



SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

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Project Name: Treatability Study for Paperboard Manufacturing Wastewater

Project Class: Environmental Services

Description: The client manufactures latex impregnated fiber board used in footwear and other articles needing stiffeners or reinforcement. The major sources of wastewater are latex washout and fiber blowdown. Fiber is separated from wash water by dissolve air flotation. No treatment was originally provided for latex wastewater. The combined discharge exceeded permit limits for biochemical oxygen demand, total suspended solids and other parameters.

An initial site visit was performed to evaluate facilities and to determine requirements for treatability studies. As a result, samples of segregated wastestreams were collected for treatability studies. The studies included chemical coagulation, biological and physical treatment evaluations. Following completion of the studies, results were presented and a preliminary engineering report was presented describing recommendations for implementation.

Project Name: Toxicity Reduction Evaluation and Wastewater Treatment Design for Paperboard Manufacturing Wastewater

Project Class: Environmental Services

Description: Laboratory biological, chemical coagulation and activated carbon treatability studies were performed to evaluate their effectiveness for toxicity reduction. Chemical and aquatic toxicity testing was performed. The results indicated that toxicity was caused by trace levels of organic contaminants, possibly surfactants. Chemical coagulation and activated carbon adsorption reduced toxicity but results were inconsistent. Biological treatment was found to be effective in eliminating acute toxicity. Due to the low level of biodegradable material present in the wastewater, the use of a cosubstrate was required.

Based on the results of the study, a sequencing batch reactor(SBR) biological treatment system was designed. Modifications were also engineered for existing physical and chemical treatment facilities.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: Evaluation of Color Removal Alternatives for Textile Dyeing and Finishing Plant

Project Class: Environmental Services

Description: Due to aesthetic concerns regarding color discharged from a nearby city Wastewater Treatment Plant (WWTP), methods of reducing color were evaluated. Color removal and reduction alternatives were evaluated at the manufacturing site and at the wastewater treatment plant. In-plant studies were performed to identify and quantify the color from various point sources within the manufacturing facility and to determine the most effective approach for segregated wastestream treatment. Once the wastestreams were characterized, treatability studies were performed. In addition, treatability studies were performed on WWTP final effluent samples.

Chemical coagulation, chlorination, ozonation and activated carbon adsorption were evaluated. The most cost effective alternative was found to be chlorination and dechlorination following biological treatment at the existing POTW. Full scale facilities have been designed and placed into operation based on the studies performed.

Project Name: Textile Dyeing and Finishing Wastewater Treatment Plant Upgrade

Project Class: Environmental Services

Description: Due to projected increases in production, a leading textile manufacturer anticipated increased flows and loadings to their 2.0 mgd extended aeration wastewater treatment plant. An evaluation of the dyeing and finishing wastewater treatment facilities was performed and a preliminary engineering report (PER) was developed detailing design modification required to upgrade the facilities to accommodate increased organic loading and flows up to 3.0 mgd. The PER covered all aspects of the operations including: hydraulics, aeration, process control, sludge handling and physical facilities.

Based on recommendations provided in the PER, the wastewater treatment plant was upgraded by the addition of a 55' diameter clarifier to handle anticipated increases in flow and solids loadings. Engineering design services were provided for this addition that included the following work: structural concrete design for clarifier incorporating equipment selected by the manufacturer and detailed in manufacturer's shop drawings, site plan development showing pertinent existing equipment and proposed equipment and piping, and pump station design to include pumphouse, pump selection, controls and all necessary piping.

Engineering design services were also provided for the clarifier flow distribution system to equally split flow to two existing clarifiers and the proposed clarifier minimizing foam generation and air flotation of the sludge. Coordination of electrical design for selected equipment and controls was also provided.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: Preliminary Engineering Report for Color Removal System: Textile Dyeing and Finishing Wastewater

Project Class: Environmental Services

Description: The client had been required to reduce effluent color levels to below 500 ADMI color units. Although chemical coagulation had been proposed at the WWTP, operating costs projected were expected to be high. In order to evaluate pretreatment options, a preliminary engineering report was provided comparing treatment options and projected operating and capital costs. As a result of this evaluation, extensive laboratory studies were performed to determine the most effective method for color removal. Chemical coagulation and chlorination were evaluated. Chlorination was determined to be the most cost effective method of treatment.

Project Name: Preliminary Engineering Report for Color Removal System: Textile Dyeing and Finishing Wastewater

Project Class: Environmental Services

Description: The client was required to evaluate pretreatment for color removal so that the POTW could comply with its permit conditions. Although chemical coagulation had been proposed at the WWTP, operating costs projected were high. In order to evaluate pretreatment options, a preliminary engineering report was provided comparing treatment options and projected operating and capital costs. As a result of this evaluation, extensive laboratory studies were performed to determine the most effective method for color removal. Chemical coagulation and chlorination were evaluated. Chlorination was determined to be the most cost effective method of treatment.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: Upgrade of Textile Dyeing and Finishing WWTP

Project Class: Environmental Services

Description: The manufacturing plant discharged wastewater from its dyeing and finishing operation that processed lightweight cotton and cotton/polyester blend knitted fabrics for the apparel market. A design was provided for the expansion of the existing Wastewater Treatment Plant to increase the capacity from 3.0 MGD to 5.0 MGD. A complete evaluation of the facilities was performed resulting in a preliminary engineering report on which the design was based. This was accomplished through the addition of a third 80 ft diameter clarifier with a dedicated sludge pumping station. Sludge drying beds were upgraded to incorporate an innovative porous asphalt design. This design allowed the benefits of sand drainage and drying while allowing bed cleaning by lightweight mechanical equipment. Sludge conditioning chemical feed facilities were also provided.

In addition to the third clarifier the completed WWTP design incorporated: a new return sludge splitter structure, modifications to existing flow control vault, a new flow control valve vault with air operated control valve and flow meter, a chemical feed system for combating filamentous bacteria utilizing hydrogen peroxide injection, and a new effluent flow measurement station with a Parshall flume element.

