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Transcript Exhibit(s)

Docket #(s): SW-01428A-09-0103

W-01427A-09-0104

W-01427A-09-0116

W-01427A-09-0120

Exhibit # : R30-R35, S2-S21

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To: Docket Control

Date: January 26, 2010

Re: Litchfield Park / Rates
SW-01428A-09-0103, etc.
Volumes I through VII, Concluded
January 5 through 15, 2010

STATUS OF ORIGINAL EXHIBITS

FILED WITH DOCKET CONTROL

City of Litchfield Park (LP Exhibits)

1 through 8

Litchfield Park Service Company (A Exhibits)

1 through 40

Residential Utility Consumer Office (R Exhibits)

1 through 8, 10 through 35

Staff (S Exhibits)

2 through 21

EXHIBITS RETURNED TO PARTIES

Residential Utility Consumer Office (R Exhibits)

9	Withdrawn

Staff (S Exhibits)

1	Not offered

Copy to:

Mr. Dwight Nodes, Assistant Chief Administrative Law Judge
Mr. Jay L. Shapiro, Litchfield Park Service Co.
Ms. Michelle Wood, RUCO
Mr. Kevin Torrey, Staff
Mr. Larry K. Udall, City of Litchfield Park

EXHIBIT R-30 ADMITTED

CATALOG OF DOCUMENTS INCLUDED IN RUCO EXHIBIT R-3

Line No.	Document Date	Document Title	Author	Page(s)
1	August 28, 2000	Clean Water Act 208 Amendment - Application for MAG	Pacific Advanced Engineering	1 thru 40
2	March 1, 2004	Design Report Phase II Expansion	Pacific Advanced Engineering	41 thru 101
3	September 9, 2004	Letter to LPSCO Re: PVRF - Phase II	ADEQ	102 thru 107
4	October 15, 2004	Aquifer Protection Program - Technical Support Request	Lisa Richey, ADEQ Proj. Mgr.	108
5	October 19, 2004	ADEQ Memo- PVWF APP ER Compliance - Inv 100310 LTF 33467	Kaumil H. Parghi, EE, ADEQ	109
6	November 12, 2004	ADEQ Memo- PVWF APP Inv No. 100310 LTF 33467 - Final Engineering Review Memo	Kaumil H. Parghi, EE, ADEQ	110
7	November 12, 2004	ADEQ Memo- PVWF APP Inv No. 100310 LTF 33467 - Final Engineering Review Summary	ADEQ	111 thru 113
8	October 12, 2004	Letter to Lisa Richey Re: PVWF APP Inv No. 100310 - Notice of Admin. Deficiencies	Pacific Advanced Engineering	114 thru 126
9	November 18, 2005	Letter from City of Goodyear in Support for PVWRF Phase II Expansion	Jim Nichols, Dpty. City Mgr.	127 thru 128
10	June 15, 2006	Ammended APP Authorizing Max. Mnthly Avg. Flow of 8.2 mgd for PVWRF w. Fact Sheet	Lisa Richey, ADEQ Proj. Mgr.	129 thru 161
11	August 1, 2007	Letter to MCESD Re: PVWRF Approval to Construct Phase 10 Surge Tank Recycle	Brian P. McBride, PE	162 thru 163
12	August 1, 2007	Letter to MCESD Re: PVWRF Approval to Construct Phase 10 Surge Tank Recycle Pipeline	Brian P. McBride, PE	164 thru 166
13	July 3, 2007	Letter to MCESD Re: PVWRF Approval to Construct Phase 1 Odor Control Upgrades	Brian P. McBride, PE	167 thru 169
14	July 3, 2007	Letter to MCESD Re: PVWRF Approval to Construct Phase 2 UV Disinfection System Upgrades	Brian P. McBride, PE	170 thru 171
15	September 1, 2007	AZPDES Permit Application Palm Valley Reclamation Plant	Narasimham Consulting Services, Inc.	172 thru 204
16	December 12, 2007	Letter to MCESD Re: PVWRF Approval to Construct Phase 5 Tertiary Pumping Capacity Increase	Brian P. McBride, PE	205 thru 206
17	December 14, 2007	Letter to MCESD Re: PVWRF Approval to Construct Phase 7 Conversion Of Digeters to a SBR	Brian P. McBride, PE	207 thru 209
18	May 2, 2008	Letter to MCESD Re: PVWRF Approval to Construct Phase 4 Influent Screeening Upgrades and Phase 8 Headworks Electrical Upgrades	Brian P. McBride, PE	210 thru 212
19	May 2, 2008	Letter to MCESD Re: PVWRF Approval to Construct ATC Application - Phase 9 Solids Handling Building Electrical Upgrades	Brian P. McBride, PE	213
20	May 30, 2008	APP Amendment Application Permit No. P-100310 for PVWRF - Replacement of Problematic Equip.	Mathew Garlick, Bus. Mgr., LPSCO	214 thru 226
21	July 7, 2008	ADEQ Decision to Grant AZPDES Permit #AZ0025712 - Letter to Ramesh Narasimhan, Narasimham Consulting Services, Inc.	Ramona Chomor, ADEQ	215 thru 268

EXHIBIT
R-31
ADMITTED

ALGONQUIN WATER

Upgrades to the Palm Valley WRF
Planning-Level Revised Cost Estimate - Total Project

COST ITEM	ESTIMATED QUANITITY	UNITS	MATERIAL/EQUIPMENT COST ESTIMATED UNIT COST	MATERIAL/EQUIPMENT COST ESTIMATED COST	INSTALLATION/LABOR COST ESTIMATED UNIT COST	INSTALLATION/LABOR COST ESTIMATED COST	TOTALS
Digester Tank Conversion to SBR							
(1) SBR Equipment Decanters Mixing/Aeration System Blower(s) Valves	1	LS	$520,000	$520,000	20%	$104,000	$624,000
(2) Influent Line Piping - 10"	1	LS	$10,000	$10,000	25%	$2,500	$12,500
(3) Effluent Line Piping - 14"	1	LS	$15,000	$15,000	25%	$3,750	$18,750
(4) Conversion of Digesters							
Clean/Drain Existing Basins	2	LS	$0	$0	$20,000	$40,000	$40,000
Demo Existing Equipment	1	LS	$0	$0	$15,000	$15,000	$15,000
Wall Coring and Penetrations	6	Each	$0	$0	$15,000	$90,000	$90,000
Subtotal							***$800,250***
Process Air Upgrade							
(1) Air Piping & Valves for SBR	1	LS	$15,000	$15,000	25%	$3,750	$18,750
(2) Air Piping & Valves for Sludge Holding	1	LS	$15,000	$15,000	25%	$3,750	$18,750
Subtotal							***$37,500***
Solids Dewatering Upgrade							
(1) Centrifuge - Skid Mounted System Temp centrifuge New centrifuge Conveyor System	1	LS	$547,000	$547,000	25%	$136,750	$683,750
(2) Grinder	1	Each	$15,500	$15,500	25%	$3,875	$19,375
(3) Suction Piping and Valves	1	LS	$25,000	$25,000	25%	$6,250	$31,250
(4) Mods to 2 ATAD Basins	2	Each	$20,000	$40,000	25%	$10,000	$50,000
(5) Mixing/Aeration Equip for ATAD Basin	1	Each	$20,000	$20,000	25%	$5,000	$25,000
(6) RDS effluent piping and valves mods	1	Each	$20,000	$20,000	25%	$5,000	$25,000
Subtotal							***$834,375***
Odor Control Upgrade							
(1) Ionstein Phase 1	1	LS	$98,320	$98,320	0%	$0	$98,320
(2) Ionstein Phase 2	1	LS	$228,320	$228,320	0%	$0	$228,320
(3) Ductwork Modifications	1	LS	$25,000	$25,000	25%	$6,250	$31,250
(4) Seal Openings in Tanks	1	LS	$40,000	$40,000	25%	$10,000	$50,000
Subtotal							***$407,890***
Air Conditioners							
(2) New AC Units	2	Each	$20,000	$40,000	25%	$10,000	$50,000
Subtotal							***$50,000***
~~**FOG Reduction System**~~							
~~(1) 3-Month Trial BioCOPE~~	0	LS	$0	$0	incl.	$0	$0
~~(2) Chemical Storage Tank - 3,000 gal~~	0	LS	$10,000	$0	25%	$0	$0
Subtotal							***$0***
UV Disinfection Upgrade							
(1) UV Reactors	2	LS	$175,000	$350,000	25%	$87,500	$437,500

ALGONQUIN WATER

Upgrades to the Palm Valley WRF
Planning-Level Revised Cost Estimate - Total Project

ES

COST ITEM	ESTIMATED QUANTITY	UNITS	MATERIAL/EQUIPMENT COST ESTIMATED UNIT COST	MATERIAL/EQUIPMENT COST ESTIMATED COST	INSTALLATION/LABOR COST ESTIMATED UNIT COST	INSTALLATION/LABOR COST ESTIMATED COST	TOTALS
(2) Demo Existing UV/Piping/Valves	1	Each	$0	$0	$5,000	$5,000	$5,000
(3) New Piping and Valves	1	LS	$5,000	$5,000	25%	$1,250	$6,250
Subtotal							***$448,750***
Headworks Upgrade							
(1) Reciprocating Stair Screen	2	Each	$187,000	$374,000	25%	$93,500	$467,500
(2) Demo Piping and Screens	1	LS	$0	$0	$15,000	$15,000	$15,000
(3) New Piping and Valves	1	LS	$15,000	$15,000	25%	$3,750	$18,750
(4) Deck Coring and Penetrations	2	LS	$0	$0	$15,000	$30,000	$30,000
Subtotal							***$531,250***
Vertical Turbine Pumps							
(1) Filter Feed Pump	1	Each	$82,000	$82,000	25%	$20,500	$102,500
(2) UV/Effluent Pump	1	Each	$64,000	$64,000	25%	$16,000	$80,000
(3) New Piping and Valves	1	LS	$5,000	$5,000	25%	$1,250	$6,250
Subtotal							***$188,750***
Surge Tank Recycle Line							
(1) Piping and Valves and pumps	1	LS	$25,000	$25,000		$25,000	$50,000
Subtotal							***$50,000***
Other Items							
(1) Plant Sewer Upgrade	1	LS	$50,000	$50,000		$25,000	$75,000
(2) Chlorine Storage and Feed Station	1	LS	$25,000	$25,000		$5,000	$30,000
Subtotal							***$105,000***
SUBTOTAL							**$3,453,765**
EI&C	1	LS			20%	of Subtotal	$690,753
Electrical Upgrades	1	LS			$450,000	$450,000	$450,000
SUBTOTAL							**$4,594,518**
Contingency	1	LS			10%	of Subtotal	$459,452
Mobilization	1	LS			5%	of Subtotal	$229,726
Contractor Fee	1	LS			10%	of Subtotal	$459,452
SUBTOTAL							**$5,743,148**
Taxes	1	LS			5%	of Subtotal	$287,157
Bonds	1	LS			0.5%	of Subtotal	$28,716
Engineering	1	LS				$675,979	$675,979
Permits	1	LS				$50,000	$50,000
TOTAL PLANNING-LEVEL ESTIMATED COST							**$6,785,000**

NOTES:
Does not include trial period of BioCOPE costs (estimated at $15,000)

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EXHIBIT
R-32
ADMITTED

Recommended Standards for Wastewater Facilities

2004 Edition

Policies for the Design, Review, and Approval of Plans and Specifications for Wastewater Collection and Treatment Facilities

A Report of the Wastewater Committee of the
Great Lakes--Upper Mississippi River Board
of State and Provincial Public Health and Environmental Managers

MEMBER STATES AND PROVINCE
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FOREWORD

In 1947, a "Committee on Development of Uniform Standards for Sewage Works" was created by the group now known as the Great Lakes -- Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers.

This Committee, composed of a representative from each state, was assigned the responsibility to review existing standards for sewage works, to investigate the possibility of preparing joint standards to be adopted by the states represented, and to report its findings to the Board.

Based on this initial report, the Board authorized the Committee to prepare sewage works design standards, which were first published in 1951. They subsequently were revised and published again in 1960, 1968, 1971, 1973, 1978, 1990 and 1997. In 1977, the Province of Ontario was invited, as a Great Lakes participant, to serve on the Committee.

These standards have again been revised and are published herein as the 2004 edition. They are intended for use as a guide in the design and preparation of plans and specifications for wastewater facilities insofar as these standards are applicable to normal situations for an individual project.

The design criteria in these standards are intended for the more conventional municipal wastewater collection and treatment systems. Innovative approaches to collection and treatment, particularly for the very small municipal systems, are not included. The individual reviewing authority should be contacted for design guidance and criteria where such systems are being considered.

Lack of description or criteria for a unit process or equipment does not suggest it should not be used, but only that consideration by the reviewing authority will be on the basis of information submitted with the design. Engineering data that may be required for new process and application evaluation is included in Paragraph 53.2 of these standards.

These standards are intended to suggest limiting values for items upon which an evaluation of the plans and specifications will be made by the reviewing authority; and to establish, as far as practicable, uniformity of practice among the several states and province. Statutory requirements, regulations, and guidelines among the states and province are not uniform and use of the standards must adjust itself to these variations. Users also should be cognizant of locally adopted standards and applicable federal requirements.

The term "shall" is used where practice is sufficiently standardized to permit specific delineation of requirements or where safeguarding of the public health or protection of water quality justifies such definite action. Other terms, such as "should," "recommended," and "preferred," indicate desirable procedures or methods, with deviations subject to individual consideration.

Definition of terms and their use in these standards is intended to be in accordance with GLOSSARY -- WATER AND WASTEWATER CONTROL ENGINEERING, jointly prepared by APHA, ASCE, AWWA, and WPCF. The customary units of expression used are in accordance with those recommended in WPCF Manual of Practice No. 6, UNITS OF EXPRESSION FOR WASTEWATER MANAGEMENT. The International Standard Units are in accordance with those recommended in National Institute of Standards and Technology (NIST) Guide for the Use of the International System of Units (SI).

Mechanically cleaned screen channels shall be protected by guard railings and deck gratings. Consideration should also be given to temporary access arrangements to facilitate maintenance and repair.

61.142 Mechanical Devices

Mechanical screening equipment shall have adequate removable enclosures to protect personnel against accidental contact with moving parts and to prevent dripping in multi-level installations.

A positive means of locking out each mechanical device and temporary access for use during maintenance shall be provided.

61.143 Drainage

Floor design and drainage shall be provided to prevent slippery areas.

61.144 Lighting

Suitable lighting shall be provided in all work and access areas. Refer to Paragraph 61.152.

61.15 Electrical Equipment and Control Systems

61.151 Timing Devices

All mechanical units which are operated by timing devices shall be provided with auxiliary controls which will set the cleaning mechanism in operation at a preset high water elevation. If the cleaning mechanism fails to lower the high water, a warning should be signaled.

61.152 Electrical Equipment, Fixtures and Controls

Electrical equipment, fixtures and controls in the screening area where hazardous gases may accumulate shall meet the requirements of the National Electrical Code for Class I, Division 1, Group D locations.

61.153 Manual Override

Automatic controls shall be supplemented by a manual override.

61.2 Fine Screens

61.21 General

Fine screens as discussed here have openings of approximately 1/16 inch (2 mm). The amount of material removed by fine screens is dependent on the waste stream being treated and screen opening size.

Fine screens should not be considered equivalent to primary sedimentation but may be used in lieu of primary sedimentation where subsequent treatment units are designed on the basis of anticipated screen performance. Selection of screen capacity should consider flow restriction due to retained solids, gummy materials, frequency of cleaning, and extent of cleaning. Where fine screens are used, additional provision for removal of floatable oils and greases shall be considered.

61.22 Design

Tests should be conducted to determine BOD_5 and suspended solids removal efficiencies at the design maximum day flow and design maximum day BOD_5 loadings. Pilot testing for an extended time is preferred.

A minimum of two fine screens shall be provided, each unit being capable of independent operation. Capacity shall be provided to treat design peak instantaneous flow with one unit out of service.

Fine screens shall be preceded by a coarse bar screening device. Fine screens shall be protected from freezing and located to facilitate maintenance.

61.23 Electrical Equipment, Fixtures and Control

Electrical equipment, fixtures and controls in the screening area where hazardous gases may accumulate shall meet the requirements of the National Electrical Code for Class I, Division 1, Group D locations.

61.24 Servicing

Hosing equipment shall be provided to facilitate cleaning. Provision shall be made for isolating and removing units from their location for servicing.

62. COMMINUTORS

62.1 General

Provisions for access, ventilation, shields, and safety shall be in accordance with Paragraphs 61.13, 61.14, and 61.15.

62.2 When Used

Comminutors may be used in lieu of screening devices to protect equipment where stringy substance accumulation on downstream equipment will not be a substantial problem.

62.3 Design Considerations

62.31 Location

Comminutors should be located downstream of grit removal equipment and be protected by a coarse screening device. Comminutors not preceded by grit removal equipment shall be protected by a 6.0 inch (150 mm) deep gravel trap.

62.32 Size

Comminutor capacity shall be adequate to handle design peak hourly flow.

62.33 Installation

A screened bypass channel shall be provided. The use of the bypass channel should be automatic for all comminutor failures.

Gates shall be provided in accordance with Paragraphs 61.123 and 61.124.

62.34 Servicing

Provision shall be made to facilitate servicing units in place and removing units from their location for servicing.

62.35 Electrical Controls and Motors

Electrical equipment in comminutor chambers where hazardous gases may accumulate shall meet the requirements of the National Electrical Code for Class I, Division 1, Group D locations. Motors shall be protected against accidental submergence.

63. GRIT REMOVAL FACILITIES

63.1 When Required

Grit removal facilities should be provided for all wastewater treatment plants, and are required for plants receiving wastewater from combined sewers or from sewer systems receiving substantial amounts of grit. If a plant serving a separate sewer system is designed without grit removal facilities, the design shall include provision for future installation. Consideration shall be given to possible damaging effects on pumps, comminutors, and other preceding equipment, and the need for additional storage capacity in treatment units where grit is likely to accumulate.

63.2 Location

63.21 General

Grit removal facilities should be located ahead of pumps and comminuting devices. Coarse bar racks should be placed ahead of grit removal facilities.

63.22 Housed Facilities

63.221 Ventilation

Refer to Paragraph 61.13. Fresh air shall be introduced continuously at a rate of at least 12 air changes per hour, or intermittently at a rate of at least 30 air changes per hour. Odor control facilities may also be warranted.

63.222 Access

Adequate stairway access to above or below grade facilities shall be provided.

63.223 Electrical

All electrical work in enclosed grit removal areas where hazardous gases may accumulate shall meet the requirements of the National Electrical Code for Class I, Division 1, Group D locations. Explosion proof gas detectors shall be provided in accordance with Section 57.

63.23 Outside Facilities

Grit removal facilities located outside shall be protected from freezing.

63.3 Type and Number of Units

Plants treating waste from combined sewers should have at least two mechanically cleaned removal of the sludge. Suction withdrawal should be provided for activated sludge clarifiers over 60 feet (18 m) in diameter, especially for activated sludge plants that nitrify.

Each settling tank shall have its own sludge withdrawal lines to ensure adequate control of sludge wasting rate for each tank.

73.21 Sludge Hopper

The minimum slope of the side walls shall be 1.7 vertical to 1 horizontal. Hopper wall surfaces should be made smooth with rounded corners to aid in sludge removal. Hopper bottoms shall have a maximum dimension of 2 feet (0.6 m). Extra depth sludge hoppers for sludge thickening are not acceptable.

73.22 Cross-Collectors

Cross-collectors serving one or more settling tanks may be useful in place of multiple sludge hoppers.

73.23 Sludge Removal Pipeline

Each hopper shall have an individually valved sludge withdrawal line at least 6 inches (150 mm) in diameter. The static head available for withdrawal of sludge shall be 30 inches (760 mm) or greater, as necessary to maintain a 3 foot per second (0.9 m/s) velocity in the withdrawal pipe. Clearance between the end of the withdrawal line and the hopper walls shall be sufficient to prevent "bridging" of the sludge. Adequate provisions shall be made for rodding or back-flushing individual pipe runs. Provisions shall be made to allow for visual confirmation of return sludge. Piping shall be provided to return sludge for further processing.

73.24 Sludge Removal Control

Separate settling tank sludge lines may drain to a common sludge well.

Sludge wells equipped with telescoping valves or other appropriate equipment shall be provided for viewing, sampling, and controlling the rate of sludge withdrawal. A means of measuring the sludge removal rate shall be provided. Air-lift type of sludge removal will not be approved for removal of primary sludges.

74. PROTECTIVE AND SERVICE FACILITIES

74.1 Operator Protection

All settling tanks shall be equipped to enhance safety for operators. Such features shall appropriately include machinery covers, life lines, stairways, walkways, handrails, and slip resistant surfaces.

74.2 Mechanical Maintenance Access

The design shall provide for convenient and safe access to routine maintenance items such as gear boxes, scum removal mechanisms, baffles, weirs, inlet stilling baffle areas, and effluent channels.

74.3 Electrical Equipment, Fixtures and Controls

Electrical equipment, fixtures and controls in enclosed settling basins and scum tanks, where hazardous concentrations of flammable gases or vapors may accumulate, shall meet the requirements of the National Electrical Code for Class 1, Division 1, Group D locations.

The fixtures and controls shall be located so as to provide convenient and safe access for operation and maintenance. Adequate area lighting shall be provided.

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factors, the minimum digestion tank capacity outlined below will be required. Such requirements assume that the raw sludge is derived from ordinary domestic wastewater, a digestion temperature is to be maintained in the range of 85° to 95°F (29 °C to 35 °C), 40 to 50 percent volatile matter in the digested sludge, and that the digested sludge will be removed frequently from the process. (See also Paragraphs 84.11 and 89.11.)

84.321 Completely Mixed Systems

For digestion systems providing for intimate and effective mixing of the digester contents, the system may be loaded up to 80 pounds of volatile solids per 1000 cubic feet of volume per day [1.3 $kg/(m^3 \cdot d)$] in the active digestion units.

84.322 Moderately Mixed Systems

For digestion systems where mixing is accomplished only by circulating sludge through an external heat exchanger, the system may be loaded up to 40 pounds of volatile solids per 1000 cubic feet of volume per day [0.65 $kg/(m^3 \cdot d)$] in the active digestion units. This loading may be modified upward or downward depending upon the degree of mixing provided.

84.323 Multistage Systems

For digestion systems utilizing two stages (primary and secondary units), the first stage (primary) may be either completely mixed or moderately mixed and loaded in accordance with Paragraphs 84.321 or 84.322. The second stage (secondary) is to be designed for sludge storage, concentration, and gas collection and shall not be credited in the calculations for volumes required for sludge digestion.

84.324 Digester Mixing

Facilities for mixing the digester contents shall be provided where required for proper digestion by reason of loading rates or other features of the system. Where sludge recirculation pumps are used for mixing they shall be provided in accordance with appropriate requirements of Paragraph 87.1.

84.4 Gas Collection, Piping, and Appurtenances

84.41 General

All portions of the gas system including the space above the tank liquor, storage facilities, and piping shall be so designed that under all normal operating conditions, including sludge withdrawal, the gas will be maintained under pressure. All enclosed areas where any gas leakage might occur shall be adequately ventilated.

84.42 Safety Equipment

All necessary safety facilities shall be included where gas is produced. Pressure and vacuum relief valves and flame traps together with automatic safety shut off valves shall be provided and protected from freezing. Water seal equipment shall not be installed. Safety equipment and gas compressors should be housed in a separate room with an exterior door.

84.43 Gas Piping and Condensate

Gas piping shall have a minimum diameter of 4 inches (100 mm). A smaller diameter pipe at the gas production meter is acceptable. Gas piping shall slope to condensation traps at low points. The use of float-controlled condensate traps is not permitted. Condensation traps shall be protected from freezing.

Tightly fitted self-closing doors should be provided at connecting passageways and tunnels which connect digestion facilities to other facilities to minimize the spread of gas. Piping galleries shall be ventilated in accordance with Paragraph 84.47.

84.44 Gas Utilization Equipment

Gas burning boilers, engines, etc., shall be located in well-ventilated rooms. Such rooms would not ordinarily be classified as a hazardous location if isolated from the digestion gallery. Gas lines to these units shall be provided with suitable flame traps.

84.45 Electrical Equipment, Fixtures, and Controls

* Electrical equipment, fixtures and controls, in places enclosing and adjacent to anaerobic digestion appurtenances, where hazardous gases may accumulate shall comply with the National Electric Code for Class 1, Division 1, Group D locations.

84.46 Waste Gas

84.461 Location

Waste gas burners shall be readily accessible and should be located at least 50 feet (15 m) away from any plant structure. Waste gas burners shall be of sufficient height and so located to prevent injury to personnel due to wind or downdraft conditions.

84.462 Pilot Light

All waste gas burners shall be equipped with automatic ignition such as a pilot light or a device using a photoelectric cell sensor. Consideration should be given to the use of natural or propane gas to ensure reliability of the pilot.

84.463 Gas Piping Slope

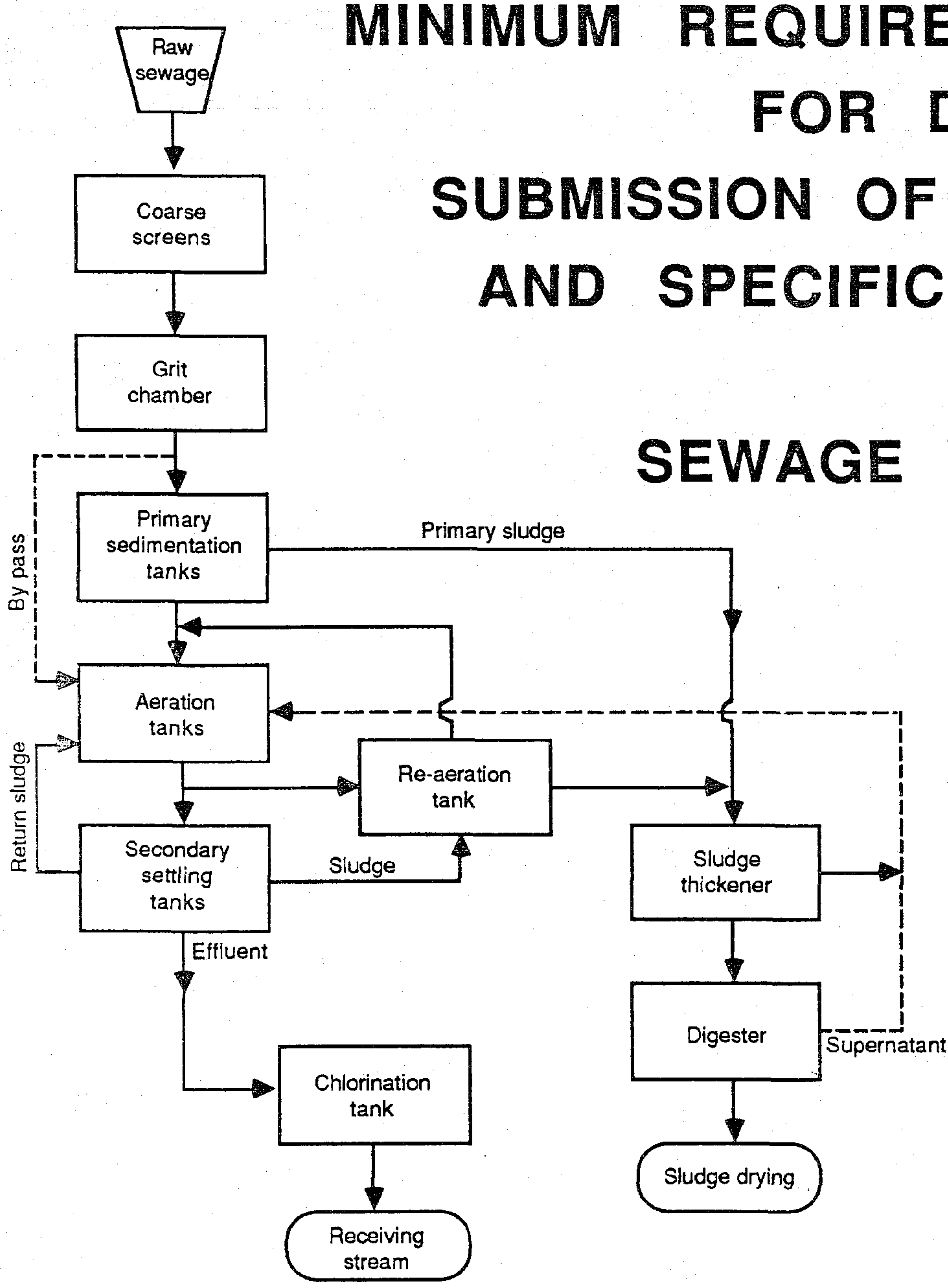
Gas piping shall be sloped at a minimum of 2 percent up to the waste gas burner with a condensate trap provided in a location not subject to freezing.

84.47 Ventilation

Any underground enclosures connecting with digestion tanks or containing sludge or gas piping or equipment shall be provided with forced ventilation for dry wells in accordance with Paragraphs 42.71 through 42.74 and 42.76. The ventilation rate for Class 1, Division 2, Group D locations including enclosed areas without a gas tight partition from the digestion tank or areas containing gas compressors, sediment traps, drip traps, gas scrubbers, or pressure regulating and control valves, if continuous, shall be at least 12 complete air changes per hour.

engineering bulletin no. 11

MINIMUM REQUIREMENTS FOR DESIGN, SUBMISSION OF PLANS AND SPECIFICATIONS OF SEWAGE WORKS



ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY

JULY 1978

engineering bulletin no. 11

Chapter 1

INTRODUCTION

ARIZONA DEPARTMENT OF HEALTH SERVICES

JULY 1978

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CHAPTER I - INTRODUCTION

CHAPTER I - INTRODUCTION

A. REQUIREMENTS.

The Department's Rules and Regulations for Sewerage Systems and Treatment Works require the approval of design reports, plans and specifications by the Department prior to construction of such systems.

Arizona State Regulation R9-8-314.A. requires that an application to construct sewerage systems, sewerage system extensions, waste treatment works or any process or equipment in whole or in part be submitted at least thirty (30) days prior to the data of approval is desired. It also requires that engineering design reports, drawings, specifications, and other additional supporting data required by the Department accompany such application.

B. PURPOSE OF BULLETIN.

The purpose of this engineering Bulletin is two fold.

1. Minimum Standards - This Bulletin is set forth as a minimum standard for the design of sewerage systems and wastewater treatment works. It has been prepared to assist organizations in complying with the Department's Rules and Regulations regarding sewerage systems and treatment works and is a compilation of the latest design criteria and practices in the sanitary engineering profession.

   This Bulletin will not address septic tank systems as a means of wastewater treatment. Septic tanks shall be designed in accordance with Engineering Bulletin No. 12. Where flows approach 20,000 gallons per day, consideration should be given to design of wastewater treatment methods other than septic tanks.

   The Department may, at its discretion, allow deviation from the recommended criteria based upon sufficient substantiating data that the criteria is restrictive and inoperative for the particular design under review.

2. Original Design - This Bulletin has been designed to serve as a guideline for the evaluation of an original design as detailed in Chapter III. Original design is defined as a newly developed or unique combination of existing processes.

   Approval of any original design will be on an experimental basis only. It will be at the discretion of the Department as to when the experimental status will be removed. Each new process will be evaluated upon its conformance with physical and biological principles; and upon its performance under full load field conditions.

3. This Bulletin applies to existing systems being expanded, modified, upgraded, rehabilitated, and to construction of new facilities. Where a health hazard, a public menace, or operating difficulties occur at, or

because of existing facilities, this engineering Bulletin should be used to evaluate the acceptability of that system to properly operate and meet applicable engineering standards.

4. This Bulletin is not to be used as a construction specification.

C. GENERAL SUBMISSION OF PLANS, SPECIFICATIONS, AND REPORTS.

1. General Requirements - All information submitted to the Department for review shall be in such detail as to permit a comprehensive evaluation to assure compliance with the requirements of the Department.

   a. Plan Documents - Any plan documents prepared for sewerage and/or wastewater treatment facilities construction shall be submitted to the Department at least 30 days prior to the date upon which action is desired.

   b. Engineer's Report.

      1) Preliminary Design Reports - Where the Engineer or his client deem a preliminary design report necessary, the report shall be prepared presenting the following information:

         a) Sewerage System.

            (1) Present area served, as well as future areas to be served, population data should accompany area analysis.

            (2) Existing and final terrain data in sufficient detail to establish general topographical features of present and future service areas.

            (3) Soil characteristics shall be outlined in the report. An indication of any unusual soil or foundation conditions at the location of all sewerage structures shall be given. The report shall also show the extent of the soil investigation, the location of all borings and sampling areas with a detailed report of the findings. Methods of dealing with special construction problems shall be discussed.

            (4) Location of existing sewer lines, lift stations, future sewer lines and lift stations in a layout form.

            (5) Discussion of the waste characteristics and volumes of industrial and commercial areas, present and future.

            (6) Discussion of the estimated volumes of domestic sewage, infiltration, etc., that the sewerage system is handling and will be required to handle for the design period.

b) Wastewater Treatment Works.

(1) Plant location, plant site plan, a description of the surrounding areas including a map of the area shall be included. Particular reference shall be made to the proximity of present and future developments, wells, streams, lakes, water plants, industrial sites, and other areas which will be affected environmentally by the plant. Discussion of the various sites available and the advantages of the final selection shall be outlined.

(2) Quantity and quality of domestic waste flows present and future. Field investigation reports shall accompany the preliminary reports to substantiate the waste flow characteristics.

(3) Quantity and quality of industrial and commercial wastes present and future. Field investigation reports shall accompany the preliminary reports to substantiate the waste flow characteristics.

(4) Maximum, average, and minimum domestic and industrial design flows being considered.

(5) Present and discuss treatment alternatives, environmental impacts, and reasons for selection of alternative.

(6) Present and discuss environmental impacts of the project during and after construction, including short- and long-term effects on the environment. The level of detail of the discussion should be sufficient to adequately address the short- and long-term impacts. Most generally, a brief synoptic approach will be sufficient. Certain projects may require in-depth research. In all cases, the latest Federal Register related to Environmental Impact Statements should be used as a guideline.

(7) Description of basic flow sheet of selected process with design criteria and flow diagram.

(8) The means of grit, grease, screenings, and sludge utilization and disposal shall be discussed in detail.

(9) The means of effluent utilization and disposal shall be discussed in detail. If discharge will require a discharge permit, analysis of the downstream use shall be included in the report.

2) Final Design Report - A final engineering design report shall be included with the final plans and specifications. The final report shall include the information set forth in the preliminary report with refinements dictated by design. Additional information required is as follows:

a) Sewerage System.

(1) Design calculations for each sewer showing present and future flows with minimum velocities, and maximum velocities.

(2) Capability of existing interceptors to carry present and future flows.

(3) Design calculations for all sewage lift stations including wet well sizing.

(4) Location of any bypasses and a detailed analysis of their anticipated use.

(5) A time schedule of construction, lift station startup, and lift station operation and maintenance manual submittal.

b) Wastewater Treatment Works.

(1) A detailed analysis of the method of treatment and its efficiency and ability to meet discharge requirements.

(2) Design calculations showing size and capacity of each unit or component part in relation to the design criteria contained in this Bulletin. The calculations should show retention times, surface loadings, weir loadings, sludge return pump sizing, sludge wasting pumping rates, and any other pertinent information regarding plant design.

(3) The means of grit, grease, screenings, and sludge utilization and disposal shall be discussed in detail, accompanied by the necessary design calculations.

(4) Design calculations for effluent disposal if other than direct discharge to a navigable waterway.

(5) A time schedule for completion of operation and maintenance manual submittal, plant construction and plant startup.

c. Detailed Plans - Minimum requirements of the plans are set forth in Chapter IV, Chapter V, and Chapter VI.

Plans relative to the modifications or extensions to existing systems shall indicate clearly the connections or relation thereto. If plans of the existing system are not on file with the Department, submission of as-built plans of the existing system or treatment works is required.

An as-built schematic of the collection system should be submitted, including approximate locations of all lines, line sizes, and inverts for major collection points. All lift stations and other special appurtenances and structures should be detailed sufficiently to determine their effects on the system. Plans of the existing treatment plant and effluent disposal system should be submitted which show the location and size of structures, equipment and piping; the hydraulic profile; and existing flow diagram in sufficient detail to determine their effects on the treatment plant.

d. Specification - Complete detailed specifications for the construction of sewer system, wastewater treatment works, and their appurtenances, shall accompany the plans.

The specifications should include:

1) Contract Documents
2) General Conditions
3) Supplemental Conditions
4) Technical Specifications
5) Standard Details
6) Applicable Addenda

e. Engineer's Seal - All plan documents for sewers and/or wastewater treatment works shall be prepared by a registered professional Engineer, licensed in the State of Arizona under provisions of ARS 32:141-145.

The necessary professional seal shall be legibly affixed to the plan documents.

f. Revision of Approved Plans - Any deviations from approved plans or specifications adversely affecting the capacity, flow or operation of units must be approved in writing by the Department before such changes are made. Plans or specifications so revised shall be submitted a minimum of 30 days prior to the construction work which will be affected by such changes to permit sufficient time for review and approval before construction.

Special consideration will be given to emergency field conditions. Waiver of the written approval and 30-day requirement will be at the discretion of the Department.

Structural revisions or other minor changes, not affecting capacities, flows or operation, will be permitted during construction without approval.

As-built plans clearly showing all alterations shall be placed on file with the department after the completion of the work.

2. State Approval - In addition to the plans, specifications, and Engineer's reports, the submittal must be accompanied with the pertinent forms requesting approval. The following forms are a minimum requirement for each submittal.

   a. Subdivision.

      1) Application for approval of sanitary facilities for subdivisions.
      2) Application for approval to construct water and/or wastewater facilities.

   b. Trailer Coach Park.

      1) Application for approval of a trailer coach park.
      2) Application for approval to construct water and/or wastewater facilities.

   c. Sewerage and/or Wastewater Treatment Project.

      1) Application for approval to construct water and/or wastewater facilities.

   Each application shall be submitted in duplicate with four (4) copies of the plans and specifications and one (1) copy of the Engineer's report.

3. Other Approval - All phases of each project shall be co-ordinated with other agencies requiring review and approval.

   Certain counties act as the review and enforcement arm of the Department. The Department has a current listing of delegated agencies and should be contacted for this list.

4. Approval to Operate - Two weeks prior to or the time differential between the preconstruction conference and commencement of construction, whichever is shorter, notice shall be given to the Department that the work will commence.

   Two weeks prior to completion of project construction, the Department shall be notified for a final inspection by the Department. Upon satisfying the requirements of the final inspection, the Department shall issue an approval to operate. Operation of the constructed facility shall not commence until the approval to operate is issued to the Owner.

   Rehabilitation and upgrading of facilities may require special prior arrangements with the Department in achieving the Certificate of Approval to Operate. Owners desiring an interim approval to operate for system shakedown shall request such in writing fourteen days prior to system startup.

5. NPDES Discharge Permit - Facilities which will discharge treated effluent into waters of the United States within the State are required to obtain a discharge permit by EPA. Forms for discharge permits may be obtained through the Department.

D. GRANTING EXCEPTION TO BULLETIN.

Persons requesting exceptions to the requirements of this Bulletin must do so in writing. An exception can be granted to portions of this Bulletin provided that the exact nature of the proposed differences be noted either in a letter or in the Engineer's Report. The justification and burden of proof for the proposed deviation is the responsibility of the applicant and his Engineer. If an exception to a design standard is requested, the request shall be accompanied by scientific justification, including computations, and practical data and experience on similar installations.

Exceptions will not be granted on items which are a State Regulation. The Department will grant exceptions at its discretion. Each exception will be reviewed individually. Granting of an exception does not nullify the established criteria of this Bulletin or provide a blanket approval to neglect the recommended design standard.

engineering bulletin no. 11

Chapter 2

EFFLUENT LIMITATIONS

ARIZONA DEPARTMENT OF HEALTH SERVICES

JULY 1978

CHAPTER II - EFFLUENT QUALITY REQUIREMENTS

CHAPTER II - EFFLUENT QUALITY REQUIREMENTS

The selection of a sewage treatment process used in treating wastewater is dictated by, among other criteria, the effluent quality required at discharge or for reuse. The Engineer should carefully review all applicable standards and effluent quality requirements in making the final process selection.

A. STREAM DISCHARGE REQUIREMENTS.

A sewage treatment plant discharging to a navigable water of the State of Arizona shall be designed to meet the effluent limitation requirements established in and by:

1. NPDES - The National Pollutant Discharge Elimination System established by PL-92-500 and administered by the Environmental Protection Agency has set discharge requirements in each state. The Department should be contacted for these discharge standards prior to final process selection. The Engineer shall use these standards in process selection to assure the Department that the effluent quality will meet the NPDES requirements.

2. Arizona Water Quality Standards - The Department's Rules and Regulations R9-21, entitled, "Water Quality Standards for Surface Waters," provide a detailed water quality standard for all surface waters of the State. The Engineer shall use these standards in process selection to assure the Department that the effluent discharge will not degrade the quality of the accepting stream.

   Figure II - 1 and Table II - 1 show and list stream segments which generally require special investigation of the affects of the effluent on the water quality of the receiving stream. The Engineer should contact the Department for the established water quality limitations if his project is located within one of these segments.

3. Basin Plan - The Engineer shall refer to the appropriate basin plan to assure compliance of the selected process with the established basin requirements and criteria.

4. 208 Plan - The Engineer shall refer to the appropriate 208 Plan to assure compliance with the 208 requirements and criteria.

5. Tertiary Areas - Certain areas of the State have been designated as tertiary areas (areas requiring a minimum of tertiary treatment before effluent discharge). Table II - 2 shows a list of surface waters of Arizona and the effluent limitations of these waters.

   The Engineer shall investigate the need for meeting tertiary treatment requirements before final process selection.

6. Continuing Planning Process - The CPP is a document published by the Department which gives input into future recommended effluent limitation policies. This document is available from the Department and shall be used by the Engineer in process selection (present and future).

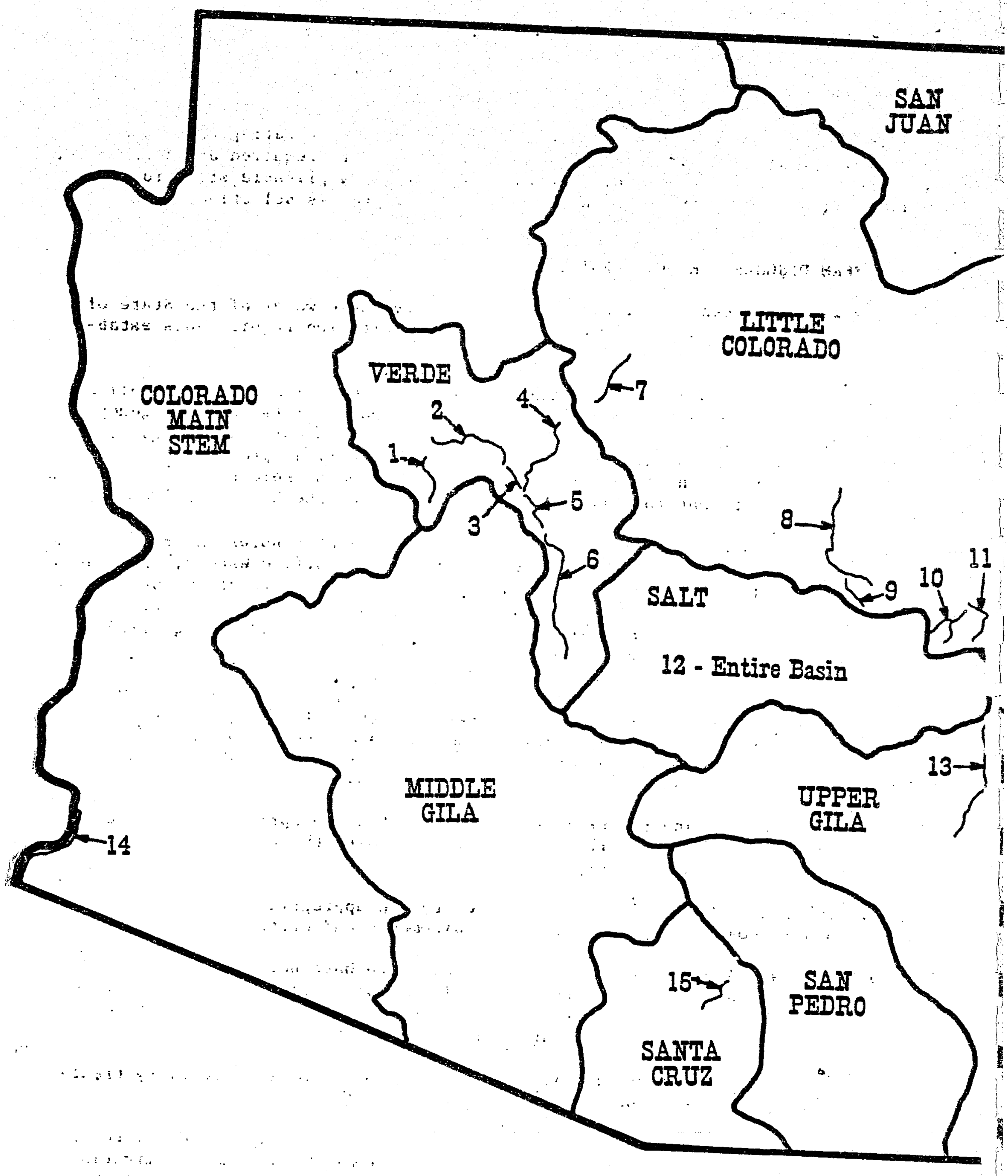

Figure II - 1

State of Arizona Water Quality Segments and River Basin Planning Areas.

