Final Report

Oak Orchard Wastewater Treatment Plant Facilities Plan Addendum Onondaga County, New York

June 2010

STEARNS & WHELER
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June 18, 2010

Ms. Patricia Pastella, P.E., Commissioner
OCDWEP
650 Hiawatha Blvd. West
Syracuse, NY 13204-1194

Re: Final Facilities Plan Addendum
Oak Orchard Wastewater Treatment Plant
Onondaga County, New York
Job No. 8612132.0

Dear Commissioner Pastella:

Stearns & Wheler is pleased to submit 10 copies of the Final Facilities Plan Addendum for the Oak Orchard Wastewater Treatment Plant. This Facilities Plan Addendum has been revised in response to comments received from the Department of Water Environment Protection in an email dated March 22, 2010. Each of the comments included in this email have been addressed and incorporated into the Final Facilities Plan Addendum.

In addition, we offer the following in response to questions provided by the County:

- As requested, we are enclosing hard copies of the Davis Road Pump Station Force Main Hydraulics. An electronic file copy of these hydraulics will be submitted separately via email.

- Section 5.1 – As requested, all of the present-worth calculations have been checked and correct as presented.

- Table 7-3 – The BOD estimate of 200 mg/L used in the calculation for sulfide production differs slightly from the BOD values included in Tables 2-1 and 2-3. The variation in actual BOD concentrations does not affect the calculations or recommendations included in the odor control analysis.

- Table 8-1 – The $700,000 total project cost included for the odor control at the Oak Orchard Wastewater Treatment Plant is accurate and includes all of the costs associated with

J:\60000\61201\Word Proc\Letters\Pastella\Pastella, Patricia - OCDWEP BGM05.doc purchase, construction and installation of a manufactured biofilter, including 30 percent contingency and design and administrative costs.

- We requested cost comparisons for VPSA versus PSA oxygen generation systems. The representative for M_2T Technologies has responded that the VPSA systems are about 20 percent more in capital cost, but utilize 40 percent more in energy cost. Because of this, PSA systems have not been built or installed for many years and are considered obsolete.

We have appreciated working with the County on development of the facilities planning for the Oak Orchard Wastewater Treatment Plant and look forward to the opportunity of working with the County on future projects.

Sincerely,

STEARNS & WHELER, LLC

Bruce G. Munn, P.E., BCEE
Service Group Manager – Wastewater

BGM/jas

Enclosures

cc: Jeanne Powers, OCDWEP (w/enc.)
Michael Lannon, OCDWEP (w/enc.)
Robert Bowker, Bowker & Associates, Inc. (w/enc.)

OAK ORCHARD WASTEWATER TREATMENT PLANT

FACILITIES PLAN ADDENDUM

ONONDAGA COUNTY, NEW YORK

Prepared for

ONONDAGA COUNTY DEPARTMENT OF
WATER ENVIRONMENT PROTECTION

Prepared by

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June 2010

Project No. 6120110

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

Page

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

This report has been prepared as an Addendum to the Oak Orchard WWTP Facilities Plan issued in April 2009 (April 2009 Facilities Plan) as requested by the Onondaga County Department of Water Environment Protection (the County). The April 2009 Facilities Plan was based on the approach that flow from the Gaskin Road Pump Station would be diverted to the Wetzel Road Wastewater Treatment Plant (WWTP). Therefore, flows and loadings from the Gaskin Road Pump Station were not included in the Oak Orchard or Davis Road Pump Station (DRPS) basis of design recommendations. Since the issuance of the April 2009 Facilities Plan, the County has decided that they will not divert the Gaskin Road Pump Station flow from the Oak Orchard WWTP to the Wetzel Road WWTP. As a result, the flows and loads developed in the April 2009 Facilities Plan for the Oak Orchard WWTP and the DRPS must be revised to account for the additional flow received from the Gaskin Road Pump Station at these facilities. The Gaskin Road Pump Station delivers approximately 0.8 million gallons per day (mgd) on an average basis and 3.5 mgd on a peak hourly basis.

This Facilities Plan Addendum documents the required revisions to the basis of design of the recommended improvements for the Oak Orchard WWTP and the DRPS as a result of the additional flows and loads from the Gaskin Road Pump Station

1.2 PROJECT SCOPE

The scope of this report includes the following tasks:

- Revise projected flows and loads to the Oak Orchard WWTP to include Gaskin Road Pump Station.
- Evaluate the impact of the Gaskin Road Pump Station flows on the proposed improvements to the Davis Road Pump Station and the Oak Orchard WWTP.

- Complete an assessment of the Siemens Water Technologies' Cannibal® Solids Reduction Process for the Oak Orchard WWTP.

- Revise the approach to odor control for the DRPS force main to include operation of both of the DRPS force mains in parallel at all times.

CHAPTER 2

WASTEWATER FLOWS AND LOADING PROJECTIONS

2.1 EXISTING WASTEWATER FLOWS AND LOADINGS

The existing influent plant data has been reviewed to determine the current flow and loading conditions for the Oak Orchard WWTP. The primary parameters of interest at this treatment plant are flow, BOD_5, TSS, TKN, ammonia, and phosphorus. The data was summarized over the period of record from January 2003 to December 2007 (Table 2-1). During that time, the average annual peak hourly flow was 7.3 mgd, maximum month flow was 8.8 mgd, and maximum peak hourly flow was 29.9 mgd.

2.2 DIVERSION OF FLOWS FROM GASKIN ROAD PUMP STATION

In the April 2009 Facilities Plan, it was anticipated that the Gaskin Road Pump Station flows and loads would be diverted from the Oak Orchard WWTP back to the Wetzel Road WWTP, which originally treated these flows. Onondaga County has decided that the Gaskin Road Pump Station flows will continue to be sent to the Oak Orchard WWTP, resulting in higher projected flows and loads for this facility.

The Gaskin Road Pump Station currently has an average daily flow of 0.8 mgd with a peak hourly flow of up to 3.5 mgd, and since wastewater load characteristics are not available for this station's flows, it is assumed the characteristics are the same as the Oak Orchard WWTP influent.

2.3 WASTEWATER FLOWS AND LOADING PROJECTIONS

The influent wastewater flows and loadings for the Oak Orchard WWTP have been projected for a 20-year planning period from 2006 to 2026. These projected flows and loads have been revised from those presented in the April 2009 Facilities Plan to include flows from the Gaskin Road Pump Station.

The projected maximum monthly and peak hourly flows for the 2026 buildout of the Oak Orchard WWTP are 12.1 mgd and 39.5 mgd, respectively. A summary of the revised Oak Orchard WWTP influent wastewater flow projections along with the basis of design flows presented in the April 2009 Facilities Plan is provided in Table 2-2.

The projected influent wastewater flows and loads for the proposed basis of design for this project are summarized in Table 2-3.

2.4 DAVIS ROAD PUMP STATION FLOW PROJECTIONS

Influent flows entering the Oak Orchard WWTP are conveyed from the Davis Road, Henry Clay, Caughdenoy Road, and Gatewood Pump Stations via the Davis Road/Clay-Cicero and Oak Orchard force main. With the addition of the Gaskin Road Pump Station flows, which are delivered to the Oak Orchard WWTP via the Henry Clay Pump Station, the peak hourly influent flows that must be accommodated by the DRPS have not changed, but the DRPS pumps must be capable of generating additional total dynamic head as a result of the additional Gaskin Road Pump Station flow in the force main system. Table 2-4 summarizes the revised peak hourly and peak day flows.

TABLE 2-1

CURRENT FLOW AND LOADING CONDITIONS
OAK ORCHARD WWTP

	UNITS	OAK ORCHARD WWTP EXISTING BASIS OF DESIGN	OAK ORCHARD WWTP CURRENT CONDITIONS[1]	GASKIN ROAD PUMP STATION CURRENT CONDITIONS
Flow				
Annual average	mgd	--	7.33	0.8
Maximum 30-day average	mgd	10.0	8.76	0.96
Peak day (24-hour average)	mgd	--	23.2	2.5
Peak hourly	mgd	24	29.9	3.5
5-Day Biochemical Oxygen Demand				
Annual average concentration	mg/L	--	213	213
Annual average mass loading	lb/day	--	13,000	1,600
Maximum 30-day average mass loading	lb/day	14,200	14,500	1,700
Total Suspended Solids (TSS)				
Annual average concentration	mg/L	--	143	143
Annual average mass loading	lb/day	--	8,740	1,050
Maximum 30-day average mass loading	lb/day	16,700	9,840	1,180
Total Kjeldahl Nitrogen (TKN)				
Annual average concentration	mg/L	--	26.0	26.0
Annual average mass loading	lb/day	--	1,590	190
Maximum 30-day average mass loading	lb/day	--	1,840	220
Total Ammonia-Nitrogen				
Annual average concentration	mg/L	--	20.8	20.8
Annual average mass loading	lb/day	--	1,270	150
Maximum 30-day average mass loading	lb/day	--	1,480	170
Total Phosphorus				
Annual average concentration	mg/L	--	4.3	4.3
Annual average mass loading	lb/day	--	260	30
Maximum 30-day average mass loading	lb/day	--	275	35

(1) Based on data from January 2003 through December 2007 inclusive of Gaskin Road Pump Station flows.

TABLE 2-2

SUMMARY OF WASTEWATER FLOW PROJECTIONS

	UNITS	CURRENT OAK ORCHARD INFLUENT FLOWS (2006)(1)	OAK ORCHARD INFLUENT FLOWS (2026)		
			BASIS OF DESIGN(2)	GASKIN ROAD PUMP STATION FLOW	PROPOSED BASIS OF DESIGN(1)
Flow					
Annual average	mgd	7.3	9.3	0.9	10.2
Maximum 30-day average	mgd	8.8	11.0	1.1	12.1
Peak day (24-hour average)	mgd	23.2	28.3	2.5	30.8
Peak hourly	mgd	29.9	36.0	3.5	39.5

(1) Influent flow with Gaskin Road Pump Station flow.
(2) From April 2009 Facilities Plan - Influent flow without Gaskin Road Pump Station flow.

TABLE 2-3

PROJECTED INFLUENT WASTEWATER FLOWS AND LOADS
OAK ORCHARD WWTP

	UNITS	PROPOSED BASIS OF DESIGN (2026)(1)
Flow		
Annual average	mgd	10.2
Maximum 30-day average	mgd	12.1
Peak day (24-hour average)	mgd	30.8
Peak hourly	mgd	39.5
5-Day Biochemical Oxygen Demand		
Annual average concentration	mg/L	222
Annual average mass loading	lb/day	18,780
Maximum 30-day average mass loading	lb/day	20,950
Total Suspended Solids (TSS)		
Annual average concentration	mg/L	183
Annual average mass loading	lb/day	15,480
Maximum 30-day average mass loading	lb/day	17,430
Total Kjeldahl Nitrogen (TKN)		
Annual average concentration	mg/L	27.9
Annual average mass loading	lb/day	2,360
Maximum 30-day average mass loading	lb/day	2,730
Total Ammonia-Nitrogen		
Annual average concentration	mg/L	20.7
Annual average mass loading	lb/day	1,750
Maximum 30-day average mass loading	lb/day	2,040
Total Phosphorus		
Annual average concentration	mg/L	5.3
Annual average mass loading	lb/day	450
Maximum 30-day average mass loading	lb/day	475

(1) Influent characteristics with Gaskin Road Pump Station flow.

TABLE 2-4

PROJECTED PEAK FLOWS

LOCATION	PEAK HOURLY (MGD)	PEAK DAY (MGD)
Henry Clay Pump Station(1)	7.12	5.35
Caughdenoy Road Pump Station	0.54	0.42
Gatewood Pump Station	0.33	0.25
DRPS – Basis of Design	31.5	24.8
Total Oak Orchard WWTP influent	39.5	30.8

(1) Includes Gaskin Road Pump Station flows.

CHAPTER 3

EFFLUENT LIMITS AND PERFORMANCE REQUIREMENTS

3.1 CURRENT SPDES LIMITS

The County is currently authorized to discharge treated wastewater effluent from the Oak Orchard WWTP to the Oneida River in accordance with the conditions of SPDES Discharge Permit No. NY0030317 administered by the New York State Department of Environmental Conservation (NYSDEC). This permit was last modified on January 1, 1998 and was last renewed on January 1, 2008. The current permit expires on December 31, 2012. A copy of the permit is provided in Appendix A. Effluent limits and performance requirements contained in the current State Pollutant Discharge Elimination System (SPDES) permit are summarized in Table 3-1.

3.2 FUTURE REQUIREMENTS

The County and Stearns & Wheler corresponded with NYSDEC representatives to identify anticipated revisions to SPDES permit effluent limits and performance requirements resulting from the expansion/upgrade of the Oak Orchard WWTP from 10 mgd in 2006 to 11 mgd in 2026. Based on these communications, NYSDEC issued a letter to the County dated July 17, 2008 with anticipated future SPDES permit discharge requirements (Appendix B) for the Oak Orchard WWTP, which are as follows:

1. There will be no change to the dissolved oxygen (D.O.) limit of 5 mg/L.

2. The mass loading of ultimate oxygen demand (UOD) will be held constant at 4,289 lbs/day.

3. The phosphorus limit of 1 mg/L will remain the same, as it is generated from a Great Lakes requirement and it is concentration based.

4. BOD_5 and TSS limits will be kept at secondary levels, increasing the lbs/day based on the increase to 11 mgd.

5. The current ammonia permit level of 400 lbs/day will be retained for the "summer" months. A "winter" limit is not necessary.

6. The total residual chlorine (TRC) at 11 mgd will be 18.8 lbs/day, equating to 0.2 mg/L at buildout. The 0.35 mg/L TRC limit will be retained for flows less than the permit flows.

7. All other permit limits are to remain the same.

It is anticipated that the NYSDEC will develop proposed limits for the revised future design flow of 12.1 mgd (up from 11 mgd in the April 2009 Facilities Plan) presented in this report on the same basis as described above. It is recommended that NYSDEC be contacted to verify future limits for the proposed capacity increase. Table 3-2 provides a summary of the anticipated future SPDES permit effluent discharge limits for the Oak Orchard WWTP.

A. **Filtration Avoidance.** Based on the future effluent discharge requirements defined above for the Oak Orchard WWTP, it is anticipated that a filtration treatment process will not be required. Filtration is not recommended unless the required CBOD concentrations are below 15 mg/L. Thus, on the basis of this anticipated performance, filtration facilities do not appear to be required for the projected SPDES permit limits if complete nitrification and satisfactory secondary settling can be provided. The proposed treatment improvements must therefore provide for complete nitrification and improved secondary settling.

Figure 3-1 provides a graphical depiction of the UOD to CBOD to TKN relationship and the need for filtration.

TABLE 3-1

CURRENT SPDES PERMIT EFFLUENT LIMITS AND PERFORMANCE REQUIREMENTS

PARAMETER	AVERAGING PERIOD	CURRENT PERMIT			
		JUNE 16 – OCTOBER 31		NOVEMBER 1 - JUNE 15	
Flow	30-day average	10 mgd		10 mgd	
$CBOD_5$	30-day average			25 mg/L	2,085 lb/day
$CBOD_5$	7-day average			40 mg/L	3,336 lb/day
TSS	30-day average	30 mg/L	2,500 lb/day	30 mg/L	2,500 lb/day
TSS	7-day average	45 mg/L	3,750 lb/day	45 mg/L	3,750 lb/day
UOD	30-day average		4,289 lb/day		
Ammonia (as NH_3)	30-day average		400 lb/day		
Dissolved oxygen	Daily minimum	5.0 mg/L			
Total phosphorus	30-day average	1.0 mg/L		1.0 mg/L	
Settleable solids	Daily maximum	0.3 ml/L		0.3 ml/L	
pH	Range	6.0 to 9.0 S.U.		6.0 to 9.0 S.U.	
Fecal coliform[(1)]	30-day geometric mean	200/100 ml		200/100 ml	
Fecal coliform[(1)]	7-day geometric mean	400/100 ml		400/100 ml	
Chlorine residual	Daily maximum	0.35 mg/L	18.4 lb/day	0.35 mg/L	18.4 lb/day

(1) Fecal coliform limits are in effect from May 15-October 15.

<u>TABLE 3-2</u>

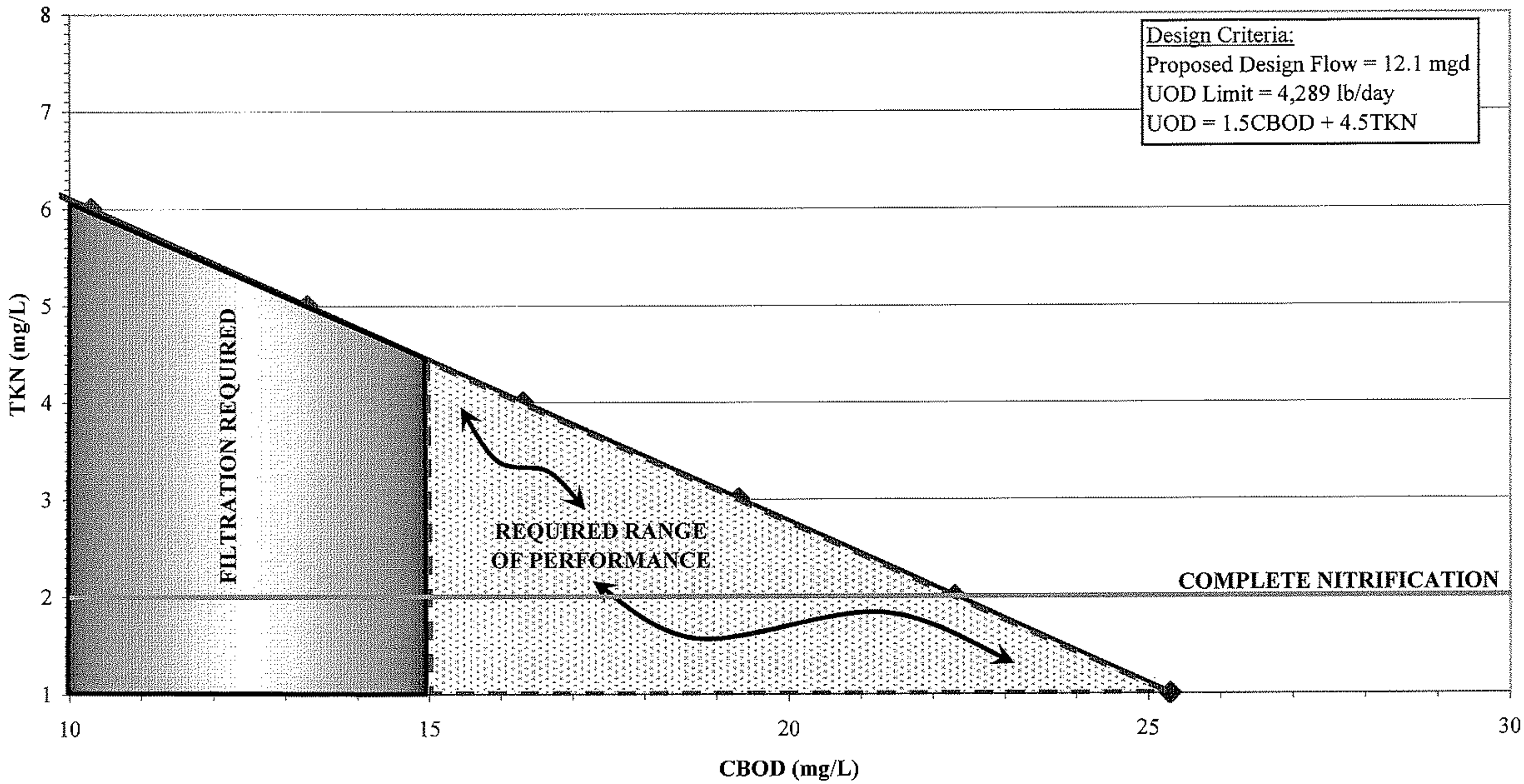
ANTICIPATED SPDES PERMIT EFFLUENT DISCHARGE LIMITS

PARAMETER	AVERAGING PERIOD	ANTICIPATED NYSDEC PERMIT LIMITS			
		JUNE 16 – OCTOBER 31		NOVEMBER 1 - JUNE 15	
Flow	30-day average	12.1 mgd		12.1 mgd	
$CBOD_5$	30-day average	25 mg/L	2,294 lb/day	25 mg/L	2,294 lb/day
$CBOD_5$	7-day average	40 mg/L	3,670 lb/day	40 mg/L	3,670 lb/day
TSS	30-day average	30 mg/L	2,752 lb/day	30 mg/L	2,752 lb/day
TSS	7-day average	45 mg/L	4,128 lb/day	45 mg/L	4,128 lb/day
UOD	30-day average		4,289 lb/day		
Ammonia (as NH_3)	30-day average		400 lb/day		
Dissolved oxygen	Daily minimum	5.0 mg/L			
Total phosphorus	30-day average	1.0 mg/L		1.0 mg/L	
Settleable solids	Daily maximum	0.3 ml/L		0.3 ml/L	
pH	Range	6.5 to 8.5 S.U.		6.5 to 8.5 S.U.	
Fecal coliform(1)	30-day geometric mean	200/100 ml		200/100 ml	
Fecal coliform(1)	7-day geometric mean	400/100 ml		400/100 ml	
Chlorine residual	Daily maximum	0.35 mg/L(2)	18.8 lb/day	0.35 mg/L(2)	18.8 lb/day

(1) Fecal coliform limits are in effect from May 15-October 15.
(2) Varies from maximum TRC concentration of 0.35 mg/L at current flows to a maximum of 18.8 lb/day (0.2 mg/L) at design flows.

FIGURE 3-1

UOD/CBOD/TKN RELATIONSHIP
WASTEWATER FACILITIES PLANNING
OAK ORCHARD WWTP AND DAVIS ROAD PUMP STATION
ONONDAGA COUNTY, NEW YORK



CHAPTER 4

DAVIS ROAD PUMP STATION IMPROVEMENTS
REVISED TO INCLUDE IMPACT OF GASKIN ROAD PUMP STATION FLOWS
(TO HENRY CLAY PUMP STATION)

Based on the projected peak hourly flow requirements for the DRPS developed in Chapter 2 of this report, the proposed improvements recommended in the April 2009 Facilities Plan must be revised to accommodate the newly developed projected peak hourly influent flows up to 31.5 mgd at the DRPS and a total peak hourly flow of 39.5 mgd in the force main system, which includes flows from three intermediate pump stations tied into the DRPS force main (including flows from Gaskin Road Pump Station via Henry Clay Pump Station). The following sections describe the evaluation of revised recommendations for the DRPS and associated force mains.

4.1 DRPS AND FORCE MAIN SYSTEM HYDRAULICS

The April 2009 Facilities Plan included recommendations for improvements to the DRPS and to the force mains at the DRPS and approaching the Oak Orchard WWTP. These recommendations included:

1. Upgrading the DRPS pumping system by replacing the complete rotating assembly for each of the four existing pumps to include new 470 HP motors of increased horsepower and new impellers, designed to provide increased pumping capacity to meet the peak hourly flow requirement of 31.5 mgd; and by upgrading the pump controls, variable frequency drives, and associated electrical circuitry, electrical service, emergency generator, and transfer switch.

2. Constructing approximately 500 feet of new 30-inch diameter force main in the yard of the DRPS site, parallel to the existing force main.

3. Constructing approximately 6,000 feet of new 36-inch diameter force main in parallel with the existing Oak Orchard force main.

The recommendations were evaluated under the new peak hourly flow requirement of the DPRS force main. An analysis of the force main system hydraulics was completed for the total future peak hourly influent flow of 39.5 mgd to the Oak Orchard WWTP. (The total peak hourly flow of 39.5 mgd includes 31.5 mgd from DRPS and a total of 8.0 mgd from three intermediate pump stations tied into the DRPS force main, including flows from Gaskin Road Pump Station via Henry Clay Pump Station). Flows from Henry Clay (and subsequently Gaskin Road Pump Station flows) are introduced into the parallel Davis Road/Clay-Cicero force mains at the far end of the force main system with respect to DRPS. Figure 4-1 shows the relationship between pumped flow from DRPS and total dynamic head in the force main system.

4.2 DEVELOPMENT OF DRPS-4 UPGRADE ALTERNATIVE

In reviewing this design pumping capacity with the manufacturer of the existing pumps (ITT Flygt), it was determined that the existing pumps could be upgraded to meet the proposed pumping conditions by replacing the existing motors and impellers with larger motors and impellers. This will simplify construction efforts by allowing the existing pump casings and floor-mounted discharge elbow assemblies to be reused, and avoiding major reconstruction to the wet well floor layout, vertical discharge piping, and common discharge header.