The design incorporated extensive improvements to the monitoring and control aspects of the WWTP utilizing three programmable logic controllers configured in local area network and a PC-based graphical operator interface software package. Functions provided by the integrated alarm and control system included: level control and monitoring of the two aeration basins, dissolved oxygen monitoring and control of the two aeration basins via switching of floating aerators, flow control to the third clarifier as a ratio of plant influent flow, automatic batch control of waste sludge from the third clarifier, automatic switchover from main to standby return sludge pumps with failure alarms, automatic restart after power interruption of all WWTP equipment, and clarifier arm drive failure monitoring.

Construction administration services were also performed, including: preparation of bid documents, prebid meetings, bid evaluation, shop drawing review, site inspections, approval of payment requests, and engineer's certification.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: Advanced WWTP Design for Residential Development

Project Class: Environmental Services

Description: The WWTP was designed to service a private residential development with 750 residential units, 18 hole golf course, and club house near Charlottesville, Virginia. All utilities in the development were public utilities. The design included a 381,000 gallon per day advanced waste treatment plant using the extended aeration, biological treatment process, sand filtration, and ultraviolet disinfection.

The Plant was dedicated to the County's Service Authority for public operation and serves the entire City's Growth area, as defined by the County Comprehensive Plan. The City's Water & Sewer Authority contractually operates the Plant.

Complete engineering services were provided, including: preliminary engineering, permitting, wetland delineation, phase I environmental assessment, tertiary treatment system design, construction administration, start-up, O&M Manual and operator training.

Construction administration services included: preparation of bid documents, prebid meetings, bid evaluation, shop drawing review, site inspections, approval of payment requests, engineer's certification and other services as requested.

The wastewater treatment system was designed to meet tertiary effluent discharge limits including: 14 mg/l total suspended solids, 14 mg/l biochemical oxygen demand and 0.90 mg/l ammonia. Facilities included: pump stations, headworks, extended aeration, chemical coagulation, flocculation, sand filtration and UV disinfection and state of the art controls and instrumentation.

Project Name: Advanced WWTP Design for Resort Community

Project Class: Environmental Services

Description: The WWTP was designed to service a private residential development with a 65 room inn, 18 hole golf course, club house and restaurant, having the equivalent of 150 residential units. A 60,000 gallon per day advanced waste treatment plant using the extended aeration, biological treatment process, sand filtration, sludge drying beds, and ultraviolet disinfection was designed to meet tertiary limits imposed for protection of the receiving stream.

Complete engineering services were provided, including: preliminary engineering, permitting, wetland delineation, tertiary treatment system design, construction administration, start-up, O&M Manual and operator training.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: WWTP Design for Military Base

Project Class: Environmental Services

Description: Design services were provided for the design of a 0.53 mgd extended aeration sewage treatment plant. The facilities were designed to treated highly variable and intermittent flows from 6 individual Army training camps at Fort A. P. Hill. The design included the conversion of two existing 1.5 MG aeration lagoons to equalization basins; the design of three extended aeration basins (biological treatment with single stage nitrogen removal) that could be operated in series or parallel; two 35' diameter clarifiers; continuous backwash filters; an ultra violet disinfection unit; a parshall flume for flow measurement; a cascade type post aeration channel; a return sludge pump station with dual pumps; aerobic digester; porous asphalt sludge drying beds; lime storage and feed facilities; and a controls and laboratory building.

Project Name: Treatability Studies and Design of SBR System for High Strength Food Processing Wastewater

Project Class: Environmental Services

Description: A phased design was provided for a snack food producer utilizing sequencing batch reactor technology(SBR). The first phase of construction included equalization basins, a dissolved air flotation unit, and a vacuum drum filter for sludge dewatering. Prior to the design of phase 2, extensive treatability studies were performed on representative wastewaters collected from other facilities operated by the company. The results of those studies revealed that a Sequencing Batch Reactor (SBR)was suitable for the high strength wastewater.

A SBR system was designed that included state of the art monitoring and control systems. Operation support personnel assisted plant operators during the startup period. Operators were instructed on proper operation of a biological treatment process, laboratory testing procedures, operations record keeping, and analysis of data.

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Project Name: WWTP Design for Fiberboard Manufacturer

Project Class: Environmental Services

Description: The client is a leading fiberboard manufacturer that has historically experienced problems complying with wastewater discharge permit limits for aquatic toxicity. After years of studies by their own company, the Virginia Department of Environmental Quality (DEQ), the Environmental Protection Agency (EPA) and other consultants, a method of compliance was not determined.

Extensive laboratory and pilot scale treatability studies were performed examining chemical precipitation, chemical coagulation, activated carbon adsorption and biological treatment to address toxicity concerns. It was determined that the toxicity was being caused by toxic organic compounds present in trace amounts and a biological treatment system was developed. This system required the use of co-substrates to effectively remove the toxic compounds. The results were presented to DEQ, and approval was obtained for the process. Assisted in the negotiation of a compliance schedule for construction of facilities.

Due to the low concentration of biodegradable material present in the wastewater, bacterial growth and treatment could not be sustained without supplement substrate feed. A cosubstrate process was developed using waste product from another industry which is high in biodegradable organic content.

Based on the results of these studies, the design of a 300,000 gpd wastewater treatment system was provided. The design included the addition of sequencing batch reactors for activated sludge biological treatment to an existing physical-chemical treatment system. Other design improvements included: an HDPE-lined 350,000 gallon influent equalization basin with two floating mixers, an influent transfer pump station utilizing two submersible centrifugals, a control building with chemical storage/feed systems and an electrical and control room, a 7,500 gallon outdoor FRP bulk storage tank with variable speed mixer, a positive displacement blower system, a 75,000 gallon effluent equalization basin with floating flow equalization decanter, and the entire electrical and control system.

Also provided were construction administration services including: preparation of bid documents, prebid meetings, bid evaluation, shop drawing review, site inspections, approval of payment requests, engineer's certification and other services as requested.

The facilities were successfully placed into operation and acute toxicity has been completely eliminated.

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Project Name: Treatability Studies and Design of WWTP for Removal of Metals

Project Class: Environmental Services

Description: Treatability studies were performed to optimize removal of copper, lead and zinc from wastewaters generated in the fabrication of copper fittings. As a result, a 20,000 gpd batch treatment system was designed for co-precipitation of metals using ferrous sulfate and pH adjustment. The system included: influent equalization and storage tanks, pumping systems, batch treatment tanks, chemical feed and control systems, sludge dewatering and associated physical facilities including a wet lab. Studies, design, construction administration and start-up services for the project were provided.