Water Quality Segment Description	River Basin Planning Area	COG Region
(1) Willow Creek and Tributaries	Verde	3
(2) Verde River from Sullivan Lake to Clarkdale	Verde	3
(3) Verde River Clarkdale to mouth of Oak Creek	Verde	3
(4) Oak Creek and tributaries to headwaters	Verde	3
(5) Verde River from Oak Creek to Camp Verde	Verde	3
(6) Verde River from Camp Verde to Bartlett Dam	Verde	1, 3, 5
(12) Salt River and lakes, and tributaries from Verde River to headwaters	Salt	1, 3, 5
(10) Little Colorado River and tributaries above Springerville	Little Colorado	3
(11) Nutrioso Creek	Little Colorado	3, 6
(9) Show Low Creek and tributaries to headwaters	Little Colorado	3
(8) Silver Creek	Little Colorado	3
(7) Rio De Flag	Little Colorado	3
(14) Colorado River from Imperial Dam to Southerly International Boundary	Colorado Main Stem	4
(13) San Francisco River and tributaries from headwaters to just below Luna Lake	Upper Gila	3, 6
(15) Sabino Creek	Santa Cruz	2

Table II - 1.

State of Arizona Water Quality Segments - Reference Figure II - 1

Water	Effluent Limitation (1)			
	BOD (5 Days 20° C) mg/1	Suspended Solids mg/1	pH	Total Phosphate (as PO_4) mg/1
1. Oak Creek and tributaries	10	10	6.5 - 8.6	3
2. Salt River Lakes (Roosevelt, Apache, Canyon, & Saguaro)	(2)	(2)	(2)	(2)
Discharges require sand filtration in addition to secondary treatment.				
3. San Francisco River and tributaries upstream (and including) Luna Lake	10	10	6.5 - 8.6	3
4. Show Low Creek and tributaries upstream (and including) Fools Hollow Lake	10	10	6.5 - 8.6	0.5
5. White River and tributaries	10	10	6.5 - 8.6	3
6. Willow Creek drainage (3)	10	10	6.5 - 8.6	3
7. Sabino Creek	10	10	6.5 - 8.6	3

(1) Standards shall be based on average of at least four weekly samples. Analytical methods shall conform to current edition of standard methods or EPA method as required for NPDES permits.

(2) No numerical standard at this time.

(3) Tertiary treatment not required if development can and will be connected to the City of Prescott waste treatment system when developed.

Table II - 2

Effluent Treatment Limitations For Surface Waters Of Arizona

7. Other Local Conditions - Other local conditions may require more stringent effluent limitations to protect the health and welfare of the public and to minimize and/or abate adverse impact of the beneficial use of the stream accepting discharge. The Engineer shall investigate all other conditions and base his final process selection upon these findings. The Engineer shall analyze all documents and materials related to each effluent limitation entity listed above and shall select the proper process necessary to meet the most stringent limitations.

B. NON-STREAM DISCHARGE.

Effluent streams which are not discharged to the State's surface waters are generally reused or held in evaporation ponds or percolation ponds. The Department's Rules and Regulations R9-20 give effluent limitations for effluent reuse. The Regulation is summarized in Section P and Q of Chapter VII of this Bulletin. The Engineer shall make final process selection to meet these effluent limitations. In addition, precautions shall be taken to provide effluent quality which will not be detrimental to ground water quality and its present and future use.

C. MONITORING REQUIREMENTS.

The need for effluent quality standards necessitates the requirement of monitor wastewater treatment works. Each plant should monitor plant operation characteristics, as well as effluent characteristics, to assist in plant operation decisions and to assure the Department that effluent quality standards are being met. The sampling and analysis records should be kept on file at the facility for review by the Department during periodic inspections.

1. Plant Performance Monitoring.

   a. Stream Discharge - Public Law 92-500 established the requirement for plants to monitor specified effluent characteristics listed on each discharge permit issued.

      Chapter VIII of this Bulletin provides information regarding the appropriate testing needed to assure compliance with EPA requirements.

   b. Non-Stream Discharge - The discharge standards previously outlined in this Chapter have been established by the State of Arizona as minimum standards. Each plant that is reusing effluent as defined in this Bulletin will be required to monitor effluent to assure compliance with these standards.

      Chapter VIII of this Bulletin provides information regarding the appropriate testing needed in the monitoring process.

2. Operation and Maintenance Control Monitoring - To assure compliance with effluent standards it is recommended that an in-plant monitoring program be established. Onset of operational problems will be detected more easily and corrective actions can be taken before discharge violations occur through an in-plant monitoring program.

A plant operation and maintenance log should be set up with the parameters listed in Chapter VIII being an integral part of the log entry. In addition, hydraulic parameters of the plant process should be logged with unexpected operational interruptions or problems noted and explained as they occur.

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Chapter 3

ORIGINAL DESIGN

ARIZONA DEPARTMENT OF HEALTH SERVICES

JULY 1978

CHAPTER III - ORIGINAL DESIGN

CHAPTER III - ORIGINAL DESIGN

A. INTRODUCTION.

Newly developed wastewater treatment processes shall be evaluated by the Department prior to issuance of Approval to Construct. In all cases, these processes will be given a temporary approval contingent upon demonstrating mathematically and with pilot plant test data that the process will operate in a manner suitable to meet discharge standards. Only one temporary approval per process may be allowed until the process proves by field performance that discharge requirements and effluent standards will be met consistantly and until operation and maintenance and educational level requirements can be established.

This Chapter sets forth principles which will provide a basis for evaluation.

B. CRITERIA FOR EVALUATING DESIGN.

1. Pilot Plant Testing with Data - All requests for approval of new processes shall be accompanied with data from pilot plant studies that have been conducted over a sufficient time frame to exhibit minimal operational problems with consistent results. The data shall present results related to seasonal variations, flow variations, temperature variations, and shall include all other variations which will cause changes in treatment efficiency and characteristics. The data shall be presented in report form and shall be in sufficient detail for the Department's evaluation and analysis. Detailed descriptions of test equipment, testing procedures, and methods of chemical analysis shall be discussed in the report.

   All new processes and test results will be protected by a non-disclosure agreement between the Department and the process developer.

2. Hydraulic Principles - All processes should be based upon sound hydraulic principles including but not limited to:

   a. Principles of conservation of mass. The conservation of mass principle states that matter can neither be created nor destroyed. Hydraulically, this principle translates to a hydraulic mass balance, i.e.,

   $$Q_{in} = Q_{out}$$

   b. Principles of Conservation of Energy - The principle of conservation of energy states that energy cannot be lost, though it may be converted to other forms. In a hydraulic system, then, the sum of all energies (kinetic, pressure, and elevation) is a constant.

   c. Principles of Impulse-Momentum - The law of momentum conservation states that momentum may not be lost in a hydraulic system, although some of it may be converted into impulse forces.

   d. Principles of Liquid-Solid Separation - If the process involves separation of the liquid and solids, then this portion of the process will be evaluated using the following:

1) Gravity Process.

a) Stokes Law of discrete particle settling

b) Hindered settling principles

2) Pressure or Vacuum Process.

a) Poiseville's Law for the flow of fluids through capillary tubes or the Darcy modified scheme.

3. Physical Principles - Certain portions of newly developed processes may involve principles of physics such as sound, electromagnetic fields, heat transfer and exchange, etc. In such instances the process development report shall clearly indicate the physical principle upon which that portion is based and provide data with calculations substantiating correlation with physical laws.

4. Chemical Principles.

a. Biochemistry - Applicable new processes shall be evaluated using principles of biochemistry. Included in the evaluation should be a mass and energy balance of the proposed process, as well as a description of the basic biochemistry.

Since biological science provides the basis of design, other factors shall be presented for evaluation which should include but not be limited to:

1) Reaction Kinetics - Rates of reaction of the biological process and their change with temperature. In the reaction rate temperature equation

$$\frac{K_2}{K_1} = \theta^{(T_2 - T_1)}$$

θ shall be evaluated and substantiated.

2) Growth Kinetics - The substrate removal rate as a function of substrate concentration and biological growth as a function of the food to microorganism ratio, or variations thereof, shall be discussed clearly and concisely with sufficient data to substantiate process kinetics.

b. Physical Chemistry - Portions of the process may be governed by laws or principles of physical chemistry.

1) Adsorption - Adsorption equilibria should be discussed and defined in terms of Langmuir, BET, or Freudlich equations. Factors affecting the design and operation should be presented, such as pH, temperature, chemical interferences, reaction rate limitations, etc.

2) Ion Exchange - Ion exchange equilibria should be discussed in terms of exchange chemistry, ion selectivity, and exchange isotherms (Langmuir or Freudlich equations). Factors affecting the design and operation should be presented such as pH, temperature, chemical interferences, etc.

3) Membrane Processes - Membrane processes should be discussed in terms of chemical selectivity, membrane permeation, principal driving force and the principles of physical chemistry. Factors affecting the design and operation should be presented such as pH, temperature, etc.

4) Gas Transfer - Where portions of the process use gas transfer (O_2, N_2, etc.), the system shall be discussed in terms of Henry's law, Dalton's law, solubility principles, and rate of gas transfer. Temperature, pH, salinity, and other factors affecting the design and operation should be presented with data.

5) Chemical Oxidation - Where chemical oxidation processes are recommended, the evaluation will be based upon principles of chemistry. Stoichiometric discussions should be presented giving data showing the oxidation reduction equations, concentrations of reactants, temperature affects, role of impurities, role of pH, catalysts with dosages, retention times of reaction vessels, and other data necessary to design and operate the process.

In the preceding discussion, it is acknowledged that the principles involved in physical chemistry and biochemistry intermesh in major areas of thermodynamics, reaction kinetics, etc. However, for purposes of simplicity the evaluation criteria have been categorized as presented.

The process whose basis for evaluation has not been presented in this Chapter will be analyzed in terms of the basic applicable principles of physics and/or chemistry.

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Chapter 4

SEWERAGE COLLECTION SYSTEMS

ARIZONA DEPARTMENT OF HEALTH SERVICES

JULY 1978

CHAPTER IV - SEWAGE COLLECTION SYSTEMS

CHAPTER IV - SEWERAGE COLLECTION SYSTEMS

A. INTRODUCTION.

This Chapter sets forth minimum standards for design and construction of sewer lines. The engineer should take every precaution to assure that pipe sizes and alignment will provide the necessary scouring velocities to give minimum sewer line maintenance. In addition, he is encouraged to recommend that the owner purchase, rent, or lease sewer service equipment, and that he establish a set preventive maintenance schedule.

The standards presented hereafter are established from general engineering experience and from general principles of open channel hydraulics. Imaginative designs based upon the general principles of open channel flow will be reviewed by the Department provided sufficient detailed analysis is presented to the Department in fulfillment of the requirements of Chapter I.

B. SEWERAGE COLLECTION SYSTEMS - GENERAL.

1. In general, sewer lines should be designed for the estimated population that will be contributary - present and future. Adequate allowance should be provided for infiltration, institutional, and industrial flows. Actual field flow measurements will be acceptable as a basis of design, provided that flow measurements are taken at representative points for specific areas of the system, i.e., high density industrial, commercial, low density industrial, residential, etc.

2. Pipe Selection - In selecting pipe material for sewers, consideration should be given to the chemical characteristics of the wastewater (especially in industrial waste flow areas), the possibility of septicity, exclusion of infiltration, external and internal pressures, abrasion and similar problems encountered with the established grades.

   All types of pipe materials used in design shall have established ASTM, ANSI, or NSF standards of manufacture or seals of approval and shall be designated for use as sewer pipe.

3. Jointing Material - The materials used and methods proposed in making joints shall be included in the Specifications. Materials used for sewer joints shall have an established record for preventing infiltration and root entrance.

   Water tightness of sewers and manholes shall be determined by one of three methods:

   a. Infiltration testing
   b. Exfiltration testing
   c. Low pressure air testing

   The testing shall be performed prior to the sewers being placed in service and shall be administered on at least 20 per cent of the total project footage, unless additional tests are required by the design Engineer or the Department.

The testing shall be administered using the shortest length of line that is practical. All lines shall be cleaned before placing in service to remove extraneous material. It is also recommended that the sewers be examined by television or other methods to assure proper construction.

Suitable waterstops shall be provided at all manhole seams.

All test results shall be made available for review by the Department prior to project acceptance.

Sewer lines installed in areas where the pipe is subject to high ground water infiltration shall be tested using direct flow measurements in each specified reach of pipe.

a. Infiltration Testing - The total infiltration shall not exceed 200 gallons per day per inch diameter per mile of pipe. If the quantity of infiltration exceeds the maximum quantity specified, immediate action shall be taken to reduce infiltration to within the specified limits.

Diameter of Sewer	Infiltration Gals/hr/100 ft.	Diameter of Sewer	Infiltration Gals/hr/100 ft.
8	1.26	54	8.51
10	1.57	60	9.45
12	1.89	66	10.39
15	2.36	72	11.34
18	2.83	78	12.29
21	3.31	84	13.23
24	3.78	90	14.17
27	4.25	96	15.12
30	4.73	102	16.07
36	5.67	108	17.01
42	6.61	114	17.95
48	7.56	120	18.90

Allowable M. H. Infiltration — 0.1 gallons per hour per vert. ft

Allowable Limits of Infiltration
200 Gal/Inch Dia/Mi/Day

b. Low Pressure Air Testing - Low pressure air testing shall be limited to pipes less than 30 inches in diameter.

1) Test Procedure:

a) Clean and wet the line to be tested.

b) Plug all pipe outlets with suitable test plugs and securely brace each plug.

c) Add air slowly to the portion of the pipe installation under test until the internal air pressure is raised to 4.0 psig.

d) Check exposed pipe and plugs for leakage by coating with a soap solution. If any failures are observed, bleed off air and make necessary repairs.

e) After an internal pressure of 4.0 psig is obtained, allow at least two minutes for internal air temperature to stabilize, adding only the amount of air required to maintain pressure.

f) After the two minute period, disconnect the air supply.

g) When the pressure decreases to 3.5 psig, start timing. Determine the time in seconds that is required for the pressure to fall from 3.5 psig to 2.5 psig. This test duration time must be equal to or greater than the minimum test duration time obtained as outlined below.

2) Minimum Test Duration Times - The following procedures for obtaining minimum test duration times from the nomograph, Figure IV - 1, are based on a maximum air loss of 0.003 cfm per square foot of internal cross sectional area but not more than 2 cfm for the entire length under test.

a) For test sections of one diameter or for sections such as laterals with a few short taps.

If the length of the section under test is not grater than the length shown in Column L_A, read the minimum test duration time in seconds from Scale T_A.

If the length of section under test is greater than L_A, but within the limits of Scale L, extend a straight line from the diameter on Scale D to the length of Scale L and read the minimum test duration in seconds on Scale T_B.

b) For test sections consisting of more than one size pipe, and for lengths not falling within the limits of Scale L.

For test section lengths falling within the limits of Scale L, extend a straight line from the diameter read on Scale D to the corresponding length of Scale L for each size

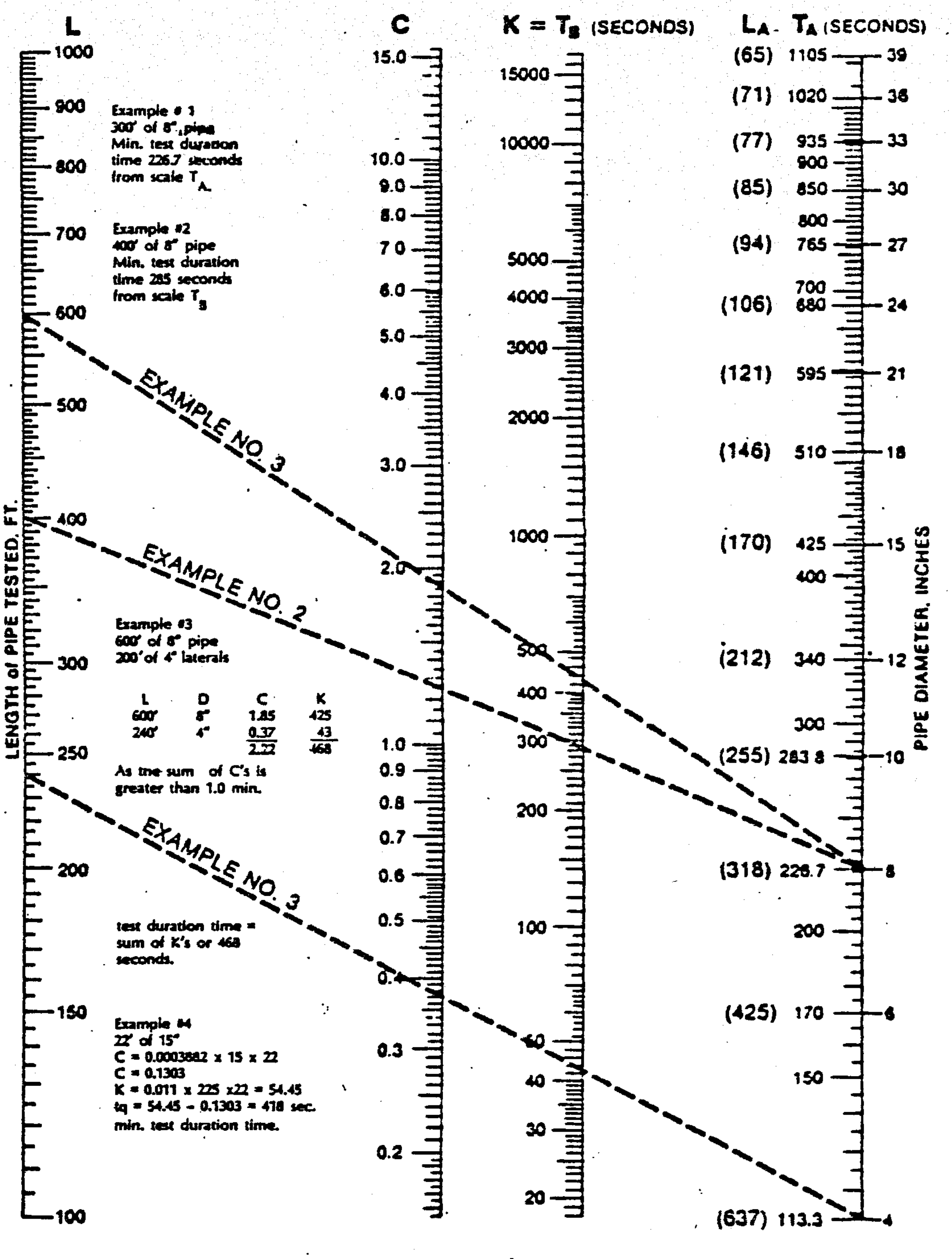


Figure IV - 1

Nomograph - Sewer Line Air Testing

of pipe included and read values for C and K directly from the corresponding Scales.

For test section lengths not falling within the limits of Scale L, calculate C and K from the formulas at the bottom of the nomograph.

Add C's and add K's.

If the total of C's is 1.0 or greater, the sum of K's equals the minimum test duration in seconds.

If the total of C's is less than 1.0, divide the sum of K's by the sum of C's. The quotient is the minimum test duration in seconds.

c. Exfiltration Testing - In areas where the sewer is not located in natural ground water table, exfiltration tests or low pressure air tests shall be used to give an indication of sewer tightness.

The exfiltration test should be conducted as follows:

1) Plug sewer at lower end of section to be tested.

2) Plug the highest end of the sewer to be tested. The sewer plug shall have a suitable air vent to allow trapped air removal.

3) Place a calibrated container at the average height of four (4) feet above the flow line of the sewer. Check the system for leaks in hoses, plugs, calibrated containers, etc. while filling through a positive shut-off valve. After filling the sewer, allow one hour for absorption of water and refill sewer line. When the water overflows the calibrated container, close the input valve and begin the test.

4) Record the elapsed time to empty the container of water and calculate the loss rate (gal/hr.).

Diameter of Sewer	Gals/Hr/100 ft.	Diameter of Sewer	Gals/Hr/100 ft.
8	1.26	18	2.83
10	1.57	21	3.31
12	1.89	24	3.78
15	2.36	27	4.25

Allowable Limits of Exfiltration
200 Gal/Inch Dia/Mi/Day @ (4 ft. head)

Exfiltration from manholes shall be limited to 0.1 gallons per hour per vert. foot.

4. Protecting Public Water Supply - Caution should be taken in design and construction to protect all water supplies from waste water contamination.

The Department has adopted regulations prohibiting cross connections. To minimize the potential of cross contamination, the Engineer shall design the horizontal and vertical separation of water and sewer lines as follows:

a. Horizontal - When water lines and sewers are laid parallel to each other, the horizontal distance between them shall not be less than six (6) feet. Each line shall be laid on undisturbed or bedded material in a separate trench. Where conditions prevent the minimum horizontal separation set forth above, or where both lines are in the same trench, both the water line and sewer shall be constructed of mechanical joint cast iron pipe, or other approved pipe, which is pressure tested to assure water tightness before backfilling. In such instances, a complete description of the circumstances and details of the proposed construction shall be attached to the plans submitted to the Department.

b. Vertical - When a sewer crosses two (2) feet or more below a water line, no extra protection is required. When a sewer crosses less than two (2) feet below a water line, the sewer shall be constructed of cast iron pipe with leaded or mechanical joints, or other approved pipe, for at least six (6) feet in both directions from the crossing, or the sewer shall be encased in concrete of 6-inch minimum thickness for the same distance. When a water line must cross under a sewer, a vertical separation of at least 18 inches between the bottom of the sewer and the top of the water line shall be maintained with support provided for the sewer to prevent settling. The sewer shall be constructed of cast iron pipe with leaded or mechanical joints, or other approved pipe at least six (6) feet in both directions from the crossing, or the sewer shall be encased in concrete of 6-inch minimum thickness for the same distance.

c. No water pipe shall pass through or come into contact with any part of the sewer manhole.

C. CAPACITIES.

Sanitary sewers should be designed for the following existing and anticipated future flows:

(1) Maximum rate of flow of domestic sewage for the entire service area for a specified time period.

(2) Infiltration that is allowed for the entire service area.

(3) Anticipated flow rates from commercial and industrial areas.

1. Design Period - Design periods should be chosen carefully and consider the following:

a. Useful life of the equipment and its component structures, taking into account obsolescence and wear and tear.

b. The ease, or difficulty, of expanding or relocating the system.

c. The anticipated population rate increase including commercial and industrial contributions.

d. The present rate of interest on accrued bond indebtedness.

e. Inflation and escalation of material and labor during the period of indebtedness.

f. The ability of the system to function properly at present flows after the expanded system is placed in operation

RECOMMENDED DESIGN PERIODS

Type of Structure	Design Period Years	Note
Laterals and submains less than 15 inches in diameter	Full Development	Requirements may change rapidly in a limited area.
Main sewers, outfalls, and interceptors	50, full development, or as specified by EPA	Difficult and expensive to enlarge

2. Design Flows - The estimates of flow of residential domestic areas can be expressed by the following equations:

$$Q_{max}/Q_{avg} = 5.0/P^{1/6}$$

$$Q_{min}/Q_{avg} = 0.2P^{1/6}$$

$$Q_{max}/Q_{min} = 25.0P^{1/3}$$

Where Q is the flow rate in gallons per day and P is the poulation in thousands.

Other widely used relationships of flow from moderate sized domestic sewage areas are

Maximum daily flow = 2 x avg daily flow
Maximum hourly flow = 1.5 x maximum daily flow, or
= 3 x average daily flow
Minimum hourly flow = 2/3 x average daily flow, or
Minimum hourly flow = 1/2 x minimum daily flow, or
= 1/3 x average daily flow

In the absence of flow data new domestic sewerage systems shall be designed on the basis of an average daily flow of not less than 100 gallons per capita per day, or as specified by EPA's cost effectiveness guidelines. Lateral and submain sewers should be designed with capacities, when flowing full, of not less than 400 gallons per capita per day. Sewer mains should be designed for not less than 250 gallons per capita per day flowing full. Interceptors should be designed for maximum flows using the preceding equations.

In commercial areas the normal domestic flow should be added to that of the commercial areas. Commercial flows should be based upon known data in the design region.

Normal dry industrial flows should be based upon known data in the design region. Any residential flow should be added to these values.

Design for wet industry should be on an industry-by-industry basis.

D. DESIGN DETAILS.

1. No sewers other than house laterals shall be less than six inches in diameter. Six-inch diameter sewers will be permitted for lines under 400 feet in length in areas where the line cannot be extended, unless indicated otherwise in this Bulletin. A manhole shall be placed at the end of the six-inch line. If the six-inch diameter line is 200 feet or less in length, a cleanout at the end of the line may be used.

   All other sewers shall be at least 8 inches in diameter.

2. Minimum Slope - All sewers shall be so designed and constructed to give mean velocities, when flowing full, of not less than 2.0 feet per second, based upon Manning's formula using an "n" value of 0.013. Use of other practical "n" values may be permitted by the plan reviewing agency if deemed justifiable on the basis of research or field data presented. Figures IV - 2 and IV - 3 are provided as a design aid.

   To prevent deposition of sand and gravel, a mean velocity of 2.5 fps should be used when the circumstances permit. To prevent abrasive action of the pipe material, the maximum velocity in the sewer shall be limited to 10 fps. Where velocities exceed this maximum figure, the lines shall be constructed of ductile iron pipe or its equivalent. Manhole inverts shall also be protected.

   All sewer lines shall be designed with due consideration given to sulfide production and control. Recommended references include EPA Process Design Manual for Sulfide Control in Sanitary Sewer Systems, and D. K. B. Thistlethwayte's Control of Sulphides in Sewerage Systems.

3. Alignment.

   a. Straight - Where a sewer with straight alignment is desired, the sewer shall be laid with uniform grade and straight alignment between manholes.

   b. Curvilinear - Horizontal and vertical curvilinear sewers will be accepted providing they meet the following criteria:

      1) The minimum velocity in the sewer flowing full is not less than 2.0 fps.

      2) The minimum radius of curvature shall be 200 feet or the radius calculated based upon one-half of the maximum allowable deflection per joint per pipe material, whichever is greater.

3) In addition to the acceptance test, the sewer line shall be cleaned to remove foreign material.

4) Manholes shall be placed at each end of the curve not to exceed 400 feet spacing.

4. Manholes and Cleanouts.

a. Location - Except as itemized below, manholes shall be installed at the end of each line, at all changes of grade, pipe size, or alignment, at all sewer pipe intersections, and at distances not exceeding those shown below:

MANHOLE SPACING

Pipe Size (in.)	Max. Manhole Spacing (ft.)
8 - 15	500
18 - 30	600
36 - 60	800
Over 60	1300

Cleanouts may be used in place of manholes at the end of laterals less than 200 feet in length.

Where manholes are located in areas of flooding, consideration shall be given in design to eliminate storm water entrance.

Sewer Size		Minimum Slope to Maintain Velocity of:					
(in)	(mm)	2.0 fps (0.6 m/s)			2.5 fps (0.75 m/s)		
n		.010	.013	.015	.010	.013	.015
8	200	.0020	.0033	.0045	.0031	.0052	.0070
10	250	.0015	.0024	.0033	.0023	.0037	.0052
12	300	.0011	.0019	.0026	.0018	.0030	.0040
15	380	.00085	.0014	.0019	.0013	.0022	.0030
18	450	.00067	.0011	.0015	.0010	.0017	.0023
24	600	.00045	.00077	.0010	.00071	.0012	.0016

Table IV-1

Minimum Slope To Maintain Indicated Velocities Flowing Full (From Manning's Formula)

b. Drop Manholes - If the difference in invert elevations between inflow and outflow sewers exceeds 30 inches, a drop manhole shall be installed.

If the difference in invert elevations between inflow and outflow sewers is less than 30 inches, the manhole invert should be filleted to prevent solids deposition.

The Engineer should design drop manholes with due consideration given to sulfides and sulfide control. Recommended references include EPA Process Design Manual for Sulfide Control in Sanitary Sewerage Systems, and D. K. B. Thistlethwayte's Control of Sulphides in Sewerage Systems.

Elimination of drop manholes by a substitution of a vertically curved sewer into a standard manhole will be considered, provided detailed hydraulic calculations are submitted showing the vertical transition curve and its conformance with velocities and principals of open channel hydraulics.

c. Diameter - The minimum inside diameter of manholes shall be 48 inches.

d. Steps - Manhole steps should be installed in sewers when the depth of the manhole exceeds 48 inches. The steps shall be spaced from 15 to 18 inches apart vertically and constructed of cast iron or plastic coated cast iron.

Ladders with cast-in anchors will be an acceptable alternate to steps.

e. Flow Channel - The flow channel through the manhole shall be steel trowel finished to conform in shape and slope to that of the sewers. The manhole shelf shall be brush or broom finished with a slope of one inch per foot.

f. Water-Tightness - Manholes should be protected from storm drainage flooding conditions whenever possible. Where the flooding cannot be avoided, solid manhole covers shall be used to prevent infiltration. Suitable waterstops shall be provided at all manhole seams.

Manholes constructed of brick or concrete block shall be waterproofed on the exterior to prevent infiltration. Where pre-cast manholes are found to leak, the manholes shall be waterproofed on the exterior.

5. Depressed Sewers - The use of depressed sewers (inverted siphons) should be kept to a minimum.

To keep velocities to a maximum and clogging by sediments to a minimum and to provide easier maintenance, at least two parallel pipes should be designed with a minimum pipe diameter of six (6) inches.

A minimum velocity of 3.0 fps should be maintained in each sewer pipe. The system should be designed to provide the minimum velocity in one pipe at minimum flows with the inlet structure arranged in such a manner as to bring additional pipes progressively into operation as the flow increases to its ultimate design flow.

Manholes shall be installed at each end of the depressed sewer to provide for cleaning and rodding.

Where circumstances warrant, a bar screen may have to be installed in a structure prior to the depressed sewer inlet. This could be especially true where 6-inch pipes are used. The design Engineer should give careful analysis and attention to potential clogging problems.

6. Depth of Sewers - Sewers shall be installed at a depth sufficient to insure adequate drainage of wastes from each service and to prevent frost damage.

   All sewers shall be designed to absorb superimposed loads and backfill overburden, without damage to the pipe material, and without adversely affecting the hydraulic characteristics of the pipe.

   It is recommended that the sewer pipe be installed at a minimum depth of 3 feet (finished grade to pipe spring line). Where pipes are required to bridge ravines, washes, and caverns, the pipe shall be of high strength material and shall be supported properly to prevent settlement or washout during storm flows.

7. Easements and Rights-of-Way - No public sewer shall be installed unless the owner has in his possession evidence of his obtaining the necessary easements and rights-of-way.

   Failure to produce these agreements upon request is ground for withdrawal of the Department's "Approval to Construct."

8. Special Conditions for Condominiums, Mobile Home, Travel Trailer, and Recreation Vehicle Parks - Condominiums, mobile home, travel trailer, and recreational parks shall be designed using the requirements of the uniform plumbing code, excluding the water-sewer main separation. The requirements of this Bulletin regarding water and sewer separation shall also apply to condominiums, mobile home, travel trailer, and recreational vehicle parks.

E. PLAN - DETAIL REQUIREMENTS.

In general, the engineering drawings submitted to the Department for approval shall meet the following requirements:

1. Standard Drawing Size - The engineering drawings shall be reproduced on paper not greater 24" x 36".

2. Plan View and Profile - Plans and profiles for sanitary sewers shall be submitted and shall be prepared using the following scales:

Horizontal	Vertical
1" = 20 feet	1" = 2 feet
1" = 30 feet	1" = 4 feet
1" = 40 feet	1" = 5 feet
1" = 50 feet	1" = 6 feet
1" - 60 feet	1" - 10 feet
1" - 100 feet	

The plans and profiles shall be in sufficient detail so as to provide a clear understanding of the size, invert and grade elevations and type of material used in construction.

The plans and profiles should show all utility locations, easements and rights-of-way, and other structural features of the sewer.

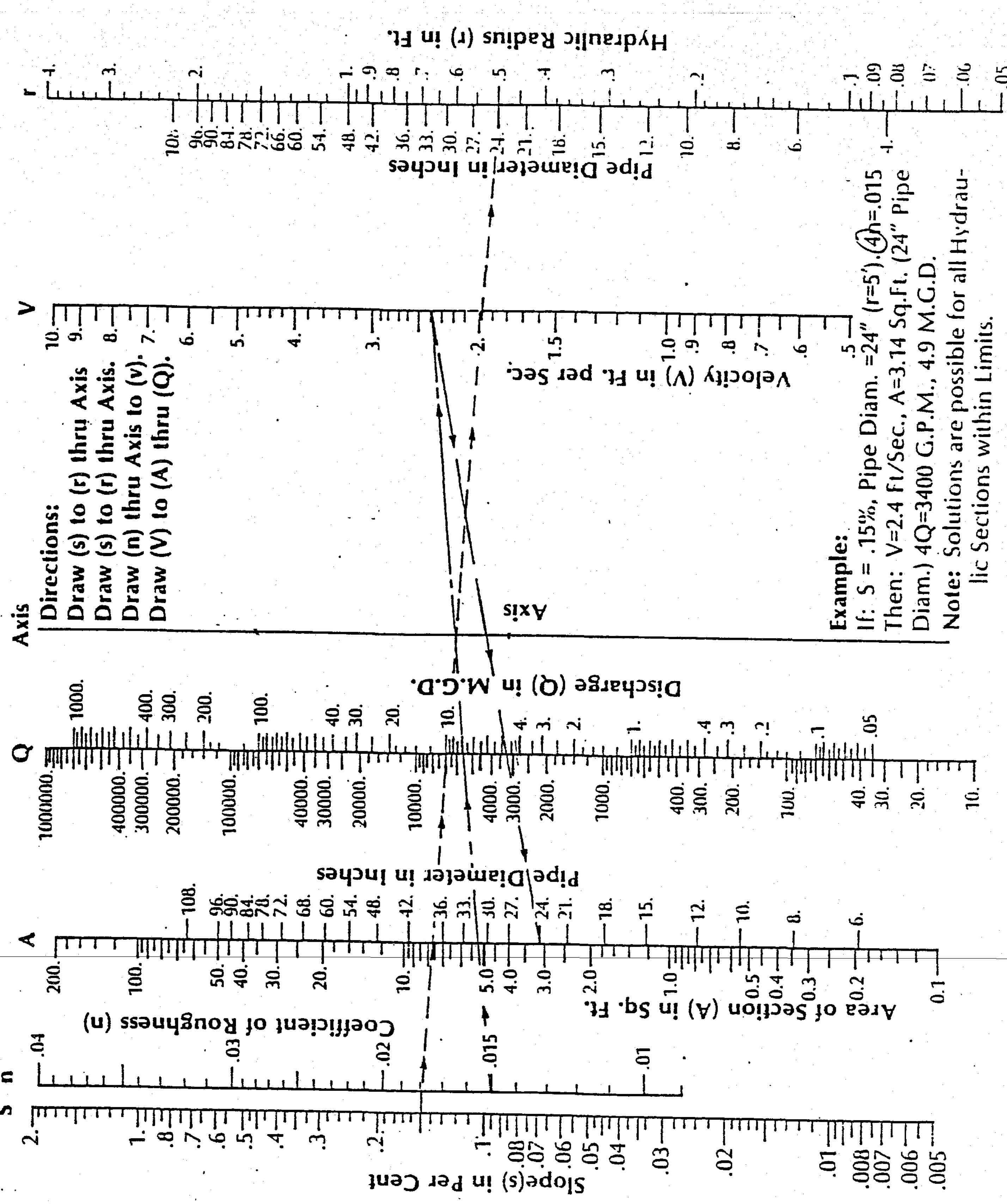
A general map, showing the vicinity of the project, area to be serviced, the location of the proposed sewers (referenced to plans and profiles), site or sites of all water and wastewater plants, wells, streets, parks, drainage areas, lakes, creeks, streams, water mains, and storm sewers, shall be included as part of the engineering drawings.

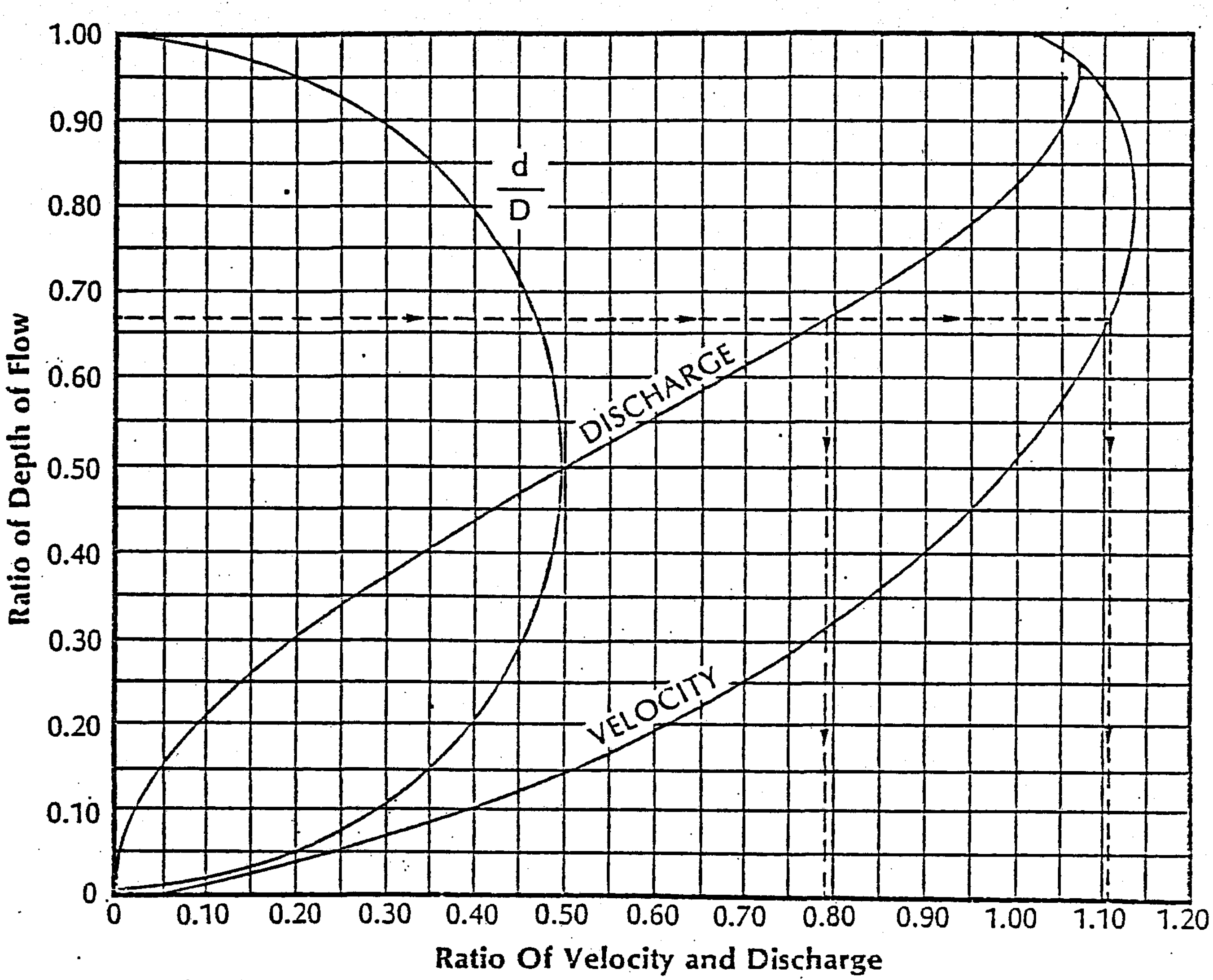
It is recommended that the general map include topographic contours at intervals of 2 feet minimum and 5 feet maximum.

Figure IV-2

Solution of Mannings Formula

$$V = \frac{1.486}{n} r^{2/3} \left(\frac{S}{100}\right)^{1/2} \text{ AND } Q = AV$$





Example: If velocity = 2.4 ft./sec. and discharge = 4.9 mgd. flowing full; then flowing 2/3 full the velocity will be 2.4 x 1.11 = 2.68 ft./sec. and discharge will be 4.9 x 0.79 = 3.79 mgd.

Figure IV-3

Velocity and Discharge for Partially Full Circular Sewers
(Comparison of the filled section to the full section from Manning's Formula)

engineering bulletin no. 11

Chapter 5

SEWAGE PUMP STATIONS

ARIZONA DEPARTMENT OF HEALTH SERVICES

JULY 1978

CHAPTER V - SEWAGE PUMP STATION

CHAPTER V - SEWAGE PUMP STATION

A. INTRODUCTION.

Chapter V provides design standards for sewage pump stations which are an integral part of the sewerage collection system. Criteria for design of in-plant sewage and sludge pumping systems are presented in Chapter VII.

1. Site Selection - In selecting a site for a sewage pumping facility, consideration should be given to:

   a. Accessibility of site
   b. Flooding conditions
   c. Potential nuisance aspects

2. Location - The potential for damage or interruption of operation due to flooding shall be considered when locating sewage pump stations. The stations' structures and electrical and mechanical equipment shall be protected from physical damage by the maximum expected one hundred (100) year flood. The station shall remain fully operational during the twenty five (25) year flood if practicable; lesser flood levels may be permitted dependent on local situations, but in no case shall less than a ten (10) year flood be used.

B. DESIGN.

1. Selection of Pumping Equipment.

   a. Pumps - The selection of sewage pumps should be made after a thorough analysis of the following factors:

      1) Design Flow - The design of the pump station will be governed by the maximum and minimum flows (present and future) contributed by the sewerage system tributary to the pumping station.

         Flow patterns and quantities for the tributary contributing to the pumping station shall be established using the criteria set forth in Chapter IV of this Bulletin.

      2) Number of Pumps - The number of pumps provided depends upon the required capacity and range of flow. The pumping station should be designed to provide a total pumping capability equal to the maximum anticipated flow with at least one of the largest pumps out of service. In no case shall less than two (2) pumps be provided in a pumping station.

      Sewage pumps having suction lifts of a maximum of fifteen (15) feet will be approved only where the pumps are self-priming and adequate maintenance provisions are included in the design. Suction lifts for pumps using foot-valves on raw sewage will not be acceptable.

      To minimize clogging, open impeller or non-clog type pumps, or ejectors, capable of passing a two and one-half inch sphere should be required. For small lifts stations (40 gpm or less) grinder pumps will be acceptable.

Where special designs of pumping stations are necessary due to pump limitations, etc.; specific details of design with reasons for equipment selection shall be issued to the Department in report form for preliminary review prior to final design.

Inspection and clean-out places on the pump bowl or a hand hole in the first fitting connected to the pump suction should be provided for clearing stoppages.

b. Pump Controls and Alarms - Pump controls can be float-operated, electrode operated, pneumatically operated, or pressure switches.

   Control mechanisms shall be located so that they will not be affected by flow currents created by the entering sewage or by pump suction.

   Provision should be made to prevent floating material in the wet well from interfering with the operation of the controls.

   When the controls are located in the dry well, the height of the float tube shall be such as to prevent overflow of sewage into the dry well.

   All lift stations shall be equipped with an audible or visual high level alarm system. Other alarms such as pump failure, etc. should be considered in the design of lift stations.

   Large lift stations should be equipped with variable speed controls to operate at varying delivery rates to permit discharging sewage from the station at approximately its rate of delivery to the pump station.

c. Electrical Equipment - The motor starters and controls shall be located in property assembled (factory or field) control panels. Factory assembled control panels are preferred. Large stations should include a separate electrical room.

   Power transformers shall be installed in an outdoor fenced enclosure, on power poles, or shall be of the lockable pad mounted type.

   Unless it can be demonstrated to the Department that it is not required, all sewage lift stations shall have provision for standby power.

   Lift stations which serve major flow areas shall be equipped with a standby generator, shall be supplied with power by two separate feeders from separate substations, or shall be supplied by a loop feeder on separate transformers from a common substation.

Electrical equipment in enclosed areas where gas may accumulate should comply with the National Board of Fire Underwriters and National Electrical Code for hazardous locations.

d. Piping and Valves - Flanged pipe and fittings should be used for exposed piping in pump stations.

Each pump shall have a separate suction. It is recommended practice for the discharge pipe to be at least one pipe size larger than the discharge nozzle and for the suction pipe to be one or two sizes larger than the suction nozzle.

A concentric increaser should be installed on the pump discharge, with a full closing gate or plug valve and check valve. The pump suction should be installed with a full closing gate valve.

Where space conditions will not permit installation of rising stem valves, non-rising gate valves, check valves, and all other types of valves shall be equipped with an indicator to show open and closed positions.

Check valves should be of the swing type, preferably with outside lever and weight. The valve should be installed in the horizontal position in direct line with the pump discharge, and should be of a type permitting the unobstructed flow of sewage when in the full open position.

e. Surge Control - The Engineer should take great care in analyzing the potential water hammer problems in force mains, the possible estimated pressure rise, and methods to reduce the maximum pressure rise to a safe limit.

Since many of the devices used to control water hammer in water pumping stations, such as surge suppressors and relief valves, are not applicable because of sewage solids, alternate solutions such as special valves with timed closures should be investigated. Hydropneumatic surge arrestors are also available for sewage applications.

A detailed treatise on water hammer by John Parmakian, entitled, "Waterhammer Analysis," is recommended by the Department and is available through Dover Publications, New York.

f. Flow Monitoring - At larger pumping stations, consideration should be given to installing suitable devices for measuring sewage flows. At smaller pumping stations consideration should be given to providing a running time meter for flow monitoring.

2. Wet Well Design.

a. Volume of Wet Well - The volume of the wet well between start and stop elevations for a single pump, a single-speed control step for variable speed, or multispeed operation is expressed as follows:

$$V_w = \frac{\emptyset q}{4}$$

where, V_w = required capacity, gallons

$\emptyset$ = minimum time of one pumping cycle or time between sucessive starts or speed increases of a pump operating over the control range, minutes

q = pump capcity, gpm, or increment in pumping capacity where one pump is operating already and a second pump is started, or where pump speed is increased.

Recommended values of $\emptyset$ for small pumps is 15 minutes (5 minutes minimum), and 20 minutes for large pumps.

b. Floors - Floors of wet wells shall have a minimum slope of one to one to the pump intakes and shall have a smooth finish.

c. Access - The wet well shall be designed with adequate access for maintenance purposes. It is recommended that the minimum dimension of the wet well be no less than five (5) feet.

d. Pump Intake Protection - Pumps shall be protected from objects which will cause clogging and station malfunction. Screening devices may be used in the wet well or in an adjacent chamber to protect pumps against clogging. Manually cleaned bar racks may be used in small stations. Larger stations should use mechanically cleaned bar racks, screenings grinders, or comminutors with a manually cleaned bypass rack.

