



# Section 3 - Pump Station Inspection and Evaluations

## 3.1 Introduction

The scope of this project included testing of 25 key pump stations and inspection of all 46 pump stations in the Town of Cary service area. Table 3-1 lists all pump stations, including those chosen by the Town for inspection and drawdown testing as part of this project, as well as those tested in the previous master plan project. The scope of general inspection included:

- Structural, mechanical, electrical, and HVAC evaluation of the building
- Dry-well, associated piping, equipment and the surrounding property
- An operational evaluation of the pumps
- Collection of pump station operating sequence data
- Odor and noise levels
- Current pump station flows

The detailed results for inspection and testing can be found in Appendix A. Air samples for odor were obtained for a one-month period in June and July of 2010, when odor levels were typically higher. A hydrogen sulfide analyzer was used to determine the odor levels. Noise readings with the pumps on and with the pumps off were collected at each pump station generally in the same trip.

## 3.2 Pump Station Flow Tests

To evaluate the operation of the pumps in the existing pump stations, pump drawdown tests were conducted. A pump drawdown test is designed to determine the capacity of the pump under the pump's typical operating conditions. The influent flow rate was estimated between drawdown tests by noting the rise in the water surface elevation in the wet well over a measured time period. The average flow rate can then be determined from the level in wet well, the area of the wet well, and the elapsed time. The pump drawdown test is then conducted with the assumption that the average influent flow rate stays constant. For a short span of testing, this assumption is valid. Figure 3-1 shows a generic illustration of the layout of a typical pump station wet well for a drawdown test.

**Table 3-1: Results of Pump Drawdown Test**

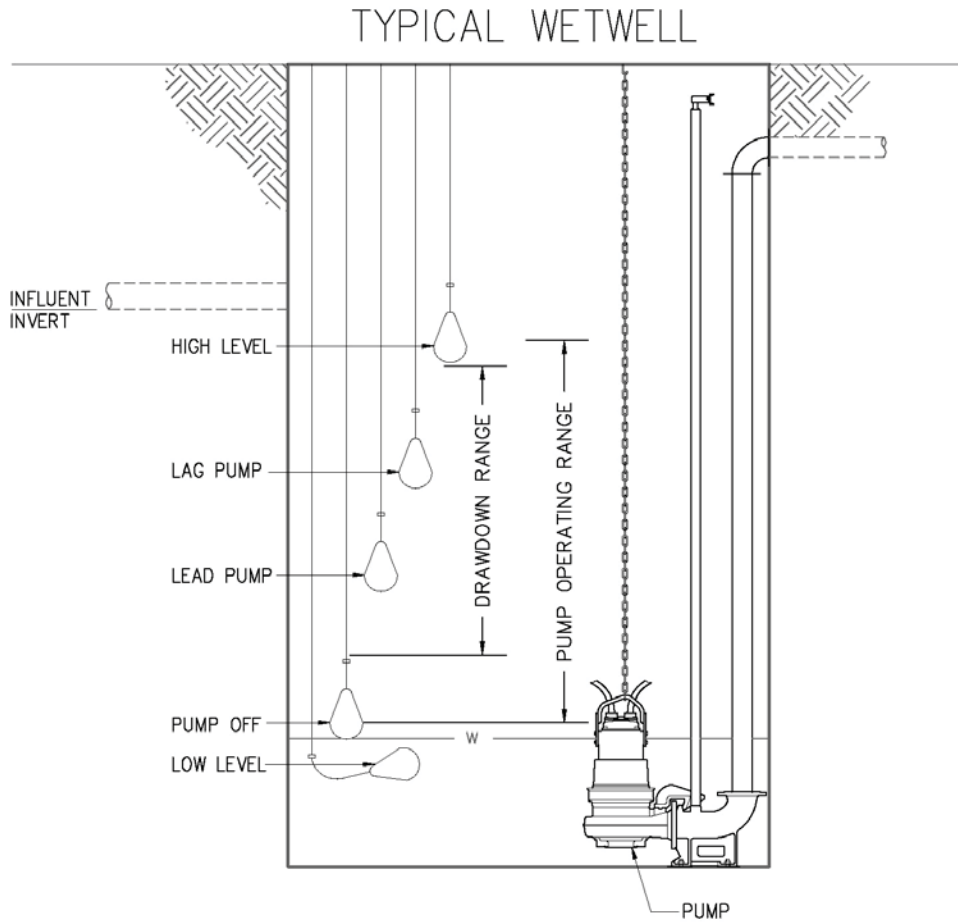
ID	Pump Station	Number of Pumps	Average Pumping Rate (gpm)				Date Tested
			1	2	3	Firm Capacity (MGD)	
001	Swift Creek	5	6,231	6,227	5,459	14.706	2010
002	Walnut Creek (to Lynn's Branch Interceptor)	3	1,788	2,437	2,065	3.847	2010
003	Kit Creek (to Triangle WWTP)	3	3,905	4,136	4,110	7.568	2010
004	White Oak (to Turkey Creek Interceptor)	2				1.634	2001
005	Nelson Road	2				1.463	2001
006	Crossroads	2	180	158		0.228	2010
007	Glenmitt Stone	2				0.036	2001
008	Fieldstone (to Turkey Creek Interceptor)	2				0.794	2001
009	SAS I-40	2	555	671		0.798	2010
010	Glenridge	2	324	378		0.467	2010
011	Jones Franklin	2	791	732		1.054	2010
012	Medfield	2	776	762		1.097	2010
013	Blanche Drive	2	215	186		0.268	2010
014	Talloway Drive	2				0.204	2001
015	Gateway Center	2	482	482		0.693	2010

