*Prepared for:*

S.M. Stoller Corporation and
US Department of Energy

# PINELLAS ENVIRONMENTAL RESTORATION PROJECT
# YOUNG – RAINEY STAR CENTER
# EVALUATION OF SUBSURFACE VAPOR INTRUSION
# BUILDING 100
# LARGO, FLORIDA

*Prepared by:*

GEOSYNTEC CONSULTANTS
130 Research Lane, Suite 2
Guelph, Ontario N1G 5G3
GeoSyntec Project Number TR0150
26 June 2003

# TABLE OF CONTENTS

Page

1. INTRODUCTION ..... 1

2. BACKGROUND ..... 2

3. CONSIDERATION OF THE RECENT OSWER GUIDANCE DOCUMENT .. 4

4. APPROACH AND RATIONALE ..... 5

5. ESTIMATED INDOOR AIR CONCENTRATIONS – ENTIRE BUILDING ... 6

6. ESTIMATED INDOOR AIR CONCENTRATIONS – BUILDING SUBSECTION ..... 8

7. RESULTS ..... 9

8. CONCLUSIONS AND CONDITIONS ..... 10

## LIST OF TABLES

Table 1: Building 100 Area – Recent Depth To Water Measurements and Inclusion/Exclusion From Vapor Intrusion Assessment
Table 2: Total Flow and Outdoor Air Flow For Each Air Handling Unit Servicing Building 100
Table 3: TCE, cDCE and VC Groundwater Concentrations
Table 4: Groundwater, Calculated Air and Target Indoor Air Concentrations

## LIST OF FIGURES

Figure 1: Building 100 Area Vinyl Chloride Concentrations, April 2002 (Provided by Stoller - GJO)
Figure 2: Building 100 Area cis-1,2-DCE Concentrations, April 2002 (Provided by Stoller - GJO)
Figure 3: Building 100 Area Trichloroethene (TCE) Concentrations, April 2002 (Provided by Stoller - GJO)
Figure 4: Building 100 HVAC Zones – 1st Floor
Figure 5: Building 100 HVAC Zones – 2nd Floor
Figure 6: Building 100: Locations of Fire Walls

# 1. INTRODUCTION

This document was prepared to provide an evaluation of the potential for subsurface vapor intrusion into Building 100 at the Young - Rainey STAR Center in Pinellas, FL, a former Department of Energy (DOE) facility that has been redeveloped into a technology and research park housing multiple tenants. Evaluation of the potential impacts of subsurface vapor intrusion to indoor air is required as part of the Environmental Indicators (EI) program initiated by the General Accounting Office under the Government Performance Results Act of 1993, which requires an assessment of Human Exposures to chemicals of potential concern (RCRIS Code CA725). Subsurface vapor intrusion to indoor air is specifically addressed under Question 3 of the Human Exposures EI, which uses a matrix of potential pathways and receptors to identify pathways that might potentially pose unacceptable risks.

This site-specific assessment of vapor intrusion into Building 100 calculates probable indoor air concentrations for comparison to appropriate indoor air quality targets for selected compounds considered most likely to pose a risk, based on the relative magnitude of their subsurface concentrations to their indoor air target concentrations. The assessment is conducted at a screening level, which means that all calculations are rounded to one significant figure, and the results are expected to have an uncertainty of about one order of magnitude. Target indoor air concentrations are based on an incremental lifetime cancer risk of $10^{-5}$ and a hazard index of 1, which is the current policy for EI determinations under the Resource Conservation and Recovery Act (RCRA).

S.M. Stoller Corporation is the prime environmental contractor for DOE at the facility and GeoSyntec Consultants, Inc. was retained by Stoller to perform this evaluation under subcontract, based on our experience with the vapor intrusion pathway.

## 2. BACKGROUND

The Young - Rainey STAR Center was a former DOE weapons manufacturing facility that operated from 1956 to 1997. Chlorinated solvents were used to clean parts in the manufacturing process. Suspected releases of trichloroethene (TCE) outside the northwest corner of Building 100 appear to have resulted in a plume of groundwater containing dissolved TCE that extends under Building 100, following the direction of groundwater flow to the southeast. Intrisic biodegradation of TCE has produced cis-1,2-dichloroethene (cDCE), and vinyl chloride (VC), which have a similar distribution in groundwater beneath Building 100. Other VOCs have concentrations that are considerably lower by comparison to their toxicity, and so TCE, cDCE and VC have been selected as target compounds for this screening-level analysis. Maps of the TCE, cDCE and VC concentrations in recent samples are shown on Figures 1 to 3.

Table 1 shows the screened interval of each monitoring well. It is important to note that the wells are not all screened across the same vertical interval. Ideally, groundwater samples should be collected from wells screened across the water table to provide groundwater chemistry data representative of the interval that is most likely to contribute vapor to overlying structures. Water levels beneath Building 100 vary seasonally from 3 to 5 feet below ground surface. The top of the well screen is listed on Table 1, to identify wells for which this is the case. Furthermore, monitoring wells beneath or immediately beside Building 100 are more relevant for use in the site-specific assessment than those at further distances. On this basis, a subset of the available monitoring wells has been selected for inclusion in the vapor intrusion assessment, as identified on Table 1.

The geologic materials beneath the site are moderate permeability fine to medium sands. The horizontal groundwater flow velocity is a few feet per year.

Building 100 has 86 air handling units (AHUs) that circulate air within the building and draw new air in from the atmosphere. The volumetric flow rates (Total Flow and Outdoor Air) for each unit are listed in Table 2. By design, approximately 20% of the flow is outdoor air, which is blown into the building by the rooftop AHUs and causes slight positive pressurization of the building. Air is lost through doors, and any other openings, so the sustained pressure differential is small; however, any positive pressure that does develop would tend to counteract potential subsurface vapor intrusion, which

is typically assumed to be drawn into the building in response to a "stack effect" induced by building heating (electrical, gas furnace, or solar). Building 100 is air-conditioned year-round, so a stack effect is not to be expected; in fact, the opposite may occur as cool air inside the building is denser than ambient air and may sink through floor cracks by gravity. The supply of outdoor air also provides for sustainable dilution of any subsurface vapors that are able to intrude by diffusion or barometric pressure fluctuations. Maps of the areas served by the AHUs are shown on Figures 4 and 5 for the first floor and the second floor, respectively. The supply of outdoor air for the entire building is 175,316 standard cubic feet per minute (scfm). Given the area of 451,596 $ft^2$ and a height of about 24 feet, this creates an air exchange rate (AER) of about 0.97 per hour, which is typical for commercial buildings.

Building 100 has a concrete floor, which was designed for heavy industrial manufacturing in most areas. Sealants have been applied to the floor, and all of the subsurface drains have been sealed by pumping full with concrete. Therefore, the floor will act as a substantial barrier to subsurface vapor intrusion, particularly compared to average residential buildings.

## 3. CONSIDERATION OF THE RECENT OSWER GUIDANCE DOCUMENT

The Office of Solid Waste and Emergency Response (OSWER) released a draft Guidance for Evaluating Vapor Intrusion (the VI Guidance) in 2002. Application of this guidance to the subject site would result in the need to perform a Site-Specific Assessment, because the groundwater concentrations are higher than the groundwater screening values listed in Table 2b or 3b for TCE, cDCE and VC. Question 6 of the VI Guidance provides a detailed and relatively prescriptive flowchart-style guide to conducting Site-Specific Assessments. Responses would include:

> *6(a) Have the nature and extent of contamination, potential preferential (pathways) and overlying building characteristics (been) adequately characterized to identify the likely-to-be-impacted buildings?*

Building 100 is the likely-to-be-impacted building, so the answer is "yes", and the flowchart progresses to:

> *6(b) Conducting EI determination (using) an appropriate and applicable (sic) (model?)*

This document is intended for an EI determination and an appropriate model is described herein, so the answer is "yes", and the flowchart progresses to:

> *6(c) Does the model predict an unacceptable risk?*

This will be addressed in the sections that follow.

## 4. APPROACH AND RATIONALE

Indoor air concentrations are often estimated from subsurface vapor concentrations using a modeled or empirical attenuation coefficient (a.k.a. "alpha factor"). If only groundwater data are available, the corresponding soil gas concentration is often calculated by multiplying the groundwater concentration by Henry's Constant, assuming equilibrium partitioning between the two phases. Fitzgerald and Fitzpatrick (1996) showed that deep soil gas concentrations are often not in equilibrium with shallow groundwater, often with concentrations lower by one or two orders of magnitude. Models used to calculate attenuation coefficients (ratio of indoor air concentration to soil gas concentration at the "source", i.e. water table in this scenario) have come under criticism, to the extent that even EPA has begun to rely on empirical attenuation coefficients (Appendix F of the VI Guidance). The empirical alpha factors span a range of several orders of magnitude, and may not even be applicable to an industrial building (net positive pressure from AHUs), since they have been developed using data from residential buildings (net negative pressure from the stack effect).

The alternate approach considered more appropriate for the site-specific conditions is to calculate the potential upward mass flux of vapors, and divide into the building ventilation rate, which yields a calculated indoor air concentration. This was performed for the entire building, and for a worst-case subsection, since the dimensions of segregated air-spaces within the building and flow rates for each AHU are known. The floor of the building was assumed to provide some resistance to upward flux of vapors. The target indoor air concentrations for a workplace were calculated from the residential target concentrations in the VI Guidance by multiplying by 40 working hours per week and dividing by (24 X 7) hours of occupancy assumed for in the residential exposure scenario considered in the VI Guidance. Permissible Exposure Levels (PELs) regulated by the Occupational Safety and Health Administration (OSHA) are applicable in workplaces, but are sufficiently higher as to be easily met.

Given that the calculations are intended to provide "order of magnitude" estimates, the vapor intrusion pathway is considered to be incomplete if the calculated indoor air concentrations are lower than the target indoor air concentrations by more than at least one order of magnitude.