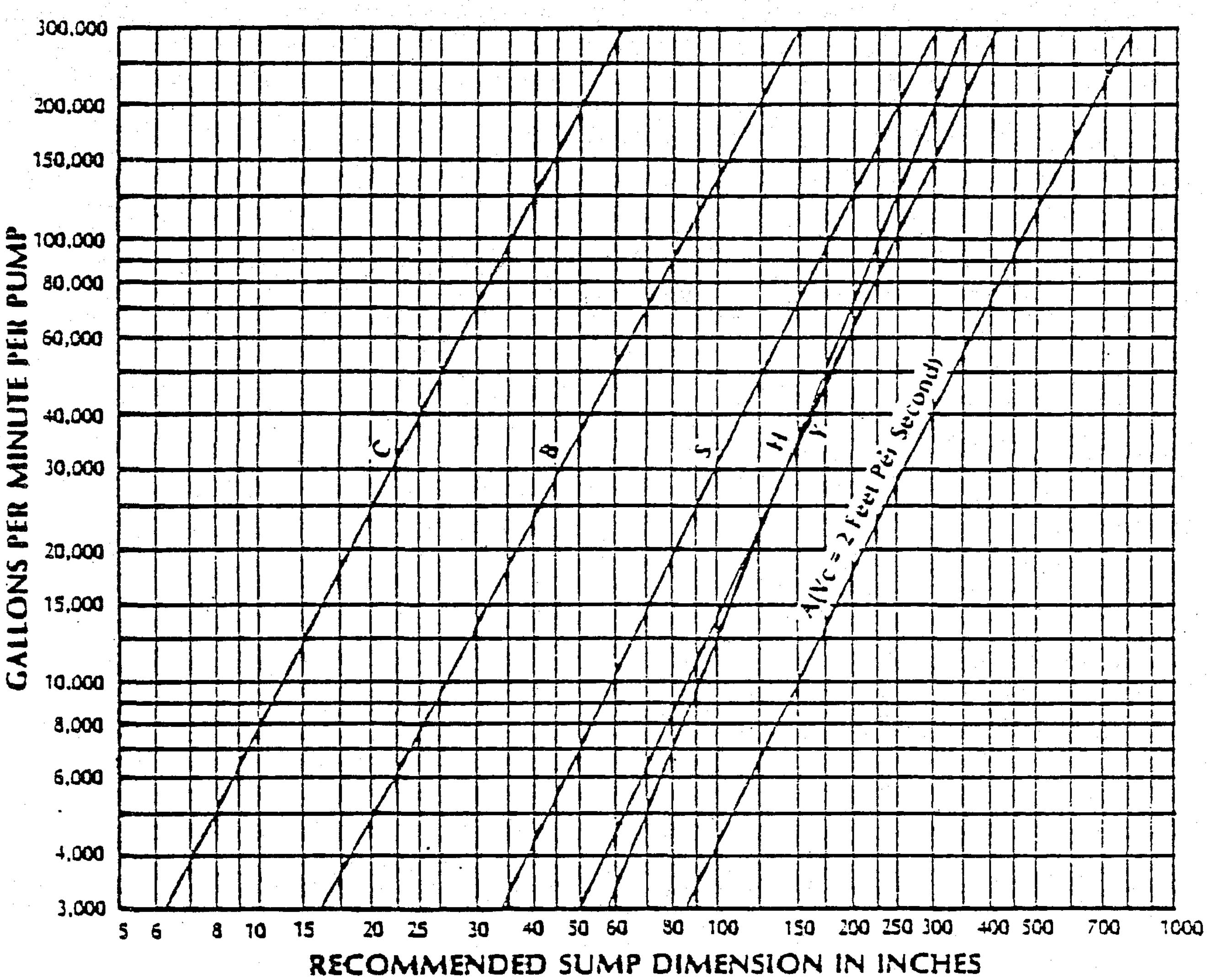
e. Rentention Time - The retention time of sewage in a wet well shall not exceed 30 minutes at average daily design flow. For areas where the retention time is greater than 30 minutes, a compressor with a diffuser bar shall be placed in the wet well to prevent the possibility of septic conditions. The compressor shall be sized at 2 scfm per 1000 gallons of storage.

f. Ventilation - Adequate ventilation shall be provided in wet wells. Ventilation should be via blower, having sufficient capacity to provide a 2-minute air change based on the wet-well volume below grade and above the minimum sewage level. The mode of operation of the ventilation system should be at the discretion of the Engineer.

g. Pump Intake Design - The Hydraulic Institute Standards gives recommended multiple pit layouts for centrifugal pump suctions. These are shown in Figures V - 1, V - 2, and V - 3. In addition, pump suction connections to wet wells are shown in Figure V - 4.

These configurations have been established through field experience and shall be minimum standards for intake design.

3. Dry Well Design - The size of the dry well depends primarily on the number and type of pumps selected. The dry well shall be deep enough that the pumps are self priming at all starting levels unless self



Figures apply to sumps for clear liquid. For fluid-solids mixtures refer to the pump manufacture.

Figure V-1

Sump Dimensions Versus Flow

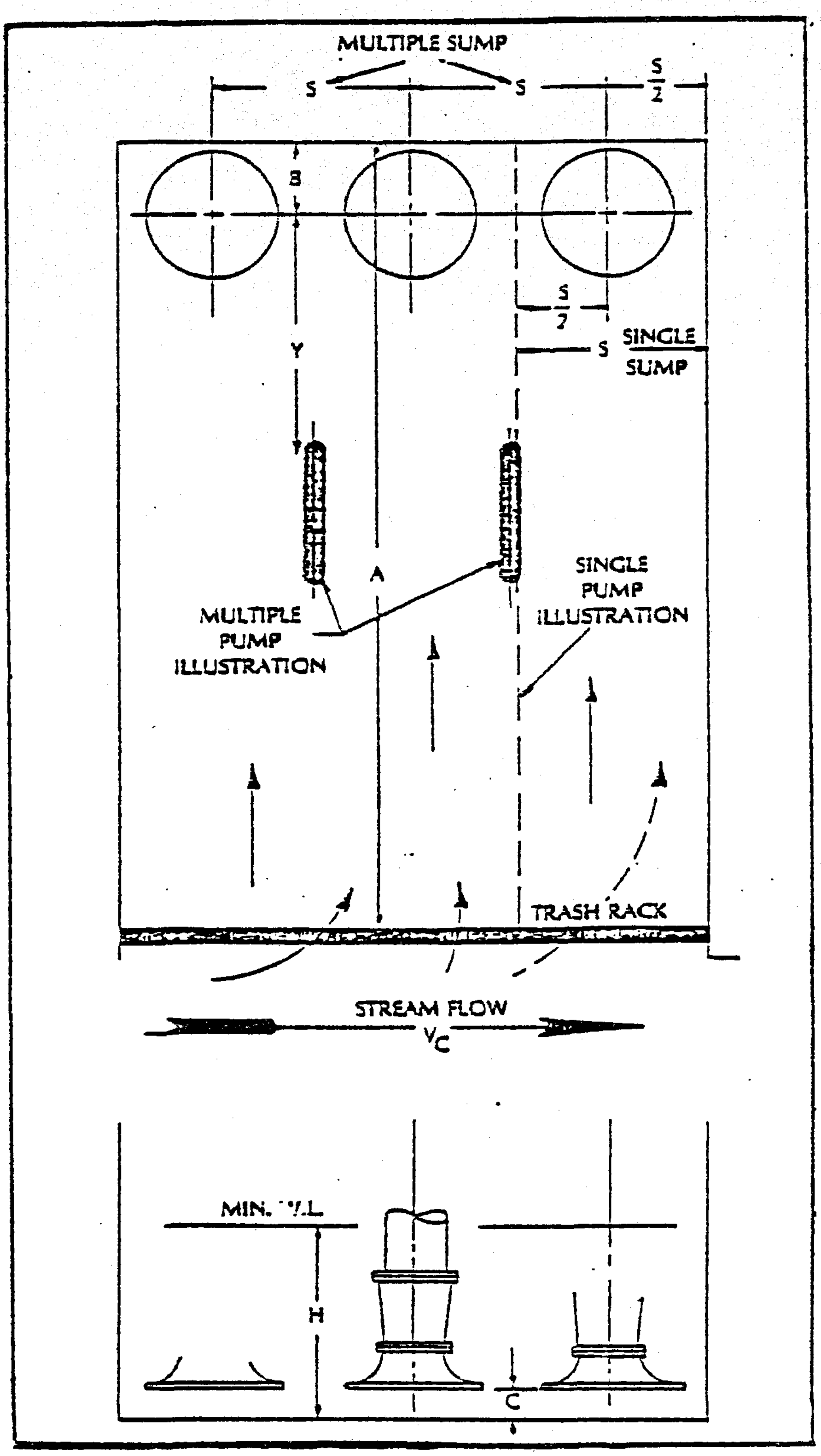
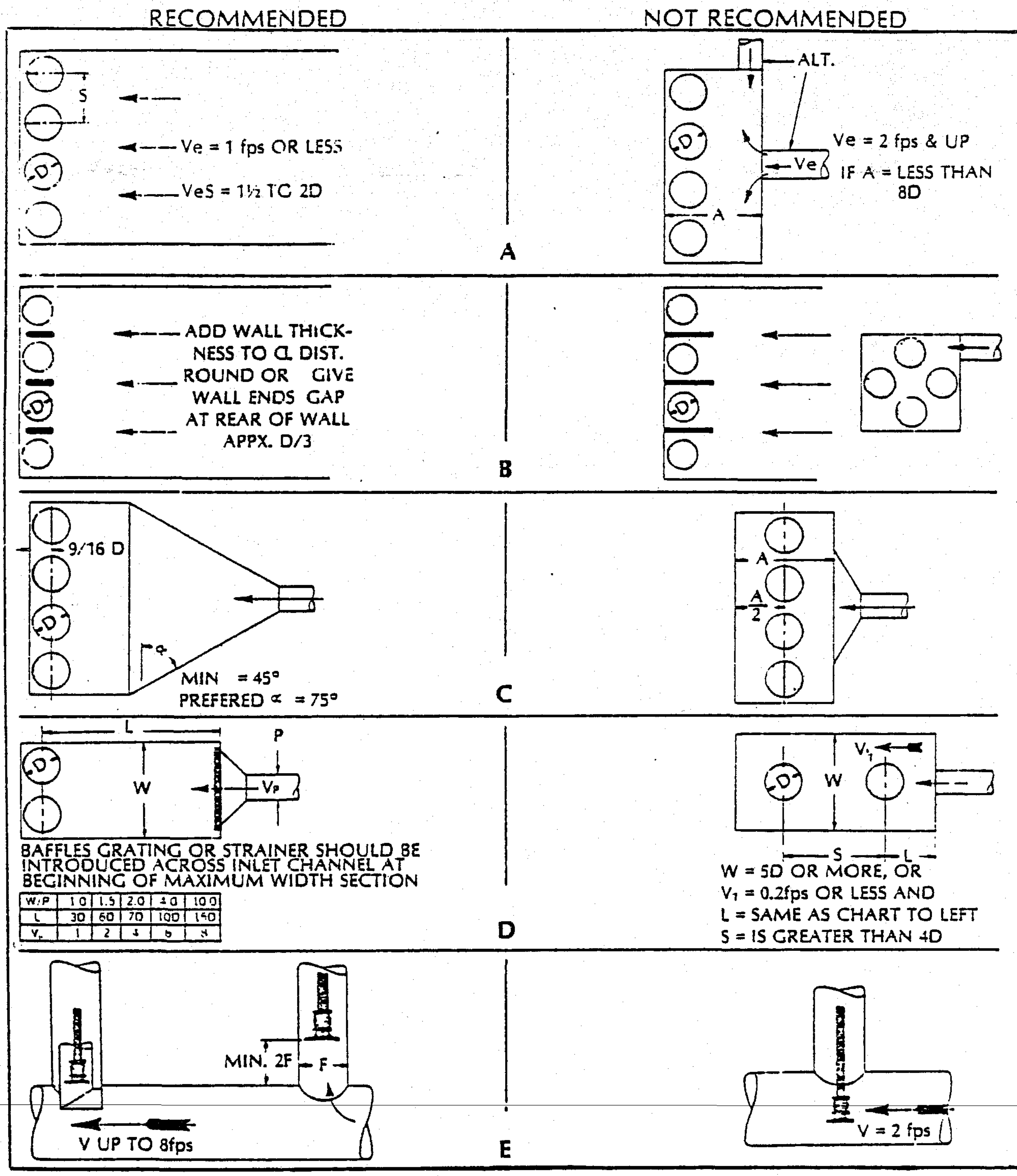


Figure V - 2

Sump Dimensions Versus Flow



NOTE: Figures apply to sumps for clear liquid. For fluid-solids mixtures refer to the pump manufacturer.

Figure V-3
Multiple Pump Pits

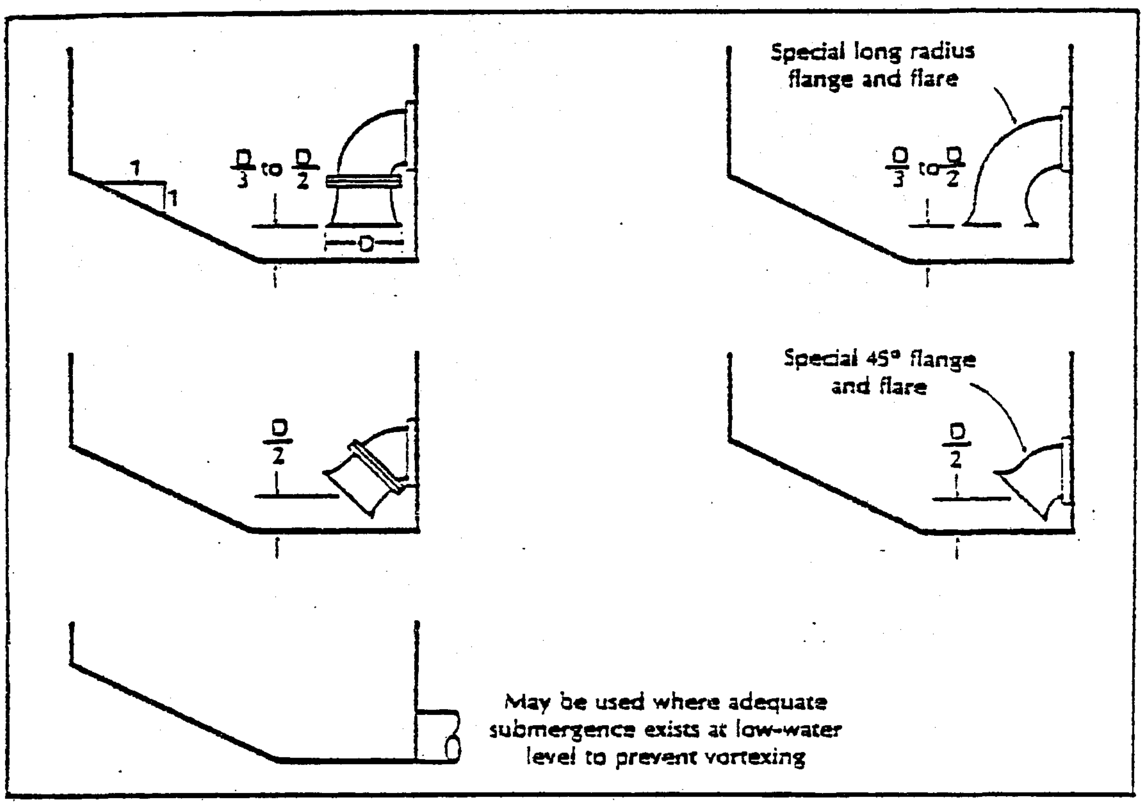


Figure V-4

Pump Suction Connections to Wet Well

priming pumps are being recommended. The pump setting shall be such that the pump's maximum suction lift is not exceeded and shall be positioned to minimize the liberation of gas.

Dry wells shall be well lighted, adequately ventilated, and provided with an automatic sump pump. The dry well shall be positively ventilated with an exhaust system which provides 30 air changes per hour based upon dry well volume below grade.

Sufficient working clearances around pumps and other machinery shall be provided to assure ease in maintenance.

Consideration shall be given to cranes or hoists for removing pumps for maintenance and replacement.

The dry well shall be separated from the wet well by a water- and gas-tight wall with separate entrances provided to each.

Stairways or access ladders shall be provided in all underground dry wells.

4. Individual Residence Lift Stations - In areas where individual residential lift stations are required to pump raw waste or effluent from individual disposal systems, the minimum design requirements are:

   a. Number of Pumps - At least one pump designed for the maximum design flow shall be provided in an enclosed sump.

   b. Controls - The lift station shall be provided with automatic "on-off" controls. A high level alarm system shall also be provided.

   c. Sump Design - The sump shall be designed in accordance with Section B.2. of this Chapter. In addition, a reserve capacity shall be provided above the high level alarm such that the total capacity of the sump equals one full day's flow volume.

5. Force Main.

   a. Velocity Requirements - The velocity of flow in the force main shall be between 3.5 and 6 fps. In no case shall a velocity less than 2 fps at minimum flow be allowed.

      Although solids will not settle out at a velocity of 2.0 fps, solids in the wastewater remaining in the line when the pump stops will settle out. To assure pickup of the deposited solids, it is recommended that a design velocity of 4.0 fps be used. Pumps can be selected to give 4.0 fps minimum velocity with both pumps in operation or at peak delivery.

      Figures V - 5 and V - 6 are provided for reference and as aid in designing force mains. Figure V - 5 is based upon Hazen-Williams' work and is for C = 100. Other values of C are presented in Table V - 1.

Type of Pipe	C
Asbestos Cement	140
Cast Iron	
New unlined	130
Old unlined	40 - 120
Cement lined	130 - 150
Bitumastic enamel lined	140 - 150
Tar-coated	115 - 135
Concrete or concrete lined	
Steel forms	140
Wooden forms	120
Centrifugally spun	135
Galvanized Iron	120
Plastic	140 - 150
Steel	
Coal-tar enamel lined	145 - 150
New unlined	140 - 150
Vitrified clay	100 - 140

Table V - 1

Values of C
Hazen Williams' Formula

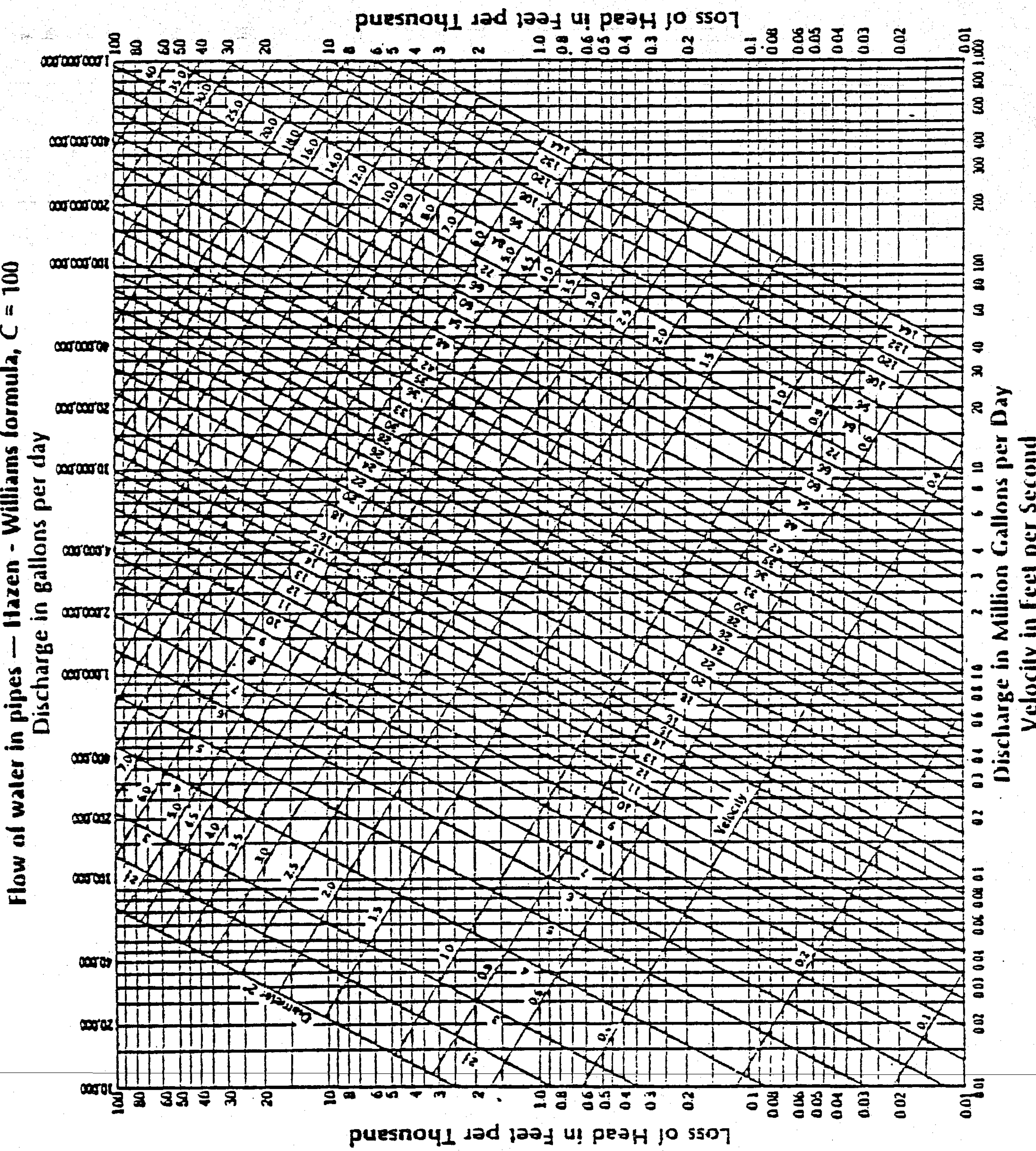
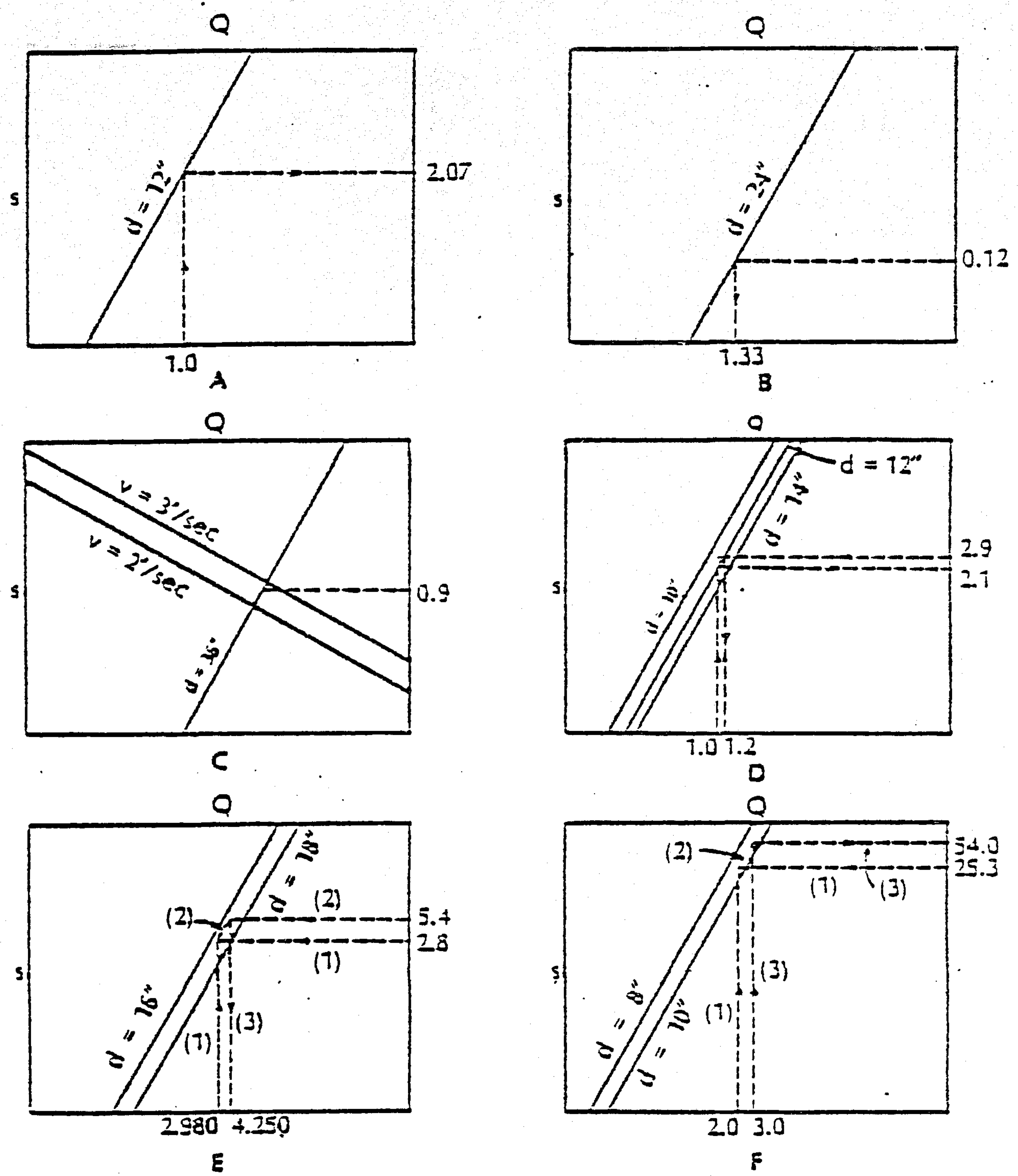


Figure V-5

Nomograph for Solution of Hazen-Williams Flow in Pipes



a. Given Q and d; to find s.
b. Given d and s; to find Q.
c. Given d and s; to find v.
d. Given Q and s; to find d.
e. Given Q and h; to find Q for different h.
f. Given Q and h; to find h for different Q.

For other than 100: (1) multiply given Q or v by (100/c) to find s; or multiply found value of Q or v by (c/100) for given s.

Figure V-6

Use of Hazen-Williams Diagram

Force mains should be designed with due consideration given to minor losses in elbows, inlet and outlet structures, etc.

b. Materials of Construction - All types of pipe materials used in design of force mains shall have established ASTM, ANSI, AWWA, and NSF standards of manufacture or seals of approval and shall be designated as pressure sewer pipe.

c. Air Release Valves - Air release valves designed for sewage shall be provided on force mains at all peaks in elevation.

d. Water Line Separation - Where a force main crosses a water line, the force main shall be enclosed in concrete for a distance of 10 feet each side of the water line.

The minimum separation between force mains and water lines shall be 2 feet (circumference to circumference) vertically and 6 feet horizontally. Measurements shall be from pipe circumferences.

e. Testing - Prior to issuance of a Certificate to Operate all force mains shall be pressure tested.

Preparatory to testing, the section of the pipeline to be tested shall be filled with water and placed under a slight pressure for at least 48 hours. The pipeline shall then be brought up to 50 psi over or 125 per cent of working class pressure, whichever is greatest, and maintained on the section under test for a period of not less than 4 hours.

Accurate means shall be provided for measuring the quantity of water required to maintain full test pressure on the line for the test period, which volume shall not exceed:

$$L = \frac{JD\sqrt{P_t}}{4500}$$

where,

L = maximum allowable leakage in gallons per hour for the section of pipeline tested
J = number of joints in length tested
D = diameter of pipe in inches
P_t = test pressure in psi

6. Lift Stations Pumping into Treatment Facilities - Sewage pumping stations lifting wastewater into treatment plants shall be evaluated to assure that under conditions of peak flow the surface loading rates on the primary clarifiers does not exceed 1200 gpdpsf and that the secondary clarifier surface loading rate will not exceed 1000 gpdpsf.

Where preliminary analysis shows excessive clarifier loadings, consideration shall be given to flow equalization or increase in clarifier surface area.

C. PLAN DETAILS REQUIREMENTS.

Engineering drawings submitted to the Department for approval shall meet the following requirements:

1. Standard Drawing Size - The engineering drawings shall be reproduced on paper not greater than 24" x 36".

2. Drawing Scale.

   a. Plan-Profiles - Plan-profiles of sewage force mains shall be submitted and shall be prepared using the following scales:

Horizontal	Vertical
1" = 20 feet	1" = 2 feet
1" = 30 feet	1" = 4 feet
1" = 40 feet	1" = 5 feet
1" = 50 feet	1" = 6 feet
1" = 60 feet	1" = 10 feet
1" = 100 feet	

   b. Details, Sections, Etc. - Details, site plans, and sections shall be at such scale as to indicate construction requirements in a clear understandable manner.

3. Drawing Details - The engineering drawings shall be of sufficient detail so as to provide a clear understanding of the location of the project, site plan of each lift station, topography of the project, all utility locations, easements and rights-of-way, and other structural features of the sewer.

   Lift station details shall show all invert elevations, structural elevations, existing and finished grade, control setting elevations, structural design of wet wells and dry wells, valve and piping, surge control devices, pump suction and discharge details, and any other details which will provide a clear understanding of the project.

   Plans and profiles of force mains shall show size, invert and grade elevations, materials of construction, utility location, and any other details which define the force main construction requirements.

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Chapter 6

SEWAGE TREATMENT WORKS DESIGN CONSIDERATIONS

ARIZONA DEPARTMENT OF HEALTH SERVICES

JULY 1978

CHAPTER VI - SEWAGE TREATMENT WORKS DESIGN CONSIDERATIONS

CHAPTER VI - SEWAGE TREATMENT WORKS DESIGN CONSIDERATIONS

A. GENERAL.

1. Treatment - The treatment plant process selection shall be such that effluent quality standards will be met under the most adverse conditions.

   The treatment plant should be designed to provide for the estimated population of 15 to 25 years. In general, if the growth rate and interest rates are low, a 20 to 25 year design period is recommended. When growth and interest rates are high, a 10 to 15 year design period may be more feasible.

2. Plant Upgrading - Upgrading of sewage treatment works may be required for several reasons including the following:

   a. Meet more stringent effluent quality standards.

   b. Increase hydraulic and/or organic loading capacity.

   c. Improve poor performance due to improper plant design and/or operation. It is recommended that the Engineer define the following aspects of the existing facility.

      1) Efficiency of treatment
      2) Normal operational and maintenance procedures
      3) Condition of structures
      4) Condition of equipment
      5) Staffing pattern and operator skill

   After appropriate analysis of the existing system, a brief description of the recommended revisions should be submitted to the Department in a preliminary report for review and comment. If the Department does not have as-built drawings of the existing facility on file, the Engineer shall provide a set of as-built drawings with his final design.

   Plans of the existing treatment plant and effluent disposal system should be submitted which show the location and size of structures, equipment, and piping; the hydraulic profile; and existing flow diagram in sufficient detail to determine their effects on the treatment process. A schematic of the effluent disposal piping should be submitted including approximate locations of all lines, line sizes, and inverts of major piping. All pumping stations and other special appurtenances and structures should be detailed sufficiently to determine their effects on the system.

3. Partial Construction - When it is anticipated that only a portion of the plant will be constructed presently, the Engineer shall furnish design data for the complete facility, including size, type, and location (future units shown dotted), design loads, process flow schemes, hydraulic profile, and other pertinent data which clearly defines the present and future installation.

   In addition, a site plan with topographic features shown shall be submitted for review.

B. PLANT LOCATION.

The treatment works site should be selected after careful analysis and study of the following factors:

(1) Flood potential
(2) Noise potential
(3) Odor potential
(4) Direction of prevailing winds
(5) Seasonal accessibility
(6) Anticipated growth patterns in the vicinity of the proposed plant site
(7) Possible elimination of sewage pump station upstream of the treatment works
(8) Disposal of waste solids
(9) Foundation conditions and topography

To avoid local objections, sewage treatment plants other than individual residential plants shall be located at the distances from contiguous property lines shown in Table VI - 1.

Table VI - 1

Minimum Setback vs. Treatment Plant Size

PLANT SIZE 10^3 GPD	Distance (Feet) (1) No Controls	(2) Aesthetic, Noise & Odor Control or Signature	(3) Enclosure with Noise & Odor Control or Signature
5 - 25	250	100	25
25 - 100	350	200	50
100 - 500	500	300	100
500 - 1	750	500	*
1 MGD	1000	750	*

*Will be reviewed on each individual project.

Column 1 requires the minimum setback with no controls.

Column 2 requires a minimum setback for a plant with aesthetic controls with the option of additional noise and odor control or the signatures of all property owners within the allowable setback.

Column 3 requires a minimum setback for a plant which is enclosed in a covered structure with the option of additional noise control and odor control or the signatures of all property owners within the allowable setback.

Noise control is defined as a sound level at the nearest existing property line not to exceed 50 db on the A network of a sound level meter. Aesthetic control is defined as landscaping in addition to chainlink fences or earthen berms.

In addition, the approval to operate will not be issued until an operation and maintenance manual is approved by the Department, and a certified plant operator has been employed to operate the facility.

The setback requirements listed above do not apply to lagoons or ponds. These types of treatment plants will be reviewed on an individual basis. It is recommended that wastewater treatment lagoon be located not closer than 1000 feet from the nearest property line.

C. EFFLUENT QUALITY.

Selection of the sewage treatment process shall be based upon the method of effluent disposal and the ability of the process to meet the effluent standards presented in Chapter II.

D. DESIGN.

1. Type of Treatment - The Engineer should give careful consideration of the type of treatment needed to achieve the goals outlined below before selecting the appropriate treatment process.

   a. Discharge Standards - The quality of effluent achieved by a given process should be evaluated on the basis of consistency in meeting established effluent standards.

   b. Operation Supervision - An optimization of manhours necessary to oversee plant operations and assure process balance and consistency in meeting effluent standards is an important part of process selection.

      The type of supervision and operation each process must have to achieve the prescribed treatment level should be carefully analyzed. Each process should be evaluated based upon, but not limited to:

      1) Operator educational level needed,
      2) Number of personnel required for proper operation,
      3) Sophistication of laboratory monitoring.

   c. Value Engineering - Value engineering is concerned with eliminating or modifying all items that contribute to the cost of a project but is not necessary for needed performance, quality, maintainability, reliability, or interchangeability. Specifically, value engineering should be a systematic creative effort directed toward an analysis of each item in the process to assure that it performs essential functions at the lowest over-all cost. The over-all cost should include, but not be limited to, costs of acquisition, construction, operation, repair, and replacement.

      Value engineering should play a major role in equipment and treatment process selection.

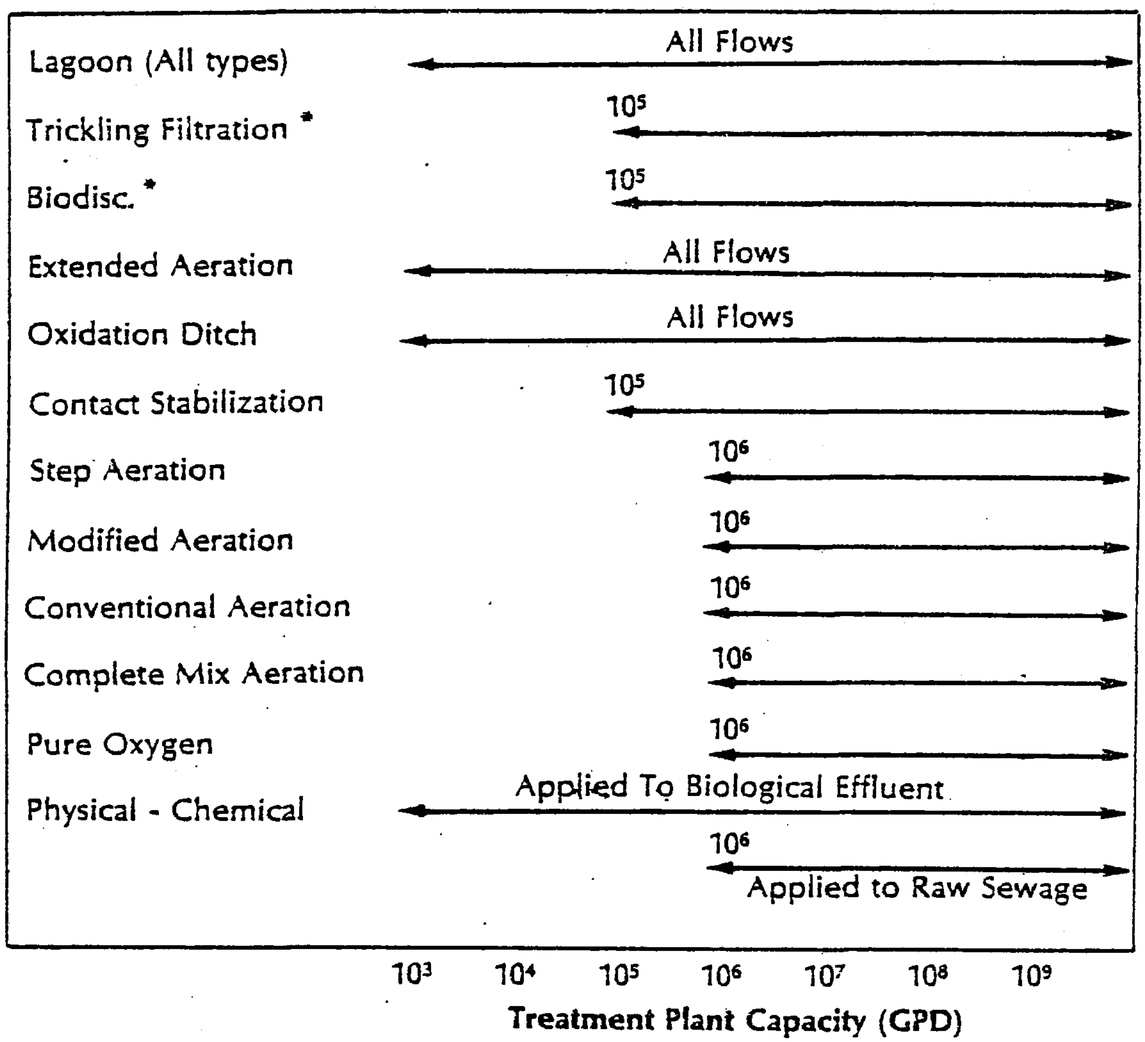


Figure VI-1

Flow Vs. Acceptible Process

* Designs at lesser flows may be considered upon consultation with the department

d. Environmental Impact - Short- and long-term impacts of each process should be examined in terms of noise, odor, nutrient control, affects of effluent quality and/or construction on flora and fauna of the receiving reservoir, and interruption or interference of construction and/or operation on the ecosystem.

The level and degree of complexity of the environmental impact statement should be commensurate with the project scope. The latest Federal Register regarding Environmental Impact Statements should be used as a guideline.

e. Operation and Maintenance - Consideration should be given to operation and maintenance requirements and costs. Equipment replacement and repair, chemical and electrical costs, administration costs, tools and special equipment, labor, and other pertinent items should be quantified and justified economically.

2. Industrial Waste Considerations - Industrial wastes discharged to treatment processes should be quantified as to treatability of the waste, the affect of unexpected discharges of each waste product on the process, and the affect of each type of industrial waste on the quality of the effluent.

3. Flow vs. Treatment Process - Figure VI - 1 shows the types of processes which are considered acceptable in relation to the quantity of waste flow treated. These requirements are based upon treating domestic wastewater. Volume treated vs. process selection may be different than indicated in Figure IV - 1 for non-domestic wastewaters. The Department should be contacted to verify acceptability of process selection on non-domestic waste prior to final design.

4. Design Loads.

a. Hydraulic - All units of sewage treatment works shall be designed using the hydraulic loading standards set forth in Chapter VII of this Bulletin. Careful attention shall be given to the affects of peak loads on all units.

Generally, the design of treatment units shall be based on the average rate of flow of domestic sewage per 24 hours, plus the average hourly rate of flow of industrial wastes during the maximum significant period.

Where recirculation is employed through a unit, the recirculated process stream shall be added to the flow rate.

b. Organic - The treatment units which require sizing based upon organic characteristics shall be designed using the organic loading standards set forth in Chapter VII of this Bulletin.

Careful attention shall be given to changes in organic characteristics especially where industrial wastes are part of the waste flow.

Figure VI - 2 gives recommended values of hydraulic and organic flow characteristics from various domestic waste generating sources. Other types of wastes should be examined as to organic characteristics.

Type of Establishment (unit basis)	Sewage Flow (gallons per unit per day)
*Airport (passenger)	4
*Apartments, multiple family (resident)	100
1 bedroom assume 2 residents, 2 bedrooms assume 3 residents, etc.	
*Camp: Campground, overnight with flush toilets(camper)	25
Campground, overnight with flush toilets and shower (camper)	50
Construction (bed)	50
Day with no meals served (camper)	15
Luxury (camper)	100-150
Resorts, day and night, with limited plumbing (camper)	50
Tourist with central bath and toilet facilities (person)	35
*Clubs: Country (resident member)	100
Country (nonresident member)	25
*Cottages with seasonal occupancy (resident)	100
*Dwellings: Boarding of rooming houses (resident)	100
Additional kitchen requirements for nonresidents boarders	10
*Dwellings: Residential (resident)	100
*Factory (person)	25
*Highway Rest Area (contact State Hwy. Dept.)	
*Hospital (bed)	250-400
*Hotel (room)	125
*Institutions other than hospitals (person)	75-125
*Laundries, self service (machine)	400
*Mobile Home: Family (per resident)	100
Retirement (resident)	75
*Motel (room)	125
*Office (person)	25
*Picnic: With bathhouses, showers & flush toilets (picnicker)	20
With toilet facilities only (picnicker)	10
*Public Restrooms (toilet)	200
*Restaurant (seat)	30
per meal served	7
*Schools: Boarding (pupil)	100
Day with cafeteria, gymnasiums & showers (pupil)	25
Day with cafeteria, but no gymnasiums or showers (pupil)	20
Day without cafeteria, gymnasiums or showers (pupil)	15
*Service Station (bay)	1000
*Shopping Center (square foot)	1
*Swimming pool (swimmer)	10
*Theaters: Drive-In (car space)	5
Movie (seat)	5
*Trailer Park: (also see mobile home)	
Travel with no sewer connection (space)	125
Travel with sewer connection (space)	175

Organic Loading. Base All Organic Loadings on 200 mg/l BOD_5 and 210 mg/l SS.

Figure VI-2

Average Daily Sewage Flow

Variations from values shown in Figure VI - 2 will be allowed as basis for design provided substantiating data is presented giving justification for the proposed design criteria.

c. Toxic Agent Limitations - Many constituents found in wastewater are toxic to biological organisms.

Figure VI - 3 gives the maximum allowable concentrations of chemical constituents which may be discharged to public sewers. They are based upon the limits which begin to inhibit normal biologoical activity of the treatment processes. These values shall be applied in the absence of more stringent applicable standards.

5. Arrangement of Plant Units - The Engineer should lay out the plant units in such a manner as to provide for operating convenience, flexibility, and economy. The plant configuration should allow for ease of plant expansion with minimum interruption of plant operation.

Two types of layouts should be considered.

a. Unit Layout - The unit layout incorporates all functions into a single unit. It is often the most economical because of common walled construction; less piping and valves; and space is conserved.

The unit layout can be expanded without interference with existing structures. Disadvantages include: 1) a complete set of treatment units is required at each expansion; 2) repairs may require entire plant shut down.

b. Functional Layout - The functional layout provides greater flexibility in operation and greater economy of construction on larger plants where each process can be sized on optimal number of units provided.

The functional design should be used where varying topography exists. It is also better suited to centralized services which is important for larger plants.

E. PLANT DETAILS.

1. Equipment Installation - It is recommended that the Engineer specify that the installation and initial operation or all major items of mechanical equipment be supervised by a representative of the selected manufacturer. The manufacturer's representative should be qualified to instruct the owner's operator in all phases of mechanical equipment operation.

2. By-Passes - By-passing of any sewage treatment works is prohibited. In larger facilities where duplicate process units are available, properly located and arranged by-pass structures shall be provided so that each unit of the plant can be removed from operation for maintenance purposes. In smaller plants where duplication of units is not possible, other suitable means of removing portions of the plant from service without discharging raw sewage in the effluent stream should be examined and proposed during design.

	ALLOWABLE DISCHARGE CONCENTRATIONS	CONCENTRATIONS INHIBITING UNIT PROCESS Aerobic	[mg/l] Anaerobic
Sulphides	◄5	5	1000
Cyanide	◄1	1	-
Chromium (hexavalent)	◄1.5	1.5	100
Nickel	◄2	2	-
Zinc	◄2	2	10
Copper	◄1	1	-
Lead	◄1.5	1.5	-
Phenols	◄1	1	
Gasoline	◄0	0	-
Fats, wax, grease, oils			
Biodegradable	◄100	100	-
Non-biodegradable	◄ 20		
pH	►5.5 ◄ 9.0	◄5.5 ►9.0	-
Temperature	150°F	150°F (65°C)	-

Figure VI-3

Toxic Chemicals vs. Concentration of Discharge To Public Sewers

3. Drains - Means should be provided to dewater each unit.

    All floors which are subject to spills of waste, wastewater, or process chemicals should be properly drained to prevent accidents.

4. Construction Materials - Materials used in sewage treatment works should be carefully selected to resist corrosive gases, oils, and other chemical constituents frequently present in sewage. Paint systems and metallic coverings should be selected to resist these constituents and should be of sufficient thickness to prolong the service life of the equipment.

5. Pipe Identification - It is recommended that all exposed piping of larger facilities be color coded to facilitate identification. The color and marking scheme shall follow the recommendations of the American National Standards Institute, "Standard Scheme for Identification of Piping Systems."

6. Tools and Operating Equipment - The specifications and/or O & M manual should contain an outline of the necessary tools and operating equipment together with the appropriate accessories which will be required by the

operator to operate and maintain the treatment works effectively. Provisions should be made to store such tools and equipment on site. Additional storage and work space (including a laboratory) should be provided to test, service and repair equipment.

