

5.0 BUILDING D&D MONITORING

The DOE decontamination and decommissioning (D&D) process is the sequence of events that occurs in the disposition of surplus DOE facilities. D&D is primarily concerned with decontamination, dismantling, removal, or entombment of the surplus facilities. The primary tasks associated with D&D are:

- Surveillance and maintenance
- Assessment and characterization
- Environmental review
- Close out

Activities associated with these tasks involve the removal of fixed materials (including residual constituents of concern), equipment, piping, tanks, ducts, ceilings and other internal building structures, and the buildings themselves. In general, implementation of D&D will be performed in phases, allowing alternative interim use of most buildings before the final decommissioning of the buildings (DOE 1994b).

Building specific D&D activities involve three major steps:

- Deactivation of building processes
- Demolition of building structures
- Remediation of building foundations and surroundings

The IMP outlines groundwater monitoring activities established to ensure that building D&D activities do not inadvertently impact surface water by degrading groundwater beneath or in contact with the base of the demolished buildings. The required groundwater monitoring will provide the data necessary to determine if the precautions and actions taken during D&D have prevented or allowed migration of contaminants to groundwater. If existing information (generally a knowledge of historical building activity and use) regarding a proposed D&D activity indicates the potential to contaminate groundwater, then a pre-D&D groundwater baseline will be established for that building. Exceedances to this baseline are defined as detected concentrations greater than the mean + 2 standard deviations (M2SD) above the baseline (K-H 1998b).

Based on the IMP, a minimum of four groundwater sampling events are required to enable determination of a unique groundwater chemistry baseline for each building that will undergo D&D groundwater monitoring. Historically, two D&D groundwater monitoring rounds have been attempted per year at each building or building complex. The D&D groundwater monitoring schedule may become accelerated for a given building if it is determined that D&D

of that building has become accelerated or for specific areas at RFETS where groundwater sample aliquots are difficult to collect because of dry conditions.

Monitoring is being accomplished by the installation of D&D monitoring wells adjacent to the specific buildings. These wells, in conjunction with appropriately located preexisting wells, will provide the data used to construct the baseline, and will also be utilized for future D&D monitoring of the building specific impacts, if any, on downgradient groundwater quality. As long as time permits, baseline determination will be based on current and future data. If the D&D schedule for a given building becomes accelerated, preexisting monitoring wells in the vicinity of the building may be utilized, as the IM/IRA suggests, for determination of the baseline utilizing sampling data from the previous three years.

If a baseline cannot be established, water quality with respect to a given building will be evaluated in terms of an upgradient/downgradient comparison of groundwater quality. Analytes will be screened in terms of concentrations relative to Tier I and Tier II groundwater action levels, which is an effective method for determining contaminants of concern. The Tier I and Tier II levels are used only as a screening tool in this instance and are not RFCA or compliance driven with regard to building D&D. Occasionally, an analyte is discussed or listed in a table even though it may be found in concentrations that are below Tier II action levels. This is only done on a case by case basis for analytes that are contaminants of concern for specific buildings.

Building demolition is described in terms of the fiscal year (FY) that the demolition is projected to take place. Following is the current estimated schedule for demolition of buildings discussed in this section. Note that Building 123 and Building 779 have previously been demolished:

- Building 444 – mid to late FY 2004
- Building 771 complex – early to mid FY 2004
- Building 886 – late FY 2003 to early FY 2004
- Building 707 – late FY 2005
- Building 776/777 – late FY 2003
- Building 371/374 – early to mid FY 2006
- Building 865 – mid FY 2005
- Building 883 – mid FY 2005
- Building 881 – mid FY 2005
- Building 991 – late FY 2004 to early FY 2005
- Building 559 – early FY 2005

Building D&D Monitoring is a relatively new section of the Annual RFCA Groundwater Monitoring Report. It will be expanded during each successive year to incorporate the D&D groundwater activities for that calendar year. The Section 5.0 subsections are organized by the particular buildings, as described in various Agency approved Sampling and Analysis Plans (SAPs) for Building D&D Groundwater Monitoring. The subsections below discuss historical D&D activities through 2000 for Building 123 (Section 5.1), Building 444 (Section 5.2), Building 771 (Section 5.3), Building 886 (Section 5.4), Building 779 (Section 5.5), Building 707 (Section 5.6), and Building 776/777 (Section 5.7). Buildings 371/374, 865, 883, 881, 991 and 559 are discussed in the same subsection (Section 5.8) because there has been no D&D groundwater monitoring data collected for them through CY 2000.

5.1 Building 123

Building 123, used as a laboratory for bioassay, dosimetry, and water quality parameter analyses, was located on Central Avenue between Third and Fourth Streets at RFETS. The building underwent D&D activities and was ultimately demolished in 1998. All that remains is the concrete building foundation. Subsequent to demolition, six monitoring wells (10098-10598) were installed with a Geoprobe rig immediately adjacent to the building foundation. Wells 10098 and 10198 are upgradient. The rest of the wells are downgradient, with well 10598 potentially being cross gradient. The purpose of these wells was twofold. First, to assess the potential impact of D&D activities on local groundwater quality and, second, to prepare an IHSS ranking for prioritizing the Building 123 site on the ER ranking list. This report is only concerned with the first of these two purposes. Figure 5-1 presents the location of Building 123 and associated D&D monitoring wells.

As described above, four sampling events are required to collect a data set to be used for determination of a unique baseline for each building which will undergo D&D groundwater monitoring. Unfortunately, the schedule for Building 123 D&D became accelerated and it was not possible to collect the required amount of pre-demolition data to derive baseline values for the site D&D wells. In addition, there were not an appropriate number or distribution of existing monitoring wells in the vicinity of Building 123 to use for baseline determination utilizing historic sampling data. Through 2000, five sampling rounds have been completed at the Building 123 D&D monitoring wells. One sampling round, post demolition, was completed at the Building 123 D&D monitoring wells during 1998. Two sampling rounds each, one in the 1st quarter and one in the 3rd quarter, were completed during 1999 and 2000.

Because a baseline cannot be established, water quality with respect to Building 123 must be evaluated in terms of an upgradient/downgradient comparison of water quality. Analytes at Building 123 have been screened in terms of concentrations relative to Tier I and Tier II groundwater action levels. The Tier I and Tier II levels are only used as a screening tool and are not RFCA or compliance driven.

Table 5-1 presents a summary of historical Building 123 D&D groundwater monitoring data. The results of the five D&D groundwater sampling rounds completed at Building 123 to date indicate that metals analyses have exhibited no results above Tier II action levels in any of the Building 123 wells. There were no analyte concentrations greater than Tier I action levels for nitrate or U-isotopes; only an isolated Tier I exceedance for PCE in February 2000 in

well 10498. The only concentrations greater than the Tier II action level for PCE (five samples, fall 1998 through 2000) and nitrate (in fall 1998, spring 1999, fall 2000) occurred in downgradient monitoring well 10498. All of the downgradient wells and one upgradient well (10098) have at least one result concentration greater than the Tier II action levels but below background M2SDs for U-isotopes.

A linear groundwater flow velocity of 167 ft/yr (1.609E-04 cm/sec) was calculated between upgradient well 10198 and downgradient well 10398 utilizing 2nd quarter 2000 water level data. Hydraulic conductivity (Rocky Flats Alluvium) and effective porosity values were used as described in Section 3.2 of this RFCA Annual Report. This flow velocity would allow groundwater to travel from well 10198 to well 10398 in approximately 1.3 years. Actual contaminant travel times can be expected to be slightly longer for weakly retarded contaminants, such as VOCs, U-isotopes, and nitrate.

In conclusion, there are no Building 123 upgradient VOC or nitrate concentrations which are greater than Tier II action levels compared to downgradient PCE concentrations (well 10498) that are greater than Tier I and Tier II action levels and downgradient nitrate concentrations (well 10498) greater than Tier II action levels. For uranium isotopes U-233/234 and U-238 there were activity concentrations above Tier II but below background M2SDs in upgradient well 10098 that are similar to activity concentrations for these analytes in three downgradient wells (10298, 10398, and 10498). Monitoring wells 10198 and 10598 are unaffected to date by PCE, nitrate, and U-isotopes. Downgradient monitoring well 10498 is the most impacted well to date at Building 123. The geologic log for this well indicates that it may be installed in a utility corridor.

Table 5-1 Historical Building 123 D&D Groundwater Monitoring Data

Well	Location	Dates	PCE (mg/L)	Nitrate (mg/L)	U-233/234 (pCi/L)	U-238 (pCi/L)
10098	Upgradient	8/98	U	1.4	1.13	1.08
		2/99	U	4.9	INSW	INSW
		8/99	U	4.3	1.32	1.103
		2/00	U	3.4	1.19	0.999
		8/00	0.1	2.9	1.21	0.920
10198	Upgradient	8/98	U	1.5	INSW	INSW
		2/99	U	0.97	INSW	INSW
		8/99	U	2.4	0.251	0.233
		2/00	U	1.7	0.393	0.351
		8/00	U	0.75	0.229	0.227
10298	Downgradient	8/98	U	0.61	1.08	1.10
		2/99	U	0.84	INSW	INSW
		8/99	U	3	0.40	0.568
		2/00	U	1.8	0.682	0.763
		8/00	U	3	0.976	0.69
10398	Downgradient	8/98	U	INSW	INSW	INSW
		2/99	U	INSW	INSW	INSW
		8/99	0.1	INSW	1.264	1.007
		2/00	U	5.1	INSW	INSW
		8-9/00	U	4.1	INSW	INSW
10498	Downgradient	8/98	15	25	1.08	1.22
		2/99	58.9	17	2.02	1.51
		8/99	24	6.8	0.964	0.522
		2/00	1400	6.9	1.15	1.19
		8/00	15	10	1.14	1.10
10598	Upgradient/ Crossgradient	8/98	U	3.7	U	0.236
		3/99	U	2.6	U	U
		8/99	U	0.37	U	U
		2/00	U	3.3	U	U
		8/00	U	1.5	U	U

Notes: Concentrations greater than Tier II shown in Bold. Concentrations greater than Tier I shown in Italicized Bold, INSW = insufficient water available for sample collection, U = non detect

5.2 Building 444

The Sampling and Analysis Plan for the D&D monitoring of the Building 444 cluster was initiated during late 1998. The Final SAP (RMRS 1999o) was submitted to the Agencies in July 1999. The D&D monitoring wells associated with the building were installed before the end of 1999. Building 444 complex is currently scheduled for demolition in 2004. This will allow adequate time to construct a groundwater chemistry baseline for these facilities.

Building 444 is located on the south side of Cottonwood Avenue between Fourth and Sixth Streets at RFETS. The Building 444 cluster was used for the manufacturing of depleted uranium and beryllium components, and did not

handle plutonium or enriched uranium. Major processes conducted in the building included machining, welding, and cleaning. Building 444 also contained a foundry and a laboratory where parts could be etched, electroplated, and coated. Uranium and beryllium are the major constituents that were used in the building. In addition, solvents from machining and cleaning, and other wastes associated with electroplating were generated. Figure 5-2 presents the location of the Building 444 cluster and the D&D groundwater monitoring wells associated with it.