The summary of the preliminary basis of design for Alternative DRPS-4 is presented in Table 4-1. Estimated project cost for this alternative is $11.8 million, with an estimated 20-year present-worth cost of $13.8 million (summarized in Table 4-2) based on electrical consumption costs of $0.17 per kilowatt-hour.

Figure 4-1

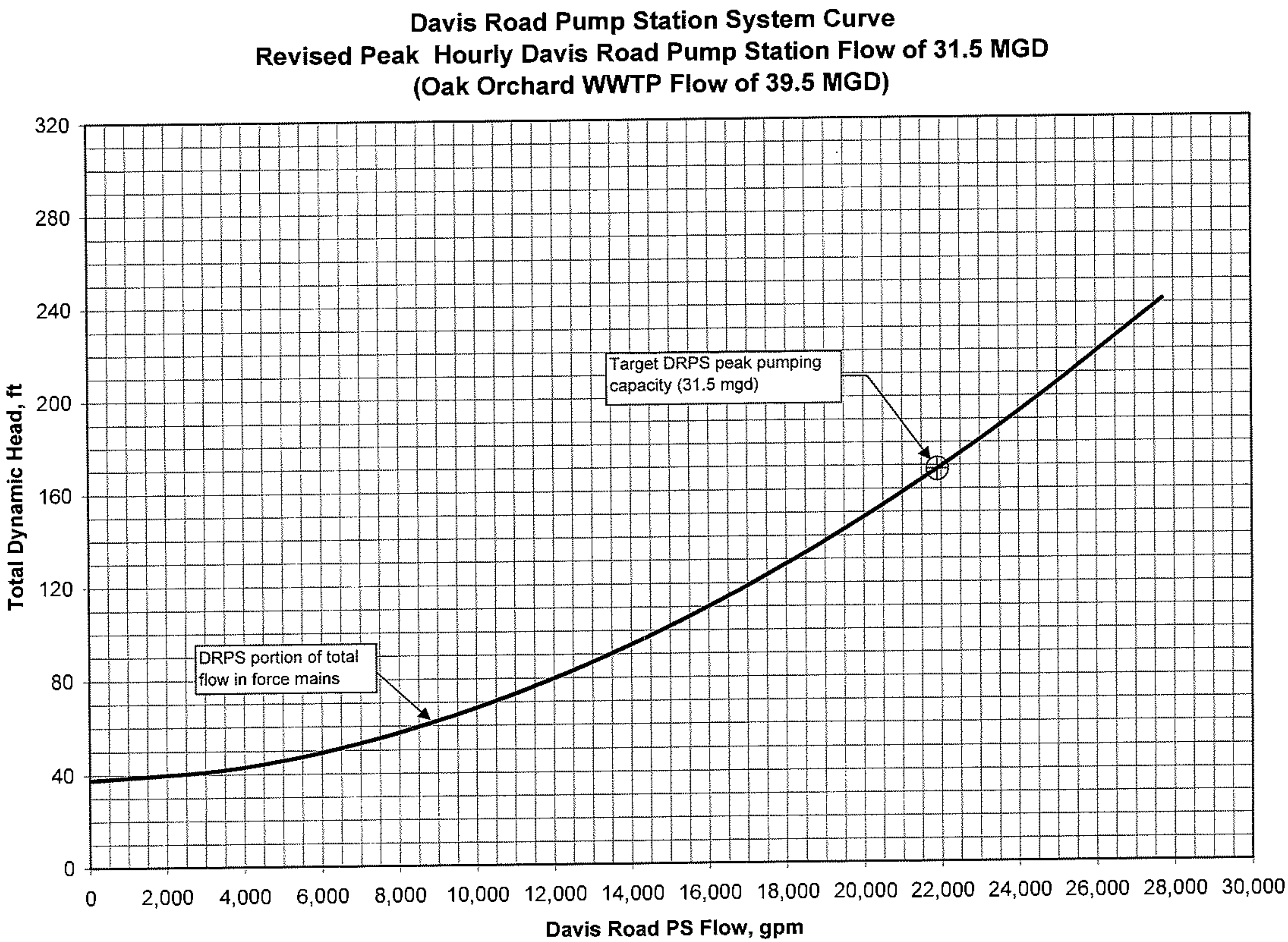

Davis Road Pump Station System Curve
Revised Peak Hourly Davis Road Pump Station Flow of 31.5 MGD
(Oak Orchard WWTP Flow of 39.5 MGD)
Total Dynamic Head, ft
320
280
240
200
160
120
80
40
0
0
2,000
4,000
6,000
8,000
10,000
12,000
14,000
16,000
18,000
20,000
22,000
24,000
26,000
28,000
30,000
Davis Road PS Flow, gpm
Target DRPS peak pumping capacity (31.5 mgd)
DRPS portion of total flow in force mains

TABLE 4-1

BASIS OF DESIGN FOR HANDLING PEAK FLOWS AT THE DAVIS ROAD PUMP STATION
Modify Oak Orchard and DRPS Force Mains and Upgrade DRPS Pumping Equipment

UNIT PROCESS	DESIGN CRITERIA	VALUE
Raw Sewage Pumps	Type Number of units Upgraded pumping capacity, each Upgraded motor horsepower Upgraded impeller diameter	Upgrade existing wet pit submersible pumps 4 7,300 gpm @ 170 feet TDH 470 560 mm
Force Main Modifications:		
• Existing DRPS 24-inch force main only (190 LF) • Add parallel 30-inch force main	• Flow velocity at design peak (31.5 mgd), fps • Flow velocity at design peak (31.5 mgd), fps	15 7
• Existing DRPS 30-inch force main only (320 LF) • Add parallel 30-inch force main	• Flow velocity at design peak (31.5 mgd), fps • Flow velocity at design peak (31.5 mgd), fps	10 5
• Existing 30-inch Oak Orchard force main only (6,000 LF) • Add parallel 36-inch force main	• Flow velocity at design peak (36.0 mgd), fps • Flow velocity at design peak (36.0 mgd), fps	11 4 to 5
Intermediate Pump Station Upgrades:		
Henry Clay Pump Station	Type Number of units Total design pumping capacity Upgraded motor horsepower	TBD TBD 4,590 gpm @ 170 feet TDH TBD
Gatewood Pump Station	Type Number of units Total design pumping capacity Upgraded motor horsepower	TBD TBD 230 gpm @ 170 feet TDH TBD
Caughdenoy Road Pump Station	Type Number of units Total design pumping capacity Upgraded motor horsepower	TBD TBD 375 gpm @ 170 feet TDH TBD

TABLE 4-2

SUMMARY OF ESTIMATED COSTS
DAVIS ROAD PUMP STATION UPGRADE ALTERNATIVES

DESCRIPTION	COSTS
New 36-inch force main (parallel with 30-inch Oak Orchard force main)	$3,370,000
New 24-inch force mains (parallel with force mains at DRPS)	$260,000
Pump upgrades (four new pumps, VFDs, and controls)	$1,800,000
Miscellaneous upgrades (flow meter, chemical piping, and valves)	$90,000
Upgrades for other pump stations	$200,000
Subtotal Capital Costs	**$5,700,000**
Site work	$400,000
Electrical (C/W for pumps and EQPS only):	
• C/W for pump upgrades, EQPS, etc.	$180,000
• Emergency generator, service, and power distribution upgrades	$600,000
Instrumentation	--
Subtotal Capital Costs	**$6,900,000**
Contingency (30%)	$2,100,000
Total Construction Costs	**$9,000,000**
Engineering/Legal/Administrative (20%)	$1,800,000
Total Design and Construction Services (2009)	**$10,800,000**
Inflation to Construction Midpoint (2012)(1)	$1,000,000
Project Cost Subtotal	**$11,800,000**
Maintenance Costs	$22,000
Additional Labor Costs	$20,000
Chemical Costs	--
Power Requirements(2)	$79,000
Annual O&M Cost (2009 Dollars)	**$121,000**
20-Year Present-Worth O&M Cost(3)	**$2,000,000**
Total 20-Year Present-Worth Cost (2012)	**$13,800,000**

(1) Based on a yearly inflation rate of 3 percent.
(2) Includes equivalent costs for influent pumping for both DRPS upgrade alternatives. Does not include O&M costs for generator upgrade.
(3) Based on an interest rate of 5 percent and an inflation rate of 3 percent.

CHAPTER 5

OAK ORCHARD WASTEWATER TREATMENT ALTERNATIVES

The current Oak Orchard WWTP was designed to provide wastewater treatment for a maximum monthly flow of 10 mgd and a peak hourly flow of 24 mgd. Based on the revised future flow and loading projections for the treatment plant, as discussed in Chapter 4, the facility must be capable of treating 12.1 mgd and 39.5 mgd on a maximum monthly and peak hourly basis, respectively. These flows represent a moderate increase over those presented in the April 2009 Facilities Plan. To achieve this treatment capacity, some of the proposed improvements discussed in the April 2009 Facilities Plan for the Oak Orchard WWTP must be modified. The following sections in this chapter provide discussion of the modified improvements to address the increased basis of design flows and loads at the plant.

5.1 PRELIMINARY TREATMENT IMPROVEMENTS

Based on the revised flows and loads for the Oak Orchard WWTP, the recommended plan from the April 2009 Facilities Plan requires minor modification. The influent screens proposed are still adequate for the revised flows, but will result in a slightly increased headloss across the screens at the new peak hourly flow. For the grit removal system, the proposed Eutek Headcell system has been enlarged to provide an additional grit settling tray in each headcell unit to handle the peak flow of 39.5 mgd.

As previously recommended, the new headworks equipment would be housed in a new Influent Building due to the condition of the existing Grit and Screenings Building.

A summary of the revised preliminary basis of design for the new screenings and grit removal facilities is presented as Table 5-1. The capital costs associated with these improvements are estimated at $9,400,000 with an associated annual O&M cost of approximately $50,000. The resulting projected 20-year present-worth cost for the new screenings and grit removal facilities is estimated at $10,200,000.

5.2 PRIMARY TREATMENT IMPROVEMENTS

For the primary treatment system, the proposed improvements to upgrade the primary clarifiers are unchanged by the increased flows and loads from the Gaskin Road Pump Station, as these units are limited to 24 mgd treatment capacity. The proposed high flow primary fine screen system, however, must be expanded to 15.5 mgd capacity to accommodate the new peak hourly design flow. To accomplish this, the two fine screen units previously proposed would be enlarged from 96-inch to 120-inch units, and the lift station upstream of the screens modified to provide the additional flow required.

A summary of the preliminary basis of design for the primary treatment modifications is provided in Table 5-2. The costs associated with these improvements are provided later in this chapter along with the biological treatment process alternatives.

5.3 WASTEWATER TREATMENT PROCESS ALTERNATIVES

The proposed wastewater treatment process recommendation of the April 2009 Facilities Plan included the upgrade and expansion of the existing high purity oxygen (HPO) treatment system with the conversion of the existing secondary clarifiers to HPO aeration tanks, and construction of three new 130-foot diameter circular secondary clarifiers.

Based on the addition of the Gaskin Road Pump Station flows to the future flow and loading projections for the Oak Orchard WWTP, the proposed upgrade alternatives from the April 2009 Facilities Plan are no longer sufficient for the revised basis of design. As a result, two additional wastewater treatment process alternatives have been developed and evaluated:

- Alternative WW-A1 – Single-Stage High Purity Oxygen Activated Sludge
- Alternative WW-A2 – High Purity Oxygen Activated Sludge followed by Integrated Fixed-Film Activated Sludge

For each alternative, the objective was to maximize the reuse of existing facilities, and where needed, construct new process tankage to provide the required additional treatment capacity to achieve the proposed basis of design.

A detailed discussion of each of the selected wastewater treatment alternatives is provided below.

A. **Alternative WW-A1 - Single-Stage High Purity Oxygen Activated Sludge.** The first of the wastewater treatment process alternatives recommended for detailed evaluation is an expansion of the HPO activated sludge system recommended in the April 2009 Facilities Plan. In addition to upgrading the existing HPO aeration tanks and converting the existing secondary clarifiers into HPO aeration tanks, two new aeration tanks would be constructed at the west end of the existing secondary clarifiers. This additional process tankage would be provided to increase the solids retention time of the system to provide sufficient nitrification for the added flows and loads associated with the wastewater contribution from the Gaskin Road Pump Station. For this alternative, the two existing secondary clarifiers (each with a total tank dimension of 140 feet long by 60 feet wide) would each be partitioned into three equal stages of 60 feet long by 46 feet wide with a pair of surface aerators in each stage. The two new aeration tanks would each be 60 feet long by 46 feet wide with surface aerators.

Under this process configuration, primary effluent would first enter the existing HPO aeration tanks for treatment, followed by the existing secondary flocculation tanks, which would be converted into uncovered aeration tanks. Coarse bubble diffused aeration would be provided in these tanks for carbon dioxide stripping and pH recovery resulting from the pH depression caused by the first set of HPO aeration tanks. From there, the HPO mixed liquor would enter the second set of HPO aeration tanks in the front end of the converted secondary clarifiers. The first two stages of treatment in the converted clarifiers would consist of closed reactors aerated with HPO, while the last stage would be uncovered and aerated with conventional surface aerators. The new aeration tanks at the end of the converted clarifiers would also be uncovered and provided with surface aeration. This configuration is recommended to provide further pH recovery to improve the nitrification rate in these stages. A detail of the biological process configuration for the converted HPO aeration tanks and the new aeration tanks is provided in Figure 5-1.

The new mechanical aerators proposed for this application are 20 to 30 percent more efficient than the existing units. The existing on-site oxygen generation equipment, located in the Oxygenation Building, would be replaced by a new vacuum pressure swing adsorption (VPSA) system as part of this alternative. The new VPSA systems are approximately 40 percent more efficient than the existing pressure swing adsorption system. For the diffused aeration system in the existing secondary flocculation tanks, two small aeration blowers, one duty and one standby, would be provided in sound-attenuated, weatherproof enclosures.

For secondary clarification, the three 130-foot diameter circular clarifiers proposed in the April 2009 Facilities Plan would be enlarged to 136-foot diameter units to accommodate the new peak hourly plant flow.

A summary of the preliminary basis of design for the single-stage HPO activated sludge alternative is presented in Table 5-3. A layout of required treatment facilities on the Oak Orchard site is included as Figure 5-2. The capital costs associated with these improvements are estimated at $60,000,000 with an associated annual O&M cost of approximately $650,000. Project costs for this alternative are provided in Table 5-4 with an estimated 20-year present-worth cost of $70,700,000. A proposed equipment list for this alternative is provided in Appendix C.

B. **Alternative WW-A2 – High Purity Oxygen Activated Sludge Followed by Integrated Fixed-Film Activated Sludge**. The second treatment alternative evaluated in detail for the Oak Orchard WWTP was HPO activated sludge treatment for BOD removal followed by integrated fixed-film activated sludge (IFAS) treatment for ammonia removal. Under this alternative, the existing HPO aeration process would be provided with new aerators and a new VPSA oxygen generation system, both providing improved efficiency over the existing equipment. Downstream of the HPO aeration tanks, the existing secondary clarifiers would be converted into IFAS aeration tanks containing medium bubble diffused aeration with the suspended-type IFAS media system. The general tank configuration would remain unchanged, and each 140-foot long by 20-foot wide clarifier would be partitioned into three IFAS zones divided by sieve assemblies, which are used to keep the IFAS media evenly distributed within the IFAS aeration tanks. The anticipated zone distribution for each of the six tanks is as follows:

- Zone 1 – 70 feet long by 20 feet wide
- Zone 2 - 35 feet long by 20 feet wide
- Zone 3 - 35 feet long by 20 feet wide

A detail of the biological process configuration for the converted IFAS aeration tanks is provided in Figure 5-3.

Effluent from the primary treatment process would enter the HPO aeration tanks for treatment to remove BOD. The flow would then be conveyed via existing channels directly to the IFAS aeration tanks for ammonia removal, passing through all three IFAS zones in series. The nitrified effluent would then be conveyed downstream to the new secondary clarifiers for solids separation followed by disinfection and discharge through plant outfall.

The process air for the IFAS aeration tanks would be provided by centrifugal blowers housed in the existing Oxygen Generation Building along with the new VPSA oxygen generation system.

For secondary clarification, three 136-foot diameter circular clarifiers would be required to accommodate the peak hourly flow of 39.5 mgd.

A summary of the preliminary basis of design for this treatment alternative is presented in Table 5-5. A layout of the required treatment facilities on the Oak Orchard site is included as Figure 5-4. The project cost associated with these improvements is estimated at $58,300,000 with an associated annual O&M cost of approximately $690,000. The anticipated O&M costs for this alternative are approximately $40,000 per year higher than those for Alternative WW-A1. Project costs for this alternative are provided in Table 5-6 with an estimated 20-year present-worth cost of $69,700,000. A proposed equipment list for this alternative is provided in Appendix C.

5.4 WASTEWATER DISINFECTION

The recommended UV disinfection system proposed in the April 2009 Facilities Plan was developed to accommodate 36 mgd. UV disinfection remains the recommended alternative for the revised peak hourly plant flow of 39.5 mgd, but the system must be expanded to provide adequate treatment. To accommodate the additional flow, the UV system requires an additional module of UV lamps for each bank which will result in slightly wider UV channels to house the units. The preliminary basis of design for the UV disinfection system is provided in Table 5-7.

The UV disinfection system has an estimated annual O&M cost of $40,000. The majority of these costs are for the electrical consumption of the system. The 20-year present-worth cost for the UV disinfection alternative was estimated at $5,800,000.

5.5 WASTEWATER TREATMENT PROCESS ALTERNATIVES COST SUMMARY

For each alternative evaluated in this chapter, capital costs, O&M costs, and 20-year present worth costs were developed. The capital costs were developed based on material cost estimates and equipment vendor cost proposals. Each capital cost estimate was developed using current costs, and then projected forward three years to an anticipated midpoint of construction by adding an inflation factor of 3 percent per year for a total of 9 percent. In addition, a 30 percent contingency cost was included for each alternative.

O&M costs for each alternative are based on anticipated labor, maintenance, electrical, and chemical costs for the proposed equipment. These costs only include the equipment evaluated in this report, and do not include O&M costs associated with existing buildings and equipment not selected for replacement. For each alternative, the cost for one additional plant staff member is included. The maintenance costs were estimated at 2 percent of the equipment purchase cost per year, and the existing electrical rate of $0.10 per kilowatt-hour was used for the electrical consumption costs at the Oak Orchard WWTP site. Where possible, existing chemical costs for the Oak Orchard WWTP were used. If these costs were not available, estimated costs were utilized.

The 20-year present-worth cost estimates were developed using capital and O&M costs and were based on an interest rate of 5 percent along with an inflation rate of 3 percent, resulting in an effective interest rate of 1.94 percent.

Based on the costs presented in Tables 5-4 and 5-6, the least cost wastewater treatment alternative is WW-A2 (HPO followed by IFAS treatment) with a total project cost of $58,300,000. and a corresponding 20-year present-worth cost of $69,700,000.

TABLE 5-1

BASIS OF DESIGN
INFLUENT PRELIMINARY TREATMENT FACILITIES

UNIT PROCESS/EQUIPMENT	DESIGN CRITERIA	VALUE
Influent screening (new)	Type	Mechanically cleaned climber
	Number of units	2
	Channel width, inches	48
	Channel depth, feet	6
	Influent flow capacity, mgd per unit	20
	Bar spacing, inches	0.5
Grit Removal (New)		
Grit concentrator units	Type	Flow-induced vortex
	Number of units	2
	Tray diameter, feet	12
	Number of trays per unit	8
	Total settling surface per unit, square feet	904
	Maximum side water depth, feet	18
	Maximum flow capacity per unit, mgd	20
	Removal efficiency at design peak hourly flow	95% for 125 microns and larger
	Removal efficiency at design average flow	95% for 75 microns and larger
	Total effluent water demand	40 gpm at 50 psi
Grit washing units	Type	Dynamic grit separator
	Number of units	2
	Unit diameter, inches	32
	Nominal flow capacity per unit, gpm	300
	Removal efficiency at design flow capacity	95% for 50 microns and larger
	Total effluent water demand	60 gpm at 50 psi continuous, plus 50 gpm at 50 psi for 1 to 2 minutes every 2 to 4 hours
Grit dewatering unit	Type	Dewatering escalator
	Number of units	1
	Clarifier dimensions, inches	72 x 72
	Escalator belt width, inches	18
	Dewatered grit capacity, cubic yard/hour	3

TABLE 5-1 (continued)

UNIT PROCESS/EQUIPMENT	DESIGN CRITERIA	VALUE
Grit dewatering unit (continued)	Dewatered grit solids concentration Dewatered grit organics concentration Total effluent water demand	60% minimum 20% maximum 15 gpm at 50 psi
Grit pumps	Type Number of units Motor horsepower Pumping capacity, gpm	Vertical cantilever or horizontal dry pit 2 15 300
Flow Monitoring (New)		
Flow element	Type Number of units Throat width, inches Maximum flow capacity, mgd	Parshall flume 1 48 44
Level sensor	Type Number of units	Ultrasonic 1
Effluent water system (new) (for grit removal system demand)	Number of pumps Pump capacity Total capacity	3 3 - 125 gpm @ 185 feet TDH 250 gpm

TABLE 5-2

BASIS OF DESIGN
PRIMARY TREATMENT PROCESSES

DESIGN CRITERIA	VALUE
No. of units	6
Type	Rectangular
Mechanism	Chain-and-flight collectors
Dimensions (each)	
Length (feet)	120
Width (feet)	20
Side water depth (feet)	11
Total surface area (ft^2)	14,400
Peak surface overflow rate (gpd/ft^2)	1,042
High flow primary fine screens	
No. of units	2
Type	Mechanical rotating drum
Screen opening (inches)	0.06
Influent pumps	
No. of units	3
Total capacity (gpm)	11,000

TABLE 5-3

BASIS OF DESIGN
ALTERNATIVE WW-A1 – HPO ACTIVATED SLUDGE EXPANSION

UNIT PROCESS/EQUIPMENT	DESIGN CRITERIA	VALUE
HPO aeration tanks (existing)	Existing Aeration Tanks	
	No. of units	2
	Dimensions (each)	
	Length (feet)	108
	Width (feet)	72
	Side water depth (feet)	9
	Stages per tank	3
	Stage dimensions (each)	
	Length (feet)	72
	Width (feet)	36
	Volume (gallons)	1,050,000
	Aerators	
	Type	Surface aerators
	No. of units	12
	Capacity (HP)	20
	Converted Aeration Tanks (Existing Secondary Flocculation Tanks)	
	No. of units	4
	Dimensions (each)	
	Length (feet)	48
	Width (feet)	13
	Side water depth (feet)	11.5
	Volume (gallons)	215,000
	Aeration	
	Type	Diffused coarse bubble
	No. of units	2 (1 duty, 1 standby)
	Capacity, each (HP)	50
	Converted Aeration Tanks (Existing Secondary Clarifiers)	
	No. of units	2
	Dimensions (each)	
	Length (feet)	140
	Width (feet)	60
	Side water depth (feet)	10
	Stages per tank	4

TABLE 5-3 (continued)

UNIT PROCESS/EQUIPMENT	DESIGN CRITERIA	VALUE
HPO aeration tanks (existing) (continued)	Converted Aeration Tanks (Existing Secondary Clarifiers) (continued)	
	Stage dimensions (each)	
	Length (feet)	60
	Width (feet)	46
	Volume (gallons)	1,260,000
	Aerators	
	Type	Surface aerators
	No. of units	12
	Capacity, each (HP)	20
	New Aeration Tanks (at end of Existing Secondary Clarifiers)	
	No. of units	2
	Dimensions (each)	
	Length (feet)	60
	Width (feet)	46
	Side water depth (feet)	10
	Volume	430,000
	Aerators	
	Type	Surface aerators
	No. of units	4
	Capacity, each (HP)	20
	Total volume (gallons)	2,960,000
	Combined HRT at maximum month flow (hours)	5.9
	Design organic loading rate (lbs BOD/1,000 ft^3)	42
	Design MLSS (mg/L)	4,000
	Design SRT (days)	11
	Aeration system	
	Type	High purity oxygen
	Oxygen generation system	
	Type	Vacuum pressure swing adsorption
	No. of adsorption vessels	2
	Capacity (tons/day O_2)	14.0
Secondary clarification (new)	No. of units	3
	Type	Circular
	Dimensions (each)	
	Diameter (feet)	136
	Side water depth (feet)	14
	Total surface area (ft^2)	43,580
	Peak surface overflow rate (gpd/ft^3)	900

TABLE 5-4

OAK ORCHARD WASTEWATER TREATMENT
ALTERNATIVE WW-A1
ENGINEER'S ESTIMATE OF PROBABLE COSTS

DESCRIPTION	COSTS
Primary clarification	$3,220,000
HPO aeration tanks	7,500,000
IFAS aeration tanks	--
Oxygen generation system and building	3,800,000
Secondary clarification	12,720,000
New lagoon bypass pipeline	610,000
Subtotal Capital Costs	**$27,850,000**
Site work	1,200,000
Electrical	4,200,000
Instrumentation	1,400,000
HVAC	700,000
Subtotal Capital Costs Contingency (30%)	**$35,400,000** 10,600,000
Total Construction Costs Engineering/Legal/Administrative	**$46,000,000** 9,000,000
Total Design and Construction Services (2009) Inflation to construction midpoint (2012) (1)	**$55,000,000** 5,000,000
Project Cost Subtotal Maintenance Costs Additional Labor Costs Chemical Costs Power Requirements	**$60,000,000** 138,000 62,000 -- 453,000
Annual O&M Cost (2009 Dollars)	**$653,000**
20-Year Present-Worth O&M Cost(2)	**$10,740,000**
Total 20-Year Present-Worth Cost (2012)	**$70,700,000**

(1) Based on a yearly inflation rate of 3 percent.
(2) Based on an interest rate of 5 percent and an inflation rate of 3 percent.