**Table 3-1: Results of Pump Drawdown Test (Continued)**

ID	Pump Station	Number of Pumps	Average Pumping Rate (gpm)				Date Tested
			1	2	3	Firm Capacity (MGD)	
016	RDU Center	2	321	336		0.463	2010
017	MacGregor Park	2				0.273	2001
018	Ronaldsby Drive	2				0.150	2001
019	Morris Branch (to Kit Creek Pump Station)	2	2,886		2,897	4.156	2010
020	Carystone	2				0.247	2001
021	Thresher Court	2				0.204	2001
023	Town Hall Dr.	2				0.199	
024	Holly Brook	2				0.209	2001
025	Rocky Branch	2	224	202		0.292	2010
026	Westwood Park	2				0.073	2001
027	Kensington	2				0.231	2001
028	Cary Glen	2				0.834	
029	Thomas Brooks	2				0.229	
030	Grey Hawk	2	185	182		0.262	2010
031	Terrington	2				0.334	
032	Park at West Lake	2				0.180	

**Table 3-1: Results of Pump Drawdown Test (Continued)**

ID	Pump Station	Number of Pumps	Average Pumping Rate (gpm)				Date Tested
			1	2	3	Firm Capacity (MGD)	
033	Forest Oaks	2	558	546		0.787	2010
034	Copperleaf	2	286	281		0.405	2010
035	West Cary	3	1,126	1,154	1,124	2.293	2010
038	Lower Breckenridge	2	802	797		1.147	2010
039	Terrace II	2				0.135	
040	West Breckenridge	2	267	291		0.385	2010
041	Woodlands	2	377	370		0.532	2010
042	Aviation Parkway	2	3,125	3,137		4.500	2010
043	Circandian Court	2	114	101		0.146	2010
044	Paramount	2	537	496		0.714	2010
046	Perimeter Park	2				3.123	
047	Lake Crabtree	2	137	139		0.198	2010
048	Kitts Creek	2	1,090	1,118		1.570	2010
049	Palaver (Copperleaf II)	2				0.226	
050	Somer (Aventon)	2				0.442	



**Figure 3-1: Typical Wet Well Section**



To conduct the drawdown tests, all pumps were shut off and the wet well was allowed to fill to a set level, normally within the typical operating range of the wet well (above the float setting to shut off all pumps and below the float setting to send an overflow alarm). Then, one pump was started and the liquid level in the wet well was pumped down to another set level, also within the typical operating range of the wet well. The time to lower the wet well from the higher to the lower level was recorded and, similar to determining the influent flow rate, the drawdown rate was calculated from the area of the wet well, the difference in the water surface levels, and the elapsed time of the drawdown. If the wet well influent can be isolated (no incoming flow being received), the drawdown rate is also the pumping rate of the pump. If the wet well influent is not isolated, as in the case of the current drawdown tests, the influent flow rate must be added to the calculated drawdown rate to determine the actual pumping rate. Calibrated flow meters are installed at certain pump stations owned by the Town, providing a direct measurement of flow rate. For these pump stations, the flow meter data was used in addition to, or in place of the drawdown procedure described above. Two to three drawdown tests were conducted on each pump in the existing pump stations. An average of the readings was used to estimate the pumping rate.

The pumping capacity of a pump is the flow rate the pump can deliver against a given pressure. As the pressure that the pump delivers against increases, the flow rate that the pump delivers decreases. As a pump wears, both the pressure and the flow rate that the pump can deliver decrease. Therefore, to determine the pumping capacity of the pumps completely, both the pressure that the pump is operating against and the flow rate that the pump delivers must be known. Generally, the pump pressure is measured with a pressure gauge mounted on the discharge header of the pump. However, for many of the pump stations in the Town of Cary collection system, pressure readings were unavailable. Therefore, the pump discharge pressures were not determined. The pump station firm capacity is defined as the maximum capacity with the largest pump out of service. Pump drawdown test results are summarized in Table 3-1. A map showing the pump stations that were tested as part of this study plus those tested in 2001 is presented in Figure 3-2.