Project Name: Preliminary Engineering Report for the Upgrade of Textile Dyeing and Finishing WWTP

Project Class: Environmental Services

Description: A detailed evaluation of the client's textile dyeing and finishing wastewater treatment plant was performed to determine current and projected operating limitations. Based on this evaluation, a preliminary engineering report was developed detailing facility upgrade requirements. Fundamental in this evaluation was the development of short and long term production projections and estimates of the impact on wastewater treatment facilities. Areas of concern included: flow equalization, clarification capacity and solids handling capacity. Recommendations were provided for phased improvements to allow increases in flow and organic loading in a stepwise fashion.

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Project Name: Design of WWTP for Sanitary Wastewater from Textile Manufacturing Facility

Project Class: Environmental Services

Description: Sanitary wastewater from this textile client's manufacturing facility was historically treated by a septic tank and sand filtration system prior to discharge to a surface water. Due to the high urea concentration and highly variable flowrates, the sand filtration system could not meet increasingly stringent permit limits for ammonia and biochemical oxygen demand.

Preliminary engineering services were provided to identify the cause of system failure and to recommend modifications required to upgrade the facilities. Following these recommendations, design, construction inspection and start-up services were provided. In addition, Operation and Maintenance Manuals for the facility were developed.

The design was based on the use of a 5000 gpd, extended aeration package plant with modifications to address requirements for nitrification, chlorination, dechlorination and post aeration. Due to the high peak flow rates, flow equalization was also provided. On site training was provided using O&M Manuals that were developed.

On-going laboratory testing services were provided as well as review of operating data and provision of operational consultation as needed.

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Project Name: Design and Construction Services for Municipal WWTP

Project Class: Environmental Services

Description: The client operates a 0.051 mgd stabilization pond wastewater treatment system which serves the community of Scottsville, Virginia. As a result of current flows approaching the design capacity of the existing facilities, projected growth for the community and marginal process performance, a preliminary engineering report(PER) was prepared evaluating options for upgrading the WWTP.

The PER recommended that extended aeration facilities be constructed with sufficient capacity to treat existing and projected flows. Due to the wide range of flows projected and the uncertainty of growth projections, it was recommended that facilities be constructed in phases. Based on the recommendations presented in the PER, the client decided to contract for the design and construction of an extended aeration treatment facility with a flow capacity of 200,000 gpd. The design would accommodate the expansion of the facilities to a flow capacity of 400,000 gpd. In addition, the design would utilize the existing stabilization lagoon for flow equalization during periods of excessive infiltration and inflow.

Design services were provided for the upgrade to the existing wastewater treatment plant recommended in the PER. The design included: extended aeration facilities incorporating a pre-engineered packaged plant with fine-bubble diffusers fed by positive displacement blowers, aerated sludge storage tank, return sludge flow measurement, and dissolved oxygen control; influent pump station revisions; headworks with aerated grit chamber and manual bar screen; flow-paced chlorination system; effluent flow measurement and sampling station; process alarms with automatic phone dialer system; and a laboratory and utility building.

The revisions to the influent pump station included: replacement of the existing long-shaft pumps with direct-coupled immersible pumps of increased capacity, new controls with variable frequency drives on each pump, upgraded dry well ventilation, and the addition of an emergency power generator and automatic transfer switch. Complete design plans and specifications were provided for all aspects of the work including: surveying, soil testing, civil, electrical, mechanical, structural, instrumentation and controls and architectural services.

Construction Administration services provided included: bidding assistance, construction inspections, shop drawing review, review of contractor requests for payment, and general technical information assistance.

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Project Name: Groundwater Treatment System Design

Project Class: Environmental Services

Description: Improper disposal of wastes from a metal can manufacturing process resulted in several areas of volatile organic compound (VOC) contamination in the groundwater at the site. The can plant was listed on the New York State Department of Environmental Conservation (NYSDEC) list of inactive hazardous waste sites.

A contract was awarded for design, construction, and operation, for a period of five years, of a groundwater collection and treatment facility at the client's site. The system involved the installation of thirteen wells, collection piping, flow metering and flow control, a soil vapor extraction system with granulated activated carbon (GAC) vapor filtration, oil-water separation for the groundwater followed by pre-filtration, sequestering agent addition, air stripping, and granulated activated carbon (GAC) liquid filtration. The facility was monitored and controlled by an integrated PLC-based system with automatic phone dialer for off-site alarm notification.

Engineering services for the instrumentation, controls, electrical, and mechanical design portion of the groundwater collection and treatment system were provided.

Project Name: Preliminary Engineering Report for Soft Drink Bottling Facility

Project Class: Environmental Services

Description: The client operates a bottling facility which discharges to a Publicly Owned Treatment Works (POTW). The discharge contains high concentrations of corn syrup used in soft drink manufacturing. The total flow for the facility is around 12,000 gallons per day and has a biochemical oxygen demand and chemical oxygen demand of approximately 2500 mg/l and 5,000 mg/l respectively. Due to increase loadings on the POTW, BOD concentrations in the discharge were required to be reduced to 250 mg/l.

A preliminary engineering report was provided that evaluated treatment alternatives and design recommendations.

Alternates evaluated included aerobic biological treatment, anaerobic treatment, biological filters and reverse osmosis. Aerobic biological treatment was selected as the most reliable and effective method of treatment and recommendations for the construction of a sequencing batch reactor were provided.

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Project Name: Evaluation of the Existing Treatment Facilities

Project Class: Environmental Services

Description: The client operates a food processing facility producing frozen dinners and other frozen food products. As a result of food preparation, high organic loadings were discharged. Of significant concern was oil and grease (O&G). Pretreatment facilities are operated to reduce organics, O&G and solids, to acceptable levels prior to discharge to the publically owned treatment works (POTW). However, due to increases in production and changes in manufacturing processes, concerns were raised regarding treatment efficiency. The project provided an evaluation of the existing treatment facilities with recommendations for improvements. Pretreatment facilities included: equalization, pH neutralization, dissolved air flotation (DAF), stabilization lagoons and activated sludge treatment. The evaluation determined that improved organics and O&G removals could be achieved by optimizing chemical treatment prior to DAF. In addition, limitations were identified with the activated sludge process and recommendations were provided for improvement.