TABLE 5-5

BASIS OF DESIGN
ALTERNATIVE WW-A2 – HPO ACTIVATED SLUDGE FOLLOWED BY IFAS

UNIT PROCESS/EQUIPMENT	DESIGN CRITERIA	VALUE
HPO aeration tanks (existing)	Existing Aeration Tanks	
	No. of units	2
	Dimensions (each)	
	Length (feet)	108
	Width (feet)	72
	Side water depth (feet)	9
	Stages per tank	3
	Stage dimensions (each)	
	Length (feet)	72
	Width (feet)	36
	Volume (gallons)	1,050,000
	Aerators	
	Type	Surface aerators
	No. of units	12
	Capacity (HP)	20
	Aeration system type	High purity oxygen
	Oxygen generation system	
	Type	Vacuum pressure swing adsorption
	No. of adsorption units	2
	Capacity (tons/day O_2)	10
IFAS aeration tanks (modified) (converted secondary clarifiers)	No. of units	6
	Reactors stages per unit	3
	Reactor stage dimensions	
	Length (feet)	1 @ 70, 2 @ 35
	Width (feet)	20
	Side water depth (feet)	10
	Total volume (gallons)	1,250,000
	Total media volume (ft^3)	62,200
	Reactor media fill (%)	50
	Design MLSS (mg/L)	3,500
	Aeration system type	Diffused medium bubble

TABLE 5-5 (continued)

UNIT PROCESS/EQUIPMENT	DESIGN CRITERIA	VALUE
IFAS aeration tanks (modified) (converted secondary clarifiers) (continued)	Process air blowers	
	No. of units	3 (1 standby)
	Blower type	Centrifugal
	Blower size (HP)	200
	Capacity (scfm)	5,700
	Total capacity (scfm)	11,400
Secondary clarification (new)	No. of units	3
	Type	Circular
	Dimensions (each)	
	Diameter (feet)	136
	Side water depth (feet)	14
	Total surface area (ft^2)	43,580
	Peak surface overflow rate (gpd/ft^2)	900

TABLE 5-6

OAK ORCHARD WASTEWATER TREATMENT
ALTERNATIVE WW-A2
ENGINEER'S ESTIMATE OF PROBABLE COSTS

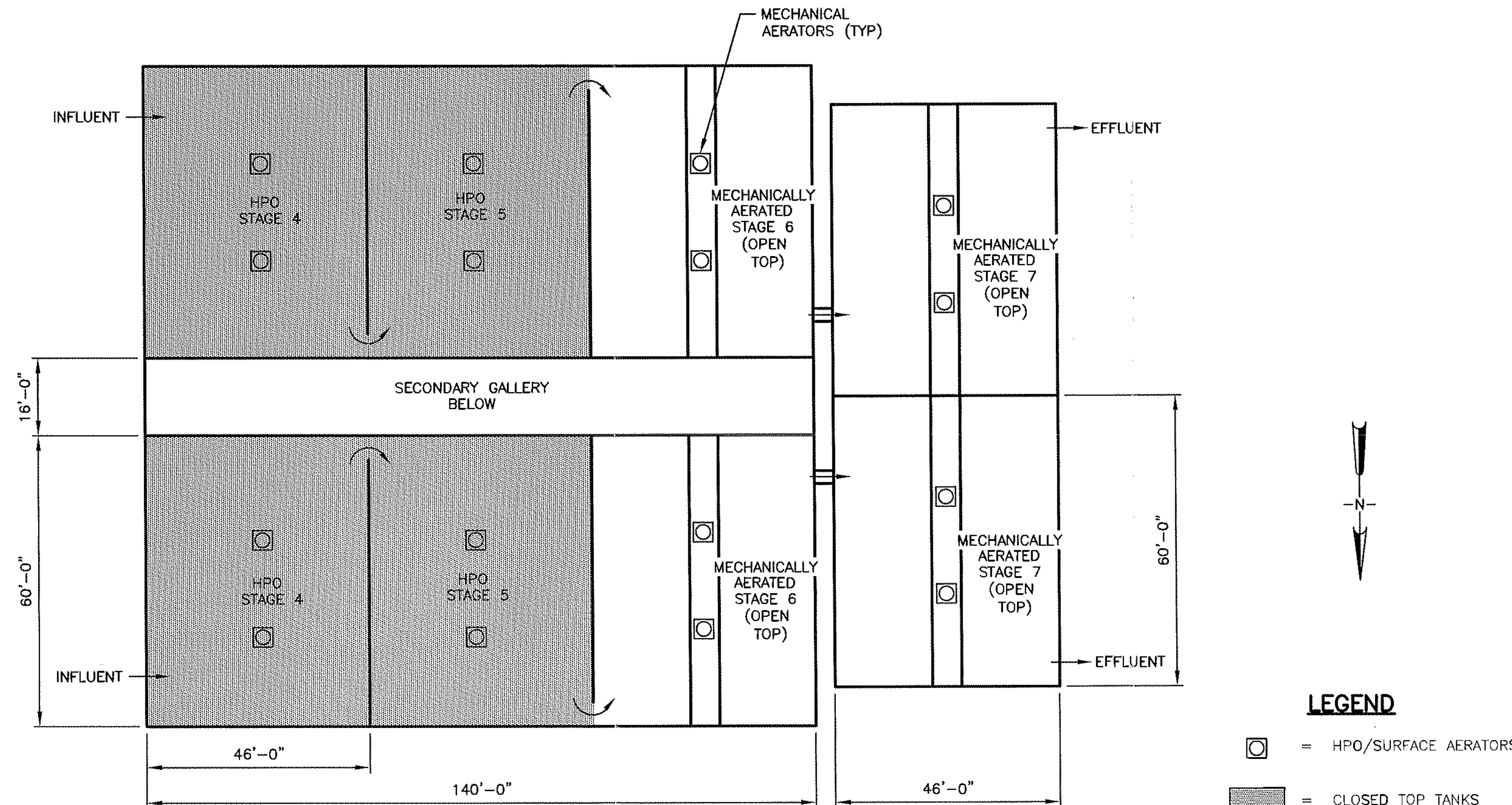
DESCRIPTION	COSTS
Primary clarification	$3,220,000
HPO aeration tanks	2,270,000
IFAS aeration tanks	5,650,000
Oxygen generation system and building	2,360,000
Secondary clarification	12,720,000
New lagoon bypass pipeline	610,000
Subtotal Capital Costs	**$26,800,000**
Site work	1,100,000
Electrical	4,200,000
Instrumentation	1,400,000
HVAC	700,000
Subtotal Capital Costs Contingency (30%)	**$34,200,000** 10,300,000
Total Construction Costs Engineering/Legal/Administrative	**$44,500,000** 9,000,000
Total Design and Construction Services (2009) Inflation to construction midpoint (2012) (1)	**$53,500,000** 4,800,000
Project Cost Subtotal Maintenance Costs Additional Labor Costs Chemical Costs Power Requirements	**$58,300,000** 161,000 62,000 -- 470,000
Annual O&M Cost (2009 Dollars)	**$693,000**
20-Year Present-Worth O&M Cost(2)	**$11,400,000**
Total 20-Year Present-Worth Cost (2012)	**$69,700,000**

(1) Based on a yearly inflation rate of 3 percent.
(2) Based on an interest rate of 5 percent and an inflation rate of 3 percent.

TABLE 5-7

BASIS OF DESIGN - ULTRAVIOLET DISINFECTION

UNIT PROCESS/ DESIGN CRITERIA	VALUE
UV Disinfection System	
Type	Horizontal, in-channel
No. of channels	2
Channel dimensions (each)	
Length (feet)	30
Width (feet)	3.3
Depth (feet)	5.2
UV banks per channel	2
No. of modules per bank	10
No. of lamps per module	8
Total number of lamps	320
Design dose ($\mu Ws/cm^2$)	31,000
Maximum power draw (kW)	80
Average power draw (kW)	26



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OAK ORCHARD WWTP
FACILITIES PLAN
FIGURE 5-1

CONVERTED HPO AERATION TANKS AND NEW AERATION TANKS

16.10.2009 PETER RENNE
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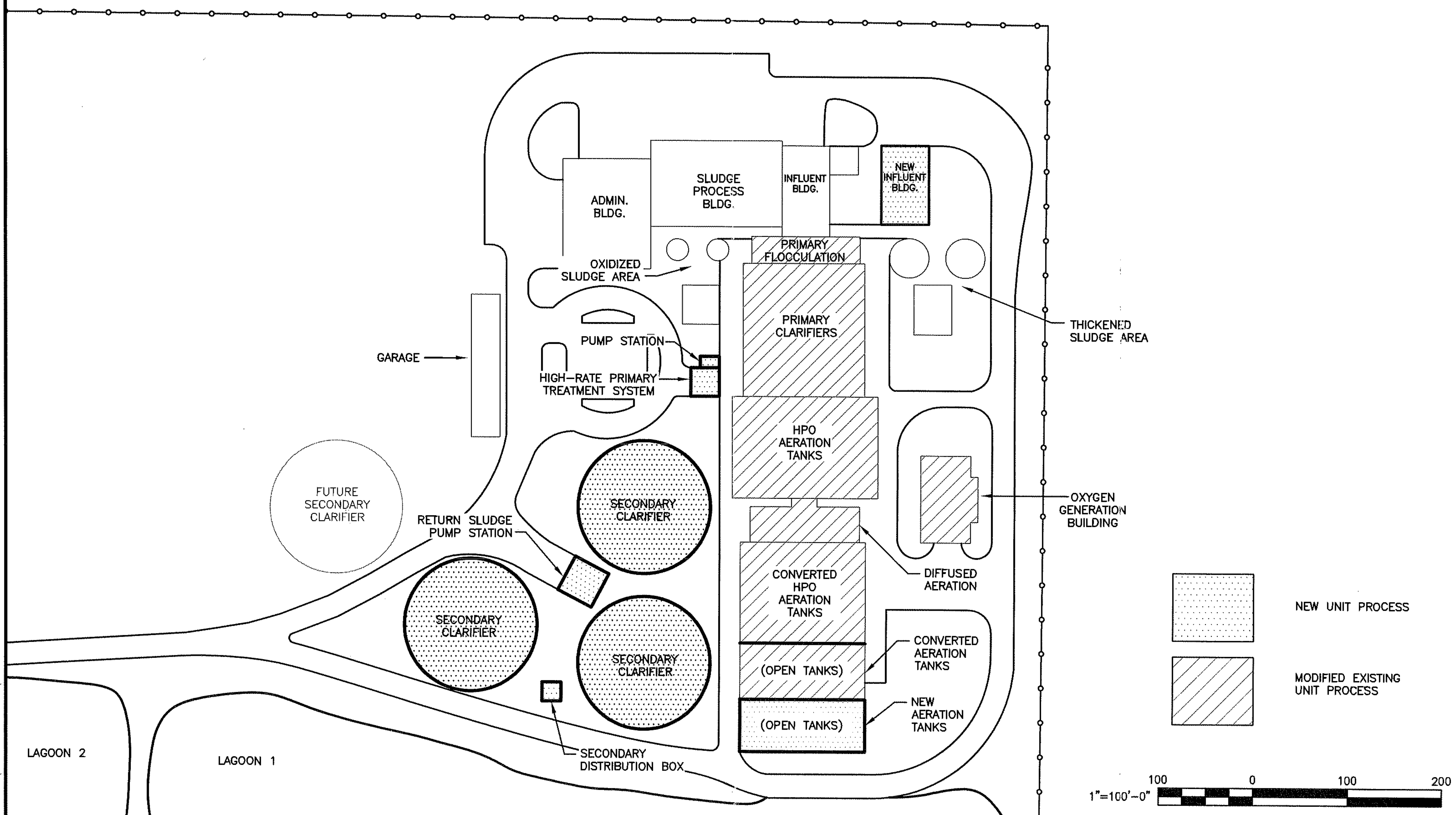

SITE PLAN

SCALE:1"=100'-0"

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OAK ORCHARD WWTP
FACILITIES PLAN
FIGURE 5-2

ALTERNATIVE WW-A1
SINGLE STAGE HPO

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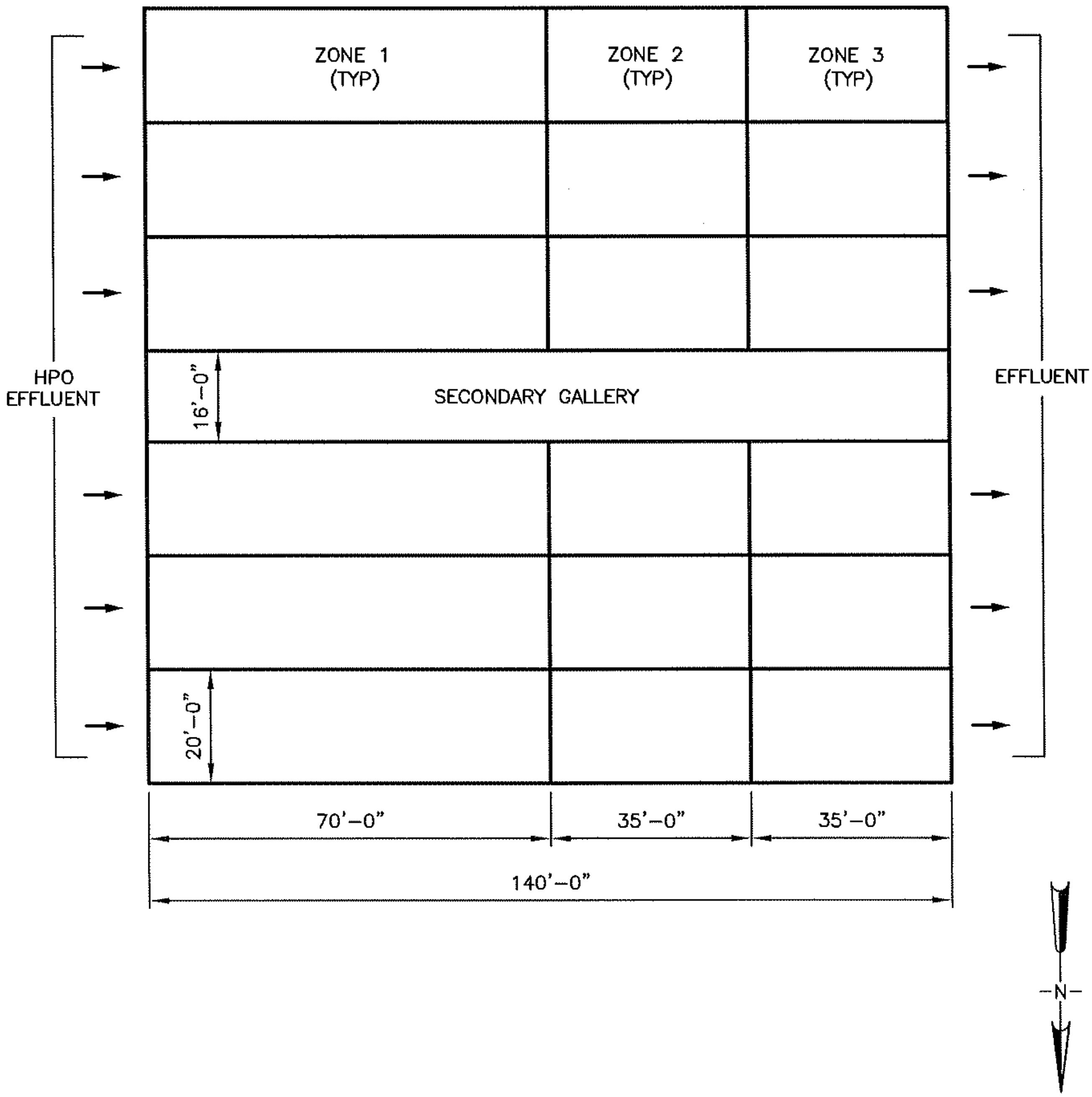
IFAS TANKS NO.1 – NO.6



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OAK ORCHARD WWTP
FACILITIES PLAN
FIGURE 5–3

IFAS AERATION TANKS

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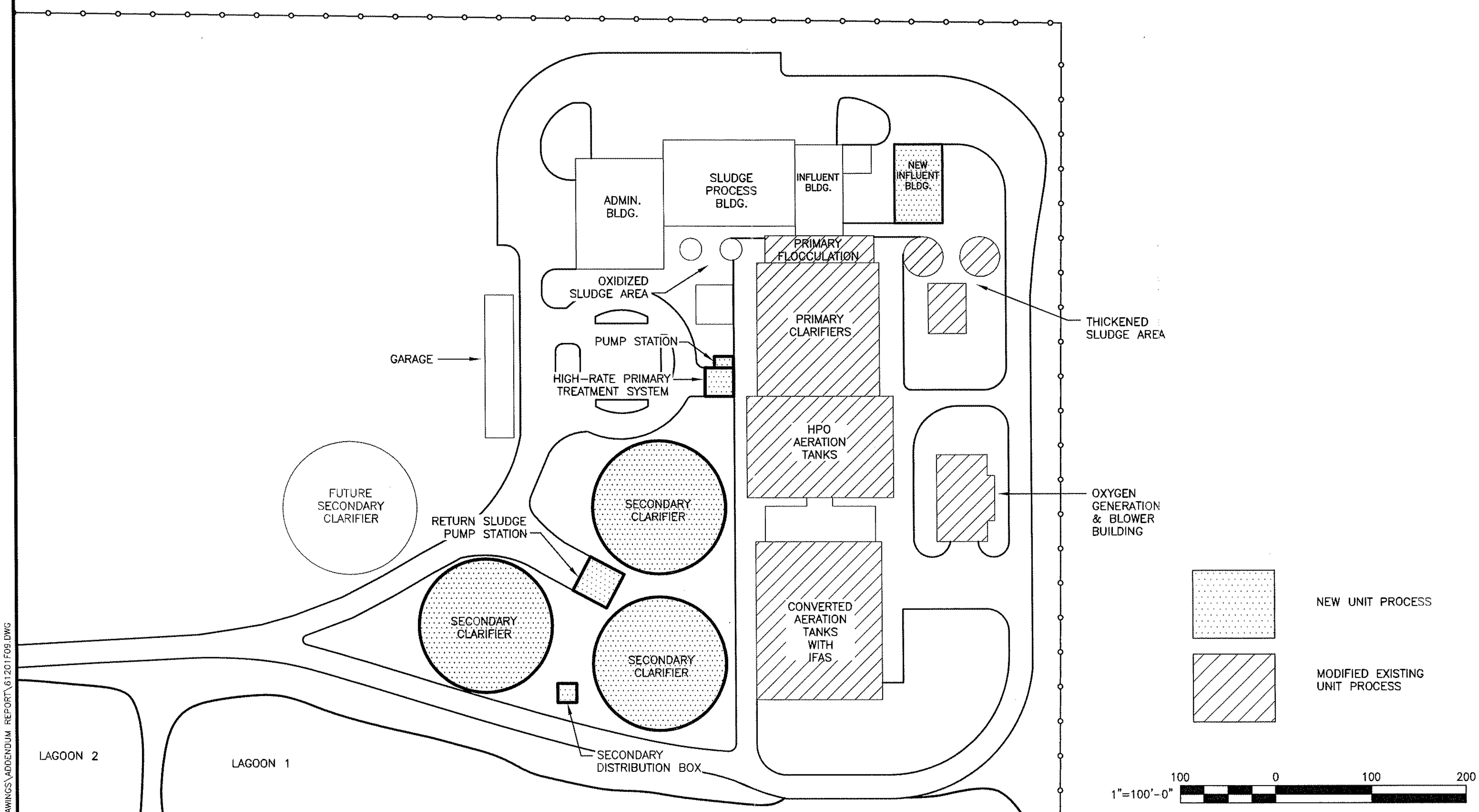

SITE PLAN

SCALE:1"=100'-0"

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OAK ORCHARD WWTP
FACILITIES PLAN
FIGURE 5-4

ALTERNATIVE WW-A2
HPO AND IFAS

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CHAPTER 6

OAK ORCHARD SLUDGE HANDLING AND DISPOSAL

6.1 CANNIBAL® SOLIDS REDUCTION PROCESS

The Cannibal® Solids Reduction Process, a proprietary system provided by Siemens Water Technologies, was reviewed and evaluated for the Oak Orchard WWTP. The system is designed to reduce the total biological solids in the treatment plant using a sidestream reactor to create a low oxidation reduction potential (ORP) environment. By fluctuating between the aerobic and non-aerobic environments within the treatment process along with the low ORP environment of the sidestream reactor, the total quantity of biological solids is decreased, reducing the need to waste solids from the biological treatment process. In addition to the sidestream reactor, this system also employs a solids separation step that consists of a rotary drum-type fine screen to remove debris and inert solids from the return activated sludge prior to entering the sidestream reactor.

Based on correspondence with the manufacturer, this system is best suited for treatment plants without primary clarification that have biological treatment processes containing aerobic and non-aerobic environments with relatively long solids retention times, such as extended aeration processes, oxidation ditches, and sequencing batch reactors. The system manufacturer also noted that HPO treatment processes are not conducive to this sludge treatment process, as the sludge from HPO systems is typically difficult to be effectively treated by this process.

For the reasons stated above, the Oak Orchard WWTP is not a good application for the Cannibal® Solids Reduction Process technology and was deleted from further consideration.

6.2 RECOMMENDED SLUDGE HANDLING IMPROVEMENTS

The recommended plan for sludge handling and disposal at the Oak Orchard WWTP in the April 2009 Facilities Plan was to rehabilitate and reuse the existing raw sludge thickeners and raw sludge holding tanks at the facility. This method of sludge handling and disposal was evaluated with the revised flows and loads. The sludge holding tanks will provide just under three days of storage at the design maximum month loadings with additional storage capacity available in the sludge thickeners. The thickened and stored sludge generated at the facility can then be disposed of by hauling the sludge to the METRO WWTP. This is the current mode of disposal at the plant. Table 6-1 provides a summary of the basis of design for the recommended sludge facilities at the Oak Orchard WWTP.

The estimated project costs for rehabilitating the existing sludge thickeners and holding tanks, as well as to provide new dewatered sludge pumps, is $1,900,000 with an associated annual O&M cost of approximately $490,000. The total 20-year present-worth cost, including project costs as well as annual O&M costs, was estimated at $10,000,000 based on interest and inflation rates of 5 percent and 3 percent, respectively.

A list of proposed equipment for each alternative has been provided in Appendix C.

