

**ARLINGTON COUNTY
WATER POLLUTION CONTROL PLANT
MASTER PLAN 2001 UPDATE
INTRODUCTION**

BACKGROUND

HISTORY

The Arlington Water Pollution Control Plant (WPCP) is located in South Arlington on 35 acres of land in a residential/commercial neighborhood. The original plant buildings were constructed in 1937 and were upgraded several times in the 50's, 60's, 70's and 90's. The Plant treats flows from nearly all of Arlington, as well as sections of Alexandria, Fairfax County, and Falls Church City. The remainder of the Arlington flow (1.8 MGD) is processed at the Blue Plains Plant in Washington, DC.

The most recent Plant expansion and upgrade work was defined in the 1988 Facility Plan. This Plan was developed for expanding the Plant flow from 30 million gallons per day (MGD) to 40 MGD. Assumptions underlying the 1988 Plan included the following:

- The WPCP would be able to fully treat wet weather flows of up to 88 MGD.
- No nitrogen removal would be mandated during the Plan implementation.
- Incineration would continue as the method for sludge disposal.

The Plan was approved by the County Board in 1988. Since then, \$118,000,000 has been spent on seven major construction projects. See Table 1 for a summary of the major projects completed, along with final costs. With the exception of the biological nutrient removal (BNR) process, all areas of the Plant can process 40 MGD of flow. Regulation changes in 1998 required Arlington to build BNR in place of the existing secondary treatment. This resulted in down-rating the capacity of the tankage, so that it is now rated at only 30 MGD, which is not currently sufficient for the County's needs. The Plant will operate the BNR system for one year and firmly establish the actual flow capacity before building additional facilities. It is expected that, with testing, the Plant staff can establish the rated flow for BNR at rates slightly above 30 MGD.

Note: DEQ has a guideline that when flows exceed 95% of the current rated flow for three consecutive months, the operating agency must provide a plan to increase capacity. Such a request was sent to Arlington at the end of 2001. The Master Plan 2001 Update provides the plan and schedule to increase/recover capacity.

**TABLE 1
WPCP EXPANSION & UPGRADE PROJECTS
1990'S**

PHASE	PROJECT	COST	YEAR COMPLETED
I	Upgrade Advanced Treatment	\$11,000,000	1992
II	New Preliminary treatment, Primaries, building additions, Improvements to operations building	\$33,000,000	1995
III	New Dewatering Building	\$33,000,000	1998
IV	New Equalization Tank, Conversion of secondary to BNR	\$38,000,000	2002
V	Distributed Control System	\$3,000,000	2002

In the intervening years since the Plan was approved, two other changes occurred. In December of 1995, a decision was made to discontinue incineration for sludge disposal. In March 1998, the County began to land apply biosolids (sludge) on farmland in Virginia. This has had major impacts on costs and relationships with other counties in Virginia. Odor problems have caused some counties to restrict the application on farms. Secondly, the State Department of Environmental Quality (DEQ) has placed an increased emphasis on wet weather bypass events at the Plant and in the sewer system. Over time they are requiring that the County add facilities to virtually eliminate all bypass events at the Plant.

GOALS OF THE MASTER PLAN 2001 UPDATE

Vision for Arlington County

"Arlington will be a diverse and inclusive world-class urban community with secure, attractive residential and commercial neighborhoods where people

unite to form a caring, learning, participating, sustainable community in which each person is important."

-Adopted by the Arlington County Board January 26, 2002

In order to contribute to the achievement of the vision for Arlington County being a world-class, secure, attractive, sustainable community where each person is important, the Master Plan 2001 Update developed an overall global plan to allow the Water Pollution Control Plant to produce better products in an environmentally friendly, cost effective, and customer responsive manner. Specifically, the Master Plan 2001 Update addresses possible upcoming regulations in the areas of nutrient limits, wet weather bypasses, and solids disposal, as well as addressing the aging infrastructure. The Plan is compatible with the strategic direction of the County Board to develop a world-class urban community with secure, attractive, residential and commercial neighborhoods. It is also compatible with the strategic direction of the Division in the areas of competitiveness, automation, and being a good neighbor. The Plan also addresses future capacity issues by planning for an increase in flow to 40 MGD by the year 2020. Finally, the Master Plan is compatible with other Division's plans such as Water Sewer Streets inflow and infiltration plan, and the Sanitary Sewer Master Plan.