Project Name: Evaluation of Chlorination for Color Removal for Textile Dyeing and Finishing Plant

Project Class: Environmental Services

Description: The client operates a yarn and fabric dyeing and finishing plant which discharges untreated wastewater to the publicly owned treatment works (POTW). Yarns and fabrics are made of cotton and polyester materials. The effluent from dyeing operations contains relatively high concentrations of salt, color, chemical oxygen demand and copper. The POTW provides extended aeration activated sludge treatment and discharges to surface water. Although biological treatment produces an acceptable discharge with respect to conventional pollutants and had not demonstrated toxicity to aquatic life, the discharge was highly colored. Due to the high proportion of POTW discharge to surface water flow, very little dilution is experienced and color levels are visually detectable.

While color levels currently meet permit requirements, the client, in anticipation of stricter guidelines, considered enhancements to the POTW treatment system to further reduce color. One option under consideration was the expansion of the existing chlorination system. In order to assess the feasibility of this option, treatability testing was performed to determine the optimal chlorine dosage and, in addition, to identify by-products of the chlorination process to determine if increased chlorination may adversely impact aquatic toxicity levels.

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Project Name: Evaluation of Chlorination for Color Removal for Textile Dyeing and Finishing Plant

Project Class: Environmental Services

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While color levels currently meet permit requirements, the client, in anticipation of stricter guidelines, considered enhancements to the POTW treatment system to further reduce color. One option under consideration was the expansion of the existing chlorination system. In order to assess the feasibility of this option, treatability testing was performed to determine the optimal chlorine dosage and, in addition, to identify by-products of the chlorination process to determine if increased chlorination may adversely impact aquatic toxicity levels.

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Project Name: Wastewater Treatment Plant Control System Upgrade

Project Class: Environmental Services

Description: This client produces electronic components for the communication industry. Existing wastewater treatment facilities included a multi stage process consisting of surge basins, two neutralization stages, a flume and clarification. In addition, a parallel process was used for aqueous neutralization. The control system for this process was composed of a mixture of hard-wired devices such as pushbuttons, selector switches, annunciator lights and control valves and pneumatic instruments such as flow and level recorders and flow controllers.

All control of the waste treatment process was done from the main control room in the plant; a series of consoles with digital indicators, trend charts, pilot lights and pushbuttons were utilized. The bulk of the system was manual or "open-loop" control. A log of the wastewater treatment operation was maintained by the operators by filling in process values at predetermined times of the day on several report sheets. The existing control system was outdated and difficult to maintain. Given the importance of this system in monitoring and controlling wastewater treatment operations, the client was interested in replacing this system with a more up to date system.

A turnkey Design-Build solution was provided for this project, the objective of which was modernization of the existing wastewater treatment plant monitoring and control system. This included: system design; purchasing, configuring, and installing all computer hardware and enclosures; purchasing and installing field interface devices; and providing software development services associated with updating the existing waste treatment control system. Our services briefly summarized were as follows:

- 1) Provided engineering services for development of control system design, definition of new Modicon PLC hardware and development of control sequences/interlocks. This involved:
 - a) development of preliminary process flow diagrams and operations sequences required for PLC logic development.
 - b) development of I/O point definitions required for control logic and operator interface development.
- 2) Provided complete PLC control system configuration and implementation including development of PLC control logic for manual (open-loop) device control, system alarms, reporting calculations, full testing and startup assistance.
- 3) Provided operator interface system development to control and display the status of the wastewater treatment system, provided three daily printed reports, and provided full testing and start up assistance.
- 4) Provided two pre-wired PLC control panels ready for installation at the plant.
- 5) Provided and installed all instrumentation including I-to-P and P-to-I converters and other feedback devices required to interface the new PLC controls with the existing field devices.
- 6) Provided hardware and configuration for interface with existing factory pager system, E-mail system, and off-site main frame data archiving system.
- 7) Provided electrical installation including preparation of working electrical drawings and supervision of field installation.
- 8) Provided complete system documentation and technical training of operations personnel.

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Project Name: Treatment of Chromium from Groundwater Recovery System

Project Class: Environmental Services

Description: Expansion of an existing U. S. Department of Energy facility High Explosive (HE) groundwater treatment system to encompass a chromium impacted area necessitated the design and installation of a chromium pretreatment system. The resultant system abated HE and chromium in a perched aquifer underlying the Pantex Nuclear Weapons Plant. Two distinct contaminant plumes existed within the aquifer; one containing 3 to 5 ppm HE, and the other containing a combination of 0.5 to 2 ppm HE and 1 to 5 ppm total chromium.

Extraction wells delivered 300 gpm HE contaminated water to an activated carbon treatment system. Three additional extraction wells allowed 50 gpm of groundwater contaminated with HE and chromium to be segregated for pretreatment of total and hexavalent chromium to less than 100 mg/L. To meet an expedited schedule, rapid completion of treatability testing, cost analysis, and design was accomplished.

Treatability testing concentrated on anion exchange and chemical treatment technologies. Anion exchange resin isotherms were developed to characterize a variety of resins and to determine anticipated resin demand. Chemical treatment studies evaluated the use of sodium bisulfite and ferrous sulfate to reduce hexavalent chromium and allow trivalent chromium to be precipitated as chromium hydroxide. Chemical demand was determined in order to present a basis for operating costs. Results indicated that chemical treatment was more effective than anion exchange for the concurrent removal of hexavalent and trivalent chromium. While anion exchange successfully removed hexavalent chromium to the established limit, the process was not effective for removing cationic trivalent chromium. Following installation, a one month field performance evaluation was conducted to confirm laboratory data and to balance maximum chromium removal with minimum chemical and energy costs.

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Project Name: Denim WWTP pH Control System Design

Project Class: Environmental Services

Description: This leading manufacturer of denim operated a textile dyeing and finishing wastewater treatment facility at its North Carolina plant. Dyeing processes used at the manufacturing facility required the use of sulfur dyes and high concentrations of caustic. Oxidation of the dyes and discharge of the caustic results in high alkalinity and high dissolved solids concentrations in the wastewater. These conditions have been determined to contribute to aquatic toxicity.