Six new D&D monitoring wells were installed at Building 444 during the fall of 1999 (40099 – 40499, and 41299). Wells 40099 and 40199 are upgradient wells, and the rest, in addition to preexisting well P419689, are downgradient wells. Except for monitoring well P419689, Building 444 D&D monitoring wells had generally only been sampled three times through CY 2000. Preexisting well P419689 had no groundwater samples collected from it between 12/96 and 11/99 (a D&D groundwater sampling round); therefore, the three years of data previous to 1999 are not available for baseline consideration. Until a geochemical baseline is established for groundwater in the vicinity of Building 444, analytes have been screened in terms of concentrations relative to Tier I and Tier II groundwater action levels. The Tier I and Tier II action levels are only used as a screening tool and are not RFCA or compliance driven.

Table 5-2 presents a summary of results of D&D groundwater monitoring at the Building 444 cluster to date. Earlier well P419689 data is included for comparison to the recent D&D data. The results of the D&D sampling completed through 2000 indicate that there are no Tier I exceedances for nitrates or metals from any Building 444 monitoring well. Monitoring well 40099, which is an upgradient well, has concentrations of TCE that exceed the Tier I action level for all three D&D sampling rounds completed through CY 2000. This well also exhibits concentrations greater than the Tier II action level for 1,1-DCE, 1,2-DCE and PCE for all three D&D sampling rounds completed through CY 2000. The analyte most commonly detected is PCE. Five wells (40099, 40299, 40499, 41299, and P419689) exhibited concentrations greater than the Tier II action level for PCE for all three D&D sampling rounds completed to date. The concentrations of PCE in downgradient well 41299 were approximately an order of magnitude higher than the other wells that contained PCE. This well was also the only other Building 444 D&D well to exhibit at least one result with a concentration greater than the Tier II action level for every one of the VOCs listed in Table 5-2. Wells 40199 and 40399 had no detections of VOCs above Tier II action levels. All the VOC detections in these two wells were extremely low concentrations. Wells 40199, 41299, and P419689 exhibited concentrations greater than Tier II action levels but below the Site M2SDs of 60.7 pCi/L and 41.8 pCi/L for U-233/234 and U-238, respectively. The only metal concentrations over Tier II action levels were for thallium.

Table 5-2 Historical Building 444 D&D Groundwater Monitoring Data

Well and Location	Dates	1,1-DCE (mg/L)	1,2-DCE (mg/L)	PCE (mg/L)	TCE (mg/L)	Thallium (mg/L)	U-233/234 (pCi/L)
40099 Upgradient	11/99	240	780	28	<i>830</i>	1.2(B)	0.176
	5/00	190	650	18	<i>500</i>	U	0.332
	12/00	538	1310	41	<i>1340</i>	3.45(B)	0.270
40199 Upgradient	11/99	U	U	0.9	0.1	U	1.224
	5/00	U	U	0.5	U	U	0.512
	11/00	U	U	0.74	U	4.64	1.10
40299 Downgradient	11/99	2	8	34	2	U	0.410
	5/00	4	11	37	13	U	0.553
	12/00	3.6	10.5	77.5	2.1	U	0.250
40399 Downgradient	11/99	U	0.5	0.5	0.2	U	0.165
	5/00	U	0.8	0.7	0.2	U	0.187
	12/00	U	0.92	0.69	1	U	0.20
40499 Downgradient	11/99	0.2	11	13	3	U	0.381
	5/00	0.1	4	7	2	U	0.236
	11/00	U	4.9	8.3	1.9	U	0.091
41299 Downgradient	11/99	16	48	290	33	U	1.797
	5/00	9	89	280	77	U	1.891
	12/00	10	31.4	216	27.2	5.37	1.30
P419689 Downgradient	3-4/96	1	5	17	2	NA	1.315
	9/96	1	4	12	1	6.3(B)	NA
	12/96	NA	NA	NA	NA	7.2(B)	1.174
	11/99	1	7	16	2	U	0.733
	5/00	1	6	17	2	U	0.888
	12/00	1	7.1	18.5	2.3	U	0.420

Notes: Concentrations greater than Tier II shown in Bold, Concentrations greater than Tier I shown in Italicized Bold, U = non detect, (B) = Analyte detected in the Method Blank, NA = Not Analyzed

In addition to the results discussed above, the following detections, which are greater than the Tier II action levels for the specific analytes, have occurred in Building 444 D&D downgradient monitoring well 41299.

- Uranium-238 was detected at concentrations of 1.047 pCi/L and 0.787 pCi/L in December 1999 and May 2000, respectively.
- Chromium was detected at concentrations of 370 µg/L and 462 µg/L in May and December 2000, respectively.

In conclusion, there were not enough D&D groundwater monitoring sampling events completed through CY 2000 to establish baseline analyte concentrations for any of the Building 444 wells. Upgradient versus downgradient well comparisons are not warranted at the Building 444 cluster because the buildings have not yet been demolished. Even though upgradient well 40099 contains TCE in concentrations which are greater than the Tier I action level,

and relatively high levels of other VOCs, downgradient well 41299 appears to be the most impacted D&D monitoring well at the Building 444 cluster. In addition to VOCs, metals and U-isotopes have impacted well 41299. Monitoring well 40399 is the only well without a concentration of any analyte that is greater than a Tier II action level. Nitrate does not appear to be an issue for the Building 444 cluster.

5.3 Building 771

The Sampling and Analysis Plan for the D&D monitoring of the Building 771 cluster was initiated during late 1998. The SAP (RMRS 1999o) was submitted Final to the Agencies in July 1999. The D&D monitoring wells associated with the building were installed before the end of 1999. The Building 771 cluster, including Buildings 771C and 774, is currently scheduled for demolition in 2004.

The Building 771 cluster is located in the former PA, at the northeast end of the diagonal road, immediately south of the PACS-3 entrance to the former PA. Building 771 was the plutonium component production facility at Rocky Flats from 1953 through 1957. After 1957 the building was used for the chemical recovery of plutonium and americium from manufacturing residues and scrap metal. The building also contained a laundry. Building 774 is part of the Building 771 complex and is located approximately 200 feet east of Building 771. Building 771C connects Buildings 771 and 774. Building 774 was used for the treatment of radioactive aqueous waste, waste oils, and non-radioactive photography solutions. Buildings 771C and 774 are to be decommissioned along with Building 771. Plutonium, americium, and solvents are the major contaminants of concern. Figure 5-3 presents the location of Building 771, including Buildings 771C and 774, and the D&D groundwater monitoring wells associated with them.

The alluvial deposits are very thin in the vicinity of the Building 771 complex. The northern portion of the Building 771 foundation is situated in weathered bedrock. In addition, a foundation drain encircles the entirety of Building 771 and most of Building 774. These circumstances combine to allow for very little available groundwater for sample collection. Future groundwater availability combined with the actual D&D date for the Building 771 complex will determine if analyte baselines are able to be calculated or if an upgradient versus downgradient well comparison will be the appropriate way to monitor building D&D impacts to groundwater, if any. Compounding this situation is the fact that the D&D of the Building 771 complex is probably going to destroy most of the currently utilized Building 771 D&D wells. The Groundwater Program is evaluating existing wells, located farther away from the Building 771 complex, that can potentially be used for future D&D monitoring.

Six new D&D monitoring wells (40599 through 40899, 41499, and 41599) were installed at the Building 771 area during the fall of 1999. Monitoring well 40899 and preexisting wells 18199 (associated with IHSS 118.1) and 20998 are upgradient D&D wells. Wells 40599, 40699, 40799, 41499, and 41599 are downgradient D&D wells. In addition, based on a post D&D well installation building walk down and recent insight into prior Building 774 operations, preexisting well P219089 has been added to the Building 771 complex D&D well list. This well, located on the north side of Building 774, will serve as an additional downgradient well; it was incorporated into the project as a D&D well through the IMP.

Only preexisting wells 20998 and 18199 (associated with IHSS 118.1) produced any samples through CY 1999. The six D&D monitoring wells installed in the fall of 1999 at Building 771 failed to produce enough water for any samples to be collected from them during the 4th quarter of 1999. Of these six wells, only wells 40799 and 41499 produced enough water for a 2nd quarter and a 4th quarter 2000 VOC sample. The rest of the new wells, except for well 40899, only produced enough water for a 4th quarter VOC sample. Well 40899 has not produced enough water for a sample to be collected from it through CY 2000. Tritium samples were also collected from wells 40599 and 41499 in the 4th quarter 2000, and from well 40799 in the 2nd and 4th quarters of 2000. These sampling results are further evidence of the lack of groundwater in this area.

Table 5-3 presents Building 771 complex D&D monitoring results to date. Until a geochemical baseline is established for groundwater in the vicinity of Building 771, analytes will be discussed in terms of concentrations relative to Tier I and Tier II groundwater action levels. The Tier I and Tier II action levels are only used as a screening tool and are not RFCA or compliance driven.

Six sets of VOC samples have been collected from preexisting upgradient monitoring well 18199 since spring 1999. The earlier sampling round data from well 18199 is presented in Table 5-3 for comparison to the recent D&D data. This well has yielded carbon tetrachloride concentrations greater than the Tier I action level and chloroform concentrations greater than the Tier II action level for each of the six sampling events. In addition, concentrations greater than the Tier II action level for PCE were observed in five out of the six events; the exception was a non-detect in March 2000. Other analyte concentrations above Tier II action levels at well 18199 include hexachloroethane at 12.6 µg/L and 17 µg/L in March and September of 1999, respectively; vinyl chloride at 120 µg/L in September 1999; and thallium at 8.23 µg/L in December 2000. There were no nitrate concentrations greater than the Tier II action level in any samples collected from well 18199.

Table 5-3 Historical Building 771 D&D Groundwater Monitoring Data

Well	Location	Dates	CCl ₄ (mg/L)	PCE (mg/L)	Chloroform (mg/L)	Others above Tier II (mg/L)
18199	Upgradient	3/99	<i>15,400</i>	37.6	2200(B)	Hexachloroethane 12.6
		9/99	<i>14,000</i>	39	2400	Hexachloroethane 17
		12/99	<i>25,300</i>	60.4	3790	Vinyl Chloride 120
		3/00	<i>39,000</i>	U	5200	-----
		5/00	<i>17,000</i>	91	3900	-----
		12/00	<i>27,300</i>	63.7	4110	Thallium 8.23
20998	Upgradient	9/98	42	U	130	-----
		4/99	48	0.3	28	-----
		6/00	150	U	130	-----
40599	Downgradient	11/00	4	4	6.8	-----
40699	Downgradient	11/00	U	2	2	1,1-Dichloroethene 389
40799	Downgradient	5/00	U	0.1	0.1	-----
		11/00	U	U	U	-----
40899	Upgradient	None	-----	-----	-----	-----
41499	Downgradient	5/00	U	U	U	TCE 53
		11/00	U	4.5	0.42	TCE 74.4
41599	Downgradient	11/00	U	2.4	U	-----
P219089	Downgradient	11/00	U	0.53	U	U-233/234 9.10 pCi/L U-238 6.40 pCi/L

Notes: Concentrations greater than Tier II shown in Bold, Concentrations greater than Tier I shown in Italicized Bold, U = non detect, (B) = Analyte detected in the Method Blank, CCl₄ = carbon tetrachloride

Results from preexisting upgradient well 20998 indicate carbon tetrachloride concentrations greater than Tier II in September 1998, April 1999, and June 2000, as well as chloroform concentrations greater than Tier II in September 1998 and June 2000. Only VOCs were analyzed in these samples.