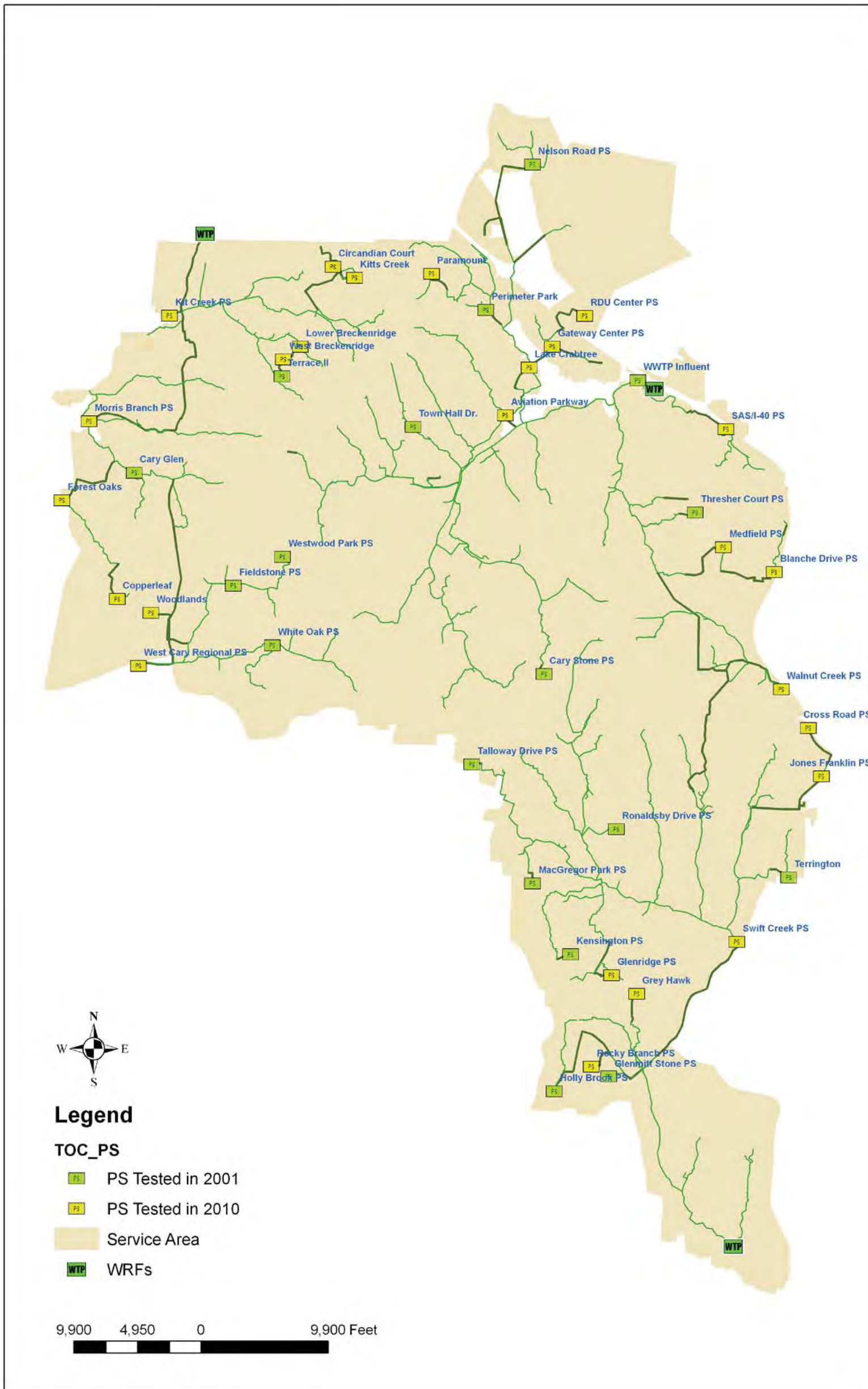


Figure 3-2: Comparison of Pump Stations Tested in 2001 vs. in 2010



### 3.2.1 Odor Samples

Collection system odors are primarily caused by sulfide ion formation from the metabolic activity of sulfate-reducing bacteria. Sulfate-reducers become prevalent once other types of bacteria have metabolized the available dissolved oxygen and nitrate in the wastewater flow. Most sulfate reduction occurs within the anaerobic portion of the slime layer along the pipe wall, which occurs more commonly in relatively small sewer lines with a high ratio of slime layer volume to wastewater volume. Sulfides are generated within the slime layer, and then diffuse into the bulk wastewater flow. Turbulent flow conditions cause sulfides to be stripped from the wastewater into the surrounding atmosphere in the form of hydrogen sulfide ( $H_2S$ ), the primary odor-causing compound. Typical locations where  $H_2S$  is released include air release valves, force main discharge points (e.g., manholes), pump station wet wells, and gravity sewer line manholes. Conditions that lead to increased sulfide production include high temperature, high biochemical oxygen demand (BOD), long detention time within the collection system, and low pH. Hydrogen sulfide is a major component of odor from wastewater and is often used as an odor indicator.

About 50% of humans can detect the characteristic odor of hydrogen sulfide at 0.00047 parts per million or higher under normal conditions. OSHA defines the Permissible Exposure Limit (PEL) of a substance as the maximum concentration that workers can be continually exposed to for an entire 8-hour work day. Currently, OSHA has set the PEL at 20 ppm for hydrogen sulfide.

Air samples for odor were obtained during warm weather, when odor levels are typically higher. A Jerome 631X Hydrogen Sulfide Analyzer was used to determine the odor levels. The Jerome 631X has the lowest range (highest sensitivity) for a handheld device. The Jerome 631X uses a gold film sensor to determine the hydrogen sulfide concentration. As the sensor adsorbs hydrogen sulfide, the sensor resistance changes, and this resistance change relates directly to the amount of hydrogen sulfide adsorbed. With a constant flow rate to the sensor, the analyzer converts the amount of hydrogen sulfide adsorbed to a concentration value. The selectivity of the instrument to hydrogen sulfide eliminates interferences from other compounds commonly occurring in the same sample, such as sulfur dioxide, carbon dioxide, carbon monoxide, and water vapor.

The Town currently has the ability to use liquid-phase treatment methods (chemical addition) at most of its pump stations that have odor control processes. A few pump stations are equipped with carbon adsorption canisters, and the Walnut Creek and Morris Branch Pump Stations have biofilters. The Town uses two liquid chemical products for odor control: Bioxide (a non-hazardous nitrate salt manufactured by US Filter) and ferrous sulfate ( $FeSO_4$ ).

Odor samples were taken at each pump station at the hatch leading to the wet well with the hatch open and at the fence corners. Odor sample results are shown in Table 3-2.

### 3.2.2 Noise Readings

Sound is a travelling wave that is an oscillation of pressure. The amplitude of this wave is proportional to the intensity of the sound. The decibel (dB) is a logarithmic unit for the ratio of sound intensity relative to a specified or implied reference level. That means that 80 dB is twice as loud as 70 dB. Table 3-3 shows some common sound levels.