TABLE 6-1

BASIS OF DESIGN
SLUDGE HANDLING AND DISPOSAL FACILITIES

UNIT PROCESS/EQUIPMENT	DESIGN CRITERIA	VALUE
Combined Sludge Thickening (Existing) Design Maximum Month Loading (2026)		
Thickener Feed Sludge	Combined sludge loading rate, gpd	82,400
	Max month dry solids loading rate, ppd	18,700
	Feed solids concentration, %	2.7
	Volatile solids content, %	70
Thickener Unit (Modified)	Type	Gravity sludge thickener (upgrade mechanisms in existing 40-foot tanks)
	Number of units	2
	Tank dimensions, each	
	Diameter	40
	Sidewater depth, feet	8
	Volume, gallons	75,000
	Total volume, gallons	150,000
	Detention time, days	3.3
	Thickened sludge, gpd	45,000
	Thickened sludge dry solids, pdd	18,800
	Thickened sludge solids concentration, %	5.0
	Thickened sludge VS content, %	70
Thickened Sludge Holding Tank	Type	Rectangular sludge holding tanks (upgrade diffusers and blowers for existing system)
	Number of units	2
	Tank dimensions, each	
	Length, feet	60
	Width, feet	18.5
	Max sidewater depth, feet[1]	16
	Volume, gallons	66,000
	Total volume, gallons	132,000
	Detention time, days	2.9
	Thickened sludge, gpd	45,000
	Thickened sludge dry solids, ppd	18,800

TABLE 6-1 (continued)

UNIT PROCESS/EQUIPMENT	DESIGN CRITERIA	VALUE
Thickened Sludge Transfer Pumps (Modified)	Type	Duplex plunger pumps
	Number of units	4
	Capacity, gpm	170

CHAPTER 7

ODOR CONTROL EVALUATION

7.1 INTRODUCTION

The Davis Road force main conveys wastewater approximately 6 miles from the DRPS to the Oak Orchard WWTP. For most of the 6 miles, the conveyance system consists of two parallel force mains of 24-inch and 36-inch diameter. The long wastewater detention times allow for development of anaerobic conditions and generation of sulfide, which can be released from solution as hydrogen sulfide gas and cause odor and corrosion problems. Over the years, the County has tried injection of several different chemicals at DRPS to suppress sulfide generation in the force main. Currently, sodium hypochlorite is injected into the force main at Davis Road to "disinfect" the sulfide-producing slime layer. This has generally been effective. However, sulfide loadings to the Oak Orchard WWTP remain relatively high. In 1994, Bowker & Associates recommended a demonstration using nitrate (Bioxide™). Although equally effective, operating costs were higher. The County used this chemical in the spring for several years, as it was found to assist with the onset of seasonal nitrification at the Oak Orchard facility. The chemical is no longer used. The County also conducted a trial using iron salts to precipitate the sulfide. This increased sludge production and adversely affected settleability.

7.2 EXISTING CONDITIONS

Figure 7-1 shows a schematic of the force main system. Table 7-1 shows flow data for 2007, and Table 7-2 summarizes two years of chemical usage data. Annual chemical cost for 2007 was approximately $211,000 using the May 2008 unit cost of $0.85/gal for sodium hypochlorite. Note that the County received a 2010 bid of $0.464/gal for sodium hypochlorite, which significantly changed the economic analysis of sulfide control alternatives, prompting an update to this report.

Despite the injection of about 650 gpd of sodium hypochlorite at the DRPS, influent sulfide levels measured in June 2007 were 2.5 to 3 mg/L, and hydrogen sulfide concentrations in the headspace of the covered aerated grit chambers typically ranged from 100 to 200 ppm. These are high levels generally associated with odor and corrosion problems and indicate an insufficient bleach dosage. The proper dosage of bleach to achieve target sulfide levels <0.5 mg/L is estimated to be 1,100 gpd, corresponding to a daily cost of $510/day ($186,000/year) using the 2010 bleach cost of $0.464/gal.

The condition of the force main system between the DRPS and the Oak Orchard WWTP is not known. In theory, a force main flowing completely full will not experience hydrogen sulfide corrosion. However, if gas pockets exist at high points, where hydrogen sulfide gas can accumulate and be biologically oxidized to sulfuric acid in the presence of oxygen, localized corrosion can occur. If the County wishes to provide some level of protection of this pipeline from H_2S corrosion, it will be necessary to add the chemicals at the DRPS to control dissolved sulfide levels in the force main. This can significantly alter the cost effectiveness of some chemicals such as hydrogen peroxide, nitrate, and to a lesser degree, oxygen.

7.3 EVALUATION OF SULFIDE CONTROL ALTERNATIVES

Figure 7-1 is a schematic of the two parallel force mains between DRPS and the Oak Orchard WWTP. In the past, the 24-inch Clay-Cicero force main was used during dry weather. In wet weather, flow was diverted to the 36-inch Davis Road force main, or both force mains were used. Currently, both force mains are currently operated simultaneously under all flow conditions. This is apparently done to prevent high "shock" loadings of sulfide during startup of a previously idle force main, causing problems with nitrification at the WWTP. As shown in Table 7-3, the use of both force mains during dry weather has major implications for sulfide generation. Operating both force mains effectively doubles the mass of sulfide generated compared to operating only the 24-inch line. Wastewater detention time more than doubles. Operating the 36-inch line instead of the 24-inch increases sulfide generation by about 40 percent.

Table 7-4 summarizes the available chemicals used for sulfide control in wastewater. Sulfide modeling using the Pomeroy-Parkhurst equation predicts end-of-pipe sulfide levels ranging from 3 to 15 mg/L depending on flow (detention time) and which force mains are in operation (this is with no chemical treatment). This results in a mass loading of sulfide to the Oak Orchard WWTP of approximately 200 to 400 lbs/day. The following analysis assumes a sulfide loading of 400 lbs/day (both force mains in operation). With both force mains in operation, predicted sulfide levels entering the Oak Orchard WWTP are 5 to 9 mg/L. The analysis assumes that all chemicals would achieve a target end-of-pipe sulfide concentration of 0.5 mg/L.

A. **Nitrate.** Bowker & Associates evaluated the Davis Road force main in 1994 and recommended a demonstration of nitrate (Bioxide™) as a more economical chemical than sodium hypochlorite. The demonstration was conducted during the summer of 1995. Among the findings were:

1. The costs of sulfide control using Bioxide™ were higher than for bleach (sodium hypochlorite).

2. The actual bleach dosages were lower than predicted by the chemical equations, since the bleach apparently acts to disinfect the sulfide-producing slime layer rather than oxidize existing sulfide.

Nitrate is not considered to be cost effective compared to bleach for this application.

B. **Iron Salts.** Iron salts (ferrous chloride or ferrous sulfate) are another class of chemicals widely used for sulfide control in wastewater systems. Recently, prices of iron salts have been highly volatile. Further, because iron precipitates sulfide as a solid, sludge production can be expected to increase by 10 to 15 percent. Iron is not recommended where UV disinfection is practiced as iron tends to coat the lamps. Onondaga County currently uses iron salts for sulfide control in the collection system serving the METRO plant.

To precipitate 400 lbs/day of sulfide, approximately 480 gpd of ferrous chloride solution (23 percent iron) would be required. A demonstration project was conducted by the County in 1993 in which iron salts were added at the DRPS. At the Oak Orchard WWTP, sludge production increased and sludge compaction was reduced, increasing the volume of liquid sludge hauled to the METRO plant. Iron salts do not offer an economic or technical benefit over the current use of sodium hypochlorite and result in greater volumes (and mass) of sludge at the Oak Orchard WWTP.

C. **Magnesium Hydroxide.** Magnesium hydroxide is a relatively new chemical used for sulfide control. It works by raising the pH to 8.5, which suppresses sulfide formation and prevents the release of H_2S gas. It is cost effective for long force mains or multiple force mains in series where high sulfide levels are expected. Unlike most other chemicals, the dosage is independent of sulfide concentration. The chemical is safe to handle and adds alkalinity to the wastewater. It must be stored in heat-traced insulated vessels with a mixer to maintain the product in suspension. Dosages are typically 50 to 100 gallons of $Mg(OH)_2$ per million gallons of wastewater. For an average flow of 7 mgd and a dosage of 70 gallons per million, this would amount to a usage rate of about 500 gpd. At a unit cost of $2.00/gallon, costs would be $1,000/day, and annual costs would exceed $350,000/year. This is significantly more than the projected cost to achieve 0.5 mg/L sulfide using bleach at the current unit cost of $0.464/gal.

A potential benefit with magnesium hydroxide is the effect of the elevated pH on downstream biological processes. The majority of flow to the Oak Orchard WWTP will enter via the Davis Road force main with a pH of 8.5. This high pH will not adversely affect the performance of the activated sludge process, and will provide a needed source of alkalinity for nitrification in the pure oxygen activated sludge process.

D. **Hydrogen Peroxide.** Hydrogen peroxide is a strong oxidant that is effective for sulfide control. It is typically added 20 to 30 minutes upstream of where sulfide control is desired in order for the reaction to be complete. In the case of Oak Orchard, this would require a remote, secure hydrogen peroxide storage and injection site. Within the past few years, a proprietary process has been developed in which an iron-based catalyst is injected simultaneously with the hydrogen peroxide that decreases the reaction time to a few minutes and reportedly improves the efficiency of sulfide oxidation.

As with all chemicals injected in proportion to the sulfide concentration, it is very difficult to match the dosage with the actual demand, often resulting in overdosing or underdosing during some period of the day. Added 20 to 30 minutes upstream of the plant, most of the force main would not be protected against H_2S corrosion. Therefore, to provide protection of the entire force main, another chemical feed application of hypochlorite at the DRPS would be required. One option is to continue to add sodium hypochlorite at Davis Road to provide protection of the force main, and then add hydrogen peroxide near the Oak Orchard WWTP to remove the remaining 2 to 3 mg/L of sulfide. This assumes that the current dosage of hypochlorite is sufficient to provide protection of most of the force main against H_2S corrosion, although data suggest that sulfide has already begun to form up to 2 miles from the Oak Orchard plant. Assuming 2.5 mg/L of sulfide remaining in the force main with upstream hypochlorite injection, the sulfide load to be treated using peroxide would be about 150 lbs/day. Oxidation of 150 lbs/day of sulfide is estimated to require 60 gpd of 50 percent H_2O_2 at a dosage ratio of 2 lbs H_2O_2/lb sulfide. At a unit cost of $3.50/gallon, the peroxide cost is projected to be $77,000/year. This would be in addition to the

$115,000/year projected to be spent on bleach at the most recent (March 2010) price of $0.464/gal.

E. **Pure Oxygen.** Oxygen is the most economical chemical for sulfide control in terms of the operating cost per pound of sulfide removed. Oxygen can be used to oxidize existing sulfide as well as to prevent sulfide generation by maintaining aerobic wastewater conditions. However, significantly higher capital expenditure is required for a dissolution system that ensures efficient oxygen transfer into the wastewater compared to a simple chemical storage/feed system. Without efficient oxygen dissolution, oxygen gas pockets can form along the crown of the pipe, and oxygen gas may be wasted through air relief valves.

Currently, the most common method of dissolving oxygen into a force main is to supersaturate a sidestream with pure oxygen, then introduce the highly oxygenated sidestream back into the bulk wastewater flow. This is the dissolution method with the proprietary ECO_2 process. Oxygen can be purchased as a liquid or generated on-site using a skid-mounted pressure swing absorption or vacuum swing absorption unit. When compared to the cost of liquid oxygen and the leasing costs of a liquid oxygen storage tank and vaporizer, on-site generation is often more economical.

Due to the very long detention times with both force mains in operation, it would be necessary to add oxygen at both the DRPS and the Henry Clay Pump Station (or some other intermediate location). This is necessary in order to maintain aerobic conditions in the force main for eight hours or more. The requirement for two oxygen injection stations substantially increases the capital cost of a sulfide control system using pure oxygen.

F. **Economic Analysis.** Table 7-5 shows an economic analysis of the screened alternatives for controlling sulfide loading to the Oak Orchard WWTP. This is based on a sulfide loading of 400 lb/day and simultaneous use of both the 24- and 36-inch force mains that results in wastewater detention times of 8 hours or more.

At the current bleach price of $0.464/gal (March 2010), sodium hypochlorite injection is clearly the most cost-effective alternative for sulfide control in the Davis Road force main system. The high cost of power ($0.17/kWh) and the capital costs of two injection sites make oxygen less economical. (see odor control memorandum in Appendix E.) There is no economic advantage to a combination of bleach and hydrogen peroxide polishing at the current low price for sodium hypochlorite.

Based on recent quotes on bulk sodium hypochlorite at other locations in the U.S., the $0.464/gal is a very attractive price. Most quotes are in the $0.90 to $1.00/gal range. Should the County's price for bleach escalate, the cost effectiveness of sulfide control using bleach could shift to another alternative. Substituting higher bleach costs into Table 7-5 shows that pure oxygen injection does not become economical until the unit cost of sodium hypochlorite is about $0.90/gal, almost double the current price. At this unit cost, magnesium hydroxide is still slightly more expensive than bleach. At the higher bleach costs, using hypochlorite to suppress sulfide generation and injecting hydrogen peroxide near the end of the force main may be more economical than bleach alone. This alternative should be re-evaluated at that time, as hydrogen peroxide prices may also change.

7.4 CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions.

1. Simultaneous operation of both force mains between the DRPS and the Oak Orchard WWTP effectively doubles the wastewater detention time and doubles the mass of sulfide generated.

2. With most sulfide control chemicals, the cost to control sulfide also doubles with the use of both force mains.

3. The current dosage of bleach at the DRPS is insufficient to reduce sulfide levels to below target levels (<0.5 ppm) at the Oak Orchard WWTP.

4. At the County's current cost of $0.464/gal for sodium hypochlorite, injection of this chemical is the most cost-effective sulfide control alternative compared to oxygen, magnesium hydroxide, and a combination of bleach and hydrogen peroxide. It should be noted that if the sodium hypochlorite cost increases to $0.90/gal, oxygen injection will become the least expensive alternative.

B. **Recommendations.**

1. The County should re-evaluate its current mode of operating both force mains simultaneously under all flow conditions, even if it requires intermittent chemical dosing when an idle force main is brought on-line.

2. Plant staff should establish a target sulfide level of 0.5 mg/L entering the plant. Current bleach dosage should be increased to achieve target sulfide concentration.

3. The force mains between DRPS and the Oak Orchard WWTP should be inspected for signs of internal H_2S corrosion at the high points.

4. To provide protection of the force mains against corrosion, chemicals such as oxygen, magnesium hydroxide, or sodium hypochlorite must be injected at the beginning of the force main at DRPS.

5. Injection of sodium hypochlorite into the force main at the DRPS is recommended as the most cost-effective current strategy for sulfide control. Annual chemical cost is projected to be $186,000/year based on a unit cost of $0.464/gal.

6. When the County's price for sodium hypochlorite reaches $0.90/gal, alternatives such as bleach injection at David Road to protect the force main, with hydrogen peroxide polishing near the Oak Orchard WWTP, or injecting pure oxygen at the DRPS and Henry Clay Pump Station should be re-evaluated.

FIGURE 7-1

SCHEMATIC OF FORCE MAIN SYSTEM
OAK ORCHARD SERVICE AREA

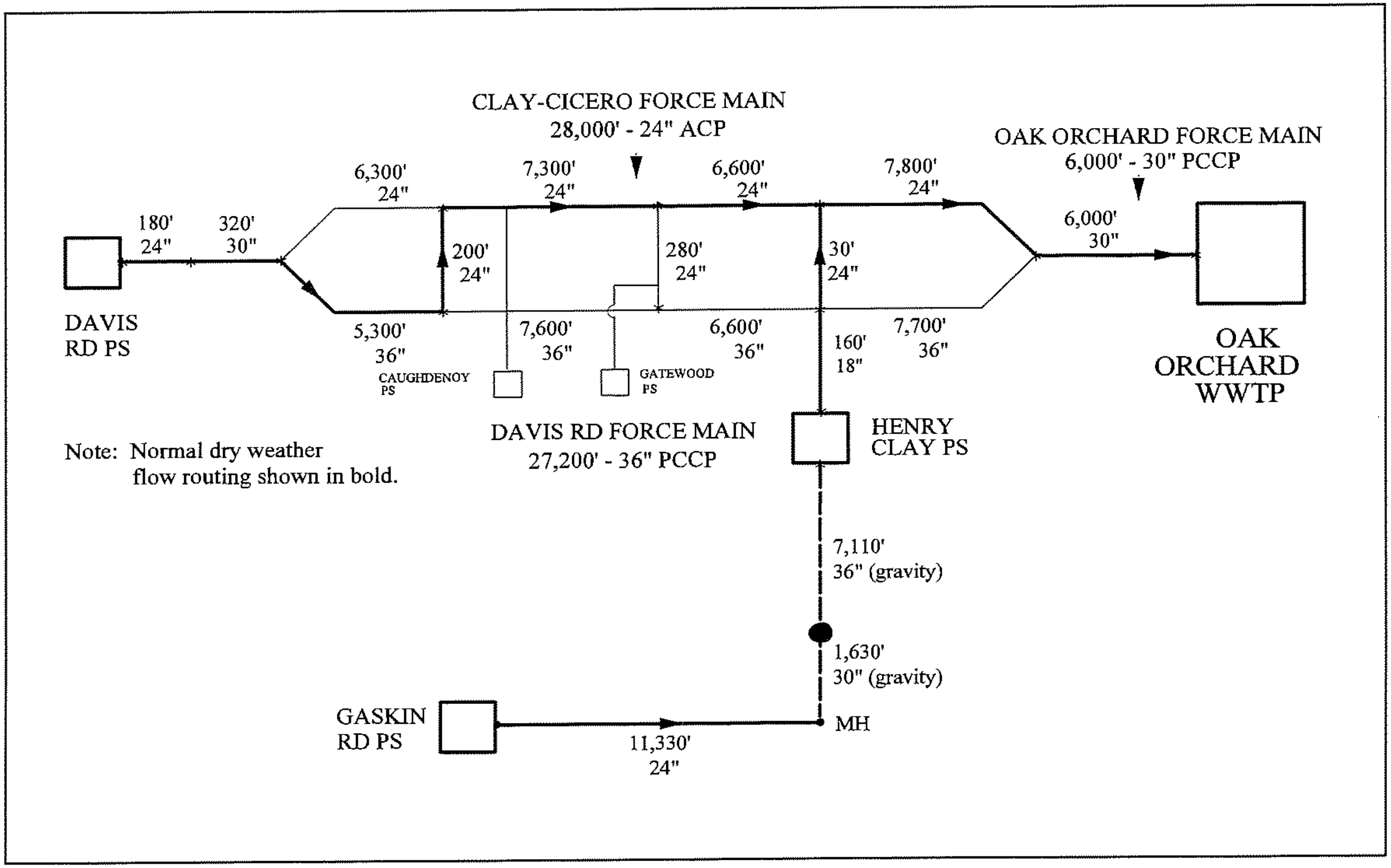


TABLE 7-1

AVERAGE MONTHLY FLOWS TO OAK ORCHARD WWTP, MGD
2007

	DAVIS ROAD PUMP STATION	HENRY CLAY PUMP STATION	MISCELLANEOUS	TOTAL TO WWTP
January	5.9	1.9	0.8	8.6
February	4.2	0.9	1.4	6.5
March	8.0	2.3	1.1	11.4
April	6.6	1.9	1.1	9.6
May	4.2	1.8	0.6	6.6
June	3.7	1.3	1.0	6.0
July	3.4	1.0	1.1	5.5
August	3.3	1.1	0.8	5.2
September	3.1	1.0	1.3	5.4
October	3.5	1.3	1.0	5.8
November	4.1	1.5	1.3	6.8
December	5.4	1.7	1.4	8.5
AVERAGE	**4.6**	**1.5**	**1.1**	**7.2**

TABLE 7-2

MONTHLY BLEACH (NaOCl) USAGE
DAVIS ROAD PUMP STATION

	2007, GPD	2006, GPD
January	462	590
February	583	574
March	377	681
April	473	487
May	604	583
June	758	810
July	1,010	691
August	955	836
September	816	777
October	845	596
November	686	534
December	585	533
TOTAL ANNUAL USAGE	**248,493**	**235,799**
AVERAGE DAILY USAGE	**680**	**646**

TABLE 7-3

PREDICTED SULFIDE LOADINGS
DAVIS ROAD FORCE MAIN[1]

FLOW, MGD	24-INCH FORCE MAIN ONLY		36-INCH FORCE MAIN ONLY		BOTH FORCE MAINS	
	DETENTION TIME, HR	SULFIDE, MG/L	DETENTION TIME, HR	SULFIDE, MG/L	DETENTION TIME, HR	SULFIDE, MG/L
3	7.1	8.1	13.4	11.2	18.7	15.6
5	4.3	4.9	8.0	6.7	11.2	9.3
7 (average flow)	3.1	3.5	5.7	4.8	8.0	6.7
9	2.4	2.7	4.5	3.8	6.2	5.2
Total sulfide mass, lbs/day		205		280		390

(1) Sulfide predicted using Pomeroy-Parkhurst equation assuming:
BOD = 200 mg/L
Temp = 25°C
$M = 0.5 \times 10^{-6}$

TABLE 7-4

OVERVIEW OF HYDROGEN SULFIDE CONTROL TECHNIQUES

TECHNIQUE	FREQUENCY OF USE	ADVANTAGES	DISADVANTAGES
OXIDATION			
Air injection	Low	Low cost, adds DO to wastewater to prevent sulfide generation	Applicable only to force mains; potential for air binding; limited rate of O_2 transfer
Oxygen injection	Low	Five times solubility of air; high DO possible; economical for force mains	Applicable only to force mains; requires on-site generation or purchase as liquid O_2
Hydrogen peroxide	Medium	Effective for sulfide control in gravity sewers or force mains; simple installation	Costs can be high to achieve low (<0.5 mg/L) sulfide; safety
Sodium hypochlorite	High	Applicable to gravity sewers or force mains; effective for broad range of odorants	Safety considerations; high chemical costs
Potassium permanganate	Medium	Effective, powerful oxidant; good for sludge handling applications	High cost, difficult to handle
PRECIPITATION			
Iron salts	High	Economical for sulfide control in gravity sewers or force mains	Does not control non-H_2S odors; sulfide control to low levels may be difficult; increased sludge production
pH ELEVATION			
Sodium hydroxide (shock dosing)	Medium	Intermittent application; simple, little equipment required	Does not provide consistent control; safety considerations
Magnesium hydroxide	Low	Maintains pH at 8 - 8.5; adds alkalinity; economical for high (>5 mg/L) sulfide levels; safe	Requires mixer to maintain slurry in suspension; cost is independent of sulfide concentration
PREVENTION			
Nitrate formulations	High	Can be used to prevent sulfide generation or oxidize sulfide in gravity sewers and force mains; safe to handle	Dosages vary depending on use: prevention vs. removal
Anthraquinones	Low	Prevents sulfide generation biochemically by disrupting sulfur cycle	Not well developed; results inconsistent and difficult to predict

TABLE 7-5

ECONOMIC EVALUATION OF SULFIDE CONTROL ALTERNATIVES
DAVIS ROAD FORCE MAIN(1)

COMPONENT	OXYGEN	HYPLOCHLORITE AND PEROXIDE	MAGNESIUM HYDROXIDE	SODIUM HYPOCHLORITE
CAPITAL COST				
Land	$0	$30,000	$0	$0
Site work	40,000	40,000	10,000	0
Force main taps, valves	80,000	10,000	10,000	0
Equipment	1,145,000	40,000	40,000	0
Installation	150,000	20,000	20,000	0
SUBTOTAL	**1,295,000**	**140,000**	**80,000**	**$0**
Contingencies (30%)	389,000	42,000	24,000	0
TOTAL CONSTRUCTION COST	**$1,648,000**	**$182,000**	**$104,000**	**$0**
Engineering/Legal/Administrative	336,000	38,000	21,000	0
TOTAL DESIGN AND CONSTRUCTION SERVICES	**$2,020,000**	**$220,000**	**$125,000**	**$$0**
Inflation to Construction Midpoint (2012)(4)	180,000	20,000	15,000	0
PROJECT COST	**$2,200,000**	**$240,000**	**$140,000**	**$0**
ANNUAL O&M COSTS				
Chemicals(2)	0 (3)	192,000	365,000	186,000
Power @ $0.17/kWh	201,000 (3)	800	800	800
Equipment lease/license fee	23,400	0	0	0
ANNUAL O&M COST	**$224,000**	**$193,000**	**$366,000**	**$187,000**
PRESENT-WORTH COST				
20-Year Present-Worth Cost(5)	3,690,000	3,180,000	6,020,000	3,080,000
TOTAL 20-YEAR PRESENT-WORTH COST	**$5,900,000**	**$3,400,000**	**$6,200,000**	**$3,100,000**

(1) Based on average flow of 7 mgd through both 24-inch and 36-inch force mains.
(2) Chemical Costs: H_2O_2 @ $3.50/gal; $Mg(OH)_2$ @ $2.00/gal; NaOCl @ $0.464/gal.
(3) Assumes on-site generation of oxygen.
(4) Based on yearly inflation rate of 3 percent.
(5) Based on interest rate of 5 percent and an inflation rate of 3 percent.