7. Grading - Final grading of the plant site should be arranged to prevent surface water from draining into any unit. Steep slopes should be avoided to prevent soil erosion.

8. Landscaping - Treatment works which are located close to residential areas should be landscaped. Concrete, asphalt, or gravel walkways should be provided to allow access to all units of the plant.

   Irrigation of the plant site with plant effluent is encouraged consistent with the reuse regulations.

9. Fencing - All wastewater treatment plants, lagoons, and ponds treating and/or processing raw, partially treated, or disinfected secondary effluent shall be fenced. Ponds holding disinfected tertiary effluent are not required to be fenced. The fence shall be a minimum of six (6) feet in height and shall be of sufficient strength to exclude livestock and other animals. Material of construction shall be chain link, wood, block, or other suitable material. All gates shall be of the lockable type.

   The fence should be located far enough from each unit to provide adequate access for maintenance.

   In areas where freezing conditions occur, consideration should be given to enclosing process units in building enclosures.

10. Posting of Site - Each treatment works site shall be posted with signs on all sides indicating that a treatment works is located on that site and that trespassing on the premises is prohibited.

11. Flood Protection - The potential for damage or interruption of operation due to flooding shall be considered when locating treatment facilities. The structures and electrical and mechanical equipment shall be protected from physical damage by the maximum expected one hundred (100) year flood. The treatment works shall remain fully operational during a twenty-five (25) year flood, if practicable: lesser flood levels may be permitted dependent on local conditions, but in no case shall less than a ten (10) year flood be used.

    Walls or berms of adequate size shall be constructed where necessary to provide protection.

12. Ground Water Table - Treatment works located in areas of high ground water shall be analyzed for buoyancy after each unit is dewatered. Units which will not withstand hydrostatic pressure shall be protected with hydrostatic relief valves in the floor of the structure.

F. ESSENTIAL FACILITIES.

1. Emergency Power - Unless it can be demonstrated to the Department that it is not required, all sewage treatment works shall have provision for standby power. A standby power source shall be provided at all sewage treatment works where a temporary power failure could allow a temporary discharge of raw or partially treated sewage which may be expected to endanger the public health, cause serious damage, or create a nuisance.

   Standby power may be via a standby generator, two separate feeders from separate substations, or a loop feeder on separate transformers from a common substation.

2. Water Supply - Where water is supplied for the uses outlined in Figure VI - 4, the supply should be of sufficient pressure and quantity to assure good plant operation and maintenance.

   The Engineer shall take care in design to eliminate cross-connections between potable water and wastewater (raw, partially-treated, or treated).

   All non-potable water supply taps or outlets shall be painted red and shall be posted with a "Contaminated Water - Do Not Drink" sign.

3. Sanitary Facilities - Treatment works which require more than 20 man-hours per week operation and/or which are provided with a laboratory building should be provided with sanitary facilities as outlined in the Uniform Plumbing Code. At least one toilet, shower, and lavatory should be provided.

4. Laboratory Equipment and Housing - All treatment works shall include a structure for storing chemicals and analytical equipment. Consideration shall be given to providing a laboratory building. The Department may give special consideration to methods of storing chemicals and analytical equipment at an off site location for treatment plants in remote areas.

   The laboratory should be equipped with the necessary items to perform the analytical testing outlined in Chapter VIII.

5. Sewage Flow Measurement - All treatment works shall be provided with flow measurement capabilities. All treatment works greater than 100,000 gpd shall be provided with the necessary equipment to indicate, record, and totalize the volume of wastewater being treated. Treatment plants under 100,000 gpd are not required to construct a totalizer-indicator recording device. However, it is recommended that they do install such a device. Acceptable flow measurement devices on plants under 100,000 gpd include weirs with flow indicators, pumping meters, Parshall flumes with indicators, or other such suitable devices.

6. Process Flow Measurement - Sewage treatment works that treat larger flows ($>$ 100,000 gpd) should provide process control measurement at all strategic operational control points (i.e., return sludge, sludge waste, air volume, etc.).

Use	Potable	Disinfected Effluent
Laboratory Drinking Water	*	–
Janitorial Cleanup in Buildings	*	–
Yard Irrigation	*	*
Yard Cleanup and Washdown	*	*

* Allowed with backflow prevention device
–Not allowed

Figure VI-4

Allowable Water Supply Useage

G. OPERATION AND MAINTENANCE MANUALS.

All sewage treatment works shall be required to possess an operation and maintenance manual, written for that particular plant, in a readily accessible location at the sewage treatment plant site.

The operation and maintenance manual shall be reviewed and approved by the Department prior to issuance of a certificate to operate and shall be prepared in accordance with the requirements of Chapter XI.

H. OPERATOR CERTIFICATION.

All treatment works constructed in the State of Arizona shall employ a certified operator to operate or oversee the operation of the facility.

The Department's Rules and Regulations R9-20, Art. 5 sets forth the requirements of operator certification and classification of sewage treatment works.

I. SAFETY FEATURES.

Special emphasis should be given to safety and safety devices in the design of all treatment works.

Adequate provision should be made to protect the operator, laborers, and plant visitors from unnecessary hazards. Chapter X of this engineering Bulletin outlines safety features and devices which should be used to assure maximum safety at the plant site.

J. PLAN DETAILS.

Plans of sewage treatment works which are submitted for the Department's review and approval should be of sufficient detail and scale as to clearly identify the proposed construction.

Each set of plans shall include the following as a minimum:

1. Cover sheet - The cover sheet shall identify the project location and drawing indes.
2. Site plan
3. Grading plan
4. Piping plan with flow diagram
5. Hydraulic profile
6. Plant details

The engineering drawings shall be reproduced on paper not greater than 24" x 36".

Sufficient data regarding invert and grade elevations shall be shown on all cross-sections.

engineering bulletin no. 11

Chapter 7

UNIT PROCESSES FOR TREATMENT OF DOMESTIC WASTES

ARIZONA DEPARTMENT OF HEALTH SERVICES

JULY 1978

CHAPTER VII - UNIT PROCESSES FOR TREATMENT OF DOMESTIC WASTES

CHAPTER VII - UNIT PROCESSES FOR TREATMENT OF DOMESTIC WASTES (Contd.)

CHAPTER VII - UNIT PROCESSES FOR TREATMENT OF DOMESTIC WASTES

A. PRETREATMENT.

In some instances, pretreatment of incoming wastes may be required to reduce operation and maintenance difficulties. Abnormal quantities of grease, septic wastes, and flow surges may dictate that one or a combination of the following methods of pretreatment be employed in design.

1. Skimming Tanks.

   a. Use Requirements - Skimming tanks should be employed where abnormal amounts of oil, grease, or other floating debris is anticipated.

   b. Location - Skimming tanks may be a separate unit preceding grit removal; combined with grit removal; or combined with primary clarification.

   c. Basin Design.

      1) Non-Aerated - The skimming tank shall be sized to provide a 15-minute retention time. The basin effluent discharge shall be of sufficient depth to assure floating matter retention.

      A positive means of continuous scum removal shall be employed in design.

      The basin shall be designed to assure solids removal from the tank floor by scour or mechanical means.

      Skimming tanks shall be designed so that it may be removed from service without interrupting the waste flow.

      2) Aerated - The formation of an easily removable greasy scum can be achieved by passing the greasy sewage through a diffused air aeration tank.

      The surface area of the tank may be designed using the following equation:

$$A = \frac{1,110\ Q}{V_r}$$

      where,

      A = surface area of tank (sf)
      Q = rate of flow of sewage (MGD)
      V_r = minimum rising velocity (inches per minute)

      In practice, V_r is in the order of 10 (verify by laboratory testing).

      Retention time will vary from 3 minutes to 15 minutes, depending upon the waste characteristics.

Air requirements vary from .03 to .10 cubic feet of air per gallon of sewage.

The length to depth ratio of the tanks should be 1.5 - 2 to 1.

Means of continuous scum removal shall be provided.

The inlet and outlet shall be placed below the scum surface to prevent entrance and exit problems.

Skimming tanks shall be designed so that it may be removed from service without interrupting the waste flow.

2. Grease Traps.

   a. Use Requirements - Grease traps are used to remove oils and greases from individual sources prior to discharge of waste to the sewer.

   b. Location - Grease traps shall be located close to the source of grease (such as, cafeterias, restaurants, schools, hospitals, manufacturing plants, garages, etc.), exterior to the facility housing.

   c. Basin Design - The basin shall be sized to provide a minimum of 30 minutes retention. The chamber velocity shall be greater than one foot per minute and not more than two feet per minute.

      The tank shall be designed with a primary and secondary chamber. The outlet shall be located below the liquid surface or a scum baffle shall be provided to assure retention of floating matter.

      The tank shall be designed to provide easy access for cleaning and maintenance of both chambers and shall be vented.

3. Preaeration.

   a. Use Requirements - The objectives of preaeration are: to improve treatability; to aid grease separation, odor control, grit removal and flocculation; to enhance uniform distribution of floating and suspended solids to treatment units; and to increase BOD removals.

   b. Location - Preaeration is employed preceding primary sedimentation. Aerated grit chambers may be modified to act as preaeration basins. Preaeration can be performed in aerated channels which distribute sewage to primary clarifiers.

   c. Basin Design - Retention times for preaeration range from 10 to 45 minutes. Tank depths are normally 15 feet, and air requirements range from 0.1 to 0.4 cubic feet per gallon of sewage.

      The use of air in primary clarifier distribution channels ranges from 0.1 to 0.4 cubic feet per gallon of sewage.

The preaeration chamber shall be designed so that it may be removed from service without interrupting the waste flow. Each basin shall be designed with a means of draining for servicing.

4. Flocculation.

   a. Use Requirements - Flocculation of sewage by air or mechanical agitation should be considered when an increase in removal of suspended solids and BOD in the primary sedimentation tank is desirable. Flocculation may be beneficial in conditioning sewage containing certain industrial wastes.

   b. Location - Flocculation is employed preceding primary sedimentation. Preaeration and flocculation may be incorporated in the same unit.

   c. Basin Design.

      1) Retention Time.

         a) Coagulation - When air or mechanical agitation with chemical addition is used to coagulate and flocculate sewage, the retention time in the basin should be 30 minutes at design flow.

         b) BOD Reduction - When air or mechanical agitation, with or without chemical addition, is used for increasing BOD reduction in primary sedimentation, the retention time should be a minimum of 45 minutes at design flow.

      2) Agitation Devices.

         a) Paddles - Paddles should have a peripheral speed of about 1.5 feet per second with variable-speed drives permitting an adjustment between 0.75 and 2.25 feet per second.

         b) Air - The quantity of air required for air agitation ranges from 0.08 to 0.15 cubic feet per gallon for a 45-minute retention time.

      3) Flash Mixer - Plants utilizing chemical addition shall be equipped with flash mixers to mix the chemical with the waste stream. The retention time required in the flash-mix channel shall range from 0.5 to 3 minutes.

      4) General Features - Inlet and outlet devices shall be designed to insure proper distribution and to prevent short circuiting.

         Each basin shall be equipped with a means of draining for servicing.

         Each unit shall be designed so that it may be removed from service without affecting any settling unit.

5. Chemical Oxidation - Pretreatment using prechlorination, preozonation, hydrogen peroxide, or other liquid or gaseous oxidants shall be designed in accordance with Section O of this Chapter.

6. Raw Sewage Holding Reservoirs.

   a. Equalization Basins.

      1) Use Requirements - The primary objective of flow equalization basins for sewage treatment works is to dampen the diurnal flow variation, and thus achieve a constant or nearly constant flow rate through the downstream processes. A secondary objective is to dampen the concentration and mass flow of wastewater constituents by blending in the equalization basin.

         A flow equialization basin should be considered where variations greater than 3:1 in maximum to minimum flows exist, or where a sewage pumping station will cause undesirable hydraulic loading on process units.

      2) Location - Equalization basins should be located downstream of bar screens and grit removal units but upstream of sedimentation basins.

      3) Design Requirements - The design of an equalization basin requires evaluation and selection of a number of features including:

         a) In-line versus side-line basins
         b) Basin volume
         c) Degree of compartmentalization
         d) Type of construction
         e) Aeration and mixing equipment
         f) Pumping and control concept

      4) Basin Volume - Two methods are available for computing equalization volume requirements.

         a) Diurnal Flow Pattern - In this case, the function of the basin is to store flows in excess of the average daily flow and to discharge them at times when the flow is less than average.

            The required volume can be determined graphically through construction of a hydrograph.

         b) Mass Loading Pattern - This method computes the volume required to dampen mass loading variations of a particular constituent to within a preset, acceptable range.

            EPA's, "Process Manual for Upgrading Existing Wastewater Treatment Plants," and "Flow Equalization," should be consulted for a more indepth approach to the volume determination.

      5) Basin Construction - In-line basins shall be designed to achieve complete mixing. Elongated tank basins will not be allowed. The inlet and outlet configurations shall be designed to prevent short

circuiting. The design shall allow for influent flow to discharge as close as possible to the basin mixers. The basin shall have beveled corners.

A high-water-level takeoff shall be provided for withdrawing floating material and foam. The basin shall be provided with an emergency overflow to the subsequent downstream unit process.

6) Air and Mixing Requirements - Mixing equipment shall be designed to blend the contents of the tank, and to prevent deposition of solids in the basin.

Mixing requirements for blending a waste having a suspended solids concentration of approximately 200 mg/1 range from 0.02 to 0.04 hp per 1000 gallons of storage (mechanical aerators).

To maintain aerobic conditions, air should be supplied at a rate of 1.25 to 2 cubic feet per minute per 1000 gallons of storage.

Baffling may be required to insure proper mixing.

The aeration equipment shall be provided with low-level shutoff controls.

7) Pumps and Controls - Pumps used in metering the waste shall be of the non-clog type, and shall be either submersible, wet well mounted, dry pit type, or air lift.

A minimum of two pumps shall be provided (one provided as a standby). The pumps shall be provided with a low level shut off and a low level and high level alarm.

A flow measuring device should be installed downstream of the basin to monitor the equalized flow.

On larger facilities instrumentation should be provided to control the preselected equalization rate by automatic adjustment of the basin effluent pumps or flow regulating device.

b. Dump Stations.

1) Recreational Vehicles.

a) Use Requirements - Holding reservoirs shall be required where a sewer does not exist and where tank pumping is readily available; or where metering of waste to a sewer or factory fabricated treatment plant is necessary.

b) Location - Holding reservoirs shall be located where they are not subject to flooding and where they will not cause nuisance or odor problems.

c) Holding Basin Design.

(1) Non-metering Type - Non-metering type holding basins shall be sized based upon the anticipated number of vehicles dumping per day, the quantity per each dump, and the desired frequency of pumping the holding reservoir.

The reservoir shall be covered and vented and provided with access manholes.

(2) Metering Reservoirs - Holding reservoirs which are used for metering shall be sized based upon the rate at which the waste may be fed into the sewer or waste treatment facility and the time distribution of the incoming waste. The Engineer shall give careful consideration to the type of waste being metered and the effect of the metering on the waste treatment facility receiving the metered waste.

WASTE CHARACTERISTICS

TYPE OF WASTE	BOD mg/1	COD mg/1	TSS mg/1	pH	GREASE mg/1
Septage	5000 (440 - 79000)	45000 (15000 - 706000)	(15000 (310 - 93000)	6 - 9 (1.5 - 12.6)	9600 (604 - 23000)
Vault Waste	35,000 - 40,000	-	70,000 - 80,000	6 - 9	-
*Chemical Toilet Waste	20,000 - 30,000	-	40,000 - 70,000	3 - 6	-
Low Volume Flush Toilets	7000	-	15000 - 20000	6 - 9	-

*Formaldehyde or zinc sulfate range from 900 mg/1 to 1200 mg/1.

In the slug dumping mode, waste treatment plants shall not be allowed to accept the above wastes if their design capacity is less than 100,000 gpd. On a metered basis extended aeration plants can be expected to treat these wastes at approximately 0.1 per cent of the plant design capacity. Conventional activated sludge plants are able to treat these wastes at about 0.4 per cent of the plant design capacity. In all cases, the Engineer shall investigate the effects of metering these wastes into the waste treatment facility under design or modification.

If aeration of the metering station is required, sufficient air shall be provided to keep the solids in suspension and to prevent septicity.

Where dilution of the metered waste is required, a back flow prevention device shall be placed in the potable dilution water line at the metering station site.

The basin shall be covered and vented, and shall be provided with a dual pumping system with controls for high and low level shut-off and alarm system.

The reservoir shall be provided with adequate access manholes.

d) Dump Station Design - The dump station shall be designed to avoid or minimize waste spills, and splashing. The station shall be provided with a four (4) inch diameter drain (minimum) and shall be provided with a washdown device with an approved backflow preventer. A six (6) inch diameter drain is preferable.

2) Marine Vehicles - The principles of design of holding reservoirs for marine vehicles should follow that of recreational vehicles. However, marine vehicle installation shall be given extra care in design to prevent potential leakage or spill of waste products into the adjacent lake or stream.

Holding reservoirs attached to boat docks shall be protected from marine vehicle collision and shall be easily accessible.

B. SCREENING DEVICES.

Screening devices in sewage treatment works are used to remove material which will damage equipment, interfere with satisfactory operation of a process or equipment, or cause other objectionable conditions in the plant or effluent disposal system.

1. Manually Cleaned Bar Screens.

a. Use Requirements - Manually cleaned bar screens may be used where protection of pumps and other equipment is required. Manually cleaned screens should be used only in a small plant where mechanical screens cannot be justified and in unit process bypasses.

b. Location - All manually cleaned bar screen equipment shall be located where it is readily accessible for maintenance. Bar screens should be located upstream of pumping equipment, wet wells, and grit chambers.

1) In Deep Pits - Manually cleaned bar screens installed in a deep pit shall be provided with stairway access, adequate lighting, and a convenient and adequate means of removing screenings. The deep pit shall be ventilated with a blower of sufficient capacity to provide a 2-minute air change based upon the chamber volume below grade and above the sewage level.

2) In Buildings - Manually cleaned bar screens installed in a building where other equipment or offices are located shall be separated from the rest of the building, provided with a separate outside entrance, provided with adequate lighting, and provided with an adequate means of removing screenings. The building shall be ventilated with a blower of sufficient capacity to provide a 2-minute air change based upon the building volume.

c. Bar Size and Spacing - Bar sizes for manually cleaned bar racks should be between 1/4 - 5/8 inches wide and 1 - 3 inches deep. Bars should be spaced a minimum of 1 inch and a maximum of 3 inches center to center. The engineer should consider using an effluent spray nozzle directed at the bar screen for self cleaning.

d. Slope - Manually cleaned bar screens should be placed on a slope of 30 to 60 degrees with the horizontal.

e. Approach Velocity - Manually cleaned bar screens should be designed to provide a velocity through the screen of 1 foot per second at average rate of flow. Velocities as high as 2 to 4 feet per second will be permitted.

The effective velocity shall be determined by considering a vertical projection of the screen openings from the channel invert to the flow line of the wastewater at design flow.

f. Area.

1) Total - The total cross-sectional area of the manually cleaned bar screen shall be a minimum of 200 per cent of inlet sewer cross-sectional area.

2) Net Submerged Area - The net submerged area is generally 2 ft^2/mgd.

g. Allowable Head Loss - The minimum allowable head loss through a manually cleaned bar screen shall be six (6) inches. The maximum head loss with clogged screen should not exceed 2.5 ft.

Three equations are available for estimating head drops across bar screens

$$h = \frac{1}{0.7}\frac{V^2 - V_1^2}{2g} \qquad (1)$$

$$h = 0.5\frac{V^2}{2g} + \frac{V^2 - V_1^2}{2g} \qquad (2)$$

$$h = \left(\frac{w}{b}\right)^{4/3}\frac{V_1^2}{2g} \qquad (3)$$

where,

h = head drop across the screen, ft.
V = velocity through the clear space of the screen, fps
V_1 = upstream velocity, fps

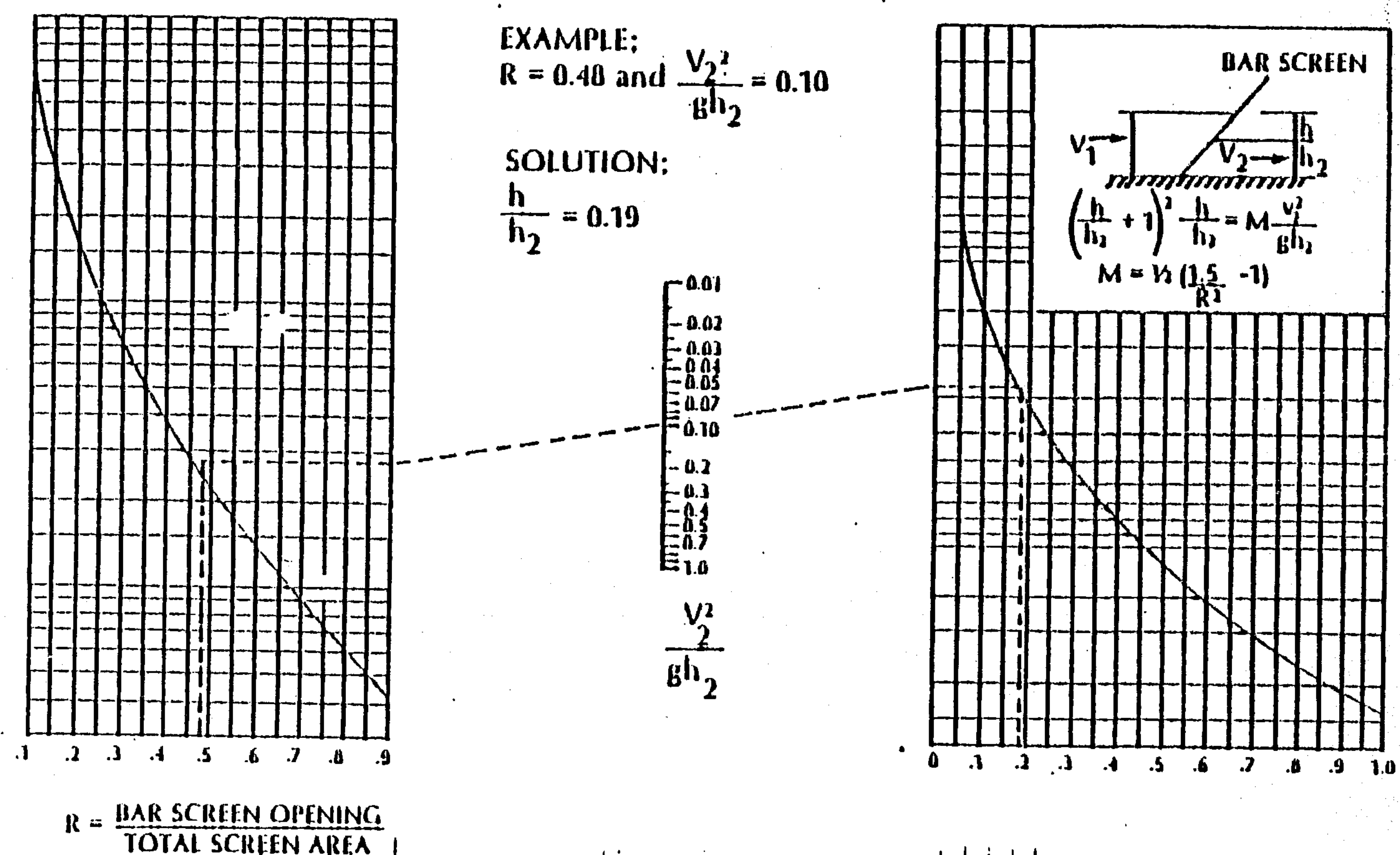


Figure VII-1

Nomograph for Calculating Head Drops Across Bar Screens

Bar Shape	β
Sharp-edged rectangular bar	2.42
Rectangular bar with semi-circular upstream face	1.83
Circular bars	1.79
Rectangular bars with semi-circular upstream and downstream	1.67
Tapering "tear-drop"	0.76

Table VII-1

Shape vs β

g = gravitational constant, 32.2 fpsps
w = maximum width of bars facing the flow, inch
b = minimum width of the opening, inch
β = a shape factor (Table VII - 1)

Equation (2) is the best practical engineering application. Yao has developed a nomograph (Figure VII - 1) for estimating head drop based upon the bar screen opening, total bar screen area, and the downstream depth (based upon requirements and principles of open channel hydraulics).

h. Channel Construction - A straight approach channel upstream of the screen shall be required to insure good velocity distribution across the screen.

The channel preceding and following the screen shall be filleted to prevent stranding and sedimentation of solids.

A minimum freeboard of 1 foot shall be provided above the upstream flowline during clogging conditions.

i. Quantity of Screenings - The total amount of screenings to be removed in a period of time, although difficult to estimate, is an important design consideration.

Figure VII - 2 shows approximate volumes of screenings that can be used for estimating methods of screenings disposal. These values should be varified at similar plants prior to final design.

Screenings vary in moisture content from 80 - 90 per cent by weight. Screenings density varies from 40 - 60 lb/ft^3.

j. Handling of Screenings.

1) Platform - Manually cleaned screening facilities shall include an amply-sized, accessible platform from which the operator may rake screenings easily and safely.

2) Drainage - Suitable drainage facilities shall be provided for the platform and screening storage area.

3) Storage - Temporary storage facilities shall be provided at all manually cleaned bar screens. The containers shall be sized to hold one day's screenings and shall be supplied with a tight fitting lid.

4) Disposal - An incinerator or a burial area for screenings shall be provided to assure satisfactory, safe disposal of all screenings. Transporting to a sanitary landfill is considered an acceptable means of disposal provided the screenings are transported in a leakproof container.

2. Mechanically Cleaned Bar Screens.

a. Use Requirements - Mechanically cleaned bar screens are preferred over manually cleaned bar screens. They may be used where protection of pumps and other equipment is required.

b. Location - All mechanically cleaned bar screen equipment shall be located where it is readily accessible for maintenance. Bar screens should be located upstream of pumping equipment, wet wells, and grit chambers.

1) In Deep Pits - Mechanically cleaned bar screens installed in a deep pit shall be provided with stairway access, adequate lighting, and a convenient and adequate means of removing screenings. The deep pit shall be ventilated with a blower of sufficient capacity to provide a 2-minute air change based upon the chamber volume below grade and above the sewage level.

2) In Buildings - Manually cleaned bar screens installed in a building where other equipment or offices are located shall be separated from the rest of the building, provided with a separate outside entrance, provided with adequate lighting, and provided with an adequate means of removing screenings. The building shall be ventilated with a blower of sufficient capacity to provide a 2-minute air change based upon the building volume.

c. Bar Size and Spacing - Bar sizes for mechanically cleaned bar screens should be between 1/4 - 5/8 inches wide and 1 - 3 inches deep. Bars should be spaced a minimum of 5/8 inches clear opening.

d. Slope - Mechanically cleaned bar screens should be placed on a slope of 60 to 90 degrees with the horizontal.

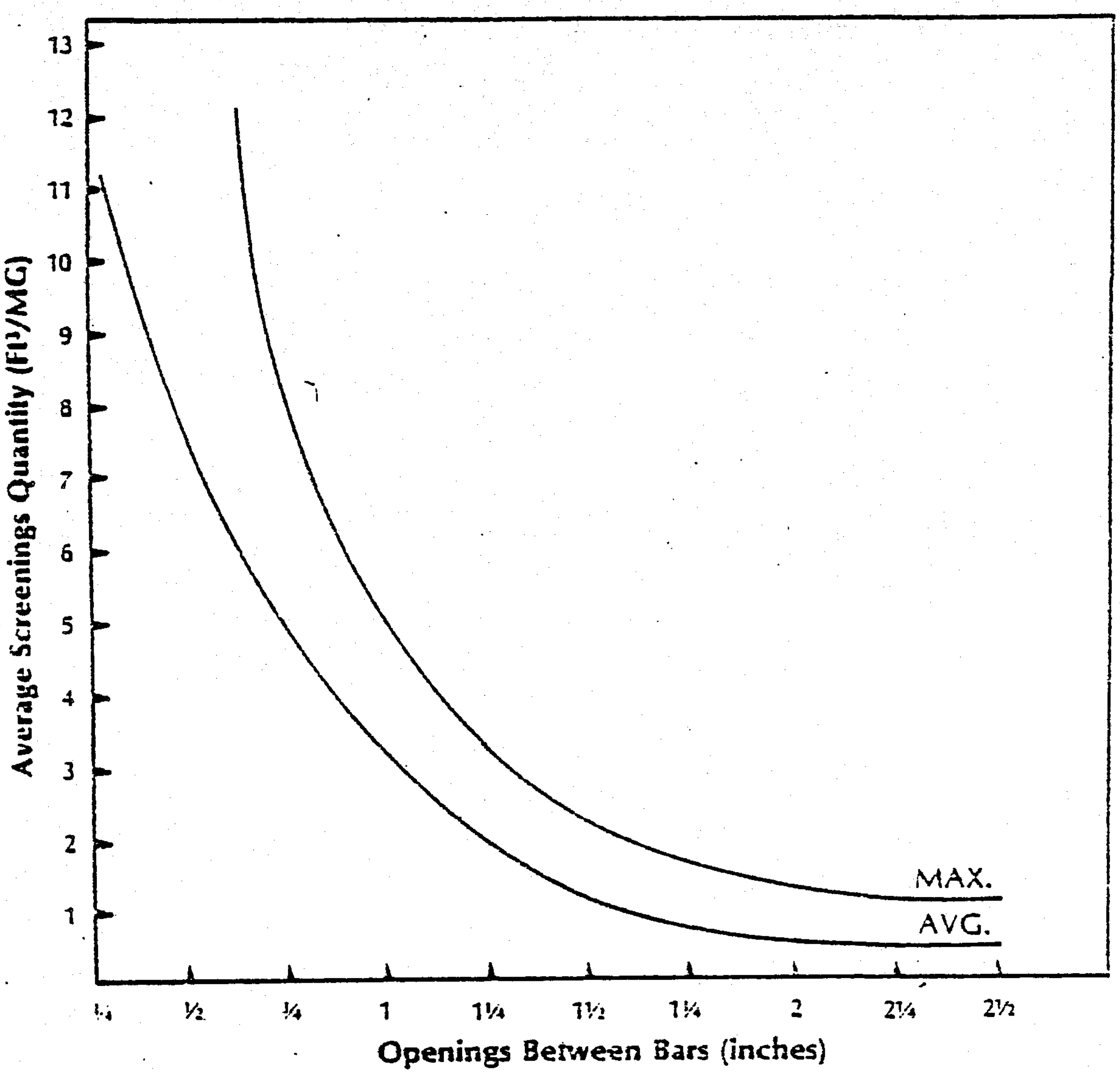


Figure VII-2

Mechanically Cleaned Bar Screen: Cubic Feet of Screenings Per Million Gallons of Sewage

e. Approach Velocity - Mechanically cleaned bar screens should be designed to provide a velocity through the screen of 1.5 feet per second at average flow rate. Maximum velocities during wet weather periods should not exceed 2.5 feet per second.

The effective velocity shall be determined by considering a vertical projection of the screen openings from the channel invert to the flow line of the wastewater at design flow.

f. Area.

1) Total - The total cross-sectional area of the mechanically cleaned bar screen shall be a minimum of 200 per cent of the inlet sewer cross-sectional area.

2) Net Submerged Area - The net submerged area is generally 2 ft^2/mgd.

g. Allowable Head Loss - The minimum allowable head loss of the mechanically cleaned bar screen shall be six (6) inches.

Figure VII - 1 can be used to estimate the head-drop requirement of mechanically cleaned bar screens.

h. Channel Construction - A straight approach channel upstream of the screen shall be required to insure good velocity distribution across the screen.

Where mechanically cleaned bar screens are employed, a manually cleaned screen shall be installed in a bypass channel to provide standby service while servicing the mechanical device.

The channel preceding and following the screen shall be filleted to prevent stranding and sedimentation of solids.

A minimum freeboard of 1 foot shall be provided above the upstream flowline during clogging conditions.

i. Quantity of Screenings - Figure VII - 2 shows anticipated average and maximum cubic feet of screenings removed by a mechanically cleaned bar screen per million gallons of sewage.

j. Handling of Screenings.

1) Platform - Mechanically cleaned screening facilities shall include an amply sized, access platform from which the operator may maintain and operate the screen easily and safely.

2) Drainage - Suitable drainage facilities shall be provided for the platform and the screenings storage area.

3) Storage - Temporary storage facilities shall be provided at the screening area. The storage container should be arranged so that the screenings empty by gravity into the container. The container shall be sized to hold one day's screenings. Screening areas where ultimate disposal is via incineration shall be equipped with suitable transport facilities (conveyor, bucket elevator, etc.) to provide minimum housekeeping.

4) Disposal - An incinerator or a burial area for screenings shall be provided to assure satisfactory, safe disposal of all screenings. Transporting to a sanitary landfill is considered an acceptable means of disposal provided the screenings are transported in a leakproof container.

k. Safety Devices, Auxiliary Controls and Alarms - All mechanical units should be operated on a "hand-off-automatic" control using a time clock. Auxiliary controls shall include a float control which will initiate the operation of the cleaning mechanism at a predetermined high water elevation. This function shall be independent of the normal operating cycle.

3. Comminutors/Barminutors.

a. Use Requirements - Comminutors and barminutors may be used in lieu of manually or mechanically cleaned bar screens. They may be installed in the wet well of a pumping station to protect the pumps from rags and large objects.

b. Location - Comminutors are generally placed, when used, between grit chambers and primary clarifiers. A smaller installation, where a low quantity of grit is anticipated, will not require grit removal, so the comminutor may be used as a pretreatment device pror to aeration.

Consideration should be given to using comminutors in lieu of other devices where the removal of screenings would be difficult (very deep pits).

c. Channel Construction - The design of approach channels shall provide gates or similar devices to stop or divert flow from any one comminutor or barminutor without interrupting the flow to other units.

In smaller installations a bypass channel shall be provided with a manually cleaned bar screen so that the comminutor or barminutor may be serviced without interrupting flow.

d. Allowable Head Loss - Manufacturers' data should be consulted to determine head-drops through comminutors or barminutors. A freeboard of 1 foot at peak design flow shall be provided for the channel depth.

e. Auxiliary Controls - Comminutors and barminutors should be provided with reversing switches to maximize operating cycles and comminutor downtime.

4. Fine Screens.

   a. Use Requirements - Fine screens may be of the fixed or rotating sieve type. These devices may be used in lieu of 1) bar screens, comminutors, or barminutors; 2) bar screens and grit chambers, comminutors and grit chambers, or barminutors and grit chambers; or 3) bar screens, grit chambers, and primary clarifiers, or comminutors, grit chambers, and primary clarifiers, or barminutors, grit chamber, and primary clarifier.

   b. Location - The fine screens may be located at the head of the process scheme, after the grit chamber, or preceding aeration.

   c. Size Openings - Fixed sieve screens are available in various wiring spaces from 0.005" to 0.100".

      Rotating sieve screens are available in various wiring spaces from 0.010" to 0.100".

   d. Head Loss Requirements - Manufacturers' data should be consulted for head-drop requirements, and inlet and effluent flow requirements.

   e. Construction Details - Since fine screening devices are generally top fed, coarse bar screens should be used preceding the units to remove large objects which might damage or clog the system.

      Effluent channels shall be designed to maintain one foot per second velocity to the following treatment unit.

      Rotating and fixed sieves shall be installed with a minimum of two (2) units. Means shall be provided for diverting flow to each unit in such a manner that any unit may be serviced without interrupting flow.

   f. Screenings Disposal - An incinerator, or a burial area for screenings, shall be provided to assure satisfactory safe disposal of all screenings. Transporting to a sanitary landfill is considered an acceptable means of disposal provided the screenings are transported in a leakproof container.

C. GRIT CHAMBER.

Grit chambers are installed to remove grit, consisting of sand, gravel, cinders, or other heavy solid materials that have specific gravities substantially greater than those of the organic solids in wastewater. They are used to provide protection of moving mechanical equipment from abrasion and abnormal wear; to reduce formation of heavy deposits in pipelines, channels, and conduits; and to reduce the frequency of digester cleaning through reduction of excessive accumulation of grit in such units.

1. Horizontal Flow Grit Chamber.

a. Use Requirements - Horizontal grit chambers should be considered at any sewage treatment works where grit is known to be present or where grit may be anticipated. Consideration should be given to grit quantities which may enter from street wash at the manholes, from garage floors or washing racks, and through joints with infiltration. Smaller sewage treatment works may not need grit removal.

b. Location - Grit chambers should be located ahead of all other units in a sewage treatment works where removal of grit would facilitate operation.

Horizontal grit chambers should be constructed preceding pumps and comminutors or barminutors. Mechanically cleaned grit chambers should, in this case, be protected by coarse bar racks.

c. Number of Units - Grit chambers shall have duplicate manually cleaned units or a single mechanically cleaned unit with a bypass.

d. Velocity Requirements - The velocity flowing through a grit chamber shall be not less than 0.8 fps nor more than 1.3 fps and as close to 1.0 fps as is practical.

e. Velocity Control - Velocity shall be controlled by design of a suitable control structure such as a proportional weir, sutro weir, or Parshall flume.

The control structure shall be designed to minimize deposition of organic matter. The Velocity control shall be based upon retaining a 0.2 mm diameter particle of assumed specific gravity of 2.65. Consideration will be given to other specified diameter providing justification is given for the different design criteria.

f. Retention Time - The retention time should be based upon peak flow and should be between 30 seconds and 1 minute.

g. Channel Construction - The grit chamber structure shall be designed to provide minimum inlet turbulence. The channel shall provide a straight approach to insure good velocity distribution across the channels.

The floor of each channel shall slope to the point of grit removal.

Each channel shall be provided with a drain.

h. Quantity of Grit - The quantity of grit depends upon:

   1) extent of building,
   2) extent of garbage disposal use,
   3) extent of paved streets,
   4) infiltration potential,
   5) extent of industrial discharges.

   The quantity of grit varies from .5 - 10 ft^3/MG where infiltration exists and between .3 - 5 ft^3/MG where the infiltration potential is minimal.

i. Grit Removal - Horizontal manually cleaned grit chambers should be constructed as shallow as possible to facilitate grit removal.

   Where deep pit grit chambers are required, manually cleaned units shall be equipped with hoisting lifts to transport grit to ground level. The deep pit facility shall be provided with an access and adequate lighting. Ventilation shall be provided with a blower of sufficient capacity to provide a 2-minute air change based upon the chamber volume below grade and above the sewage level.

j. Grit Washing - It is recommended that installation of grit washing equipment be considered prior to grit disposal.

k. Grit Disposal - Acceptable alternatives for disposing of grit include on-site burial or transporting to landfill.

2. Aerated Grit Chamber.

   a. Use Requirements - Aerated grit chambers offer the following advantages over conventional grit chambers:

      1) The sewage may be freshened by the air.
      2) Low hydraulic head loss is required in the design.
      3) The controllable air-induced water velocity enhances the removal of grit having a low organic content.
      4) Grit larger than a desired size can be preferentially removed, assuming a constant specific gravity for all the grit involved.
      5) The grit removal efficiency can be maintained over a larger flow range.

   Aerated grit chambers may be used in lieu of manually cleaned or mechanically cleaned grit chambers. In addition, the aerated grit chamber may be incorporated with preaeration units to provide grit removal and sewage freshening.

b. Location - Grit chambers should be located ahead of all other units in a sewage treatment works where removal of grit will facilitate operation.

Aerated grit chambers shall be preceded by coarse bar screens.

c. Number of Units - Aerated grit chambers shall be designed so that one (1) chamber can be removed from operation for servicing without disturbing the plant flow.

d. Velocity Requirements - The Cross-sectional area of the chamber shall be such that the nominal flow through velocity is no greater than 0.5 fps.

e. Air Requirements - The amount of air fed to the chamber will be a function of the maximum particle size allowed to flow through the grit chamber and its settling characteristics.

General practice varies from 3 - 8 scfm/ft of chamber length. Means of adjusting the quantity of air flow shall be provided for operational flexibility.

f. Retention Time - The aerated grit chamber shall be designed so that the retention time does not exceed 3 minutes at maximum rate of flow.

g. Quantity of Grit - The quantity of grit removed by an aerated grit chamber generally varies from 1 to 12 cu ft/MG. The average quantity is 4 cu ft/MG.

h. Channel Construction - Aerated grit chambers should be designed using the following criteria:

Width to depth ratio - 1:1
Length to width - 2:1 to 4:1

The chamber shall be designed with a grit hopper (approximately 3 feet deep) of near vertical sides located under the air diffusers.

Air diffusers should be located 18 - 24 inches above the normal plane of the chamber bottom.

The entrance channel should be designed to introduce flow in the direction of the roll.

The chamber bottom shall be constructed so that it slopes in the direction of the grit hopper and with the velocity vector of the liquid medium at the tank bottom.

i. Grit Removal - Grit removal may be provided by grab buckets, screw conveyors, jet pumps, chain and bucket conveyors or air lifts.

j. Grit Washing - Provisions should be made for washing the grit prior to ultimate grit disposal.

k. Grit Disposal - Acceptable alternatives for disposing of grit include on-site burial and transporting to landfill.

3. Mechanical.

a. Use Requirements - Mechanical grit chambers may be used in lieu of manually cleaned or aerated grit chambers.

b. Location - Mechanical grit chambers should be located ahead of all other units in a sewage treatment works where removal of grit would facilitate operation.

c. Number of Units - One mechanically cleaned grit chamber is required. The unit shall be designed with a bypass to facilitate maintenance without interrupting plant flow.

d. Velocity Requirements - Mechanically cleaned grit chambers should be designed for approximately 1 fps velocity at maximum flow.

e. Retention Time - The retention time of the mechanically cleaned grit chamber ranges from 30 seconds to 1 minute.

f. Quantity of grit - The quantity of grit removed by a mechanically cleaned grit chamber varies from 1 to 12 cu ft/MG with an average of 4.0 cu ft/MG.

g. Channel Construction - Mechanically cleaned grit chambers are generally square construction.

The tank bottom should be flat and must be provided with a grit hopper at the side of the tank contiguous to the grit removal mechanism. The center mounted rotating mechanism should be provided with an access platform for drive maintenance.

The inlet structure should extend the length of one side with the outlet structure extending the length of the side opposite the inlet.

The inlet shall be provided with baffles to prevent short circuiting in the basin.

h. Grit Removal - Grit removal may be maintained using a reciprocating rake, screw conveyor, or air lift pumps.

i. Grit Washing - Provisions should be made for grit washing prior to ultimate grit disposal.

j. Grit Disposal - Acceptable methods of grit disposal include burial or landfill.

4. Cyclonic-Degritters.

a. Use Requirements - Cyclonic-degritters may be used in lieu of mechanical, manually cleaned, or aerated grit chambers.

b. Location - Cyclonic-degritters should be located ahead of all other units in a sewage treatment works where removal of grit would facilitate operation.

c. Number of Units - One cyclonic-degritter is required as minimum. The unit shall be designed with a bypass to facilitate maintenance without interrupting plant flow.

d. Sizing Degritters - Generally, the following information is required for sizing the cyclone degritter:

1) plant flow, MGD
2) cubic feet of grit per MG
3) weight of grit per cubic foot
4) per cent solids in flow.

Since cyclonic-degritters are a manufactured product, the Engineer should work with the manufacturer in sizing each unit to assure achievement of maximum grit and minimum organic removal.

e. Equipment - Cyclonic-degritters are composed of two units, 1) the cyclone, 2) the classifier.

The cyclone separates coarse and fine grit from the light weight organics. The cyclone should be designed to prevent entry-to-overflow short circuiting and should be provided with an adjustable apex and quick disconnect assembly at the apex housing to remove oversized objects.

The classifier acts as a final grit washing and dewatering device. It should be designed with an adjustable weir which regulates the depth of liquid.

f. Grit Disposal - Acceptable methods of grit disposal include burial or landfill.

D. SEDIMENTATION/CLARIFICATION.

The objective of treatment by sedimentation is to remove settleable solids and floating matter economically and, thereby, reduce the suspended solids content of the liquid-solids medium.

1. Mechanical - Rectangular and Circular.

a. Use Requirements - Sedimentation basins are installed as primary solids separation units, intermediate solids separation units (in some instances), and as a final solids separation unit.

b. Location - Primary basins are located between grit removal units and aeration.

Intermediate basins are located between separate aeration compartments such as in the trickling filtration application.

Final basins are located between aeration units and disinfection.

Variations in location in the flow scheme exist depending upon the particular selected process.

c. Number of Basins - Multiple basins should be considered on larger installations. Consideration should also be given to more than one basin when removal of a single unit from service for a short period would result in objectionable conditions. Provisions shall be made to bypass each unit for servicing without interrupting the plant flow.

d. Design Loadings - Table VII - 2 itemizes the recommended sedimentation basin design loadings.

In addition, Figure VII - 3 and Figure VII - 4 are graphical presentations of the maximum allowable surface loading rate and weir loading rate for the extended aeration and the contact stabilization process. Under no circumstance shall the surface loading rate exceed 1200 gpdpsf for primary sedimentation or 1000 gpdpsf for secondary sedimentation.

e. Basin Design.

1) Inlet - The inlets shall be designed to dissipate the inlet velocity, to distribute the flow equally, and to prevent short circuiting.

Inlet channels or pipes shall be designed to maintain a velocity of at least 1 foot per second at one-half design flow.

Corner pockets and dead ends shall be eliminated by use of corner fillets and proper channeling.

Flow through velocities in rectangular basins shall not exceed 100 feet per hour.