The only concentrations greater than Tier II action levels in the six new Building 771 D&D wells and preexisting well P219089 are listed in the far right column of Table 5-3. These include 1,1-DCE (389 µg/L) in downgradient well 40699 in November 2000, TCE in downgradient well 41499 in May (53 µg/L) and November (74.4 µg/L) 2000, and U-233/234 (9.10 pCi/L) and U-238 (6.40 pCi/L) in well P219089 in November 2000. These uranium results are below the U-233/234 and U-238 site background values (M2SDs) of 60.7 pCi/L and 41.8 pCi/L, respectively. There was also a tritium detection of 437 pCi/L (below Tier II) at well 40799 in May 2000.

D&D well 20998 is currently being monitored as part of the Building 771 network. However, since well 21098 is close to 20998 and serves other monitoring functions, and is in a better location to monitor upgradient groundwater conditions, it should be used instead of well 20998 for the D&D monitoring of Building 771.

In conclusion, there were not enough D&D groundwater monitoring sampling events completed through CY 2000 to establish baseline analyte concentrations for any of the Building 771 wells except monitoring well 18199 (for specific VOCs only; carbon tetrachloride, chloroform, and PCE). These baselines will be calculated when enough additional data is available to calculate analyte baselines for other Building 771 D&D wells. Upgradient versus downgradient well comparisons are not warranted at Building 771 because the building has not yet been demolished. Nitrate does not appear to be an issue for Building 771.

Upgradient monitoring well 18199 contains carbon tetrachloride in concentrations that are greater than the Tier I action level, and relatively high levels of chloroform. The source for this contamination is IHSS 118.1, which is approximately sixty feet upgradient of well 18199. We do not see appreciable carbon tetrachloride in downgradient wells at Building 771 and, in addition, currently have very little groundwater in these wells. It can be surmised that the extensive footing drain systems for Buildings 771 and 774 are intercepting a large amount of upgradient groundwater that may have significant VOC contamination.

Efforts to determine the location and extent of the footing drains for Buildings 771 and 774 have only provided partial information on where they outfall. One footing drain for Building 771, location 771-FDOUT #2 is a footing drain outfall with minor amounts of water and low levels of carbon tetrachloride. Samples from manholes 771NWMANHOLE and 771NWMANHOLE#3 showed appreciable flow but no detections of carbon tetrachloride. A literature review and walkdown of the Bowman's Pond area has determined that there are four outfalls in the area. Three of these outfalls are probably tied to Building 774 footing drains. The fourth outfall, which is the farthest west of the four, may receive contributions from Building 771 footing drains. The Bowman's Pond evaluation project was conducted in 1999 to evaluate the sediments in the pond for possible remediation (see 1999 RFCA Annual Groundwater Report). Surface water samples from the pond showed concentrations of carbon tetrachloride that range from 5 – 21 µg/L. A grab sample from each of the footing drain outfalls collected in May 2001 showed 18 µg/L of carbon tetrachloride in the westernmost footing drain outfall. Given that these drains provide a direct conduit to surface water, it is proposed to collect an additional round of samples from these drains, preferably during storm and non-storm events. Based on the results obtained, one or more of these drains may be recommended for inclusion in the D&D monitoring for Buildings 771/774.

5.4 Building 886

The Sampling and Analysis Plan for the D&D monitoring of Building 886 was initiated during late 1998. The SAP (RMRS 1999o) was submitted Final to the Agencies in July 1999. The D&D monitoring wells associated with the building were installed before the end of 1999. Building 886 is currently scheduled for demolition in late 2003 and early 2004. This should allow adequate time to construct a groundwater chemistry baseline for the monitoring wells at this building.

Building 886 is located on the south side of Central Avenue at RFETS, approximately 300 feet southeast of the PACS-1 entrance to the former PA. The building was first occupied in 1965 and housed the Critical Mass Laboratory that was used to conduct criticality experiments for nuclear safety research and development.

Plutonium, uranium, and nitrate were considered to be the contaminants of concern at Building 886 based on research of historical practices at the building. Figure 5-4 presents the location of Building 886 and the D&D groundwater monitoring wells associated with it.

Three new D&D monitoring wells (40999, 41099, and 41199) were installed at Building 886 during the fall of 1999. Well 40999 and preexisting well P317989 are upgradient D&D wells. Wells 41099, 41199, and preexisting well 22996 are downgradient D&D wells. Three D&D sampling rounds were completed at Building 886 through CY 2000. Preexisting well P317989 had no groundwater samples collected from it between 3/21/95 and 11/10/99 (a D&D groundwater sampling round); therefore, the previous three years of data are not available for D&D groundwater chemistry baseline consideration. Groundwater data have been collected from well 22996 for the 3rd and 4th quarters of 1996, the 1st and 3rd quarters of 1998, the 1st, 3rd, and 4th quarters of 1999, and 1st, 2nd, and 4th quarters of 2000.

Table 5-4 presents a summary of Building 886 D&D groundwater monitoring data collected through CY 2000. Monitoring well 22996 data collected before commencement of D&D sampling at Building 886 is also presented in Table 5-4 for comparison to the more recent D&D data. Until a geochemical baseline is established for Building 886, analytes will be discussed in terms of concentrations relative to Tier I and Tier II groundwater action levels. The Tier I and Tier II action levels are only used as a screening tool and are not RFCA or compliance driven.

The results of the three D&D sampling rounds completed at Building 886 through CY 2000 indicate there were no concentrations of any analytes greater than Tier I action levels. Concentrations greater than Tier II action levels exist for U-233/234 and U-238 for every Building 886 D&D monitoring well for every sampling round that produced enough water for a U-isotope sample. In addition, U-235 concentrations greater than the Tier II action levels were found in all U-isotope samples collected from upgradient well P317989 and downgradient well 41099. All of the U-isotope results are below the U-233/234 and U-238 site background values (M2SDs) of 60.7 pCi/L and 41.8 pCi/L, respectively, although the concentrations in P317989 and 41099 approach the M2SD values.

Samples from downgradient well 41099 contained nitrate concentrations greater than the Tier II action level for every D&D sampling round completed to date. No other Building 886 D&D well has nitrate concentrations that approach the Tier II action level. The only VOC detections at any Building 886 D&D well are very low concentrations of PCE in upgradient well 40999 (0.2 µg/L) and downgradient well 41199 (2.0 µg/L), and TCE in well 22996 (range 0.7 – 1.0 µg/L). Metals results indicate that upgradient well P317989 has been impacted by selenium in concentrations greater than the Tier II action levels; downgradient well 41099 has been impacted by cadmium and thallium in concentrations greater than the Tier II action levels.

In conclusion, there were not enough D&D groundwater monitoring sampling events completed through CY 2000 to establish baseline analyte concentrations for any of the Building 886 wells except monitoring well 22996 (for U-233/234 and U-238). These baselines will be calculated when enough additional data is available to calculate analyte baselines for other Building 886 D&D wells. Upgradient versus downgradient well comparisons are not

warranted at Building 886 because the building has not yet been demolished. At this time, nitrate and VOCs do not appear to be a pre-D&D issue for Building 886.

Table 5-4 Historical Building 886 D&D Groundwater Monitoring Data

Well	Location	Dates	U-233/234 (pCi/L)	U-238 (pCi/L)	Metals (mg/L)	Nitrate (mg/L)	Others (mg/L or pCi/L)
40999	Upgradient	11/99	8.883	6.807	Cadmium 4.1	U	PCE 0.2
		6/00	10.70	7.83	INSW	0.54	----
		11/00	10.0	8.30	INSW	INSW	----
P317989	Upgradient	11/99	INSW	INSW	Selenium 121	3.8	----
		6/00	51.10	38.50	Selenium 120	INSW	U-235 2.28
		12/00	INSW	INSW	Cadmium 2.45 Selenium 128	INSW	----
41099	Downgradient	11/99	51.65	33.77	Cadmium 2.3	47	U-235 2.316
		6/00	45.50	27.10	Selenium 12.3	47	U-235 1.41
		11/00	42.0	27.0	Cadmium 5.4 Cadmium 5.43 Selenium 4.15 Thallium 4.89	36	U-235 1.40
41199	Downgradient	11/99	10.74	3.997	Cadmium 1.6	1.5	PCE 2.0
		6/00	8.39	4.33	Selenium 3.2	5.6	----
		11/00	8.60	3.70	----	INSW	----
22996	Downgradient	8/96	2.335	2.13	Cadmium 4.6(B)	1.9	----
		11/96	2.325	1.836	Thallium 7.8(B)	0.65	----
		3/98	3.01	2.68	NA	NA	----
		8/98	2.86	2.40	NA	NA	----
		2/99	3.573	3.011	Selenium 2.7(B)	NA	TCE 0.99
		8/99	3.38	2.48	Selenium 1.4(B)	NA	TCE 0.7
		11/99	3.58	2.399	Selenium 2(B)	3.3	TCE 0.7
		2/00	3.598	2.509	Selenium 1.5(B)	INSW	TCE 1.0
		6/00	4.62	3.02	Selenium 2.8 (B)	4.2	TCE 1.0
		12/00	2.30	1.60	----	0.9	----

Notes: Concentrations greater than Tier II shown in Bold, Concentrations greater than Tier I shown in Italicized Bold, U = non detect, (B) = Analyte detected in the Method Blank, NA = not analyzed, INSW = Insufficient water available for sample collection

5.5 Building 779

Building 779, placed into service in 1969, housed minor production and plutonium recovery operations but was primarily a research and development facility. Some metal parts were assembled in this building and bulk plutonium residues were recovered (DOE 1992a). The remainder of the operations conducted in Building 779 were research and development activities which included the following operations: pyrochemical technology, coatings, plutonium and non-plutonium physical metallurgy, chemical technology in support of plutonium recovery operations in Building 771, and product physical chemistry (DOE 1992a). The building, located in the former PA approximately 200 feet south of the westernmost Solar Pond, was demolished in 1999.

Three D&D monitoring wells, 02297, 02397, and 02497 were installed in 1997. Well 02397 is for upgradient D&D monitoring; wells 02297 and 02497 were for downgradient D&D monitoring. However, during building D&D activities in late 1999, monitoring well 02297 was destroyed; it was replaced in 2000 with downgradient monitoring

well 02500. Monitoring well 02500 is similar in well construction to well 02297 and, therefore, D&D monitoring data from that location includes previous data collected from well 02297. In addition, at the request of CDPHE, another new D&D well, 00100, was added to the program during 2000. This well, located near the northeast corner of Building 779, is a relatively deep well (approximately 32 feet bgs) positioned to monitor groundwater quality downgradient of the Building 779 basement and sub-basement.

As described above in the introduction to Section 5.0, a minimum of four sampling events are required to collect a data set to be used for determination of a unique baseline for each building which will undergo D&D groundwater monitoring. Unfortunately, in addition to the destroyed monitoring well (02297), the construction of its replacement well (02500) and additional basement monitoring well (00100), the schedule for Building 779 D&D became accelerated and it was not possible to collect the required amount of pre-demolition data to derive baseline values for the D&D wells. In addition, there were not an appropriate number or distribution of preexisting monitoring wells in the vicinity of Building 779 to sample for collection of baseline data utilizing the previous three years sampling data. Figure 5-5 presents the building location and the associated D&D monitoring wells.