CHAPTER 8

THE RECOMMENDED PLAN – 20-YEAR PLANNING PERIOD

The following recommendations were developed for the DRPS and Oak Orchard WWTP for the planning period through 2026 based on the revised flows and loads associated with the Gaskin Road Pump Station.

8.1 DAVIS ROAD PUMP STATION

The recommended plan for upgrading the DRPS includes upgrading the existing pumping system to increase peak pumping capacity to 31.5 mgd, and constructing modifications to the force main system between the DRPS and the Oak Orchard WWTP for improved hydraulic capacity to allow total peak flow of 39.5 mgd. The following is a list of items included in this proposed plan:

1. Replace the four existing submersible raw sewage pumps at the DRPS with new higher capacity units and install new check valves.

2. Perform a video inspection of the existing DRPS force main to verify the condition and integrity of the existing pipe.

3. Install approximately 500 feet of new 30-inch diameter force main in the yard of the DRPS site, parallel to the existing force main.

4. Install approximately 6,000 feet of new 36-inch diameter force main in parallel with the existing Oak Orchard force main.

5. Modify/replace pumps at other pump stations connected to the DRPS force main.

The total project cost for implementation of the proposed DRPS improvements, including the odor control improvements for the Oak Orchard force main, is estimated at $11,800,000.

8.2 OAK ORCHARD WWTP IMPROVEMENTS

The Oak Orchard WWTP will be expanded to provide capacity for treatment of the projected flows and loads for the existing sewer service area through the year 2026, including the Gaskin Road Pump Station service area. As part of this capacity expansion, the Oak Orchard facilities will be upgraded to provide reliable ammonia removal, improved secondary clarification, and ultraviolet disinfection. The recommended plan for the expansion and upgrade of the Oak Orchard WWTP includes the wastewater treatment alternative WW-A2, which consists of a HPO treatment process for BOD removal, followed by an IFAS treatment system for ammonia removal. In addition to this, upgrades of the plant's preliminary and primary treatment systems as well as the effluent disinfection system are recommended.

The recommended plan for expanding and upgrading the Oak Orchard WWTP is illustrated in Figure 8-1. As shown, expansion and upgrading will include the following:

1. New influent building, including mechanical bar screening equipment and vortex grit removal facilities.

2. Upgrade of the existing primary clarifiers to convert the existing traveling bridge collector mechanisms to chain-and-flight type.

3. New high flow primary treatment system consisting of mechanical fine screens to provide added treatment capacity during high flow events.

4. Upgrade of the existing HPO aeration equipment and oxygen generation equipment.

5. Retrofit of the existing secondary clarifiers for use as IFAS aeration tanks, including the addition of aeration diffusers and suspended-type IFAS media.

6. New aeration blowers to provide process air for the IFAS treatment system.

7. Three new 136-foot diameter circular secondary clarifiers and a return sludge pumping station.

8. Construction of a new ultraviolet disinfection system.

9. Rehabilitation of the existing raw sludge gravity thickeners and sludge storage tanks, including the addition of new sludge pumping equipment.

10. New odor control facilities.

11. Existing building improvement modifications (refer to the April 2009 Facilities Plan).

12. Miscellaneous project improvements (refer to the April 2009 Facilities Plan).

   a. Scum/grease truck drain piping.
   b. Sludge truck loading area containment and drain piping.
   c. Miscellaneous HVAC improvements and miscellaneous site improvements.

8.3 FACILITY ASSESSMENTS AND MISCELLANEOUS IMPROVEMENTS

In addition to the major items identified in Sections 8.1 and 8.2 for the DRPS and the Oak Orchard WWTP, there are several additional items that were identified for improvement in the original April 2009 Facilities Plan based on facility assessments performed in November 2006, as well as other miscellaneous improvements recommended by the project team. The status of these items is provided below:

A. **Facility Assessments.**

1. **Davis Road Pump Station.**

   a. Install safety cages for the mechanical screens to completely enclose the operating and channel floor openings. – *Not completed.*

   b. Patch repair spalled concrete and re-anchor handrail for the concrete stairway at the Control Building. – *Completed.*

   c. Reinstall electrical pullbox cover. – *Status to be verified.*

2. **Oak Orchard WWTP.**

a. Reinstall electrical pullbox covers at the Administration Building and the Sludge Processing Building. – *Status to be verified.*

b. Install a threshold between Rooms #131 and #134 at the Administration Building. – *Completed.*

c. Grit and Screenings Building

- Provide wraps around exterior structural support columns to contain falling brick and mortar. – *Completed (installed plywood, no wraps.)*
- Relocate electrical and control components for the clamshell grit bucket to ground level for improved operator access. – *Not completed.*
- Take odor control room out of service and avoid loading the upper level floor slab due to deteriorated concrete. – *Not completed.*
- Replace roll-up door pushbutton with a NEMA 7 rated unit. – *Not completed.*

d. Replace door and hardware at the Grit and Screening Building electrical substation. – C*ompleted.*

e. Broken windows in the Oxygen Generation Building. Remove broken glass from window and cover with plywood or similar material. – *Completed.*

f. Replace various grounding bond straps that have completely corroded. – *Ongoing.*

The additional future needs identified in the April 2009 Facilities Plan for the DRPS and the Oak Orchard WWTP remain unchanged.

B. **Miscellaneous Improvements.** In addition to the facility assessments discussed above, other miscellaneous improvements were also identified by the project team in the April 2009 Facilities Plan for the Oak Orchard WWTP. The following list is an update on the status of these items.

1. Scum removal and disposal improvements. – *No longer needed (operational changes).*

2. Sludge tanker fill station improvements. – *Not completed.*

3. Other miscellaneous improvements. – *Not completed.*

An updated summary of the estimated construction cost allowances for the miscellaneous improvements is provided in Table 8-1.

TABLE 8-1

MISCELLANEOUS IMPROVEMENTS CONSTRUCTION COST ALLOWANCE

ITEM	CONSTRUCTION COST ALLOWANCE
Sludge tanker fill station drain system	$50,000
Street light replacement	10,000
Remodeling of lab to office space	10,000
Construction of road salt storage area	30,000
Replace stock room air handling unit	50,000
Replace existing boiler stacks	50,000
TOTAL CONSTRUCTION COST ALLOWANCE	**$200,000**

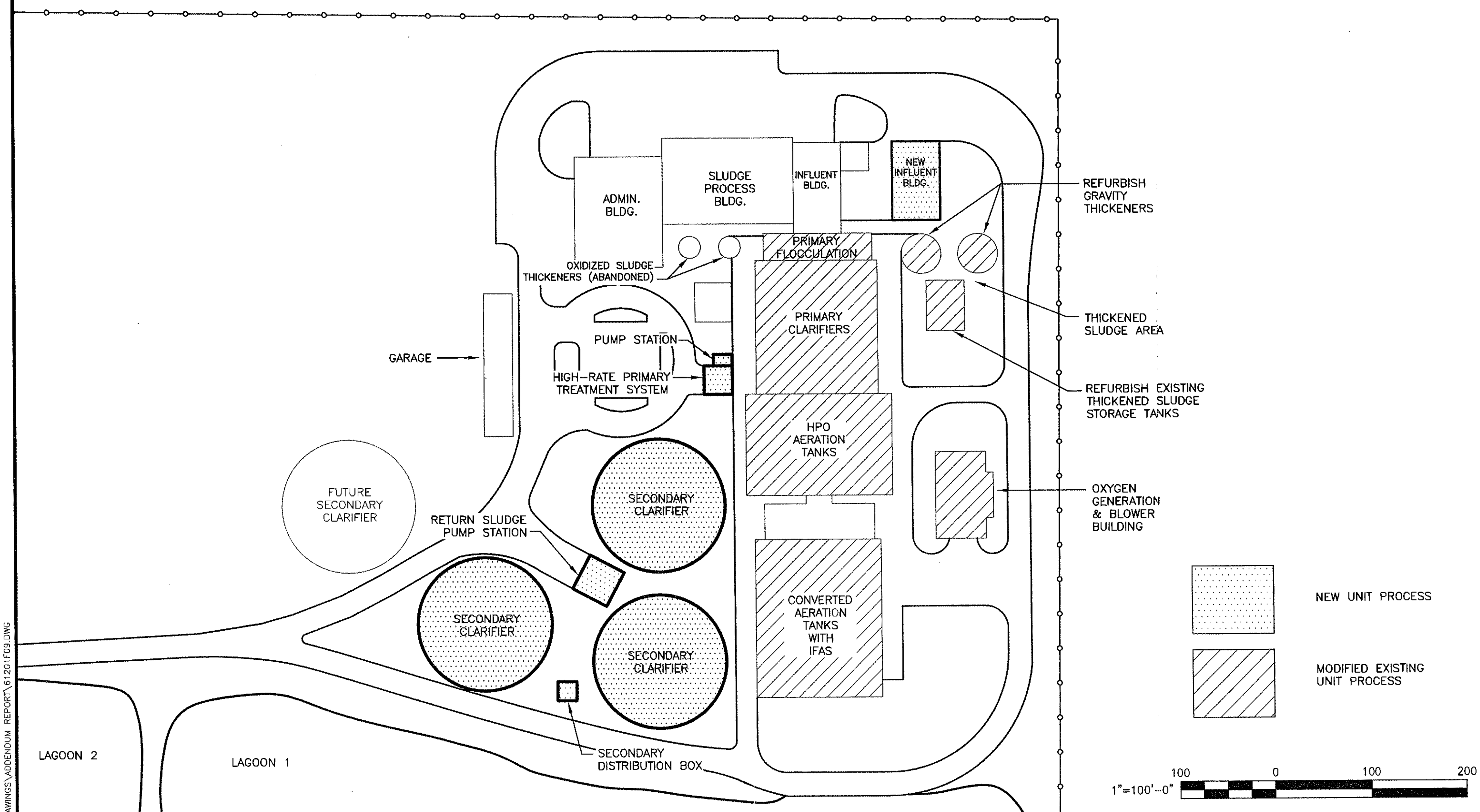
8.4 PROJECT COSTS

Project costs for expansion and upgrading of the Oak Orchard WWTP are presented in Table 8-2. As shown, the total project cost for the Davis Road and Oak Orchard plant improvements is estimated at $94,000,000.

TABLE 8-2

RECOMMENDED ALTERNATIVES
ENGINEER'S ESTIMATE OF PROBABLE COSTS

	TOTAL ESTIMATED PROJECT COST
DRPS Improvements	
Capacity expansion	$11,800,000
Oak Orchard WPCP Improvements	
Headworks	9,400,000
WWTP process	58,300,000
Disinfection	5,100,000
Sludge treatment and disposal	1,900,000
Odor control	700,000
Improvements to buildings and structures	6,700,000
Miscellaneous improvements	200,000
Total Project Cost (Projected to Year 2012)	**$94,000,000**



SITE PLAN

SCALE: 1"=100'-0"

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STEARNS & WHELER LLC
Environmental Engineers & Scientists
CAZENOVIA, NEW YORK

DATE: 10/09 JOB No.: 61201

OAK ORCHARD WWTP
FACILITIES PLAN
FIGURE 8-1

RECOMMENDED PLAN

15.10.2009 PETER RENNE
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CHAPTER 9

RECOMMENDED PLAN - PHASED APPROACH

9.1 PROJECT PHASING

A phased approach to improvements is recommended for the DRPS and Oak Orchard WWTP, as the current flows and loads being processed by these two facilities are less than the projected future design conditions. The phased approach improvements are recommended to address:

- odor and corrosion control
- consistent treatment performance, year-round nitrification capability
- consistent permit compliance
- energy savings improvements of equipment and existing building systems
- upgrade of existing building systems
- treatment of Gaskins Road Pump Station flows

These improvements are required to address problems with corroded equipment in the screenings and grit area, unreliable oxygen generation equipment and oxygen compressor, poor performance by the secondary clarifiers, and to update old and inefficient building systems. The following paragraphs describe the recommended phased approach to the project.

9.2 DAVIS ROAD PUMP STATION

The revised recommended plan for phased upgrading of the DRPS includes upgrade of the existing wastewater pumps to provide additional flow and installation of the new force main improvements to reduce system headloss. These improvements are necessary to address recurring hydraulic surcharging of the influent sewer to the DRPS, and odorous and corrosive conditions in the Davis Road force main and at the Oak Orchard WWTP. There is no phased approach recommended for the improvements to the DRPS. Therefore, the total project cost for the phased implementation of the proposed DRPS improvements is estimated at $11,800,000, which is the same as that estimated for the full recommended plan.

9.3 OAK ORCHARD WWTP IMPROVEMENTS

The recommended phased approach for the upgrade of the Oak Orchard WWTP includes portions of Alternative WW-A2 along with preliminary treatment and effluent disinfection upgrades as listed below. The recommended plan for upgrading the Oak Orchard WWTP is illustrated in Figure 9-1. As shown, upgrading will include the following:

1. Modifications to existing influent building, including new mechanical bar screening equipment and grit system blowers and piping.

2. Upgrade of the existing primary clarifiers to convert the existing traveling bridge collector mechanisms to chain-and-flight type.

3. Upgrade of the existing HPO aeration equipment and oxygen generation equipment.

4. Retrofit of the existing secondary clarifiers for use as IFAS aeration tanks including the addition of aeration diffusers and suspended-type IFAS media.

5. Three new 136-foot diameter circular secondary clarifiers and a return sludge pumping station.

6. Construction of a new ultraviolet disinfection system.

7. Rehabilitation of the existing raw sludge gravity thickeners, including the addition of new sludge pumping equipment. This equipment is old and in need of replacement in order to maintain reliable performance for continued service.

8. Existing building improvement modifications (refer to the April 2009 Facilities Plan).

9. Miscellaneous plant improvements (refer to the April 2009 Facilities Plan).

Project costs for the Phase I upgrade of the Oak Orchard WWTP and DRPS odor control improvements are presented in Table 9-1. As shown, the total project cost for the Davis Road and Oak Orchard plant improvements is estimated at $77,000,000.

TABLE 9-1

PHASE I RECOMMENDED ALTERNATIVES
ENGINEER'S ESTIMATE OF PROBABLE COSTS

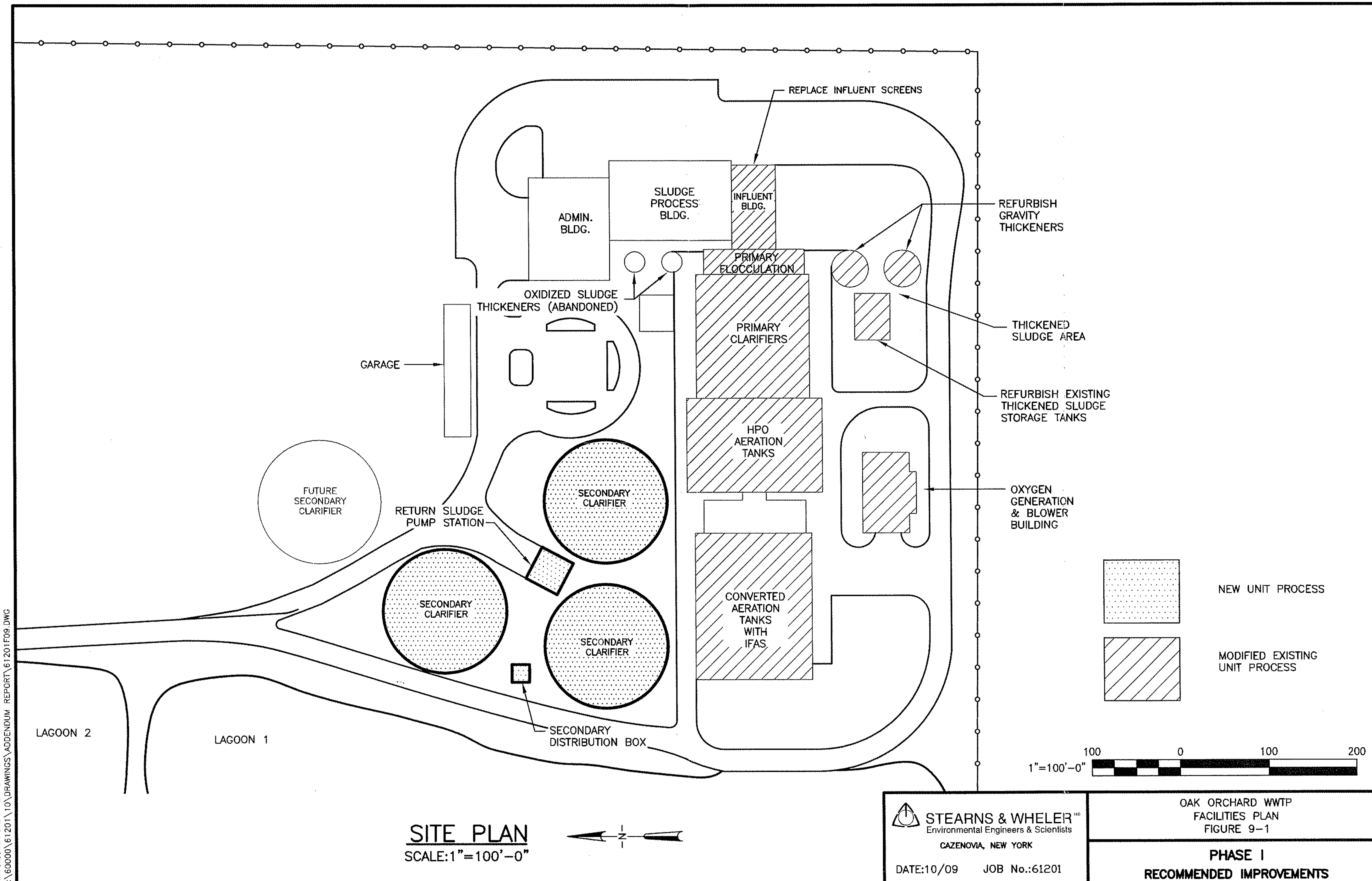
	TOTAL ESTIMATED PROJECT COST
DRPS Improvements	
Capacity expansion	$11,800,000
Oak Orchard WPCP Improvements	
Headworks	2,300,000
WWTP process	48,600,000
Disinfection	5,100,000
Sludge treatment and disposal	1,900,000
Improvements to buildings and structures	6,700,000
Miscellaneous improvements	200,000
Total Project Cost (Projected to Year 2012)	**$77,000,000**

9.4 FUTURE PHASE II RECOMMENDATIONS

When the influent flows and loads begin to approach the year 2026 design conditions, the following Phase II recommendations may be implemented:

1. Construction of the high flow primary fine screen system for increased primary treatment capacity.

2. Construction of the new Influent Building, including new screenings and grit removal systems.



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APPENDICES

APPENDIX A

CURRENT SPDES DISCHARGE PERMIT

(5/97)

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
State Pollutant Discharge Elimination System (SPDES)
NOTICE / RENEWAL APPLICATION / PERMIT

Please read **ALL** instructions on the back before completing this application form. Please **TYPE** or **PRINT** clearly in ink.

PART 1 - NOTICE

03/15/2007

Permittee Contact Name, Title, Address	Facility and SPDES Permit Information
ONONDAGA COUNTY DEPT OF WATER ENV PROT RICHARD L. ELANDER 650 HIAWATHA BLVD WEST SYRACUSE NY 13204-1194	Name: OAK ORCHARD STP Ind. Code: 4952 County: ONONDAGA DEC No.: 7-3124-00018/00001 SPDES No.: NY 003 0317 Expiration Date: 01/01/2008 Application Due By: 07/05/2007

Are these name(s) & address(es) correct? if not, please write corrections above.

The State Pollutant Discharge Elimination System Permit for the facility referenced above expires on the date indicated. You are required by law to file a complete renewal application **at least 180 days prior to expiration of your current permit. Note the "Application Due By" date above.**

CAUTION: This short application form and attached questionnaire are the only forms acceptable for permit renewal. Sign Part 2 below and mail only this form and the completed questionnaire using the enclosed envelope. *Effective April 1, 1994 the Department no longer assesses SPDES application fees.*

If there are changes to your discharge, or to operations affecting the discharge, then in addition to this renewal application, you must also submit a separate permit modification application to the Regional Permit Administrator for the DEC region in which the facility is located, as required by your current permit. See the reverse side of this page for instructions on a modification request.

PART 2 - RENEWAL APPLICATION

CERTIFICATION: I hereby affirm that under penalty of perjury that the information provided on this form and all attachments submitted herewith is true to the best of my knowledge and belief. False statements made herein are punishable as a Class A misdemeanor pursuant to section 210.45 of the Penal Law.

Randy R. Ott, P.E. — Commissioner
Name of person signing application (see instructions on back) — Title

[signature] — 5/24/07
Signature — Date

RECEIVED NYSDEC ENVIRONMENTAL PERMITS JUN 1 AM 10:04

PART 3 - PERMIT (Below this line - Official Use Only)

Effective Date: 1/1/08 **Expiration Date:** 12/31/12

William R. Adriance
Permit Administrator

Address: NYSDEC - Division of Environmental Permits
Bureau of Environmental Analysis
625 Broadway, Albany, NY 12233-1750

[signature] — JUL 12 2007
Signature — Date

This permit together with the previous valid permit for this facility issued 1/1/03 and subsequent modifications constitute authorization to discharge wastewater in accordance with all terms, conditions and limitations specified in the previously issued valid permit, modifications thereof or issued as part of this permit, including any special or general conditions attached hereto. Nothing in this permit shall be deemed to waive the Department's authority to initiate a modification of this permit on the grounds specified in 6NYCRR §621.14, 6NYCRR §754.4 or 6NYCRR §757.1 existing at the time this permit is issued or which arise thereafter.

~~Attachments: General Conditions dated __/__~~

File: SPDES

New York State Department of Environmental Conservation
Division of Environmental Permits, 4th Floor
625 Broadway, Albany, New York 12233-1750
Phone: (518) 402-9167 • FAX: (518) 402-9168
Website: www.dec.state.ny.us

Erin M. Crotty
Commissioner

02 AUG -1 AM 11:49

RECEIVED
ONONDAGA COUNTY

July 29, 2002

RICHARD L ELANDER PE
ONONDAGA COUNTY DEPT OF WATER ENV PROT
650 HIAWATHA BLVD W
SYRACUSE, NY 13204

FACILITY INFORMATION

OAK ORCHARD STP
LOCATION : CLAY (T)
COUNTY : ONONDAGA
DEC NO : 7-3124-00018-00001-
SPDES NO : NY 003 0317

Dear SPDES Permittee:

Enclosed please find your renewed State Pollutant Discharge Elimination System (SPDES) ~~permit. This renewal permit together with the previously issued valid permit constitute authorization~~ to discharge wastewater in accordance with all terms, conditions and limitations specified in your previously issued permit, including any valid modifications.

The instructions and other information that you received with the NOTICE/RENEWAL APPLICATION/PERMIT package fully described procedures for renewal and modification of your SPDES permit under the Environmental Benefit Permit Strategy (EBPS). As a reminder, SPDES permits are renewed at a central location in Albany in order to make the process more efficient. All other concerns with your permit such as applications for permit modifications, permit transfers to a new owner, name changes, and other questions should be directed to the Regional Permit Administrator at the following address:

Ralph Manna
NYSDEC REGION 7
615 Erie Blvd W
Syracuse, NY 13204-2400
(315) 426-7438

If you have already filed an application for modification of your permit, it will be processed separately through our regional office. If you have questions concerning this permit renewal, please contact Erin L. Burns at (518) 402-9170.

Sincerely,

Barbara B. Rinaldi

Barbara B. Rinaldi
Deputy Chief Permit Administrator

Enclosure
cc: RPA
RWE
BWP

91-20-5 (5/97)

NEW YORK STA[TE] DEPARTMENT OF ENVIRONMENTAL CONSERV[ATIO]N

State Pollutant Discharge Elimination System (SPDES)

NOTICE / RENEWAL APPLICATION / PERMIT

Please read **ALL** instructions on the back before completing this application form. Please **TYPE** or **PRINT** clearly in ink.

PART 1 - NOTICE 03/15/2002

Permittee Contact Name, Title, Address.