A toxicity reduction investigation was performed during which laboratory and full scale trials demonstrated that the addition of a strong acid such as sulfuric acid to the wastewater would provide several benefits including: reduction in alkalinity, reduction in aquatic toxicity, improved pH control; and reduction in operating costs.

A pH control system described below was designed. This system provided more precise control of pH resulting in optimal performance with respect to the benefits stated above. The major design features include: sulfuric acid for influent pH neutralization by means of a chemical feed system in conjunction with an automatic closed-loop pH sensing and control system and an influent neutralization reactor consisting of a concrete basin to provide time for chemical reaction and control as well as a degree of chemical equalization.

A detailed listing of design features follows:

1. Acid Pump Building; a concrete block building, to contain the Acid Feed System comprised of two pairs of different capacity diaphragm metering pumps. The system was designed such that one split-range pair (one small and one large) is to provide adequate acid delivery for normal operation. The other pair is for redundancy and/or future peak design conditions. Coordinated control of the split-range pumps was accomplished by a PLC, which receives a proportional control signal from a pH controller and sends appropriate control signals to the metering pumps. The building also contains an emergency eye wash/shower, ventilation fan, electric heater, and lighting.
2. Acid Storage Tank Containment Structure; a concrete containment structure surrounding a 10,000 gallon Acid Storage Tank. The structure provided sufficient volume for the entire tank contents, an eight inch rainfall event, and leave three ft freeboard.
3. React Basin; a concrete structure with a volume of 36,000 gallons which provides 6 minutes of detention at an ultimate flowrate of 6,000 gpm. At the WWTP design flowrate of 2.5 mgd (1735 gpm) the React Basin provided 20 minutes detention. There is a flow splitter structure included in the side of the React Basin with two equal elevation weir plate of equal length to split flow equally to the two Aeration Basins. Slide gates are provided to allow blocking flow to either basin. There is a floating mixer centrally located in the React Basin which pumps liquid from the surface downward toward the bottom in a toroidal motion. New piping intercepts the existing force main and redirect flow to the React Basin. Valving provides to by-pass the React Basin through the existing force main piping and basin inlets.
4. Control System; an Integrated Monitoring and Control System, based on a programmable logic controller (PLC) and two dedicated loop controllers provided automatic control and overall system monitoring of the pH adjustment process and its support sub-systems. Each of the large pumps has its own electronic variable speed drive unit which allows either local manual control or remote automatic control. In manual control mode, pump operation is controlled via start/stop pushbuttons with output flowrate determined by a speed selector pot with pump speed indicated on the controller's display panel.

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In the auto mode, speed is determined from a remote proportional signal provided by the PLC via a remote I/O (input/output) unit located in the Acid Pump Building. Each of the small pumps has a three position toggle selector switch which allows either local manual control or remote automatic control or neither (off). In manual control mode, pump output flowrate determined by a speed selector knob and by a stroke length selector knob. In the auto mode, speed is determined from a remote discrete signal provided by the PLC via a remote I/O (input/output) unit located in the Acid Pump Building. There are alarms provided by the system for all major process conditions, each annunciated by the Operator Panel on the main control panel accompanied by an audio-visual horn/light system.

Project Name: Interceptor Design

Project Class: Environmental Services

Description: Approximately 10,000 LF of gravity sewer line and associated structures was designed to accommodate a base flow of 2 mgd. The design utilized ABS Truss Pipe with welded joints to minimize infiltration and inflow and consisted of 8', 10', 12' and 15' diameter pipe. Special considerations were required to address stream crossings and borings through railroad embankments.

Project Name: Biological Pretreatment System Design

Project Class: Environmental Services

Description: This textile client's manufacturing facility discharged wastewater to the local county treatment plant and was required to comply with pretreatment limits for numerous parameters. Of specific concern are limits for pH and biochemical oxygen demand (BOD). The pH limits of 6.0 to 10.0 and the BOD average limit of 300 mg/l have been periodically exceeded resulting in permit violations.

At the client's request, an evaluation of the feasibility of using an aerated lagoon for pretreatment was conducted. The process model indicated that equalization would likely provide compliance with pH and BOD limitations. However, the analysis also indicated that the growth of biological solids may result in suspended solids concentrations which exceed the pretreatment limit. Based on this analysis, the client commissioned the design of an aerated lagoon which could be converted to a biological sequencing batch reactor (SBR) in the event that suspended solids compliance could not be accomplished.

Designed and constructed the pretreatment facilities which included a 150,000 gallon basin, influent screening, aerators and continuous pH monitoring and recording. The basin was designed to allow conversion to a SBR with minimal changes to the structures. Due to permit compliance schedule requirements, the project was expedited and placed into service only four months after notification to proceed with construction was received.

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Project Name: Sanitary Pump Station Design

Project Class: Environmental Services

Description: Services provided for a private residential development with 750 residential units, 18 hole golf course, and club house east of Charlottesville. All utilities in the development were public utilities. A Sewage Pump Station was required to service a section of the sanitary collection system. The 370 gpm pump station was designed to meet Albemarle County Service Authority specifications, and strict architectural guidelines required for the upscale development.

The Pump Station was dedicated to the Albemarle County Service Authority for public operation and will serve the entire Rivanna Growth area, as defined by the County Comprehensive Plan. Rivanna Water & Sewer Authority will contract operate the Plant.

Complete engineering services were provided including: preliminary engineering, permitting, wetland delineation, system design, and construction administration. Construction administration services included: preparation of bid documents, prebid meetings, bid evaluation, shop drawing review, site inspections, approval of payment requests, engineer's certification and other related services.

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Project Name: Effluent Diffuser Design

Project Class: Environmental Services

Description: A multi-port diffuser structure was designed for a leading textile manufacturer's Virginia facility.

The final effluent from the Waste Water Treatment Plant (WWTP) required a rapid mixing zone (RMZ) to incorporate the effluent into the receiving waters in accordance with Virginia water quality regulations. The critical design condition was to achieve effective mixing under low flow conditions in the stream to reduce acute toxicity. Low flow in the body of water, at the site of the client's outfall structure, developed relatively small ambient velocities in the location of the outfall and embankment. Small lateral dispersion developed by the ambient currents made the RMZ very small with regard to acute toxicity (4 ft. radius max.). In order to meet the necessary dilution, intermediate division of the total mass was necessary before the final effluent reached the receiving waters. Furthermore, the physical flow discharged by the WWTP is small and would not generate a significant momentum through a multi-ported single pipe diffuser.