Clarification Application	Average Design Flow	Surface Loading Rate GPD/SF	Weir Loading Rate GPD/LIN. FT.	Retention Time Hrs.	Anticipated Underflow Concentration % Wt.
PRIMARY	To 1.0 MGD Above 1.0 MGD	600 800 (700 - 1000) *	15,000 (15,000 - 15,000) *	2.5 2.0 (1.75 - 4)	3 - 5
SECONDARY 1. Conventional, complete mixed, modified, and step aeration					
a. Air	To 0.5 0.5 - 1.5 Above 1.5	600 700 800	10,000 (8,000 - 15,000) *	3.0 2.5 2.0	0.5 - 1.0
b. Pure O_2	To 0.5 0.5 - 1.5 Above 1.5	600 700 800	10,000 (8,000 - 15,000) *	3.0 2.5 2.0	2 - 3
2. Trickling filter, biofilter					
a. Standard	All	1000	15,000	2.0	3 - 5
b. High rate	All	800	10,000	2.0	3 - 5
c. Intermediate	All	1000	15,000	2.0	3 - 5
3. Contact stabilization	To 0.5 0.5 - 1.0 1.0 - 1.5 Above 1.5 MGD	See Figure VII - 3 700 800	See Figure VII - 4	3.6 3.0 3.0 2.5	0.5 - 1.0
4. Extended aeration	To 0.05 0.05 - 0.15 Above 0.15 MGD	See Figure VII - 3	See Figure VII - 4	4.0 4.0 3.6	0.5 - 1.0
5. Physical - Chemical a. Primary, secondary, and tertiary					
1) Alum	All	450 (500 - 600)*	8,000	3.0	0.5 - 1.0
2) Iron	All	600 (700-800)*	10,000	2.5	0.5 - 1.0
3) Lime	All	1000 (1400 - 1600)*	15,000	2.0	3 - 5

* Higher values are for peak loading only —

Table VII — 2
Recommended Clarifier Loadings

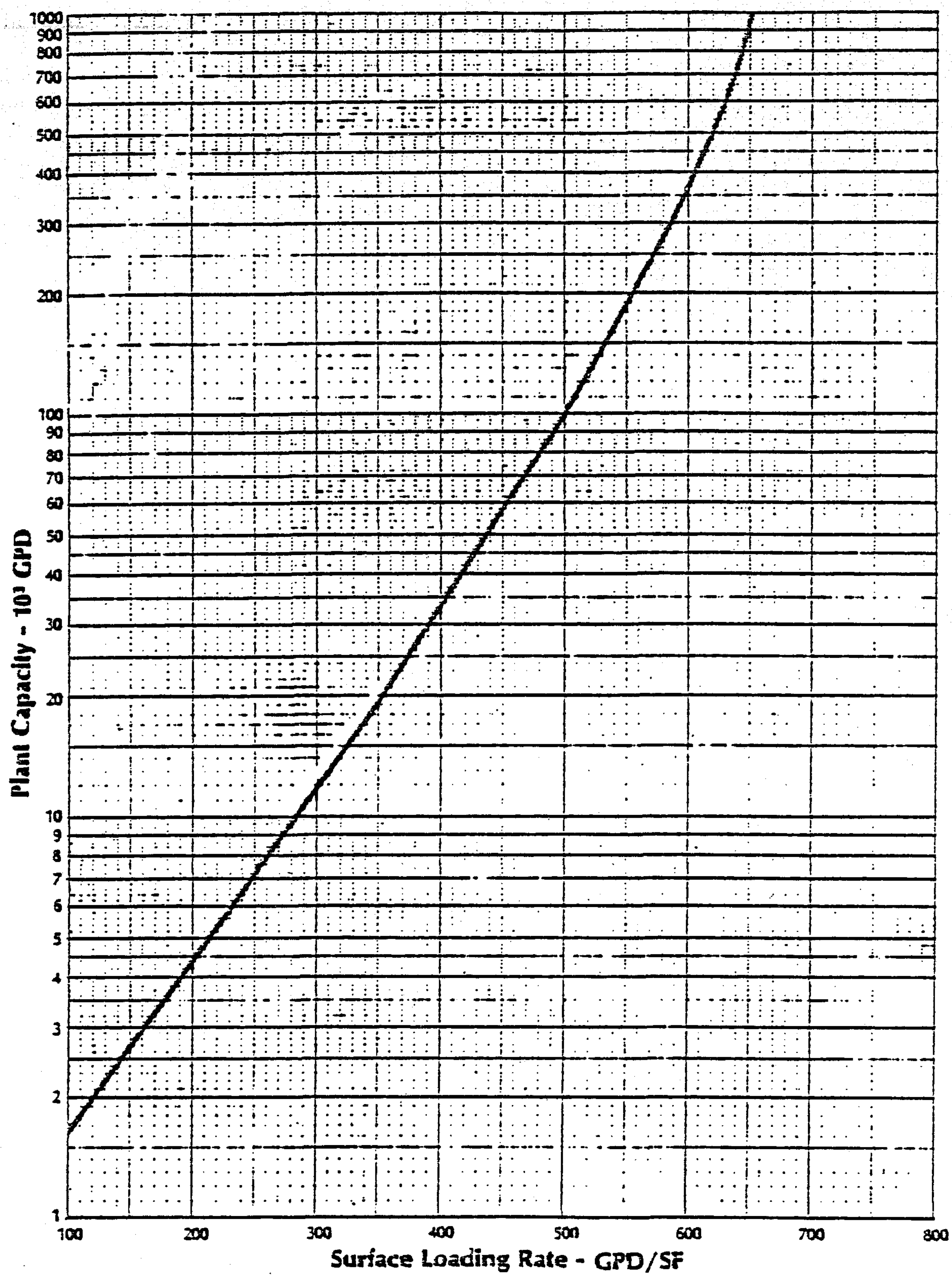


Figure VII-3

Maximum Clarifier Surface Loading Rate
vs
Plant Average Daily Flow
for
Extended Aeration and Contact Stabilization

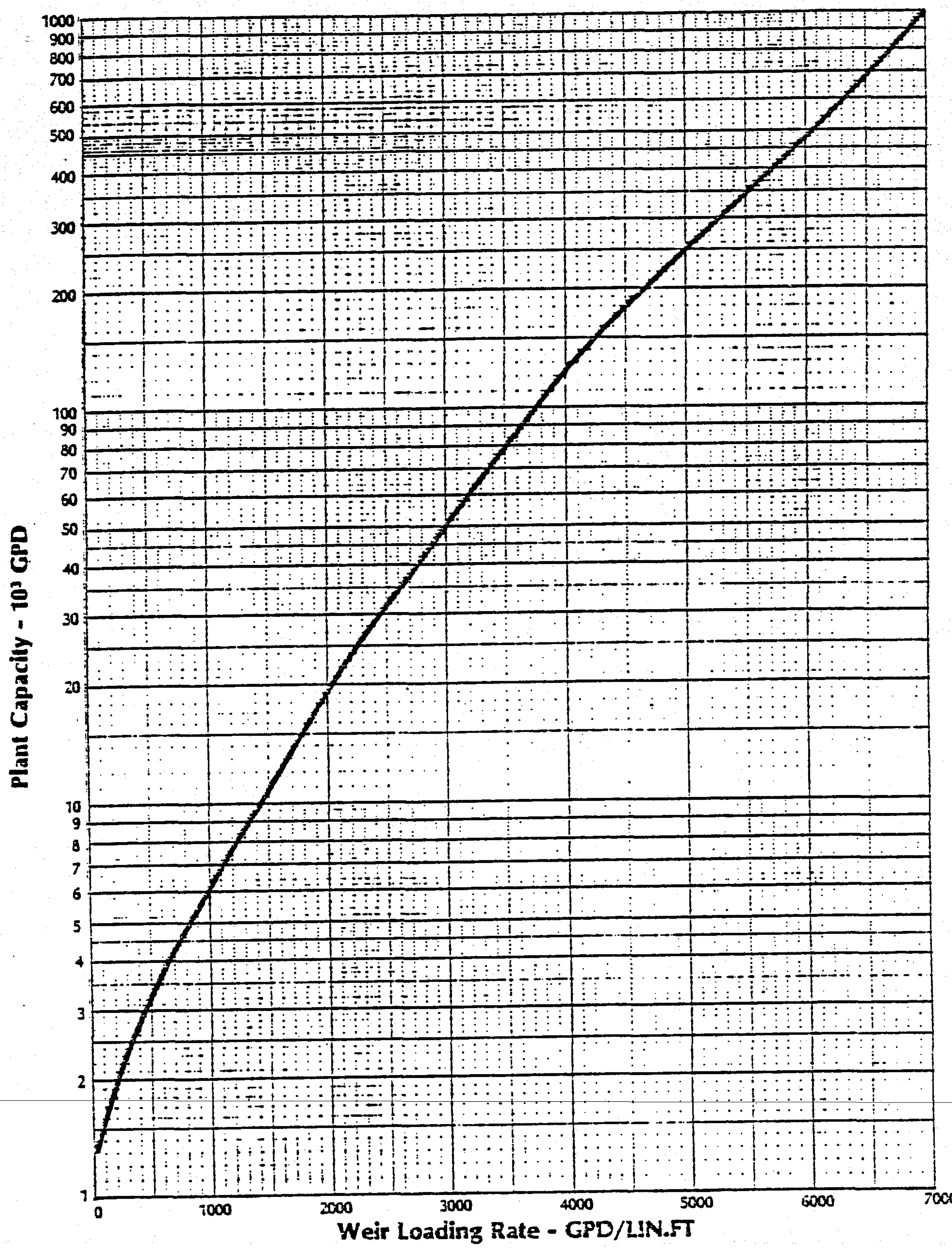


Figure VII-4

Maximum Clarifier Weir Loading Rate
vs
Plant Average Daily Flow
for
Extended Aeration and Contact Stabilization

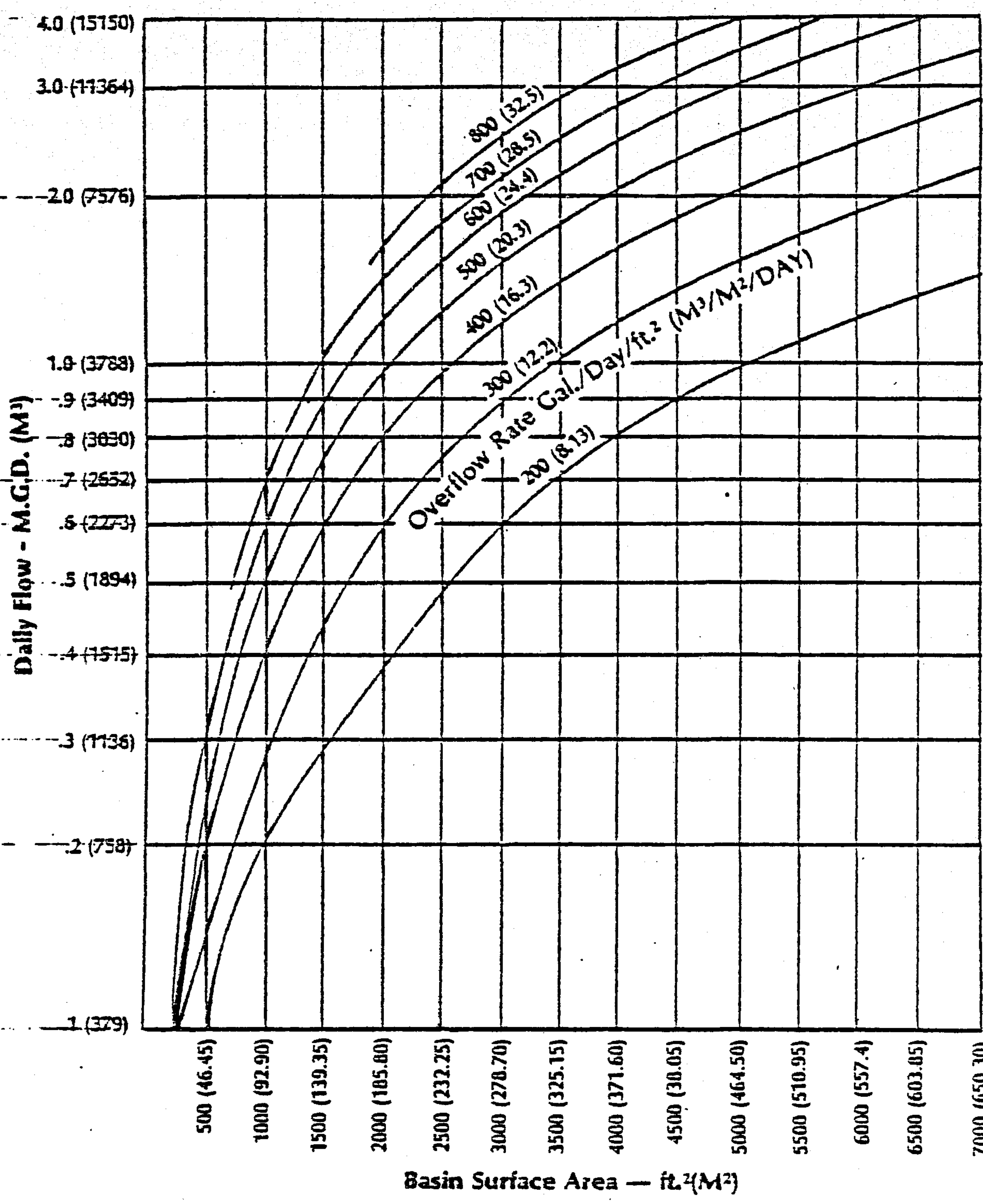


Figure VII-5

Overflow Rate
Basin Surface Area - ft.²(m²)

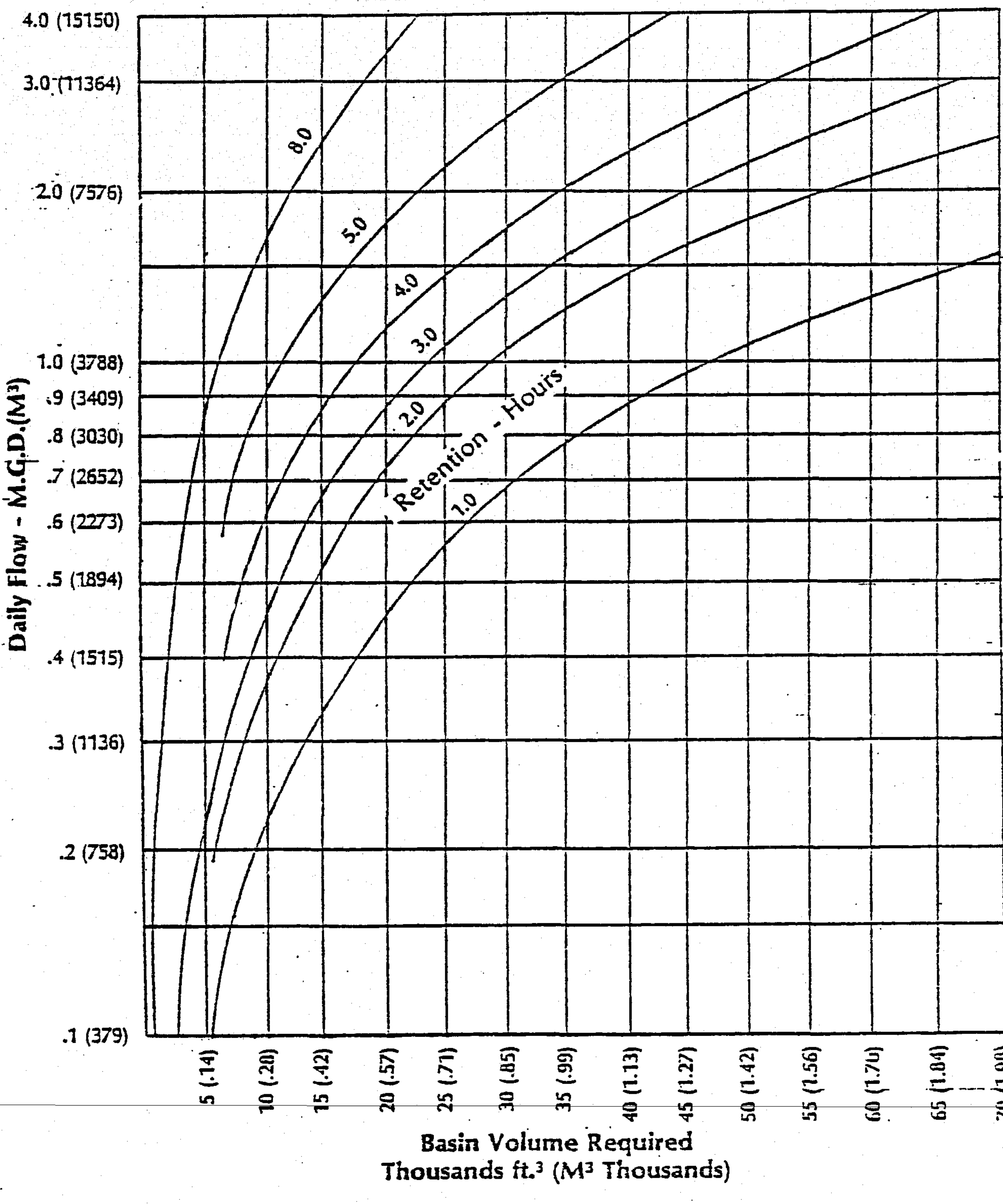


Figure VII-6

Retention Time
Basin Volume Required

2) Length/Width - Rectangular - Length to width ratios of rectangular basins range from 4:1 to 5:1.

3) Weirs - Overflow weirs shall be adjustable. Weir plates with 90° V-notches for low flows or launders with multiple weirs are preferred. The upflow velocity in the immediate vicinity of the weir should be limited to between 12 and 24 fph.

4) Scum Baffles - Effective scum baffles shall be provided ahead of the outlet weirs on all sedimentation basins.

5) Sludge Removal - Provisions shall be made to permit continuous sludge removal from final sedimentation basins when the sludge is returned to primary sedimentation basins.

Each sludge hopper shall have an individually valved sludge withdrawal line at least six (6) inches in diameter. Head available for withdrawal of sludge shall be at least 30 inches. Sludge hoppers shall be accessible for maintenance from the operating level. The minimum slope of the side walls of sludge hoppers shall be 1.7 vertical to 1 horizontal. Clearance between the end of the sludge draw-off pipe and the hopper walls shall be sufficient to prevent "bridging" of solids. Hopper bottoms shall have a maximum dimension of 2 feet.

6) Skimming Requirements and Controls - Effective scum collection and removal facilities shall be provided ahead of the outlet weirs on all sedimentation basins. The equipment should be automatic or provide for easy scum removal, and shall discharge to a sludge well for pumping to sludge disposal.

7) Mechanical Equipment - Sedimentation basin equipment is either of the scraper type or suction type (final sedimentation only). Peripheral speeds of scraper mechanisms is generally 5 - 8 fps. Suction type mechanisms travel between 4 - 12 fpm.

Sludge withdrawal is generally controlled by telescoping valves which may be varied to match sludge pumping rates.

8. Safety Controls - All sedimentation basins shall be provided with easy access for maintenance. Operator safety shall be assured by installation of stairways, walkways, handrails, etc.

The sedimentation mechanism shall be provided with adequate safety mechanisms to prevent drive failure or overloading.

9. Sampling facilities - Appropriate equipment shall be provided for viewing and sampling and return sludge from the final sedimentation basin.

2. Non-Mechanical.

   a. Use Requirements - Non-mechanical basins shall be restricted to combined aerator-clarifier units which are less than 100,000 gpd capacity.

   b. Location - Non-mechanical sedimentation basins are located at the effluent side of extended aeration or contact stabilization aeration basins.

   c. Design Loadings - Figure VII - 3 and Figure VII - 4 provide a graphical presentation of the maximum allowable surface loading rate and weir overflow rate. Table VII - 2 gives the recommended retention times for these basins.

   d. Basin Design.

      1) Inlet Structure - The inlet structure from the aeration basin may be by pipe, elbow, tee, or other such means which will distribute the sludge adequately and will prevent short circuiting or clarifier turbulence. The inlet velocity to the sedimentation basin shall not exceed 1 fpm at design flow. Flow through velocities shall not exceed 100 feet per hour.

      2) Width to Length Ratios - Non-mechanical sedimentation basins are generally provided with a length to width ratio of 1:2.

      3) Weirs - Overflow weirs shall be adjustable. Weir plates of 90° V-notches for low flows or launders with multiple weirs are preferred. The upflow velocity in the immediate vicinity of the weir should be limited to between 12 and 24 fph.

      4) Scum Baffles - Effective scum baffles shall be provided ahead of the outlet weirs on all sedimentation basins.

      5) Sludge Removal - Sludge removal shall be continuous, via air lift or sludge pumps. Sludge hoppers shall have a minimum slope of 1.7 vertical to 1.0 horizontal to reduce "bridging" of solids.

   e. Skimming Requirements and Controls - Effective scum collection facilities should be provided ahead of the outlet weirs on all sedimentation basins. The equipment should be automatic or provide for easy scum removal, and should be designed to discharge to a sludge well for pumping to sludge disposal, or for smaller plants return the scum to the aeration basin.

   f. Pumping Capacities and Pumping Rate Controls - Return sludge pumping capacities should be provided which will allow a variable control range of 0.5 to 1.5 times the average daily flow.

g. Safety Controls - All sedimentation basins shall be provided with easy access for maintenance. Operator safety should be assured by installation of walkways, handrails, etc.

h. Sampling Facilities - Appropriate equipment shall be provided for viewing and sampling the return sludge from the final sedimentation basin.

3. Tube Settlers.

a. Use requirements - Tube settlers are used in secondary sedimentation of biological and physical chemical process schemes. The advantage in using tube settlers is the achievement of a higher surface loading rate as compared to sedimentation basins without settlers. The higher loading rates will result in smaller basin dimensions and, thus, reduce construction costs.

b. Design Loadings - Table VII - 3 gives the recommended allowable design loads to be used in designing sedimentation basins using tube settlers.

Clarifier Type	Maximum Design gpm/ft^2	Maximum Peak gpm/ft^2
Suction	0.7	1.8
Scraper and non-mechanical	0.5	1.5

Table VII -3

Recommended Allowable
Design Loading Using Tubular Settlers

NOTE: The rates given above are for liquid temperatures of 70°F. For liquid temperatures of 40°F, the rates shall be reduced by a factor of 2. Rates for temperatures between 40°F and 70°F shall be reduced proportionately. Design loadings shall be for the minimum liquid temperature at the clarifier inlet for the plant locality.

The solids loading rate on the basin shall not exceed 40 lb/sf/da.

$$\text{Solids loading (psf/day)} = \frac{(MLSS)\ (2Q)\ (8.34)}{A}$$

$$= \frac{16.68\ (MLSS)Q}{A}$$

MLSS - Concentration mixed liquor suspended solids - mg/l
Q - Design flow - MGD
A - Total basin surface area (square feet)

c. Basin Depth - The recommended side water depth in a circular basin with center feed is 10 feet minimum. In rectangular basins, the recommended minimum depth is 12 feet. These limits are based upon satisfying thickening requirements of the activated sludge solids. Shallower basins may be used depending upon circumstances of design.

d. Chemical Feed System - The treatment facility should have the capability of feeding chemicals to the influent of the clarifier during periodic minor upsets in the process. The purpose of the chemical feed system is to enable the operator to exert control over flocculation of the activated sludge solids.

Chemical feed systems shall include provisions for feeding metallic salts (alum or ferric chloride) and polyelectrolyte. The metallic salts should be fed to either the primary or aeration system. The polyelectrolyte should be fed to the influent of the secondary sedimentation basin. Anticipated chemical dosages are:

Alum - 100 - 150 mg/l as $Al_2\ (SO_4) - H_2O$

$FeCl_3$ - 45 - 90 mg/l as $FeCl_3$

Polyelectrolyte - 0.5 to 1.0 mg/l

e. Return Sludge Capability - The return sludge pumping capacity shall be equal to 100 per cent of the design basin flow rate.

f. Skimming Requirements - A suitable means of skimming shall be provided for removing floating materials in the area ahead of the tubes. Baffling ahead of the tube settlers may be required with certain clarification equipment.

Provisions for skimming the area above the tubes shall be provided (manual or automatic) to prevent dislodged materials from passing into the final effluent.

The weirs and launders shall be provided with scum baffles ahead of the weirs.

g. Tube Cleaning - A tube cleaning system consisting of air wash shall be provided.

h. Non-mechanical Clarifiers - The bottom slopes of non-mechanical clarifiers shall be a minimum of 1 to 1.

E. TRICKLING FILTERS

1. Introduction - A trickling filter is a biological treatment process which uses surface growth of organisms on a media as compared to dispersed growth in the activated sludge process.

In a manner analagous to the activated sludge process (using plug flow), the BOD removal is related to the biological surface available and time of interface contact between the wastewater and the biological surface. In a trickling filter, the mean time of contact is expressed as

$$t = \frac{CD}{Q_h^{\,n}} \qquad (1)$$

where,

C, n = constants which vary depending upon the specific surface and the particular configuration of media packing employed
D = media depth (ft)
Q_h = hydraulic loading (gpm/sf)

The BOD removal rate in the biological process is proportional to the amount of BOD remaining as expressed in the following equation:

$$\frac{L_e}{L_o} = e^{-k\,t} \qquad (2)$$

where,

L_e = BOD remaining (mg/l)
L_o = BOD feed (mg/l)
k = coefficient incorporating the surface area of active film per unit volume
t = contact time (days)

A generalized relationship may be derived from the above equations where the constants (k and C) combined:

$$\frac{L_e}{L_o} = e^{-K_T D/Q_h^{\,n}} \qquad (3)$$

The value of K_T varies with temperature as expressed by the following equation:

$$K_T = K_{20}(1.035)^{T-20} \qquad (4)$$

where,

K_T = BOD removal rate constant at design temperature
K_{20} = BOD removal rate constant at 20°C (See Table VII - 4.)
T = design temperature (°C)

Eckenfelder modified equation (3) to a retardant form in describing overall removal since all components of the organic waste are not removed at the same rate. The modification is expressed as:

$$\frac{L_e}{L_o} = \frac{100}{1 + \frac{CD^{(1 - m)}}{Q_h^{\,n}}} \qquad (5)$$

Statistical analysis of dates from rock filters treating domestic wastes yields the equation:

$$\frac{L_e}{L_o} = \frac{100}{1 + \frac{2.5D^{0.67}}{Q_h^{\,0.50}}} \qquad (6)$$

When recirculation is used, the rock filter performance can be estimated by the equation

$$\frac{L_e}{L_a} = \frac{1}{(1 + N)(1 + \frac{2.5D^{0.67}}{Q_h^{\,0.5}}) - N} \qquad (7)$$

where,

L_a = influent sewage BOD_5, mg/l
N = recirculation ratio
L_o = admixture of recirculated flow BOD = $\frac{L_a + NL_e}{N + 1}$

Eckenfelder derived an equation to include the effect of recirculation on the removal capabilities of plastic media towers. That equation is expressed as

$$\frac{L_e}{L_a} = \frac{1}{(1 + N)e^{\frac{K_T D}{Q_h}\left(\frac{1}{1 + N}\right)} - N}$$

Figures VII - 7, 8, and 9 give graphical solutions to equation (3) for plastic media (after B. F. Goodrich Corporation).

Detailed discussions of process design may be found in Eckenfelder's works and Metcalf and Eddy's "Wastewater Engineering."

2. Use Requirements - Trickling filters may be used as "roughing" filters to reduce organic loads on other biological process units or may be used as the prime source of biological treatment.

3. Types and Design Loadings - Trickling filters are classified as standard rate filters and high rate filters.

Table VII - 4 gives general features and recommended loading criteria for trickling filters.

4. Distribution Equipment.

   a. Distribution - The sewage may be distributed over the filter by rotary distributors, horizontal or traveling distributors, or other suitable devices which provide the required continuity and uniformity of distribution. At average design flow, the deviation from a calculated uniformly distributed volume per square foot of the filter surface shall not exceed plus or minus 10 per cent at any point.

   b. Dosing - Sewage may be applied to the filters by siphons, pumps, or by gravity discharge from preceding treatment units when suitable flow characteristics have been developed. Application of sewage shall be such that the time interval between applications does not exceed 5 minutes at design flows.

   c. Hydraulics - All hydraulic factors, including recirculation, which involve proper distribution of the sewage on the filters should be carefully calculated. For reaction type distributors, a minimum head of 24 inches between low water level in the siphon chamber and center of the distributor arms is good design practice.

   d. Clearance - A minimum clearance of 6 inches between the media and distributor arms shall be provided. Greater clearance will be required where icing occurs.

5. Media.

   a. Quality - The filter media may be crushed rock, slag, or specially manufactured material. The media shall be durable, resistant to spalling or flaking, and shall be insoluable in sewage. The top 18 inches shall have a loss by the 20-cycle, sodium sulfate soundness test of not more than 10 per cent, as prescribed by ASCE Manual of Engineering Practice, Number 13, the balance to pass a 10-cycle test using the same criteria. Slag media shall be free from iron and sulphur. Manufactured media shall be structurally stable and chemically and biologically inert.

   b. Depth - Crushed rock and slag media shall have a minimum depth of 5 feet above the underdrains and shall not exceed 7 feet in depth except where special construction is justified to the Department.

      Manufactured media shall have a minimum depth of 5 feet above the underdrains and should not exceed 20 feet in depth except where special construction is justified to the Department.

	Hydraulic Loading (MGAD)	Organic Loading (lb BOD/acre/ft/day)	Depth ft	n	K_{20}	Recirculation
Standard Rate						
Rock, etc.	2 - 5	400 (200 - 1100)	6 (5 - 10)	0.50	.33	None
Manufactured Media						
Rings	10 - 150	-	21 (14 - 28)	.39	.46	None
Sheet-type	10 - 150	-	21 (14 -28)	.5	.33 - .40	None
High Rate						
a. Single Stage						
Rock, etc.	16 (10 - 30)	2000 (1300 - 3900)	4 (3 - 6)	0.50	.33	0.5 - 3.0
Manufactured Media						
Rings	30 - 500		21 (14 - 28)	.39	0.46	0.5 - 3.0
Sheet-type	30 - 500	-	21 (14 - 28)		.33 - .40	0.5 - 3.0
b. Two Stage						
Rock, etc.	16 (10 - 30)	2500 (2000 - 3000)	4 (3 - 6)	0.50	.33	0.5 - 4.0
Manufactured Media						
Rings	30 - 500	-	21 (14 - 28)	.39	0.46	0.5 - 4.0
Sheet-type	30 - 500	-	21 (14 - 28)	.5	.33 - .40	0.5 - 4.0

Table VII - 4

Recommended Trickling Filter Design Criteria

Figure VII - 7

Biofilter Synthetic Media Design Chart

Municipal Waste — 5 - 10% Industrial

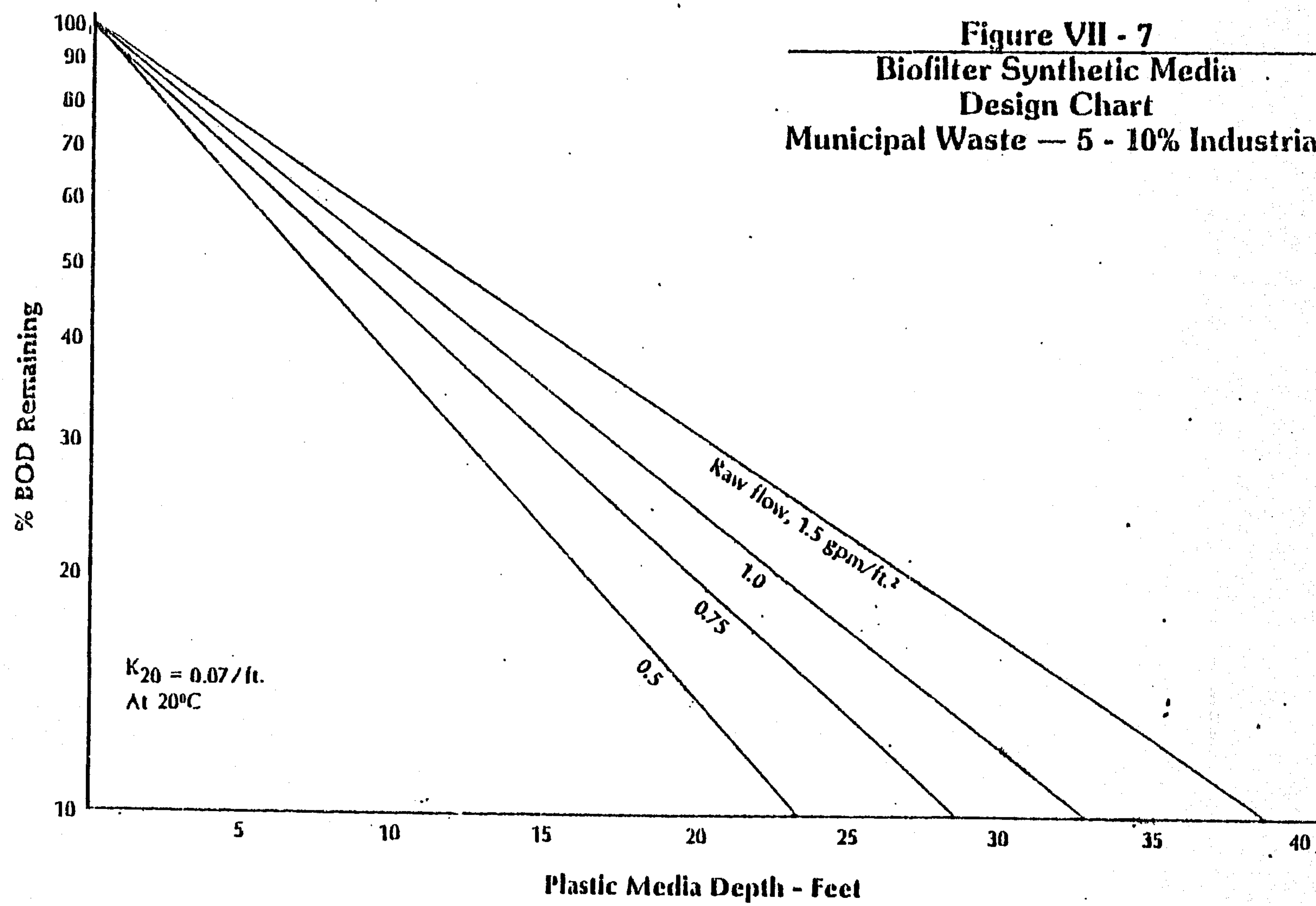


Figure VIII - 8

Biofilter Synthetic Media Design Chart Domestic Waste Only

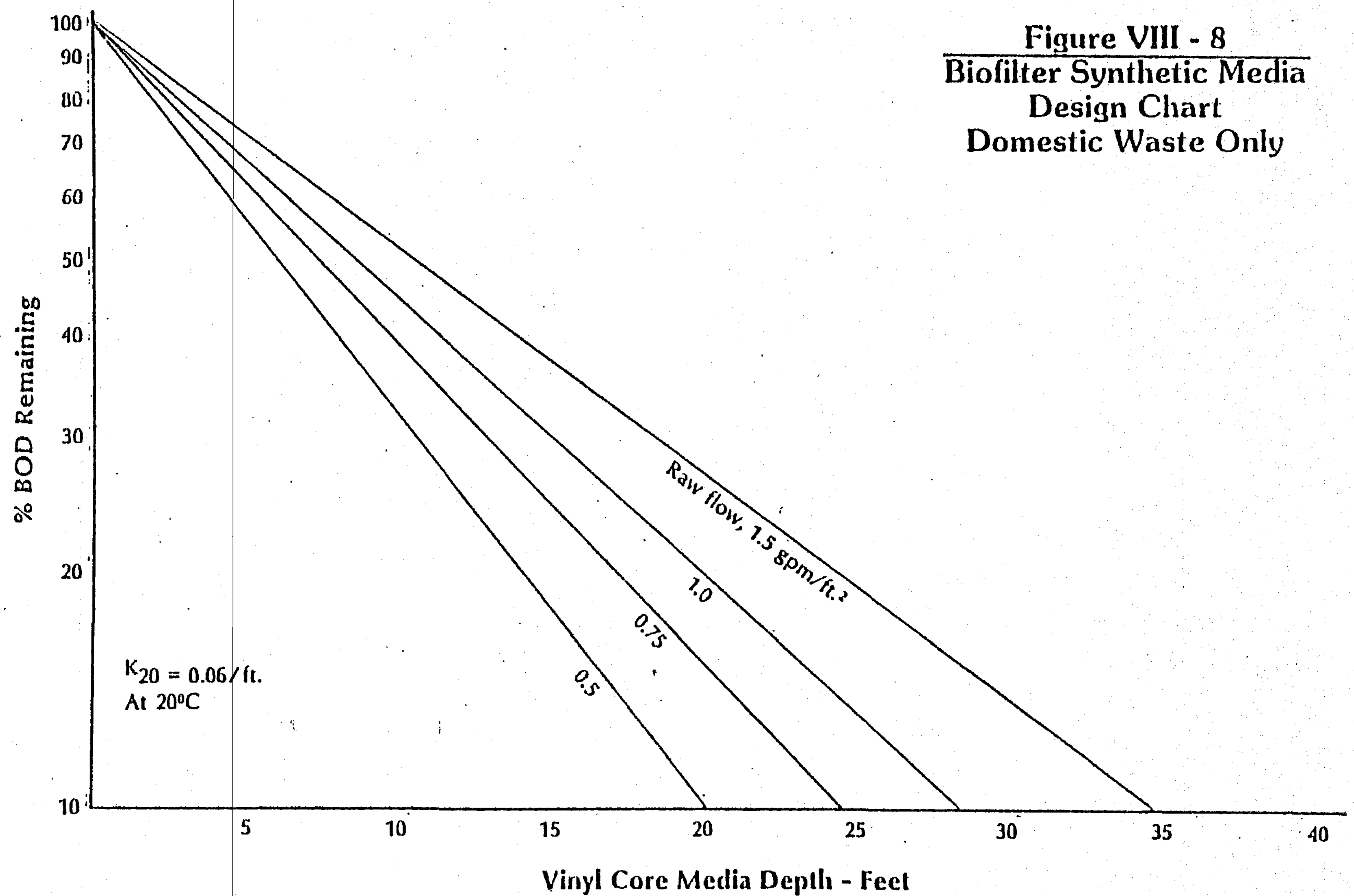
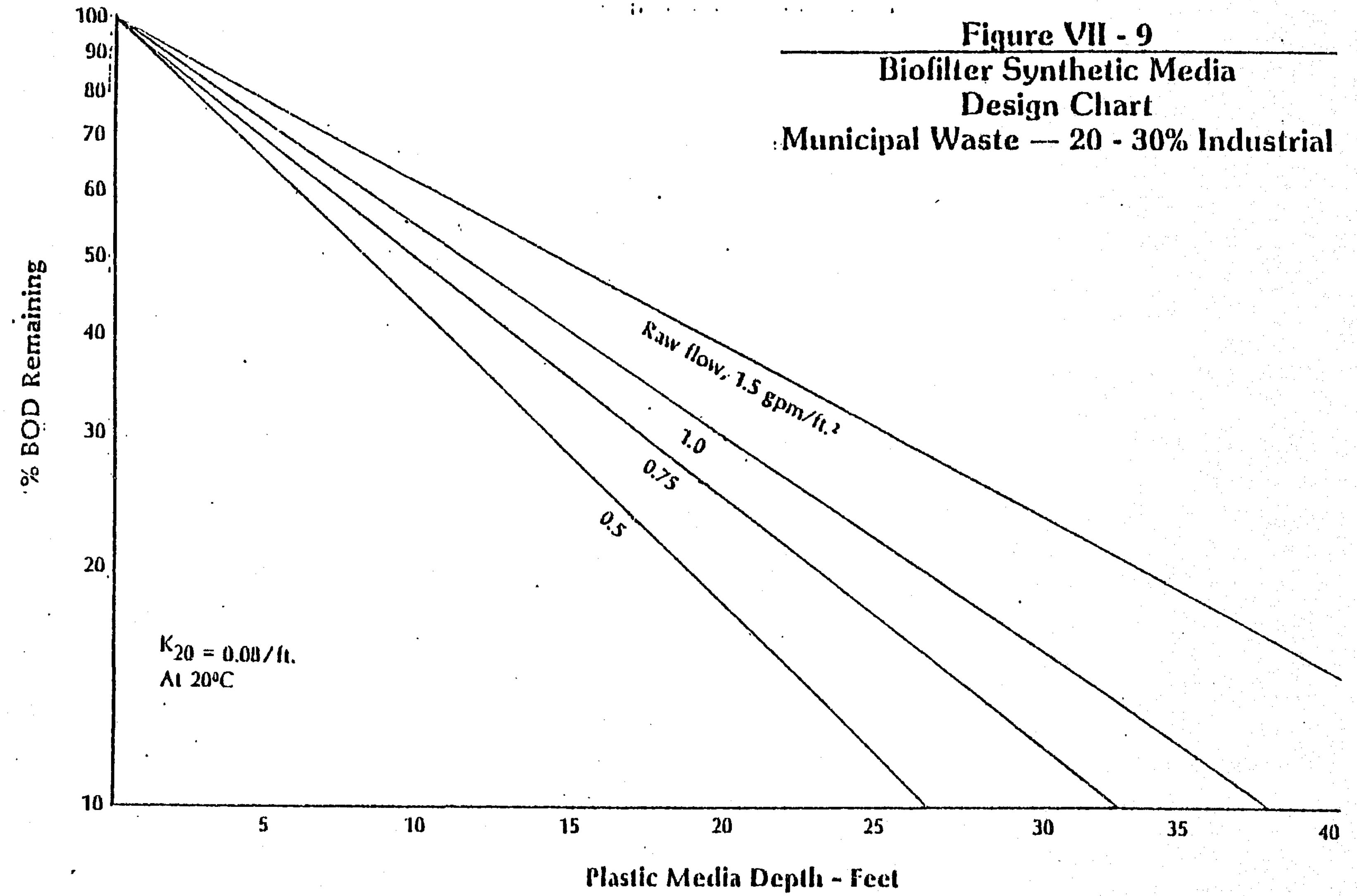


Figure VII - 9

Biofilter Synthetic Media Design Chart

Municipal Waste — 20 - 30% Industrial



c. Size and Grading of Media.

1) Rock, Slag, and Similar Media - Rock, slag and similar media shall not contain more than 5 per cent by weight of pieces whose longest dimension is 3 times the least dimension. They shall be free from thin elongated and flat pieces, dust, clay, sand, or fine material and shall conform to the following size and grading when mechanically graded over vibrating screen with square openings:

Passing 4 1/2 inch screen -	100% by weight
Retained on 3 inch screen -	95% - 100% by weight
Passing 2 inch screen -	0 - 2% by weight
Passing 1 inch screen -	0 - 1% by weight

2) Hand Packed Field Stone:

Maximum dimension of stone - 5 inches
Minimum dimension of stone - 3 inches

d. Handling and Placing of Media - Material delivered to the project site shall be stored on wood planked or other approved clean hard surfaced areas. All material shall be rehandled at the filter site and no material shall be dumped directly into the filter. Crushed rock, slag, and similar media shall be rescreened or forked at the filter site to remove all fines. Such material shall be placed by hand to a depth of 12 inches above the tile underdrains and all material shall be carefully placed so as to not damage the underdrains. The remainder of the material may be placed by means of belt conveyors or equally effective mthods.

Manufactured media shall be handled and placed as recommended by the manufacturer and as approved by the Engineer.

Trucks, tractors, or other heavy equipment shall not be driven over the filter during or after construction.

6. Under-Drainage System.

a. Arrangement - Underdrains with semicircular inverts or equivalent should be provided. The underdrainage system shall cover the entire floor of the filter. Inlet openings into the underdrains shall have an unsubmerged gross combined area equal to at least 15 per cent of the surface area of the filter.

b. Bottom Slope - The underdrains shall have a minimum slope of 1 per cent. Effluent channels shall be designed to produce a minimum velocity of 2 feet per second at average daily rate of application to the filter.

c. Flushing - Provisions shall be made for flushing the underdrains. In small filters, use of a peripheral head channel with vertical vents is acceptable for flushing purposes. Inspection facilities should be provided.

d. Ventilation - The underdrain system, effluent channels and effluent pipe, shall be designed to permit free passage of air. The size of drains, channels, and pipe should be such that not more than 50 per cent of their cross sectional area will be submerged under the design hydraulic loading. Where standard rate filters are to be provided, consideration should be given to the design of the effluent channels for eventual conversion to high rate operation.

7. Control Devices - Flow measurement devices shall be provided to permit measurement of flow to the filter. Flow measurement should be installed to record dosing feed and recirculation quantities.

8. Maintenance Considerations - All distribution devices, underdrains, channels and pipes shall be installed so that they may be properly maintained, flushed, or drained.

9. Freezing Protection and Odor Control - Consideration shall be given to protecting the filter from freezing when the climate and other conditions are expected to require freezing protection.

   Where odor control is necessary, consideration should be given to covering each unit.

F. ACTIVATED SLUDGE.

The activated sludge process uses a dispersed growth phase for reduction of organics in the waste stream as compared to the surface growth of the trickling filter process.

The works of Michaelis-Menton and Monod in relating organic removal rate as a function of organic feed concentrations and biological growth rates as a function of food microorganism ratios have been the foundation for designing the activated sludge process. Chapter 10 of Metcalf and Eddy's "Wastewater Engineering" presents in-depth discussions of growth kinetics as they apply to sewage treatment.

1. Design Parameters - Table VII - 5 is a compilation of recommended design parameters for activated sludge processes. Designs using values other than those shown in Table VII - 5 shall be submitted with justification for variance.

2. Return Sludge Requirements.

   a. Sludge Pumps - The return sludge pumps shall be of such capacity as is required for returning sludge as governed by Table VII - 5. The pumps shall be designed to provide variable delivery. A standby pumping unit shall be provided equal in capacity to the largest single pump.

   b. Pipe Velocity - The velocity range of flow in the return sludge lines shall be between 2 fps and 8 fps.