ONONDAGA COUNTY DEPT OF ~~DRAINAGE~~ Water Environment Protection
~~DAVID FRACHETTI~~ Richard L. Elander PE Commissioner
650 HIAWATHA BLVD W
SYRACUSE NY 13204

Facility and SPDES Permit Information

Name: OAK ORCHARD STP
Ind. Code: 4952 County: ONONDAGA
DEC No.: 7-3124-00018/00001
SPDES No.: NY 003 0317
Expiration Date: 01/01/2003
Application Due By: 07/05/2002

Are these name(s) & address(es) correct? if not, please write corrections above.

The State Pollutant Discharge Elimination System Permit for the facility referenced above expires on the date indicated. You are required by law to file a complete renewal application **at least 180 days prior to expiration of your current permit. Note the "Application Due By" date above.**

~~**CAUTION:** This short application form and attached questionnaire are the only forms acceptable for permit renewal. Sign Part~~ 2 below and mail only this form and the completed questionnaire using the enclosed envelope. *Effective April 1, 1994 the Department no longer assesses SPDES application fees.*

If there are changes to your discharge, or to operations affecting the discharge, then in addition to this renewal application, you must also submit a separate permit modification application to the Regional Permit Administrator for the DEC region in which the facility is located, as required by your current permit. See the reverse side of this page for instructions on filing a modification request.

PART 2 - RENEWAL APPLICATION

CERTIFICATION: I hereby affirm that under penalty of perjury that the information provided on this form and all attachments submitted herewith is true to the best of my knowledge and belief. False statements made herein are punishable as a Class A misdemeanor pursuant to section 210.45 of the Penal Law.

Richard L. Elander, P.E. — Commissioner

Name of person signing application (see instructions on back) — Title

[signature] — 6/5/02

Signature — Date

PART 3 - PERMIT (Below this line - Official Use Only)

Effective Date: 01/01/03 Expiration Date: 01/01/08

Barbara B. Rinaldi

Permit Administrator

Address: NYSDEC - Division of Environmental Permits
Bureau of Environmental Analysis
625 Broadway, Albany, NY 12233-1750

Barbara B. Rinaldi — 07/29/02

Signature — Date

This permit together with the previous valid permit for this facility issued 08/26/97 and subsequent modifications constitute authorization to discharge wastewater in accordance with all terms, conditions and limitations specified in the previously issued valid permit, modifications thereof or issued as part of this permit, including any special or general conditions attached hereto. Nothing in this permit shall be deemed to waive the Department's authority to initiate a modification of this permit on the grounds specified in 6NYCRR §621.14, 6NYCRR §754.4 or 6NYCRR §757.1 existing at the time this perm[it is] issued or which arise thereafter.

Attachments: General Conditions dated 11/90

FINAL - SB Copy

New York State Department of Environmental Conservation
Division of Environmental Permits, Suite 206
615 Erie Blvd. W., Syracuse, NY 13204-2400
(315) 426-7438

John P. Cahill
Commissioner

97 DEC -5 PM 12: 03
RECEIVED
ONONDAGA COUNTY

December 3, 1997

Onondaga County Dept. of Drainage & Sanitation
650 Hiawatha Boulevard West
Syracuse, NY 13204-1194

Attn: John Karanik, Commissioner

RE: State Pollutant Discharge Elimination System (SPDES) Permit for Oak Orchard STP - #NY 003 0317, Appl. ID #7-3124-00018/00001

Dear Commissioner Karanik

Enclosed please find the State Pollutant Discharge Elimination System (SPDES) permit for your facility. Accompanying the permit is a set of General Conditions governing it and also a list of effluent limitations which must be monitored for the surface discharge.

The records of this monitoring should be summarized and submitted on a signed Discharge Monitoring Report according to the schedule listed on the Monitoring, Recording, and Reporting page of your permit.

If you have any questions, please contact this office.

Sincerely,

Robert A. Torba
Deputy Permit Administrator

cc: Water Division, Region 7
R. Hannaford
EPA Region II
Onondaga County Health Dept.
Onondaga County EMC

91-20-2 (1/89)

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

State Pollutant Discharge Elimination System (SPDES)

DISCHARGE PERMIT

Special Conditions (Part I)

Industrial Code: 4952
Discharge Class (CL): 05
Toxic Class (TX): N
Major Drainage Basin: 07
Sub Drainage Basin: 03
Water Index Number: ONT. 66-11
Compact Area: GLWQA- IJC

SPDES Number: NY-0030317
DEC Number: 7-3124-00018/00001
Effective Date (EDP): 01/01/98
Expiration Date (ExDP): 01/01/2003
Modification Date(s):
Attachment(s): General Conditions (Part II) Date: 11/90

This SPDES permit is issued in compliance with Title 8 of Article 17 of the Environmental Conservation Law of New York State and in compliance with the Clean Water Act as amended, (33 U.S.C. Section 1251 et. seq.)(hereafter referred to as "the Act").

PERMITTEE NAME AND ADDRESS Attention: John M. Karanik, Commissioner

Name: Onondaga County Department of Drainage and Sanitation
Street: 650 Hiawatha Blvd. West
City: Syracuse State: NY Zip Code: 13204-1194

is authorized to discharge from the facility described below:

FACILITY NAME AND ADDRESS

Name: Oak Orchard Wastewater Treatment Plant
Location (C,T,V): Clay (T) County: Onondaga
Facility Address: 4300 Oak Orchard Road
City: Clay State: NY Zip Code: 13212
NYTM - E: NYTM - N: 4
From Outfall No.: 001 at Latitude: 43° 12′ 05″ & Longitude: 76° 13′ 00″
into receiving waters known as: Oneida River Class: B

and; (list other Outfalls, Receiving Waters & Water Classifications)

in accordance with the effluent limitations, monitoring requirements and other conditions set forth in Special Conditions (Part I) and General Conditions (Part II) of this permit.

DISCHARGE MONITORING REPORT (DMR) MAILING ADDRESS

Mailing Name: Onondaga County Department of Drainage and Sanitation
Street: 650 Hiawatha Blvd. West
City: Syracuse State: NY Zip Code: 13204-1194
Responsible Official or Agent: Randy R. Ott, P.E., Proc. Phone: (315)435-2260

This permit and the authorization to discharge shall expire on midnight of the expiration date shown and the p[illegible]ittee shall not discharge after the expiration date unless this permit has been renewed, or extended pursuant to law. [illegible] authorized to discharge beyond the expiration date, the permittee shall apply for a permit renewal no less than 180 [illegible] prior to the expiration date shown above.

[illegible]RIBUTION:
DOW - R7
R. Hannaford
Onondaga County Health Dept
USEPA Region II
Onondaga County EMC

Permit Administrator:	
Robert A. Torba	
Address:	
615 Erie Boulevard W., Syracuse, NY 13204	
Signature: Robert A. Torba	Date: 12/2/97

AL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning 1/1/98 and lasting until January 1, 2003 the discharges from the permitted facility shall be limited and monitored by the permittee as specified below:

LIMITATIONS APPLY: [ ] All Year [X] Seasonal from June 16 to October 31

Outfall Number 001

EFFLUENT LIMITATIONS

[X] Flow	30 day arithmetic mean	10	[X] MGD [ ] GPD
[ ] BOD, 5 - Day	30 day arithmetic mean	mg/l and	lbs/day(1)
[ ] BOD, 5 - Day	7 day arithmetic mean	mg/l and	lbs/day
[X] UOD(2)	30 day arithmetic mean	mg/l and 4289	lbs/day
[X] Solids, Suspended	30 day arithmetic mean	30 mg/l and 2500	lbs/day(1)
[X] Solids, Suspended	7 day arithmetic mean	45 mg/l and 3750	lbs/day
~~[X] Effluent disinfection required:~~	[ ] All Year [X] Seasonal from June 16 to October 15		
[X] Coliform, Fecal	30 day geometric mean shall not exceed 200/100 ml		
[X] Coliform, Fecal	7 day geometric mean shall not exceed 400/100 ml		
[X] Chlorine, Total Residual	Daily Maximum	0.35 mg/l & 18.4 lbs/day	
[X] pH	Range	6.0 to 9.0	SU
[X] Solids, Settleable	Daily Maximum	0.3	ml/l
Phosphorus, Total	30 day arithmetic mean	1.0 mg/l as P	
Ammonia (as NH_3)	30 day arithmetic mean	400 lbs/day	
Oxygen, Dissolved	Minimum	5.0 mg/l	
[ ]			
[ ]			
[ ]			

MONITORING REQUIREMENTS

Parameter	Frequency	Sample Type	Sample Location Influent	Sample Location Effluent
[X] Flow, [X] MGD [ ] GPD	Continuous	Recorder	X	
[X] CBOD, 5 - Day, mg/l	2/week	24-hr. comp.	X	X
[X] Solids, Suspended, mg/l	2/week	24-hr. comp.	X	X
[X] Coliform, Fecal, No./100 ml(3)	2/week	Grab		X
[X] Nitrogen, TKN (as N), mg/l	2/week	24-hr. comp.		X
[X] Ammonia (as NH_3), mg/l	2/week	24-hr. comp.		X
[X] pH, SU (standard units)	3/day	Grab	X	X
[X] Solids, Settleable, ml/l	3/day	Grab	X	X
[X] Chlorine, Total Residual, mg/l(3)	3/day	Grab		X
[X] Phosphorus, Total (as P), mg/l	2/week	24-hr. comp.		X
[X] Temperature, Deg. C	3/day	Grab	X	X
[X] Oxygen, Dissolved	2/week	Grab		X
[ ]				
[ ]				
[ ]				

S: (1) and effluent value shall not exceed 15 % and 15 % of influent values for $CBOD_5$ & TSS respectively.
(2) Ultimate Oxygen Demand shall be computed as follows:
UOD = 1 ½ x $CBOD_5$ + 4 ½ x TKN (Total Kjeldahl Nitrogen)
(3) Monitoring of these parameters is only required during the period when disinfection is required.

91-20-2b (1/89)

…AL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning 1/1/98 and lasting until January 1, 2003 the discharges from the permitted facility shall be limited and monitored by the permittee as specified below:

LIMITATIONS APPLY: [ ] All Year [X] Seasonal from November 1 to June 15

Outfall Number 001

EFFLUENT LIMITATIONS

[X] Flow	30 day arithmetic mean	10	[X] MGD	[ ] GPD	
[X] CBOD, 5 - Day	30 day arithmetic mean	25	mg/l and	2085	lbs/day(1)
[X] CBOD, 5 - Day	7 day arithmetic mean	40	mg/l and	3336	lbs/day
[ ] UOD(2)			mg/l and		lbs/day
[X] Solids, Suspended	30 day arithmetic mean	30	mg/l and	2500	lbs/day(1)
[X] Solids, Suspended	7 day arithmetic mean	45	mg/l and	3750	lbs/day

[X] Effluent disinfection required: [ ] All Year [X] Seasonal from May 15 to June 15

~~[X] Coliform, Fecal~~	~~30 day geometric mean shall not exceed 200/100 ml~~	
[X] Coliform, Fecal	7 day geometric mean shall not exceed 400/100 ml	
[X] Chlorine, Total Residual	Daily Maximum	0.35 mg/l & 18.4 lbs/day
[X] pH	Range	6.0 to 9.0 SU
[X] Solids, Settleable	Daily Maximum	0.3 ml/l
[X] Phosphorus, Total	30 day arithmetic mean	1.0 mg/l as P
[ ]		
[ ]		
[ ]		
[ ]		
[ ]		

MONITORING REQUIREMENTS

Parameter	Frequency	Sample Type	Sample Location Influent	Sample Location Effluent
[X] Flow, [X] MGD [ ] GPD	Continuous	Recorder	X	
[X] CBOD, 5 - Day, mg/l	2/week	24-hr. comp.	X	X
[X] Solids, Suspended, mg/l	2/week	24-hr. comp.	X	X
[X] Coliform, Fecal, No./100 ml(3)	2/week	Grab		X
[ ] Nitrogen, TKN (as N), mg/l				
[ ] Ammonia (as NH_3), mg/l				
[X] pH, SU (standard units)	3/day	Grab	X	X
[X] Solids, Settleable, ml/l	3/day	Grab	X	X
[X] Chlorine, Total Residual, mg/l(3)	3/day	Grab		X
[X] Phosphorus, Total (as P), mg/l	2/week	24-hr. comp.		X
[X] Temperature, Deg. C	3/day	Grab	X	X
[ ]				
[ ]				
[ ]				
[ ]				

N…S: (1) and effluent value shall not exceed 15 % and 15 % of influent values for $CBOD_5$ & TSS re spectively.
(2) Ultimate Oxygen Demand shall be computed as follows:
$UOD = 1\frac{1}{2} \times CBOD_5 + 4\frac{1}{2} \times TKN$ (Total Kjeldahl Nitrogen)
(3) Monitoring of these parameters is only required during the period when disinfection is required.

)AL EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning EDP 1/1/98

and lasting until EDP + 5 YEARS 1/1/2003

the discharges from the permitted facility shall be limited and monitored by the permittee as specified below:

Outfall Number & Effluent Parameter	Discharge Limitations Daily Avg.	Discharge Limitations Daily Max.	Units	Minimum Monitoring Requirements Measurement Frequency	Minimum Monitoring Requirements Sample Type
001					
Iron, Total Recoverable	-	80	lbs/day	1/month	24-hr. comp.

CTION LEVEL REQUIREMENTS (TYPE II)

The parameters listed below have been reported present in the discharge but at levels that currently do not require technology or water quality based effluent limits. Action levels have been established which if routinely or excessively exceeded will result in reconsideration of technology or water quality based effluent limits. Routine action level monitoring results, if not provided for on the Discharge Monitoring Report (DMR) form, shall be appended to the DMR for the period during which the sampling was conducted.

If discharges of any substance exceed their respective action level:

(1) for four of six consecutive samples, or
(2) for two of six consecutive samples by 20% or more, or
(3) for any 1 sample by 50% or more

the permittee shall undertake a short-term, high-intensity monitoring program for this parameter. Samples identical to those required for routine monitoring purposes shall be taken on each of three consecutive operating days and analyzed. Results shall be expressed in terms of both concentration and mass, and shall be submitted no later than the end of the third month following the month when any of the criteria listed above was met. Results may be appended to a DMR or transmitted under separate cover to the same address. If levels higher than the action levels are confirmed the permit may be reopened by the Department for consideration of revised action levels or effluent limits.

The permittee is not authorized to discharge any of the listed parameters at levels which may cause or contribute to a violation of water quality standards.

tfall No. 001

uent Parameter	Action Level	Units	Minimum Monitoring Requirements Measurement Frequency	Sample Type
Chloroform	1.3	lbs/day	1/quarter	24-hr. comp.(1)
Cadmium, Total Recoverable	0.4	lbs/day	1/quarter	24-hr. comp.
Chromium, Total Recoverable	1.9	lbs/day	1/quarter	24-hr. comp.
Copper, Total Recoverable	1.8	lbs/day	1/quarter	24-hr. comp.
Nickel, Total Recoverable	2.9	lbs/day	1/quarter	24-hr. comp.
Zinc, Total Recoverable	5.4	lbs/day	1/quarter	24-hr. comp.
Arsenic, Total Recoverable	Monitor(2)	lbs/day	1/quarter	24-hr. comp.
Phenols, Total	Monitor(2)	lbs/day	1/quarter	24-hr. comp.

(1) The 24-hr. composites shall be collected as 3 grab samples at 8 hr. intervals.

(2) These parameters have been identified in the effluent. Therefore, a 3-day, short term, high intensify monitoring program shall be conducted within six months of the issuance of this permit.

PRETREATMENT PROGRAM IMPLEMENTATION REQUIREMENTS

A. DEFINITIONS. Generally, terms used in this Section shall be defined as in the General Pretreatment Regulations (40 CFR Part 403). Specifically, the following definitions apply to terms used in this Section (PRETREATMENT PROGRAM IMPLEMENTATION REQUIREMENTS):

1. Categorical Industrial User (CIU) - an industrial user of the POTW that is subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N;

2. Local Limits - General Prohibitions, specific prohibitions and specific limits as set forth in 40 CFR 403.5.

3. The Publicly Owned Treatment Works (the POTW) - as defined by 40 CFR 403.3(o) and that discharges in accordance with this permit.

4. Program Submission(s) - requests for approval or modification of the POTW Pretreatment Program submitted in accordance with 40 CFR 403.11 or 403.18 and approved by letter dated June 11, 1984.

5. Significant Industrial User (SIU) -

a. CIUs;

b. Except as provided in 40 CFR 403.3(t)(2), any other industrial user that discharges an average of 25,000 gallons per day or more of process wastewater (excluding sanitary, non-contact cooling and boiler blowdown wastewater) to the POTW;

c. Except as provided in 40 CFR 403.3(t)(2), any other industrial user that contributes a process wastestream which makes up 5 percent or more average dry weather hydraulic or organic capacity of the POTW treatment plant;

d. Any other industrial user that the permittee designates as having a reasonable potential for adversely affecting the POTW's operation or for violating a pretreatment standard or requirement.

6. Substances of Concern - Substances identified by the New York State Department of Environmental Conservations Industrial Chemical Survey as substances of concern.

B. IMPLEMENTATION. The permittee shall implement a POTW Pretreatment Program in accordance 40 CFR Part 403 and as set forth in the permittee's approved Program Submission(s). Modifications to this program shall be made in accordance with 40 CFR 403.18. Specific program requirements are as follows:

1. Industrial Survey. To maintain an updated inventory of industrial dischargers to the POTW the permittee shall:

a. Identify, locate and list all industrial users who might be subject to the industrial pretreatment program from the pretreatment program submission and any other necessary, appropriate and available sources. This identification and location list will be updated, at a minimum, every five years. As part of this update the permittee shall collect a current and complete New York State Industrial Chemical Survey form (or equivalent) from each SIU.

b. Identify the character and volume of pollutants contributed to the POTW by each industrial user identified in B.1.a above that is classified as a SIU.

c. Identify, locate and list, from the pretreatment program submission and any other necessary, appropriate and available sources, all significant industrial users of the POTW.

PRETREATMENT PROGRAM IMPLEMENTATION REQUIREMENTS (continued)

2. Control Mechanisms. To provide adequate notice to and control of industrial users of the POTW the permittee shall:

   a. Inform by certified letter, hand delivery courier, overnight mail, or other means which will provide written acknowledgement of delivery, all industrial users identified in B.1.a. above of applicable pretreatment standards and requirements including the requirement to comply with the local sewer use law, regulation or ordinance and any applicable requirements under section 204(b) and 405 of the Federal Clean Water Act and Subtitles C and D of the Resource Conservation and Recovery Act.

   b. Control through permit or similar means the contribution to the POTW by each SIU to ensure compliance with applicable pretreatment standards and requirements. Permits shall contain limitations, sampling frequency and type, reporting and self-monitoring requirements as described below, requirements that limitations and conditions be complied with by established deadlines, an expiration date not later than five years from the date of permit issuance, a statement of applicable civil and criminal penalties and the requirement to comply with Local Limits and any other requirements in accordance with 40 CFR 403.8(f)(1).

3. Monitoring and Inspection. To provide adequate, ongoing characterization of non-domestic users of the POTW, the permittee shall:

   a. Receive and analyze self-monitoring reports and other notices. The permittee shall require all SIUs to submit self-monitoring reports at least every six months unless the permittee collects all such information required for the report, including flow data.

   b. The permittee shall adequately inspect each SIU at a minimum frequency of once per year.

   c. The permittee shall collect and analyze samples from each SIU for all priority pollutants that can reasonably be expected to be detectable at levels greater that the levels found in domestic sewage at a minimum frequency of once per year.

   d. Require, through permits, each SIU to collect at least one 24 hour, flow proportioned composite (where feasible) effluent sample every six months and analyze each of those samples for all priority pollutants that can reasonably be expected to be detectable in that discharge at levels greater than the levels found in domestic sewage. The permittee may perform the aforementioned monitoring in lieu of the SIU except that the permittee must also perform the compliance monitoring described in 3.c.

4. Enforcement. To assure adequate, equitable enforcement of the industrial pretreatment program the permittee shall:

   a. Investigate instances of noncompliance with pretreatment standards and requirements, as indicated in self-monitoring reports and notices or indicated by analysis, inspection and surveillance activities. Sample taking and analysis and the collection of other information shall be performed with sufficient care to produce evidence admissible in enforcement proceedings or in judicial actions. Enforcement activities shall be conducted in accordance with the permittee's Enforcement Response Plan developed and approved in accordance with 40 CFR Part 403.

   b. Enforce compliance with all national pretreatment standards and requirements in 40 CFR Parts 406 - 471.

   c. Provide public notification of significant non-compliance as required by 40 CFR 403.8(f)(2)(viii).

   d. Pursuant to 40 CFR 403.5(e), when either the Department or the USEPA determines any source contributes pollutants to the POTW in violation of Pretreatment Standards or Requirements the Department or the USEPA shall notify the permittee. Failure by the permittee to commence an appropriate investigation and subsequent enforcement action within 30 days of this notification may result in appropriate enforcement action against the source and permittee.

PRETREATMENT PROGRAM IMPLEMENTATION REQUIREMENTS (continued)

5. Recordkeeping. The permittee shall maintain and update, as necessary, records identifying the nature, character, and volume of pollutants contributed by SIUs. Records shall be maintained in accordance with Part II.10.3.a.

6. Staffing. The permittee shall Maintain minimum staffing positions committed to implementation of the Industrial Pretreatment Program at 6 full time equivalent and make good faith efforts to keep such positions filled at all times. Further, the permittee shall provide training to pretreatment program staff adequate to allow performance of duties required by this permit.

C. SLUDGE DISPOSAL PLAN. The permittee shall notify NYSDEC, and USEPA as long as USEPA remains the approval authority, 60 days prior to any major proposed change in the sludge disposal plan. NYSDEC may require additional pretreatment measures or controls to prevent or abate an interference incident relating to sludge use or disposal.

D. REPORTING. The permittee shall provide to the offices listed on the Monitoring, Reporting and Recording page of this permit and to the Chief-Water Permits and Compliance Branch; USEPA Region II; 26 Federal Plaza; New York, NY 10278; a periodic report, prepared and submitted in accordance with the consistent periodic reporting format established by the Department in the document entitled NYSDEC POTW Periodic Pretreatment Report - 1994, that briefly describes the permittee's program activities over the previous year. This report shall be submitted to the above noted offices within 60 days of the end of the reporting period. The reporting period shall be Annual, with reporting period(s) ending on December 31.

The periodic report shall include:

1. Industrial Survey. Updated industrial survey information in accordance with 40 CFR 403.12(i)(1) (including any NYS Industrial Chemical Survey forms updated during the reporting period).

2. Implementation Status. Status of Program Implementation, to include:

   a. Any interference, upset or permit violations experienced at the POTW directly attributable to industrial users.

   b. Listing of significant industrial users issued permits.

   c. Listing of significant industrial users inspected and/or monitored during the previous reporting period and summary of results.

   d. Listing of significant industrial users notified of promulgated pretreatment standards or applicable local standards who are on compliance schedules. The listing should include for each facility the final date of compliance.

   e. Summary of POTW monitoring results not already submitted on Discharge Monitoring Reports and toxic loadings from SIU's organized by parameter.

   f. A summary of additions or deletions to the list of SIUs, with a brief explanation for each deletion.

3. Enforcement Status. Status of enforcement activities to include:

   a. Listing of significant industrial users in Significant Non-Compliance (as defined by 40 CFR 403.8(f)(2)(vii)) with federal or local pretreatment standards at end of the reporting period.

   b. Summary of enforcement activities taken against non-complying significant industrial users. The permittee shall provide a copy of the public notice of significant violators as specified in 40 CFR Part 403.8(f)(2)(vii).

RECORDING, REPORTING AND ADDITIONAL MONITORING REQUIREMENTS

a) The permittee shall also refer to the General Conditions (Part II) of this permit for additional information concerning monitoring and reporting requirements and conditions.

b) The monitoring information required by this permit shall be summarized, signed and retained for a period of three years from the date of the sampling for subsequent inspection by the Department or its designated agent. Also;

[X] (if box is checked) monitoring information required by this permit shall be summarized and reported by submitting completed and signed Discharge Monitoring Report (DMR) forms for each 1 month reporting period to the locations specified below. Blank forms are available at the Department's Albany office listed below. The first reporting period begins on the effective date of this permit and the reports will be due no later than the 28th day of the month following the end of each reporting period.

