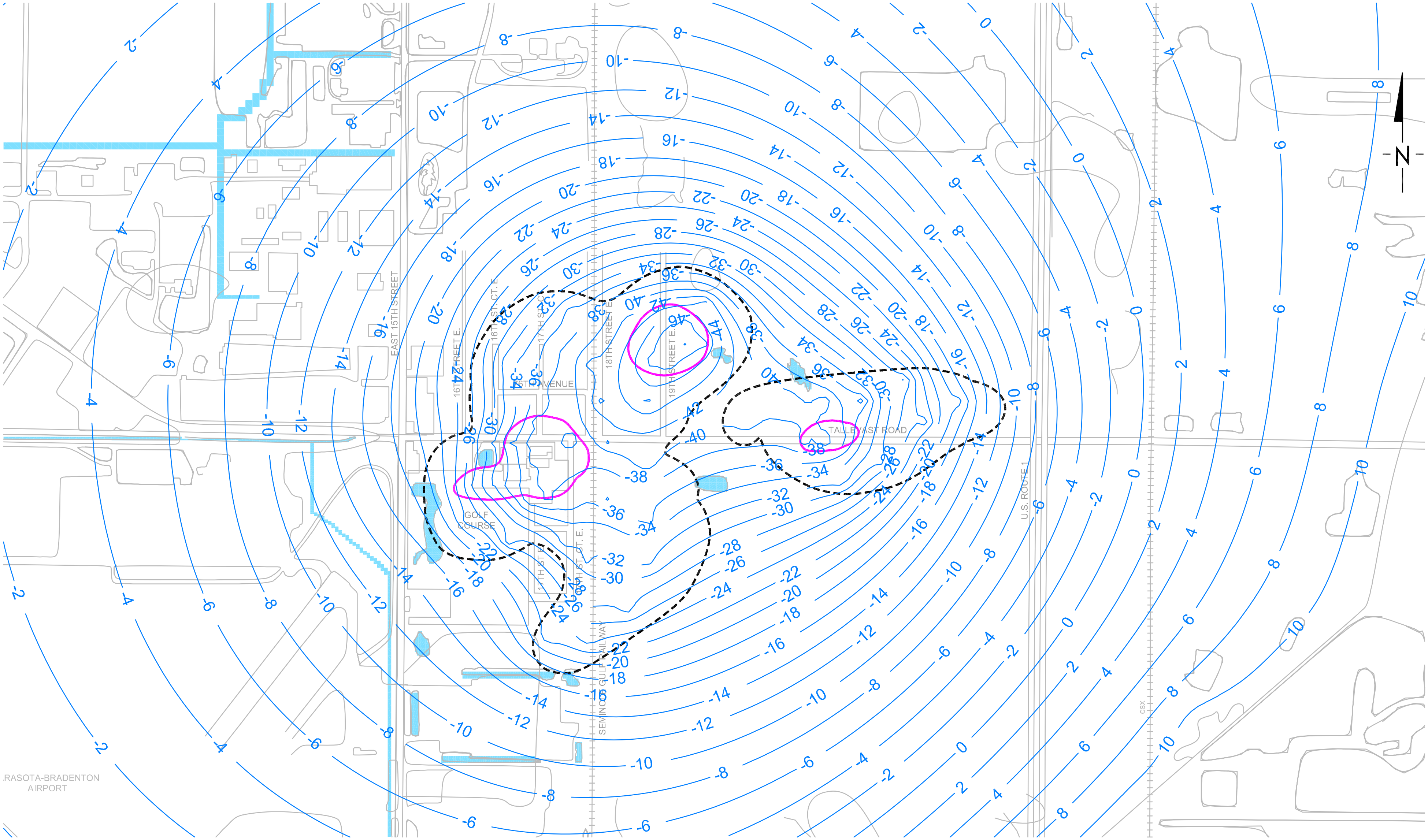

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SCALE IN FEET

CONCEPTUAL HYDRAULIC CONTAINMENT SCENARIO FOR DISCUSSION PURPOSES ONLY

LEGEND

COMPOSITE 10X GCTL

TARGET CAPTURE ZONE INCLUDING 100 FT BUFFER

Figure 9. Predicted potentiometric surface in the AF Gravels (model Layer 10) under Scenario A.

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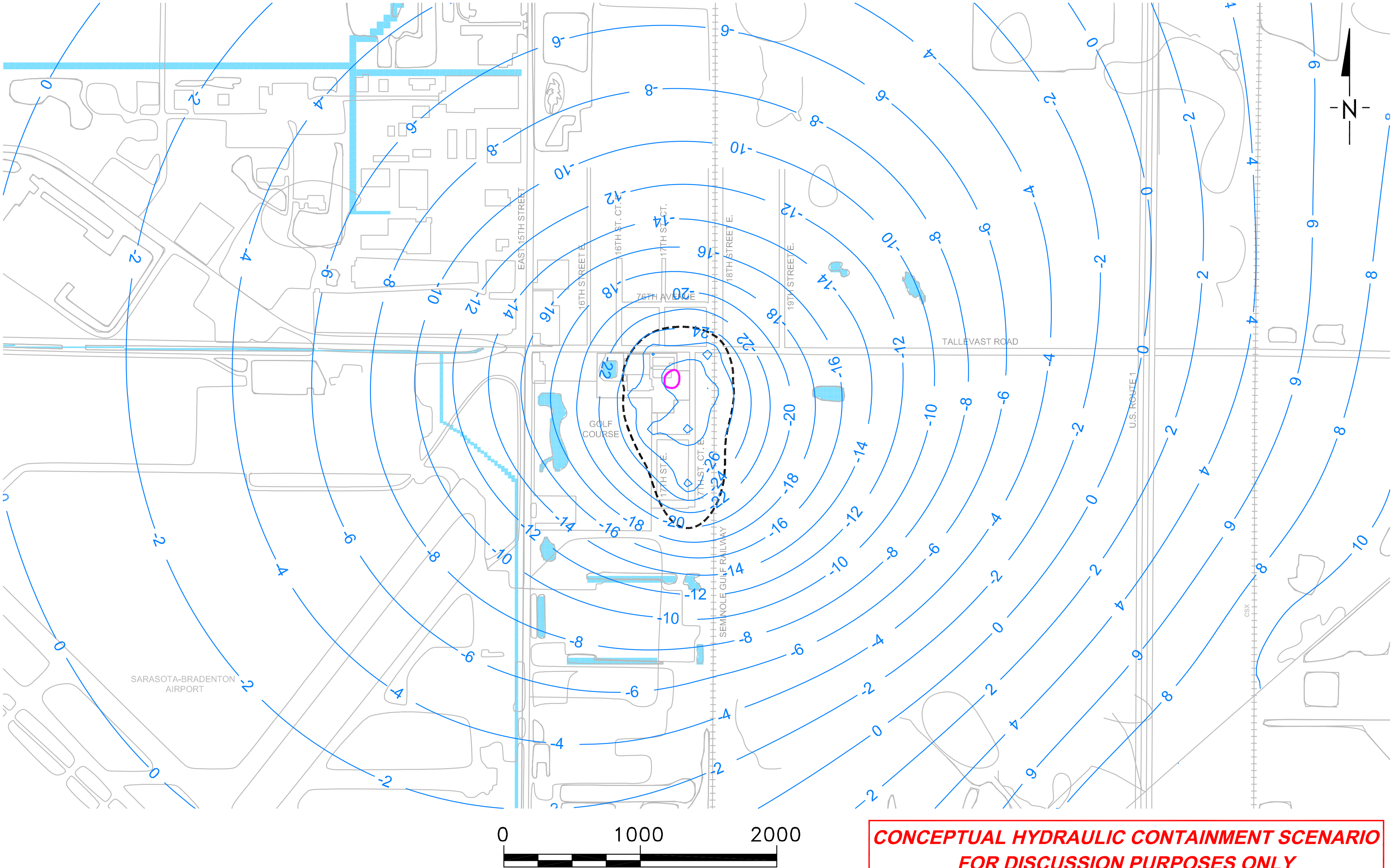

CONCEPTUAL HYDRAULIC CONTAINMENT SCENARIO FOR DISCUSSION PURPOSES ONLY

LEGEND

COMPOSITE 10X GCTL

TARGET CAPTURE ZONE INCLUDING 100 FT BUFFER

Figure 10. Predicted potentionetric surface in the S&P Sands (model Layer 12) under Scenario A.