Noise is any displeasing sound. Noise pollution is a major cause of annoyance. In 2005 a study in Spain by Jesús Barreiro, Mercedes Sánchez, Montserrat Viladrich-Grau found that in urban areas households are willing to pay approximately four Euros per decibel per year for noise reduction.

Noise readings with the pumps and generators on and off were collected at each pump station, where applicable, using a digital sound level meter. Noise readings were taken near the pumps with them on and off. Also, noise levels were taken at the fence line with the generator, if available, turned on and off. The reading taken at the fence line just off-site serves as a conservative approximation to the noise impact on the general populace near the pump station site. Relative sound levels are presented in Table 3-4.

**Table 3-2: Results of Odor Tests**

ID	Pump Station	Average Odor Reading at the Fence (ppm)	Odor Reading at Top of the Wet Well (ppm)
1	Swift Creek	0.002	0.007
2	Walnut Creek	0.009	0.210
3	Kit Creek	0.006	14.250
6	Crossroads	0.002	6.200
9	SAS I-40	0.003	0.290
10	Glenridge	0.002	0.490
11	Jones Franklin	0.003	0.333
12	Medfield	0.002	0.200
13	Blanche Drive	0.002	0.370
15	Gateway Center	0.000	0.400
16	RDU Center	0.001	0.280
19	Morris Branch	0.000	0.218
25	Rocky Branch	0.002	0.260

**Table 3-2: Results of Odor Tests (Continued)**

ID	Pump Station	Average Odor Reading at the Fence (ppm)	Odor Reading at Top of the Wet Well (ppm)
30	Grey Hawk	0.002	0.800
33	Forest Oaks	0.000	0.230
34	Copperleaf	0.006	0.360
35	West Cary	0.000	4.567
40	West Breckenridge*	0.000	0.000
41	Woodlands	0.002	0.140
42	Aviation Parkway	0.005	2.600
43	Circandian Court	0.000	0.074
44	Paramount	0.000	0.180
47	Lake Crabtree	0.000	0.007
48	Kitts Creek	0.000	0.260

\* West Breckenridge has been taken offline.



**Table 3-3: Typical Noise Levels**

Intensity Compared to 70 dB	Decibels (dB)	Practical Comparison
16	110	Live Rock Concert
8	100	Jet Take-Off at 300ft
4	90	Orbital Sander
2	80	Busy Residential Road
1	70	Busy Restaurant
0.5	60	Office
0.25	50	Quiet Suburb
0.125	40	Library
0.0625	30	Quiet Rural Area
0.03125	20	Rustling Leaves
0.015625	10	Breathing

**Table 3-4: Results of Noise Tests**

ID	Pump Station	Generator Available (Y/N)	Sound Level at the Fence with Generator Off (dB)	Sound Level at the Fence with Generator On (dB)	Sound Level with Pump Off (dB)	Sound Level with Pump On (dB)
1	Swift Creek	Y	64	74	N/A	N/A
2	Walnut Creek	Y	69	81	77	76
3	Kit Creek	N	61	N/A	84	83
6	Crossroads	Y	70	79	75	74
9	SAS I-40	Y	73	90	76	74
10	Glenridge	Y	64	80	62	67
11	Jones Franklin	Y	73	85	75	71
12	Medfield	N	61	N/A	65	63
13	Blanche Drive	Y	68	93	74	66
15	Gateway Center	N	71	N/A	67	69
16	RDU Center	N	66	N/A	72	68
19	Morris Branch	Y	58	72	75	72
25	Rocky Branch	Y	57	97	57	60
30	Grey Hawk	Y	63	83	74	70
33	Forest Oaks	Y	58	83	58	67

**Table 3-4: Results of Noise Tests (Continued)**

ID	Pump Station	Generator Available (Y/N)	Sound Level at the Fence with Generator Off (dB)	Sound Level at the Fence with Generator On (dB)	Sound Level with Pump Off (dB)	Sound Level with Pump On (dB)
34	Copperleaf	Y	60	79	75	60
35	West Cary	Y	54	58	71	65
38	Lower Breckenridge	Y	58	91	89	77
40	West Breckenridge *	Y	N/A	N/A	N/A	N/A
41	Woodlands	Y	58	81	63	59
42	Aviation Parkway	Y	62	N/A	71	70
43	Circandian Court	Y	61	77	65	64
44	Paramount	N	59	N/A	74	64
47	Lake Crabtree	N	74	N/A	85	76
48	Kitts Creek	Y	64	85	67	61

\* West Breckenridge has been taken offline.

### 3.3 Odor Control Technology Overview

The odor control technologies considered for the pump stations and force mains are chemical scrubbing, bio-filtration, carbon scrubbing, and chemical addition.



### 3.3.1 Chemical Scrubbers

Chemical scrubbers, also known as packed bed scrubbers, are widely used and have a long performance history. They can be implemented individually or in combination. Packed bed scrubbers utilize chemical reactions to remove odorous compounds. For sulfur-related compounds, alkaline scrubbing can be employed. For alkaline scrubbing, the traditional chemicals are sodium hydroxide and sodium hypochlorite, although oxidants such as ozone and hydrogen peroxide can also be used.

Packed bed scrubbers rely on recirculation of a liquid consisting of chemicals and make-up water to provide the retention time required for adequate gas-liquid transfer. The foul air flows upward through media while recirculated chemical solution flows downward. The media is typically small plastic spheres designed to provide optimal surface area for gas-liquid mass transfer. As the recirculated liquid comes in contact with the foul air, the contaminants in the air are transferred to the liquid. Recirculated liquid is continuously wasted and replenished with fresh make-up water to prevent saturation of sulfides in the recirculated liquid.