Parameter Process	Aeration Period hrs	% Recycle	BOD Design Load Lbs/1000 CF	Lbs/Lb mlss	LB O2/Lb bod Removed	Cu Ft Air/Lb bod Removed	MLSS mg/1	Sludge Age-Days	Lb Solids/Lb bod Removed	Primary Treatment Required
Conventional	4 - 8	25 - 50	35 (20-40)	0.25 - 0.50	0.8 - 1.0	700 - 1000	1500 - 3000	3.7 - 7.0	0.5	yes
Step - Feed	2 - 4	25 - 75	50 (40 - 60)	0.25 0.50	0.8 - 1.0	500 - 700	200 - 3500	3.5 - 7.0	0.5	yes
Complete-Mix	3 - 5	25 - 100	50 - 120	0.5 - 0.75	0.8 - 1.0		3000 - 6000	3.5 - 7.0	0.5	yes
Kraus	4 - 8	50 - 100	40 - 100	0.3 - 0.8		800	2000 - 4000		0.5	yes
High Rate	.5 - 2	100 - 500	100 - 1000	0.4 - 1.5	0.65 - 0.80		4000 - 10,000	0.5 - 2.0	0.6 - 0.7	yes
Modified Aeration	1.5 - 3	5 - 20	100 (75 - 150)	1.5 - 5.0	0.65 - 0.80	400 - 600	200 - 500	0.5 - 2.0	0.6 - 0.7	no
Pure Oxygen	1 - 3	25 - 50	100 - 250	0.25 - 1.0	0.8 - 1.5		6000 - 8000	1.0 - 2.0	0.3 - 0.7	yes
Deep Shaft Aeration **	1.0 - 3.0	100		0.8 - 1.1			4000 - 6000	4.0 - 5.0	0.25 - 0.5	no
Contact Stabilization To 0.5 MGD	Contact Basin 3.0	25 - 100	30	0.2 - 0.5	0.8 - 1.0		Contact - 1000 - 3000	3.5 - 7.0	0.5	no
0.5 to 1.5 MGD	3.0 - 2.0		30 to 50				Reaeration - 4000 - 10,000			
1.5 MGD up	1.5 - 2.0		50							
Extended Aeration	24	75 - 150	12.5 (10 - 20)	0.05 - 0.15		2100	2000 - 4000	10 or more		no

* consult manufacturer

** design governed by Chapter III

***Contact Basin - 30 to 35 percent of total aeration capacity. Reaeration Basin comprises the balance of the aeration capacity.

Note: All other activated sludge processes shall be governed by chapter III

Table VII - 5

Recommended Design Criteria For Activated Sludge Process

c. Sludge Wasting - Provisions shall be provided on the return sludge piping for wasting sludge to the primary sedimentation unit or to other sludge handling facilities.

3. Basin Configuration.

   a. General - The dimensions of each independent aeration tank shall be such as to maintain effective mixing and utilization of air.

      1) Diffused Aeration - Liquid depths should not be less than 10 feet, nor more than 15 feet. Length to width ratios are generally 4:1 to 5:1, while width to depth ratios vary from 1:1 to 2.2:1. The liquid depth may be less for small plants or those with special configurations.

      2) Mechanical Aeration - Liquid depths of basins employing mechanical aeration equipment vary with the size of the mechanical aerator. Figure VII - 10 gives recommended liquid depths using mechanical aeration devices.

         The shape of the tank and installation of aeration equipment shall provide for positive control of short-circuiting through the tank.

   b. Inlets and Outlets.

      1) Controls - Inlets and outlets for each aeration tank unit shall be suitably equipped with valves, gates, stop plates, weirs, or other devices to permit flow control to any unit and to maintain a reasonably constant liquid level.

      2) Conduits - Channels and pipes carrying liquids with solids in suspension shall be designed to maintain self-cleaning velocities or shall be agitated to keep such solids in suspension at all rates of flow within the design limits.

   c. Freeboard - All aeration basins shall have a freeboard of not less than 6 inches. Greater heights are desirable. Consideration should be given to providing positive means of froth and foam control.

4. Aeration Equipment - Aeration equipment shall be capable of maintaining a minimum of 2.0 mg/l of dissolved oxygen in the mixed liquor at all times and shall provide thorough mixing of the mixed liquor. Diffused aeration generally requires 20 to 30 scfm/1000 cf of tank volume to insure good mixing. Typical power requirements vary from 0.5 to 1.0 hp/1000 cf of tank volume for mechanical aeration.

   a. Diffused Aeration.

      1) Diffusers and Piping - The air diffuser system, including piping, should be capable of delivering 200 per cent of the average air requirements. The diffuser units shall be designed with individual control volves. These valves shall be of the type that will permit throttling.

A pressure relief valve and pressure gauge shall be provided on the main air supply pipe.

The diffuser units shall be designed to be removed from service for inspection and cleaning without dewatering the aeration basin.

2) Blowers and Compressors.

a) Capacity of blowers of air compressors shall be designed for air intake temperatures of 120°F and shall be designed with compensation for pressure changes with altitude variation.

b) Dual Units - The blowers shall be installed in multiple units. The capacity of each shall be such that the maximum air demand will be met with the single largest unit out of service.

c) Air Filters - Air filters shall be provided in numbers, arrangements, and capacities to furnish an air supply having dust content of not more than 0.5 mg per 1000 cubic feet in all air delivered to diffusers.

d) Noise Level - Blowers and compressors shall be selected to meet OSHA noise level standards. Suitable mufflers, silencers, etc. shall be employed to provide a noise level acceptable to OSHA.

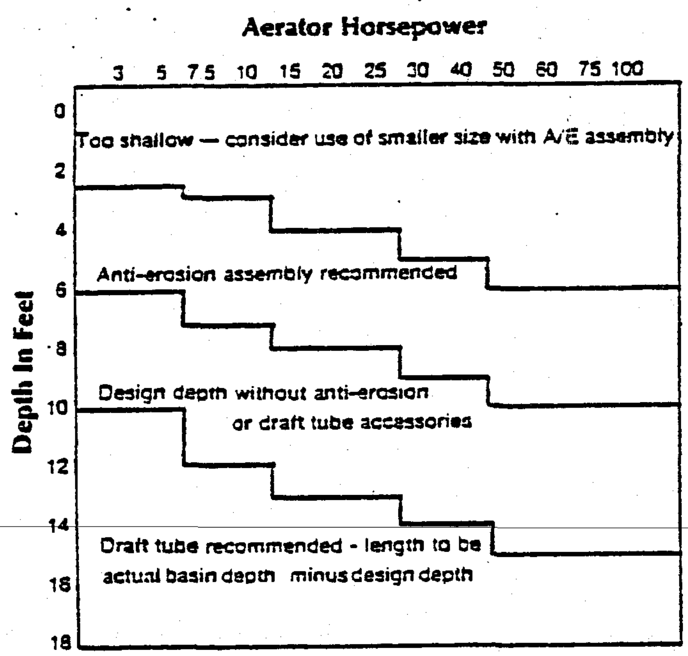


Figure VII - 10

Recommended Depth of Basin vs Mechanical Aerator Application

e) Control of Air Supply - The blowers and compressors shall be designed to provide for variation in the volume of air delivered either through throttling valves, variable pitch pulley arrangements, or other suitable methods.

b. Mechanical Aeration - Mechanical aerators are available in floating or fixed systems.

1) Floating Aerators - Floating aerators may be used in water depths varying from 3 to 20 feet. Figure VII - 10 shows application methods using various size aerators at specified depths.

Antierosion devices shall be required in relatively shallow basin depths. Aerated lagoons shall be constructed with riprap or a concrete pad under each aerator covering a minimum area of 1.5 times the impeller diameter.

The use of draft tubes will be required in deeper basins. Caution shall be used when the depth is more than 1.5 times the length of the shortest side wall. Anti-vortexing devices may be required under these conditions.

Floating aerators shall be provided with corrosion resistant tie-down hardware.

2) Fixed Aerators - Fixed aerators may be used in water depths up to 30 feet.

The same precautions as outlined for the floating aerators apply and require investigation.

Fixed aerators shall be mounted on easily accessible platforms with walkways and suitable guardrailing.

Suitable equipment should be provided for removing the aerators from the platform. Adequate working space shall be provided for maintenance.

3) Design Factors - Items requiring investigation when applying mechanical aerators include:

a) depth of tank
b) aerator spacing
c) tank geometry
d) type of activated sludge process
e) use of baffles
f) impeller freeboard
g) zone of aerator influence.

Aerator manufacturers should be consulted to assure proper equipment application in all areas above.

4) Field Transfer Requirements - The design Engineer should give consideration to requiring oxygen transfer field testing on units greater than 50 hp. to assure sufficient oxygen is being transferred and proper mixing occurs.

5. Waste Sludge Disposal - Waste activated sludge disposal may include anaerobic digestion and aerobic digestion with any of the means outlined in Section M.

Installations not employing sludge drying beds or other acceptable means of sludge disposal shall be equipped with an aerated sludge holding tank. The sludge holding tank volume shall be at least 10 per cent of the average daily flow with minimum 100 gallons capacity allowable.

The sludge holding tank shall be designed with provisions for decanting supernatant and shall be provided with means of draining and desludging.

6. Sludge Reaeration.

a. Use Requirements - Sludge reaeration should be considered in design when a temporary means is sought to increase the capacity of an overloaded waste treatment plant.

b. Design Criteria.

1) Organic Loading - Organic loading of the sludge reaeration ranges from 2 to 6# BOD per 1000 cf aeration volume.

2) Oxygen Requirements - Sludge reaeration oxygen generally requires 1.25# O_2/lb. BOD removed.

3) Retention Time - The aeration time in the sludge reaeration basin shall be between 3 to 6 hours.

4) Mixed Liquor Suspended Solids - MLSS concentrations generally vary from 4000 to 10,000 mg/l.

5) Mixing Requirements - Mixing requirements for the basin should be 20 to 30 scfm/1000 cu ft of tank volume for diffused aeration and 0.5 to 1.0 hp/1000 cu ft of tank volume for mechanical aerators.

6) Basin Design - The basin design should parallel the concepts presented in Section L.

7. Special Considerations for Factory Built Treatment Plants.

a. Hydraulic Requirements - The design Engineer should carefully review the hydraulic characteristics of all factory built treatment plants before finalizing design.

Clarifiers shall be designed to prevent short circuiting, vortexing, uneven distribution of solids loading or other hydraulic problems which will cause solid washout.

For rectangular tanks, horizontal flow - though velocities based on the maximum mixed liquor flow - shall not exceed 100 fph.

b. Time Clock Control - All factory built waste treatment plants shall be provided with time clock controls for the aeration equipment capable of 15 minute interval adjustments. Alternators for blowers shall be provided.

c. Blower Housing - All factory built waste treatment plants shall be furnished with aeration equipment in a lockable, well-ventilated housing to protect the blowers and electrical controls.

d. Grit Tanks - Preaeration grit tanks will not be allowed on factory built waste treatment systems.

e. Flow Equalization - Flow equalization shall be considered where:

1) High fluctuations ($>$3:1 peak to average flow) of flow occur,
2) The clarifier loading exceeds normal storage requirements,
3) A sewage pumping station precedes the waste treatment facility.

Design of the equalization basin shall follow the requirements established in Section A.

8. Sampling and Measuring Devices.

a. Sampling Devices - Sampling ports shall be placed at the following locations:

1) aeration basin inlet
2) aeration basin outlet
3) return sludge line
4) waste sludge line.

b. Flow Measurement Devices - Flow meters should be placed at the following locations:

1) air supply line to aeration basin
2) return sludge line
3) waste sludge line
4) at locations where the waste flow is split.

Metering may be of the recording type, time clock pump control or other suitable means.

9. Individual Home Aerobic Systems.

a. Use Requirements - Individual aerobic systems may be used where a central sewer system is not feasible and where the soil conditions will allow subsurface irrigation and/or percolation.

b. Design Criteria.

1) Hydraulic - The clarifier shall be designed for a maximum surface loading of 92 gpdpsf.

2) Organic - The aeration basin shall be designed for an organic loading of 12# BOD_5/1000 cf volume.

3) Retention Times - The aeration basin shall be designed for a minimum retention time of 24 hours.

The clarifier shall be designed for a minimum retention time of six hours.

4) Air Requirements - The aeration system shall be designed to provide complete basin mixing and maintain a 2.0 mg/l dissolved oxygen level in the liquid.

Aerators shall be sized using 2100 scf/#BOD per day or 1.5 lb O_2 per lb BOD per day.

Mixing requirements shall be at least 15 scfm/1000 cf of aeration volume.

c. Effluent Disposal - Acceptable effluent disposal methods for individual aerobic systems include percolation, evapotranspiration and subsurface irrigation.

Percolation systems shall be designed in accordance with Engineering Bulletin No. 12. Other forms of effluent disposal shall be designed in accordance with Sections P and Q.

G. FLOTATION THICKENERS.

1. Use Requirements - Flotation thickeners are used primarily with waste activated sludge. Applications of combinations of primary clarifiers and flotation thickeners may be warranted where excessive amounts of grease, oils, etc., are found in raw wastewater. Flotation thickening may also be used to thicken mixtures of primary and secondary sludges.

2. Design Requirements - Proper sizing requires knowledge of the following:

(1) pounds of sludge available to thicken
(2) operational cycle
(3) solids loading
(4) hydraulic loading
(5) air to solids ratio.

Activated sludge can be thickened by flotation, but solids concentrations in the influent to the flotation thickener should not exceed 15,000 ppm (1.5%) for effective flotation.

Type of Sludge	Recommended Design Loading lb/sf/hr
Waste Activated Sludge	1.5 (1.2 - 2.5)
50% Primary + 50% Waste Activated	3.5 (2.5 - 4.5)
Primary Only	To 6.5

Table VII - 6

Solids Loading Dissolved Air Flotation

a. Operation Cycle.

Plants less than 2.0 MGD - 40 hrs/wk
Plants 2.0 - 5.0 MGD - 80 hrs/wk
Plants greater than 5.0 MGD - 100 - 168 hrs/wk

b. Solids Loading - Table VII - 6 gives recommended design solids loading for flotation thickening.

Where possible, pilot plant studies should be used in sizing flotation thickeners.

c. Hydraulic Loading - The hydraulic loading of the flotation thickener is of secondary importance. However, it should be the controlling factor if waste activated sludge is less than 3,000 mg/l (0.3%) solids.

The hydraulic loading should never exceed 2.0 gpm/sq ft and should be in the 1.25 - 1.75 gpm/sf range. Reducing overflow rates below 1.0 gpm/sf does not improve removal.

d. Air to Solids Ratio - Air to solids ratio should be designed at 0.02 pounds per pound of dry solids. This is approximately equal to 0.30 cubic feet of air per pound of dry solids.

e. Recycle Ratio: For an air to solids ratio of 0.02 lbs/lb, the recycle flow is generally equal to 2 or 2.5 times the influent flow. The pressure system flow will normally be equal to 1/3 or 1/2 of the raw waste flow.

Primary tank effluent or plant effluent is recommended as the source of air charged water.

H. GRAVITY THICKENERS.

1. Use Requirements - Gravity thickening is the most economical means of thickening sewage treatment works sludges. It is used primarily for concentrating sludge to reduce the quantity of water which would have to be pumped to digesters, holding tanks, drying beds, and/or sludge facilities.

2. Location - Sludge thickeners should be located between primary and/or final sedimentation basins, and sludge digestion or sludge dewatering facilities.

3. Design Parameters - When designing a gravity sludge thickener, consideration should be given to the following:

   a. Thickening of mixed sludges (primary and secondary) should be considered at each plant. Secondary sludges normally release their bound water slowly, but mixtures of secondary and primary and/or digested sludge respond well to thickening.

   b. The liquid displacement period in gravity thickeners is of secondary importance for all sludges. However, a retention time of 4 hours and surface loading rates of 400 to 900 gpd/sf are recommended.

      When thickening a combination of primary and waste activated sludge, the curve shown in Figure VII - 11 can be used to predict the sludge concentration expected in the underflow solids based upon the per cent (by weight) of the activated sludge in the mixture.

      This curve follows the following equation:

$$\% \text{ solids} = \frac{6.43(PAS)^2 - 11.93(PAS) + 8}{100}$$

where,

$$PAS = \text{fraction of total solids that is due to the waste activated sludge} = \frac{\text{pounds of waste activated sludge}}{\text{total pounds dry solids}}$$

Table VII - 7 gives recommended design loading rates and the expected underflow concentrations for gravity thickeners.

When thickening a combination of primary and waste activated sludge, the curve shown in Figure VII - 12 can be used to predict the sludge loading rate (lbs/sf/day) based upon the per cent (by weight) of the activated sludge in the mixture.

The curve is defined by the equation:

$$SLR = \frac{1}{\frac{PAS}{5} + \frac{(1 - PAS)}{22}}$$

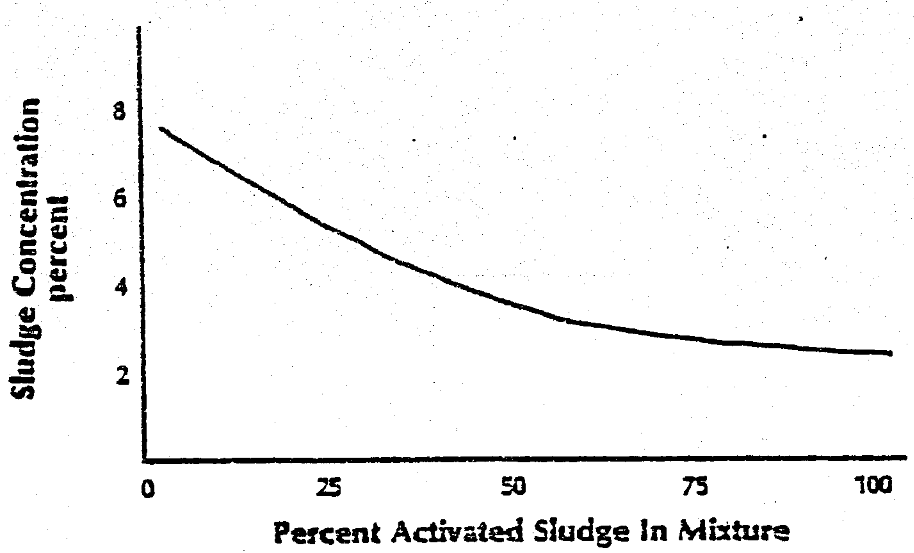


Figure VII - 11

Gravity Thickener - Underflow Sludge Concentration vs Percent Activated Sludge Mixture

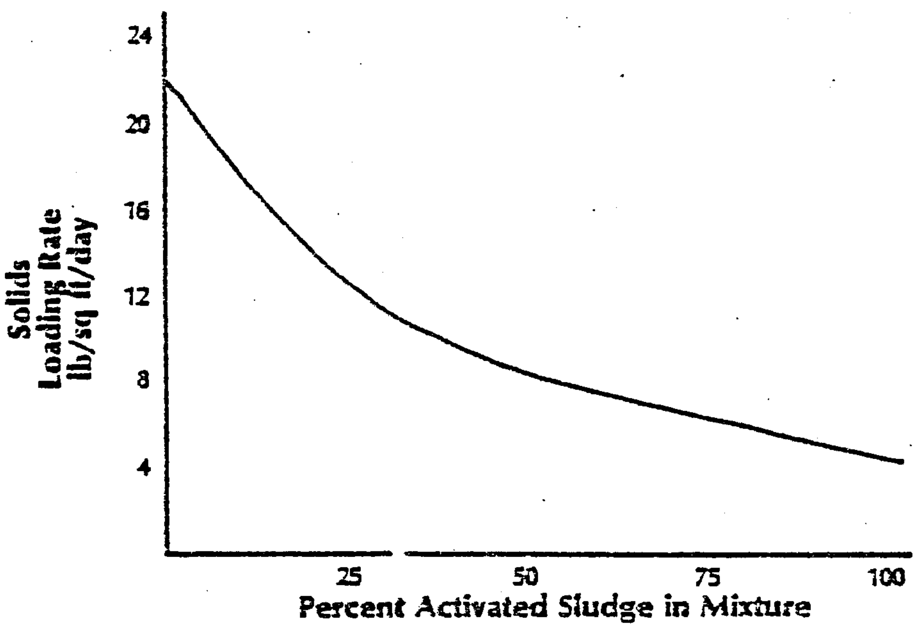


Figure VII - 12

Gravity Thickener Solids Loading Rate vs Per Cent Activated Sludge Mixture

Sludge Type	Loading lbs/sq ft/day	% Solids in Underflow
Primary	22 (20 - 30)	10 (8 - 10)
Trickling Filter	9 (8 - 10)	8 (7 - 9)
Waste Activated Sludge a. Air b. Pure Oxygen	4 (4 - 12) 5	2 (2 - 3.5) 4
Primary + Trickling Filter	15 (12 - 20)	8 (7 - 9)
Primary + Waste Activated	10 (8 - 16)	5 (4.5 - 9)
Activated Physical - Chemical		
a. Lime	30	15
b. Alum	5	1.5
c. Iron	10	3

Table VII - 7

Recommended Solids Loading Rates for Gravity Thickeners

where,

SLR = Solids loading rate (lbs/sf/day)

$$PAS = \frac{\text{pounds of waste activated sludge}}{\text{total pounds of dry solids}}$$

4. Basin Design.

   a. Inlet - The inlet shall be designed to dissipate the inlet velocity, to distribute the flow equally, and to prevent short circuiting.

   b. Weirs - The basin shall be provided with adjustable weir plates.

   c. Scum Baffles - Effective scum baffles shall be provided ahead of the overflow weirs.

   d. Sludge Removal - Provisions shall be made to permit continuous sludge removal or to provide sufficient sludge storage for intermittent sludge removal.

e. Skimming Requirements and Controls - Effective scum collection and removal facilities shall be provided ahead of the outlet weirs on all thickeners.

The equipment shall be automatic and shall discharge to a sludge well for pumping to sludge disposal.

f. Mechanical Equipment - Thickener equipment is either of the scraper type or suction type. Thickener mechanisms with pickets are preferred over mechanisms without pickets. Tip speeds should not exceed 7 fpm.

g. Safety Controls - All thickener basins shall be provided with easy access for maintenance. Operator safety shall be assured by installation of stairways, walkways, handrails, etc.

The thickener mechanism shall be provided with adequate safety mechanisms to prevent drive failure or overloading.

h. Depth - Thickeners should be designed with a minimum side water depth of 10 feet. A side water depth of 14 feet is preferred.

I. PHYSICAL CHEMICAL TREATMENT.

Physical chemical treatment is employed where the effluent stream requires a limitation of nutrients (phosphorous and nitrogen) and, thus, requires a reduction of the constituents prior to final effluent discharge.

The major advantages of physical chemical treatment include:

(1) The physical chemical treatment systems have the capability of producing treatment efficiencies well in excess of those of biological systems.

(2) The present suggested physical and chemical processes are generally controllable and lend themselves to automation.

(3) The physical chemical treatment systems are not typically subject to process failure due to unexpected waste loads of biologically toxic materials.

(4) The physical chemical treatment systems require less land area than biological systems.

Disadvantages of physical chemical treatment include:

(1) The quantity of sludge produced is much greater than with conventional processes.

(2) Processes employing iron and/or alum result in large amounts of ions being (chloride or sulfates) added to the wastewater.

(3) The physical chemical treatment process is limited in its ability to remove colloidal and nonadsorbable organics, and soluble organic phosphorous and nitrogen.

1. Nutrient Removal.

a. Phosphorous Removal - Phosphorous removal can be accomplished by addition of lime or mineral salts at various locations in the treatment facility. Locations of chemical addition are shown in Table VII - 8.

1) Basic Design Considerations - The quantity of phosphorous in domestic sewage is approximately equivalent to 3.5 pounds P per capita per year. The average total phosphorous concentration in domestic raw wastewater is found to be about 10 mg/l expressed as elemental phosphorous (P). These figures are rough guides to Engineers and should not be used as a basis of design. Sampling of the wastewater and analyses for phosphorous are recommended in all cases.

Economic analyses should be performed regarding the use of flow equalization techniques to dampen diurnal flow variation. The possibility of reduction of downstream costs and increased efficiencies may justify using flow equalization.

2) Design Criteria.

a) Mineral Salts - Determination of mineral salt dosage requirements must be performed in the laboratory or in field pilot work to assure effective phosphorous removal. Table VII - 9 tabulates anticipated ranges of metallic salt on a mole of chemical per mole of phosphorous basis.

The values in Table VII - 9 should provide a residual phosphorous <1 mg/liter.

Unit Process	Chemical: Iron	Alum	Lime
1. Primary Clarification	x	x	x
2. Trickling Filter Process			
a. Primary Clarification	x	x	—
b. Trickling Filter		Not recommended	
c. Secondary Clarification	x	x	—
3. Activated Sludge			
a. Aeration Basin	x	x	—
4. Secondary Effluent	x	x	x

Table VII - 8

Points of Chemical Addition, Phosphorous Removal

Chemical	Moles of Chemical per Mole of Phosphorous
Alum [Al (III)]	1.5 - 3.0
Iron [Fe (II)]	1.8 - 2.6
Iron [Fe (III)]	1.8 - 2.2

Table VII - 9

Dose Range of Alum and Iron Salt for Phosphorous Removal

b) Lime - The amount of lime required for phosphorous removal is independent of the amount of phosphorous present. It is a function of the wastewater alkalinity and hardness.

Two basic schemes are employed when applying lime for phosphorous removal at primary clarification.

(1) Low Lime Treatment - Low lime treatment involves addition of lime to the primary influent sufficient to increase the flow stream pH to 9.5 - 10.0. The biological process serves as the recarbonation stage and additional phosphorous removal will occur in aeration.

The low lime process would be more attractive where low alkalinity of the raw sewage exists.

(2) High Lime Treatment - High lime treatment involves the addition of sufficient lime in the primary influent to achieve pH 11. Recarbonation will be required to adjust the pH before biological treatment.

High lime treatment is applicable when effluent standards require softening, low levels of soluble metallic compounds, increased virus removal, or consistent effluent phosphorous concentrations below 1.0 mg/l.

Two lime treatment systems are employed with phosphorous removal of secondary effluents: (a) single stage, (b) two stage.

(a) Single Stage - In single stage, lime is mixed with water to raise the pH to the desired value which is dependent upon the required phosphorous removal (generally, 9.5 - 11.0). After clarification, the effluent stream is recarbonated to prevent post precipitation of $CaCO_3$ prior to discharge.

(b) Two Stage - In two stage treatment, sufficient lime is added to the feed water in the first stage to raise the pH to 11, where precipitation of hydroxyapatite, $CaCO_3$, and $Mg(OH)_2$ occurs. After first stage clarification, carbon dioxide is used to adjust to pH 10 where $CaCO_3$ precipitation results. The $CaCO_3$ is removed by clarification and the effluent is discharged.

Table VII - 10 gives anticipated values of lime required for phosphorous removal. These values are general ranges. Determination of lime dose requirements must be performed in the laboratory or in field pilot work to assure effective phosphorous removal.

Process Scheme	Lime Dose (mg/l)
Primary	
a. Low Lime	150 - 250
b. High lime	300 - 500
Secondary Effluent	250 - 350

Table VII - 10

Dose Range of Lime for Phosphorous Removal

3) Equipment Requirements.

a) Coagulant Mixing - The coagulants, mineral salts or lime shall be thoroughly mixed with the waste stream prior to the flocculation chamber. Acceptable means include flash mixers, high velocity pipe lines, or other methods demonstrating good mixing capabilities.

Flash mixers shall be designed for a retention time of 20 to 60 seconds.

b) Flocculator - The flocculation basin (clarifier or aeration basin) shall be designed to provide sufficient time for chemical precipitation of the phosphorous compounds. Five minutes is generally sufficient to assure floc formation.

The design shall assure a gentle delivery of the flocculated wastewater to the clarification basin.

c) Recarbonation - Addition of CO_2 to the waste stream for pH adjustment may be performed by on-site generation or by gas CO_2 systems.

d) Chemical Equipment and Handling - The EPA Process Design Manual for Phosphorous Removal, as well as chemical feed equipment manufacturers and chemical companies, should be consulted when designing chemical feed systems.

All necessary precautions should be taken to assure operator safety in handling and operating chemical storage and feed systems.

b. Nitrification Facilities - The nitrification facility is comprised of additional aeration tanks with clarification following the activated sludge or trickling filter process.

1) Design Criteria - Table VII - 11 gives tabulated criteria for design of nitrification systems based upon actual pilot plant studies. It is recommended that pilot plant testing be performed to varify these loadings for the specific plant design.

2) Basin Configuration - The basin configuration and physical features shall follow the guidelines established in Section F.

Tanks may be designed for either diffused-air or mechanical aeration systems.

a) pH Control - Consideration should be given to providing facilities for pH adjustment. Continuous pH monitoring shall be provided at the effluent port of each aeration basin.

Figure VII - 13 shows the permissible volumetric loading of the nitrification tank at pH 8.4 and at various temperatures and MLVSS concentrations. Figure VII - 14 shows the corrections that must be applied to the permissible loadings when the pH is different than 8.4.

Parameter	Value Range
Basin Influent BOD (mg/l)	50
Size	See Figure VII - 14
MLVSS (mg/l)	1500 - 2500
pH	8.3 - 8.7
D.O. (mg/l) Avg. flow	3.0
Peak flow	1.0
Clarification Basin	
Hydraulic Loading (gpd/sf)	400 - 600
Side Water Depth (ft)	12 - 15

Table VII - 11

Nitrification System Design Criteria

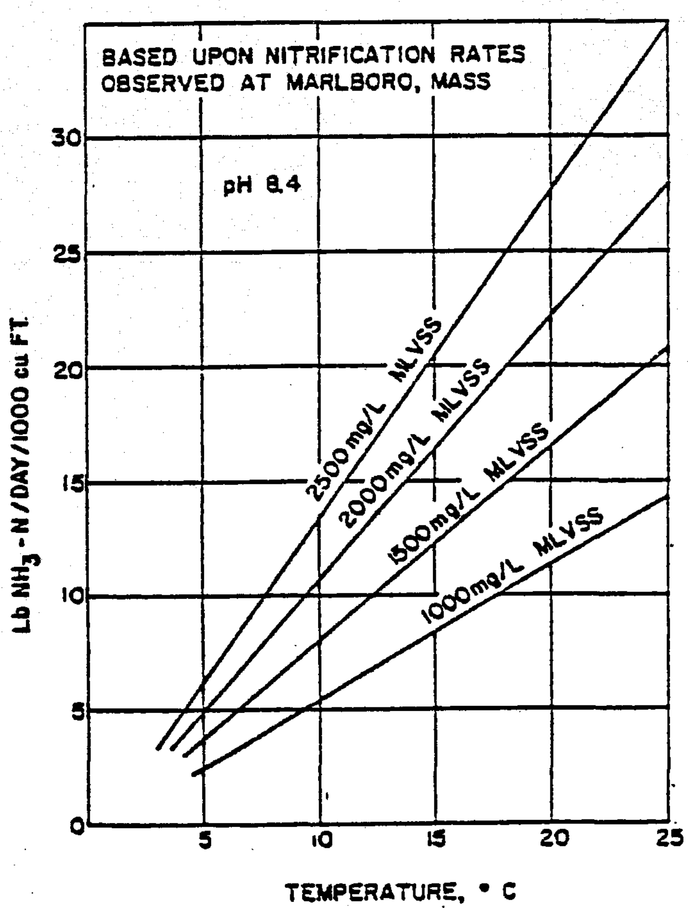


Figure VII - 13

Permissible nitrification-tank loadings.

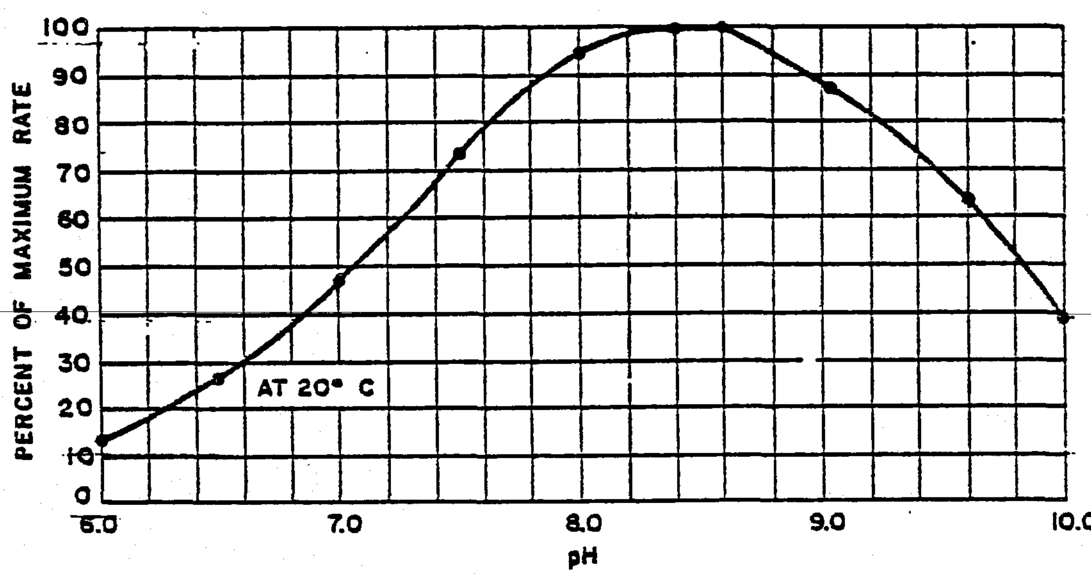


Figure VII - 14

Percent of maximum rate of nitrification at constant temperature versus pH.

3) Oxygen Requirements - Stoichiometrically, each pound of ammonia nitrogen requires 4.6 pounds of oxygen.

An additional allowance should be made for carbonaceous BOD that escapes from the preceding secondary treatment process.

The total oxygen requirement shall be corrected to meet actual operating conditions of

a) temperature
b) minimum D.O.
c) coefficient of wastewater oxygen-uptake rate (alpha)
d) coefficient of wastewater D.O. saturation (beta)
e) altitude of plant.

4) Sludge Recycle and Wasting - Provisions shall be made to adjust the return sludge rate between 50 and 100 per cent of the average daily flow.

Sludge wasting will be required periodically. Provisions shall be made to dispose of the waste nitrification sludge with the waste sludge from the carbonaceous treatment process.

5) Foam Control - Foam spray systems shall be provided on basins where MLSS concentrations will be greater than 2000 mg/1.

6) Inhibiting Factors - The following substances have been found to inhibit the nitrification process in concentrations greater than those indicated:

Substance	Concentration (mg/1)
Halogen substituted phenolic compounds (mg/1)	0
Thiourea and thiourea derivatives (mg/1)	0
Halogenated solvents (mg/1)	0
Heavy metals, (mg/1)	10
Phenol and Creasol, (mg/1)	20
Cyanides (mg/1)	20

c. Denitrification - The denitrification process consists of contacting the nitrified waste stream with methyl alcohol in a reaction vessel followed by short term aeration prior to clarification.

1) Design Criteria - Table VII - 12 gives tabulated criteria for the design of denitrification systems. Pilot plant testing should be performed to verify these loadings for the specific project.

2) Basin Configuration - The basin configuration and physical features shall follow the guidelines established in Section F. Basins should be plug flow designed to minimize short circuiting.

Parameter	Value Range
Basin	
Size	See Figure VII 17
MLVSS mg/1	1000 - 3000
pH	6.5 - 7.5
Methanol to Nitrate Nitrogen Ratio	3 - 4
Clarification Basin	
*Hydraulic Loading (gpd/sf)	1200
Side Water Depth (feet)	12 - 15

* at peak load conditions

Table VII - 12

Denitrification System Design Criteria

Figure VII - 17 shows the permissible volumetric loading of the denitrification basin as related to MLVSS concentrations and operating temperatures. Figure VII - 16 shows the correction that must be applied to the permissible loading when the pH is not in the optimum range.

a) pH Control - Consideration should be given to providing facilities for pH adjustment. Continuous pH monitoring shall be provided at the effluent port of each basin channel.

b) Basin Mixing - The contents of the denitrification tank shall be mixed with underwater mixers comparable to those used in flocculation basins in water treatment tanks. The mixing shall be designed to keep the MLSS in suspension without pickup of atmospheric oxygen.

Power requirements generally range from .25 to .5 hp per thousand cubic feet for proper mixing.

3) Aeration - Prior to clarification, degasification via aeration shall be required to prevent nitrogen gas bubbles from interferring with sludge settling. The aeration basin shall be designed to provide 5 to 10 minutes detention at peak flow.

Either diffused or mechanical aeration will be acceptable for degasification. Aeration and mixing capabilities of the aeration equipment shall be in compliance with the regulations in Section F.

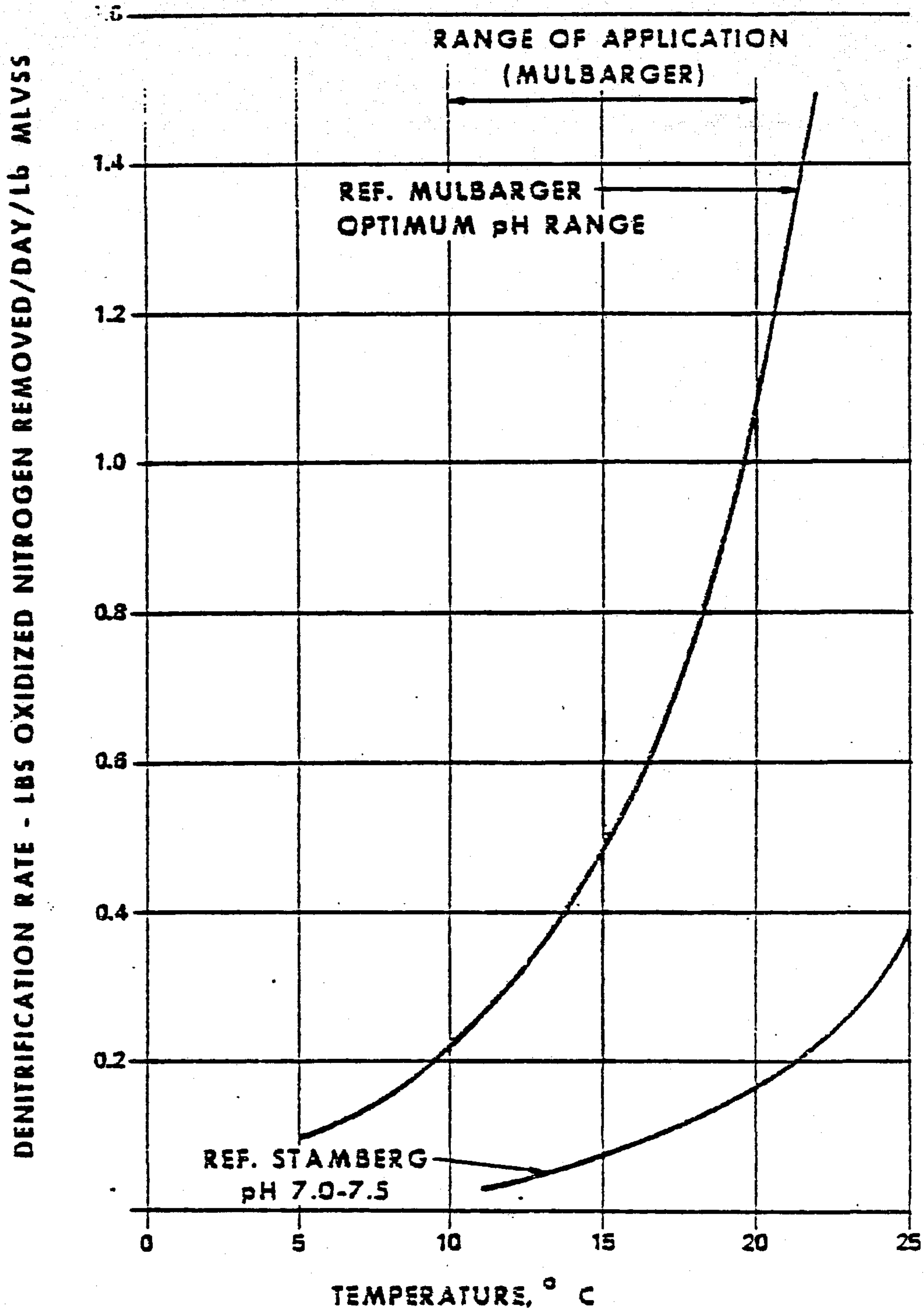


Figure VII - 15

Effect of Temperature on Rate of Denitrification.

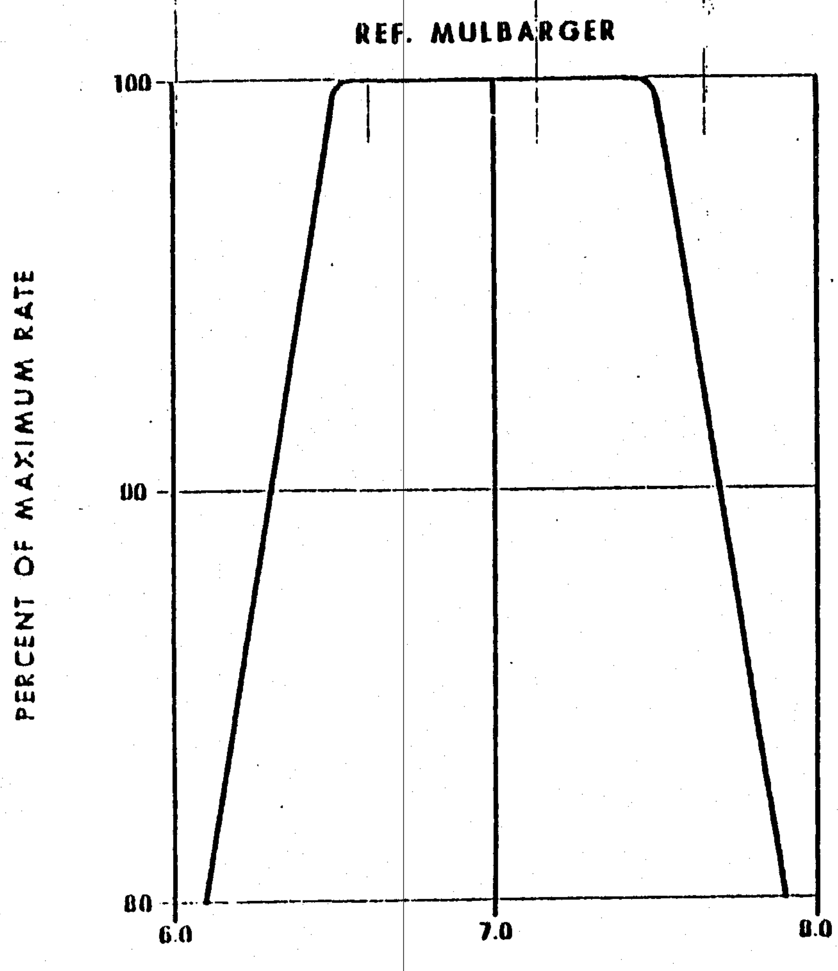


Figure VII - 16

Percent of maximum rate of denitrification versus pH.

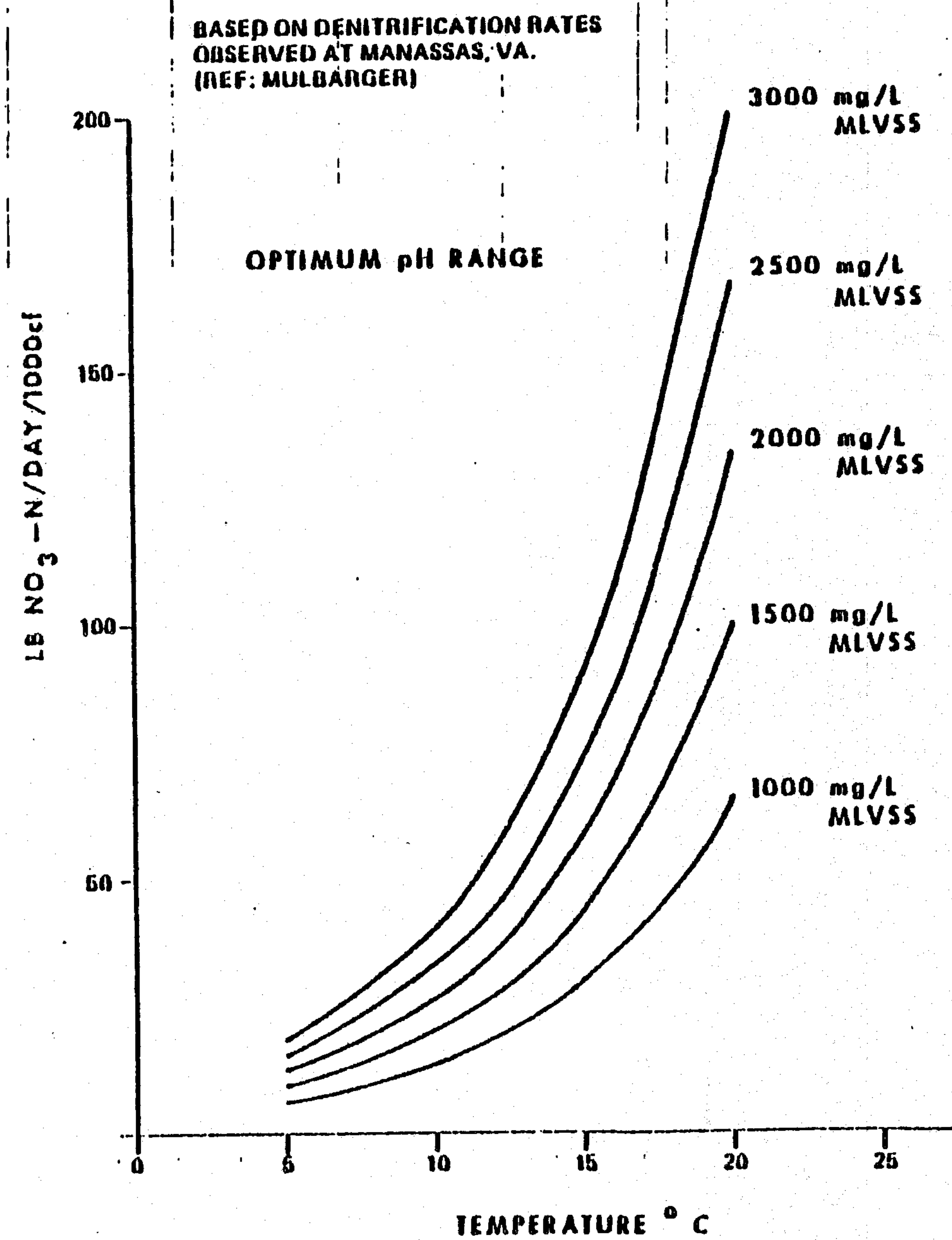


Figure VII - 17

Permissable denitrification-tank loadings.