Because a baseline cannot be established, water quality with respect to Building 779 must be evaluated in terms of an upgradient/downgradient comparison. Analytes at Building 779 have been screened in terms of concentrations relative to Tier I and Tier II groundwater action levels. The Tier I and Tier II levels are only used as a screening tool and are not RFCA or compliance driven.

The alluvial deposits are very thinly saturated in the vicinity of Building 779. In addition, a foundation drain dewateres the northwest and northern edge of the former building. These circumstances combine at drier times of the year to allow only minimal amounts of groundwater to be available for sample collection. In most cases, through CY 2000, three sampling rounds have been completed at Building 779 D&D monitoring wells 02397 and 02297/02500 for VOCs. Fewer rounds have been completed for the other analyte groups. Monitoring well 02497 has produced seven sets of VOC samples and four sets of nitrate samples. No sampling rounds were completed during 1997 at the Building 779 D&D monitoring wells because of lack of water. Sampling rounds were accomplished with varying success at the Building 779 D&D monitoring wells during the period of 1998 through 2000. Not all monitoring wells produced the same number of sampling rounds or amount of samples per round during the period because the wells were either dry or did not produce enough groundwater for full sample suites. Monitoring well 02397 produced no samples during 1999. During CY 2000, monitoring wells 00100 and 02500 were sampled in the 4th quarter for VOCs, nitrate, metals, Pu/Am, and U-isotopes (full suite). Well 02397 was sampled during the 2nd quarter of 2000 for VOCs and nitrate. Well 02497 was sampled during the 2nd quarter of 2000 for VOCs, nitrate, and U-isotopes; and during the 4th quarter of 2000 for VOCs and metals.

Table 5-5 presents summary results of all D&D groundwater sampling at Building 779 to date. These data indicate that there were no contaminant concentrations from any Building 779 D&D monitoring well greater than the Tier I action levels for the specific analytes. All four Building 779 D&D wells have at least one analyte concentration greater than a Tier II action level. Upgradient well 02397 has the only nitrate concentrations which are greater than Tier II action levels. New monitoring well 00100 is the only well that exhibited VOC concentrations (TCE and

carbon tetrachloride) greater than Tier II action levels. Downgradient monitoring wells 02497 and 02297/02500 have produced samples with concentrations of U-233/234 and U-238 that are greater than the Tier II action levels for those analytes for all sampling rounds in which there was enough groundwater available for a U-isotope sample. Well 02497 also exhibited an americium result of 0.233 pCi/L in May 1999, which is greater than the Tier II action level, and concentrations of cadmium and thallium in November 2000 above their respective Tier II action levels. In addition to the VOCs, samples from well 00100 in December 2000 had concentrations of U-233/234 and plutonium (0.68 pCi/L) which are greater than the Tier II action levels for those analytes. All the U-isotope results were below Site background M2SD values.

A linear groundwater flow velocity of 72 ft/yr (7.0E-05 cm/sec) was calculated between upgradient well 02397 and downgradient well 02500 utilizing 4th quarter 2000 water level data. Hydraulic conductivity (Rocky Flats Alluvium) and effective porosity values were used as described in Section 3.2 of this RFCA Annual Report. This flow velocity would allow groundwater to travel from well 02397 to well 02500 in approximately 5 years. Actual contaminant travel times can be expected to be much longer for highly retarded contaminants such as plutonium and americium, and slightly longer for weakly retarded contaminants, such as VOCs, U-isotopes, and nitrate. The groundwater travel time from the sub-basement to well 00100, a distance of approximately 210 feet, would be about 3 years. (See Section 5.5.1 for more discussion of the Building 779 sub-basement.)

In conclusion, there are upgradient Building 779 nitrate concentrations that are greater than Tier II action levels compared to no Tier II level nitrate concentrations in downgradient Building 779 D&D wells (although downgradient wells 02497 and 02297/02500 show recent nitrate concentrations that are approaching the Tier II action level). There are no upgradient U-isotope, VOC, metals, or Pu/Am concentrations to date that approach the concentrations of these analytes observed in downgradient Building 779 wells. Nitrate appears to be the only upgradient contaminant of concern to Building 779.

Table 5-5 Historical Building 779 D&D Groundwater Monitoring Data

Well	Location	Dates	CCl ₄ (mg/L)	TCE (mg/L)	Nitrate (mg/L)	U-233/234 (pCi/L)	U-238 (pCi/L)	Others (mg/L or pCi/L)
02397	Upgradient	3/98 11/98 5/00	U U U	U 1.0 U	INSW 12 19	0.582 INSW INSW	0.69 INSW INSW	Pu/Am U Thallium 1.1 INSW
02497	Down- gradient	3/98 6/98 11/98 5/99 11/99 5/00 11/00	U U U 0.5 0.3 0.4 U	1.0 0.6 3 2 2 4 2.4	5.9 6.2 INSW INSW 8.7 4.7 INSW	INSW INSW INSW 2.599 1.842 1.42 INSW	INSW INSW INSW 1.076 0.918 0.808 INSW	INSW INSW INSW Am 0.233 Cadmium 2.2 Chloroform 12 Cadmium 15.1 Thallium 5.33
00100	Down- gradient	12/00	14.8	61.8	3.1	1.10	0.61	Pu 0.68 PCE 4.2
02297 then 02500	Down- gradient	6/98 5/99 11/00	U 0.8 U	2 2 1.5	INSW 8.2 7.4	INSW 8.169 4.20	INSW 4.103 2.10	INSW INSW -----

Notes: Concentrations greater than Tier II shown in Bold, Concentrations greater than Tier I shown in Italicized Bold, U = non detect, (B) = Analyte detected in the Method Blank, NA = not analyzed, INSW = Insufficient water available for sample collection, CCl₄ = carbon tetrachloride.

5.5.1 Building 779 Sub-Basement

While the demolition of Building 779 was occurring, it was learned from building personnel that there was a small sub-basement area beneath the Building 779 basement. The sub-basement area contained four vaults, the bases of which are approximately 24 feet below the Building 779 ground floor. Upon inspection, it was noted that three of the vaults contained water, potentially groundwater which may have seeped into them and mobilized existing point source contamination. The CDPHE expressed concern because the previously submitted Final Building 779 D&D Groundwater Monitoring SAP did not address these below basement structures. CDPHE requested that the vaults with water be sampled.

The results of the initial December 1999 sampling effort indicated that water from all three vaults (Pit 1A, Pit 2A, Pit 2B) contained numerous metals (including beryllium) above Tier II but below Tier I groundwater action levels. The water in Pit 1A contained U-233/234 and U-238 in concentrations that exceed the site background values for groundwater (60.7 pCi/L for U-233/234 and 41.8 pCi/L for U-238). Plutonium and americium were found above their Tier II groundwater action levels in Pits 2A and 2B. The levels found in Pit 1A (plutonium 74.9 pCi/L and americium 31.3 pCi/L) exceed their respective Tier I groundwater action levels. In addition, 1,1,2,2,-tetrachloroethane (PCA) was found in the Pit 1A sample at a concentration exceeding its Tier I groundwater action level. Pit 1A appeared to be the most impacted. The Building 779 sumps/vaults were pumped out after the first sampling round. A second sampling round was taken of the influent water to help determine if this new recharge water would have analyte concentrations similar to that collected from the standing water in the sub-basement

vaults. The results of the May 2000 confirmatory sampling round indicate that Pit 1A was the only Building 779 vault with any results above Tier II action levels. The Tier II exceedances were for metals (cadmium, chromium, lead, and nickel) and radionuclides (americium, plutonium, uranium-238, and uranium-233/234). There were no uranium isotope results above the site background values listed above.

In addition to the Building 779 vaults, Building 783, containing three below grade vaults, and Building 782, which contains a sump, were sampled in May 2000. These below grade structures were not included in the initial, December 1999, sampling round. The results of the May 2000 sampling indicate that there is some contamination in these structures. The Building 783 vaults show some slight Tier II exceedances for americium, U-233/234 and U-238, arsenic and manganese. The Building 782 sump showed Tier II exceedances for U-233/234, nitrate, and TCE.

Water levels were measured in the Building 779 and 783 vaults and Building 782 sump five times between April 2000 and January 2001. Water levels were measured from surveyed measuring points so that water level elevations could be calculated for each location. The water level elevations in the subgrade structures could then be compared to the local water table elevation so that assumptions could be made with respect to the origin of the water in the structures. Building 779 Pits 2A and 2B were dry except for the July 2000 measurements. Pit 1B only contained water during the July and October 2000 monitoring visits. Pit 1A contained water during each of the five monitoring visits. The Building 783 vaults and the Building 782 sump contained water during each of the five monitoring visits.

Buildings 779, 783, and 782 are located between the 5970 and 5975 potentiometric contours on Plates 4 and 5 of this report. The water level elevations for the Building 783 vaults, which range from elevation 5969.3 to 5971.7 for the five monitoring events, correlate well with the elevation of the potentiometric surface in that area. The Building 782 sump water levels range from elevation 5963.4 in April 2000 to 5970.3 in January 2001. This is inconsistent with the local water table elevation in that the water level is progressively higher during the five monitoring visits, when it might be expected that the water level would be highest in April and lowest in January. The Building 779 vaults exhibit water levels that range from elevation 5960.4 to 5962.5. These levels are consistent to each other but are well below the water table elevation in the vicinity of Building 779. Only the Building 783 vaults water level elevations correlate to the local water table elevation.

The results of the two rounds of Building 779 sub-basement vault sampling and five rounds of water level measurements imply that the major source of the contamination is material originally contained in the below grade vaults and not the groundwater which may be seeping into the vaults. If the source of the contamination was infiltrating groundwater, then the results of the two rounds of sampling for the vaults would be similar, and wells adjacent to Building 779 would probably show similar contamination. PCA was detected in Pit 1A during the first round of sampling above its Tier I action level, but was not even detected above its Tier II action level in the second round. Vaults 2A and 2B showed no Tier II exceedances for any analytes for the second round after having many Tier II exceedances for metals and radionuclides during the first sampling round. The fact that the water in the vaults was pumped out between the first and second sampling events probably contributed to the significant difference in concentrations of radionuclides, PCA, and some metals.

As discussed above, a new D&D monitoring well (00100) was constructed during 2000 at the request of the CDPHE. The well is located northeast of Building 779 and is completed to the appropriate depth to monitor groundwater downgradient of the sub-basement vaults. The screened interval of this well extends from elevation 5971 to 5946. The CDPHE also requested that the outfall from the Building 779 foundation drain (SW085) be sampled during 2000. The foundation drain, located at elevation 5975, is a gravity flow drain. Because of its intake elevation, the foundation drain probably has no relevance to the Building 779 sub-basement contamination. Groundwater elevations in monitoring wells adjacent to Building 779 during 2000 confirm that the foundation drain was above the groundwater elevations in the wells during 2000, hence samples could not be collected. A grab sample was collected from the outfall during May 2001. Previous sampling includes eleven samples collected from the Building 779 foundation drain outfall from July 1988 through May 1990. No samples were collected from the outfall between May 1990 and May 2001.