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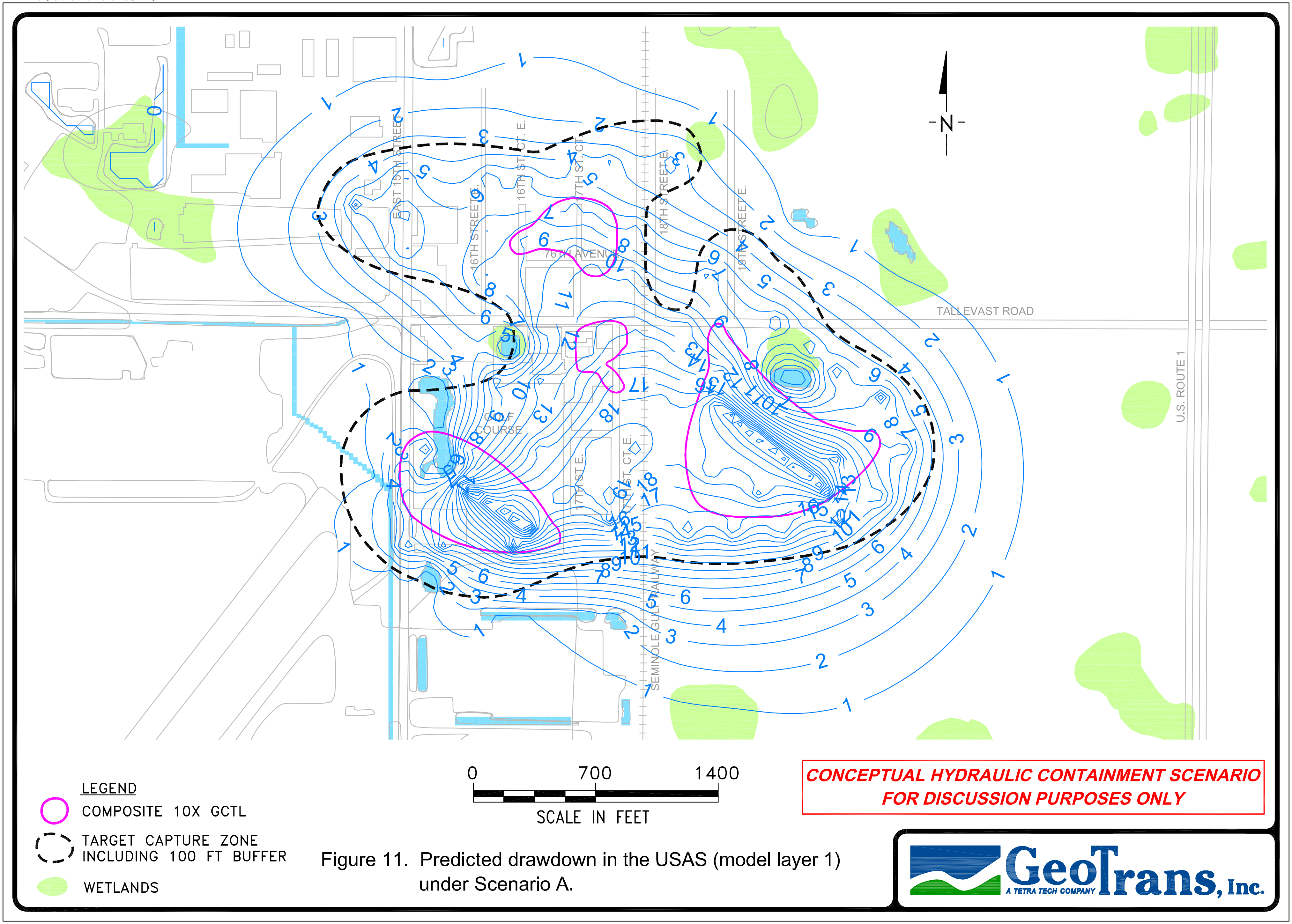

Figure 11. Predicted drawdown in the USAS (model layer 1) under Scenario A.

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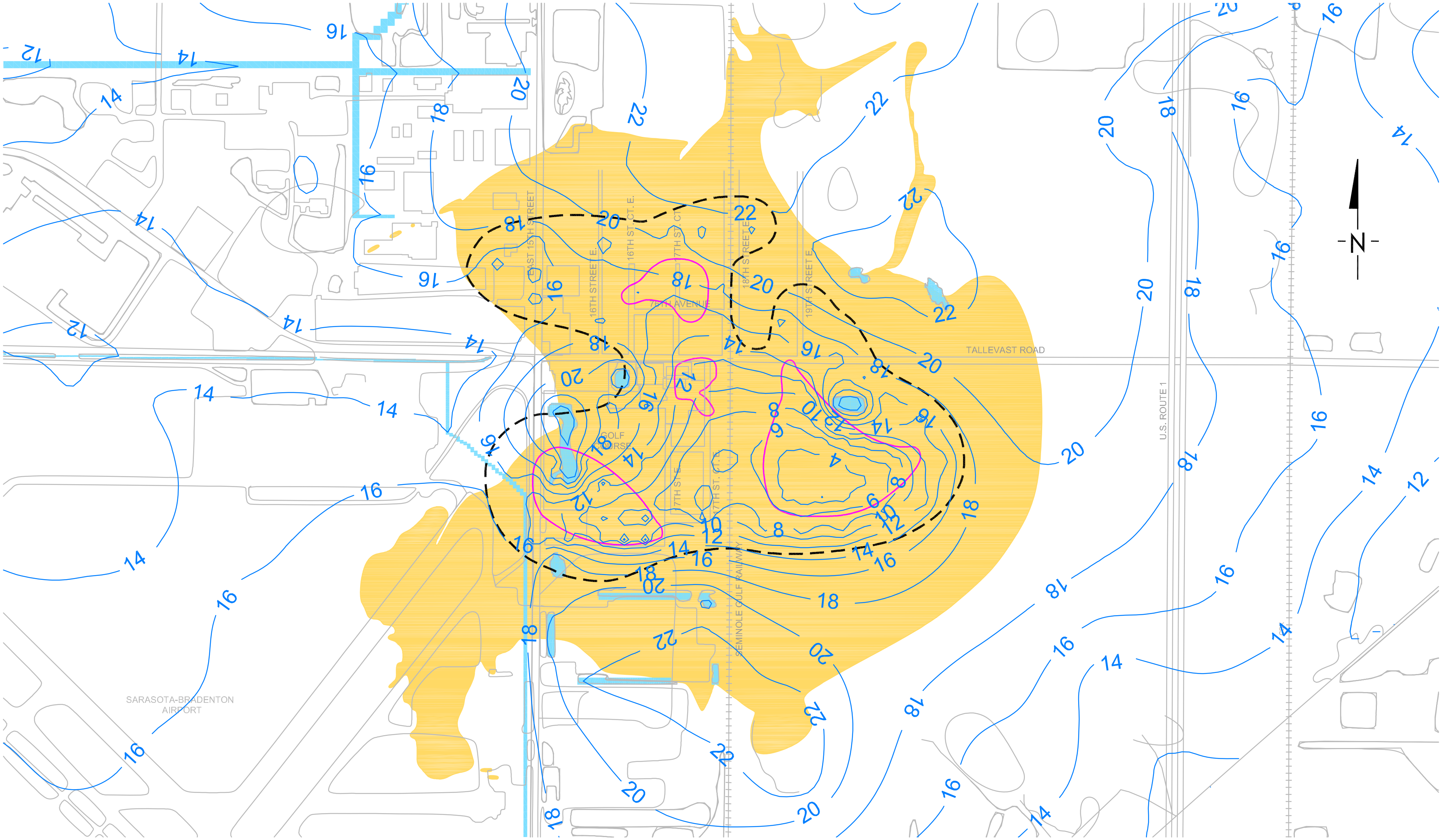

LEGEND

COMPOSITE 10X GCTL

TARGET CAPTURE ZONE INCLUDING 100 FT BUFFER

ZONE OF HYDRAULIC CONTAINMENT

0 1000 2000

SCALE IN FEET

CONCEPTUAL HYDRAULIC CONTAINMENT SCENARIO FOR DISCUSSION PURPOSES ONLY

Figure 12. Predicted zone of hydraulic containment in the USAS (model Layer 1) under Scenario B.

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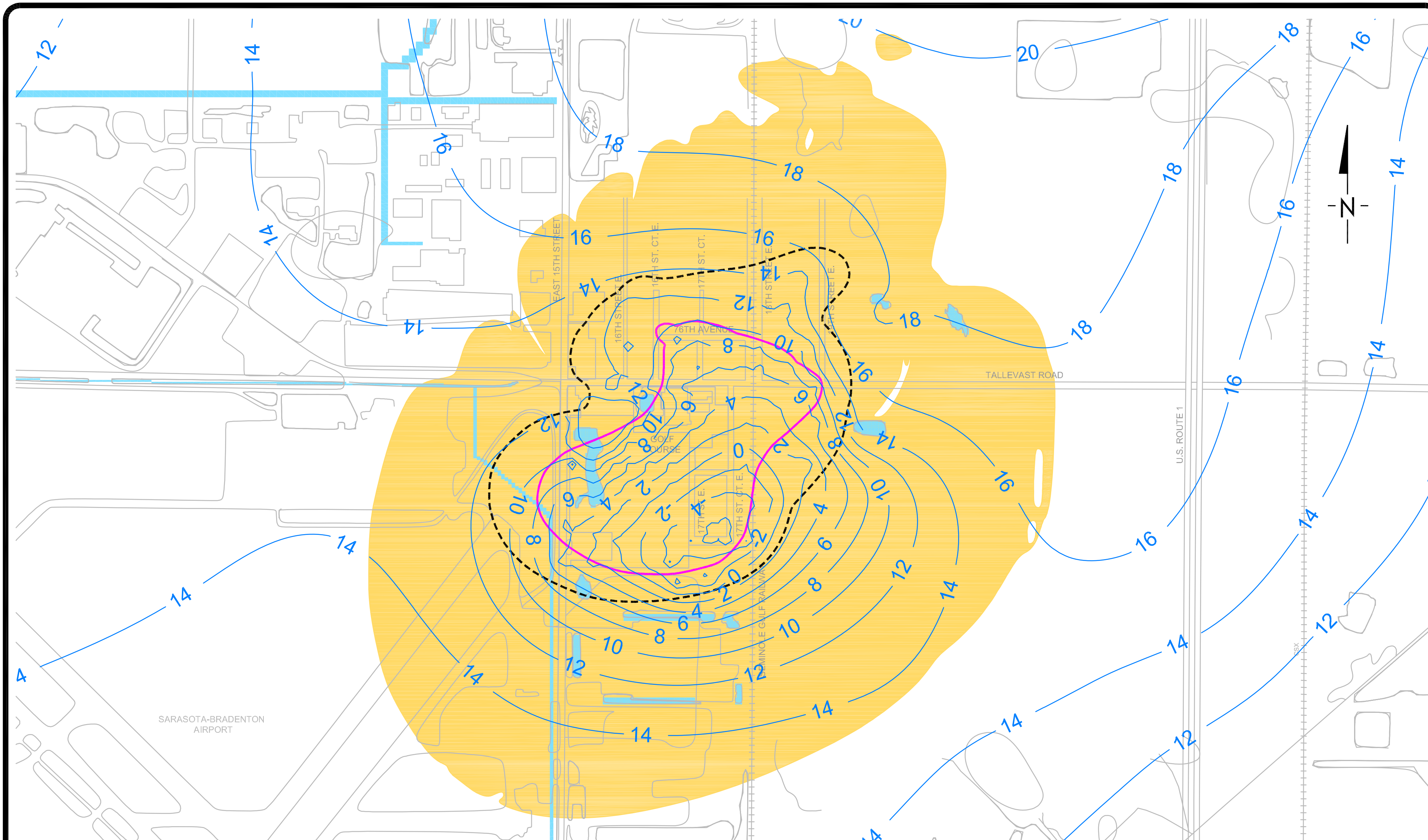