There are six major issues that are driving the overall Plan. All items are interrelated.

- Redundancy and Capacity of the BNR process
The current capacity of the process is 30 MGD. Regulation changes in 1998 reduced the capacity of the new BNR process from 40 to 30 MGD. Plant staff hopes to increase that rating with the first full year's operation, which begins mid 2002. However, as new housing is built and the population density increases in Arlington, flows and loading will increase gradually. New liquid treatment facilities are needed to stay ahead of the actual flow increases. Additional facilities are also needed to provide adequate redundancy to ensure compliance with the permit.
- Wet Weather (storm flow) Treatment
Over a recent 5-year period (1994 through 1998, inclusive), the Plant averaged eight bypass events and 85 million gallons of

partially treated wastewater per year. This far exceeded other plants in the region and has caused DEQ to focus on the Arlington facility. One of the main reasons for the high number of bypass events is the pre-1968 plumbing code, which allowed roof and area-way drains to connect to the sanitary sewer system. The other reason was mostly due to processing limitations through the secondary treatment process. A plan is currently in place to reduce the bypass events by one-half by August 2003. However, DEQ expects the Plant to make continued improvements in reducing bypasses even further. Over time they are requiring that the County add facilities to virtually eliminate all bypass events at the Plant. This may possibly be reflected in the new permit in 2003.

- Odor/aesthetics/security of the facility

The Plant staff has been working closely with the neighbors to improve the Plant's image in the community. Odors have always been a serious concern. Much has been done, but more improvement is still possible. With the Potomac Yards project and new development in Alexandria, the Plant will soon have residential and commercial neighbors on all four sides. In this next round of improvements, the staff has committed to improving the aesthetics of the overall facility and reducing the potential for odor release even further. In the aftermath of September 11, 2001, the staff is also planning to improve security at the facility.

- Achieve more stringent effluent limits

With the emphasis on the health of the Chesapeake Bay, some members of the US Congress are now calling for more restrictions on nitrogen and phosphorus limits from all treatment plants in the Bay area. The Plant is currently constructing to achieve an 8 mg/l voluntary total nitrogen limit. Some groups are now suggesting that the limit be lowered to 3 mg/l. To meet this limit reliably, more tankage and systems must be constructed. Additionally, the 2010 Chesapeake Bay Agreement preliminary technical information points towards lower phosphorus limits, possibly as low as 0.075 mg/l (the current limit is 0.18 mg/l total phosphorus). In the future (2008 to 2010), the use of chlorine compounds for the final disinfection process may be banned. If this should occur, it would require the County to replace the chlorination/dechlorination process with ultraviolet (UV) disinfection or some other technology.

- Solids disposal

All area jurisdictions face the possibility that land application of Class B biosolids soon will not be allowed in Virginia. During most of CY 2001, the County was restricted from land application due to odors, and landfill was the only option. Changes have been made to the process, and, as of the end of October 2001 Arlington has returned to land applying to remote sites only. The landfills have also placed restrictions and constraints on receiving Arlington's biosolids, although landfilling remains a viable option at this time. The Master Plan 2001 Update Team has concluded that additional on-site processing would make the material more acceptable for any final reuse or disposal option. This conclusion was confirmed in a report, done separately by the County and another consulting team, in early 2002. The report, entitled "Supplement to the 1995/1999 Sludge Management Alternatives Studies" will be published separately.
- Aging Infrastructure

There are structures at the Plant and off-site lift stations that need major improvement or even replacement. This is particularly true in the advanced treatment part of the Plant. Some 30-year old structures have shown signs of failure. The Master Plan 2001 Update evaluates replacing these aging facilities with more modern systems.