As shown in Table 5-5, the groundwater sample collected from monitoring well 00100 in December 2000 resulted in concentrations of plutonium, U-233/234, carbon tetrachloride and TCE that are greater than the Tier II action levels for those analytes. The May 2001 foundation drain outfall sample yielded concentrations of plutonium (0.47 pCi/L), americium (0.32 pCi/L), U-233/234 (5.90 pCi/L), and U-238 (3.20 pCi/L) that are all greater than their respective Tier II action levels.

The historical results from the Building 779 foundation drain from July 1988 through May 1990 (eleven sampling rounds) show result concentrations of U-233/234 (9 results), U-235 (3 results), U-238 (8 results), plutonium (7 results), americium (6 results), tritium (1 result), beryllium (2 results), strontium-89/90 (1 result), and nitrate (10 results) greater than their respective Tier II action levels. In addition, cadmium had 2 results and each of the following had one result greater than its Tier II action level: antimony, chromium, manganese, nickel and vanadium.

In conclusion, new D&D monitoring well 00100 provides a monitoring point downgradient of Building 779 that will allow a determination to be made of upgradient versus downgradient water quality with respect to the basement and sub-basement vaults. The foundation drain, which continues to dewater the northern end of the remaining Building 779 foundation (when the water table is high enough), is capable of capturing potentially contaminated groundwater in the vicinity of the building. The May 2001 outfall sampling event confirms the historical foundation drain data from 1988 through 1990. It would be difficult to ascertain the origin of the groundwater captured by the Building 779 foundation drain, with respect to D&D monitoring, and, therefore, the meaningfulness of samples collected from the drain outfall (with respect to D&D monitoring). Continued monitoring of the outfall would be of doubtful value, and is probably not warranted.

5.6 Building 707

A Sampling and Analysis Plan for the D&D groundwater monitoring of Building 707 (RMRS 2000c) was prepared early in CY 2000 and submitted to the CDPHE and U.S. EPA in April 2000. Comments were received from the Agencies in early July 2000, and a meeting was held at RFETS on July 19, 2000, to resolve issues pertaining to the investigation at this building. The Final SAP for this building was submitted to the Agencies in August 2000.

Building 707 is scheduled for demolition in late 2005, which should provide adequate time to construct a baseline for the D&D monitoring wells.

Building 707 is located on the north side of Central Avenue between Eighth and Ninth Streets in the former PA. It is just south of the Building 776/777 complex. Building 707 is a two-story building with a single story section on its east side. The two-story portion is 72,240 square feet, while the single story section is 18,560 square feet. The main floor of the building is compartmentalized into eight modules (A through H). There is a small basement (called the C-pit) under Module C with an area of 1,000 square feet. During its operation, no significant changes were made to the building design.

Construction of Building 707 began in 1967 to support production of the Part V weapons design that could not be fully accommodated in Building 776/777. Because of a major fire in 1969 at Building 776/777, Building 707 acquired additional plutonium foundry, casting, and machining functions that were moved from Building 776/777. After the fire in Building 776/777, Building 707 became the main plutonium components production facility at the plant. Plutonium manufacturing operations began in May 1970 and between 1970 and 1989, Building 707 provided metallurgical support for plutonium and was involved in final product assembly. Plutonium was cast into ingots in the foundry, then rolled and formed prior to being machined, cleaned, and assembled in various areas within the building. Plant operations involving radioactive and fissile material were discontinued in 1989. As of 1992, certain non-production operations had resumed in Building 707.

Well installation and groundwater sampling activities that took place at this building during 2000 include the installation and development of downgradient D&D monitoring wells 00200 and 00300. Preexisting wells 60499 and 60599, installed for the East Industrial Area Plume (EIAP) characterization project, are utilized as upgradient Building 707 D&D wells. EIAP well 61499 and preexisting well P218089 are utilized as downgradient D&D wells. Because P218089 was not sampled between May 1995 and December 2000, the previous three years of data is not available for chemical baseline determination. Besides the monitoring wells, the Building 707 D&D SAP states that a VOC sample will be collected from the Building 707 foundation drain at FD-707-4, which is a manhole within Building 763 just southeast of the building. In addition, the SAP states that radionuclide and metals samples from the foundation drain will be collected from surface water sampling station GS40 located just east of the 750 Pad. Figure 5-6 presents the site location as well as the location of D&D monitoring wells.

Based on the research performed in support of the Building 707 D&D SAP, the most abundant potential contaminants associated with Building 707 are plutonium, americium, U-isotopes, chlorinated solvents, and a variety of metals including lead, chromium, and mercury. Table 5-6 presents a summary of Building 707 D&D groundwater monitoring data collected through CY 2000. Until a geochemical baseline is established for Building 707, analytes will be discussed in terms of concentrations relative to Tier I and Tier II groundwater action levels. The Tier I and Tier II action levels are only used as a screening tool and are not RFCA or compliance driven with regard to building D&D.

Except for downgradient D&D wells 00200 and P218089, there has been little groundwater available for sampling through CY 2000. The alluvial saturated thickness in this portion of the site is very thin. In addition, the Building 707 foundation drain is extensive and encompasses the entire building except for the northwest corner. At certain times of the year UHSU groundwater flow may be restricted to the weathered bedrock. Upgradient wells 60499 and 60599 and downgradient well 61499 have only had enough water available for VOC analyses. Downgradient well 00300 was dry during CY 2000.

The results of the D&D sampling rounds to date are inconclusive because of the small number of results available. There were no concentrations of any analytes that were above Tier I action levels. Upgradient well 60599 has been impacted by PCE in concentrations greater than the Tier II action level during the 1st and 4th quarters of 2000. Samples from downgradient well P218089 contained activity concentrations of U-233/234 and U-238 greater than the Tier II action level during the 4th quarter of 2000. Downgradient well 00200 samples had cadmium and thallium (B qualified) concentrations greater than the Tier II action level during the 4th quarter of 2000. VOC sample results from FD-707-4 during the 4th quarter 2000 were all non-detect. Many samples were collected from surface water station GS40 during CY 2000. The results of these analyses indicate that concentrations of U-233/234, U-238, and antimony above their respective Tier II action levels are consistently found in this water. No plutonium or americium was detected at concentrations above their respective Tier II action levels in samples from station GS40.

Table 5-6 Historical Building 707 D&D Groundwater Monitoring Data

Well	Location	Dates	U-233/234 (pCi/L)	Pu/Am (pCi/L)	CCl ₄ (mg/L)	TCE (mg/L)	Others (mg/L or pCi/L)
60499	Upgradient	1/00	INSW	INSW	U	0.8	Chloroform 11 PCE 0.3
		12/00	INSW	INSW	0.66	1.5	Chloroform 9.5 PCE 1.1
60599	Upgradient	2/00	INSW	INSW	U	U	PCE 100
		12/00	INSW	INSW	0.7	U	PCE 111
61499	Downgradient	5/00	INSW	INSW	U	0.1	PCE 5
		12/00	INSW	INSW	U	U	INSW
P218089	Downgradient	12/00	3.30	Am U Pu 0.008	U	U	U-238 2.30
00200	Downgradient	11/00	U	U	1.4	0.27	Cadmium 8.49 Thallium 3.78(B) PCBs U
00300	Downgradient	Dry	Dry	Dry	Dry	Dry	Dry

Notes: Concentrations greater than Tier II shown in Bold, Concentrations greater than Tier I shown in Italicized Bold, U = non detect, (B) = Analyte detected in the Method Blank, NA = not analyzed, INSW = Insufficient water available for sample collection, CCl₄ = carbon tetrachloride

5.7 Building 776/777

A Sampling and Analysis Plan for the D&D groundwater monitoring of Building 776/777 (RMRS 2000c) was prepared early in CY 2000 and submitted to the CDPHE and U.S. EPA in April 2000. Comments were received from the Agencies in early July 2000, and a meeting was held at RFETS on July 19, 2000, to resolve issues pertaining to the investigation at this building. The Final SAP for this building was submitted to the Agencies in August 2000. Building 776/777 is scheduled for demolition in late 2003. This may allow adequate time for construction of a chemical baseline for the D&D monitoring wells.

The building 776/777 complex is located in the former PA, between Eighth and Ninth Streets, just north of Building 707. Buildings 776 and 777 share a common wall, utilities, and maintenance. All floors in the building are reinforced concrete slabs. The main floor has an area of 135,000 square feet. Metal processing facilities occupy 62,000 square feet and waste handling occupies 63,000 square feet. The second floor contains 88,000 square feet and is almost entirely occupied by utilities. There are two sub-basement areas: a four bay area of approximately 1,600 square feet and an elevator pit area which is adjacent to the tunnel connecting Buildings 776 and 771.

Building 776/777 began operations in 1957 and has undergone several major production changes since then. Beginning in 1958 and continuing through 1969, Building 776 was the main manufacturing facility for plutonium weapons components and housed a plutonium foundry and fabrication operations. The main function of Building

777 was assembly of parts. After the devastating fire in 1969, the majority of the Building 776/777 foundry and fabrication operations were transferred to Building 707. Limited production operations were resumed in Building 776/777 several months after the fire; however, the main focus of the building moved towards waste and residue handling, disassembly of site returns, and special projects. Processes included waste size reduction, pyrochemistry, coatings operations, machining, and product assembly and disassembly, including testing and inspection. Post-1989 production curtailment activities included waste handling and maintenance activities in Building 776, and a tritium surveillance laboratory and container repackaging operations in Building 777 (DOE 1994a).

Well installation and groundwater sampling activities that took place at this building during 2000 include the installation and development of upgradient monitoring well 00400 and downgradient monitoring wells 00500, 00600, and 00700. Preexisting monitoring well 60299, part of the EIAP investigation, will be utilized as a Building 776/777 upgradient D&D well. Figure 5-7 presents the building location along with the locations of the D&D monitoring wells.

Based on the research performed in support of the Building 776/777 D&D SAP, the most abundant potential contaminants associated with Building 776/777 are plutonium, americium, U-isotopes, tritium, chlorinated solvents, a variety of metals including beryllium, and potentially nitrate. Table 5-7 presents summary Building 776/777 D&D groundwater monitoring data collected through CY 2000. Until a geochemical baseline is established for Building 776/777, analytes will be discussed in terms of concentrations relative to Tier I and Tier II groundwater action levels. The Tier I and Tier II action levels are only used as a screening tool.

Except for upgradient D&D well 60299, all of the Building 776/777 D&D wells produced full sample suites (VOCs, metals, U-isotopes, Pu/Am, tritium, nitrate, and TRPH) in the 4th quarter of 2000. Monitoring well 60299 only produced enough water for VOC samples in the 1st and 4th quarters of 2000. In addition, a nitrate sample was collected from this well in the 4th quarter of 2000.

The results of the 4th quarter 2000 sampling round show that the carbon tetrachloride concentration in downgradient well 00700 is greater than the Tier I action level. There were no concentrations of any other analytes that were above Tier I action levels from Building 776/777 D&D wells. Chloroform; 1,1-DCE; 1,2-DCA; and PCE concentrations in well 00700 were all greater than their respective Tier II action levels. Upgradient well 00400 has been impacted by U-isotopes, cadmium, and thallium in concentrations greater than the Tier II action level. Downgradient well 00500 exhibited manganese and thallium (B qualified) concentrations greater than their respective Tier II action levels. Tritium was detected in downgradient well 00700 at an estimated concentration of 300 pCi/L; tritium was non-detect at all other wells. Beryllium and total recoverable petroleum hydrocarbons (TRPH) were non-detect at all wells; nitrate was either non-detect or at a concentration below its Tier II action level at all wells.