## 5. ESTIMATED INDOOR AIR CONCENTRATIONS – ENTIRE BUILDING

The upward flux of VOCs from groundwater to indoor air is influenced by several processes: upward aqueous diffusion across the capillary fringe, volatilization from the top of the capillary fringe to soil gas, and upward diffusion through both soil gas and pore water, transport through the floor slab (or discontinuities in it), and dilution in circulating air within the building. Gaseous diffusion coefficients are typically about 4 orders of magnitude higher than aqueous diffusion coefficients, so aqueous diffusion across the capillary fringe is likely to be a rate-limiting step, at least compared to the rates of volatilization and gaseous diffusion through the unsaturated zone. To a first approximation, the upward flux across the capillary fringe can be calculated using Fick's First Law:

$$F = A\ D\ dC_{gw}/dz$$

Where:
F is the mass flux (mg/s)
A is the area of the floor ($m^2$)
D is the effective diffusion coefficient ($m^2/s$)
$C_{gw}$ is groundwater concentration ($mg/m^3$)
z is the vertical dimension

The most conservative estimate of the upward flux would result from assuming maximum values for the concentration gradient, diffusion coefficient and floor area:

**Floor Area**: The footprint of the entire Building 100 is about 451,596 $ft^2$.

**Diffusions Coefficient**: The upper end range of effective aqueous diffusion coefficients is about $5 \times 10^{-10}$ $m^2/s$ (Freeze and Cherry, 1979).

**Concentration Gradient**: The concentrations gradient is the difference in concentration across the capillary fringe divided by the thickness of the capillary fringe. There are not measurements of the concentrations at the top of the capillary fringe, so these were assumed to be zero, which maximizes the concentration gradient and is clearly a conservative end-member. The concentration at the bottom of the capillary fringe should be a measure of central tendency of the groundwater concentrations

within the footprint of the area of interest. The groundwater data did not fit either a normal or log-normal distribution, so it is difficult to discern whether the best measure of central tendency is an arithmetic or geometric mean, so calculations have been performed using both methods of central tendency. Table 3 shows the list of monitoring wells that are near or under Building 100 and have screened intervals that are near or spanning the water table, along with representative values for the concentrations of TCE, cDCE and VC. Representative concentrations were assigned by selecting the highest concentration in recent samples, or one-half the detection limit if no recent samples had detectable concentrations. This is conservative because some samples had elevated detection limits so a value of ½ the detection limit probably over-estimates the actual concentration; however, this is still considered acceptable for a screening-level assessment. A conservative estimate of the thickness of the capillary fringe is 0.1 m.

The most conservative estimate of the indoor air concentration would result from dividing the upward diffusive flux across the capillary fringe by the supply of outdoor air to Building 100 provided by the AHUs (175,316 scfm). However, this would fail to recognize the resistance imposed by the floor slab, and any benefit derived by slight positive pressurization of the building by the AHUs. The floor slab probably provides a resistance that would diminish vapor intrusion by at least one order of magnitude, based on studies of building sealing (Personal Communication with Ron Mosely of US EPA) that show barriers are typically capable of reducing indoor air concentrations by one to two orders of magnitude. The positive pressurization of the building would have an effect similar to subslab de-pressurization, which can typically reduce indoor air concentrations by 2 or 3 orders of magnitude. Given that Building 100 is not sealed tightly enough to sustain a large pressure gradient, the benefit of positive pressurization has been conservatively assumed to reduce indoor air concentrations by only one order of magnitude. The two factors together result in a factor of 100, therefore, the indoor air concentrations ($C_{ia}$) can be calculated as:

$$C_{ia} = F/(100 \times 175{,}316 \text{ scfm})$$

## 6. ESTIMATED INDOOR AIR CONCENTRATIONS – BUILDING SUBSECTION

A second set of calculations was performed to assess whether indoor air concentrations might be higher within subsections of Building 100, especially where groundwater concentrations are highest. By inspection of the groundwater concentration data in Figures 1, 2 and 3, the maximum concentrations are located in the area immediately downgradient of the suspected source area beside Recovery Wells RW01 and RW02, located at the northwest corner of Building 100. A firewall segregates the northwest corner of Building 100 from the rest of the building (including Areas 105, 123, 124, 192, 193, 194, and 195), covering an area (A) of approximately 70,000 square feet, as shown in Figure 6. This area is serviced by AHUs 94, 135, 138, 160, 161, 162, 166, 167, 169, 171, 173, 216, and 217. The total outdoor air supply provided by these AHUs is 15,470 scfm. The calculated indoor air concentrations for this subsection of Building 100 were calculated using the same equations, with modified input values for the groundwater concentration, floor area and outdoor air supply, as follows:

$$F = 70{,}000\ ft^2\ D\ dC_{gw}/dz$$

$$C_{ia} = F/(100 \times 15{,}470\ scfm)$$

The values for $C_{gw}$ were calculated two ways, using arithmetic mean and geometric mean values, as shown on Table 3.

## 7. RESULTS

The calculated indoor air concentrations for TCE, cDCE and VC are presented on Table 4 and summarized below:

| | TCE | cDCE | VC |
|---|---|---|---|
| Target Indoor Concentration (ug/m3) (see Table 4) | 1 | 147 | 12 |
| Building Calculated Indoor Air Concentration (Cia) | | | |
| Using Arithmetic Mean (ug/m3) | 0.07 | 0.13 | 0.03 |
| Using Geometric Mean (ug/m3) | 0.00005 | 0.00018 | 0.00016 |
| Subsection Calculated Indoor Air Concentration (Cia) | | | |
| Using Arithmetic Mean (ug/m3) | 0.15 | 0.28 | 0.07 |
| Using Geometric Mean (ug/m3) | 0.00012 | 0.00068 | 0.00074 |
| Cia more than 1 order of magnitude below target? | YES | YES | YES |

Using arithmetic mean values, the calculated indoor air concentrations for TCE, cDCE and VC were lower than the target indoor air concentration by one to three orders of magnitude, which is generally greater than the target uncertainty in the screening level analysis. The TCE target indoor air concentration is based on a revised cancer potency factor that is still considered to be a draft value, and would be more than 60 times higher if the former cancer potency factor was used.

Using geometric mean values, the calculated indoor air concentrations for TCE, cDCE and VC were lower than the target indoor air concentration by more than three orders of magnitude, which indicates that the outcome of the screening does not depend on the method of central tendency selected.

## 8. CONCLUSIONS AND CONDITIONS

Considering the conservative assumptions made in these calculations, the analysis indicates that subsurface vapor intrusion for TCE, cDCE and VC are unlikely to cause indoor air concentrations above the target levels. Therefore, the pathway can be considered "incomplete" (according to the definition in the Guidance) for the EI determination.

The analysis presented in this document is conditional on the continued operation of the AHUs similar to their current configuration. It is unlikely that this will change, since the climate in Florida is such that virtually all such buildings are air-conditioned year-round. Any significant change in the air-conditioning of the building is likely to also significantly affect the occupancy, so this constraint is not considered to be a major limitation.

# TABLE 1
## BUILDING 100 AREA - RECENT DEPTH TO WATER MEASUREMENTS AND INCLUSION/EXCLUSION FROM VAPOR INTRUSION ASSESSMENT
### Star Rainey Center, Pinellas, Florida

| Parameter | Well | Date | Depth to water (ft bls) | Top of screen (ft bls) | Located beside or under Building 100 Footprint? | Include or exclude from vapor intrusion assessment? |
|---|---|---|---|---|---|---|
| PIN06 | 0500 | 07/10/02 | 3.55 | 3 | yes | include |
| PIN06 | 0500 | 10/07/02 | 3.50 | 3 | yes | include |
| PIN06 | 0500 | 01/06/03 | 2.28 | 3 | yes | include |
| PIN06 | 0500 | 04/04/03 | 3.27 | 3 | yes | include |
| PIN06 | 0501 | 07/10/02 | 3.91 | 3 | yes | include |
| PIN06 | 0501 | 10/07/02 | 4.70 | 3 | yes | include |
| PIN06 | 0501 | 01/06/03 | 2.55 | 3 | yes | include |
| PIN06 | 0501 | 04/04/03 | 3.49 | 3 | yes | include |
| PIN09 | 0500 | 07/10/02 | 3.25 | 3 | yes | include |
| PIN09 | 0500 | 10/07/02 | 2.55 | 3 | yes | include |
| PIN09 | 0500 | 01/06/03 | 1.76 | 3 | yes | include |
| PIN09 | 0500 | 04/04/03 | 2.57 | 3 | yes | include |
| PIN10 | 0500 | 07/10/02 | 5.60 | 3 | no | exclude |
| PIN10 | 0500 | 10/07/02 | 6.23 | 3 | no | exclude |
| PIN10 | 0500 | 01/06/03 | 5.06 | 3 | no | exclude |
| PIN10 | 0500 | 04/04/03 | 5.89 | 3 | no | exclude |
| PIN12 | 0508 | 07/10/02 | 3.55 | 3 | yes | include |
| PIN12 | 0508 | 10/07/02 | 3.33 | 3 | yes | include |
| PIN12 | 0508 | 01/06/03 | 2.75 | 3 | yes | include |
| PIN12 | 0508 | 04/04/03 | 3.43 | 3 | yes | include |
| PIN12 | 0509 | 07/10/02 | 3.63 | 3 | yes | include |
| PIN12 | 0509 | 10/07/02 | 2.89 | 3 | yes | include |
| PIN12 | 0509 | 01/06/03 | 2.61 | 3 | yes | include |
| PIN12 | 0509 | 04/04/03 | 3.09 | 3 | yes | include |
| PIN12 | 0510 | 07/10/02 | 4.52 | 3 | yes | include |
| PIN12 | 0510 | 10/07/02 | 4.00 | 3 | yes | include |
| PIN12 | 0510 | 01/06/03 | 3.10 | 3 | yes | include |
| PIN12 | 0510 | 04/04/03 | 3.84 | 3 | yes | include |
| PIN12 | 0511 | 07/09/02 | 6.66 | 3 | yes | include |
| PIN12 | 0511 | 10/07/02 | 6.23 | 3 | yes | include |
| PIN12 | 0511 | 01/06/03 | 5.57 | 3 | yes | include |
| PIN12 | 0511 | 04/04/03 | 6.18 | 3 | yes | include |
| PIN12 | 0512 | 07/09/02 | 2.69 | 3 | yes | include |
| PIN12 | 0512 | 10/07/02 | 2.54 | 3 | yes | include |
| PIN12 | 0512 | 01/06/03 | 1.97 | 3 | yes | include |
| PIN12 | 0512 | 04/04/03 | 2.37 | 3 | yes | include |
| PIN12 | 0513 | 07/10/02 | 4.18 | 15 | yes | include |
| PIN12 | 0513 | 10/07/02 | 4.52 | 15 | yes | include |
| PIN12 | 0513 | 01/06/03 | 4.02 | 15 | yes | include |
| PIN12 | 0513 | 04/04/03 | 4.30 | 15 | yes | include |
| PIN12 | 0514 | 07/10/02 | 4.30 | 30 | yes | exclude |
| PIN12 | 0514 | 10/07/02 | 4.68 | 30 | yes | exclude |
| PIN12 | 0514 | 01/06/03 | 4.31 | 30 | yes | exclude |
| PIN12 | 0514 | 04/04/03 | 4.56 | 30 | yes | exclude |
| PIN12 | 0515 | 07/10/02 | 3.56 | 15 | yes | include |
| PIN12 | 0515 | 10/11/02 | 3.18 | 15 | yes | include |
| PIN12 | 0515 | 01/06/03 | 3.46 | 15 | yes | include |