Separate pipes were specified to carry each portion of the final effluent to each diffuser port; this ensures effective division of the flow within the RMZ spatial constraints. Using weir structures to divide the mass flow before discharge ensured that each port would discharge one-fourth of the acute mass and reflected the mathematical modeling upon which the design was based. Once the diffuser structure was configured as described, environmental constraints required substantial structural design due to episodic flooding of the channel such as recently experienced under Hurricane Fran. The particular body of water experiences significant trees moving downstream under flood conditions due to the erosion of the primary channel. Therefore, the flow splitting structure, as well as the diffuser structure, will experience heavy flood, submergence and probable collision with large trees which must be countered to enable the system to function under all flow regimes.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: Municipal WWTP Design Using SBR Technology

Project Class: Environmental Services

Description: The client provided water and wastewater services to portions of the counties of Greene, Orange, and Madison in central Virginia. One of the treatment facilities is owned and operated by the authority and serves a subdivision, a planned community development in northeast Orange County. The development comprises approximately 2,400 current connections with 1,600 lots available for construction. In addition, a shopping center and commercial area at the entrance to Lake of the Woods is serviced by the facility.

Engineering services were provided for the upgrade of the POTW facility. The POTW upgrade replaced an existing 0.25 MGD packaged treatment system with a 0.5 MGD sequencing batch reactor (SBR). The projected loading to the POTW is: BOD5 = 200 mg/l, TSS = 200 mg/l, TKN = 40 mg/l. The anticipated permit limits were BOD5 = 20 mg/l, TSS = 20 mg/l, Ammonia = 2.0 mg/l.

The new system was sited to maximize the use of the existing facilities. An existing 750,000 gallon Emergency Storage Basin provides at least 24 hours storage capacity if normal operations are interrupted. The existing packaged treatment plant was converted to an aerobic digester. Existing sand drying beds were converted and expanded utilizing porous asphalt. Flat Run influent is pumped into two 275,000 gallon SBR basins on an alternating schedule, then gravity decanted into an 80,000 gallon post equalization basin, and continues through ultraviolet disinfection and post aeration before discharging into Flat Run. Waste Sludge is pumped into the digester, dewatered on the drying beds and hauled away for land application or landfill disposal. Chemical feed systems are provided for SBR and digester alkalinity adjustment and for digested sludge treatment prior to dewatering.

The design incorporated an integrated monitoring and control system based on a PLC accessed via a graphical operator interface panel. Automatic sludge wasting is provided based on sludge age (SRT) process control concepts. Effluent equalization flow control is provided based on adaptive feed-forward concepts. A new Operations Building was provided which houses the electrical and control system, a lab, a restroom, an Operator's Office, a Chemical Storage and Feed System room, and a maintenance room.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: Dyeing and Finishing WWTP Design

Project Class: Environmental Services

Description: A leading textile manufacturer proposed to build manufacturing facilities near Mexico City. Three manufacturing divisions would jointly occupy the site and would operate individual facilities. Utilities, including water and wastewater treatment, would be constructed to support all operations. Water and wastewater requirements were estimated initially to be approximately 2.5 mgd with potential increase to 4.0 mgd as operations expand.

A Basic Engineering Design Specifications Report was developed which outlined the critical construction and equipment requirements utilizing proven textile wastewater treatment processes. Basic specifications were provided for critical process components including manufacturer and model number. Design criteria were provided for unit operations including tank sizes and flow rates. Process control strategies were provided for unit operations including pH adjustment, disinfection, activated sludge return and wastage, nutrient feed, waste sludge conditioning and dewatering, and wastewater sampling. A complete functional description of an integrated monitoring and control system was provided as well as detailed instrumentation and data collection equipment specifications. A conceptual site plan and a conceptual hydraulic profile were provided showing layout of equipment and support facilities.

Following approval by the client, this information was reviewed with Mexican engineering team members. Following their review and certification of the treatment process and design criteria, a Mexican project management and construction firm transferred information to a Mexican construction company for completion of detailed design, drawings, and specifications. The Mexican construction company was responsible for incorporating these Basic Engineering Design Specifications into the overall project design, specifications, and site plan.

Design review, O&M Manual, start-up, and operational training was provided.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: Denim Dyeing and Finishing WWTP Design and Construction Administration

Project Class: Environmental Services

Description: A joint venture between two leading U.S. textile manufactures proposed to construct a wastewater treatment facility in Mexico to process combined discharges from separate dyeing and finishing facilities. One manufacturing facility would produce denim and the wastewater would consist primarily of dyes and auxiliaries associated with indigo and sulfur dyeing operations. The other would manufacture cotton and polyester blended fabric using reactive dyes. All wastewaters associated with scouring, dyeing, washing and finishing would be discharged to the wastewater treatment plant (WWTP). Sanitary wastewater from each facility would also be discharged to the WWTP. The proposed WWTP would provide screening, disinfection, pH neutralization, equalization, biological treatment, and chemical coagulation. Sludge would be dewatered and disposed by land application. Water and wastewater requirements were estimated initially to be approximately 2.67 mgd with potential increase to 8.0 mgd as operations expand.

A Basic Engineering Design Specifications Report was developed describing the critical construction and equipment requirements utilizing proven textile wastewater treatment processes. Basic specifications were provided for critical process components including manufacturer and model number. Design criteria were provided for unit operations including tank sizes and flow rates. Process control strategies were provided for unit operations including pH adjustment, disinfection, activated sludge return and wastage, nutrient feed, chemical coagulation, waste sludge conditioning and dewatering, and wastewater sampling. A complete functional description of an integrated monitoring and control system was provided as well as detailed instrumentation and data collection equipment specifications. A conceptual site plan and a conceptual hydraulic profile were provided showing layout of equipment and support facilities.

Following approval by both firms, this information was presented to the construction company that was responsible for development of detailed engineering design drawings and specifications based on the design criteria presented. This company also managed bidding, contract award, and construction of the project. Design review and construction support was provided.