LEGEND

COMPOSITE 10X GCTL

TARGET CAPTURE ZONE INCLUDING 100 FT BUFFER

ZONE OF HYDRAULIC CONTAINMENT

0 1000 2000

SCALE IN FEET

CONCEPTUAL HYDRAULIC CONTAINMENT SCENARIO FOR DISCUSSION PURPOSES ONLY

Figure 13. Predicted zone of hydraulic containment in the LSAS (model Layer 4) under Scenario B.

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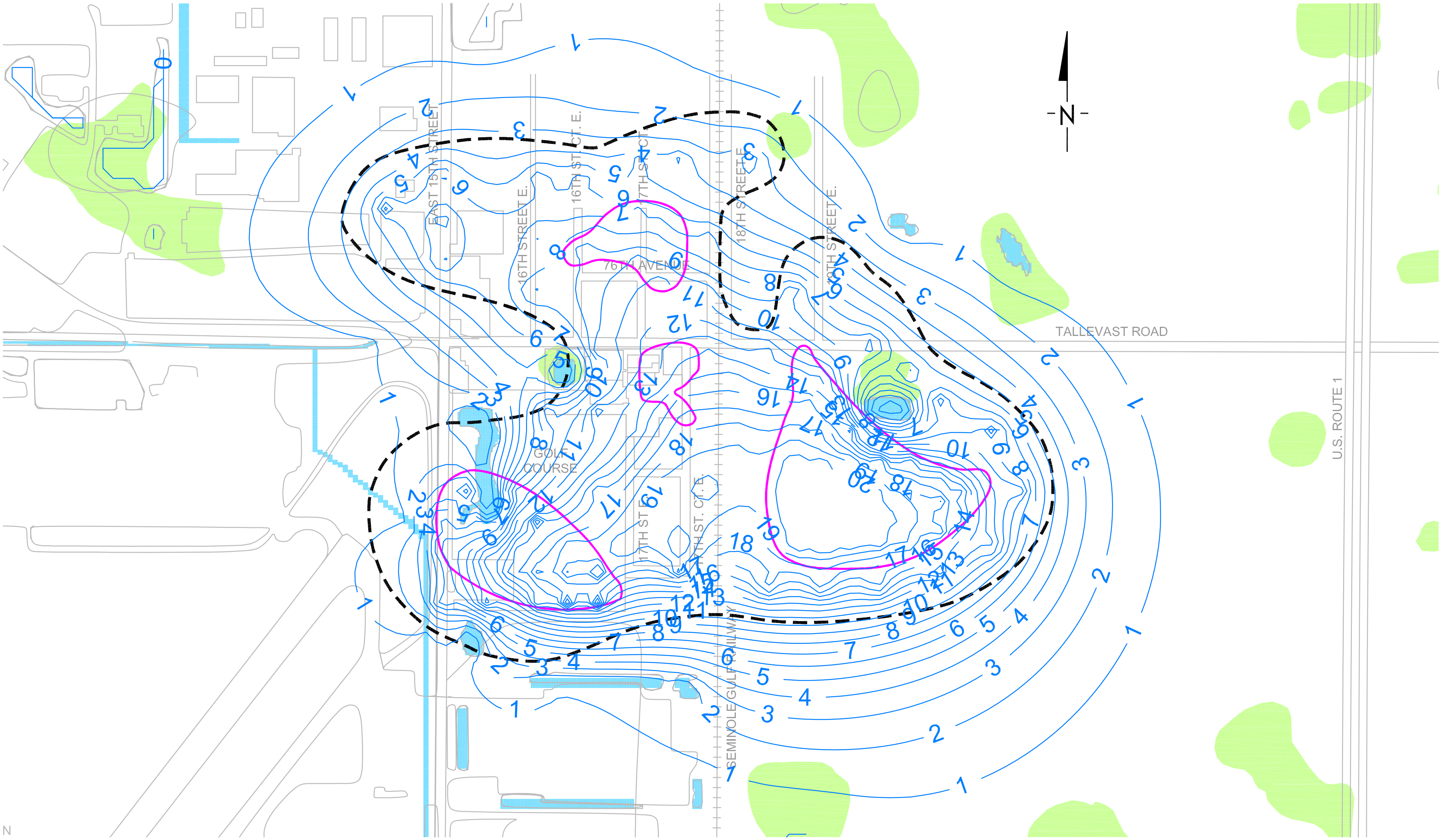
0507171173A.DWG



LEGEND

- COMPOSITE 10X GCTL
- TARGET CAPTURE ZONE INCLUDING 100 FT BUFFER
- WETLANDS

0 700 1400

SCALE IN FEET

CONCEPTUAL HYDRAULIC CONTAINMENT SCENARIO FOR DISCUSSION PURPOSES ONLY

Figure 14. Predicted drawdown in the USAS (model layer 1) under Scenario B.

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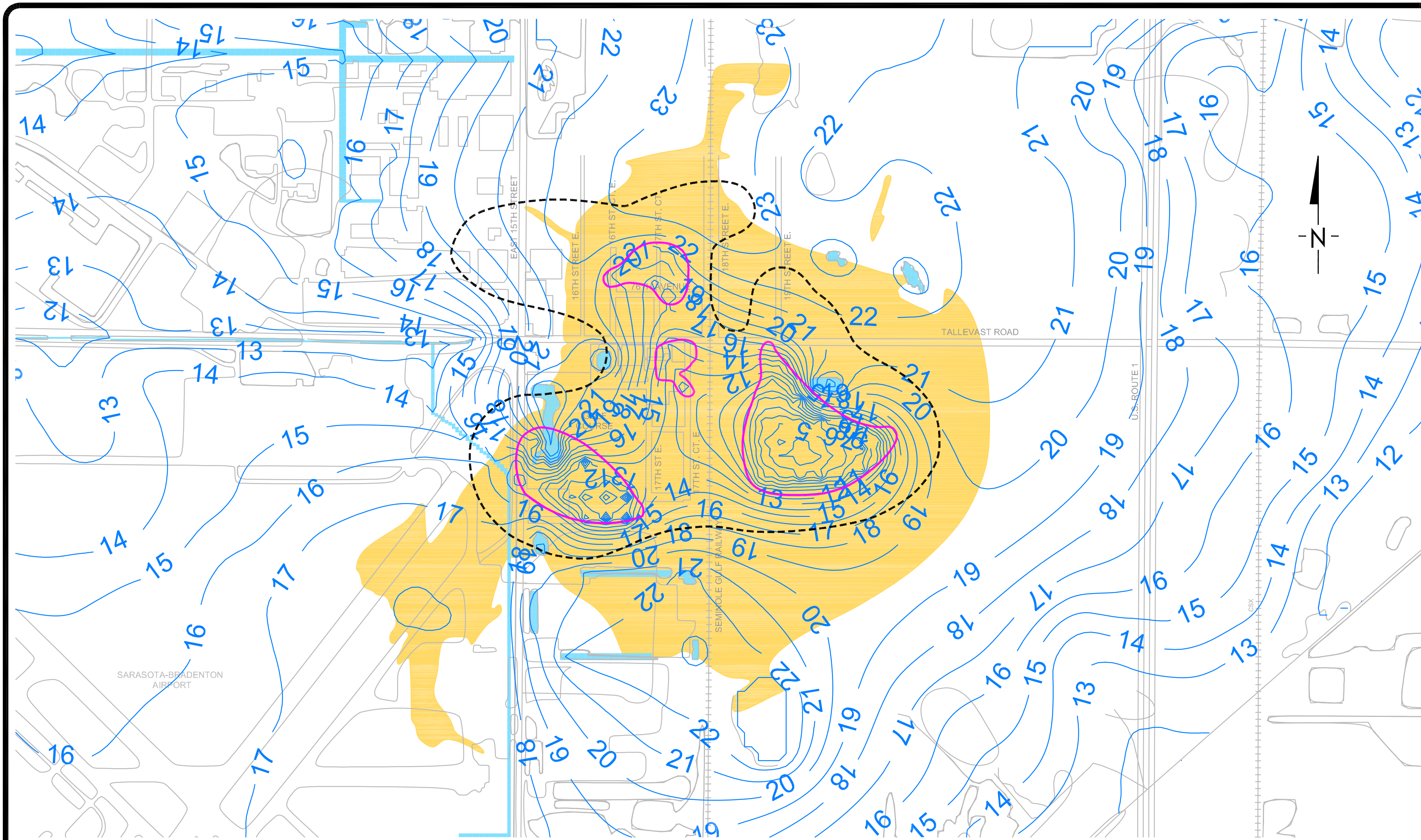
0507171174A.DWG



LEGEND

COMPOSITE 10X GCTL

TARGET CAPTURE ZONE INCLUDING 100 FT BUFFER

ZONE OF HYDRAULIC CONTAINMENT

0 1000 2000

SCALE IN FEET

CONCEPTUAL HYDRAULIC CONTAINMENT SCENARIO FOR DISCUSSION PURPOSES ONLY

Figure 15. Predicted zone of hydraulic containment in the USAS (model Layer 1) under Scenario C.