Send the original (top sheet) of each DMR page to:

Department of Environmental Conservation Division of Water Bureau of Water Compliance Programs 50 Wolf Road ~~Albany, New York 12233-3506~~	Onondaga Co. Dept. of Health P.O. Box 1325 421 Montgomery Street ~~Syracuse, New York 13202~~

Phone: (518) 457-3790

Send the first copy (second sheet) of each DMR page to:

Department of Environmental Conservation
Regional Water Engineer
Regin 7
Region 7
615 Erie Blvd. West
Syracuse, New York 13204-2400

c) A monthly "Wastewater Facility Operation Report..." (form 92-15-7) shall be submitted (if box is checked) to the [ ] Regional Water Engineer and/or [ ] County Health Department or Environmental Control Agency listed above.

d) Noncompliance with the provisions of this permit shall be reported to the Department as prescribed in the attached General Conditions (Part II).

e) Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

f) If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR Part 136 or as specified in this permit, the results of this monitoring shall be included in the calculations and recording on the Discharge Monitoring Reports.

g) Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in this permit.

h) Unless otherwise specified, all information recorded on the Discharge Monitoring Report shall be based upon measurements and sampling carried out during the most recently completed reporting period.

i) Any laboratory test or sample analysis required by this permit for which the State Commissioner of Health issues certificates of approval pursuant to section five hundred two of the Public Health Law shall be conducted by a laboratory which has been issued a certificate of approval. Inquiries regarding laboratory certification should be sent to the Environmental Laboratory Accreditation Program, New York State Health Department Center for Laboratories and Research, Division of Environmental Sciences, The Nelson A. Rockefeller State Plaza, Albany, New York 12201.

APPENDIX B

FUTURE SPDES PERMIT DISCHARGE REQUIREMENTS

cc/ KKO, JJO, KEB, JJM, ...
cc S&W: Jerry Hook, Nick Hadala, Bruce Munn

New York State Department of Environmental Conservation
Division of Water, Region 7
615 Erie Boulevard West, Syracuse, New York 13204-2400
Phone: (315) 426-7500 • FAX: (315) 426-7459
Website: www.dec.state.ny.us

DEPARTMENT WATER ENVIRONMENT PROTECTION
2008 JUL 17 PM 12:15
RECEIVED ONONDAGA COUNTY

Alexander B. Grannis
Commissioner

RECEIVED STEARNS & WHELER L.L.C.
JUL 23 2008

Randy R. Ott, P.E.
Commissioner
Onondaga County Department
Of Water Environment Protection
650 Hiawatha Blvd. West
Syracuse, NY 13204-1194

Re : Oak Orchard WWTP SPDES Permit
NY 0030317 Proposed Upgrade Effluent Limitations.

Dear Commissioner Ott:

The New York State Department of Environmental Conservation (NYSDEC) acknowledges receipt of the above correspondence dated 05/07/2008 and replies as follows.

The NYSDEC has consulted the following Personnel : Mr Charles St. Lucia and Mr. John Weidman of the Central Office in Albany. It is our understanding that in the proposed upgrade of the Oak Orchard WWTP to accommodate the increase in the allowable discharge from 10 MGD to 11 MGD (a 30 day average basis)for the 20 year planning period (2006-2026), should be in keeping with the following findings and recommendations :

"(1) The D. O. Limit of 5.0 mg/l can be retained and with the mass loading of UOD held constant at 4289 lbs/day there should be no impact on the ambient dissolved oxygen.

(2) The Phosphorus limit of 1.0 mg/l is based on a Great Lakes requirement and is concentration based.

(3) BOD5 & TSS - keep at secondary levels increasing the lbs/day based on 11 MGD.

(4) Ammonia - retain the current-permit limit for "summer" ammonia of 400 lbs/day. A "winter" limit is not necessary.

(5) TRC - total residual chlorine at 11 MGD can be 18.8 lbs/day. This equates to 0.2 mg/l at buildout. The 0.35 mg/l limit can be retained for flows < the permit flow.

(6) Other limits to remain as is.

(7) I have not specifically looked at any of the toxic parameters (metals, etc.) but a good conservative approach would be to retain the mass levels listed."

Please contact me if you have any further questions.

Sincerely,

S.E.Mahamooth, P.E..
NYSDEC/Division of Water

cc : Jeanne C. Powers, OCDWEP
John Saraceni, OCDWEP
Joseph Mastriano, OCDWEP
Charles St. Lucia, P.E., NYSDEC
John Weidman, P.E., NYSDEC
Jim Burke, P.E., NYSDEC

APPENDIX C

LISTING OF PROPOSED EQUIPMENT

APPENDIX C

LISTING OF PROPOSED EQUIPMENT
ALTERNATIVE WW-A1 HIGH PURITY OXYGEN SYSTEM EXPANSION

ITEM	LOCATION	QTY	SIZE / CAPACITY	TYPICAL MANUFACTURERS	TYPE / MODEL	TOTAL EQUIPMENT COST
Influent Screens	Influent Building	2	1/2-inch spacing / 20 mgd	IDI, Fairfield	Mechanical Climber-Type Bar Screen	$400,000
Grit Removal Units	Influent Building	2	20 mgd	Eutek	Flow-Induced Vortex Grit Removal	$560,000
Clarifier Sludge & Scum Collection Mechanisms	Primary Clarifiers	6	20 ft x 120 ft	Siemens, Guardian, PolyChem	Rectangular Chain & Flight	$440,000
Primary Treatment Fine Screen Influent Pumps	PTFS Building	2	5,500 gpm	Flygt, ABS, Flowserve	Submersible Centrifugal	$330,000
Primary Treatment Fine Screens	PTFS Building	2	0.06-inch / 8.0 mgd	Parkson	Mechanical Rotating Drum	$310,000
Mechanical Aerators	HPO Aeration Tanks	12	20 hp	m2t Lotepro	Surface Aerators	$2,500,000
Mechanical Aerators	HPO Aeration Tanks	16	20 hp	m2t Lotepro	Surface Aerators	
Purge Blowers	HPO Aeration Tanks	4	-	m2t Lotepro	Centrifugal	
Oxygen Generation System	Oxygen Generation Building	1	14 tons/day	m2t Lotepro, Praxair	Vacuum Pressure Swing Adsorption	$2,000,000
- Adsorption Vessels	Oxygen Generation Building	2	-	m2t Lotepro, Praxair	-	
- Air Blower	Oxygen Generation Building	1	50 hp	m2t Lotepro, Praxair	-	
- Vacuum Pump	Oxygen Generation Building	1	500 hp	m2t Lotepro, Praxair	-	
Clarifier Drive Mechanisms	Secondary Clarifiers	3	-	WesTech, Dorr Oliver EIMCO	Circular, Center Feed	$1,100,000
Effluent Weirs & Launders	Secondary Clarifiers	3	-	WesTech, Dorr Oliver EIMCO	Circular, Center Feed	
RAS Pumps	Recirculation PS	3	6,300 gpm	Chicago, ITT-AC, Wemco, Hayward-Gordon	Centrifugal (Non-Clog or Recessed Impeller)	$150,000
WAS Pumps	Recirculation PS	2	TBD	Chicago, ITT-AC, Wemco, Hayward-Gordon	Centrifugal (Non-Clog or Recessed Impeller)	$100,000
UV Disinfection System	UV Building	1	31,000 $\mu Ws/cm^2$ / 40 mgd	Trojan UV, Wedeco, Sunlight Systems	Horizontal In-Channel	$750,000

APPENDIX C

LISTING OF PROPOSED EQUIPMENT
ALTERNATIVE WW-A2 HIGH PURITY OXYGEN SYSTEM AND INTEGRATED FIXED-FILM ACTIVATED SLUDGE

ITEM	LOCATION	QTY	SIZE / CAPACITY	TYPICAL MANUFACTURERS	TYPE / MODEL	TOTAL EQUIPMENT COST
Influent Screens	Influent Building	2	1/2-inch spacing / 20 mgd	IDI, Fairfield	Mechanical Climber-Type Bar Screen	$400,000
Grit Removal Units	Influent Building	2	20 mgd	Eutek	Flow-Induced Vortex Grit Removal	$560,000
Clarifier Sludge & Scum Collection Mechanisms	Primary Clarifiers	6	20 ft x 120 ft	Siemens, Guardian, PolyChem	Rectangular Chain & Flight	$440,000
Primary Treatment Fine Screen Influent Pumps	PTFS Building	3	5,500 gpm	Flygt, ABS, Flowserve	Submersible Centrifugal	$330,000
Primary Treatment Fine Screens	PTFS Building	2	0.06-inch / 8.0 mgd	Parkson	Mechanical Rotating Drum	$310,000
Mechanical Aerators	HPO Aeration Tanks	12	20 hp	m2t Lotepro	Surface Aerators	$1,200,000
Purge Blowers	HPO Aeration Tanks	2	-	m2t Lotepro	Centrifugal	
Oxygen Generation System	Oxygen Generation & Blower Building	1	14 tons/day	m2t Lotepro, Praxair	Vacuum Pressure Swing Adsorption	$1,250,000
- Adsorption Vessels	-	2	-	m2t Lotepro, Praxair	-	
- Air Blower	-	1	50 hp	m2t Lotepro, Praxair	-	
- Vacuum Pump	-	1	500 hp	m2t Lotepro, Praxair	-	
IFAS Equipment	IFAS Tanks	4	62,200 ft^3 media	Kruger, IDI, Entex	Floating Plastic Media Medium Bubble Diffusers	$3,250,000
Aeration Blowers	Oxygen Generation & Blower Building	3	200 hp / 5,700 scfm	Continental, Gardner Denver	Multistage Centrifugal	
Clarifier Drive Mechanisms	Secondary Clarifiers	3	136 feet	WesTech, Dorr Oliver EIMCO	Circular, Center Feed	$1,100,000
Effluent Weirs & Launders	Secondary Clarifiers	3	136 feet	WesTech, Dorr Oliver EIMCO	Circular	
RAS Pumps	Recirculation PS	3	6,300 gpm	Chicago, ITT-AC, Wemco, Hayward-Gordon	Centrifugal (Non-Clog or Recessed Impeller)	$150,000
WAS Pumps	Recirculation PS	2	TBD	Chicago, ITT-AC, Wemco, Hayward-Gordon	Centrifugal (Non-Clog or Recessed Impeller)	$100,000
UV Disinfection System	UV Building	1	31,000 $\mu Ws/cm^2$ / 40 mgd	Trojan UV, Wedeco, Sunlight Systems	Horizontal In-Channel	$750,000

APPENDIX C

LISTING OF PROPOSED EQUIPMENT
SLUDGE HANDLING AND DISPOSAL (NO CHANGE)

ITEM	LOCATION	QTY	SIZE / CAPACITY	TYPICAL MANUFACTURERS	TYPE / MODEL	TOTAL EQUIPMENT COST
COMBINED SLUDGE THICKENING & HOLDING (EXISTING):						
Thickener Tank Mechanisms	Raw Sludge Thickeners	2	2 HP,Replace to match existing in 40' circular gravity thickener tanks	Walker, EIMCO	Motor driven picket type	$75,000
Air Diffusers	Thickened Sludge Storage Tanks	1	Replace to match existing	Sanitaire, EDI	TBD	$50,000
Blowers	Thickened Sludge Area	1	Replace to match existing	Dresser Roots, Kaeser	Positive displacement	
Thickened sludge transfer pumps	Thickened Sludge Area	4	70 gpm, duplex plunger pump	Komline-Sanderson	Duplex plunger pump	$30,000

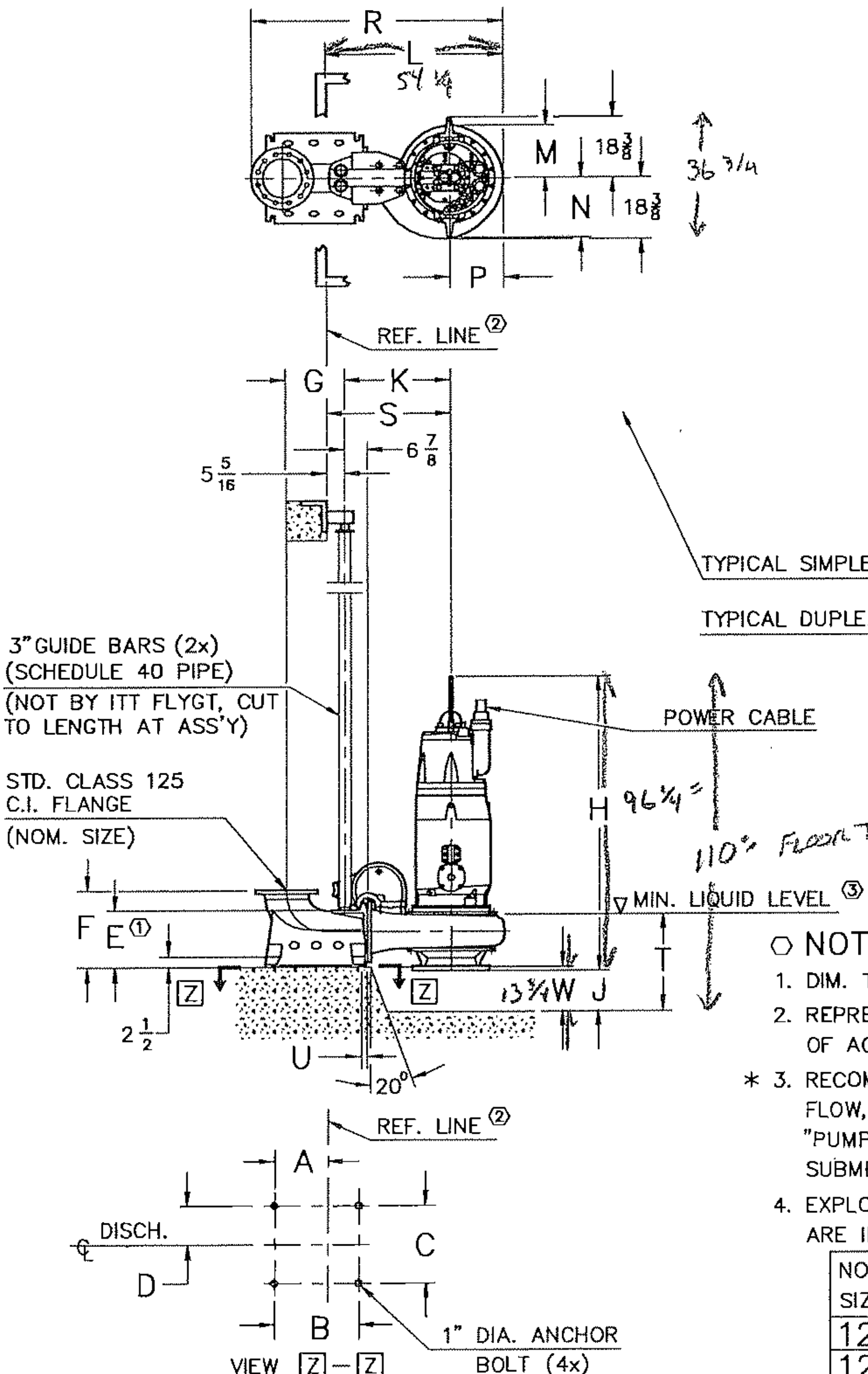
APPENDIX D

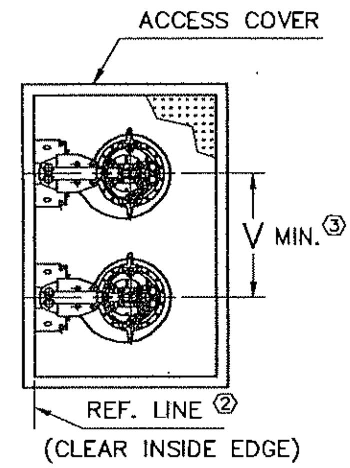
DAVIS ROAD PUMP STATION
PUMP CATALOG CUT SHEETS

→ EXISTING PUMPS

SECTION	PAGE
4	1
SUPERSEDES	ISSUED
	6/94

CP-3312 (700 Series Drives)
Outline Dimensions





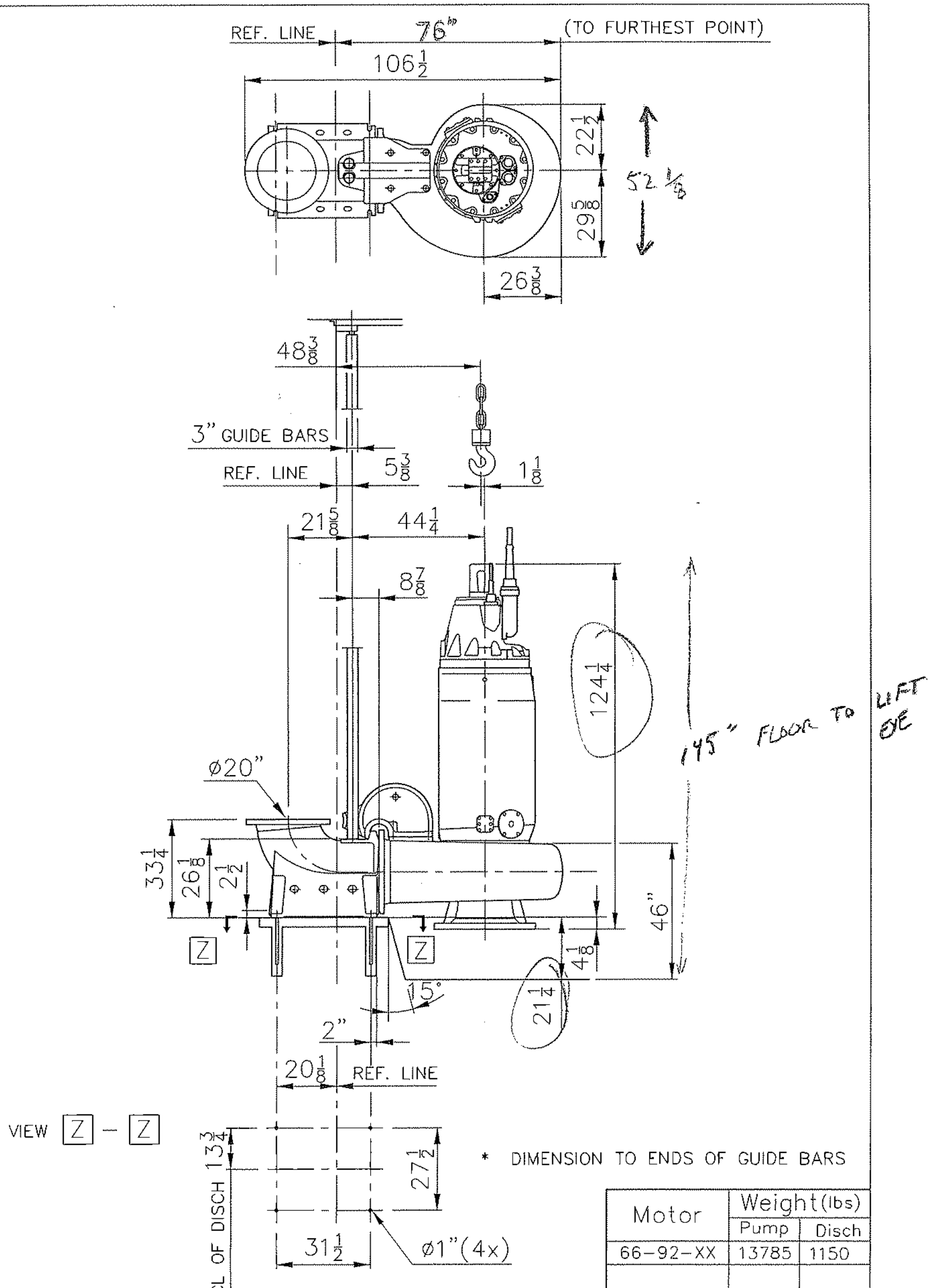
○ NOTES:

1. DIM. TO ENDS OF GUIDE BARS.
2. REPRESENTS CLEAR INSIDE EDGE OF ACCESS FRAME OR OPENING.
3. * RECOMMENDED VALUE VARIES WITH FLOW, SEE SEP. BROCHURE "PUMPING STATIONS WITH LARGE SUBMERSIBLE CENTRIFUGAL PUMPS"
4. EXPLOSION–PROOF DRIVE UNITS ARE IN PARENTHESES.

NOM. SIZE	DRIVE UNIT	WEIGHT (LBS) PUMP	DISCH
12"	705 (715)	4400	530
12"	735 (745)	4840	530
12"	765 (775)	5280	530

ALL DIMENSIONS IN INCHES

NOM. SIZE	DRIVE UNIT	DIMENSIONAL CHART A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	V	W
12"	705 (715)	16 1/4	25 5/8	23 3/4	11 7/8	18 1/2	23 3/4	18 3/4	90 3/4	12 3/4	32 1/2	54 1/4	16	18 3/4	16 1/2	78 1/4	38	*	2	*	13 3/4
12"	735 (745)	16 1/4	25 5/8	23 3/4	11 7/8	18 1/2	23 3/4	18 3/4	96 1/4	12 3/4	32 1/2	54 1/4	16	18 3/4	16 1/2	78 1/4	38	*	2	*	13 3/4
12"	765 (775)	16 1/4	25 5/8	23 3/4	11 7/8	18 1/2	23 3/4	18 3/4	101	12 3/4	32 1/2	54 1/4	16	18 3/4	16 1/2	78 1/4	38	*	2	*	13 3/4



* DIMENSION TO ENDS OF GUIDE BARS

Motor	Weight (lbs)	
	Pump	Disch
66-92-XX	13785	1150

FLYGT AUTOCAD DRAWING

Denomination: Dimensional drwg CP 3531 965/975 ø20"

Drawn by	Checked by	Date	Scale	Reg no		
NK		090402		5399	6848800	3

APPENDIX E

UPDATED BOWKER & ASSOCIATES MEMORANDUM
(MARCH 31, 2010)
REVISED SULFIDE CONTROL STRATEGY FOR
DAVIS ROAD PUMP STATION

BOWKER & ASSOCIATES, INC
CONSULTING ENGINEERS

477 Congress Street
Suite 1004
Portland, Maine 04101

Office (207) 874-8077 www.bowkerandassoc.com FAX (207) 874-8022

MEMORANDUM

Subject: Updated, Revised Sulfide Control Strategy for Davis Rd Force Main System

From: Robert P.G. Bowker

To: Bruce Munn, Stearns & Wheler

Date: March 31, 2010

1. INTRODUCTION

The Davis Rd Force Main conveys wastewater approximately six miles from the Davis Rd Pump Station to the Oak Orchard Wastewater Treatment Plant (WWTP). For most of the six miles, the conveyance system consists of two parallel force mains of 24-in and 36-in diameter. The long wastewater detention times allow for development of anaerobic conditions and generation of sulfide, which can be released from solution as hydrogen sulfide gas to cause odor and corrosion problems. Over the years, the County has tried injection of several different chemicals at Davis Rd PS to suppress sulfide generation in the force main. Currently, sodium hypochlorite is injected into the force main at Davis Rd to "disinfect" the sulfide-producing slime layer. This has generally been effective. However, sulfide loadings to the Oak Orchard WWTP remain relatively high. In 1994, Bowker & Associates recommended a demonstration using nitrate (Bioxide™). Although equally effective, operating costs were higher. The County did use this chemical for several years in the spring, as it was found to assist with the onset of seasonal nitrification at the Oak Orchard facility. The chemical is no longer used. The County also conducted a trial using iron salts to precipitate the sulfide. This increased sludge production and adversely affected settleability.

2. EXISTING CONDITIONS

Figure 1 shows a schematic of the force main system. Table 1 shows flow data for 2007, and Table 2 summarizes two years of chemical usage data. Annual chemical cost for 2007 was estimated to be $211,000 using the May, 2008 unit cost for sodium hypochlorite of $0.85/gal. Note that the County received a 2010 bid for sodium hypochlorite of $0.464/gal, which significantly changed the economic analysis of sulfide control alternatives, prompting this update to the November 18, 2009 memorandum.

Despite the injection of about 650 gal/d of sodium hypochlorite at Davis Rd PS, influent sulfide levels measured in June, 2007 were 2.5 to 3 mg/L, and hydrogen sulfide concentrations in the headspace of the covered aerated grit chambers typically ranged from 100 to 200 ppm. These are high levels generally associated with odor and corrosion problems, and indicate an insufficient bleach dosage. The proper dosage of bleach to achieve target sulfide levels <0.5 mg/L is estimated to be 1,100 gal/d, corresponding to a daily cost of $510/d ($186,000/yr) using the 2010 bleach cost of $0.464/gal.