An advantage of wet scrubbing is that the percent removals achieved can be very high. Hydrogen sulfide removal rates above 99% are not uncommon. Another advantage of wet scrubbing is the controlled process which directly responds to changes in hydrogen sulfide concentrations. Chemical addition is based on incoming airflow conditions. The disadvantages of chemical scrubbers are the cost of the chemicals required and the added maintenance of having chemicals onsite.

The number of stages in a chemical scrubber is dependent upon expected removal efficiency and hydrogen sulfide concentration. Chemical scrubbers can be installed in stages depending on the percent removal required. For a one-stage or single stage scrubber, sodium hydroxide (caustic) and sodium hypochlorite are added in the same stage. The high pH created in the recirculation liquid converts hydrogen sulfide gas to sodium sulfide and water. If the pH of the recirculated liquid drops below 10, the reaction can be reversed, and hydrogen sulfide will be regenerated. In order to keep the sulfide ion from reforming hydrogen sulfide, sodium hypochlorite is added. Sodium hypochlorite reacts with the sulfide ion to convert it to sulfite, which remains dissolved in water.

A schematic of a typical one-stage packed bed chemical scrubber is shown in Figure 3-3.

As shown in Figure 3-6 a multi-stage scrubber, foul air passes through a series of packed bed stages. The foul air enters the first stage in which the scrubbing liquid typically consists of make-up water and caustic. The caustic removes approximately 80 to 90 percent of the hydrogen sulfide in the foul air by converting it to sodium sulfide. Subsequent stages consist of co-current or counter-current air flow passing the packed media. In the intermediate stages, the scrubbing solution usually consists of caustic, sodium hypochlorite and make-up water. The scrubbing liquid in the last stage consists of water and sodium hypochlorite, which removes the remainder of the hydrogen sulfide as well as the organics in the foul air. The stage with primarily sodium hypochlorite is typically used as a polishing step which furthers hydrogen sulfide removal and prevents the sulfide from coming out of solution. Due to the increased removal efficiency, the package packed tower wet scrubber systems included in the cost analysis in this memorandum are multi-stage scrubbers.