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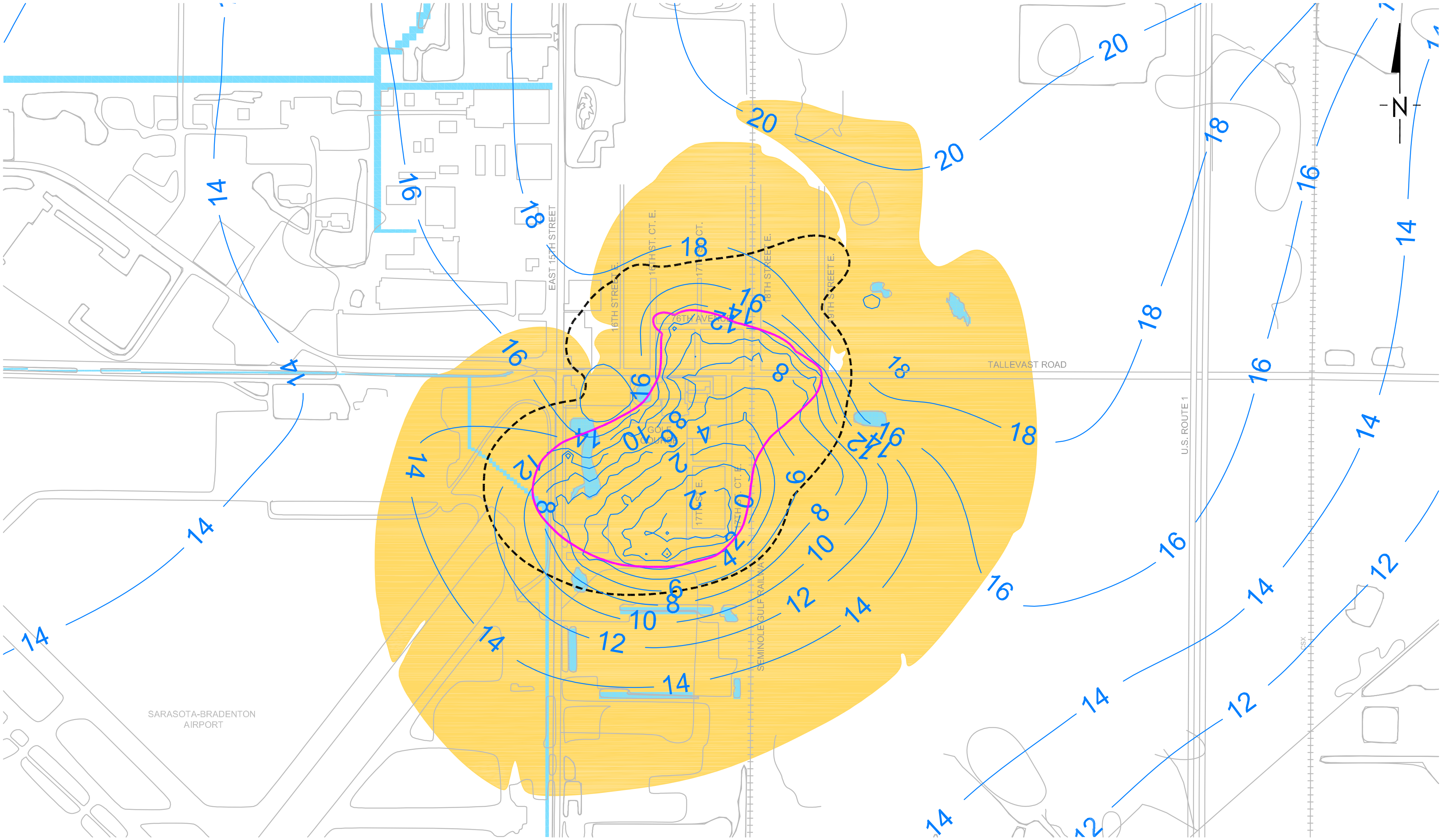
0507171175A.DWG



LEGEND

COMPOSITE 10X GCTL

TARGET CAPTURE ZONE INCLUDING 100 FT BUFFER

ZONE OF HYDRAULIC CONTAINMENT

0 1000 2000

SCALE IN FEET

CONCEPTUAL HYDRAULIC CONTAINMENT SCENARIO FOR DISCUSSION PURPOSES ONLY

Figure 16. Predicted zone of hydraulic containment in the LSAS (model Layer 4) under Scenario C.

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0507171176A.DWG

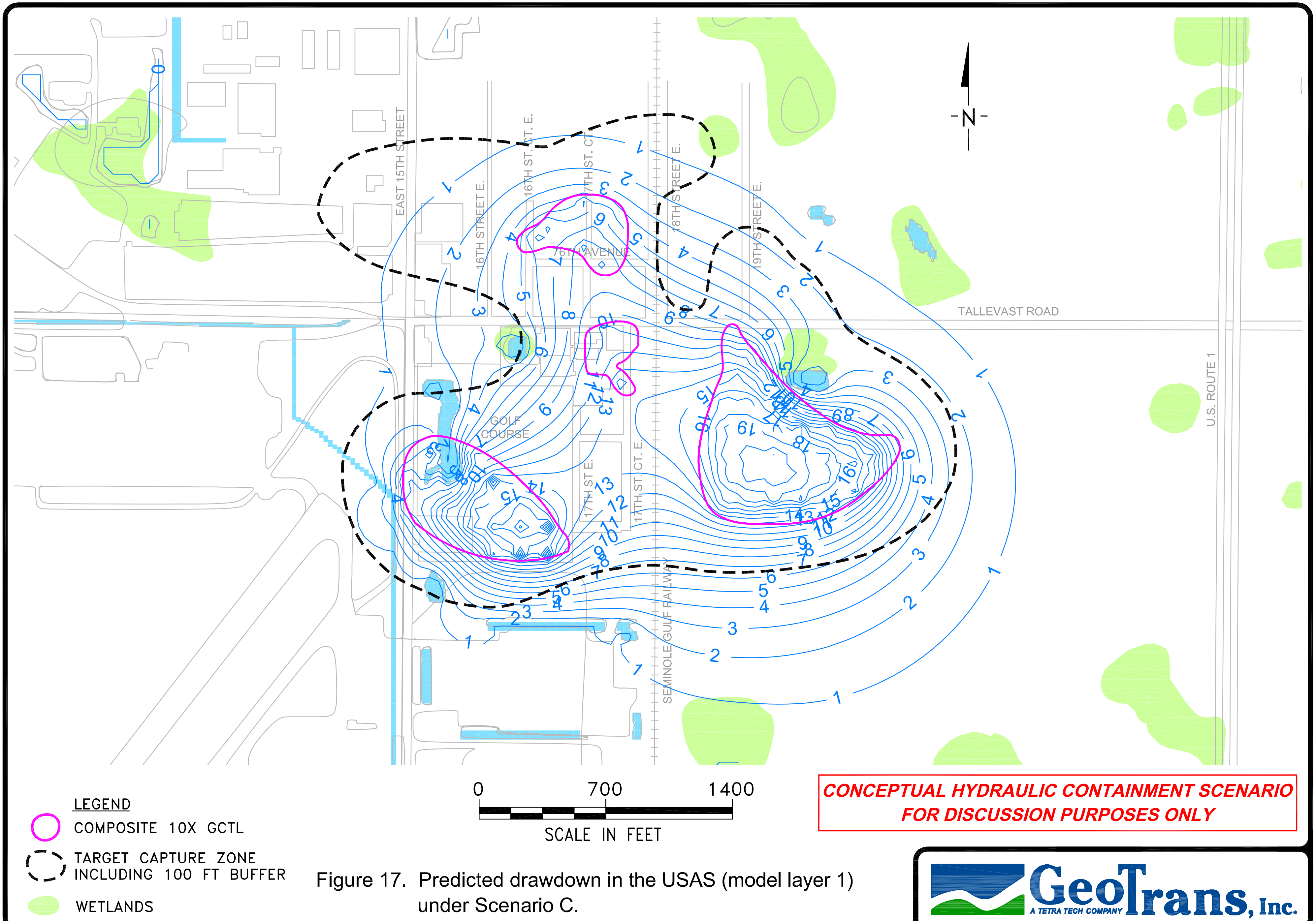

Figure 17. Predicted drawdown in the USAS (model layer 1) under Scenario C.