Project Name: Textile Wastewater Treatment Plant Operations and Maintenance Manual, and Operator Training

Project Class: Environmental Services

Description: A comprehensive operations and maintenance (O&M) manual was developed for a textile wastewater treatment system. The O&M manual presented: process descriptions, process control strategies, operational guidelines, general maintenance practices, health and safety practices, and worksheets for process control calculations. Manuals for equipment used in the system and construction drawings were integrated into the manual. The manual was provided in paper and electronic formats in both English and Spanish. The O&M Manual was used for operator and supervisor training.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: Operations & Maintenance Manual

Project Class: Environmental Services

Description: A comprehensive integrated manual was developed with all materials included on one CD for use on a personal computer. This included text, drawings, pictures, spreadsheets, and other documents that described major equipment and systems, operational instructions, and relevant supplemental information. The materials on the CD were accessed by means of a self-contained navigation system allowing quick jumping from point to point throughout the manual. This was accomplished by using a "hot" table of contents as well as strategically placed "links" in the various sections.

Project Name: WWTP Design and Construction Services

Project Class: Environmental Services

Description: Engineering Design Services and construction services were provided for the treatment of wastewater from textile dyeing and finishing operations. Services included: design drawings, construction specification, equipment specifications, design of the WWTP Controls Systems, periodic construction management services in coordination with client's civil Construction Manager, and WWTP start-up training and assistance. A detailed operations and maintenance (O&M) manual was developed in both English and Spanish in both hard and electronic forms.

The design capacity of the plant was 2.8 mgd and the extended aeration activated sludge process was used. Due to the high color level entering the plant from cotton dyeing operations, a unique anoxic treatment process was employed to decolorize azo-reactive dyes. This process proved to be extremely successful and significantly reduced operating cost for color removal. Chemical treatment was also included providing the capability to remove virtually all color prior to discharge. The design also included a sludge thickener, recessed plate filter press for sludge dewatering, and an advance process control and monitoring system.

Start-up training and on-going support using an internet based environmental management system were also provided.

Project Name: Engineering Services for Upgrade of Existing WWTP

Project Class: Environmental Services

Description: Professional Engineering services were provided as well as site visits in support of the upgrade of an existing wastewater treatment plant. Engineering Design Services were provided including Construction Drawings and Documents; complete listing of all required specific WWTP equipment necessary to purchase and install in the WWTP; design of the WWTP Controls Systems; periodic construction management services in coordination with client's civil Construction Manager, and WWTP start-up services.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: WWP Evaluation

Project Class: Environmental Services

Description: An existing WWTP was evaluated to verify its design capacity and capabilities for compliance with projected tertiary discharge limits. The influent pump station and each unit operation were evaluated and recommendations for upgrade were provided.

Project Name: Textile WWTP Upgrade

Project Class: Environmental Services

Description: Aeration, mixing and cooling requirements for an existing textile WWTP were evaluated and recommendations for upgrading were presented.

Project Name: WWTP Effluent Diffuser Design

Project Class: Environmental Services

Description: An effluent diffuser was designed for the discharge of treated textile wastewater into the receiving stream. The diffuser provided immediate dilution of wastewater to mitigate downstream issues relating to color, metals, sulfates, and potential aquatic toxicity.

Project Name: Cambodian Plant WWTP Evaluation

Project Class: Environmental Services

Description: An evaluation was provided of wastewater treatment operations at a textile manufacturing plant in Cambodia. A site visit to evaluate existing facilities was performed. A preliminary engineering report was provided with recommendations for work needed to comply with Cambodian discharge standards.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: China and Vietnam WWTP Evaluations

Project Class: Environmental Services

Description: An evaluation was provided of wastewater treatment operations at manufacturing facilities in China and Vietnam. Site visits to facilities in China and Vietnam were performed. Design criteria and operating data for existing facilities were reviewed to determine or verify treatment capacities. Design criteria for upgrading facilities to meet discharge requirements were developed. A final report regarding the site visits and evaluations with recommendations for work needed to upgrade the existing wastewater treatment plants was provided.

Project Name: Design Upgrade

Project Class: Environmental Services

Description: Design upgrade

Project Name: Denim Wastewater Treatment Plant Design

Project Class: Environmental Services

Description: Design and construction administration services were provided for denim dyeing and finishing plant located in Nicaragua. The design included all required disciplines and included detailed drawing and specification in English and Spanish. The design included secondary biological treatment with chemical coagulation for color removal. Specification included bid packages and assistance in reviewing and selecting of the successful bidder was provided. Site inspections were performed during the construction to review performance relative to design requirements.

After completion of construction, start-up services were provided. These services included development of an O&M Manual in English and Spanish, operator training, and one-year of operational assistance utilizing an internet based data management system.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: WWTP Design and Construction for Biological Nutrient Removal

Project Class: Environmental Services

Description: Design services were provided for the design of wastewater treatment facilities for biological nutrient removal. The design capacity of the plant was 2.0 mgd. The WWTP was designed to meet total nitrogen and phosphorus discharge limits of 3 and 0.3 mg/L, respectively. The five stage Bardenpho Process was utilized in the design for biological treatment. Chemical precipitation of phosphorus was also provided for treatment redundancy.

In addition to the Bardenpho process, effluent filtration was provided with deep bed denitrification. Sludge handling facilities included mechanical sludge thickening, aerobic digestion and sludge dewater using recessed plate filter presses.

An advanced monitoring and control SCADA system was provided. The system monitored process variables and controlled return sludge flow, waste sludge flow, pH, dissolved oxygen (DO), and nitrate with closed loop feed of required chemicals.

Construction administration services were provided. These services included construction inspections, shop drawing review, and contract administration.

A detailed operation and maintenance manual (O & M Manual) was provided with interactive electronic format. The manual was used for operating training.

Start-up services were provided and on-going operational support was provided for one year after start-up to assure successful operation and transition to owner personnel.