Table 5-7 Historical Building 776/777 D&D Groundwater Monitoring Data

Well	Location	Dates	Pu/Am (pCi/L)	U-isotopes (pCi/L)	Metals (mg/L)	VOCs (mg/L)
60299	Upgradient	3/00	INSW	INSW	INSW	TCE 1.0 CCl ₄ , PCE <1
		11/00	INSW	INSW	INSW	TCE 2.1 CCl ₄ , PCE <1
00400	Upgradient	11/00	Am U Pu 0.012	U-233/234 2.60 U-238 1.20	Cadmium 7.09 Thallium 4.95	TCE 1.6 CCl ₄ , PCE U
00500	Downgradient	11/00	Am U Pu 0.058	U-233/234 0.18 U-238 0.16	Thallium 3.82(B) Manganese 2540	PCE U CCl ₄ , TCE <1
00600	Downgradient	11/00	Am U Pu 0.016	U-233/234 0.19 U-238 0.20	Manganese 1150 Arsenic 11.6	All U
00700	Downgradient	11/00	Am U Pu U	U-233/234 0.035 U-238 0.028	Manganese 88	CCl ₄ 3920 Chloroform 244 1,1-DCE 366 1,2-DCA 8 PCE 9.9

Notes: Concentrations greater than Tier II shown in Bold, Concentrations greater than Tier I shown in Italicized Bold, U = non detect, (B) = Analyte detected in the Method Blank, NA = not analyzed, INSW = Insufficient water available for sample collection, CCl₄ = carbon tetrachloride

5.8 Building 371/374, 865, 883, 881, 991, 559

A Sampling and Analysis Plan for the D&D groundwater monitoring of Buildings 371/374, 865, and 883 (RMRS 2000c) was prepared early in CY 2000 and submitted to the CDPHE and U.S. EPA in April 2000. Comments were received from the Agencies in early July 2000, and a meeting was held at RFETS on July 19, 2000, to resolve issues pertaining to the investigations at the individual building areas. The Final SAP for these buildings was submitted to the Agencies in August 2000. It was anticipated that well installation and groundwater sampling activities would take place for these buildings during the summer and fall of 2000. D&D wells were not installed at Buildings 371/374, 883, and 865 during CY 2000 because of D&D scheduling changes, which allowed for delay of well installation. Building 371/374 D&D wells were installed during the spring of 2001. To date, Building 883 and 865 D&D wells have not been installed. It is anticipated that D&D wells will be installed at these buildings during the fall of 2001. Individual sections for each of these buildings will be initiated in the 2001 Annual RFCA Groundwater Monitoring Report.

A Sampling and Analysis Plan for the D&D groundwater monitoring of Buildings 881, 991, and 559 (RMRS 2001d) was prepared early in CY 2001 and submitted to the CDPHE and U.S. EPA in April 2001. Comments were received from the Agencies in May 2001 and DOE responses to Agency comments were submitted in late May 2001. The

Final SAP for these buildings was submitted to the Agencies in July 2001. It is anticipated that well installation and groundwater sampling a

ctivities for these buildings may take place during the fall of 2001.

Figure 5-1
Building 123 Location Map
with D&D Monitoring Wells
2000 Annual RFCA
Groundwater Monitoring Report

EXPLANATION

- IMP Well Type**
- Water Quality Flow Monitoring
 - Industrial Area Flow Monitoring
 - Background Flow Monitoring
 - D&D Monitoring
 - Non-IMP

- Water Level Contours**
Second Quarter 2000
- 20-Foot Water Level Contour
 - - - Dashed where inferred
 - 5-Foot Intermediate Contour
 - - - Dashed where inferred
 - Foundation Drain

- Pertinant B123 IHSSs**
- Pertinant B123 IHSSs
- Standard Map Features**
- Buildings and other structures
 - ▣ Demolished buildings
 - Streams, ditches, or other drainage features
 - Fences and other barriers
 - Topographic Contour (5-Foot)
 - Paved roads
 - Dirt roads

DATA SOURCE BASE FEATURES:
 Buildings, fences, hydrographic roads and other structures from 1994 aerial fly-over data captured by EGS GRS, Las Vegas. Digitized from the orthophotographs, 1/95. Topographic contours were derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc 10N and LANTICE to process the DEM data to create 5-foot contours. The DEM data was captured by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at 10 meter resolution. DEM post-processing performed by MK, Winter 1997.

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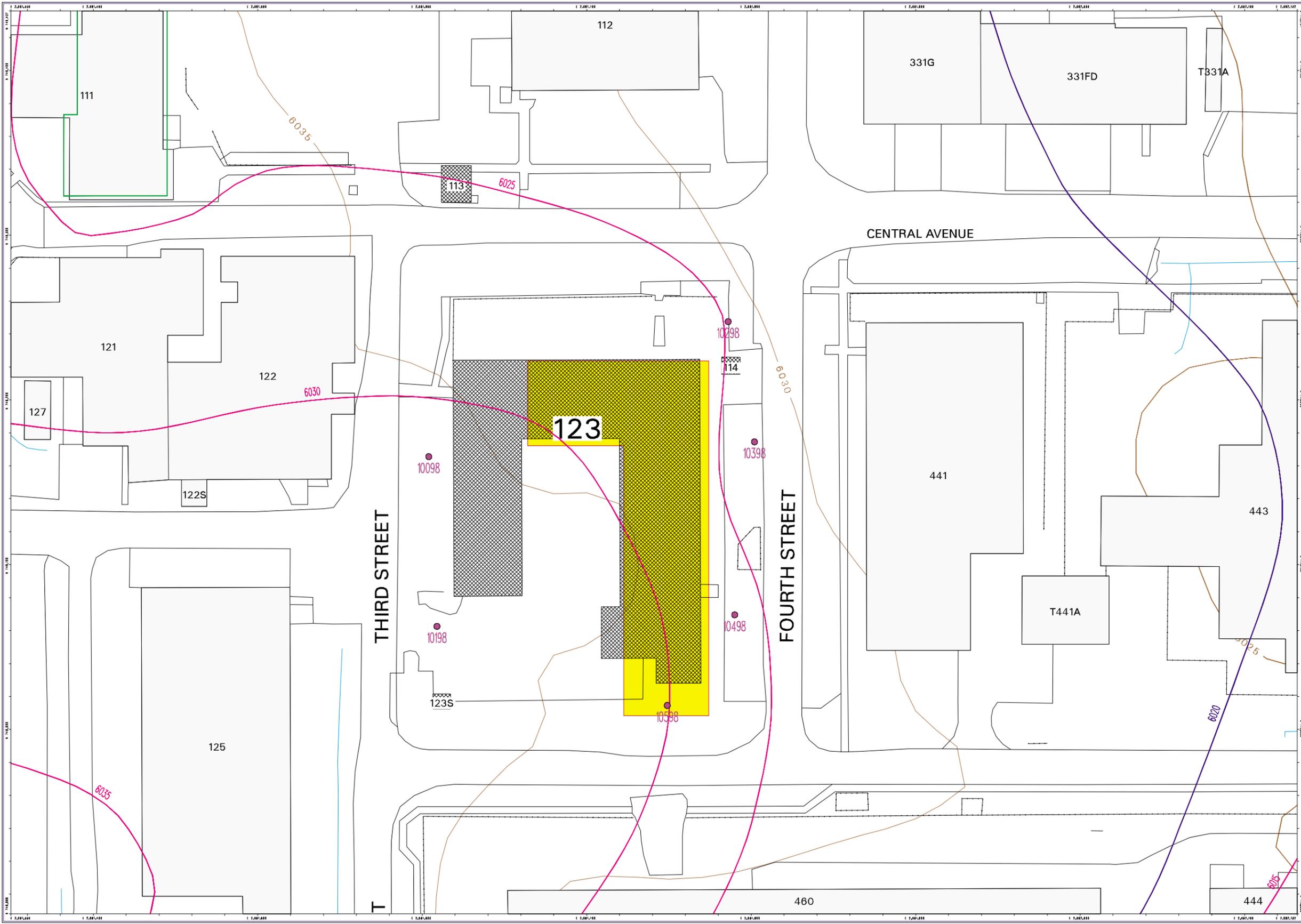
Scale = 1:2710
 1 inch represents approximately 59 feet



State Plane Coordinate Projection
 Colorado Central Zone
 Datum: NAD27

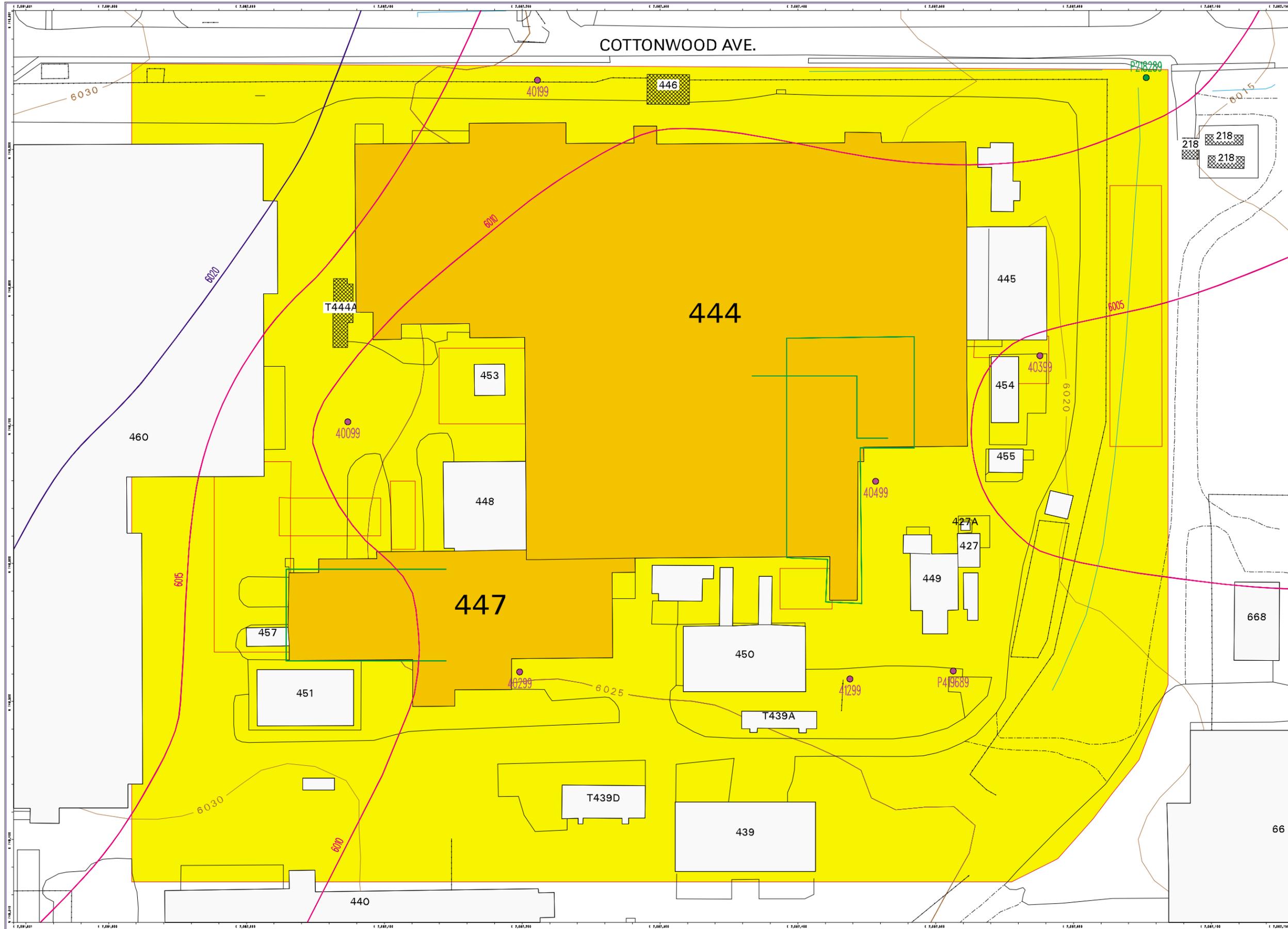
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 Rocky Flats Environmental Technology Site