GeoTrans, Inc.
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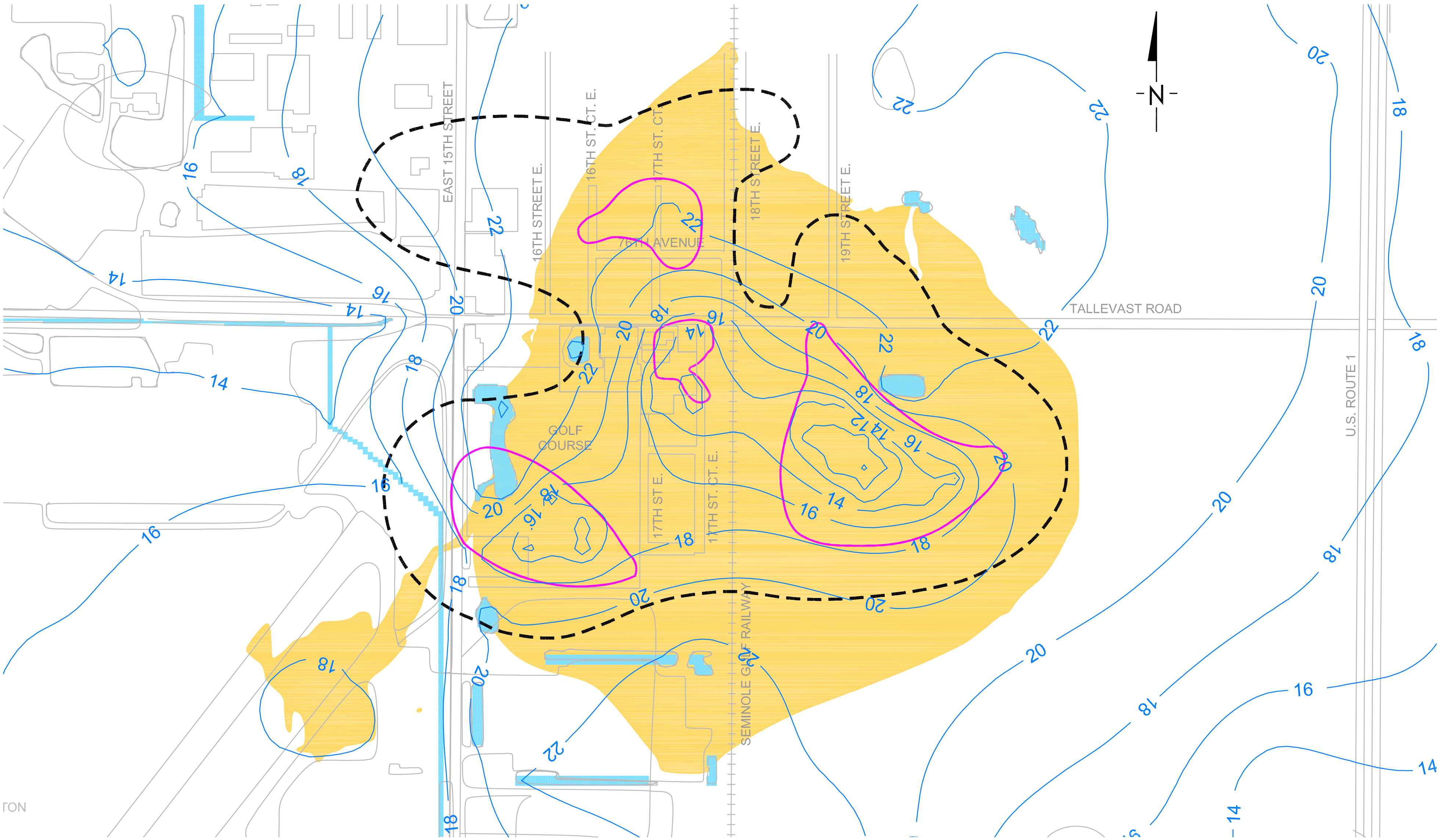
0507171177A.DWG



LEGEND

COMPOSITE 10X GCTL

TARGET CAPTURE ZONE
INCLUDING 100 FT BUFFER

ZONE OF HYDRAULIC
CONTAINMENT

0 700 1400

SCALE IN FEET

CONCEPTUAL HYDRAULIC CONTAINMENT SCENARIO
FOR DISCUSSION PURPOSES ONLY

Figure 18. Predicted zone of hydraulic containment in the USAS (model Layer 1) under Scenario D.

GeoTrans, Inc.
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0507171178A.DWG

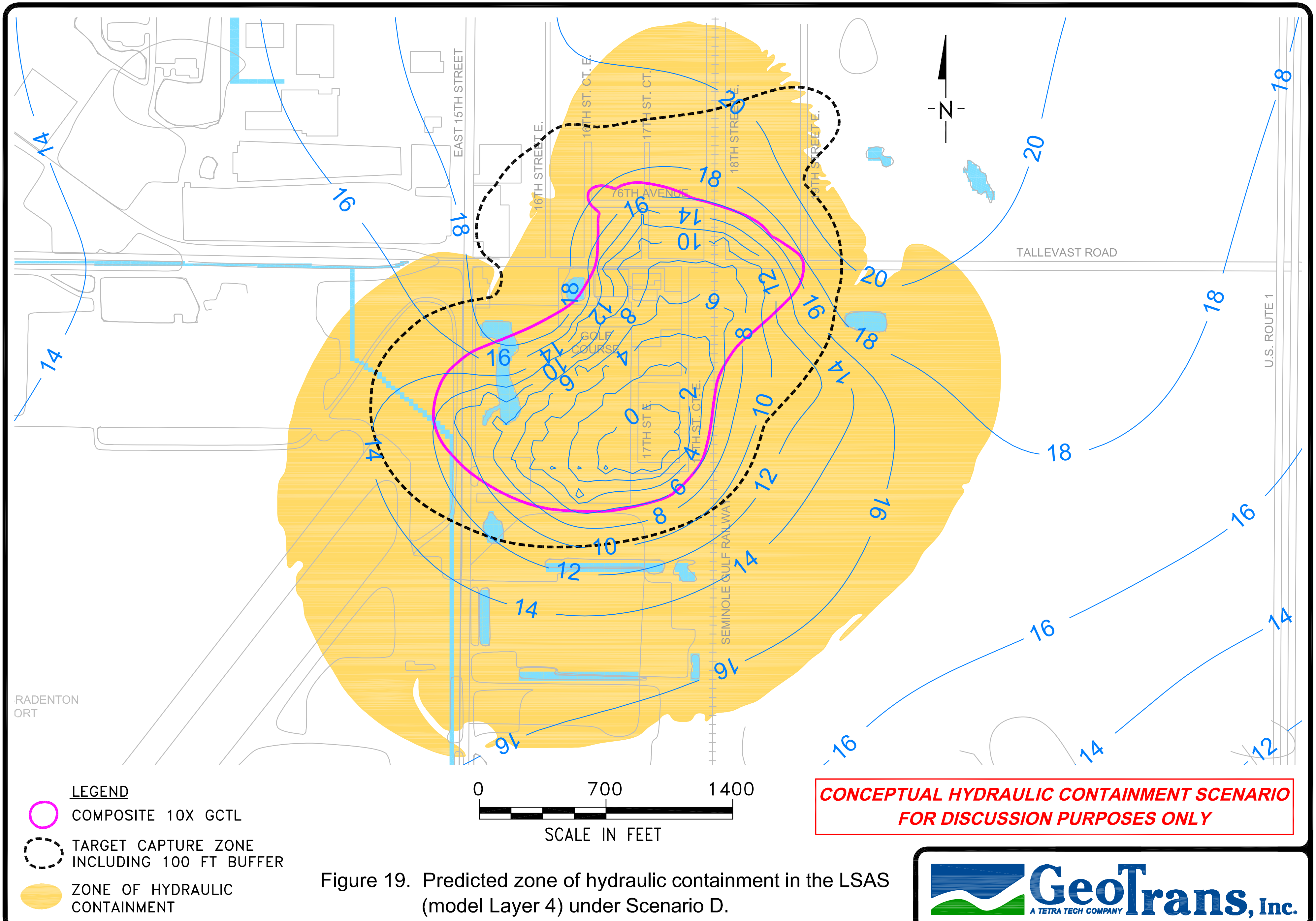


Figure 19. Predicted zone of hydraulic containment in the LSAS (model Layer 4) under Scenario D.