**TABLE 1**
**BUILDING 100 AREA - RECENT DEPTH TO WATER MEASUREMENTS AND INCLUSION/EXCLUSION FROM VAPOR INTRUSION ASSESSMENT**
**Star Rainey Center, Pinellas, Florida**

| Parameter | Well | Date | Depth to water (ft bls) | Top of screen (ft bls) | Located beside or under Building 100 Footprint? | Include or exclude from vapor intrusion assessment? |
|---|---|---|---|---|---|---|
| PIN12 | 0516 | 07/10/02 | 3.61 | 30 | yes | exclude |
| PIN12 | 0516 | 10/07/02 | 3.84 | 30 | yes | exclude |
| PIN12 | 0516 | 01/06/03 | 3.38 | 30 | yes | exclude |
| PIN12 | 0516 | 04/04/03 | 3.75 | 30 | yes | exclude |
| PIN12 | 0517 | 07/10/02 | 3.02 | 15 | yes | include |
| PIN12 | 0517 | 10/07/02 | 3.44 | 15 | yes | include |
| PIN12 | 0517 | 01/06/03 | 2.98 | 15 | yes | include |
| PIN12 | 0517 | 04/04/03 | 3.40 | 15 | yes | include |
| PIN12 | 0518 | 07/10/02 | 3.07 | 30 | yes | exclude |
| PIN12 | 0518 | 10/07/02 | 3.60 | 30 | yes | exclude |
| PIN12 | 0518 | 01/06/03 | 3.07 | 30 | yes | exclude |
| PIN12 | 0518 | 04/04/03 | 3.34 | 30 | yes | exclude |
| PIN12 | 0520 | 07/10/02 | 3.80 | 36 | yes | exclude |
| PIN12 | 0520 | 10/07/02 | 2.88 | 36 | yes | exclude |
| PIN12 | 0520 | 01/06/03 | 2.30 | 36 | yes | exclude |
| PIN12 | 0520 | 04/04/03 | 3.10 | 36 | yes | exclude |
| PIN12 | 0521 | 07/10/02 | 4.25 | 19.5 | yes | exclude |
| PIN12 | 0521 | 10/07/02 | 4.12 | 19.5 | yes | exclude |
| PIN12 | 0521 | 01/06/03 | 2.98 | 19.5 | yes | exclude |
| PIN12 | 0521 | 04/04/03 | 3.89 | 19.5 | yes | exclude |
| PIN12 | 0522 | 07/10/02 | 5.08 | 32 | yes | exclude |
| PIN12 | 0522 | 10/07/02 | 4.95 | 32 | yes | exclude |
| PIN12 | 0522 | 01/06/03 | 3.84 | 32 | yes | exclude |
| PIN12 | 0522 | 04/04/03 | 4.78 | 32 | yes | exclude |
| PIN12 | 0523 | 07/10/02 | 5.18 | 18 | yes | exclude |
| PIN12 | 0523 | 10/07/02 | 4.91 | 18 | yes | exclude |
| PIN12 | 0523 | 01/06/03 | 3.83 | 18 | yes | exclude |
| PIN12 | 0523 | 04/04/03 | 4.74 | 18 | yes | exclude |
| PIN12 | 0524 | 07/10/02 | 2.69 | 27 | yes | exclude |
| PIN12 | 0524 | 10/07/02 | 3.05 | 27 | yes | exclude |
| PIN12 | 0524 | 01/06/03 | 2.65 | 27 | yes | exclude |
| PIN12 | 0524 | 04/04/03 | 2.74 | 27 | yes | exclude |
| PIN12 | 0525 | 07/10/02 | 3.07 | 12 | yes | include |
| PIN12 | 0525 | 10/07/02 | 3.41 | 12 | yes | include |
| PIN12 | 0525 | 01/06/03 | 3.00 | 12 | yes | include |
| PIN12 | 0525 | 04/04/03 | 3.3 | 12 | yes | include |
| PIN12 | 0526 | 07/10/02 | 2.72 | 19.5 | no | exclude |
| PIN12 | 0526 | 10/07/02 | 3.13 | 19.5 | no | exclude |
| PIN12 | 0526 | 01/06/03 | 2.54 | 19.5 | no | exclude |
| PIN12 | 0526 | 04/04/03 | 2.99 | 19.5 | no | exclude |
| PIN12 | 0527 | 07/10/02 | 13.73 | 118 | ? | exclude |
| PIN12 | 0527 | 10/07/02 | 13.31 | 118 | ? | exclude |
| PIN12 | 0527 | 01/06/03 | 12.35 | 118 | ? | exclude |
| PIN12 | 0527 | 04/04/03 | 13.53 | 118 | ? | exclude |
| PIN12 | 0528 | 07/10/02 | 13.34 | 121 | no | exclude |
| PIN12 | 0528 | 10/07/02 | 13.03 | 121 | no | exclude |
| PIN12 | 0528 | 01/06/03 | 12.05 | 121 | no | exclude |
| PIN12 | 0528 | 04/04/03 | 13.46 | 121 | no | exclude |

**TABLE 1**
**BUILDING 100 AREA - RECENT DEPTH TO WATER MEASUREMENTS AND INCLUSION/EXCLUSION FROM VAPOR INTRUSION ASSESSMENT**
**Star Rainey Center, Pinellas, Florida**

| Parameter | Well | Date | Depth to water (ft bls) | Top of screen (ft bls) | Located beside or under Building 100 Footprint? | Include or exclude from vapor intrusion assessment? |
|---|---|---|---|---|---|---|
| PIN12 | RW01 | 07/10/02 | 17.76 | 19 | yes | exclude |
| PIN12 | RW01 | 10/07/02 | 20.18 | 19 | yes | exclude |
| PIN12 | RW01 | 01/06/03 | 17.11 | 19 | yes | exclude |
| PIN12 | RW01 | 04/04/03 | 18.92 | 19 | yes | exclude |
| PIN12 | RW02 | 10/07/02 | 7.19 | 25 | yes | exclude |
| PIN12 | RW02 | 01/06/03 | 5.60 | 25 | yes | exclude |
| PIN12 | RW02 | 04/04/03 | 6.88 | 25 | yes | exclude |
| PIN12 | S29C | 07/10/02 | 4.92 | 14 | yes | include |
| PIN12 | S29C | 10/07/02 | 4.37 | 14 | yes | include |
| PIN12 | S29C | 01/06/03 | 3.45 | 14 | yes | include |
| PIN12 | S29C | 04/04/03 | 4.25 | 14 | yes | include |
| PIN12 | S30B | 07/10/02 | 5.12 | 5 | yes | include |
| PIN12 | S30B | 10/07/02 | 4.58 | 5 | yes | include |
| PIN12 | S30B | 01/06/03 | 3.66 | 5 | yes | include |
| PIN12 | S30B | 04/04/03 | 4.43 | 5 | yes | include |
| PIN12 | S31B | 07/10/02 | 4.63 | 5 | yes | include |
| PIN12 | S31B | 10/07/02 | 4.13 | 5 | yes | include |
| PIN12 | S31B | 01/06/03 | 3.14 | 5 | yes | include |
| PIN12 | S31B | 04/04/03 | 4.07 | 5 | yes | include |
| PIN12 | S32B | 07/10/02 | 4.96 | 5.5 | yes | include |
| PIN12 | S32B | 10/07/02 | 4.35 | 5.5 | yes | include |
| PIN12 | S32B | 01/06/03 | 3.24 | 5.5 | yes | include |
| PIN12 | S32B | 04/04/03 | 4.30 | 5.5 | yes | include |
| PIN12 | S33C | 07/10/02 | 5.32 | 11 | yes | include |
| PIN12 | S33C | 10/07/02 | 4.71 | 11 | yes | include |
| PIN12 | S33C | 01/06/03 | 3.47 | 11 | yes | include |
| PIN12 | S33C | 04/04/03 | 4.70 | 11 | yes | include |
| PIN12 | S35B | 07/10/02 | 4.96 | 5 | yes | include |
| PIN12 | S35B | 10/07/02 | 4.33 | 5 | yes | include |
| PIN12 | S35B | 01/06/03 | 3.90 | 5 | yes | include |
| PIN12 | S35B | 04/04/03 | 4.35 | 5 | yes | include |
| PIN12 | S36B | 07/10/02 | 4.67 | 5 | yes | include |
| PIN12 | S36B | 10/07/02 | 4.11 | 5 | yes | include |
| PIN12 | S36B | 01/06/03 | 3.61 | 5 | yes | include |
| PIN12 | S36B | 04/04/03 | 4.13 | 5 | yes | include |
| PIN12 | S37B | 07/10/02 | 5.07 | 5 | yes | include |
| PIN12 | S37B | 10/07/02 | 4.46 | 5 | yes | include |
| PIN12 | S37B | 01/06/03 | 3.51 | 5 | yes | include |
| PIN12 | S37B | 04/04/03 | 4.45 | 5 | yes | include |
| PIN12 | S54D | 07/10/02 | 4.74 | 36 | yes | exclude |
| PIN12 | S54D | 10/07/02 | 4.26 | 36 | yes | exclude |
| PIN12 | S54D | 01/06/03 | 3.65 | 36 | yes | exclude |
| PIN12 | S55B | 07/10/02 | 4.42 | 10 | yes | include |
| PIN12 | S55B | 10/07/02 | 3.95 | 10 | yes | include |
| PIN12 | S55B | 01/06/03 | 3.58 | 10 | yes | include |
| PIN12 | S55B | 04/04/03 | 3.97 | 10 | yes | include |