PLAN DEVELOPMENT

Because of the variety of issues faced, the Plant staff thought it best to involve a team of experts, rather than the expertise of just a single firm. Six of the best experts in wastewater treatment that we could locate worked alongside Plant staff to develop the Plan. (See Appendix A for the curriculum vitae of the Master Plan Team). The diversity of opinion among the team ensured that a wide variety of possibilities were examined. At the first meeting in April 2001, the team used a document that identified the Plant infrastructure and processes as well as all major issues (Status Quo Report - Appendix D).

The team brainstormed potential options for meeting the goals. Evaluation criteria were developed, which allowed the team to narrow down the possibilities. Major factors in the evaluation criteria were (listed in order of priority):

- Reliability
- Operability
- Public Acceptance
- Life cycle cost
- Ability to upgrade/expand as needed
- Flexibility
- Constructability/maintenance during construction

A potential list of alternative solutions was developed by the team that required further study. The expert on the team in that particular area was assigned the task of developing technical memoranda, which defined design criteria and estimated costs. Weekly conference calls were held to check status, resolve issues, etc.

At the second meeting in June 2001, the team critiqued the technical memos and ultimately developed a summary plan that incorporates all the issues. From June 2001 to the present (August 2002), the Plan was revised to account for the failing lime reaction tanks. During that period, the Plan also was reviewed extensively, before final publication.

In February 2002, a team of construction experts was convened for the purpose of planning out a logical construction sequence, based on process and physical constraints. From this effort, several schedules were developed, which can be modified based on available funding (See Appendix C).

STRUCTURE OF THE PLAN

The technical portion of the Plan is structured into 19 technical memoranda (TM) as follows:

- TM I - Alternative process configurations to study.
- TM II - Plant flows and properties.
- TM III - Mass balances.
- TM IV - Primary and Secondary Treatment options.
- TM V - Advanced treatment options.
- TM VI - Wet weather storm flow management.
- TM VII - Treatment to achieve a TN of < 3 mg/l.
- TM VIII - Recommended liquid treatment summary.

- TM IX - Multi-point ferric addition.
- TM X - Solids - Thickening options.
- TM XI - Solids - Lime stabilization options.
- TM XII - Solids - Anaerobic digestion options.
- TM XIII - Solids - Aerobic digestion option.
- TM XIV - Solids - Heat drying option.
- TM XV - Solids - Incineration option.
- TM XVI - Solids - Recommended solids treatment summary.
- TM XVII - Odor control options.
- TM XVIII - Infrastructure needs.
- TM XIX - Pump Station Study (prepared by Whitman, Requardt and Associates).

Each TM develops a series of alternatives for the processes being evaluated. Discussion on pros and cons is presented, along with cost estimates for each major option. Since the TMs were developed over the course of one year, some situations changed in the Plant, most significantly the failure of the LRTs. The team did not go back and redo the entire TM, but, rather left the discussion as originally developed, to allow the reader to see the thought process behind the final recommendations.

The cost estimates were developed as "planning-level estimates" (+/- 30%), which allows for contingencies not yet foreseen at this level in the process. The estimates were developed by estimating construction costs, and then adding factors for yard piping, electrical, instrumentation, and site work (total of 7.5%). Then a factor of 35% was added for scope contingency to allow for changes when conditions are better known during final design. Then another factor of 35% is added to cover design, program management, inspection, and construction contingency. Since the above percentages are multiplied in series, the overall multiplier is 1.96 times the base construction cost. All cost estimates in the TMs are in 2001 dollars. After a schedule is developed, factors for inflation can be introduced.

The reader can review TMs VIII, XVI, XVIII, and XIX to understand the final recommendations.

DESIGN PARAMETERS

The Plan was developed based on the following design parameters. The numbers reflect the current VPDES Permit.