Prepared by: GIS Dept. 303-966-7707
 Prepared for:



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Figure 5-2
Building 444 Location Map
with D&D Monitoring Wells
2000 Annual RFCA
Groundwater Monitoring Report



- EXPLANATION**
- IMP Well Type**
- Water Quality Flow Monitoring
 - Industrial Area Flow Monitoring
 - Background Flow Monitoring
 - D&D Monitoring
 - Non-IMP

- Water Level Contours**
Second Quarter 2000
- 20-Foot Water Level Contour
 - - - Dashed where inferred
 - 5-Foot Intermediate Contour
 - - - Dashed where inferred
 - Foundation Drain

- Pertinent B444 IHSSs**
- Pertinent B444 IHSSs
 - D&D Building

- Standard Map Features**
- Buildings and other structures
 - ▣ Demolished buildings
 - Streams, ditches, or other drainage features
 - Fences and other barriers
 - Topographic Contour (5-Foot)
 - Paved roads
 - Dirt roads

DATA SOURCE BASE FEATURES:
 Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas. Digitized from the orthophotographs, 1/95. Topographic contours were derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc TN and LATICE to process the DEM data to create 5-foot contours. The DEM data was captured by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at 10 meter resolution. DEM post processing performed by MK, Winter 1997.

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Scale = 1:820
 1 inch represents approximately 88 feet

State Plane Coordinate Projection
 Colorado Central Zone
 Datum: NAD27

U.S. Department of Energy
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GIS Dept. 303-866-7707

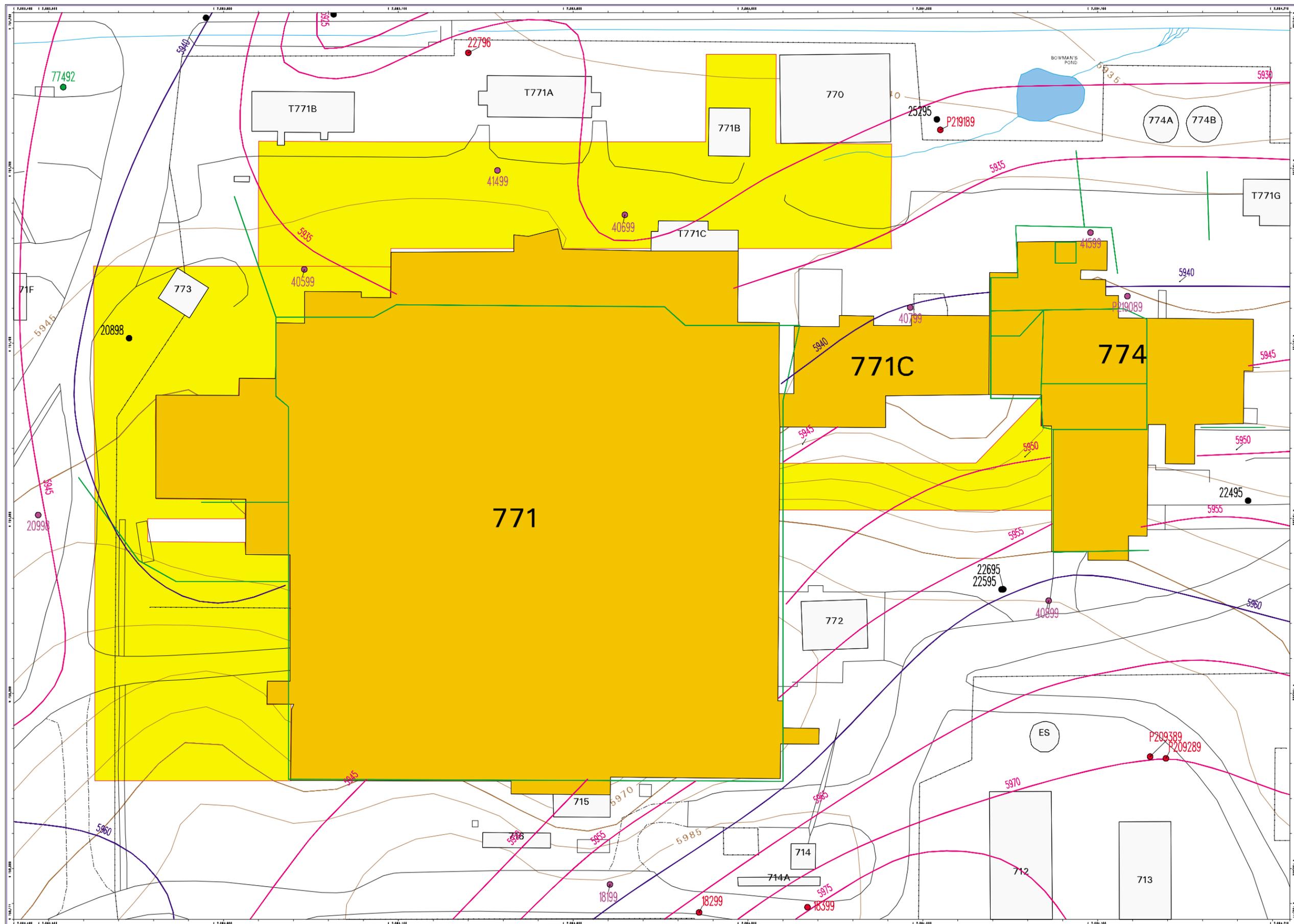
Prepared by: **DynCorp**
 THE ART OF TECHNOLOGY

Prepared for: **Kaiser-Hill**
 CONSULTANTS

MAP ID: 01-0884
 September 25, 2001

NT_Svr hr:projects\fy2001\01-0884\bidg_444-nt.aml

Figure 5-3
Building 771 Location Map
with D&D Monitoring Wells
2000 Annual RFCA
Groundwater Monitoring Report



- EXPLANATION**
- IMP Well Type**
- Water Quality Flow Monitoring
 - Industrial Area Flow Monitoring
 - Background Flow Monitoring
 - D&D Monitoring
 - Non-IMP
- Water Level Contours**
Second Quarter 2000
- 20-Foot Water Level Contour
 - - - Dashed where inferred
 - 5-Foot Intermediate Contour
 - - - Dashed where inferred
 - Foundation Drain
- Standard Map Features**
- Buildings and other structures
 - ⊠ Demolished buildings
 - Lakes and ponds
 - Streams, ditches, or other drainage features
 - Fences and other barriers
 - Topographic Contour (5-Foot)
 - Paved roads
 - Dirt roads

DATA SOURCE BASE FEATURES:
 Buildings, fences, hydrography, roads, and other structures from 1994 aerial fly-over data captured by EG&G RSI, Las Vegas. Digitized from the orthophotographs, 1:95. Topographic contours were derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc TIN and LATICE to process the DEM data to create 5-foot contours. The DEM data was captured by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at 10 meter resolution. DEM post-processing performed by MK, Winter 1997.

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Scale = 1:840
 1 inch represents approximately 53 feet

State Plane Coordinate Projection
 Colorado Central Zone
 Datum: NAD27

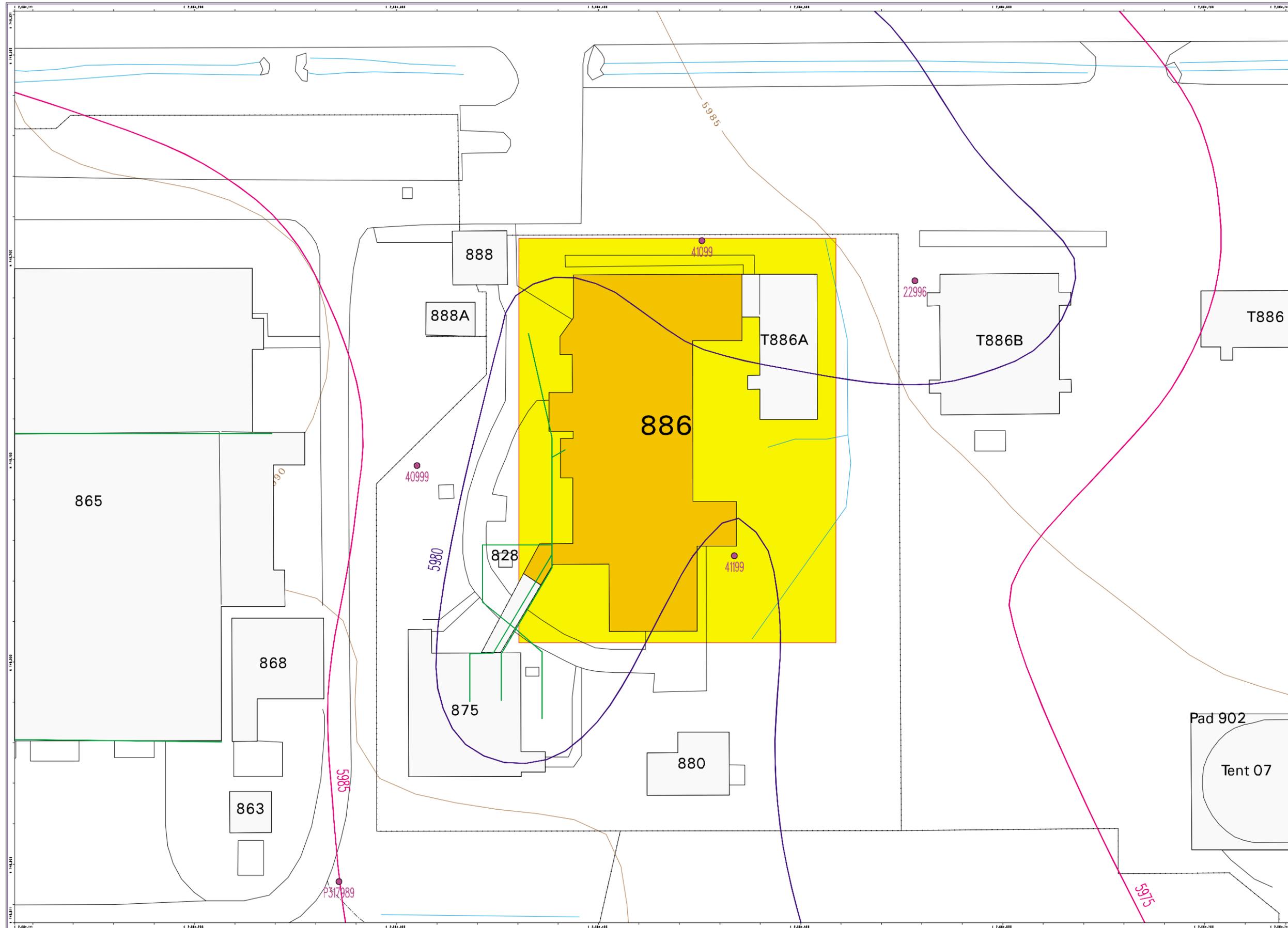
U.S. Department of Energy
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Prepared by: **DynCorp**
 THE ART OF TECHNOLOGY