The condition of the force main system between the Davis Rd PS and the Oak Orchard WWTP is not known. In theory, a force main flowing completely full will not experience hydrogen sulfide corrosion. However, if gas pockets exist at high points, where hydrogen sulfide gas can accumulate and be biologically oxidized to sulfuric acid in the presence of oxygen, localized corrosion can occur. If the County wishes to provide some level of protection of this pipeline from H_2S corrosion, it will be necessary to add the chemicals at the Davis Road PS to control dissolved sulfide levels in the force main. This can significantly alter the cost-effectiveness of some chemicals such as hydrogen peroxide, nitrate, and to a lesser degree oxygen.

3. EVALUATION OF SULFIDE CONTROL ALTERNATIVES

Figure 1 shows a schematic of the two parallel force mains between Davis Rd PS and the Oak Orchard WWTP. In the past, the 24-in Clay-Cicero force main was used during dry weather. In wet weather, flow was diverted to the 36-in Davis Rd force main, or both force mains were used. Currently, both force mains are currently operated simultaneously under all flow conditions. This is apparently done to prevent high "shock" loadings of sulfide during start-up of a previously idle force main, causing problems with nitrification at the WWTP. As shown in Table 3, the use of both force mains during dry weather has major implications for sulfide generation. Operating both force mains effectively doubles the mass of sulfide generated compared to operating only the 24-in line. Wastewater detention time more than doubles. Operating the 36-in line instead of the 24-in increases sulfide generation by about 40 percent.

Table 4 summarizes the available chemicals used for sulfide control in wastewater. Sulfide modeling using the Pomeroy-Parkhurst equation predicts end-of-pipe sulfide levels ranging from 3 to 15 mg/L depending on flow (detention time) and which force mains are in operation. (This is with no chemical treatment.) This results in a mass loading of sulfide to the Oak Orchard WWTP of approximately 200 to 400 lb/d. The following analysis assumes a sulfide loading of 400 lb/d (both force mains in operation). With both force mains in operation, predicted sulfide levels entering the Oak Orchard WWTP are 5 to 9 mg/L. The analysis assumes that all chemicals would achieve a target end-of-pipe sulfide concentration of 0.5 mg/L.

3.1 Nitrate

Bowker & Associates evaluated the Davis Rd force main in 1994 and recommended a demonstration of nitrate (Bioxide™) as a more economical chemical than sodium hypochlorite. The demonstration was conducted during the summer of 1995. Among the findings were:

1. The costs of sulfide control using Bioxide™ were higher than for bleach (sodium hypochlorite), and
2. The actual bleach dosages were lower than predicted by the chemical equations, since the bleach apparently acts to disinfect the sulfide-producing slime layer rather than oxidize existing sulfide.

Nitrate is not considered to be cost-effective compared to bleach for this application.

3.2 Iron salts

Iron salts (ferrous chloride or ferrous sulfate) are another class of chemicals widely used for sulfide control in wastewater systems. Recently, prices of iron salts have been highly volatile. Further, because iron precipitates sulfide as a solid, sludge production can be expected to increase by 10 to 15 percent. Iron is not recommended where UV disinfection is practiced as iron tends to coat the lamps. The County of Onondaga currently uses iron salts for sulfide control in the collection system serving the Metro plant.

To precipitate 400 lb/day of sulfide, approximately 480 gal/day of ferrous chloride solution (23% iron) would be required. A demonstration project was conducted by the County in 1993 in which iron salts were added at the Davis Rd PS. At the Oak Orchard WWTP, sludge production increased and sludge compaction was reduced, increasing the volume of liquid sludge hauled to the Metro plant. Iron salts do not offer an economic or technical benefit over the current use of sodium hypochlorite, and result in greater volumes (and mass) of sludge at the Oak Orchard WWTP.

3.3 Magnesium Hydroxide

Magnesium hydroxide is a relatively new chemical used for sulfide control. It works by raising the pH to 8.5, which suppresses sulfide formation and prevents the release of H_2S gas. It is cost effective for long force mains or multiple force mains in series where high sulfide levels are expected. Unlike most other chemicals, the dosage is independent of sulfide concentration. The chemical is safe to handle, and adds alkalinity to the wastewater. It must be stored in heat-traced insulated vessels with a mixer to maintain the product in suspension. Dosages are typically 50 to 100 gallons of $Mg(OH)_2$ per million gallons of wastewater. For an average flow of 7 mgd and a dosage of 70 gallons per million, this would amount to a usage rate of about 500 gallons per day. At a unit cost of $2.00/gal, daily costs would be $1,000/d, and annual costs would exceed $350,000/yr. This is significantly more than the projected cost to achieve 0.5 mg/L sulfide using bleach at the current unit cost of $0.464/gal.

Another potential issue with magnesium hydroxide is the effect of the elevated pH on downstream biological processes. Since the vast majority of flow to the Oak Orchard WWTP enters via the Davis Rd FM, wastewater with a pH of 8.5 would receive little dilution. According to a technical representative of Premier Chemicals, this high pH will not adversely affect the performance of the activated sludge process, and will provide a needed source of alkalinity for nitrification in the pure oxygen activated sludge process.

3.4 Hydrogen Peroxide

Hydrogen peroxide is a strong oxidant that is effective for sulfide control. It is typically added 20 to 30 minutes upstream of where sulfide control is desired in order for the reaction to be complete. In the case of Oak Orchard, this would require a remote, secure hydrogen peroxide storage and injection site. Within the past few years, a proprietary process has been developed in which an iron-based catalyst is injected simultaneously with the hydrogen peroxide that decreases the reaction time to a few minutes and reportedly improves the efficiency of sulfide oxidation.

Added 20 to 30 minutes upstream of the plant, most of the force main would not be protected against H_2S corrosion. Therefore, hydrogen peroxide alone is not a fair comparison to the other alternatives that do provide force main protection. One option is to continue to add sodium hypochlorite at Davis Rd to provide protection of the force main, and then add hydrogen peroxide near the Oak Orchard WWTP to remove the remaining 2 to 3 mg/L of sulfide. This assumes that the current dosage of hypochlorite is sufficient to provide protection of most of the force main against H_2S corrosion, although data suggest that sulfide has already begun to form up to two miles from the Oak Orchard plant. Assuming 2.5 mg/L of sulfide remaining in the force main with upstream hypochlorite injection, the sulfide load to be treated using peroxide would be about 150 lb/day. Oxidation of 150 lb/d of sulfide is estimated to require 60 gal/d of 50% H_2O_2 at a dosage ratio of 2 lb H_2O_2 per lb sulfide. At a unit cost of \$3.50/gal, the peroxide cost is projected to be \$77,000/yr. This would be in addition to the \$115,000/yr projected to be spent on bleach at the most recent (March 2010) price of \$0.464/gal.

3.5 Pure Oxygen

Oxygen is often the most economical chemical for force main sulfide control in terms of the operating cost per pound of sulfide removed. Oxygen can be used to oxidize existing sulfide as well as to prevent sulfide generation by maintaining aerobic wastewater conditions. However, significantly higher capital expenditure is required for a dissolution system that ensures efficient oxygen transfer into the wastewater compared to a simple chemical storage/feed system. Without efficient oxygen dissolution, oxygen gas pockets can form along the crown of the pipe, and oxygen gas may be wasted through air relief valves.

Currently, the most common method of dissolving oxygen into a force main is to supersaturate a sidestream with pure oxygen, then introduce the highly oxygenated sidestream back into the bulk wastewater flow. This is the dissolution method with the proprietary ECO_2 process. Oxygen can be purchased as a liquid or generated on-site using a skid-mounted Pressure Swing Absorption (PSA) or Vacuum Swing Absorption (VSA) unit. When compared to the cost of liquid oxygen and the leasing costs of a liquid oxygen storage tank and vaporizer, on-site generation is often more economical.

Due to the very long detention times with both force mains in operation, it would be necessary to add oxygen at both the Davis Rd PS and the Henry Clay PS (or some other intermediate location). This is necessary in order to maintain aerobic conditions in the force main for 8 hours or more. The requirement for two oxygen injection stations substantially increases the capital cost of a sulfide control system using pure oxygen.

3.6 Economic Analysis

Table 5 shows an economic analysis of the screened alternatives for controlling sulfide loading to the Oak Orchard WWTP. This is based on a sulfide loading of 400 lb/d and simultaneous use of both the 24-in and 36-in force mains that results in wastewater detention times of 8 hours or more.

At the current bleach price of $0.464/gal (March 2010), sodium hypochlorite injection is clearly the most cost-effective alternative for sulfide control in the Davis Road force main system. The high cost of power ($0.17/kwh) and the capital costs of two injection sites makes oxygen less economical. (Vendor estimates for oxygenation systems at Davis Rd PS and Henry Clay PS are included in Appendix A.) There is no economic advantage to a combination of bleach and hydrogen peroxide polishing at the current low price for sodium hypochlorite.

Based on recent quotes on bulk sodium hypochlorite at other locations in the U.S., the $0.464/gal is a very attractive price. Most quotes are in the $0.90 to $1.00/gal range. Should the County's price for bleach escalate, the cost-effectiveness of sulfide control using bleach could shift to another alternative. Substituting higher bleach costs into Table 5 shows that pure oxygen injection does not become economical until the unit cost of sodium hypochlorite is about $0.90/gal, almost double the current price. At this unit cost, magnesium hydroxide is still slightly more expensive than bleach. At the higher bleach costs, using hypochlorite to suppress sulfide generation and injecting hydrogen peroxide near the end of the force main may be more economical than bleach alone. This alternative should be re-evaluated at that time, as hydrogen peroxide prices may also change.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

1. Simultaneous operation of both force mains between Davis Rd PS and the Oak Orchard WWTP effectively doubles the wastewater detention time and doubles the mass of sulfide generated.
2. With most sulfide control chemicals, the cost to control sulfide also doubles with the use of both force mains.
3. The current dosage of bleach at the Davis Rd PS is insufficient to reduce sulfide levels to below target levels (<0.5 ppm) at the Oak Orchard WWTP.

4. At the County's current cost of \$0.464/gal for sodium hypochlorite, injection of this chemical is the most cost-effective sulfide control alternative compared to oxygen, magnesium hydroxide, and a combination of bleach and hydrogen peroxide.

4.2 Recommendations

1. The County should re-evaluate its current mode of operating both force mains simultaneously under all flow conditions, even if it requires intermittent chemical dosing when an idle force main is brought on-line.
2. Plant staff should establish a target sulfide level of 0.5 mg/L entering the plant. Current bleach dosage should be increased to achieve the target sulfide concentration.
3. The two force mains between Davis Rd PS and the Oak Orchard WWTP should be inspected for signs of internal H_2S corrosion at the high points.
4. To provide protection of the force mains against corrosion, chemicals such as oxygen, magnesium hydroxide, or sodium hypochlorite must be injected at the beginning of the force main at Davis Rd PS.
5. Injection of sodium hypochlorite into the force main at Davis Rd PS is recommended as the most cost-effective current strategy for sulfide control. Annual chemical cost is projected to be \$186,000/yr based on a unit cost of \$0.464/gal.
6. When the County's price for sodium hypochlorite reaches \$0.90/gal, alternatives such as 1) bleach injection at David Rd to protect the force main, with hydrogen peroxide polishing near the Oak Orchard WWTP, or 2) injecting pure oxygen at Davis Rd PS and Henry Clay PS should be re-evaluated.

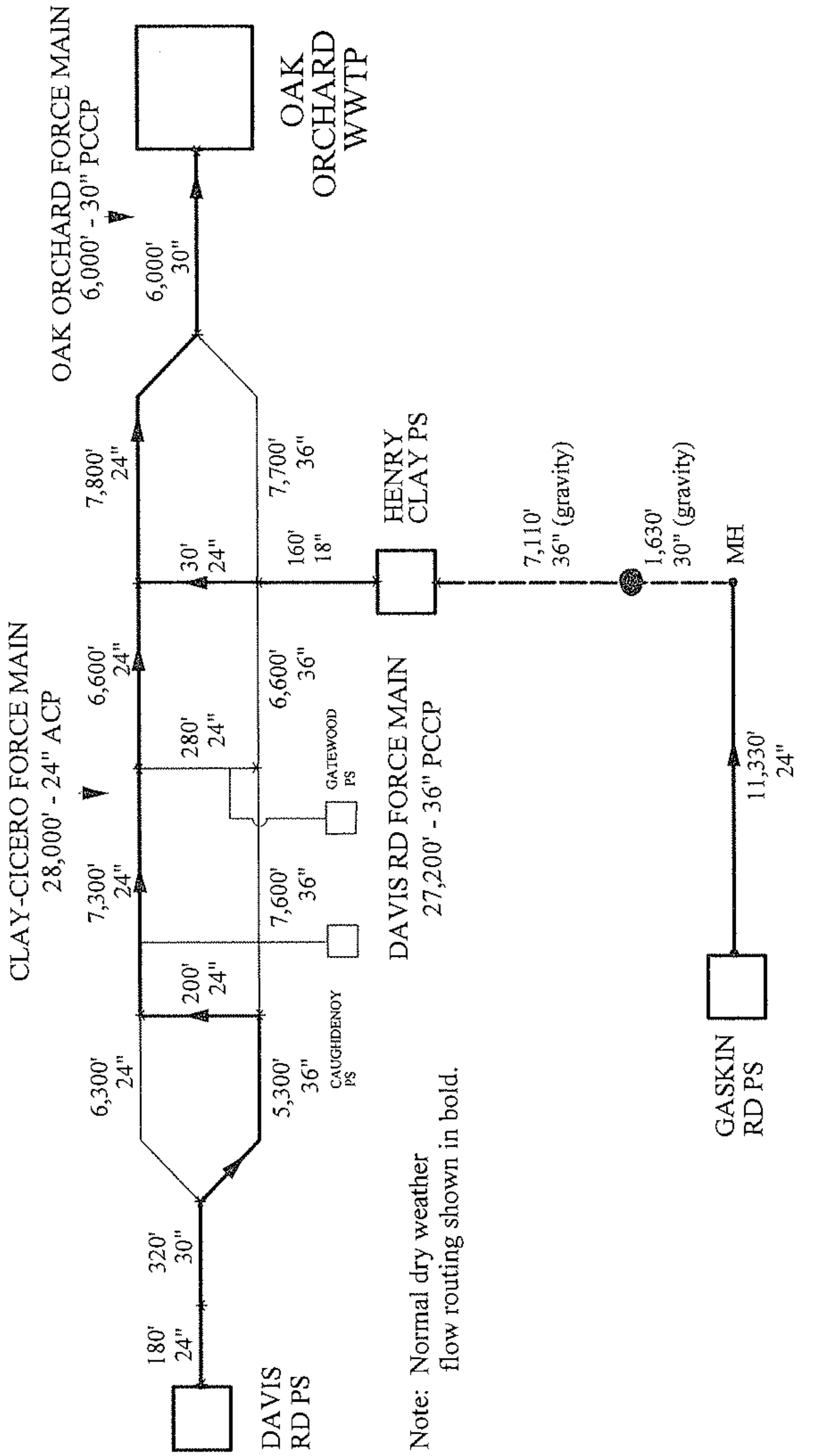


FIGURE 1 SCHEMATIC OF FORCE MAIN SYSTEM; OAK ORCHARD SERVICE AREA

TABLE 1

AVERAGE MONTHLY FLOWS TO OAK ORCHARD WWTP, MGD 2007

	Davis Rd. PS	Henry Clay PS	Misc.	Total to WWTP
JAN	5.9	1.9	0.8	8.6
FEB	4.2	0.9	1.4	6.5
MAR	8.0	2.3	1.1	11.4
APR	6.6	1.9	1.1	9.6
MAY	4.2	1.8	0.6	6.6
JUN	3.7	1.3	1.0	6.0
JUL	3.4	1.0	1.1	5.5
AUG	3.3	1.1	0.8	5.2
SEPT	3.1	1.0	1.3	5.4
OCT	3.5	1.3	1.0	5.8
NOV	4.1	1.5	1.3	6.8
DEC	5.4	1.7	1.4	8.5
AVERAGE	4.6	1.5	1.1	7.2

TABLE 2

MONTHLY BLEACH (NaOCl) USAGE
Davis Rd PS

Month	2007 gal/d	2006 gal/d
January	462	590
February	583	574
March	377	681
April	473	487
May	604	583
June	758	810
July	1,010	691
August	955	836
September	816	777
October	845	596
November	686	534
December	585	533
TOTAL ANNUAL USAGE	248,493	235,799
AVERAGE DAILY USAGE	680 gpd	646 gpd

TABLE 3

PREDICTED SULFIDE LOADINGS
Davis Rd Force Main[1]

Flow mgd	24-inch FM only		36-inch FM only		Both FMs	
	Detention time, hr	Sulfide, mg/L	Detention time, hr	Sulfide, mg/L	Detention time, hr	Sulfide, mg/L
3	7.1	8.1	13.4	11.2	18.7	15.6
5	4.3	4.9	8.0	6.7	11.2	9.3
7 (avg. flow)	3.1	3.5	5.7	4.8	8.0	6.7
9	2.4	2.7	4.5	3.8	6.2	5.2
Total sulfide mass, lbs per day		205		280		390

1 Sulfide predicted using Pomeroy-Parkhurst equation assuming
BOD = 200 mg/L,
temp = 25°C
$M = 0.5 \times 10^{-6}$

TABLE 4

OVERVIEW OF HYDROGEN SULFIDE CONTROL TECHNIQUES
Bowker & Associates, Inc.

Technique	Frequency of Use	Advantages	Disadvantages
I. OXIDATION			
Air injection	Low	Low cost, adds DO to wastewater to prevent sulfide generation	Applicable only to force mains; potential for air binding; limited rate of O_2 transfer
Oxygen injection	Low	5 times solubility of air; high DO possible; economical for force mains	Applicable only to force mains; requires on-site generation or purchase as liquid O_2
Hydrogen peroxide	Medium	Effective for sulfide control in gravity sewers or force mains; simple installation	Costs can be high to achieve low (<0.5 mg/L) sulfide; safety
Sodium hypochlorite	High	Applicable to gravity sewers or force mains; effective for broad range of odorants	Safety considerations; high chemical costs
Potassium permanganate	Medium	Effective, powerful oxidant; good for sludge handling applications	High cost, difficult to handle
II. PRECIPITATION			
Iron salts	High	Economical for sulfide control in gravity sewers or force mains	Does not control non-H_2S odors; sulfide control to low levels may be difficult; increased sludge production
III. pH ELEVATION			
Sodium hydroxide (shock dosing)	Medium	Intermittent application; simple, little equipment required	Does not provide consistent control; safety considerations
Magnesium hydroxide	Low	Maintains pH at 8–8.5; adds alkalinity; economical for high (>5 mg/L) sulfide levels; safe	Requires mixer to maintain slurry in suspension; cost is independent of sulfide concentration
IV. PREVENTION			
Nitrate formulations	High	Can be used to prevent sulfide generation or oxidize sulfide in gravity sewers and force mains; safe to handle	Dosages vary depending on use: prevention vs. removal
Anthraquinones	Low	Prevents sulfide generation biochemically by disrupting sulfur cycle	Not well developed; results inconsistent and difficult to predict

TABLE 5

ECONOMIC EVALUATION OF SULFIDE CONTROL ALTERNATIVES
Davis Rd Force Main[1]

Component	Oxygen	Hypochlorite + Peroxide	Magnesium Hydroxide	Sodium Hypochlorite
CAPITAL COST, $				
Land	$0	$30,000	0	0
Site work	40,000	40,000	10,000	0
Force main taps, valves	80,000	10,000	10,000	0
Equipment	1,145,000	40,000	40,000	0
Installation	150,000	20,000	20,000	0
SUBTOTAL	1,295,000	140,000	80,000	0
Engineering and contingencies (35%)	453,000	49,000	28,000	0
TOTAL CAPITAL COST	$1,748,000	$189,000	$108,000	$0
O&M COSTS, $/YR				
Chemicals[2]	0[3]	192,000	365,000	186,000
Power @ $0.17/kwh	200,900[3]	800	800	800
Equipment lease/license fee	23,400	0	0	0
TOTAL O&M COST	$224,300	$192,800	$365,500	$186,800
ANNUALIZED COST, $/YR				
Annualized capital (5%; 20 yr)	140,300	15,200	8,700	0
O&M	224,300	192,800	365,500	186,800
TOTAL ANNUAL COST	$364,600	$208,000	$374,200	$186,800

1 Based on average flow of 7 mgd through both 24-in and 36-in force mains
2 Chemical costs: H_2O_2 @ $3.50/gal; $Mg(OH)_2$ @ $2.00/gal; NaOCl @ $0.464/gal
3 Assumes on-site generation of oxygen

APPENDIX A

COST ESTIMATE FOR OXYGEN DISSOLUTION SYSTEMS FROM ECO_2

ECO2

Onondaga Co, NY, Davis Road
ECO2 SuperOxygenation for H2S odor control
Preliminary design & budget estimate
Bob Bowker, 11/6/2009, Submitted by Eco Oxygen Technologies
Oxygen supply by on site oxygen generation PSA

Design Operating Conditions		units	quantity	rate	cost
Force Main Flow		gpm		3,500	
Oxygen Demand (Maximum)		lbs / day		3,700	
Electrical Unit Cost		$ / kwhr		$0.05	
Annual Usage		days		365	
Target Performance Level					
ECO2 System Design and Capital Cost		**units**	**quantity**	**rate**	**cost**
ECO2 cone with PLC oxygen flow control	8	ft. Dia.	1	$418,036	$418,036
Oxygen dissolution	3,700	lbs / day	1	3,700	
Side Stream Flow	3,800	gpm	1	3,800	
Sub total					$418,036
Outsourced/3rd party Capital Cost		**units**	**quantity**	**rate**	**cost**
Installation			1	$0	$0
Side Stream Pump	25	hp	1	$0	$0
Oxygen Generator	4,000	lbs / day	1	$148,408	$148,408
Sub total					$148,408
Annual Operating Cost		**units**	**quantity**	**rate**	**cost**
Electrical draw - Oxygen Generator	1,452	kwhr / day	1	$0.05	$26,500
Electrical draw - Side Stream Pump	21	hp	1	$0.05	$6,700
O&M - Oxygen Generator & Side Stream Pump				20%	$6,600
License fee - ECO2 process technology	3,700	lbs / day	1	$0.01	$13,510
Sub total					$53,310
Total Capital Cost Estimate					**$566,444**
Total Annual Operating Cost Estimate					**$53,310**

Notes:

Cost of installation to be quoted by local qualified contractor
Cost estimate for side stream pump based on closed impellor design for clean water applications
Cost estimates valid for 30 days and do not include taxes or shipping
Cost estimates subject to verification of design data
Purchase subject to Terms & Conditions of Purchase Agreement and Process Technology License Agreement

ECO Oxygen Technologies
3939 Priority Way South Drive, Suite 400, Indianapolis, IN 46240
Tel: 317-706-6484 Fax: 317-816-0940 www.eco2tech.com

ECO2

Onondaga Co, NY, Henry Clay PS
ECO2 SuperOxygenation for H2S odor control
Preliminary design & budget estimate
Bob Bowker, 11/6/2009, Submitted by Eco Oxygen Technologies
Oxygen supply by on site oxygen generation PSA

Design Operating Conditions		**units**			
Force Main Flow		gpm		2,450	
Oxygen Demand (Maximum)		lbs / day		2,700	
Electrical Unit Cost		$ / kwhr		$0.05	
Annual Usage		days		365	
Target Performance Level					
ECO2 System Design and Capital Cost		**units**	**quantity**	**rate**	**cost**
ECO2 cone with PLC oxygen flow control	8	ft. Dia.	1	$418,036	$418,036
Oxygen dissolution	2,700	lbs / day	1	2,700	
Side Stream Flow	3,400	gpm	1	3,400	
Sub total					$418,036
Outsourced/3rd party Capital Cost		**units**	**quantity**	**rate**	**cost**
Installation			1	$0	$0
Side Stream Pump	20	hp	1	$0	$0
Oxygen Generator	3,000	lbs / day	1	$110,975	$110,975
Sub total					$110,975
Annual Operating Cost		**units**	**quantity**	**rate**	**cost**
Electrical draw - Oxygen Generator	1,089	kwhr / day	1	$0.05	$19,900
Electrical draw - Side Stream Pump	18	hp	1	$0.05	$6,000
O&M - Oxygen Generator & Side Stream Pump				20%	$5,200
License fee - ECO2 process technology	2,700	lbs / day	1	$0.01	$9,860
Sub total					$40,960
Total Capital Cost Estimate					**$529,011**
Total Annual Operating Cost Estimate					**$40,960**

Notes:

Cost of installation to be quoted by local qualified contractor
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