<u>Parameter</u>	<u>Monthly average</u>
CBOD	5 mg/l
Total Phosphorus	0.18 mg/l
Suspended solids	6.0 mg/l
Ammonia-N (April-November)	1.0 mg/l
Ammonia-N (November-March)	2.0 mg/l
pH	6.0 - 8.5
Dissolved oxygen	6.0 mg/l (minimum)
Fecal Coliform (MPN/100ml)	200
Total Nitrogen	8 mg/l (annual average) - Required by the grant received

RECOMMENDATIONS OF THE PLAN

The complete Master Plan 2001 Update lists a multitude of individual projects that address upcoming issues at the Plant. Overall Plan components listed by the issue addressed are:

- Redundancy and capacity of BNR and wet weather treatment
 - * Demo first step LRTs and AWT Thickener and Lime Building.
 - * Add Aeration Tank #5 and Clarifiers 7 and 8 with a new pumping station, or consider membrane bio reactors (MBR) technology as costs are lowered.
 - * Improvements to existing clarifier flow distribution.

- Wet weather treatment
 - * Add equalization capacity of 11.3 million gallons.
 - * Add a new Preliminary Treatment facility for flows greater than 88 MGD.
 - * Upgrade carbon filters.

- Odor/Aesthetics/Security
 - * Odor reduction efforts for primary settling tanks.
 - * Odor reduction efforts for aeration tanks.
 - * Add scrubber facilities for new solids treatment processes.
 - * Build a new HHW facility.
 - * Make miscellaneous aesthetic improvements in each of the major projects.
 - * Install new fencing or a wall around the Plant.
 - * Improve security; install new access gates, etc.

- More stringent effluent limits
 - * Demo second step LRTs.
 - * Add a fourth anoxic zone to all of the aeration tanks.
 - * Add Aeration Tank # 6 and Clarifier # 9.
 - * Methanol addition for denitrification.
 - * Centrate equalization.
 - * New disinfection process.

- Solids Processing
 - * Interim dewatering building (DWB) improvements.
 - * Test/install solids irradiation system for producing Class A solids⁽¹⁾
 - * Replace existing screens with fine screens in existing PTB.
 - * New thickeners.
 - * Demo existing digesters.
 - * New anaerobic digesters for Class B solids.
 - * Pasteurization or Heat Drying for Class A solids.

(1) A possible alternative to anaerobic digestion and heat drying.

- Aging infrastructure
 - * Electrical upgrades to Distribution Centers.
 - * Communication upgrades to fiber optic system.
 - * Multi-point ferric addition.
 - * Rebuild secondary clarifiers 4, 5, and 6.
 - * ASE line extension and distribution box.
 - * Mono-media gravity filters.
 - * Plant water improvements.
 - * Backwash tank and pump improvements.
 - * Lift Station Projects.
 - * Truck dump pad.

Many of the above projects have multiple benefits, e.g. the addition of aeration tanks and clarifiers also improves the capacity for wet weather treatment. Nearly all of the projects are interrelated.

It is also recommended that this Master Plan team, or a similar group, reconvene every 3 to 5 years for the purpose of evaluating the progress of the Plan. As always, new regulations/constraints/issues develop over time. It was intended that the Master Plan 2001 Update be a flexible document, that could be modified over time as conditions change.

PRIORITIES

After review of the overall Master Plan 2001 Update, the Plant Staff set the following priorities. These projects are the ones to be built first and would be included in Design Packages # 1 and # 2.

- Build liquid treatment capacity first in order to ensure adequate process redundancy, wet weather treatment, permit compliance, and increase dry weather capacity.
- Address aging infrastructure issues, especially the LRT failure, and the repair/modification to the AWT filters.
- Make improvements to the solids handling facilities.
- Locate, finalize, and implement biosolids alternatives that are environmentally friendly, and are more cost-effective than digestion and heat drying.

The next round of projects would address the more stringent effluent limits. These are expected to begin approximately 2010. If the EPA mandates more stringent permit limits or provides partial grants for achieving lower nutrient limits, this may accelerate the project/construction schedule and associated cash flow.

The final set of projects addresses the solids issues in approximately the year 2010. It is anticipated that the existing method of disposal, lime stabilization, will be appropriate for many years. In the meantime, other solids management options can be evaluated. However, if the Virginia General Assembly bans or severely restricts land application, the County will have to move quickly to develop an acceptable alternative. This could cause the more expensive option, digestion and heat drying, to move up in the schedule.