Prepared for: **Kaiser Hill**
 CONSULTING

MAP 01-0884
 September 26, 2001

**Figure 5-4
Building 886 Location Map
with D&D Monitoring Wells**
**2000 Annual RFCA
Groundwater Monitoring Report**



EXPLANATION

- IMP Well Type**
- Water Quality Flow Monitoring
 - Industrial Area Flow Monitoring
 - Background Flow Monitoring
 - D&D Monitoring
 - Non-IMP

**Water Level Contours
Second Quarter 2000**

- 20-Foot Water Level Contour
- - - Dashed where inferred
- 5-Foot Intermediate Contour
- - - Dashed where inferred
- Foundation Drain

**Pertinent B886 IHSSs
D&D Building**

- Standard Map Features**
- Buildings and other structures
 - ▣ Demolished buildings
 - Streams, ditches, or other drainage features
 - Fences and other barriers
 - Topographic Contour (5-Foot)
 - Paved roads
 - Dirt roads

DATA SOURCE BASE FEATURES:
Buildings, fences, hydrography, roads, and other structures from 1994 aerial fly-over data captured by EGIS/RSI, Las Vegas.
Digitized from the orthophotographs, 1995.
Topographic contours were derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc 7M and LANTICE to process the DEM data to create 5-foot contours. The DEM data was captured by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at 10 meter resolution. DEM post-processing performed by MK, Winter 1997.

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Scale = 1:1500
1 inch represents approximately 47 feet



State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

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Figure 5-5
Building 779 Location Map
with D&D Monitoring Wells
2000 Annual RFCA
Groundwater Monitoring Report



- EXPLANATION**
- IMP Well Type**
- Water Quality Flow Monitoring
 - Industrial Area Flow Monitoring
 - Background Flow Monitoring
 - D&D Monitoring
 - Non-IMP
- Water Level Contours**
Second Quarter 2000
- 20-Foot Water Level Contour
 - - - Dashed where inferred
 - 5-Foot Intermediate Contour
 - - - Dashed where inferred
 - Foundation Drain
- Standard Map Features**
- Basements
 - Buildings and other structures
 - Demolished buildings
 - Solar Evaporation Ponds (SEPs)
 - Streams, ditches, or other drainage features
 - Fences and other barriers
 - Topographic Contour (5-Foot)
 - Paved roads
 - Dirt roads

Approximate current extent of Unsaturated Alluvium
 Pertinent B779 IHSSs

- DATA SOURCE BASE FEATURES:**
 Buildings, fences, hydrographs, roads and other structures from 1994 aerial fly-over data captured by EG&G PSI, Las Vegas. Digitized from the orthophotographs, 1/95. Topographic contours were derived from digital elevation model (DEM) data by Atkinson Fluidbed (AFK) using ESRI Arc 700 and LATTICE to process the DEM data to create 5-foot contours. The DEM data is as captured by the Remick Sensing, Las Las Vegas, NV, 1994 Aerial Flyover at 10 meter resolution. DEM post-processing performed by MKG, Winter 1997.

NOTES:
 Building 779 sub-basement vaults located directly below basement.

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Scale = 1 : 500
 1 inch represents approximately 47 feet

State Plane Coordinate Projection
 Colorado Central Zone
 Datum: NAD83

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Figure 5-6
Building 707 Location Map
with D&D Monitoring Wells
2000 Annual RFCA
Groundwater Monitoring Report



- EXPLANATION**
- IMP Well Type**
- Water Quality Flow Monitoring
 - Industrial Area Flow Monitoring
 - Background Flow Monitoring
 - D&D Monitoring
 - Non-IMP
 - ★ Surface Water Location

- Water Level Contours**
Second Quarter 2000
- 20-Foot Water Level Contour
 - - - Dashed where inferred
 - 5-Foot Intermediate Contour
 - - - Dashed where inferred
 - Foundation Drain
- Approximate current extent of Unsaturated Alluvium
- Pertinent B707 IHSSs
- D&D Building

- Standard Map Features**
- ▭ Buildings and other structures
 - ▨ Demolished buildings
 - Streams, ditches, or other drainage features
 - Fences and other barriers
 - Topographic Contour (5-Foot)
 - Paved roads
 - Dirt roads

DATA SOURCE BASE FEATURES:
 Buildings, fences, hydrography, roads and other structures from 1984 aerial fly-over data captured by EGIS RSL, Las Vegas. Digitized from the orthophotographs. 1/95
 Topographic contours were derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc TIN and LATTICE to process the DEM data to create 5-foot contours. The DEM data was captured by the Remote Sensing Lab, Las Vegas, NV, 1984 Aerial Flyover at 10 meter resolution. DEM post-processing performed by MKC, Winter 1997.

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Scale = 1:750
 1 inch represents approximately 631 feet

State Plane Coordinate Projection
 Colorado Central Zone
 Datum: NAD83

U.S. Department of Energy
 Rocky Flats Environmental Technology Site

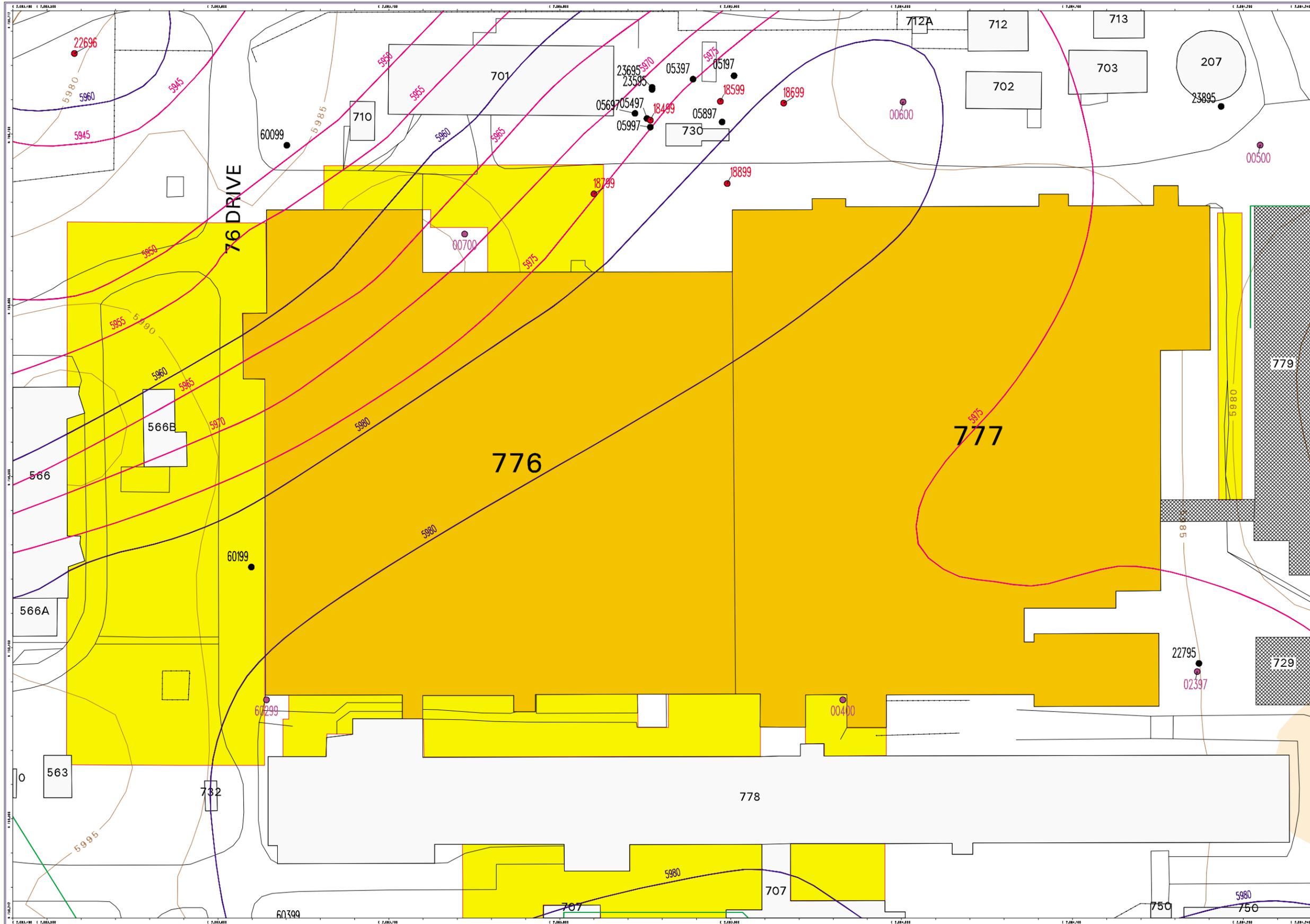
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MAP ID: 01-0884
 September 26, 2001

Figure 5-7
Building 776/777 Location Map
with D&D Monitoring Wells
2000 Annual RFCA
Groundwater Monitoring Report



- EXPLANATION**
- IMP Well Type**
- Water Quality Flow Monitoring
 - Industrial Area Flow Monitoring
 - Background Flow Monitoring
 - D&D Monitoring
 - Non-IMP

- Water Level Contours**
Second Quarter 2000
- 20-Foot Water Level Contour
 - - - Dashed where inferred
 - 5-Foot Intermediate Contour
 - - - Dashed where inferred
 - Foundation Drain

- Approximate current extent of Unsaturated Alluvium
- Pertinent B776/777 IHSSs
- D&D Building

- Standard Map Features**
- Buildings and other structures
 - Demolished buildings
 - Streams, ditches, or other drainage features
 - Fences and other barriers
 - Topographic Contour (5-Foot)
 - Paved roads
 - Dirt roads

DATA SOURCE BASE FEATURES:
 Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EGIS/RSI, Las Vegas. Digitized from the orthophotographic, 1/95. Topographic contours were derived from digital elevation model (DEM) data by Morrison Knudsen (MK) using ESRI Arc TIN and LANTICE to process the DEM data to create 5-foot contours. The DEM data was captured by the Remote Sensing Lab, Las Vegas, NV, 1994 Aerial Flyover at ~10 meter resolution. DEM post processing performed by MK, Winter 1997.

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Scale = 1:680
 1 inch represents approximately 67 feet

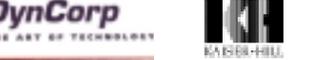


State Plane Coordinate Projection
 California Central Zone
 Datum: NAD27

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MAP ID: 01-0886 September 25, 2011

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