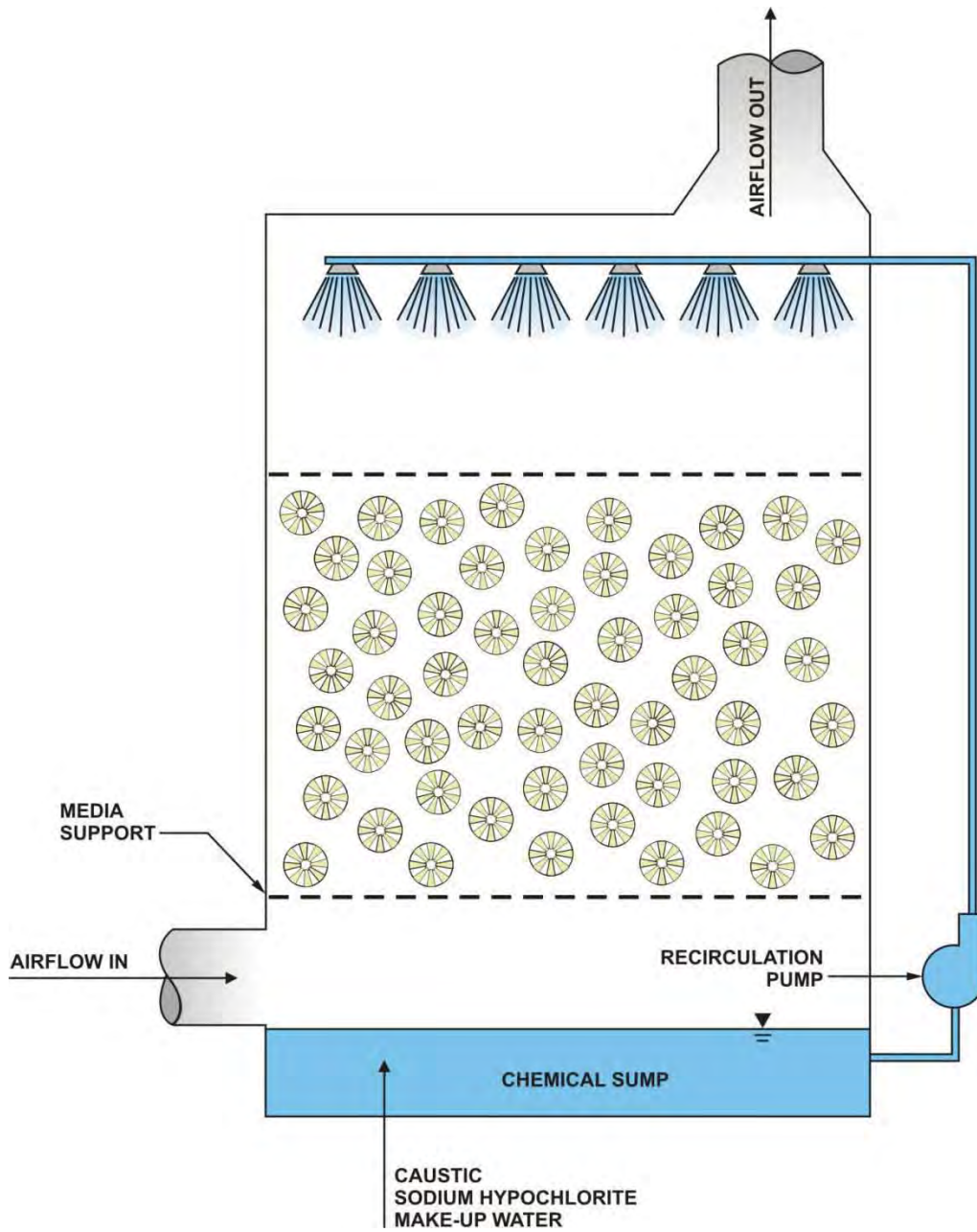
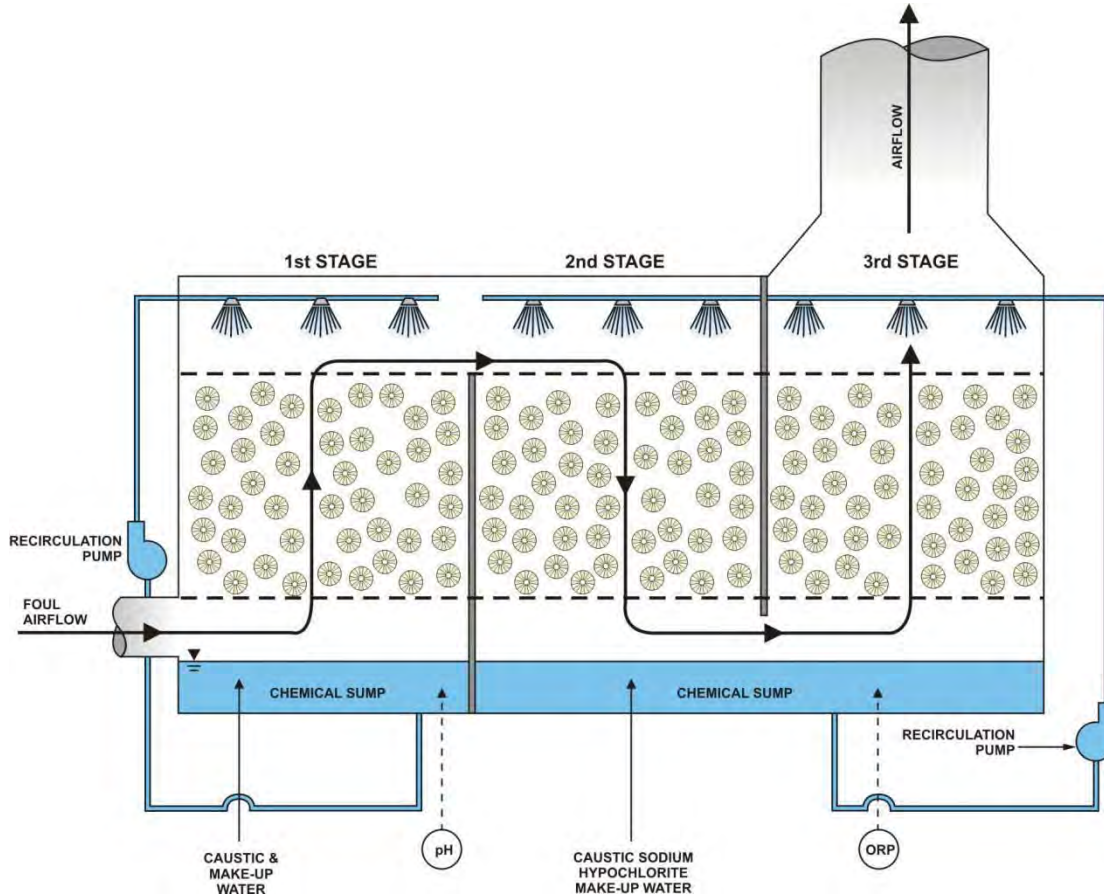


Figure 3-3: One-Stage Packed Bed Chemical Scrubber



A schematic of a typical multi-stage scrubber is shown in Figure 3-4.



**Figure 3-4: Multi-stage Packed Bed Chemical Scrubber**

For both single and multi-stage scrubbers, a portion of the scrubbing liquid is automatically wasted and make-up water is continuously added. Caustic feed is automatically controlled to maintain a setpoint pH in the scrubbing liquid, and sodium hypochlorite feed is automatically controlled to maintain a setpoint oxidation reduction potential (ORP) in the scrubbing liquid.

### 3.3.2 Biofilters

Biofilters use a biological process to remove odorous compounds from the foul air. Two types of biofilters can be used: (1) bed and (2) tower. The maximum capacity of tower biofilters is typically limited, whereas the bed type can be constructed as large as necessary, assuming that space is available.





Biofilters have the advantage of requiring little maintenance and having little chemical cost. Some types of manufactured biofilters do have chemical addition to aid biological growth during periods of lower hydrogen sulfide concentration. Typically, this is just a nutrient-rich solution to promote biological growth. Because odor reduction is accomplished through a biological process, conditions that promote the growth of odor-removing bacteria must be maintained. The bed material must be continually wetted and some source of trace nutrients must be available in order to achieve acceptable removal efficiencies.

The biofilter bed can be constructed of several different materials. Compost-type material (organic media) is typically used, but inorganic and synthetic medias are also available. Inorganic media resembles lava rocks, and has the necessary trace nutrients embedded in the media. The inorganic media has several significant advantages. The minimum detention time required for synthetic media is 20 to 40 seconds, depending on loading, whereas organic media requires a one-minute or greater residence time. The depth of inorganic media beds can be up to 5 feet deep, while organic beds are limited to 3 feet. Therefore, use of inorganic biofilter media results in significantly smaller bio-filters, an important consideration when installing new odor control units at space-limited sites. Other advantages of inorganic media are much longer life (10 years compared to 3 years), a long media warranty (10 years) and the ability to regenerate the media rather than replace it. For this study, the use of inorganic media has been assumed due to the space constraints.