GeoTrans, Inc.
A TETRA TECH COMPANY

0507171179A.DWG

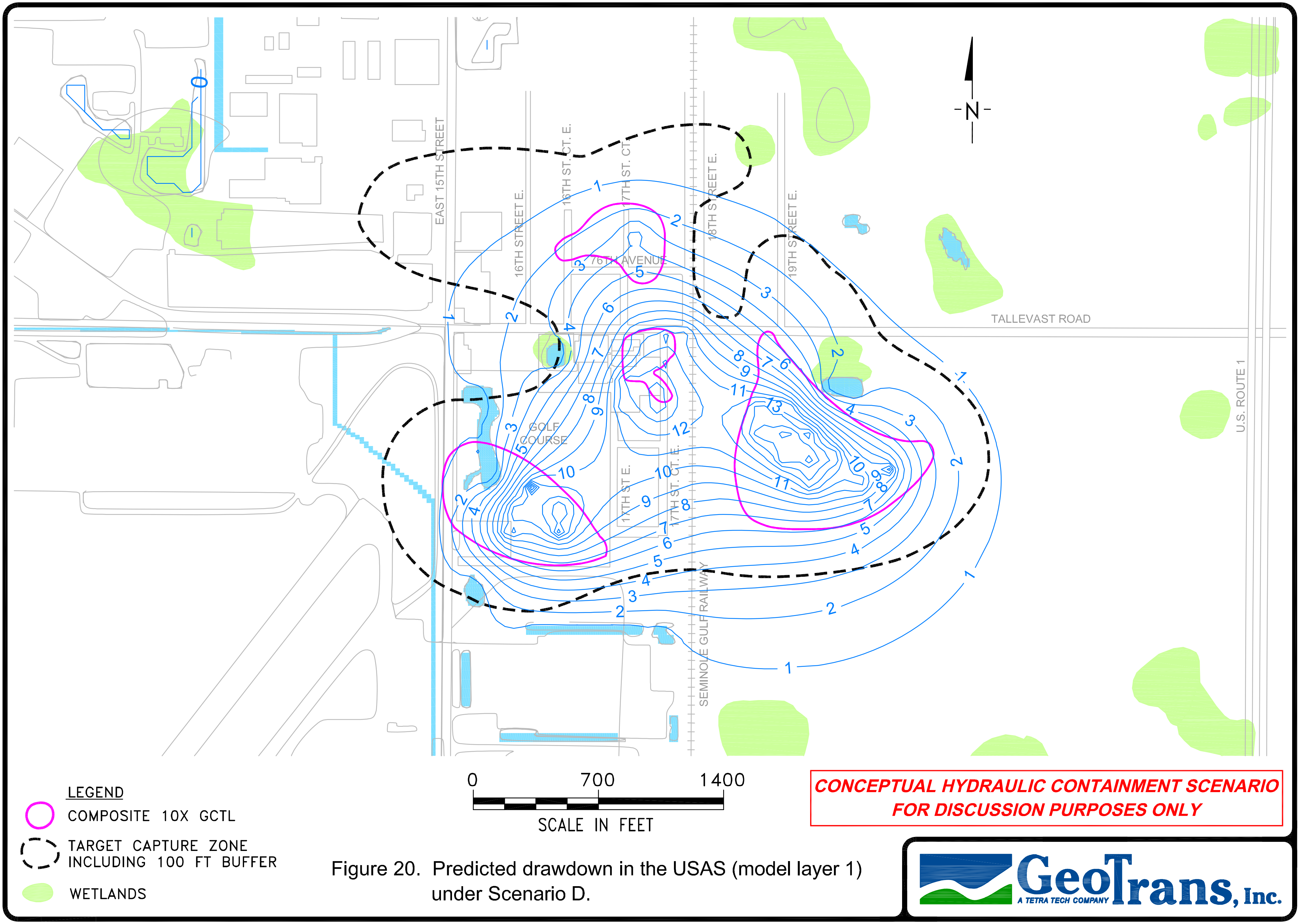
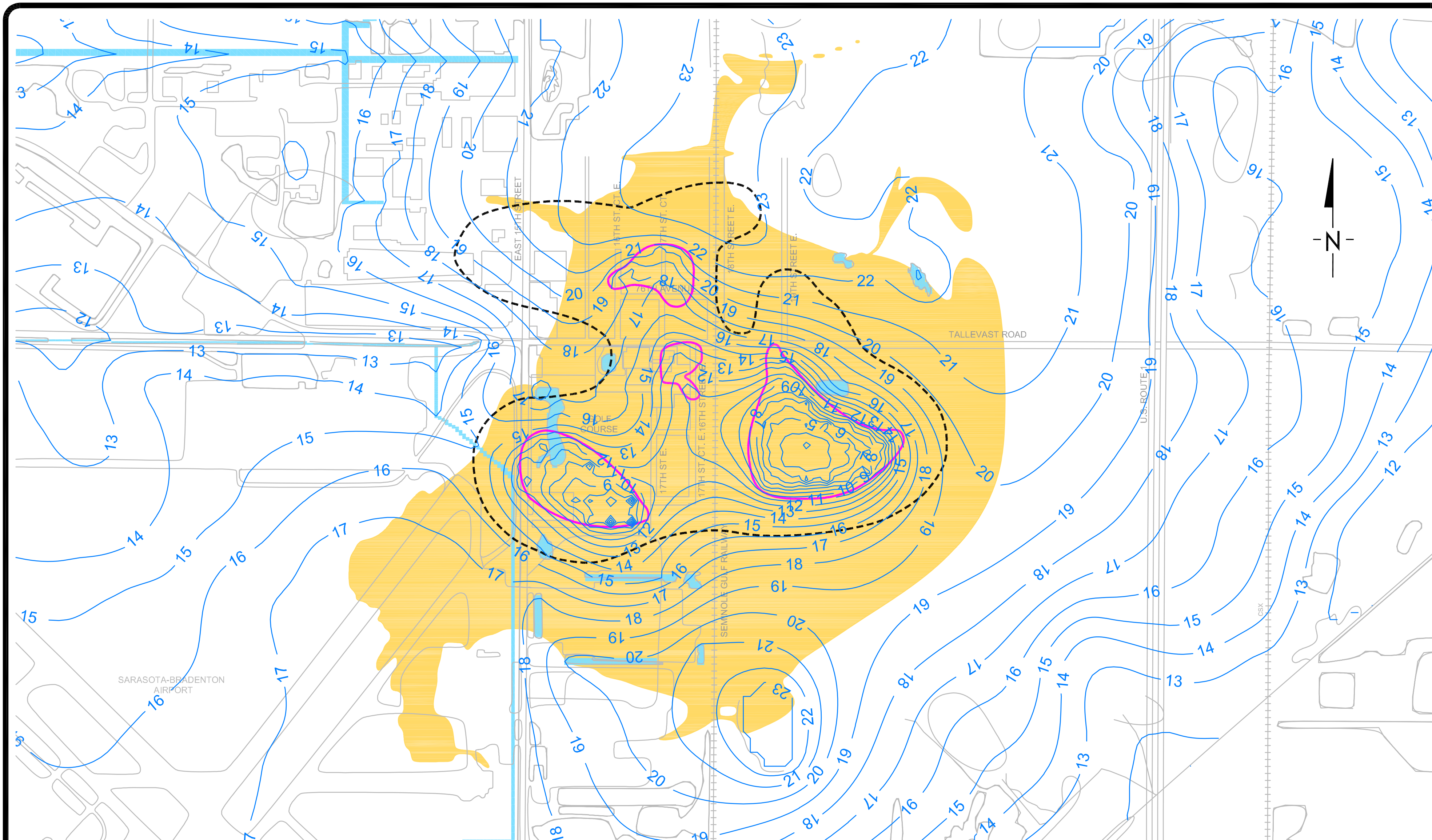


Figure 20. Predicted drawdown in the USAS (model layer 1) under Scenario D.

GeoTrans, Inc. A TETRA TECH COMPANY

0507171180A.DWG



LEGEND

COMPOSITE 10X GCTL

TARGET CAPTURE ZONE INCLUDING 100 FT BUFFER

ZONE OF HYDRAULIC CONTAINMENT

0 1000 2000

SCALE IN FEET

CONCEPTUAL HYDRAULIC CONTAINMENT SCENARIO FOR DISCUSSION PURPOSES ONLY

Figure 21. Predicted zone of hydraulic containment in the USAS (model Layer 1) under Scenario C-2.

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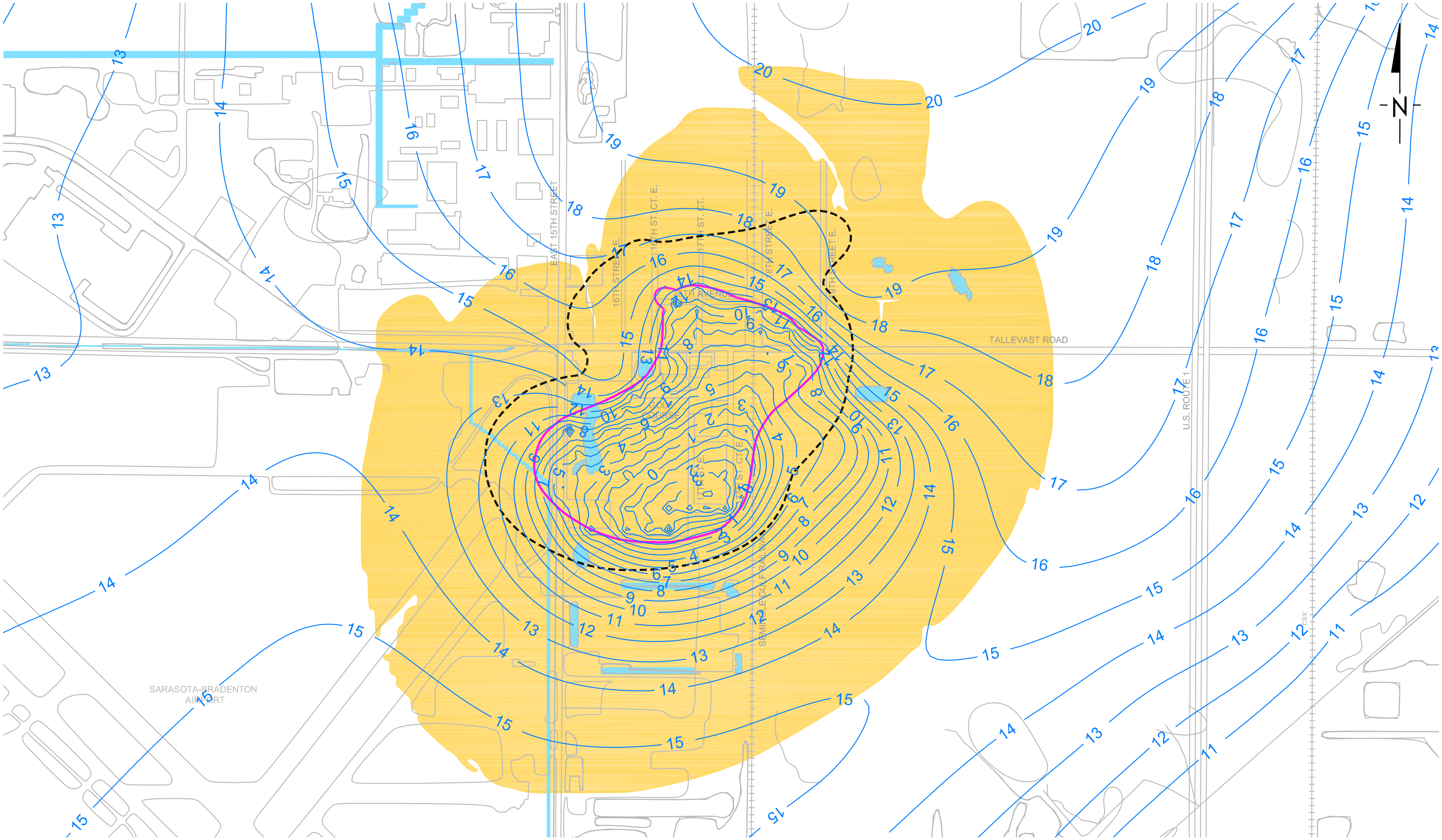
0507171181A.DWG