**TABLE 1**
**BUILDING 100 AREA - RECENT DEPTH TO WATER MEASUREMENTS AND INCLUSION/EXCLUSION FROM VAPOR INTRUSION ASSESSMENT**
**Star Rainey Center, Pinellas, Florida**

| Parameter | Well | Date | Depth to water (ft bls) | Top of screen (ft bls) | Located beside or under Building 100 Footprint? | Include or exclude from vapor intrusion assessment? |
|---|---|---|---|---|---|---|
| PIN12 | S55C | 07/10/02 | 4.42 | 20.5 | yes | exclude |
| PIN12 | S55C | 10/07/02 | 3.93 | 20.5 | yes | exclude |
| PIN12 | S55C | 01/06/03 | 3.60 | 20.5 | yes | exclude |
| PIN12 | S55C | 04/04/03 | 4.00 | 20.5 | yes | exclude |
| PIN12 | S55D | 10/07/02 | 4.28 | ? | ? | exclude |
| PIN12 | S55D | 01/06/03 | 8.29 | ? | ? | exclude |
| PIN12 | S56B | 07/10/02 | 4.02 | 10 | yes | include |
| PIN12 | S56B | 10/07/02 | 3.90 | 10 | yes | include |
| PIN12 | S56B | 01/06/03 | 3.43 | 10 | yes | include |
| PIN12 | S56B | 04/04/03 | 3.84 | 10 | yes | include |
| PIN12 | S56C | 07/10/02 | 4.02 | 20.5 | yes | exclude |
| PIN12 | S56C | 10/07/02 | 3.86 | 20.5 | yes | exclude |
| PIN12 | S56C | 01/06/03 | 3.39 | 20.5 | yes | exclude |
| PIN12 | S56C | 04/04/03 | 3.83 | 20.5 | yes | exclude |
| PIN12 | S56D | 07/10/02 | 4.15 | 31 | yes | exclude |
| PIN12 | S56D | 10/07/02 | 3.90 | 31 | yes | exclude |
| PIN12 | S56D | 01/06/03 | 3.51 | 31 | yes | exclude |
| PIN12 | S56D | 04/04/03 | 3.87 | 31 | yes | exclude |
| PIN12 | S57B | 07/10/02 | 3.86 | 10 | yes | include |
| PIN12 | S57B | 10/07/02 | 3.66 | 10 | yes | include |
| PIN12 | S57B | 01/06/03 | 3.36 | 10 | yes | include |
| PIN12 | S57B | 04/04/03 | 3.71 | 10 | yes | include |
| PIN12 | S57C | 07/10/02 | 3.92 | 20.5 | yes | exclude |
| PIN12 | S57C | 10/07/02 | 3.83 | 20.5 | yes | exclude |
| PIN12 | S57C | 01/06/03 | 3.45 | 20.5 | yes | exclude |
| PIN12 | S57C | 04/04/03 | 3.80 | 20.5 | yes | exclude |
| PIN12 | S57D | 07/10/02 | 3.95 | 31.5 | yes | exclude |
| PIN12 | S57D | 10/07/02 | 3.86 | 31.5 | yes | exclude |
| PIN12 | S57D | 01/06/03 | 3.56 | 31.5 | yes | exclude |
| PIN12 | S57D | 04/04/03 | 3.88 | 31.5 | yes | exclude |
| PIN12 | S59B | 07/10/02 | 3.87 | 10 | yes | include |
| PIN12 | S59B | 10/07/02 | 3.87 | 10 | yes | include |
| PIN12 | S59B | 01/06/03 | 3.44 | 10 | yes | include |
| PIN12 | S59B | 04/04/03 | 3.85 | 10 | yes | include |
| PIN12 | S59C | 07/10/02 | 3.8 | 20.5 | yes | exclude |
| PIN12 | S59C | 10/07/02 | 3.88 | 20.5 | yes | exclude |
| PIN12 | S59C | 01/06/03 | 3.50 | 20.5 | yes | exclude |
| PIN12 | S59C | 04/04/03 | 3.83 | 20.5 | yes | exclude |
| PIN12 | S59D | 07/10/02 | 3.82 | 31 | yes | exclude |
| PIN12 | S59D | 10/07/02 | 3.85 | 31 | yes | exclude |
| PIN12 | S59D | 01/06/03 | 3.52 | 31 | yes | exclude |
| PIN12 | S59D | 04/04/03 | 3.83 | 31 | yes | exclude |
| PIN12 | S60B | 07/10/02 | 3.95 | 10 | yes | include |
| PIN12 | S60B | 10/07/02 | 4.18 | 10 | yes | include |
| PIN12 | S60B | 01/06/03 | 3.72 | 10 | yes | include |
| PIN12 | S60B | 04/04/03 | 4.05 | 10 | yes | include |

# TABLE 1
## BUILDING 100 AREA - RECENT DEPTH TO WATER MEASUREMENTS AND INCLUSION/EXCLUSION FROM VAPOR INTRUSION ASSESSMENT
### Star Rainey Center, Pinellas, Florida

| Parameter | Well | Date | Depth to water (ft bls) | Top of screen (ft bls) | Located beside or under Building 100 Footprint? | Include or exclude from vapor intrusion assessment? |
|---|---|---|---|---|---|---|
| PIN12 | S60C | 07/10/02 | 3.95 | 20.5 | yes | exclude |
| PIN12 | S60C | 10/07/02 | 4.20 | 20.5 | yes | exclude |
| PIN12 | S60C | 01/06/03 | 3.80 | 20.5 | yes | exclude |
| PIN12 | S60C | 04/04/03 | 4.04 | 20.5 | yes | exclude |
| PIN12 | S60D | 07/10/02 | 4.04 | 31 | yes | exclude |
| PIN12 | S60D | 10/07/02 | 4.31 | 31 | yes | exclude |
| PIN12 | S60D | 01/06/03 | 3.98 | 31 | yes | exclude |
| PIN12 | S60D | 04/04/03 | 4.18 | 31 | yes | exclude |
| PIN12 | S67B | 07/10/02 | 3.65 | 10 | yes | include |
| PIN12 | S67B | 10/07/02 | 3.83 | 10 | yes | include |
| PIN12 | S67B | 01/06/03 | 3.36 | 10 | yes | include |
| PIN12 | S67B | 04/04/03 | 3.69 | 10 | yes | include |
| PIN12 | S67C | 07/10/02 | 3.87 | 20 | yes | exclude |
| PIN12 | S67C | 10/07/02 | 3.97 | 20 | yes | exclude |
| PIN12 | S67C | 01/06/03 | 3.50 | 20 | yes | exclude |
| PIN12 | S67C | 04/04/03 | 3.91 | 20 | yes | exclude |
| PIN12 | S67D | 07/10/02 | 3.93 | 30 | yes | exclude |
| PIN12 | S67D | 10/07/02 | 4.19 | 30 | yes | exclude |
| PIN12 | S67D | 01/06/03 | 3.73 | 30 | yes | exclude |
| PIN12 | S67D | 04/04/03 | 4.04 | 30 | yes | exclude |
| PIN12 | S68B | 07/10/02 | 3.69 | 10 | no | exclude |
| PIN12 | S68B | 10/07/02 | 4.34 | 10 | no | exclude |
| PIN12 | S68B | 01/06/03 | 4.01 | 10 | no | exclude |
| PIN12 | S68B | 04/04/03 | 4.23 | 10 | no | exclude |
| PIN12 | S68C | 07/10/02 | 3.91 | 18 | no | exclude |
| PIN12 | S68C | 10/07/02 | 4.05 | 18 | no | exclude |
| PIN12 | S68C | 01/06/03 | 3.72 | 18 | no | exclude |
| PIN12 | S68C | 04/04/03 | 3.96 | 18 | no | exclude |
| PIN12 | S68D | 07/10/02 | 3.93 | 30 | no | exclude |
| PIN12 | S68D | 10/07/02 | 4.30 | 30 | no | exclude |
| PIN12 | S68D | 01/06/03 | 3.91 | 30 | no | exclude |
| PIN12 | S68D | 04/04/03 | 4.20 | 30 | no | exclude |
| PIN12 | S69B | 07/10/02 | 1.93 | 10 | no | exclude |
| PIN12 | S69B | 10/07/02 | 2.45 | 10 | no | exclude |
| PIN12 | S69B | 01/06/03 | 1.90 | 10 | no | exclude |
| PIN12 | S69B | 04/04/03 | 2.27 | 10 | no | exclude |
| PIN12 | S69C | 07/10/02 | 1.82 | 20 | no | exclude |
| PIN12 | S69C | 10/07/02 | 2.35 | 20 | no | exclude |
| PIN12 | S69C | 01/06/03 | 1.87 | 20 | no | exclude |
| PIN12 | S69C | 04/04/03 | 2.20 | 20 | no | exclude |
| PIN12 | S69D | 07/10/02 | 2.15 | 30 | no | exclude |
| PIN12 | S69D | 10/07/02 | 2.67 | 30 | no | exclude |
| PIN12 | S69D | 01/06/03 | 2.34 | 30 | no | exclude |
| PIN12 | S69D | 04/04/03 | 2.43 | 30 | no | exclude |
| PIN12 | S70B | 07/10/02 | 2.49 | 10 | no | exclude |
| PIN12 | S70B | 10/07/02 | 2.91 | 10 | no | exclude |
| PIN12 | S70B | 01/06/03 | 2.47 | 10 | no | exclude |
| PIN12 | S70B | 04/04/03 | 2.78 | 10 | no | exclude |