Tower or modular biofilters are typically enclosed biofilters having a more compact design than bed-type biofilters. Tower or modular biofilters usually consist of a skid-mounted fiberglass enclosure that contains the biofilter media and a recirculation pump for make-up water and nutrient additive. The make-up water is sprayed over the media to create an environment in which sulfide-reducing bacteria thrive. Nutrient is also added to the make-up water periodically to maintain the bacteria during lower hydrogen sulfide intervals. A schematic of a typical tower-type biofilter is shown in Figure 3-5.

One disadvantage of bed-type biofilters is the space that is required. A typical design will require 1 ft<sup>2</sup> for every 1 – 3 cubic feet per minute (cfm) of treated air. The area can become quite large when a high volume of air requires treatment. Another disadvantage is that due to the bed type construction, the biofilter becomes an area odor source. Little dispersion exists over the surface of the bed; therefore the required percent removals from a biofilter need to be greater than required by wet scrubbing. Finally, due to the fact that it is not a controlled process, the removal performance can be inconsistent. In some cases, the removals have been reported to be high, whereas in other cases, the removals have been poor. For the analysis in this memorandum, it was assumed that tower or modular biofilters are used to reduce space requirements.

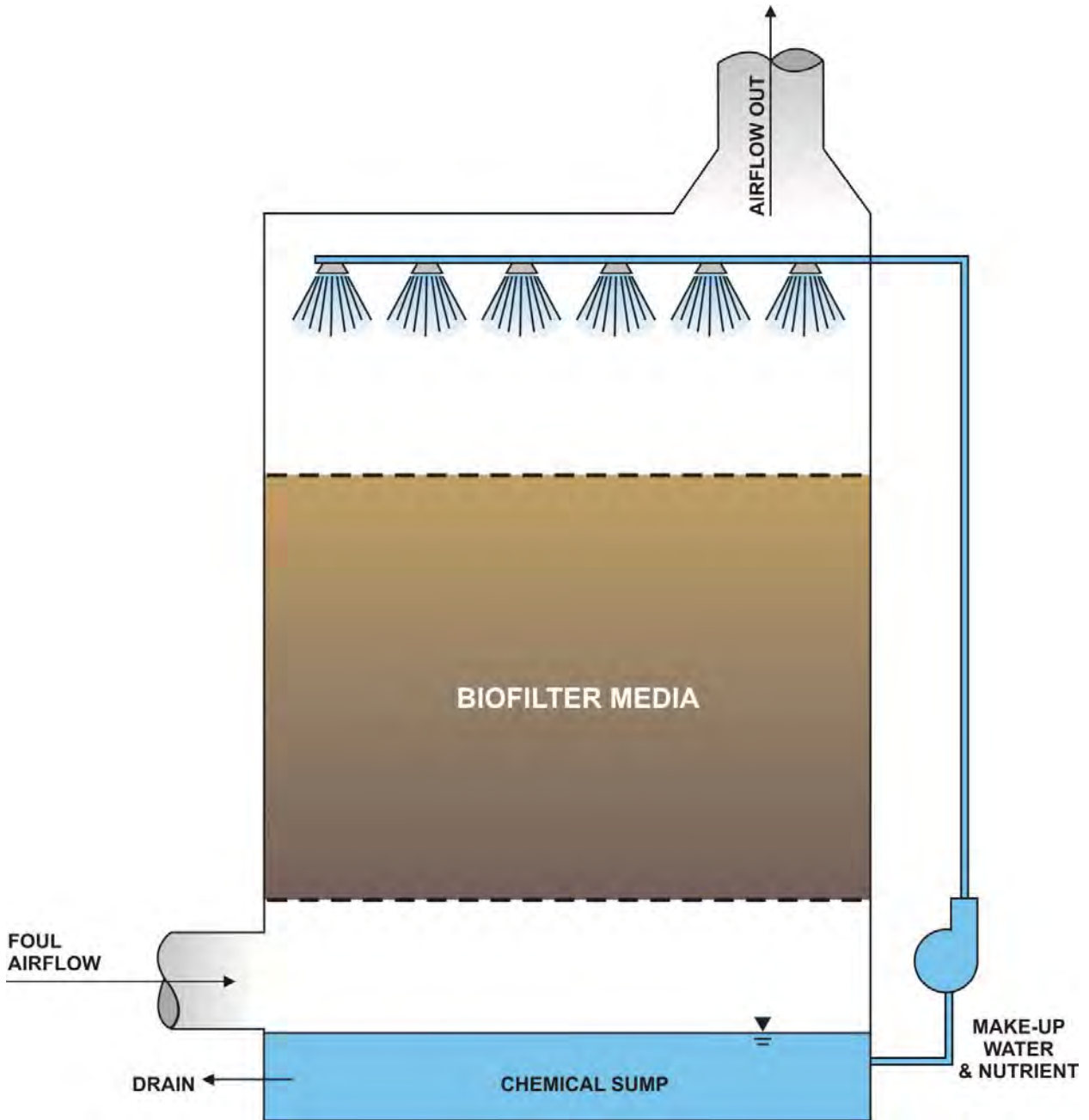


Figure 3-5: Tower Type Biofilter

### 3.3.3 Carbon Adsorption

Carbon can be effective for odor control. The removal efficiencies for most odor-causing compounds found in wastewater treatment facilities are very high. However, carbon can have disadvantages as well. If the concentration of odor is high, the carbon will tend to be consumed quickly, thereby requiring regeneration or replacement. This can cause disposal problems and higher operating costs. Figure 3-6 below shows a typical carbon scrubber used at a pump station application.