4) Sludge Return and Wasting - Provisions shall be made to vary the return sludge rate between 50 and 100 per cent of the average daily flow.

Sludge wasting will be required periodically. Provisions shall be made for wasting sludge to the carbonaceous sludge scheme. The waste sludge line should also be designed to transport sludge to the nitrification basin when desired.

d. Ammonia Removal.

1) Air Stripping.

a) General - Ammonia stripping consists of a process which

(1) raises the pH of the effluent to values in the range of 10.8 to 11.5.

(2) allowing formation and reformation of water droplets in a stripping tower.

(3) providing air-liquid contact and droplet agitation by high volume air circulation through the tower.

b) Design Criteria - Typical design criteria for ammonia removal using the air stripping tower is given in Table VII - 13.

c) Equipment Requirements.

(1) Tower - Two basic types of stripping towers may be used in the ammonia removal process.

(a) countercurrent
(b) cross flow

Parameter	Value
Hydraulic Loading	1 - 3 gpm/ft^2
Air-to-water ratio	300 - 500 ft^3/min per gpm
Air pressure drop	0.5 to 1.25 inches water
Fan tip speed	9000 to 12000 fpm
Packing depth	20 - 25 ft.
Packing spacing	2 - 4 inches horizontal and vertical
Packing material	Wood, plastic

Table VII - 13

Recommended Design Criteria
Ammonia Removal Air Stripping Towers

(2) Air-Liquid Distribution - The tower shall be designed to provide uniform distribution of liquid and air over the tower area.

(3) pH Elevation - Adequate chemical feed systems shall be provided to raise the influent stream to the tower to pH 11.0. The Engineer shall provide complete analysis of buffer capacities, alkalinity, and other pertinent waste characteristics as part of the design report.

(4) Access - Access shall be provided to the tower packing for cleaning and descaling. High pressure cleaning equipment shall be provided to assist in descaling operation.

2. Organic Removal.

a. Carbon Adsorption.

1) Use Requirements - There are currently two approaches for the use of granular activated carbon in wastewater treatment.

a) Activated carbon may be employed in a "tertiary" treatment sequence following conventional primary and biological treatment. Tertiary treatment processes using carbon range from secondary effluent treatment with activated carbon only to systems employing chemical clarification, nutrient removal, filtration, carbon adsorption and disinfection.

b) Activated carbon may be employed in a "physical-chemical" treatment process in which raw wastewater is treated in a primary sedimentation unit with chemicals prior to carbon adsorption.

2) Design Criteria - Table VII - 14 presents general design criteria which should be used in designing carbon adsorption columns using granular activated carbon.

In-depth discussion of carbon adsorption design is found in the EPA Technology Transfer publication, "Process Design Manual for Carbon Adsorption."

3) General Structural Requirements.

a) Number of Columns - A minimum of two columns (or pairs of columns) shall be provided to assure adequate treatment with one column (or pair of columns) out of service for repairs.

b) Gravity vs. Pressure - Either gravity or pressure carbon columns will be acceptable.

c) Flow Distribution and Collection Requirements - The columns shall be designed to assure good distribution and collection of the water at the inlet and outlet of the carbon column.

Parameter	Downflow	Upflow
Flow rate/column (GPM/SF)		
Average	3 - 9	3 - 6
2-hour peak	8	5 - 15
Retention Time (Total Treatment)		
(minutes)		
Low quality (COD 20 mg/1)	30	7.5 - 30
High quality (COD 20 mg./1)	30	
Bed Depth (feet)	8 - 10	5 - 20
Carbon Size (mesh size granules)	8 x 30, or	
	12 x 40	12 x 40
Backwash Frequency		
Headloss (feet)	6	
Minimum	once daily	
Air Backwash		
Rate (scfm/sf)	3	3 - 5
Duration Time (minutes)	5 - 10	5
Water Backwash (gpm/sf)	14 - 18	15 - 20
	15 - 20	15 - 20
Carbon Capacity (lb COD/lb Carbon)	15 - 20	15 - 20
High quality effluent	0.5 lb	1.0
Low quality effluent	1.0	
Tertiary system	0.5	

Table VII - 14

Recommended Carbon Adsorption Design Criteria

In open columns of design similar to gravity filters, the backwash collection troughs shall be covered with a screen to prevent loss of carbon during backwash.

d) Depth to Diameter Ratio - With good design of the flow distribution and collection system, the depth to diameter ratio is not critical but should not be less than 1:1.

Columns using the media as a means of flow distribution should be designed with a depth to diameter ratio greater than 4:1 to prevent short circuiting.

4) Carbon Regeneration - Since organic saturation of carbon beds occurs, the Engineer should investigate the feasibility of carbon regeneration. The best means of restoring the adsorptive capacity of carbon is by thermal regeneration. By heating the carbon in a multiple hearth incinerator at temperatures of 1650° to 1750°F and providing a low oxygen steam atmosphere, carbon can be restored to near virgin adsorptive capacity with only 10 - 15 per cent burning and attrition loss. The Engineer should design these systems with the aid of the multiple hearth incinerator manufacturers.

J. FILTRATION.

There are a number of different types of filters using sand and other media that can be used to improve the quality of the sewage treatment plant effluent. The size of the waste treatment facility and the quantity of flow to be filtered will dictate which type would be most suitable.

Filtration devices are generally gravity fed or pressure fed vessels.

1. Gravity Filters.

a. Use Requirements - Gravity filters are classified as intermittent slow filters and rapid filters.

Intermittent filtration is generally used in smaller plants for effluent polishing. Rapid filtration is generally used in intermediate to large facilities for suspended solids removal and effluent polishing.

b. Number of Units - Intermittent gravity filters shall be designed in duplicate to provide for maintenance and continuous treatment while one unit is out of service.

The rapid rate filter systems shall be designed to provide a total filtration capacity equal to the maximum anticipated flow with at least one of the largest filters out of service. In no case shall less than two (2) filters be provided. Consideration will be given to automatic backwash systems on plants less than 250,000 gpd capacity which briefly ($<$15 minutes) interrupt the filter operation during backwash.

c. Intermittent Sand Filtration.

1) Design Loading - The surface loading rate of biologically treated effluents shall not exceed 800,000 gpd per acre.

2) Media - The media shall consist of sand and gravel which is clean graded. The media shall be placed in a minimum of 3 layers of gravel, topped with a layer of sand, as required by Table VII - 15.

The layer of gravel around the underdrains shall be placed to a depth of at least 6 inches over the top of the underdrains.

Layer	Media Size	Depth
Bottom (Layer 1)	¾" - 1 ¼"	12"
Layer #2	¼" - ¾"	6"
Layer #3	⅛" - ¼"	6"
Sand	E.S. - .3 to .6 mm U.C. - less than 3.5	24"

Table VII - 15

Intermittent Sand Filter Media Requirements

3) Dosing.

a) Volume - A dosing tank shall be provided such that the filter bed will be covered to a depth of 2 to 4 inches by each dose.

b) Siphon - The siphon shall have a discharge capacity, at minimum head, at least 100 per cent in excess of the maximum rate of inflow to the dosing tank and, at average head, at least 1 cubic foot per second per 5000 square feet of each filter bed.

c) Siphon Discharge Lines - The siphon discharge lines to the beds shall have sufficient capacity to permit the full rated discharge of the siphons through the drawing head range.

4) Distribution and Underdrains.

a) Arrangement - Troughs or piping used for distribution of the secondary effluent over the filter surface should be so located that the maximum lateral travel is not more than 20 feet. Provisions should be made at each discharge port for adjustment of the flow.

b) Splash Slabs - Splash slabs are required at each point of discharge.

c) Drain - A drain opening from troughs or discharge piping shall be required.

d) Underdrains - Open jointed or perforated vitrified clay, concrete, or PVC pipe may be used for the underdrains. The piping shall be sloped to the outlet and shall be spaced not more than 10 feet between centers.

The soil base of the filters shall be sloped to the underdrain trenches. Asphalt or other impervious materials are acceptable base alternatives and may be required to protect the ground water quality.

d. Rapid Rate Filtration.

1) Design Loading - Table VII - 16 gives the tabulation of recommended design criteria for the rapid rate gravity filter as related to media employed.

2) Basin Configuration.

a) Length, Width, and Depth - The rapid filters are usually rectangular in shape with a length to width ratio of 1.25 to 1.0.

The depth of the filter unit should be as shallow as possible and be controlled by the minimum permissible distance from filter bottom to freeboard required above the wash water trough or by the maximum operating head of the filter. The overall depth of a filter unit is generally in excess of 8 feet.

b) Wash Water Troughs - Wash water troughs shall be arranged so that the horizontal flow distance is less than 3 feet for any one gutter. The edge-to-edge distances of parallel gutters should therefore not exceed 6 feet.

All troughs shall be set at the same elevation with overflow weirs along gutter edges by level.

The trough weir shall be located so that loss of sand during backwash will be minimized. The bottom of the wash water trough shall be at least 12 inches above the unexpanded bed.

c) Filter Underdrainage - Filter underdrains shall be placed in a manner such that the rate of removal of filtered water be uniform over the entire filter bottom and that the backwash water be distributed uniformly.

d) Rate Controllers - All filtration units shall be equipped with suitable rate control devices for providing a constant rate or variable declining rate to the unit.

Table VII - 16

Recommended Design Criteria
Rapid Rate Gravity Filter

Characteristic	Value: Range	Value: Typical
Single-Media		
Sand:		
Depth, in.	10 - 36	24
Effective Size, mm.	0.5 - 0.6	0.5
Uniformity Coefficient	1.2 - 1.8	1.6
Filtration Rate, gpm/sf	12 - 5	3
Water Backwash Rate, gpm/sf (minimum 50% Bed Expansion)	12 - 18	15
Air Backwash Rate, scfm/sf	3 - 5	3
Dual-Medium		
Anthracite:		
Depth, in.	8 - 24	18
Effective Size, mm.	0.8 - 2.0	1.2
Uniformity Coefficient	1.4 - 1.8	1.5
Sand:		
Depth, in.	10 - 24	12
Effective Size, mm.	0.3 - 0.8	0.5
Uniformity Coefficient	1.2 - 1.6	1.4
Filtration Rate, gpm/sf	2 - 10	6
Water Backwash Rate, gpm/sf	13 - 18	15
Air Backwash Rate, scfm/sf	3 - 5	3
Multi-Medium		
Anthracite		
Depth, in.	8 - 20	15
Effective Size, mm.	1.0 - 2.0	1.4
Uniformity Coefficient	1.4 - 1.8	1.5
Sand:		
Depth, in.	8 - 16	12
Effective Size, mm.	0.4 - 0.8	0.6
Uniformity Coefficient	1.2 - 1.6	1.4
Gannet:		
Depth, in.	2 - 4	3
Effective Size, mm.	0.2 - 0.6	0.3
Uniformity Coefficient		1.0
Filtration Rate, gpm/sf	2 - 12	6
Water Backwash Rate, gpm/sf	13 - 20	15
Air Backwash Rate, scfm/sf	3 - 5	3

Filter Pipe	Velocity (fps) Min.	Max.
Influent	1.25	2.5
Effluent	2.1	4.2
Rewash	8.0	10.0
Backwash	8.0	12.0
Surface Wash	8.0	12.0
Backwash Waste	4.0	6.0

Table VII - 17

Recommended Velocities for Filtration Piping

e) Back Wash Water System - All rapid filtration units shall be equipped with an air scour or mechanical scour method for filter cleaning at 50 per cent bed expansion.

f) Recommended Pipe Velocities - Average and maximum flow velocity guides for sizing piping on filter plants are tabulated in Table VII - 17.

g) Sampling - The filter shall be equipped with sampling ports or taps at the inlet and discharge.

3) Chlorination - Consideration should be given to the addition of chlorine to the filters.

4) Disposal of Wash Water - Dirty wash water generated during backwash shall be collected in a storage basin and shall be metered to the headworks of the waste treatment facility or sludge stabilization process.

The return rate to the headworks shall not exceed 15 per cent of the average design flow and shall be considered as part of the hydraulic and organic plant loading.

2. Pressure Filtration.

a. Use Requirements - Pressure filters are generally used on facilities where high terminal headlosses are expected (15 - 20 ft) or where the additional head will permit flow to pass through downstream units without repumping. They are most commonly used in small-to-medium sized treatment plants where premanufactured units are economical.

b. Design Criteria - The design criteria for pressure filters follows the recommended criteria set forth in Table VII - 16.

c. Basin Configurations - Pressure filters are generally premanufactured items. Basin sizes and appurtenant structures should be as recommended by the equipment manufacturer.

The basic operation of the pressure system will follow the sequence of the rapid rate system. Cleaning and backwashing requirements are also similar.

d. Chlorination - Consideration should be given to chlorinating the filters.

e. Disposal of Wash Water - Dirty wash water generated during backwash shall be collected in a storage basin and shall be metered to the headworks of the waste treatment facility.

The return rate to the headworks shall not exceed 15 per cent of the average design flow and shall be considered as part of the hydraulic and organic plant loading.

f. Controls - The pressure filters shall be provided with the necessary controls to provide automatic operation, including a 50 per cent bed expansion backwash. The controls may be based upon pressure differential or time clock. The piping inlet and outlet shall be provided with a pressure gauge.

g. Sampling - The filter shall be equipped with sampling ports or taps at the inlet and discharge.

K. WASTEWATER LAGOONS AND PONDS.

A lagoon is defined as a discharging reservoir used for stabilizing or treating raw or partially treated wastewater by natural biological processes. A pond is defined as a reservoir used for holding, storing, and/or treating and disposing of wastewater and/or wastewater effluent.

1. Lagoons.

a. Use Requirements - Waste treatment lagoons can be divided into three basic types: 1) aerobic, 2) aerobic-anaerobic, 3) anaerobic.

Table VII - 18 itemizes the use requirements of each type and the estimated effluent characteristics from flow-through lagoons expressed in terms of effluent suspended solids and influent BOD_5. The Table shows a range of values because the effluent composition will vary with lagoon locality and mode of operation.

b. Design Parameter vs. Lagoon Type - Table VII - 19 gives recommended design limits for lagoon systems by lagoon type.

Types of Lagoons and Lagoon Systems	Application	Effluent Characteristics				
		Suspended solids, mg/liter*			BOD_5, mg/liter†	
		Algae $(BOD_5)_i$	Micro-organisms $(BOD_5)_i$	Other $(SS)_i$	Soluble $(BOD_5)_i$	Suspended $(SS)_e$
Aerobic (6-18 in. deep)	Nutrient removal, treatment of soluble organic wastes, production of algal cell tissue	0.5-1.2	0.2-0.5	Low	0.02-0.1	0.3-1.2
Aerobic (up to 60 in. deep)	Treatment of soluble organic wastes and secondary effluents	0.4-1.0	0.2-0.5	Low	0.02-0.1	0.3-1.0
Aerobic-anaerobic (oxygen source: algae)	Treatment of untreated screened or primary settled wastewater and industrial wastes	0.2-0.8	0.2-0.5	0.1-0.4	0.02-0.1	0.3-1.0
Aerobic-anaerobic with and without effluent recirculation (oxygen source: surface aerators)	Treatment of untreated screened or primary settled wastewater and industrial wastes	0.02-0.1	0.2-0.5	0.1-0.4	0.02-0.1	0.3-0.8
Anaerobic	Treatment of domestic and industrial wastes	...	0.1-0.3	0.3-0.5	0.05-0.2	0.3-0.8
Anaerobic + aerobic-anaerobic with recirculation from aerobic-anaerobic to anaerobic	Complete treatment of wastewater and industrial wastes	...	0.2-0.5	0.05-0.15	0.05-0.1	0.3-0.8
Anaerobic + aerobic-anaerobic + aerobic pond system with recirculation from aerobic to anaerobic	Complete treatment of wastewater and industrial wastes with high bacterial removals	0.05-0.1	0.02-0.05	0.03-0.1	0.02-0.1	0.3-1.0

* Effluent suspended solids are composed of algae and other microorganisms, which are estimated in terms of influent $(BOD_5)_i$ and a fraction of the influent suspended solids $(SS)_i$.

† Effluent BOD_5 is composed of a fraction of the soluble influent BOD_5 $(BOD_5)_i$ plus a contribution from the effluent suspended solids $(SS)_e$.

Table VII - 18

Application and Effluent Characteristics of Various Types of Stabilization Lagoons and Lagoon Systems

Parameter	Aerobic High rate	Facultative	Aerobic - Anaerobic		Anaerobic
Lagoon Cell Size, Acres (Max.)	10	10	10	10	2.0
Operation	Series or Parallel	Series or Parallel	Series or Parallel	Series or Parallel	Series
Detention time, days	—	10 - 40	7 - 30	7 - 20	20 - 50
Depth, ft.	1 - 1.5	3 - 4	3 - 6	3 - 15	8 - 15
pH	6.5 - 10.5	6.5 - 10.5	6.5 - 9.0	6.5 - 8.5	6.8 - 7.2
Temperature range, °C	0 - 40	0 - 50	0 - 50	0 - 50	6 - 50
Optimum temperature, °C	20	20	20	20	30
BOD_5 Loading, lb/acre/day	30 - 200	15 - 120	15 - 50	30 - 100	200 - 500
BOD_5 Conversion	80 - 95	80 - 95	80 - 95	80 - 95	50 - 85
Recirculation	yes	yes	yes	yes	—
Principal Conversion Products	Algae, CO_2, bacterial cell tissue	Algae, CO_2, bacterial cell tissue	Algae, CO_2, CH_4, bacterial cell tissue	CO_2, CH_4, bacterial cell tissue	CO_2, CH_4, bacterial cell tissue
Algal Concentration, mg/l		80 - 200	40 - 160	10 - 40	—
Primary Oxygen Source	Algae	Algae	Algae	Mechanical or Diffused Aeration	—

Table VII - 19

Design Criteria - Wastewater Lagoons

1) Aerobic Lagoon Design - The design of an aerobic lagoon requires that the oxygen resources of the pond be equated to the applied organic loading. The principal source of oxygen in the aerobic lagoon is photosynthesis which is governed by solar energy.

The yield of oxygen can be estimated with the following equation:

$$Y_{O_2} = 0.25FS_{avg}$$

where,

Y_{O_2} = oxygen yield, lb O_2/acre/day

F = oxygenation factor

S_{avg} = solar radiation, cal/cm^2-day (varies with latitude) - See Table VII - 20.

The oxygenation factor is a representation of the ratio of the oxygen produced to the BOD that will be satisfied in the pond. The use of F of 1.6 will assure BOD removals of from 85 to 90 per cent.

The organic surface loading expressed in lb. BOD/acre/day can be obtained through the following equation:

$$L_o' = C' \left(\frac{d'}{t}\right) BOD_L$$

where,

L_o' = organic loading, lb. BOD/acre/day

C' = conversion factor, 0.226

d' = pond depth, inches

t = retention time, days

BOD_L = ultimate BOD, mg/l

By equating oxygen yield to organic loading, the following equation results, which can be used in the design of aerobic lagoons:

$$\frac{d'}{t} = 1.1 \frac{FS_{avg}}{BOD_L}$$

Values of S may be found from Table VII - 20.

For any worst winter and/or summer month in Arizona, a P = 75 should be used for design.

The design procedure shall be to:

Latitude deg. N.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
30 Max.	136	176	218	261	290	296	289	271	231	192	148	126
Min.	76	96	135	151	184	163	178	166	147	113	90	70
32 Max.	124	166	211	245	269	296	289	268	226	184	137	114
Min.	66	87	126	145	178	165	177	162	140	104	81	21
34 Max.	113	157	203	229	288	297	289	265	220	176	127	102
Min.	57	79	119	140	174	167	175	158	133	96	71	22
36 Max.	102	148	195	213	287	297	288	263	214	168	116	90
Min.	48	69	111	135	170	169	174	154	126	88	61	22
38 Max.	91	139	188	197	286	298	288	260	208	160	105	78
Min.	39	61	103	130	166	171	173	150	119	80	51	23
40 Max.	80	130	181	181	286	298	288	258	203	152	95	66
Min.	30	51	95	125	162	173	172	147	113	72	42	24

$S_{avg} = S_{min} + P(S_{max} - S_{min})$
where P = total hours sunshine divided by total possible hours sunshine

Table VII - 20

Probable Values of Visible Solar Energy as a Function of Latitude and Month

a) Determine average minimum and maximum solar radiation.
b) Determine retention times during winter and summer.
c) Determine lagoon surface area requirements.
d) Determine organic surface loading.

2) Aerobic-Anaerobic Lagoon Design - Proper design of aerobic-anaerobic lagoons requires consideration of:

a) BOD removal characteristics
b) biological oxygen requirements
c) oxygen transfer
d) basin geometry
e) sludge production

The design of the aerobic-anaerobic lagoon is based upon the principle of the BOD mass balance for a lagoon operating at steady state conditions.

$$\text{lb BOD removal/day} = \text{lb BOD}_{in}\text{/day} - \text{lb BOD}_{out}\text{/day}$$

Assuming that loss or gain of water in evaporation, percolation, and precipitation is small and can be neglected, the mass balance equation can be written methematically as

$$MV' = C_iQ - C_eQ$$

where,

M = BOD removal rate, pounds per day

V' = lagoon volume, gallons

Q = flow rate of sewage, MGD

C_i = BOD_{in}, pounds

C_e = BOD_{out}, pounds

All BOD is 5-day, 20°C.

The power required to surface mix the aerobic-anaerobic lagoon may be from atmospheric conditions or mechanical aeration. In either case the efficiency of BOD removal based upon first-order kinetics is:

$$\%\ \text{removal} = \frac{C_e}{C_i} = 100 - \frac{100}{1 + K_t t}$$

where,

K_T = BOD removal rate coefficient at temperature T (°C)

t = retention time, days

Since the designer generally knows the percentage of removal desired and wishes to solve for the retention time necessary to achieve this removal, the equation is rearranged:

$$t = \frac{\%\ \text{removed}}{(100 - \%\ \text{removed})K_T}$$

A K_T value of 0.25^{-1} at 20°C (K_{20}) should be used for design of lagoons treating domestic wastes.

Since K_T varies with temperature, the reaction rate must be converted to the rate constant of the system under design according to the equation:

$$K_T = K_{20}\ \theta^{(T - 20)}$$

where,

K_{20} = 0.25 day^{-1} (domestic waste only)

θ = 1.058

T = temperature (°C) of designed system

K_T = rate constant at T°C

The lagoon system must also be designed as a reactor with axial dispersion, first-order kinetics, and arbitrary entrance and conditions.

Figure VII - 18 shows a plot of BOD removal for axial dispersion factors varying from zero (0) for an ideal plug-flow reactor to infinity (∞) for a complete-mix reactor. Lagoons should be designed using dispersion factors of 0.1 to 2.0. It is recommended that a d = 1.0 be used for atmospheric oxygen transfer at shallow depths (3.0 feet) and that a d = 0.5 be used in the design of mechanically aerated lagoons of depths in the order of 6 feet. Lagoons deeper than 10 feet should use a d = 0.0625.

The design procedure shall be to:

a) based upon the lagoon depth and loading characteristics, select the dispersion factor.

b) from Figure VII - 18, determine the value of $K_T t$ for the selected dispersion factor and the desired efficiency.

c) determine the winter and summer reaction rate constants.

d) determine the winter and summer retention times.

e) determine the lagoon volume and surface area requirements, summer and winter.

f) Determine the horsepower requirements for surface aeration. Check the horsepower input to determine if complete mixing will occur. Note: Complete mixing should not occur in a properly designed aerobic-anaerobic lagoon.

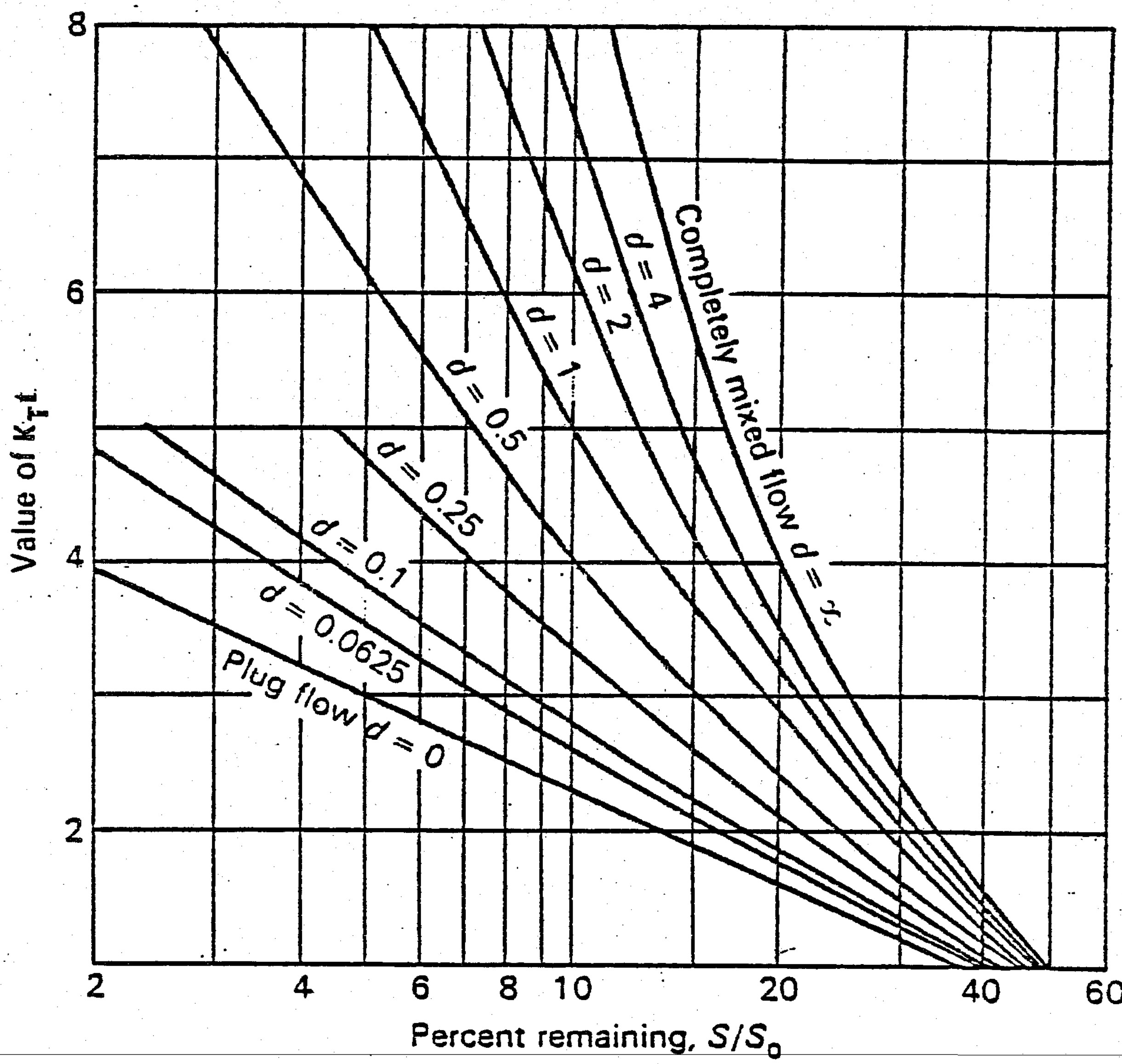


Fig. VII - 18

Values of $K_T t$ vs. % Remaining
For Various Dispersion Factors
In Lagoon Design

3) Anaerobic Lagoon Design - Anaerobic lagoon should be designed using the basic principles of anaerobic digestion. The anaerobic lagoon is essentially a large unheated unmixed digester; therefore, the basic design should follow that found in the anaerobic digestion design criteria in Section L.

c. Industrial Wastes - Due consideration shall be given to the type and affects of industrial wastes on the treatment process.

d. General Design Features.

1) Multiple Units - Multiple cells designed to permit both series and parallel operation are required for all installations. This flexibility is desirable when loadings are light or when a community is installing a new sewer system, since in the period preceding substantial connections, the entire discharge can be put into a single cell, thus facilitating the maintenance of satisfactory water levels. In addition, when a low algae content in the effluent is desired, the cells may be advantageously operated in parallel during fall, winter, and spring when algae development is less intensive and in series during the summer months. Series operation is also beneficial where a high level of BOD or coliform removal is important.

Where a greater degree of treatment is necessary or desirable, or more cells in series may be added to the primary cell. The primary cell, when designed for series operation, should be designed to handle the maximum loading.

2) Lagoon Shape - The shape of all cells should be such that there are no narrow or elongated portions. Round, square, or rectangular cells with a length not exceeding 3 times the width are considered most desirable. Dikes should be rounded at corners to minimize accumulations of floating materials.

3) Lagoon Construction Details.

a) Embankments and Dikes - Embankments and dikes shall be constructed of relatively impervious materials and compacted sufficiently to form a stable structure. Soils with a permeability coefficient ranging from 10^{-2} to 10^{-4} cm/sec are considered to be relatively impervious. Vegetation should be removed from the area upon which the embankment is to be placed.

The minimum embankment top width shall be 8 feet to permit access of maintenance vehicles. Lesser top widths will be considered for berms where vehicles will not enter.

Inside and outside embankment slopes shall not be steeper than 3 horizontal to 1 vertical unless sufficient erosion protection is given embankments.

Embankment slopes should not be flatter than:

(1) Inner - 4 horizontal to 1 vertical. Flatter slopes are sometimes specified for larger installations because of wave action but have the disadvantage of added shallow areas conducive to emergent vegetation.

(2) Outer - sufficient to prevent significant volumes of surface water from entering the lagoons.

b) Freeboard - Minimum freeboard shall be 3 feet.

c) Depth - Minimum and maximum depths shall be as allowed in Table VII - 19.

d) Seeding - Embankments shall be seeded from the exterior berm toe to 1 foot above the lagoon high water line measured on the dike slope. Perennial type, low growing, spreading grasses that withstand erosion and can be kept mowed are most satisfacotry for seeding of embankments. In general, alfalfa and other long-rooted crops should not be used in seeding, since the roots of this type plant are apt to impair the water holding efficiency of the dikes. Additional protection for embankments (riprap) may be necessary where the dikes are subject to erosion due to flooding of an adjacent watercourse or internal wave action.

e) Vegetation Control - A method shall be specified which will prevent vegetation growth over the bottom of the lagoon and up to 1 foot above the water line on the dikes.

f) Embankment Compaction - Embankment of earth material shall be placed in horizontal layers not exceeding 8 inches in loose measurement and compacted as follows:

(1) Where embankments 5 feet or less in height are to be constructed, the top 6 inches of the ground on which the embankment material is to be placed shall be compacted to a density of not less than 90 per cent of the maximum density.

(2) Embankment material shall be compacted to a density of not less than 95 per dent of maximum density.

4) Lagoon Bottom - The lagoon bottom shall be as level as possible except at the discharge of the inlet. Finished elevations should not be more than 3 inches from the average elevation of the bottom. Shallow or feathering fringe areas usually result in locally unsatisfactory conditions.

The bottom shall be cleared of vegetation and debris. Organic material thus removed shall not be used in the dike core construction. However, suitable topsoil relatively free of debris may be used as cover material on the outer slopes of the embankment.

The soil formation or structure of the bottom should be relatively tight to avoid excessive liquid loss due to percolation or seepage. Soil borings and tests to determine the characteristics of surface soil and subsoil shall be made a part of preliminary surveys to select lagoon sites. Gravel and limestone areas may be used only where the lagoon system is properly lined.

The ability to maintain a satisfactory water level in the lagoons is one of the most important aspects of design. Removal of porous topsoil and proper compaction of subsoil improves the waterholding characteristics of the bottom. Removal of porous areas, such as gravel or sandy pockets, and replacement with well-compacted clay or other suitable material may be required.

When the wastewater contains toxic substances; where the possibility of ground water contamination exists; or where the soil percolation rate is less than 60 minutes per inch, sealing of the lagoon bottom with a clay blanket, bentonite, or other sealing material shall be required.

Supplementary field survey data including soil borings, and percolation testing shall be submitted to the Department with the final design report for approval,

5) Influent Lines - All types of pipe used in design shall have established ASTM, ANSI, or NSF standards of manufacture.

Influent lines should be located along the bottom of the lagoon so that the top of the pipe is just below the average elevation of the lagoon bottom. This line can be placed at zero grade.

The discharge point of the influent line to a single celled lagoon shall be placed and positioned to minimize short circuiting of the raw wastewater. Each cell of a multiple celled lagoon operated in parallel should have its own near center inlet, but this does not apply to those cells following the primary cell when series operation alone is used. Influent lines or interconnecting piping to secondary cells of multiple celled lagoons operated in series may consist of pipes through the separating dikes. Influent lines to rectangular lagoons should terminate at approximately the third point farthest from the outlet structure. The effluent piping should be located to minimize short-circuiting within the lagoon.

The inlet line shall discharge horizontally into a shallow, saucer-shaped depression. The depth of the depression shall be not more than the diameter of the influent pipe plus 1 foot.

The end of the discharge line should rest on a suitable concrete apron with a minimum size of 2 feet square.

6) Manholes - A manhole shall be installed at the terminus of the outfall line or force main and shall be located as close to the dike as topography permits, and its invert should be at least 6 inches above the maximum operating level of the lagoon to provide sufficient hydraulic head without surcharging the manhole.

   Manholes which accept flow from force mains should provide proper energy dissipation of the incoming waste.

7) Overflow Structures and Interconnecting Piping - Interconnecting piping and overflows should be of cast iron pipe or corrugated metal pipe of ample size. Plastic pipe will not be allowed due to solar radiation deterioration of material.

   Overflow structures should consist of a manhole or box equipped with multiple-valved lagoon drawoff lines or an adjustable overflow device so that the liquid level of the lagoon can be adjusted to permit operational flexibility. The drawoff lines or overflow devices shall be designed to operate at maximum of 1 foot intervals. The lowest of the drawoff lines of such structure should be 12 inches off the bottom to control eroding velocities and to avoid pickup of bottom deposits. The overflow from the lagoon shall be taken 6 inches below the water surface to release the best effluent and insure retention of floating solids. The structure should also have provisions for draining the lagoons.

   When possible, the outlet structure should be located on the windward side to prevent short circuiting. Consideration must be given in the design of all structures to protect against freezing or ice damage under winter conditions. All overflow structures shall have access platforms as required.

8) Interconnecting Piping - Interconnecting piping for multiple unit installations operated in series shall be valved or provided with other arrangements to regulate flow between structures and permit flexible depth control. The interconnecting pipe to the secondary cell should discharge horizontally near the lagoon bottom to minimize need for erosion control measures and should be located as near the dividing dike as construction permits.

9) Flow Measurement - Provisions for flow measurement shall be provided on the inlet and outlet.

10) Depth Control - The Engineer shall make provision for depth control of the lagoon system.

    Optimum liquid depth is influenced to a degree by lagoon area since circulation in larger installations permits greater liquid depths. The basic plan of operation may also influence depth.

Facilities to permit operation at selected depths between the limits shown in Table VII - 19 are required for operational flexibility. Where winter operation is desirable, the operating level can be lowered before ice formation and gradually increased to its maximum depth by retention of winter flows. In the spring, the level can be lowered to any desired depth at the time surface runoff and dilution water are generally at a maximum. Shallow operation can be maintained during the spring with generally increased depths to discourage emergent vegetation. In the fall, the levels can be lowered and again be ready for retention of winter storage.

e. Lagoon Recirculation - Lagoon recirculation involves interlagoon and intralagoon recirculation as opposed to mechanical mixing in the lagoon cell. The effluents from lagoon cells are mixed with the influent to the cells. In intralagoon recirculation, effluent from a single cell is returned to the influent to that cell. In interlagoon recirculation, effluent from another is returned and mixed with influent to the lagoon.

Both methods return active algal cells to the feed area to provide photosynthetic oxygen for satisfaction of the organic load. Intralagoon recirculation allows the lagoon to gain some of the advantages that a completely mixed environment would provide if it were possible in a lagoon. It helps prevent odors and anaerobic conditions in the feed zone of the lagoon.

One objective of recirculation in the series arrangement is to decrease the organic loading in the first cell of the series. While the loading per unit surface is not reduced by this configuration, the retention time of the liquid is reduced. The method attempts to flush the influent through the lagoon faster than it would travel without recirculation. The hydraulic retention time of the influent and recycled liquid in the first, most heavily loaded lagoon in the series system is:

$$t = \frac{V_c}{(1 + r)F'}$$

where V_c is the volume of lagoon cell; F' is the influent flow rate; r, or R/F', is the recycle ratio; and R is the recycle flow rate. R generally varies from 0.5 to 2.0 F'_{avg}.

Another advantage of recirculation in the series configuration is that the BOD_5 in the mixture entering the lagoon is reduced, and is given by the expression:

$$S_m = \frac{S_{in}}{1 + r} = \left(\frac{r}{1 + r}\right) S_3$$

where S_m is the BOD of the mixture, S_3 is the effluent BOD_5 from the third cell, and S_{in} is the influent BOD_5. Thus, S_m would be only 20 per cent of S_{in} with a 4:1 recycle ratio, as S_3 would be negligible in almost all cases. Thus, the application of organic load in the lagoon is spread more evenly throughout the lagoons, and organic loading and odor generation near the feed points are less. Recirculation in the series mode has been used to reduce odors in those cases where the first lagoon is anaerobic.

The parallel configuration more effectively reduces lagoon loadings than does the series configuration, because the mixture of influent is spread evenly across all lagoons instead of the first cell in a series. Recirculation has the same benefits in both configurations.

Recirculation usually is accomplished with high-volume, low-head propeller pumps. Design of the pumping system shall be in accordance with the requirements in Section N. Siphon breaks shall be provided to insure positive backflow protection.

Lagoon configuration should allow full use of the wetted cell area. Transfer inlets and outlets should be located to eliminate dead spots and short circuiting that may be detrimental to photosynthetic processes. Wind directions should be studied, and transfer outlets located to prevent dead pockets where scum will tend to accumulate.

f. Algae Removal - Specific attention shall be given to removing algae from wastewater lagoon effluents. Acceptable methods for achieving algae removal include:

1) Dissolved Air Flotation - Dissolved air flotation is a feasible alternative when coagulating chemicals are employed with the operation. Alum is the primary coagulant used at doses ranging from 125 to 300 mg/l. Overflow rates vary from 1.3 to 4.0 gallons per minute per square foot, while retention times vary from 8 to 17 minutes. Pressurized recycle ranges from 25 to 100 per cent at pressures between 35 and 70 psig. Air to solids ratio generally ranges from 0.05 to 0.10.

2) Centrifugation - Successful algae removal has been achieved by using the centrifugation operation without coagulants. 80 - 90 per cent removal can be achieved on effluent SS of 200 mg/l.

3) Coagulation-Flocculation-Sedimentation - High efficiency of algae removal can be achieved using the coagulation-flocculation-clarification operation. Alum is generally used as the primary coagulant. Doses range from 45 to 500 mg/l. Overflow rates for the sedimentation basins range from 0.2 to 0.8 gpm/ft^2. Tubular settlers have allowed the loading rate to increase to 2.0 - 2.5 gpm/sf. Hydraulic retention times range from 3 to 4 hours for conventional clarification. The flocculation tank design will require retention times of 25 minutes with a G value of 36 to 51 per second. Underflows from the clarifier are generally 1.0 to 1.5 per cent by weight.

Coagulation-Clarification Followed by Filtration - The application of polishing clarification effluent will result in effluent solids less than 10 mg/l. Loading rates of rapid sand or multimedia filters will range from 2.0 gpm/ft^2 to 5.5 gpm/ft^2.

Intermittent Sand Filtration - Intermittent sand filtration is also an acceptable algae removal alternative. Feed SS concentrations of 72 mg/l have been reduced to 4 mg/l with loading rates ranging from 4.6 to 9.2 gpdpsf.

6) Slow Rock Filter - The upflow submerged rock filter has been found to be an effective means of algae removal. A 24-hour hydraulic retention time at a surface loading rate of 0.008 gpm/ft^2 has been used. The unit may be sized using 27 ft^3 of filter volume for 100 gpcpd. River run gravel between 1/2 to 2 inches and crushed rock between 2 - 3 inches may be used as the filter media. The system may be designed to provide a hydraulic flow range between 3 to 7 gallons per day per cubic feet of submerged filter volume.

7) Other Methods - Other methods such as fill-draw ponds, etc. will be considered in accordance with the requirements of Chapter III.

In all cases, it is recommended that pilot studies be employed to establish design criteria for the facility under design.

2. Ponds.

a. Use Requirements and Classification - Ponds are classified into three catagories:

1) evaporation
2) percolation
3) effluent holding

The evaporation pond may be used for raw sewage or sewage effluent. The percolation and effluent holding pond shall only be applied to wastewater effluent.

b. Design Parameters vs. Pond Type.

1) Evaporation Ponds - Evaporation ponds shall be designed using the evaporation data established by Figure VII - 19 and Figure VII - 20. Since localized conditions are not shown in Figure VII - 20, the Engineer shall make necessary adjustments based upon elevation. The pond shall be designed such that periods of high evaporation can be maintained in one basin with subsequent basins in series which will absorb the flow in periods of low evaporation.

Evaporation ponds shall be designed using the principles of mass balance.

$$Q_{in} = Q_{out}$$
$$Q_{in} = Q_{evaporation} - Q_{precipitation}$$

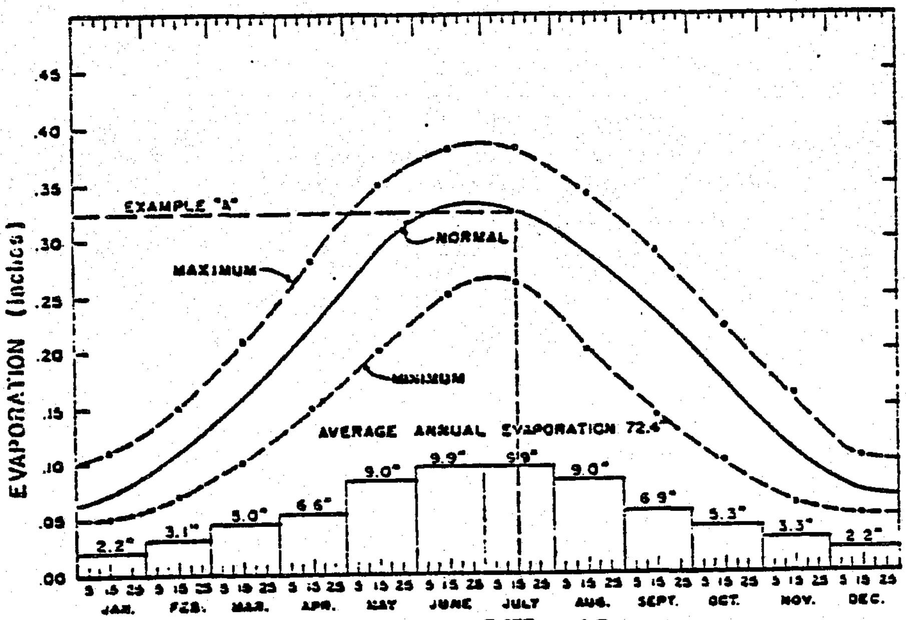


Figure VII - 19

Maximum, Normal and Minimum Daily Evaporation and Average Monthly Evaporation From Open Water Surfaces (Adjustment Factor = 1.00)

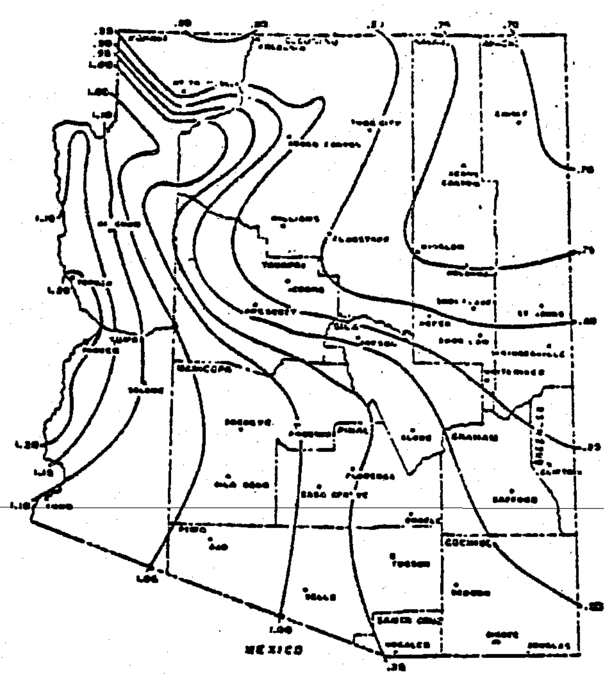


Figure VII **- 20**

Evaporation Adjustment Factors for Arizona

Since evaporation ponds are designed based upon surface area requirements, the depth of the pond is unimportant. The evaporation ponds shall be sealed with pond liners, soil cement, asphaltic material, clay compounds, or other approved sealing methods.

2) Percolation Ponds - Percolation ponds shall not be used for effluent disposal where the possibility of ground water contamination exists. The Engineer shall submit data showing the impact on the ground water using the percolation method.

The percolation pond shall be designed, using principles of mass balance.

$$Q_{in} = Q_{evaporation} - Q_{precipitation} + Q_{percolation}$$

The Engineer shall provide percolation data at the elevation of the pond floor to substantiate design criteria. The percolation data shall be established in a manner which uses only the bottom area of the test hole. The Engineer shall provide the proper number of percolation tests and boring logs, the detailed boring logs, and data regarding location of ground water table as specified in Engineering Bulletin No. 19.

Special attention shall be given to the existing soil conditions and soil chemistry related to the increase of salinity concentration and its affect on the soil and its ability to provide stable percolation.

Provisions shall be made in pond construction to temporarily drain one cell to scarify and renew the bottom surface area without interrupting operation of the pond system.

3) Effluent Holding Basins - Effluent holding basins shall be designed for the full retention intended and shall be provided with an emergency overflow. The basin may be earthen (sealed or unsealed), concrete or constructed of other suitable materials of construction.