**TABLE 1**
**BUILDING 100 AREA - RECENT DEPTH TO WATER MEASUREMENTS AND INCLUSION/EXCLUSION FROM VAPOR INTRUSION ASSESSMENT**
**Star Rainey Center, Pinellas, Florida**

| Parameter | Well | Date | Depth to water (ft bls) | Top of screen (ft bls) | Located beside or under Building 100 Footprint? | Include or exclude from vapor intrusion assessment? |
|---|---|---|---|---|---|---|
| PIN12 | S70C | 07/10/02 | 2.69 | 20 | no | exclude |
| PIN12 | S70C | 10/07/02 | 3.08 | 20 | no | exclude |
| PIN12 | S70C | 01/06/03 | 2.70 | 20 | no | exclude |
| PIN12 | S70C | 04/04/03 | 2.94 | 20 | no | exclude |
| PIN12 | S70D | 07/10/02 | 2.89 | 30 | no | exclude |
| PIN12 | S70D | 10/07/02 | 3.19 | 30 | no | exclude |
| PIN12 | S70D | 01/06/03 | 2.72 | 30 | no | exclude |
| PIN12 | S70D | 04/04/03 | 3.08 | 30 | no | exclude |
| PIN12 | S71B | 07/10/02 | 4.48 | 10 | no | exclude |
| PIN12 | S71B | 10/07/02 | 4.63 | 10 | no | exclude |
| PIN12 | S71B | 01/06/03 | 4.18 | 10 | no | exclude |
| PIN12 | S71B | 04/04/03 | 4.39 | 10 | no | exclude |
| PIN12 | S71C | 07/10/02 | 4.39 | 20 | no | exclude |
| PIN12 | S71C | 10/07/02 | 4.70 | 20 | no | exclude |
| PIN12 | S71C | 01/06/03 | 4.27 | 20 | no | exclude |
| PIN12 | S71C | 04/04/03 | 4.56 | 20 | no | exclude |
| PIN12 | S71D | 07/10/02 | 4.23 | 30 | no | exclude |
| PIN12 | S71D | 10/07/02 | 4.55 | 30 | no | exclude |
| PIN12 | S71D | 01/06/03 | 4.03 | 30 | no | exclude |
| PIN12 | S71D | 04/04/03 | 4.45 | 30 | no | exclude |
| PIN12 | S72B | 07/10/02 | 4.58 | 10 | no | exclude |
| PIN12 | S72B | 10/07/02 | 4.85 | 10 | no | exclude |
| PIN12 | S72B | 01/06/03 | 4.33 | 10 | no | exclude |
| PIN12 | S72B | 04/04/03 | 4.66 | 10 | no | exclude |
| PIN12 | S72C | 07/10/02 | 4.34 | 20 | no | exclude |
| PIN12 | S72C | 10/07/02 | 4.7 | 20 | no | exclude |
| PIN12 | S72C | 01/06/03 | 4.17 | 20 | no | exclude |
| PIN12 | S72C | 04/04/03 | 4.55 | 20 | no | exclude |
| PIN12 | S72D | 07/10/02 | 4.71 | 30 | no | exclude |
| PIN12 | S72D | 10/07/02 | 5.00 | 30 | no | exclude |
| PIN12 | S72D | 01/06/03 | 4.48 | 30 | no | exclude |
| PIN12 | S72D | 04/04/03 | 4.82 | 30 | no | exclude |
| PIN12 | S73B | 07/10/02 | 3.05 | 10 | no | exclude |
| PIN12 | S73B | 10/07/02 | 3.59 | 10 | no | exclude |
| PIN12 | S73B | 01/06/03 | 3.03 | 10 | no | exclude |
| PIN12 | S73B | 04/04/03 | 3.47 | 10 | no | exclude |
| PIN12 | S73C | 07/10/02 | 3.23 | 20 | no | exclude |
| PIN12 | S73C | 10/07/02 | 3.71 | 20 | no | exclude |
| PIN12 | S73C | 01/06/03 | 3.21 | 20 | no | exclude |
| PIN12 | S73C | 04/04/03 | 3.58 | 20 | no | exclude |
| PIN12 | S73D | 07/10/02 | 3.48 | 30 | no | exclude |
| PIN12 | S73D | 10/07/02 | 3.90 | 30 | no | exclude |
| PIN12 | S73D | 01/06/03 | 3.38 | 30 | no | exclude |
| PIN12 | S73D | 04/04/03 | 3.65 | 30 | no | exclude |
| PIN12 | TE03 | 07/09/02 | 2.98 | ? | no | exclude |
| PIN12 | TE03 | 10/07/02 | 3.63 | ? | no | exclude |
| PIN12 | TE03 | 01/06/03 | 2.12 | ? | no | exclude |

**TABLE 1**
**BUILDING 100 AREA - RECENT DEPTH TO WATER MEASUREMENTS AND INCLUSION/EXCLUSION FROM VAPOR INTRUSION ASSESSMENT**
**Star Rainey Center, Pinellas, Florida**

| Parameter | Well | Date | Depth to water (ft bls) | Top of screen (ft bls) | Located beside or under Building 100 Footprint? | Include or exclude from vapor intrusion assessment? |
|---|---|---|---|---|---|---|
| PIN21 | 0500 | 07/09/02 | 4.22 | 7 | no | exclude |
| PIN21 | 0500 | 10/07/02 | 4.31 | 7 | no | exclude |
| PIN21 | 0500 | 01/06/03 | 3.73 | 7 | no | exclude |
| PIN21 | 0500 | 04/04/03 | 4.16 | 7 | no | exclude |
| PIN21 | 0501 | 07/09/02 | 4.31 | 20 | no | exclude |
| PIN21 | 0501 | 10/07/02 | 4.48 | 20 | no | exclude |
| PIN21 | 0501 | 01/06/03 | 3.97 | 20 | no | exclude |
| PIN21 | 0501 | 04/04/03 | 4.35 | 20 | no | exclude |
| PIN21 | 0502 | 07/09/02 | 1.98 | 7 | no | exclude |
| PIN21 | 0502 | 10/07/02 | 2.09 | 7 | no | exclude |
| PIN21 | 0502 | 01/06/03 | 1.48 | 7 | no | exclude |
| PIN21 | 0502 | 04/04/03 | 1.94 | 7 | no | exclude |
| PIN21 | 0503 | 07/09/02 | 1.48 | 20 | no | exclude |
| PIN21 | 0503 | 10/07/02 | 2.21 | 20 | no | exclude |
| PIN21 | 0503 | 01/06/03 | 1.62 | 20 | no | exclude |
| PIN21 | 0503 | 04/04/03 | 2.04 | 20 | no | exclude |
| PIN21 | 0504 | 07/09/02 | 3.66 | 7 | no | exclude |
| PIN21 | 0504 | 10/07/02 | 3.91 | 7 | no | exclude |
| PIN21 | 0504 | 01/06/03 | 3.42 | 7 | no | exclude |
| PIN21 | 0504 | 04/04/03 | 3.79 | 7 | no | exclude |
| PIN21 | 0505 | 07/09/02 | 3.54 | 20 | no | exclude |
| PIN21 | 0505 | 10/07/02 | 3.74 | 20 | no | exclude |
| PIN21 | 0505 | 01/06/03 | 3.41 | 20 | no | exclude |
| PIN21 | 0505 | 04/04/03 | 3.65 | 20 | no | exclude |
| PIN21 | 0512 | 07/09/02 | 3.50 | 20 | no | exclude |
| PIN21 | 0512 | 10/07/02 | 3.73 | 20 | no | exclude |
| PIN21 | 0512 | 01/06/03 | 3.24 | 20 | no | exclude |
| PIN21 | 0512 | 04/04/03 | 3.59 | 20 | no | exclude |

*Notes:*
ft bls - feet below land surface

# TABLE 2

## TOTAL FLOW AND OUTDOOR AIR FLOW FOR EACH AIR HANDLING UNIT SERVICING BUILDING 100

**Star Rainey Center, Pinellas, Florida**

| | Air Circulated in Building 100 | |
|---|---|---|
| A.H.U. # | Total Flow (cfm) | Outdoor Air Flow (cfm) |
| 1 | 9,800 | 1,960 |
| 3 | 9,100 | 1,820 |
| 5 | 4,800 | 960 |
| 7 | 8,400 | 1,680 |
| 9 | 8,000 | 1,600 |
| 11 | 6,000 | 1,200 |
| 14 | 2,050 | 410 |
| 15 | 13,800 | 2,760 |
| 16 | 2,550 | 510 |
| 19 | 7,280 | 1,456 |
| 26 | 14,200 | 2,840 |
| 29 | 5,800 | 1,160 |
| 30 | 11,700 | 2,340 |
| 31 | 8,600 | 1,720 |
| 40 | 27,000 | 5,400 |
| 44 | 27,000 | 5,400 |
| 47 | 4,500 | 900 |
| 48 | 6,100 | 1,220 |
| 49 | 4,500 | 900 |
| 51 | 36,700 | 7,340 |
| 55 | 6,400 | 1,280 |
| 60 | 8,400 | 1,680 |
| 62 | 8,400 | 1,680 |
| 64 | 15,600 | 3,120 |
| 66 | 32,800 | 6,560 |
| 72 | 29,000 | 5,800 |
| 77 | 18,000 | 3,600 |
| 78 | 15,000 | 3,000 |
| 79 | 7,500 | 1,500 |
| 82 | 9,000 | 1,800 |
| 85 | 14,100 | 2,820 |
| 87 | 12,000 | 2,400 |
| 89 | 10,800 | 2,160 |
| 91 | 5,000 | 1,000 |
| 94 | 6,900 | 1,380 |
| 103 | 26,400 | 5,280 |
| 104 | 10,300 | 2,060 |
| 106 | 10,300 | 2,060 |
| 107 | 6,000 | 1,200 |
| 109 | 11,500 | 1,200 |
| 118 | 5,500 | 1,100 |
| 121 | 2,000 | 400 |
| 123 | 8,500 | 1,700 |
| 133 | 2,000 | 400 |
| 135 | 4,000 | 800 |
| 138 | 16,800 | 3,360 |
| 141 | 15,000 | 3,000 |
| 146 | 2,400 | 480 |
| 149 | 1,200 | 240 |
| 150 | 1,200 | 0 |