Carbon adsorption scrubbers are common on transmission lines or force mains. Activated carbon canisters can be installed on the discharge side of air release valves along the force main to control odors during valve operation. The canisters are compact, require little maintenance, and depending on the hydrogen sulfide loading, provide a safe and economical solution to transmission line odors. Figure 3-7 shows a typical example of a passive air canister-type odor scrubber for a force main application.



**Figure 3-6: Carbon Odor Scrubber**

### 3.3.4 Chemical Addition

An option for minimizing odors along the force main route is the addition of chemicals at the pump station. Chemicals that have been utilized to limit sulfide formation include chlorine, oxygen, potassium permanganate, and metal salts such as ferrous sulfate or ferric chloride. Oxygen and chlorine both are added to wastewater as non-selective oxidants, meaning they will not exclusively react with hydrogen sulfide-producing compounds. Potassium permanganate also acts as a non-selective oxidant; however, it is not typically fed in wastewater force mains. Metal salts can be added to the wastewater to control odors by reacting with dissolved sulfide to produce insoluble metal sulfide, which precipitates out of the wastewater. A proprietary chemical such as Bioxide® is a solution of nitrous salt that essentially binds with the sulfur in the wastewater, preventing the formation of hydrogen sulfide. Bioxide® has also been shown to also reduce the mercaptan concentration, another potential odor source in wastewater.



**Figure 3-7: Passive Canister Carbon Scrubber**



The list of odor control measure at each pump station is also shown in Table 3-5. The Town will continue its efforts in eliminating odors at these sewer pump stations.

**Table 3-5: Odor Control Measure at each Pump Station**

Pump Station			Odor Control Measure
001	Swift Creek	7802 Holly Spring Rd	Odor Scrubber/Ferrous Sulfide
002	Walnut Creek	1100 Buck Jones Road	Ferrous Sulfate/Biofilter
003	Kit Creek	2605 Alston Avenue	Bioxide
004	White Oak	2505 NC 55 Hwy	Ferrous Sulfate
005	Nelson Road	4908 Nelson Road	None
006	Crossroads	401 Crossroads Blvd.	Bioxide
007	Glenmitt Stone	4139 Mitt Glen Lane	None
008	Fieldstone	8000 Branton Drive	None
009	SAS I-40	351 SAS Campus Drive	None
010	Glenridge	306 Copper Hill Drive	Bioxide / Charcoal
011	Jones Franklin	2104 Jones Franklin Road	Carbon Canister
012	Medfield	1401 1/2 Baker Road	None
013	Blanche Drive	6106 Blanche Drive	Bioxide
014	Talloway Drive	2005 1/2 Talloway Drive	None
015	Gateway Center	1317 Aviation Parkway	None
016	RDU Center	3101 RDU Drive	None

**Table 3-5: Odor Control Measure at each Pump Station (Continued)**

Pump Station			Odor Control Measure
017	MacGregor Park	403 Gregson Drive.	None
018	Ronaldsby Drive	223 Ronaldsby Drive	None
019	Morris Branch	251 Beckingham Lp.	Ferrous Sulfate/Biofilter
020	Carystone	224 Kristin Court	None
021	Thresher Court	107 Thresher Court	None
023	Town Hall Dr.	635 Town Hall Drive	Bioxide
024	Holly Brook	4908 Holly Brook Drive	Carbon Canister
025	Rocky Branch	205 Drakewood Place	Bioxide
026	Westwood Park	1090 Glendon Way	None
027	Kensington	10899 Penny Road	None
028	Cary Glen	319 Belles Landing Court	Ferrous Sulfate
029	Thomas Brooks	128 Brooks Park Lane	None
030	Grey Hawk	611 Hawks Ridge Court	Bioxide
031	Terrington	5956 Terrington Ln	Bioxide
032	Park at West Lake	4900 West Lake Road	Carbon Canister (Removed)
033	Forest Oaks	2586 New Hope Church Road	Bioxide/Carbon Absorber
034	Copperleaf	7055 Copperleaf Place	Bioxide/(Carbon Canister Removed)

**Table 3-5: Odor Control Measure at each Pump Station (Continued)**

Pump Station			Odor Control Measure
035	West Cary	3905 Green Level West Rd.	Ferrous Sulfate
038	Lower Breckenridge	650 Willingham Way	Carbon Canister
039	Terrace II	598 Walnut Woods Drive	None
040	West Breckenridge	820 Parkside Valley Drive	None
041	Woodlands	7748 Mills Rd.	Bioxide / Carbon Canister
042	Aviation Parkway	414 Aviation Parkway	None
043	Circadian Court	1004 Circadian Court	Bioxide/Carbon Canister
044	Paramount	5180 Paramount Parkway	None
046	Perimeter Park	350 Perimeter Park Drive	None
047	Lake Crabtree	1040 Aviation Parkway	None
048	Kitts Creek	1601 Legendary Lane	Bioxide
049	Palaver (Copperleaf II)	6841 Palaver Lane	Carbon Canister
050	Somer (Aventon)	100 Aventon Lane	Bioxide/Carbon Canister



### 3.3.5 Recommendation

The hydrogen sulfide concentration at the Kit Creek and West Cary Regional Pump Station appear to be relatively high compared to that at the other pump stations. However, they are well below the limits set up by OSHA. In addition, they are located in the woods far away from the existing housing in the adjoining areas. It is anticipated that over time, more construction may take place at the land near those two pump stations and the current odor of hydrogen sulfide may present as a nuisance for those new development. We would recommend that the Town of Cary explore more alternatives to mitigate odor issues at those two pump stations.