LEGEND

COMPOSITE 10X GCTL

TARGET CAPTURE ZONE INCLUDING 100 FT BUFFER

ZONE OF HYDRAULIC CONTAINMENT

0 1000 2000

SCALE IN FEET

Figure 22. Predicted zone of hydraulic containment in the LSAS (model Layer 4) under Scenario C-2.

CONCEPTUAL HYDRAULIC CONTAINMENT SCENARIO FOR DISCUSSION PURPOSES ONLY

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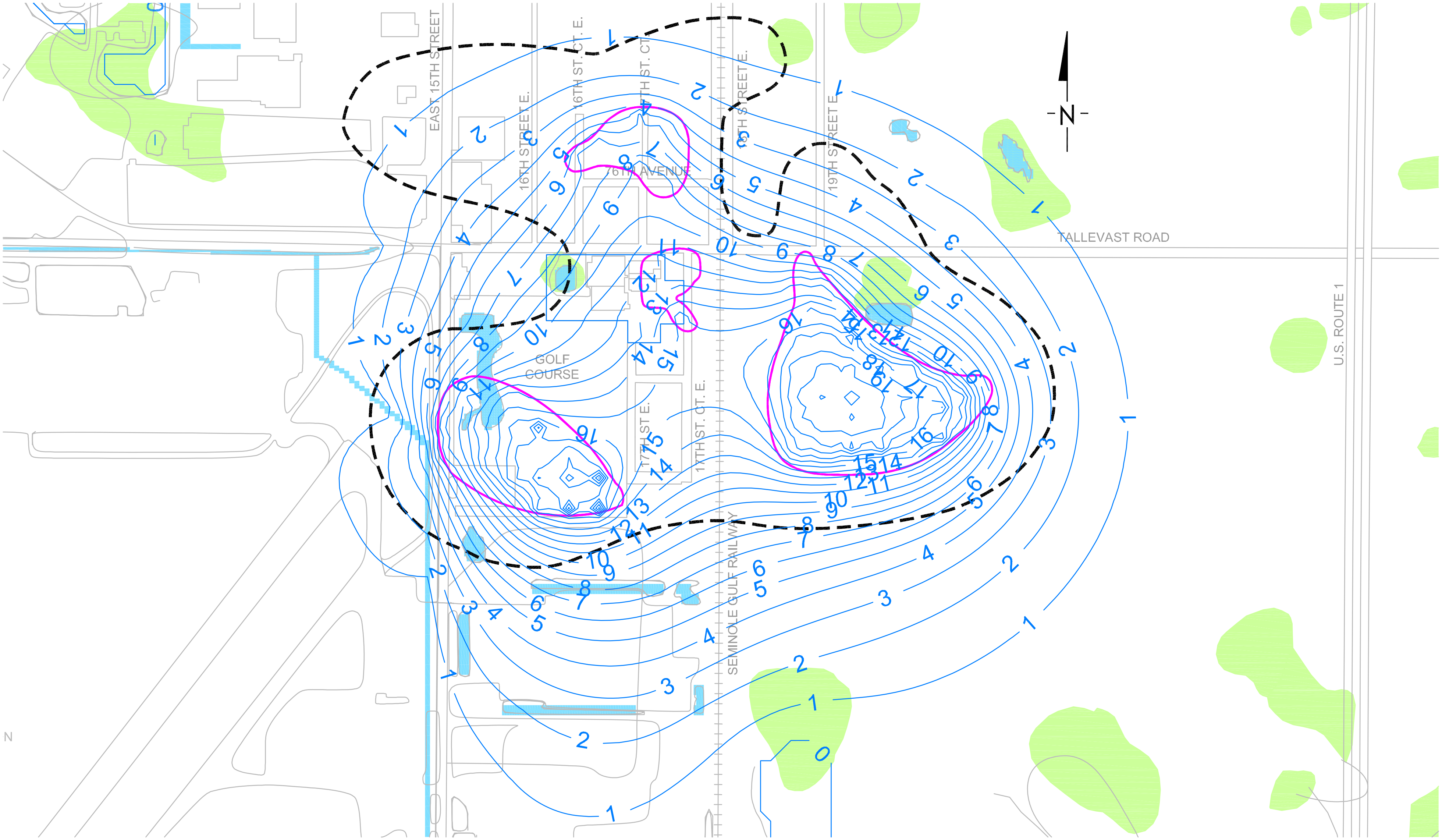

LEGEND

COMPOSITE 10X GCTL

TARGET CAPTURE ZONE INCLUDING 100 FT BUFFER

WETLANDS

0 700 1400

SCALE IN FEET

CONCEPTUAL HYDRAULIC CONTAINMENT SCENARIO FOR DISCUSSION PURPOSES ONLY

Figure 23. Predicted drawdown in the USAS (model layer 1) under Scenario C-2.

GeoTrans, Inc.

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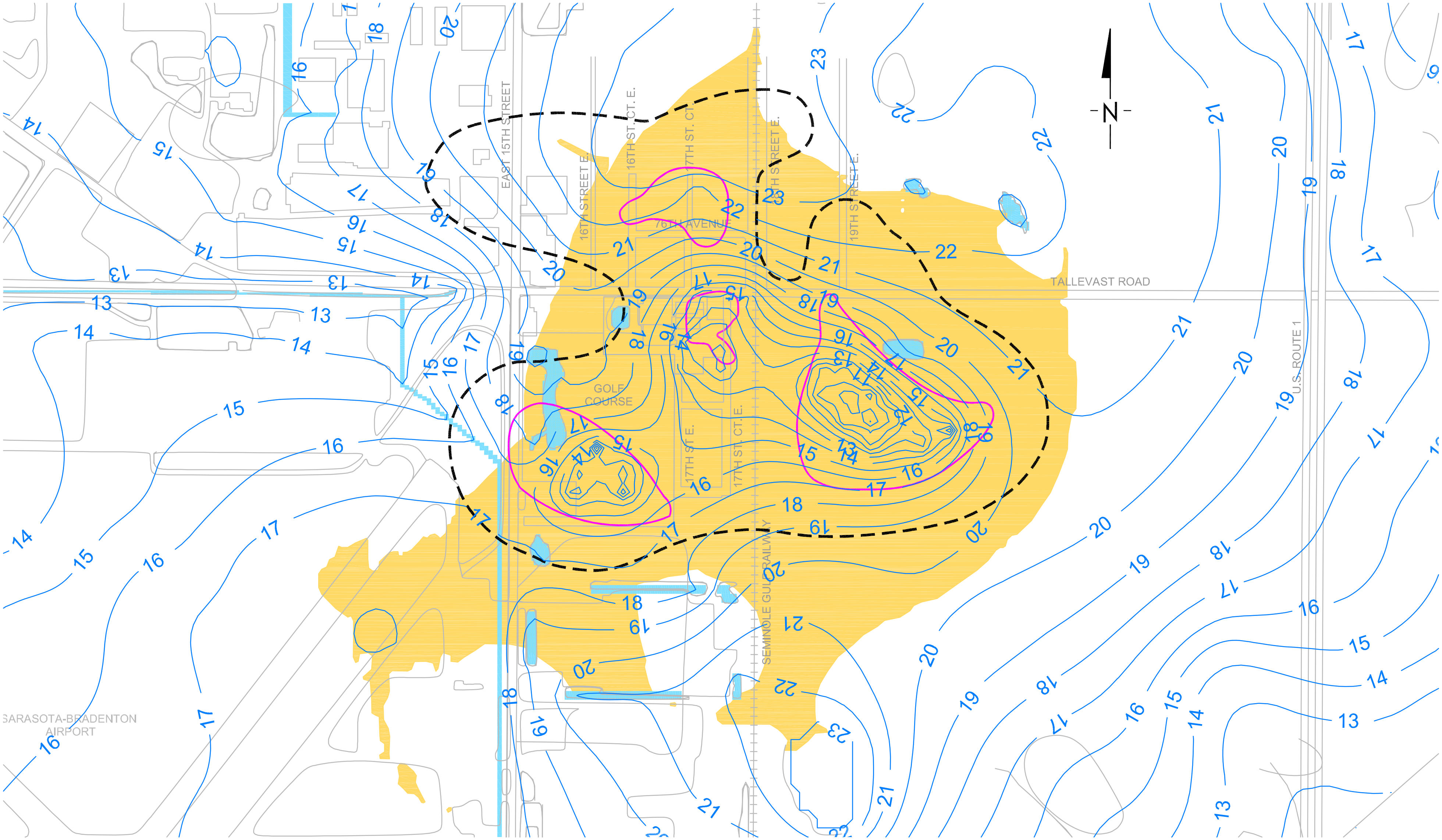
0507171183A.DWG



LEGEND

COMPOSITE 10X GCTL

TARGET CAPTURE ZONE INCLUDING 100 FT BUFFER

ZONE OF HYDRAULIC CONTAINMENT

0 800 1600

SCALE IN FEET

CONCEPTUAL HYDRAULIC CONTAINMENT SCENARIO FOR DISCUSSION PURPOSES ONLY

Figure 24. Predicted zone of hydraulic containment in the USAS (model Layer 1) under Scenario D-2.