# TABLE 2
## TOTAL FLOW AND OUTDOOR AIR FLOW FOR EACH AIR HANDLING UNIT SERVICING BUILDING 100
### Star Rainey Center, Pinellas, Florida

| A.H.U. # | Air Circulated in Building 100 | |
|---|---|---|
| | Total Flow (cfm) | Outdoor Air Flow (cfm) |
| 151 | 9,000 | 1,800 |
| 152 | 11,000 | 2,200 |
| 154 | 30,000 | 6,000 |
| 160 | 10,600 | 2,120 |
| 161 | 2,900 | 580 |
| 162 | 1,850 | 370 |
| 163 | 5,000 | 1,000 |
| 166 | 13,400 | 2,680 |
| 167 | 13,400 | 2,680 |
| 168 | 13,400 | 2,680 |
| 169 | 7,000 | 1,400 |
| 170 | 7,600 | 1,520 |
| 171 | 2,800 | 560 |
| 173 | 3,400 | 680 |
| 176 | 4,000 | 800 |
| 183 | 7,500 | 1,500 |
| 184 | 11,300 | 2,260 |
| 189 | 16,500 | 3,300 |
| 190 | 13,500 | 2,700 |
| 191 | 24,000 | 4,800 |
| 192 | 25,800 | 5,160 |
| 193 | 26,300 | 5,260 |
| 194 | 5,400 | 1,080 |
| 195 | 17,600 | 3,520 |
| 196 | 13,000 | 2,600 |
| 197 | 9,800 | 1,960 |
| 198 | 6,000 | 1,200 |
| 199 | 4,400 | 880 |
| 200 | 11,900 | 2,380 |
| 202 | 1,200 | 240 |
| 203 | REDUNDANT | |
| 204 | 4,800 | 960 |
| 206 | 2,000 | 400 |
| 207 | REDUNDANT | |
| 209 | 1,900 | 380 |
| 210 | 1,200 | 240 |
| 216 | 1,200 | 240 |
| 217 | REDUNDANT | |
| 221 | 2,750 | 550 |
| 222 | REDUNDANT | |

| | | |
|---|---|---|
| Total circulated | 883,280 | |
| Total outdoor air | | 175,316 |
| Percentage outdoor air | | 20% |
| Exhaust | | 140,253 |

| | | |
|---|---|---|
| Building Area | 451,596 | square feet |
| Building Volume | 10,838,300 | cubic feet |

*Notes:*
A.H.U. - air handling unit
cfm - cubic feet per minute

# TABLE 3
## TCE, cDCE AND VC GROUNDWATER CONCENTRATIONS
### Star Rainey Center, Pinellas, Florida

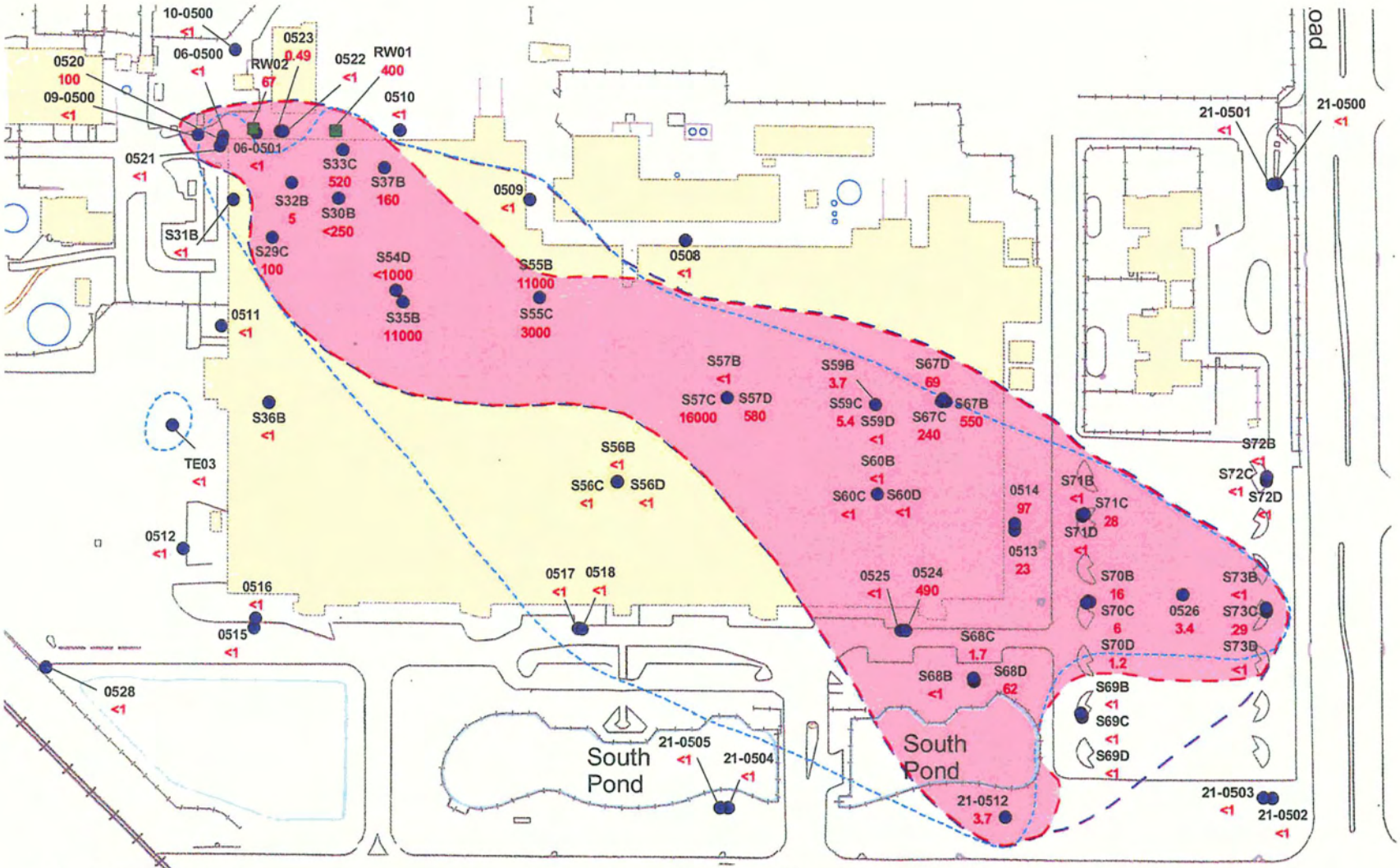
| All Wells Near Building and Water Table | | | | Subset of Wells Representing Building Subsection | | | |
|---|---|---|---|---|---|---|---|
| Well ID | TCE (ug/L) | cDCE (ug/L) | VC (ug/L) | Well ID | TCE (ug/L) | cDCE (ug/L) | VC (ug/L) |
| 6-500 | 0.2 | 1 | 0.5 | 6-500 | 0.2 | 1 | 0.5 |
| 6-501 | 0.5 | 0.2 | 0.5 | 6-501 | 0.5 | 0.2 | 0.5 |
| 9-500 | 0.25 | 0.24 | 0.23 | | | | |
| 508 | 0.5 | 0.67 | 0.5 | | | | |
| 509 | 44 | 6 | 3.5 | | | | |
| 510 | 0.22 | 0.17 | 2 | 510 | 0.22 | 0.17 | 2 |
| 511 | 0.5 | 0.5 | 0.5 | 511 | 0.5 | 0.5 | 0.5 |
| 512 | 0.5 | 0.5 | 0.5 | | | | |
| 513 | 0.27 | 31 | 48 | | | | |
| 515 | 0.5 | 0.5 | 0.5 | | | | |
| 517 | 0.5 | 0.5 | 0.5 | | | | |
| 525 | 0.5 | 2.6 | 0.34 | | | | |
| S29C | 0.5 | 1.1 | 120 | | 0.5 | 1.1 | 120 |
| S30B | 23,000 | 22,000 | 125 | S30B | 23,000 | 22,000 | 125 |
| S31B | 1.1 | 1.3 | 0.5 | S31B | 1.1 | 1.3 | 0.5 |
| S32B | 0.36 | 18 | 9.8 | S32B | 0.36 | 18 | 9.8 |
| S33C | 7.5 | 340 | 580 | S33C | 7.5 | 340 | 580 |
| S35B | 47,000 | 110,000 | 19,000 | S35B | 47,000 | 110,000 | 19,000 |
| S36B | 0.5 | 0.5 | 0.5 | | | | |
| S37B | 0.43 | 230 | 160 | S37B | 0.43 | 230 | 160 |
| S55B | 25 | 1,800 | 11,000 | S55B | 25 | 1,800 | 11,000 |
| S56B | 0.5 | 0.5 | 0.5 | | | | |
| S57B | 27 | 23 | 10 | | | | |
| S59B | 0.5 | 0.5 | 3.7 | | | | |
| S60B | 0.5 | 5.9 | 0.56 | | | | |
| S67B | 5 | 600 | 550 | | | | |

*Notes:*
TCE - trichloroethene
cDCE - cis-1,2-dichloroethene
VC - vinyl chloride
µg/L - micrograms per litre

# TABLE 4
## GROUNDWATER, CALCULATED AIR AND TARGET INDOOR AIR CONCENTRATIONS
### Star Rainey Center, Pinellas, Florida

| | All Wells Near Building and Water Table | | | Subset of Wells Representing Building Subsection | | |
|---|---|---|---|---|---|---|
| | TCE | cDCE | VC | TCE | cDCE | VC |
| **Groundwater Concentrations (µg/L)** | | | | | | |
| Arithmetic Mean | 2,697 | 5,195 | 1,216 | 5,836 | 11,199 | 2,583 |
| Geometric Mean | 2 | 7 | 6 | 5 | 27 | 29 |
| **Calculated Indoor Air Concentrations (µg/m3)** | | | | | | |
| Arithmetic Mean | 0.07 | 0.13 | 0.03 | 0.15 | 0.28 | 0.07 |
| Geometric Mean | 0.00005 | 0.00018 | 0.00016 | 0.00012 | 0.00068 | 0.00074 |
| **Target Indoor Air Concentrations (µg/m3)** | | | | | | |
| OSWER Table 2b | 0.22 | 35 | 2.8 | 0.22 | 35 | 2.8 |
| Workplace equivalent | 1 | 147 | 12 | 1 | 147 | 12 |