Project Name: Preliminary Engineering Report for Biological Nutrient Removal

Project Class: Environmental Services

Description: A preliminary engineering report (PER) was provided establishing the design criteria for a biological nutrient removal facility treating domestic wastewater. Effluent total nitrogen and phosphorus limits of 3.0 and 0.3 mg/L were required for compliance with the Chesapeake Bay Nutrient Initiative. The PER presented design criteria for the five stage Bardenpho process and redundant systems for deep bed denitrification and phosphorus removal. The design capacity of the plant was 2.0 mgd.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: Turnkey Textile Dyeing and Finishing WWTP Design and Construction

Project Class: Environmental Services

Description: Turnkey engineering and construction services were provided for a 1.5 mgd wastewater treatment facility located in Honduras. The discharge contained wastewater from cotton and cotton/poly blended fabric dyeing and finishing operations as well as sanitary discharges from the facility. The system provided extended aeration biological treatment and utilized ozonation for color removal. On-site oxygen generation was provided. Design, construction, start-up, and training services were provided, including Operations and Maintenance Manual.

Project Name: Turnkey Textile Dyeing and Finishing WWTP Design and Construction

Project Class: Environmental Services

Description: Turnkey engineering and construction services were provided for a 3.75 mgd wastewater treatment facility located in Honduras. The discharge contained wastewater from cotton and cotton/poly blended fabric dyeing and finishing operations as well as sanitary discharges from the facility. The system provided extended aeration biological treatment and utilized ozonation for color removal. On-site oxygen generation was provided. Design, construction, start-up, and training services were provided, including Operations and Maintenance Manual.

Project Name: WWTP Design and Start Up Services

Project Class: Environmental Services

Description: An activated sludge wastewater treatment system was designed for the treatment of polyester fabric dyeing and finishing wastewater. The design capacity of the facility was 132,000 gpd with processes including: influent lift station, screening, activated sludge treatment, sedimentation, and sludge dewatering. Support services were provided for construction and start-up.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: Waste Load Allocation (WLA) Model

Project Class: Environmental Services

Description: A mathematical water quality model was developed to project waste load allocation for client's plant discharge into a nearby river. The model predicts the waste assimilation capacity (WAC) of the portion of the river impacted by the client's WWTP effluent. After configuration and calibration, the water quality model was used as a basis for both process design and negotiating regulatory permit requirements.

As a result of the model, discharge limits were increased to be compatible with the receiving streams assimilative capacity. This resulted in significant operating cost savings.

Project Name: WWTP Permit Renewal

Project Class: Environmental Services

Description: Stream modeling work was reviewed in conjunction with WWTP discharge permit renewal. The municipal WWTP discharged into a receiving stream with limited assimilative capacity and restrictive water quality standards. Modeling work was essential in obtaining the least restrictive discharge limits compatible with stream preservation.

Project Name: O & M Manual Update & Chemical Treatment Start Up

Project Class: Environmental Services

Description: A WWTP operation and maintenance manual (O & M Manual) was developed that included all materials on one CD for use on a personal computer. The manual included text, drawings, pictures, spreadsheets and other documents, as required, to describe all equipment, systems and operational instructions. Materials are accessed by means of a self-contained navigation system allowing quick jumping from point to point throughout the manual.

Engineering and Operator training assistance was also provided. Client's staff was trained in Jar testing procedures, calculations of chemical dosages based on Jar Testing results, and setting chemical feed control system based on calculated dosages. Engineering assistance consisted of review of equipment purchases, assistance with PLC programming, control system start up, and final engineering inspection and certification.

SELECTED PROJECT DESCRIPTIONS FOR APPLIED TECHNOLOGY AND ENGINEERING, P.C.

Project Name: Muncipal WWTP Design

Project Class: Environmental Services

Description: Initial work with the muncipal client involved identification of process and operational limitations leading to the design and installation of supplemental aeration facilities and nutrient feed at the Client's 1.8 MGD WWTP. On-going operational support was provided including operator training and review of treatment plant performance with recommendations for operational responses. Design for sewerage interceptor systems and pretreatment program evaluation and recommendations were also provided. In addition, design services for an expansion project were provided that included: solids handling building, personnel building, chlorination/dechlorination building and equipment, sludge thickening, recessed plate filter press, chemical feed systems, aerobic digestion and associated equipment and facilities. Construction administrative services, O&M manuals, start-up training and supervision were also provided. As a result of continued growth, additional expansion of the WWTP was required and design services were provided for an additional expansion of the WWTP from 1.8 MGD to 3.6 MGD and for replacement of the two associated influent pumping stations. During this process assistance was provided in obtaining funding through the Virginia Revolving Loan Program. The completed design included: two influent pump stations; headworks with dual train centrifugal grit removal systems with classifier and mechanical filter screen with manual by-pass bar screen; additional extended aeration facilities incorporating two parallel concrete aeration basins with fine-bubble diffusers fed by positive displacement blowers in conjunction with floating mechanical mixers with automatic dissolved oxygen control; a third 80 ft diameter clarifier with suction arm sludge collector directly to its return sludge pumps; a return sludge pump station with duplex centrifugal pumps and automatic batch waste sludge control as well as a scum removal pump; and a second aerobic sludge digester. The design features incorporated into each of the two influent pump stations included: separate wet and dry well portions in a 30 ft deep reinforced concrete structure with appropriate ventilation and lighting; automatic mechanically cleaned bar screen; three close-coupled influent pumps with controls utilizing variable frequency drives on two pumps, flow measurement utilizing electromagnetic flow meter; emergency power generator and automatic transfer switch; and controls and alarms based on wet well level and pump operational status. The design incorporated extensive improvements to the monitoring and control aspects of the WWTP. An integrated system was designed utilizing five programmable logic controllers (PLC's), each contained in a distributed local control panel, with a sixth PLC located 5000 feet from the WWTP in a remote pump station. The PLC's in these panels communicate over a local area network and all can be addressed via a PC-based graphical operator interface software package. Alarm status, operational status, and various flowrate data are brought back to the PC for display, logging, trending, and reporting. The control aspects of the system include: wet well level control in both influent pump stations via VFD's on pumps, operator selectable flow ratio control of RAS relative to final effluent flow, dissolved oxygen control in all four aeration basins, and proportional influent flow sampling based on the sum of flow signals from the two influent pump stations. Assistance was provided to the Client to obtain necessary NPDES and other regulatory permits. This involved extensive negotiations with the State Department of Environmental Quality regarding limitations set forth in the Upper Roanoke River Water Quality Management Plan. Through these negotiations, less stringent permit limits were obtained which avoided the need for tertiary treatment. Construction administrations services were provided for the expansion.