GeoTrans, Inc.
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0507171184A.DWG

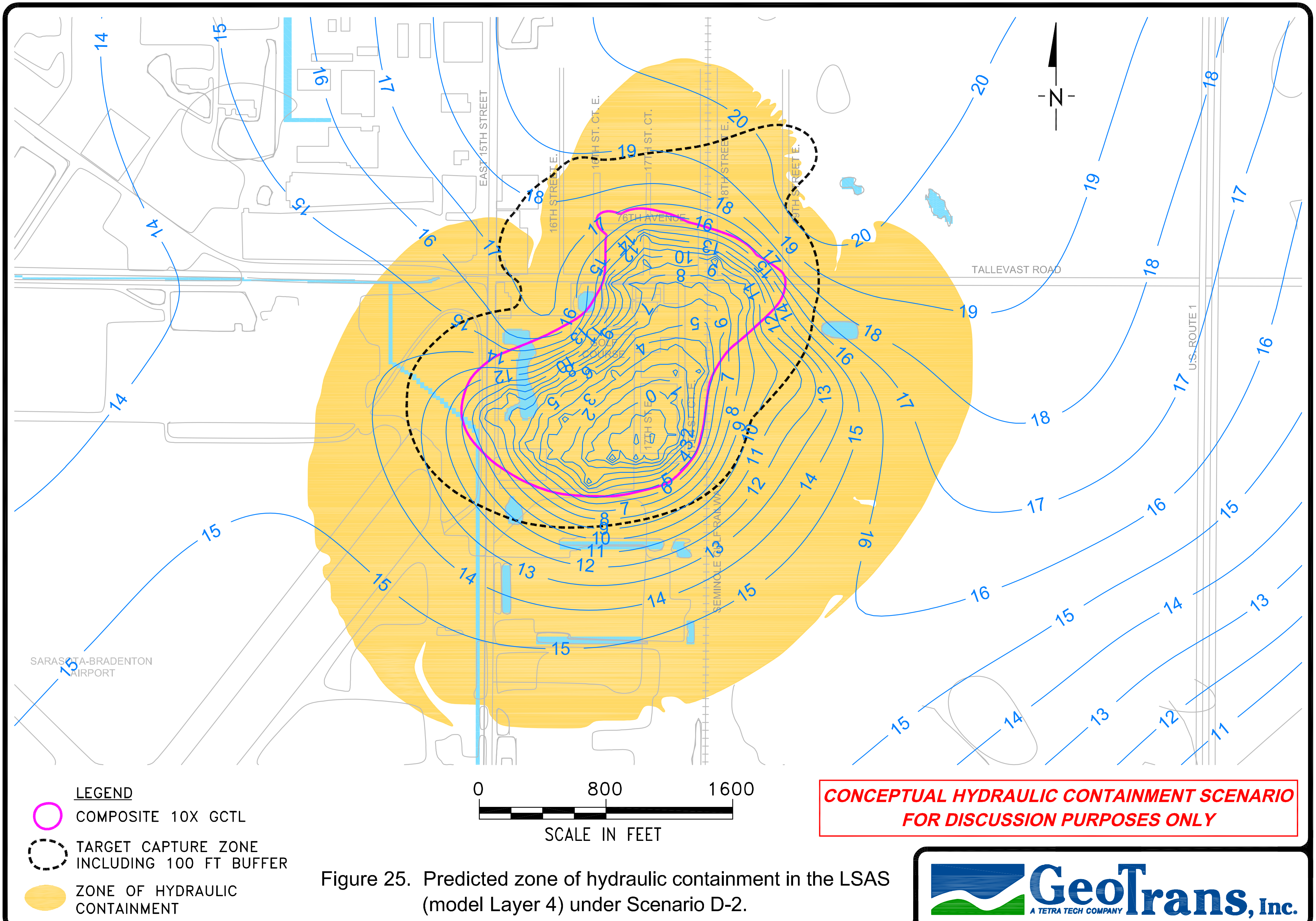
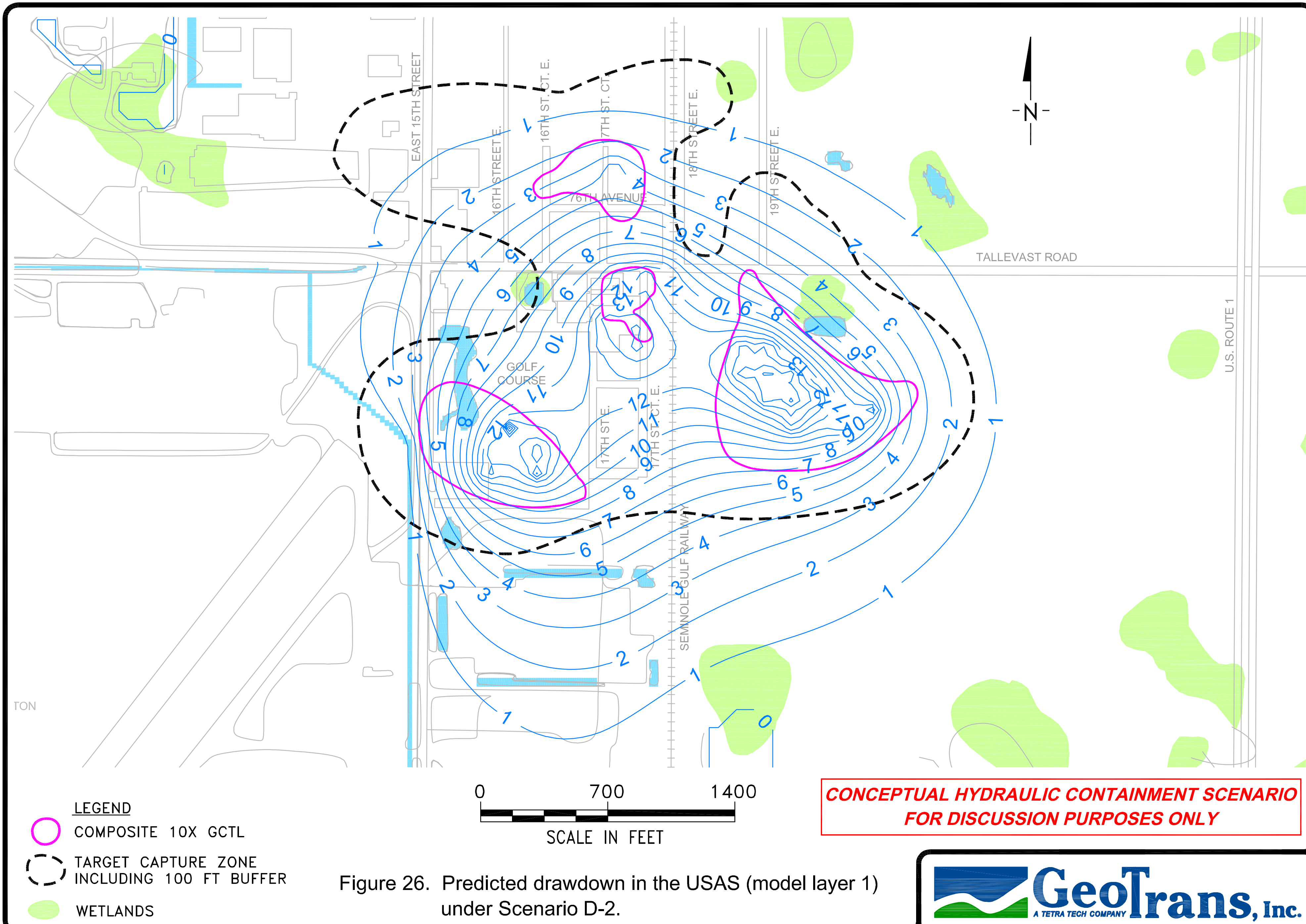


Figure 25. Predicted zone of hydraulic containment in the LSAS (model Layer 4) under Scenario D-2.

GeoTrans, Inc.
A TETRA TECH COMPANY

0507171185A.DWG



CONCEPTUAL HYDRAULIC CONTAINMENT SCENARIO
FOR DISCUSSION PURPOSES ONLY

Figure 26. Predicted drawdown in the USAS (model layer 1) under Scenario D-2.

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