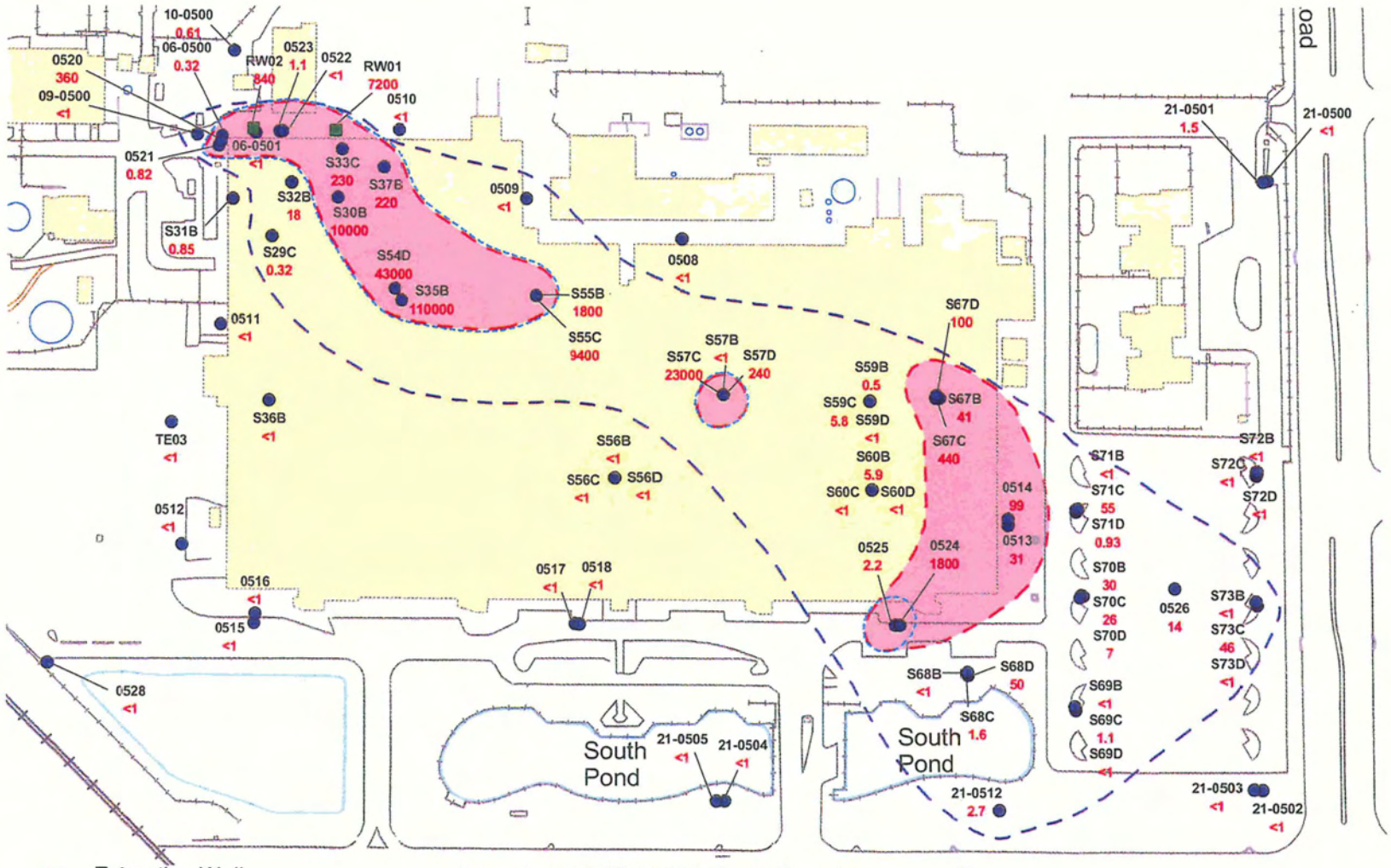
*Notes:*
TCE - trichloroethene
cDCE - cis-1,2-dichloroethene
VC - vinyl chloride
µg/L - micrograms per liter
µg/m3 - micrograms per cubic meter




Drawings Provided by Stoller-GJO

**Building 100 Area**
**Vinyl Chloride Concentrations, April 2002**
**Largo, Florida**

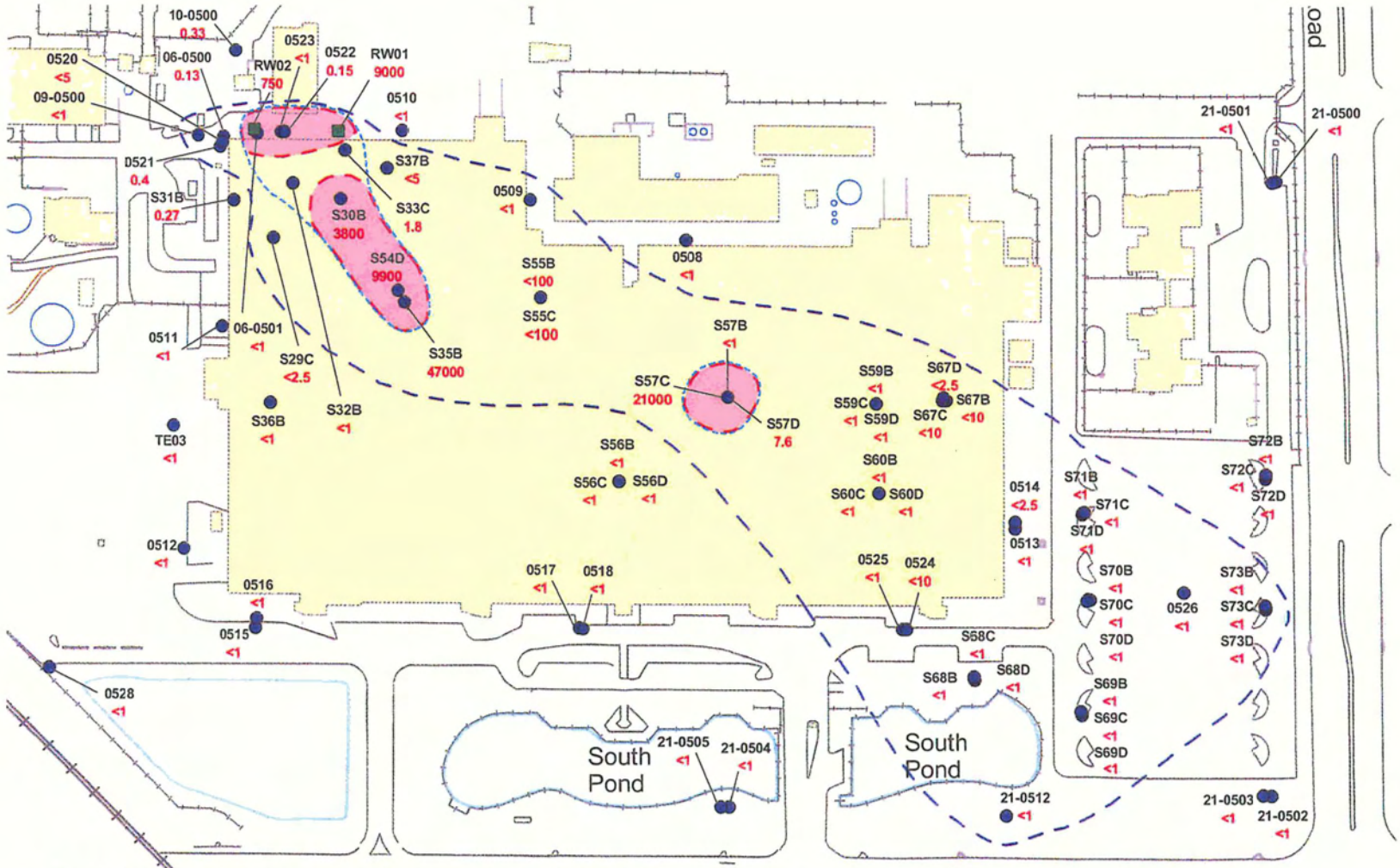
| June 2003 | Figure: 1 | GeoSyntec Consultants |
|---|---|---|




Drawings Provided by Stoller-GJO

**Building 100 Area**
**cis-1,2-DCE Concentrations, April 2002**
**Largo, Florida**

June 2003 | Figure: 2 | GeoSyntec Consultants

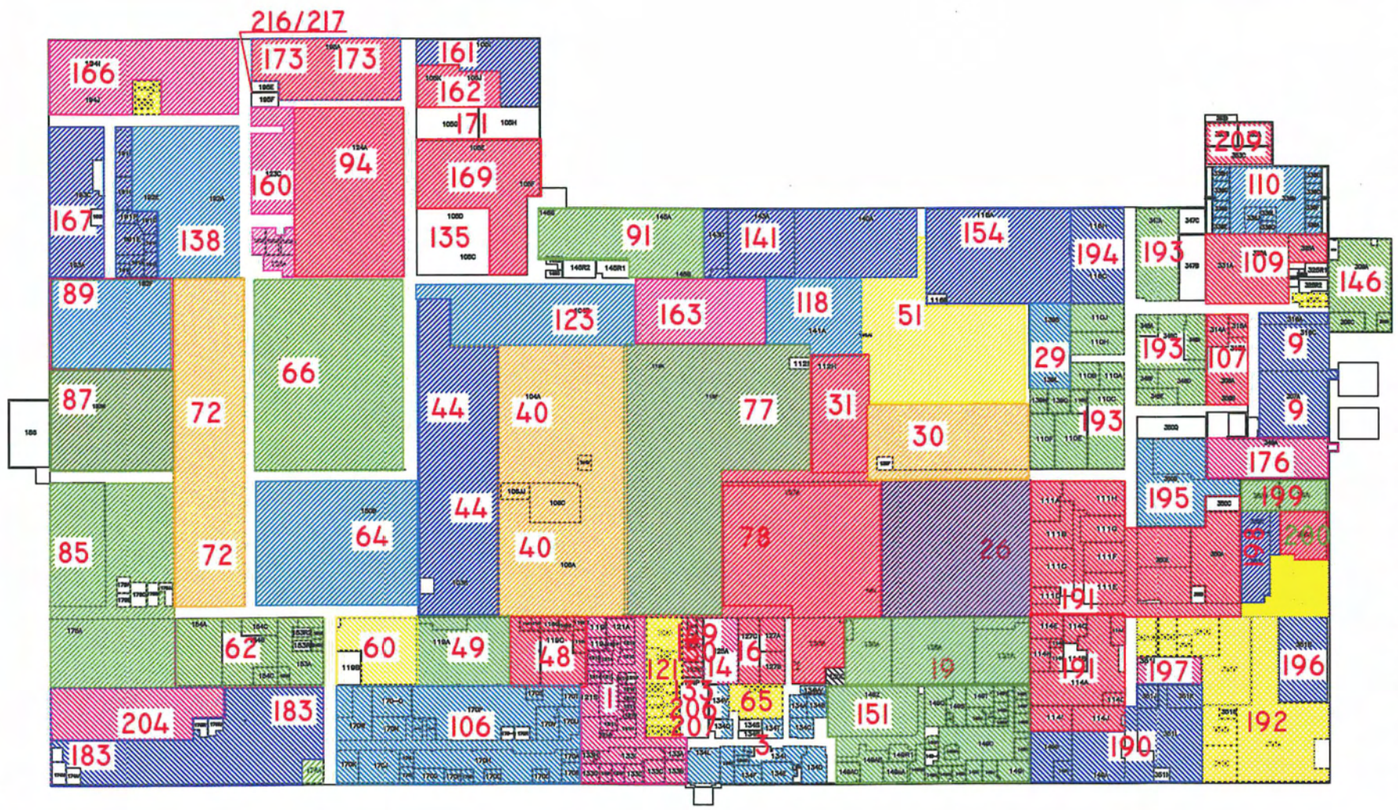



Drawings Provided by Stoller-GJO

**Building 100 Area**
**Trichloroethene (TCE) Concentrations, April 2002**
**Largo, Florida**

| June 2003 | Figure: 3 | GeoSyntec Consultants |
|---|---|---|

SEPT. 27,2000
HVAC2 (LOCKHEED)




AHU # 01 AREA 133
AHU # 3 AREA 134
AHU # 5 AREA 135
AHU # 7 AREA 136
AHU # 9 AREA 316
AHU # 11 AREA 1115 ECKERD
AHU # 14 AREA 125
AHU # 15 AREA 132
AHU # 16 AREA 125
AHU # 30 AREA T3H
AHU # 31 AREA CENTRAL ENV TEST
AHU # 40 AREA CCA
AHU # 44 AREA ARC PACER AND JTT,CEC,AITG,J-STARS,MUST
AHU # 51 AREA T3(H)
AHU # 54 AREA MAGNASTAR
AHU # 55 AREA 148
AHU # 48 CAFETERIA
AHU # 49 CAFETERIA
AHU # 60 CAFETERIA
AHU # 62 RAY MED CNTR.A-154
AHU # 64 QRS
AHU # 66 STORES-BULK
AHU # 72 AEIA, GAS-1,TOMAHAWK & GROWTH
AHU # 77 CENTRAL ENV TEST &CCA
AHU # 78 SPITFIRE,ARC222,SKYFIRE
AHU # 79 AREA 173 RAY OFFICE
AHU # 82 AREA 189 RAY OFFICE
AHU # 85 AREA 185/175 CABLE COE
AHU # 87 AREA 183/CABLE COE
AHU # 89 AREA183/CABLE COE
AHU # 91 AREA 117/MAGNASTAR
AHU # 92 AREA 500
AHU # 93 500 OFICE
AHU # 100 500
AHU # 103 AREA 188/ECKERD
AHU # 104 AREA 171/ECKERD
AHU # 106 AREA 170/FORENSICK
AHU # 107 300 BLDG
AHU # 109 300 BLDG
AHU # 115 AREA 124/STORES/CAROSELS
AHU # 116 200 BLDG
AHU # 117 200 BLDG
AHU # 118 AREA 141/ MAGNASTAR
AHU # 121 AREA 122
AHU # 125 AREA 800
AHU # 127 BLDG 200
AHU # 129 BLDG 600
AHU # 132 AREA 130
AHU # 133 AREA 134
AHU # 136 BLDG 600
AHU # 137 BLDG 600
AHU # 138 AREA192/ TEST ENGR'G
AHU # 141 AREA 143/NESP,SMART-T
AHU # 146 AREA 300

AHU # 148 BLDG 550
AHU # 149 AREA 122

AHU # 151 AREA 149/RAY OFFICE
AHU # 152 AREA 147/SPJC
AHU #154 AREA116/ATNAVICS,FBPAR
AHU # 156 BLDG 400
AHU # 157 BLDG 400
AHU # 158 BLDG 400
AHU # 159 BLDG 400
AHU # 160 102M/RAY MAINT
AHU # 161 AREA 105/SHIPPING
AHU # 162 AREA 105/RECIEVING
AHU # 163 AREA 117/MAGNASTAR
AHU # 166 AREA 194/METROLOGY
AHU # 167 AREA 193/TEST ENGR'G
AHU # 169 AREA 105M/PACK & SHIP
AHU # 171 AREA 105M/PACK & SHIP
AHU # 173 AREA 195/MAINTENANCE
AHU # 175 AREA 349/NOVA
AHU # 176 AREA 500 SHOP
AHU # 177 BLDG 400
AHU # 178 BLDG 400
AHU # 183 AREA 174/RAY OFFICES
AHU # 184 AREA 190/RAY OFFICES
AHU # 189 AREA 357/ORCI
AHU # 190 AREA 351/CTC
AHU # 191 AREA 350/CTC
AHU # 192 AREA 351/CTC
AHU # 193 AREA 348/CTC
AHU # 194 AREA 116/RAYTHEON
AHU # 195 AREA 350/CTC
AHU # 196 AREA 351/CTC CLEAN RM
AHU # 197 AREA 351I/CTC
AHU # 198 AREA 350X/CTC
AHU # 199 AREA E50U/CTC
AHU # 200 AREA 350W/V/CTC
AHU # 202 AREA 137
AHU # 203 AREA 137
AHU # 204 AREA 176/RAY OFFICE
AHU # 206 AREA 134
AHU # 207 AREA 134
AHU # 209 AREA 353 RAYTHEON
AHU # 210 AREA 137
AHU # 211 AREA 137
AHU # 212 AREA 137
AHU # 213 AREA 137
AHU # 216 AREA 195 UPS
AHU # 217 AREA 195 UPS
AHU # 218 BLDG 1200
AHU # 219 BLDG 1200
AHU # 220 BLDG 1200
AHU # 221 AREA 357
AHU # 222 AREA 357
AHU # 223 AREA 137 UPS
AHU # 225 BLDG 400
AHU # 226 BLDG 400
AHU # 227 BLDG 400
AHU # 228 BLDG 200
AHU # 229 BLDG 200
AHU # 231 BLDG 1200
AHU # 232 BLDG 1200
AHU # 233 BLDG 400
AHU # 234 BLDG 400

**Building 100 HVAC Zones - 1st Floor**
**Largo, Florida**

**Scale: None**

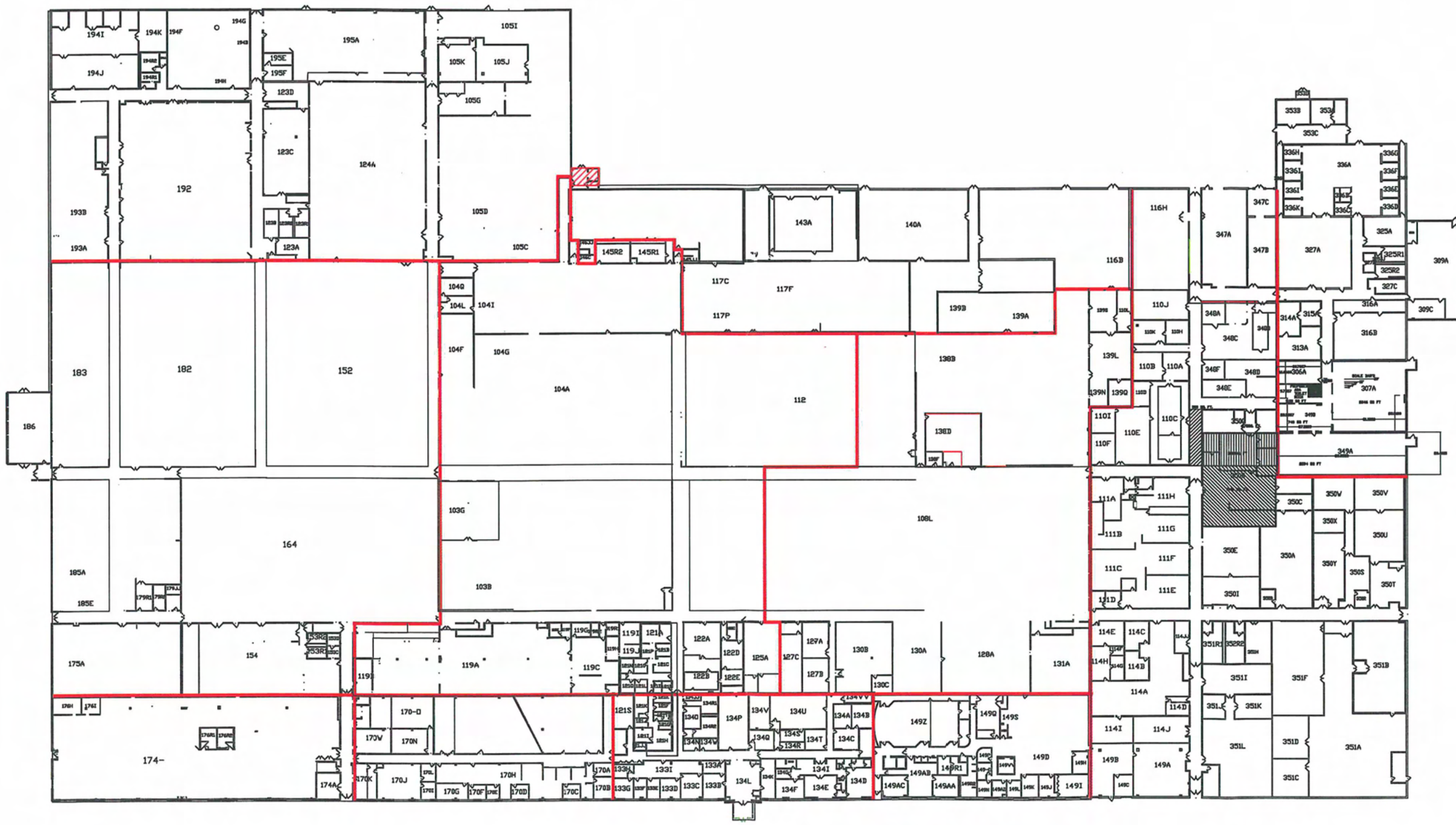
| June 2003 | Figure: 4 | GeoSyntec Consultants |
|---|---|---|

SEPT. 27,2000
HVAC2.DWG (LOCKHEED)

Scale: None

**Building 100 HVAC Zones - 2nd Floor**
**Largo, Florida**

| June 2003 | Figure: 5 | GeoSyntec Consultants |
|---|---|---|




FIRE WALLS

**Building 100 : Locations of Fire Walls**
**Largo, Florida**

**Scale: None**

| June 2003 | Figure: 6 | GeoSyntec Consultants |
|---|---|---|