When the wastewater contains toxic substances; where the possibility of ground water contamination exists; or where the soil percolation rate is less than 60 minutes per inch, sealing of the lagoon bottom with a clay blanket, bentonite, or other sealing material shall be required.

c. General Features.

1) Pond-Dike Construction.

a) Pond Dikes shall be constructed with a maximum 3:1 slope unless indicated otherwise in this Bulletin.

Pond Type	Minimum Depth	Maximum Depth
Evaporation		
1. Effluent	3	8
2. Raw Waste	3	5
Percolation	3	8
Effluent Holding	3	15

Table VII - 21

Recommended Pond Operating Depths

The dikes shall be protected against wave action erosion from at least 1 foot below the minimum water surface to at least 1 foot above the maximum water surface.

b) The top of the dike shall be at least 8 feet in width.

c) Minimum freeboard shall be 3 feet.

2) Pond Depth - The minimum and maximum depths recommended for each type pond is tabulated in Table VII - 21.

3) Multiple Units - Consideration should be given to assuring operational flexibility by providing multiple pond cells connected in parallel and series. The design shall be such that any unit may be removed from operation without interrupting treatment.

4) Pond Shape - The shape of all cells should be such that there are no narrow or elongated portions. Round, square, or rectangular ponds with a length not exceeding 3 times the width are considered most desirable. Dikes should be rounded at corners to minimize accumulations of floating materials.

5) Influent Lines - Any generally accepted material for underground sewer construction shall be used for the influent line to the pond. The material selected should be adapted to local conditions.

A manhole shall be installed at the terminus of the outfall line or the force main and shall be located as close to the dike as topography permits, and its invert should be at least 6 inches above the maximum operating level of the pond to provide sufficient hydraulic head without surcharging the manhole.

Influent lines should be located along the bottom of the pond so that the top of the pipe is just below the average elevation of the pond bottom. This line can be placed at zero grade.

The inlet line of raw waste evaporative ponds shall discharge horizontally into a shallow, saucer-shaped depression. The depth of the depression shall be not more than the diameter of the influent pipe, plus 1 foot.

The end of the discharge line should rest on a suitable concrete apron with a minimum size of 2 feet square.

6) Flow Measurement - Provisions for flow measurement should be provided on the inlet.

3. Other Requirements.

a. Pond or Lagoon Sealing - Ponds or lagoons may be sealed by chemical or geological means such as soil cement, asphaltic products, special chemicals which seal the pond or lagoon, or by bentonite clay/soil mixture.

In some cases, these methods should only be employed where a constant level in the pond or lagoon will be maintained.

The Engineer should consult the manufacturer of the product and/or a soils engineering laboratory for the proper soil/cement ratio, chemical/soil ratio, or clay/soil ratio in each particular application.

The side slope requirement shall be 3:1 ratio maximum in all cases where chemical or geological sealants are employed.

b. Pond Lining - Where plastic or rubber liners are employed to seal ponds or lagoons, the liner shall be not less than 20 mils in thickness, and should preferrably be 40 mils. Exposed liner materials shall be selected to provide minimum deterioration.

The liners shall extend over the freeboard of the ponds or lagoons, and a positive seal shall be provided at all points requiring a break in the pond lining.

The use of pond liners may enable the Engineer to provide a side slope of greater than 3:1 depending upon soil conditions. In such cases, soils reports shall be submitted to the Department varifying the ability of the soil to maintain such a slope.

A positive means of tiedown of the liner around the top periphery shall be included in the design of the liner application.

L. SLUDGE STABILIZATION.

Digestion, either aerobic or anaerobic, is a means of stabilizing waste solids by long term retention, thereby reducing the BOD and destroying volatile solids.

1. Anaerobic Digestion.

a. Design Criteria - Recommended loadings and retention times for heated digesters are tabulated in Table VII - 22.

b. General Structural Requirements.

1) Multiple Units - Multiple tanks are recommended. Where a single digestion tank is used, it is desirable to have a lagoon or storage tank for emergency use so that the tank may be taken out of service without unduly interrupting plant operations.

Provision for sludge storage and supernatant separation in an additional unit may be required, depending on raw sludge concentration and disposal methods for sludge and supernatant.

2) Depth - The proportion of depth to diameter should be such as to allow for the formation of a reasonable depth of supernatant liquor. Depths normally range from 15 to 30 feet side water depth.

3) Maintenance Provisions - To facilitate emptying, cleaning, and maintenance, the following features are desirable:

a) Slope - The tank bottom shall slope to drain toward the withdrawal pipe. Generally, the bottom slopes are 1 vertical to 6 or more horizontal.

	Conventional Single Stage (Unmixed)	First Stage High-Rate (Complete Mixing)
Loading (lb VS destroyed/ft³ day)	0.02 - 0.05	0.1 - 0.2
Retention Time (days)	30 - 90	10 - 15
Volatile Solids Reduction (%)	50 - 70	50

Table VII - 22

Recommended Anaerobic Digestion Design Criteria

b) Access Manholes - At least 2 access manholes shall be provided in the top of the tank in addition to the gas dome. One opening should preferably be large enough to permit the use of mechanical equipment to remove grit and sand. A separate side wall manhole shall be provided.

c) Cleanouts - Cleanouts shall be provided on the sludge inlets and outlets, sludge recirculation lines, and other piping which may be subject to plugging.

4) Sludge Inlet and Outlets - Multiple sludge inlets and draw-offs and, where used, multiple recirculation suction and discharge points to facilitate flexible operation and effective mixing of the digester contents shall be provided unless adequate mixing facilities are provided within the digester. One inlet should discharge above the liquid level and be located at approximately the center of the tank to assist in scum breakup. Raw sludge inlet discharge points shall be so located as to minimize short circuiting to the supernatant draw-off.

5) Tank Capacity - In recent years, a number of modifications to the conventional anaerobic sludge digestion process have been developed, especially in the area commonly known as "high rate digestion". Design standards, operating data and experience are not well established for some of these modifications. This should be considered in the selection and design of the process modification.

The total digestion tank capacity should be determined by rational calculations based upon such factors as volume of sludge added, its per cent solids and character, the temperature to be maintained in the digesters, the degree or extent of mixing to be obtained, the degree of volatile solids reduction required, and the size of the installation with appropriate allowances for sludge and supernatant storage.

When such calculations are not submitted to justify the design based on the above factors, the minimum combined disgestion tank capacity shall be as follows:

a) Completely Mixed Systems - The system shall be loaded not to exceed 80# VS/1000 cf/day in the active digestion units.

b) Moderately Mixed Systems - The system shall be loaded not to exceed 40 lb VS/1000 cf/day in the active digestion units.

Such requirements assume that the raw sludge is derived from ordinary domestic wastewater, a digestion temperature is to be maintained in the range of 85° to 95°F, 40 to 50 per cent volatile matter in the digested sludge, and that the digested sludge will be removed frequently from the process.

c. Gas Collection, Piping, and Appurtenances - All portions of the gas system including the space above the tank liquor, storage facilities and piping shall be so designed that under all normal operating conditions, including sludge withdrawal, the gas will be maintained under pressure. All enclosed areas where any gas leakage might occur shall be adequately ventilated.

1) Safety Equipment - All necessary safety facilities shall be included where gas is produced. Pressure and vacuum relief valves and flame traps, together with automatic safety shut-off valves, are essential. Water seal equipment shall not be installed.

2) Gas Piping and Condensate - Gas piping shall be of adequate diameter and shall slope to condensation traps at low points. The use of float controlled condensate traps is not permitted.

3) Gas Utilization Equipment - Gas burning boilers, engines, etc. should be located at ground level and in well ventilated rooms. Gas lines to these units shall be provided with suitable flame traps.

4) Electrical Systems - Electrical systems and components (e.g., motors, lights, cables, conduits, switchboxes, control circuits, etc.) in enclosed or partially enclosed spaces where volatile flammable liquids or flammable gases are handled, processed or used but in which the hazardous liquids, vapors or gases normally will be confined within closed containers or closed systems should comply with the National Electrical Code requirements for Class I Division 2 locations.

5) Waste Gas - Waste gas burners shall be readily accessible and should be located at least 25 feet away from any plant structure if placed at ground level, or may be located on the roof of the control building if sufficiently removed from the tank. In remote locations, it may be permissible to discharge the gas to the atmosphere through a return-bend screened vent terminating at least 10 feet above the walking surface provided the assembly incorporates a flame trap.

6) Ventilation - Any underground enclosure connecting with digestion tanks or containing sludge or gas piping or equipment shall be provided with forced ventilation. Ventilation may be either continuous or intermittent. Continuous ventilation should provide at least 6 complete air changes per hour. Intermittent ventilation shall provide at least 30 complete air changes per hour.

All intermittently operated ventilating equipment should be interconnected with the respective lighting system. Consideration should be given also to automatic controls where intermittent operation is used. Switches for operation of ventilation equipment should be marked and conveniently located. Tightly fitting self-closing doors should be provided at connecting passageways and tunnels to minimize the spread of gas.

7) Meter - A gas meter with by-pass should be provided to meter total gas production.

d. Digestion Tank Heating.

1) Insulation - Wherever possible, digestion tanks should be constructed above ground water level and should be suitably insulated to minimize heat loss.

2) Heating Facilities - Sludge may be heated by circulating the sludge through external heaters or by units located inside the digestion tank.

a) External Heating - Piping shall be designed to provide for the preheating of feed sludge before introduction to the digesters. Provisions shall be made in the layout of the piping and valving to facilitate cleaning of these lines. Heat exchanger sludge piping should be sized for heat transfer requirements.

b) Internal Coils - Hot water coils for heating digestion tanks should be at least 2 inches in diameter and the coils, as well as the support brackets and all fastenings, should be of corrosion resistant materials. The use of dissimilar materials should be avoided to minimize galvanic action. The high point in the coils should be vented to avoid air lock.

Other types of heating facilities will also be considered on their own merits.

3) Heating Capacity - Sufficient heating capacity shall be provided to maintain a constant design sludge temperature. Where digestion tank gas is used for other purposes, an auxiliary fuel may be required.

4) Hot Water Internal Heating Controls.

a) Mixing Valves - A suitable automatic mixing valve shall be provided to temper the boiler water with return water so that the inlet water to the heat jacket or coils can be held to below a temperature at which caking will be accentuated. Manual control should also be provided by suitable by-pass valves.

b) Boiler Controls - The boiler shall be provided with suitable automatic controls to maintain the boiler temperature at approximately 180°F to minimize corrosion and to shut off the main gas supply in the event of pilot burner or electrical failure, low boiler water level, or excessive temperature.

c) Thermometers - Thermometers shall be provided to show temperatures of the sludge, hot water feed, hot water return, and boiler water.

5) External Heater Operating Controls - All controls necessary to insure effective and safe operation are required.

6) Digester Mixing - Facilities for mixing the digester contents shall be provided where required for proper digestion by reason of loading rates, or other features of the system.

e. Supernatant Withdrawal.

1) Piping Size - Supernatant piping should not be less than 6 inches in diameter.

2) Withdrawal Arrangements.

a) Withdrawal Levels - Piping shall be arranged so that with drawal can be made from 3 or more levels in the tank. A positive unvalved vented overflow shall be provided.

b) Withdrawal Selection - On fixed cover tanks the supernatant withdrawal level should preferably be selected by means of interchangeable extensions at the discharge end of the piping.

c) Supernatant Selector - If a supernatant selector is provided, provisions shall be made for at least 1 other draw-off level located in the supernatant zone of the tank, in addition to the unvalved emergency supernatant draw-off pipe. High pressure back-wash facilities shall be provided.

3) Sampling - Provision shall be made for sampling at each supernatant draw-off level. Sampling pipes should be at least 1 1/2 inches in diameter.

4) Alternate Supernatant Disposal - An alternate disposal method for the supernatant liquor such as a lagoon, an additional sand bed or hauling from the plant site should be provided for use in case supernatant is not suitable or other conditions make it advisable not to return it to the plant headworks. Consideration should be given to supernatant conditioning, where appropriate, in relation to its effect on plant performance and effluent quality.

2. Aerobic Digestion.

a. Design Criteria - Table VII - 23 gives recommended design criteria for aerobic digestion.

Parameter	Value
Hydraulic retention time, (day @ 20°C)	
Activated sludge only	12 - 16
Activated sludge from plant, operated without primary settling	16 - 18
Primary plus activated or tricklying filter	18 - 22
Solids loading, lb. VS/ft³/day	0.1 - 0.2
Oxygen requirements (lb/lb)	
Cell tissue	2
BOD in primary sludge	1.7 - 1.9
Mixing requirements	
Mechanical aerators, hp/1000 ft³	0.5 - 1.0
Diffused air mixing, scfm/1000 ft³	20 - 30
Dissolved Oxygen level in liquid, mg/l	1 - 2

Table VII - 23

Recommended Design Criteria for Aerobic Digesters

b. General Structural Requirements - Aerobic sludge digestion is accomplished in a tank or tanks designed to provide effective air mixing, reduction of the organic matter, supernatant separation, and sludge concentration under controlled conditions.

1) Number of Tanks - Multiple tanks are recommended. A single sludge digestion tank may be used in the case of small treatment plants. The design of the facility should be such that the single tank will not adversely affect normal plant operations.

The size and number of aerobic sludge digestion tank or tanks should be determined by rational calculations based upon such factors as volume of sludge added, its per cent solids and character, the degree of volatile solids reduction required, the size of installation with appropriate allowance for sludge and supernatant storage.

2) Mixing - Aerobic sludge digestion tanks shall be designed for effective mixing by satisfactory aeration equipment. If diffusers are used, they shall be non-clogging and shall be designed to permit removal for inspection, maintenance, and replacement without dewatering the tanks.

3) Supernatant Separation - Facilities shall be provided for effective separation or decantation of supernatant.

c. Sampling Devices - Provision shall be made for sampling the supernatant draw-off, incoming feed, and stabilized sludge withdrawal.

M. SLUDGE HANDLING AND DISPOSAL.

Sludge handling and disposal techniques employed in waste treatment are a function of the type, size, and location of the treatment plant, unit operations used in treatment, and the method of ultimate solids disposal.

The basic unit operations may include sludge conditioning, sludge beds or mechanical dewatering, incineration, or some other drying operation, and ultimate sludge disposal via sanitary landfill or spreading of sludge on agricultural land.

1. Sludge Conditioning.

a. Use Requirements - Sludge conditioning involves addition of any material to the sludge or any physical process to which the sludge is subjected prior to dewatering, for the purpose of increasing production rate, increasing cake solids content, and improving solids capture.

Heat treatment or chemical oxidation of sludges generally will eliminate the need for chemical conditioning, and will also provide a stable, sterilized sludge.

The Engineer should perform field testing to determine the most feasible means of sludge conditioning prior to dewatering and/or sludge disposal.

b. Chemical Dose Requirements - The most commonly used chemicals employed in sludge conditioning are ferric chloride, ferrous chloride, aluminum sulfate, lime, and polyelectrolytes.

At times, combinations of chemicals may be required to achieve the best dewatering capability. For instance, combinations generally are ferric or ferrous chloride and lime, aluminum sulfate and lime, or ferric chloride and polymer.

The criteria presented under the specific method of dewatering includes general ranges of required chemical doses. Chemical requirements should be confirmed in the laboratory or by pilot testing prior to design and definitely before equipment startup.

1) Chemical Feed Equipment.

a) Chemical Mix Tanks - Chemical mix tanks should be designed to hold one shift's supply of conditioning chemicals. They are generally mixed at 20 per cent by weight for ferric chloride and lime. The polyelectrolyte mix concentrations should be at the recommendation of the polymer manufacturer.

The chemical tanks shall be provided with a mixer of sufficient horsepower to assure complete dispersion and mixing of the chemicals.

The tanks shall be adequately protected from chemical corrosiveness. Fiberglass or rubber-lined tanks are generally employed.

b) Chemical Feed Pumps - The chemical feed pumps shall be of the variable delivery type suitable for the chemical service required. Lime feed pumps are generally of the plunger type. Ferric chloride or polyelectrolyte pumps usually of the noncorrosive diaphragm type.

2) Chemical Conditioning Tank - Prior to transport to the selected method of dewatering the sludge shall be pumped through a conditioning tank where the chemicals are mixed with the sludge. The tank shall be equipped with a variable slow speed agitation device (propeller or paddle mixer, or rotating drum).

The tank shall be provided with slide gates to adjust retention time of the sludge flow through.

It is standard practice in centrifugation dewatering to add the chemicals at the centrifuge feed entrance.

c. Heat Treatment - Sludge conditioning by heat treatment is accomplished by breaking down the affinity of the sludge particle for water so that the majority of the liquid in the sludge can be easily separated from the solids.

The conditioning is generally accomplished by pumping the sludge from a storage basin through a grinder pump into a heat exchanger. The method of primary heat exchange may be either water to sludge or sludge to sludge. Temperature elevation through the heat exchanger is generally from 60°F to approximately 350°F.

The sludge is then pumped to a reaction vessel with a retention time of between 30 and 60 minutes. Reactor temperature is increased through steam injection at 120 - 350 psig to between 350° to 450°F. Sludge is then run through another heat exchanger to reduce the temperature to about 120°F. The sludge is then stored for dewatering equipment or transported to sludge beds.

1) Equipment Requirements.

a) Sludge Grinders - Prior to pumping to the heat exchangers, the sludge shall be ground or macerated to reduce plugging of exchanger tubing.

b) Heat Exchanger - The heat exchanger may be of the water to sludge type or the sludge to sludge type.

They should be designed to meet all requirements of A.S.M.E.

Sludge velocities in the heat exchanger shall be limited to 4 - 6 pfs.

c) Reactor - The steam injected reaction vessel shall be designed and constructed to meet all requirements of A.S.M.E.

d) Off-Gas Control - Any off-gas from the system shall be controlled by providing a completely enclosed system or through an after-burner-scrubber system.

e) Access - All portions of the equipment shall have ready access for maintenance, repair, degreasing, and descaling.

2) Other Design Considerations - Close attention should be given to the characteristics of the liquor after heat treatment.

Generally, the return liquor that is transported to the head of the plant will have a 4000 mg/1 BOD_5. Suspended solids will be approximately 200 mg/1. COD will be approximately 12,000 mg/1. This is accumulated from decant liquor, dewatering filtrate or centrate, and sludge thickening tank overflow. pH will be from 0.5 to 4.0 units less than the feed pH depending upon the manufacturer's product.

3) Sizing Criteria - Since each manufacturer may use varying criteria, sizing of the system should be performed using the manufacturer's recommendations.

2. Sludge Dewatering.

a. Sludge Drying Beds - Sludge drying beds may be one of two basic types.

1) evaporation beds
2) combination evaporation-percolation beds

The combination evaporation-percolation beds (commonly called sand beds) should only be employed in regions of a soft water municipal supply. Hard waters result in sludge crystalization with mineral salt ($CaCO_3$) deposits which cause solidification of the sand and decrease drainage substantially.

Evaporation beds should be used in lieu of combined evaporation-percolation beds where water hardness is high. The mineral salt deposits will seal the bed bottom and result in drying by evaporation.

1) Design Criteria.

a) Evaporation Beds - Solids loading rates should range between 2.2 to 2.4 lb DS/yr/cf of bed capacity.

b) Combined Percolation-Evaporation Beds - Solids loading rates for combined beds is shown in Table VII - 24.

2) Basin Requirements.

a) Evaporation Beds.

(1) Number of Beds - Not less than 2 beds shall be provided, arranged so as to facilitate sludge removal.

(2) Sludge Influent - The influent sludge pipe to each bed cell shall terminate at least 12 inches above the surface and be so arranged that it will drain. Concrete splash pads shall be provided at sludge discharge points.

(3) Depth - The depth of the sludge shall not exceed 24 inches.

(4) Dike Construction - The dikes shall be constructed to prevent surface water from entering the bed. Interior dikes may be sloped approximately 1:1. The exterior dike shall be 8 feet wide at the top so that vehicles may drive around the bed.

(5) Liquor Decanting - The sludge beds shall be provided with a suitable means of decanting the liquor. The decanting device shall be adjustable. The decanted liquor should be returned to the plant headworks or

Type of Sludge	Sludge Loading Dry Solids (lb/sf/yr)
Primary, Digested	27.5
Primary and Trickling Filter, Digested	22.0
Primary and Activated, Digested	15.0
Activated, Digested	10.0
Chemically Precipitated	22.0

Table VII - 24

Criteria for Design of Combined Evaporation Percolation Sludge Drying Beds other suitable means of disposal. Conditioning of the decant liquor may be required to reduce biological impact on other unit processes of the plant.

b) Combined Evaporation-Percolation Beds.

(1) Number of Beds - Not less than 2 beds shall be provided properly arranged so as to facilitate sludge removal.

(2) Sludge Influent - The sludge pipe to the beds shall terminate at least 12 inches above the surface and be so arranged that it will drain. Concrete splash plates shall be provided at sludge discharge points.

(3) Bed Construction.

(a) Media.

[1] Gravel - Properly graded gravel to a depth of 12 inches shall be provided, extending at least 6 inches above the top of the underdrains. The top 3 inches shall consist of gravel 1/3 to 1/4 inch in size.

[2] Sand - The top course shall consist of at least 6 - 9 inches of clean coarse sand. The finished sand surface should be level.

(b) Underdrains - Underdrains shall be sewer pipe at least 6 inches in diameter laid with open joints spaced not more than 10 feet apart.

(c) Walls - Walls shall be water-tight and extend 15 - 18 inches above and at least 6 inches below the sand surface. Outer walls should be curbed to prevent soil from washing on the beds.

(d) Drainage Disposal - Drainage from beds should be returned to the raw or settled sewage, if possible. Where chlorination is required, the filtrate shall be returned to a point preceding the chlorination process.

3) The Engineer shall thoroughly investigate soil characteristics and potential ground water problems in applying sludge drying beds. Certain conditions may require lining or sealing of the bed bottom and should be acknowledged.

b. Vacuum Filtration.

1) Design Criteria - Table VII - 25 tabulates recommended design criteria for vacuum filtration of sewage sludges. This Table is

Type of Sludge	Feed (2) Wt. % DS	Multiplier	Rate (2) lb/DS/hr/sf	% Moisture Range	Avg. (4)	% $FeCl_3$ of DS	% CaO of DS
Primary, Raw	8.0	1.20	9.6	54-80	67	1.5	7.0
Primary, Digested	6.0	0.88	5.25	65-80	75	3.0	10.0
Primary, Digested and Elutriated	5.0	0.80	4.0	75-80	78	2.5	4.0[1]
Primary and Trickling Filter, Raw	7.0	1.10	8.0	58-82	70	1.5	8.0
Primary and Trickling Filter, Digested	7.0	1.00	7.0	67-80	75	3.0	8.5
Primary and Trickling Filter, Digested and Elutriated	6.0	0.80	4.8	68-80	75	2.5	4.0[1]
Activated (Conventional), Raw (3)	2.5	0.68	1.7	83-85	84	5.5	
Contact Stabilization or Extended Aeration	2.6	0.60	1.6	75-85	80	4.0	8.0
Primary and Waste Actived, Raw 3:1 P to A	4.0	0.88	3.5	72-87	79	4.0	3.0
Primary and Waste Activated Digested 3:1	4.5	0.75	3.4	72-80	78	4.0	12.0
Primary and Waste Activated, Digested and Elutriated	4.0	0.75	3.0	72-80	78	5.0	5.0[1]
Heat Treated:							
Primary Raw	10-12		18		60		
Primary and Waste Activated, Raw	8		10		65		
Waste Activated, Raw	6		6		70		
Physical Chemical:							
Lime (5)	10		8-10	60-70	65		
Alum	2		1		80		
Ferric Chloride	2		1		80		

NOTES

(1) Lime can be used in many cases to produce higher filtration rates, lower cake moisture and to control pH.

(2) Average for most treatment plants. However, feed solids content will affect filtration rates directly. Use the multiplier shown to obtain design or assume rate for calculations. Example: If design rate for a project is 7% (raw) primary sludge solids, filtration rate is 1.20 x 7.0 = 8.4 lb. DS/hr./sq. ft. Variations in particular or anticipated sludge should be considered and the multiplier adjusted accordingly.

(3) Concentrated (thickened) waste activated sludge. Filtration should not be considered at any lower feed solids concentration. It is strongly recommended that a higher concentration be obtained by flotation or gravity thickening, if possible.

(4) The average cake moisture and chemical figures listed should be used only as guides.

(5) Addition of 1% polyelectrolyte to dewatering.

Table VII - 25

Recommended Sewage Sludge Vacuum Filtration Design Criteria

for systems using ferric chloride and lime as conditioning chemicals. Rates and dosages of polyelectrolyte conditioned sludge is shown in Table VII - 26.

2) Equipment Requirements - The basic equipment requirements of the vacuum filter station include the vacuum filter, vacuum pump, sludge conveyor, filtrate receiver, filtrate pump, and sludge pump.

   a) Vacuum Pump - As a general rule of tumb, vaccum pumps are selected for an air flow of 1.8 - 2.0 scfm per sq. foot of filter area on conventional sewage sludge applications. Heat treated sludge dewatering applications require 3.0 scfm per square foot or greater.

   b) Sludge Pumps - Sludge pumps feeding vacuum filters are generally of the reciprocating plunger or progressive cavity type which are capable of pumping high solids material. See Section N for pump system design recommendations.

      Duplicate sludge pumps shall be required for standby purposes.

   c) Controls - Vacuum filters shall be equipped with level controls in the filter vat which interlock to the chemical conditioning equipment and the sludge pump for operational control.

   d) Sludge Conveyance - Sludge conveyance systems may be tubular or belt conveyors. Discharge hoppers with breakers should be considered to contain the filter cake and prevent cake bridging.

Type of Sludge	Rate lb DS/hr/sq. ft.	% Moisture	% Polymer of DS
Primary (Raw)	8 - 10	65 - 75	0.2 - 1.2
Primary, Digested	7 - 8	68 - 75	0.2 - 1.5
Primary and Trickling Filter, Raw	4 - 6	70 - 80	0.4 - 1.8
Primary and Activated Sludge, Raw	4 - 6	75 - 82	0.5 - 2.0
Primary and Activated Sludge, Digested	3.5 - 6	78 - 85	0.5 - 2.3

Table VII - 26

Vacuum Filtration Design Criteria for Polymer Conditioned Sludge

Wastewater Sludge Type	Sludge Solids (%)	Cake Solids Recovery (%)	Characteristic Chemical Addition
Raw or digested primary	28 - 35	70 - 90	no
Raw or digested primary, plus trickling filter humus	20-30	80-95 60-75	yes no
Raw or digested primary, plus activated sludge	15-30	80-95 50-65	yes no

Table VII - 27

Sludge Dewatering in Solid Bowl and Basket Centrifuge

c. Centrifugation.

1) Design Criteria - Selection of centrifuges for solids dewatering is dependent upon the equipment manufacturer's rating and performance information. Since wastewater sludges differ from location to location, pilot plant tests should be run before final design decisions are made.

Table VII - 27 and Table VII - 28 give typical performance data for solid bowl and basket centrifuges.

2) Equipment Requirements.

a) Sludge Pumps - The sludge feed pumps should be a constant uniform rate pump such as a progressive cavity pump. The pumps shall be duplicate for standby service and shall be variable delivery. See Section N for pump system design recommendations.

b) Sludge Conveyance - Sludge conveyance systems may be tubular or belt conveyor. Discharge hoppers with breakers should be considered to contain the centrifuge discharge and to prevent hopper bridging.

d. Filter Press.

1) Design Criteria - Pressure filters should be designed under the guidance of the equipment manufacturer. Table VII - 29 gives a tabulation of results from typical filter press installations.

The values given in Table VII - 29 are based upon operating experiences. Pilot plant testing should be performed before selecting and sizing the equipment.

Centrifuge Type	Feed Solids Concentration (% by wt)		Feed Rate (gpm)		Solids Capture (%)		Cake Concentration (% solids by wt.)		Polymer Addition (lb/ton dry solids)	
	Oxygen	Conventional	Oxygen	Conventional	Oxygen	Conventional	Oxygen	Conventional	Oxygen	Conventional
Solid Bowl										
Raw wastewater	2-3	1.5-2.5	50-60	45-55	85-90	80-85	10-13	9-11	3	6-10
Primary effluent	2-3	0.7-1.3	90-100	55-65	90-95	80-85	8-10	8-9	3	6-10
Basket										
Raw wastewater	2-3	1.5-2.5	35-40	20-35	92-96	90-95	9-12	9-11	0	0
Primary effluent	2-3	0.7-1.3	35-45	35-45	92-97	90-95	10-14	9-11	0	0

Table VII - 28

Dewatering of Oxygen Activated Sludges in Solid Bowl and Basket Centrifuges (37)

Sludge Type	Suspended (%)	Conditioning of Dry Solids (%)		Cake Solids (%)	Time Cycle (hr)
Raw Primary	5 - 10	Ash	100	50	1.5
		$FeCl_3$	5		
		Lime	10	45	2.0
Raw Primary with less than 50% EAS	3 - 6	Ash	150	50	2.0
		$FeCl_3$	5		
		Lime	10	45	2.5
Raw Primary with more than 50% EAS	1 - 4	Ash	200	50	2.0
		$FeCl_3$	6		
		Lime	12	50	2.5
Digested and Digested with less than 50% EAS	6 - 10	Ash	100	50	1.5
		$FeCl_3$	5		
		Lime	10	45	2.0
Digested with more than 50% EAS	2 - 6	Ash	200	50	1.5
		$FeCl_3$	7.5		
		Lime	15	45	2.5
EAS	Up to 5	Ash	250	50	2.0
		$FeCl_3$	7.5		
		Lime	15	45	2.5

Table VII - 29

Typical Filter Press Production Data

2) Equipment Requirements - The basic filter press flow scheme includes a sludge storage tank, sludge conditioning tank, conditioning chemical makeup and feed equipment, high pressure sludge pumps, filter press, and cake hopper.

   a) Sludge Conditioning Tank - The sludge conditioning tank shall be designed to hold and adequately mix the sludge and conditioning chemicals for each press batch.

   b) Sludge Pumps - Dual high-pressure, continuous feed pumps shall be designed to provide a pressure of up to 250 psig. One pump shall be standby.

   c) Controls - The filter press shall be provided with the necessary controls to semi-automatically operate the system excluding the press dump at each cycle's end.

      At the end of the press time, the press shall open and remain so until the operator manually closes the press.

Suitable controls shall be supplied to shut the system down so the operator can complete removal of the sludge cake prior to the next batch.

d) Sludge Conveyance - Sludge conveyance is generally by conveyor and sludge hopper. The hopper should be provided with breaker bars to break the sludge cake prior to transport.

3. Sludge Drying and Incineration.

a. Use Requirements - Heat drying by the flash drying or rotary kiln method is employed for the purpose of removing sludge moisture so that it can be incinerated efficiently or processed into fertilizer.

Incineration is employed as a method of sludge volume reduction.

b. Flash Drying.

1) Design Criteria - Flash drying is the most frequently used method of heat drying of sludge. It involves pulverizing the sludge in a mill or by an atomized suspension process in the presence of hot gases. The hot gases and sludge are mixed achieving an 8 per cent weight solids. The solids are captured in a cyclone separator. Drying temperatures are approximately 700°F.

The Engineer should design this type system with the assistance of the manufacturer.

2) Air Pollution Control - The Engineer shall provide evidence that the system will operate within air discharge quality standards established by the Arizona Department of Health Services, Bureau of Air Quality Control.

c. Rotary Dryers.

1) Design Criteria - Rotary kiln dryers may provide direct or indirect heat through the passing of hot gases counter current to the movement of the sludge in the kiln. The kiln temperature is approximately 700°F. The wet sludge is fed in one end of the slowly rotating drum. The gases vaporize moisture from the sludge. Dried sludge emerges at the opposite end. The emergent gases flow through a cyclone or scrubber for fine particle classification.

The Engineer should design this type system with the assistance of the manufacturer.

2) Air Pollution Control - The Engineer shall provide evidence that the system will operate within air discharge quality standards established by the Arizona Department of Health Services, Bureau of Air Quality Control.

Material	Wet Feed % Solids	% Combustible	Heat Valve Btu/lb. combustibles
Scum	40 - 50	85 - 95	14,000 - 16,500
Grit	40 - 60	30 - 60	10,000 - 11,000
Screening	30 - 40	80 - 95	7,500 - 8,500
Primary, Raw	25 - 32	60 - 75	10,500 - 12,000
Rimary & T.F., Raw	23 - 25	60 - 75	10,000 - 11,000
(1) Primary & Act., Raw	20 - 24	60 - 75	9,500 - 10,500
Primary, Digested	23 - 26	40 - 5.	9,500 - 10,500
Primary & T.F., Digested	20 - 25	40 - 55	9,500 - 10,500
(2) Primary & Act., Digested	18 - 25	40 - 55	9,000 - 10,000
Waste Act., Digested	15 - 18	40 - 55	8,500 - 9,500

Notes

(1) Centrifuge cake if mixture of 60% primary and 40% activated will co-tain 17% - 20% dry solids.

(2) Centrifuge cake will contain 13% - 15% dry solids.

Table VII - 30

Typical Sludge Feed Characteristics

d. Multiple Hearth Incinerator.

1) Design Criteria - The actual determination of the furnace size is made on the basis of the processing rate of wet feed per square foot of furnace area.

Table VII - 30 tabulates typical sludge feed characteristics for design of incinerators.

Furnace sludge feed rates vary with the dry solids content of the sludge. Table VII - 31 shows representative feed rates to incinerator versus per cent dry solids of feed.

The Engineer should consult the incinerator manufacturer for assistance in design.

2) Air Pollution Control - The Engineer shall provide evidence that the system will operate within air discharge quality standards established by the Arizona Department of Health Services, Bureau of Air Quality Control.

4. Sludge Disposal - Two generally accepted methods of sludge disposal are landfill and soil spreading or injection.

a. Landfill - The sanitary landfill may be used for disposal of raw or stabilized sludge, septage, chemical vault sludge, sludge from drying beds, drying lagoons, mechanically dewatered sludge, and ash from mechanical drying or incineration.

% Dry Solids in Feed	Wetcake lb/sf-hr
25	7 - 12
18 - 22	6 - 11
14 - 17	5 - 9

Table VII - 31

Sludge Feed Rates to Incinerators

All sludges shall be disposed at designated sites in each county and must be in accordance with the State solid waste management program.

The Engineer shall provide the Department with details regarding the size, method of operation, location, etc. of the landfill where the sludge will be disposed. Assurance must be given that the sanitary landfill is managed such that wastes are systematically deposited and covered with sufficient soil to control environmental impacts within defined areas. The leachate and runoff from a sanitary landfill should be minimized and, when necessary, collected and suitably treated to prevent pollution of ground and surface waters.

b. Soil Spreading and Injection - Stabilized sewage sludge, drying bed sludge, drying lagoon sludge, mechanically dewatered sludge, or ash from mechanical drying or incineration may be disposed of by either soil spreading or soil injection of a land farm, crop land or non-dairy cattle grazing land.

Raw sewage sludge, septage, chemical vault sludge, and other raw waste sludge may be disposed only by injection.

The Engineer shall be required to provide the Department with the size, method of operation, location, etc. of the soil spreading or injection operation, including information on runoff control, erosion, and leachate control.

1) Types of Crops - All sewage sludge may only be applied to crop lands used for growing field corn, wheat, and forage crops. In addition, forest land may be a feasible alternative to improve soil fertility and increase tree growth.

   In no case will sewage sludge be applied to root crops or crops intended for human consumption.

Relative Soil Conditions	Application Rate (Tons dry solids per acre per year)
Slight Limitations	10 - 20
Moderate Limitations	10

Table VII - 32

Application Rates to Crop Land

For advice concerning crops which can be satisfactorily grown in sludge enriched soils, the local representatives of the U. S. Department of Agriculture, or the Agricultural Departments of University of Arizona or Arizona State University should be consulted.

2) Application Rates - Application rates depend on sludge composition, soil characteristics, climate, vegetation, and cropping practices. Applying sludge at a rate to support the nitrogen needs of the selected crop avoids overloading the soil with problem constituents. A rough guide for applying acceptable sludge to soils is given in Table VII - 32. The sludge application rates should be justified in accordance with the nitrogen and heavy metal content of the sludge.

3) Monitoring Requirements - Specific points which must be continuously considered and/or monitored during sludge utilization are:

   a) The trace element composition of sludge, soil, and crops.

   b) The nitrogen content of sludge, soil, and crops and potential nitrate contamination of the ground waters.

   c) Hydraulic overloading of the soil.

   d) Ultimate land use.

   e) Practice to control runoff and erosion. The leachate and runoff should be minimized and, when necessary, collected and suitably treated to prevent pollution of ground and surface waters.

4) Sludge Conveyance Systems - In designing a sludge application system, the method of conveying sludge from the plant to the cropland should carefully consider:

   a) sludge characteristics
   b) distance to transport
   c) sludge volume
   d) elevation differences
   e) land availability.

Conveyance may be accomplished by tank truck, rail, or pipeline.

Retention basins at the treatment plant or near the land application site should be considered for storage when land spreading is not feasible.

5) Methods of Application - Dilute sludge may be applied by ridge and furrow irrigation, spray sprinkler irrigation systems, or tank trucks with surface spray systems. More concentrated sludges may use sludge spreader trucks or other suitable surface application systems.

6) Other Deisgn Considerations - The Engineer should investigate toxic constituent levels of the sludge, soil composition, soil pH, drainability, permeability, ground water level, and the affects each will have on crops, soils, and ground water.

N. IN-PLANT SEWAGE AND SLUDGE PUMPING STATIONS.

1. Pump Requirements.

a. Sewage - The pump most commonly used for raw sewage service in the single end-suction volute-type centrifugal with an overhung impeller of either the radial non-clog or mixed-flow type.

b. Sludge - Sludge pumps are generally of three types: plunger, centrifugal, and progressing cavity.

c. Capacity - Pump capacities shall be of adequate size to meet the flow variation requirements. Provisions for varying pump delivery is desirable.

d. Duplicate Units - Duplicate pumps shall be provided where failure of 1 unit will seriously hamper plant operation.

e. Materials of Construction - All raw sewage and sludge pumps should be manufactured of abrasion resistant material.

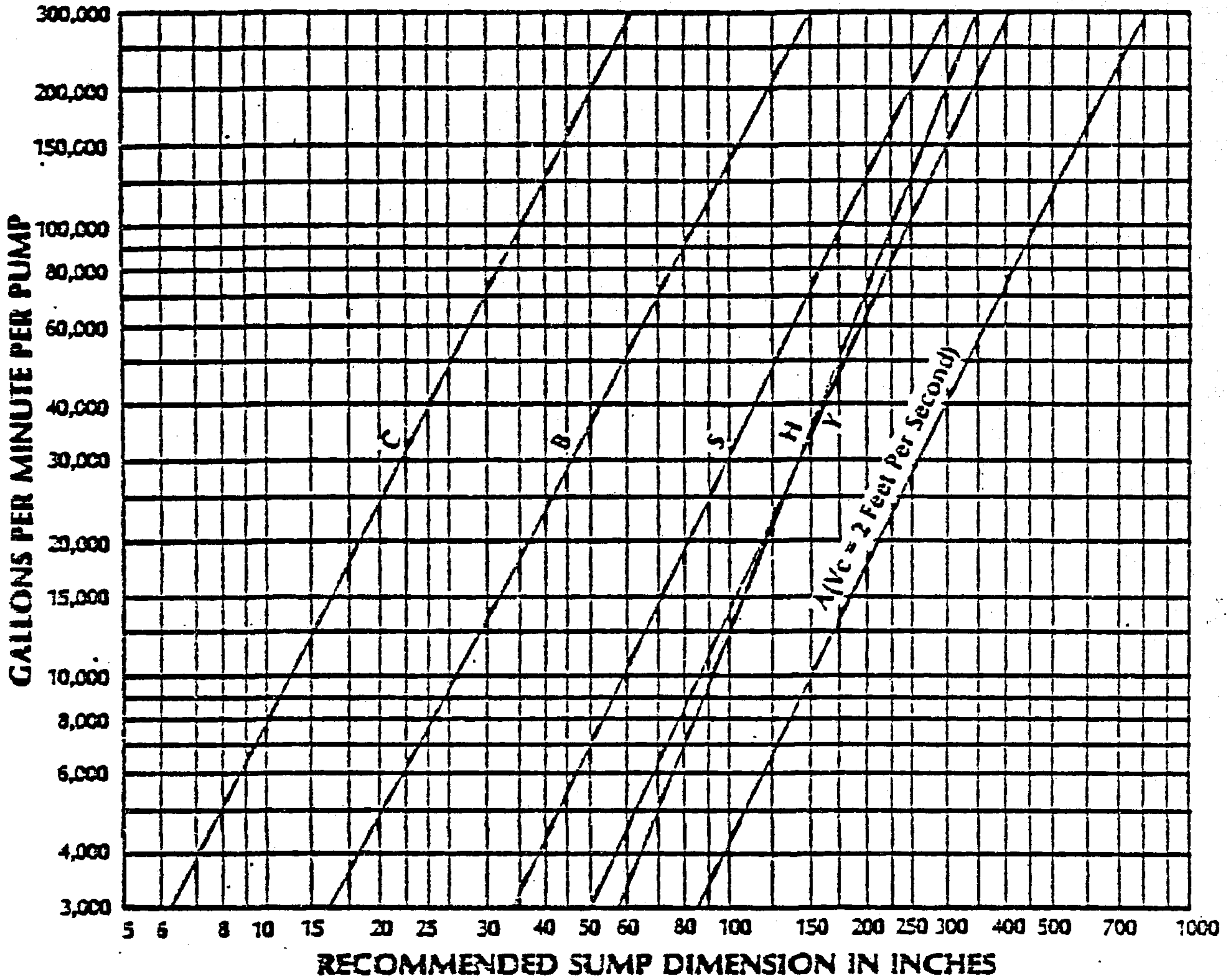
All pumps should be corrosion resistant.

f. Sampling Facilities - All pumps shall be equipped with quick closing sampling valves unless sampling facilities of the flow stream are otherwise provided. The size of valve and piping should be at least 1 1/2 inches.

2. General Structural Details.

a. Wet Well Design.

1) Wet Well Capacity - The wet well capacity may be sized using the recommendations of Figures VII - 21, 22, 23, and 24. However, there is no method applicable to all conditions. Care should be taken in using the sump capacity graph.



Figures apply to sumps for clear liquid. For fluid-solids mixtures refer to the pump manufacture.

Figure VII-21

Sump Dimensions Versus Flow

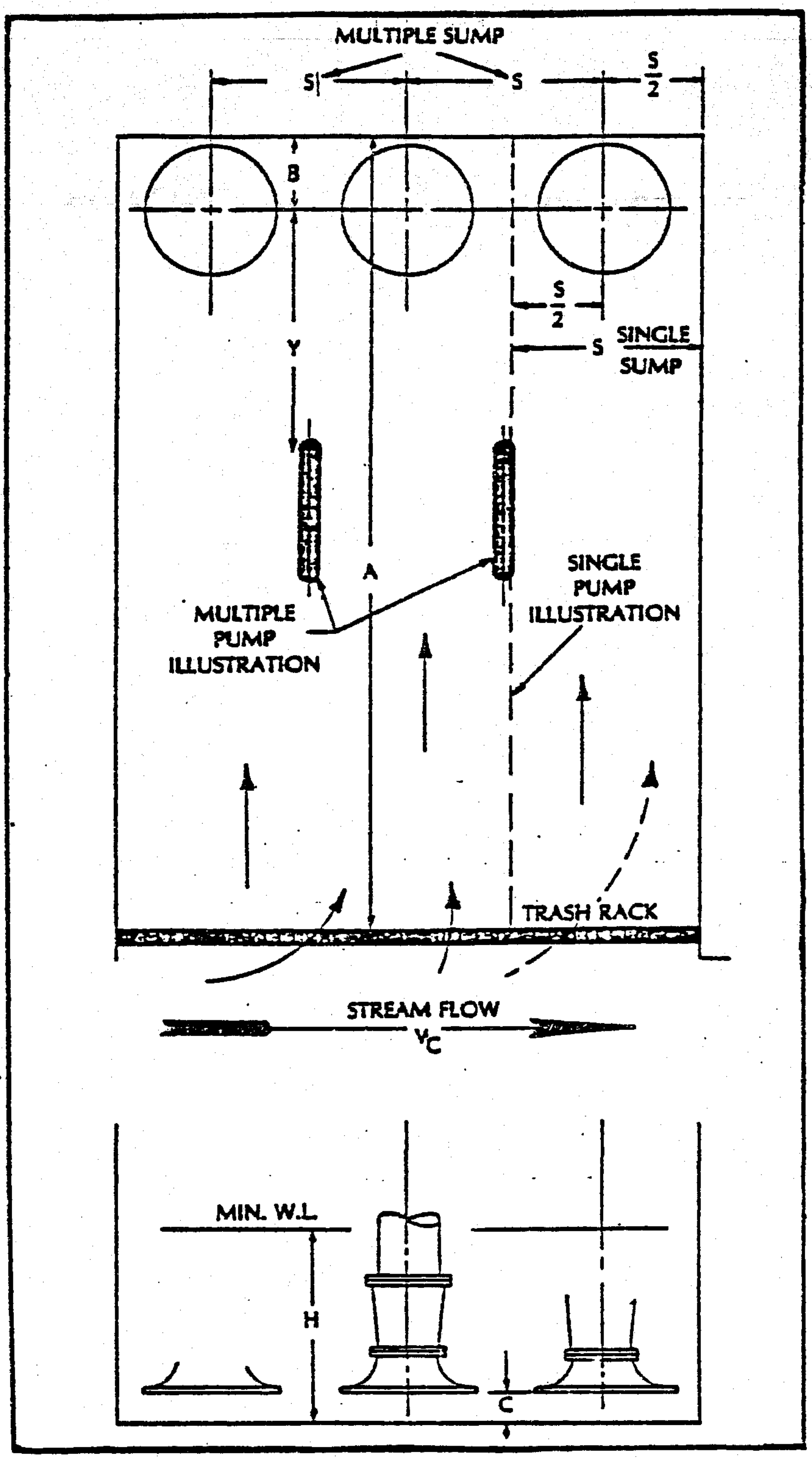
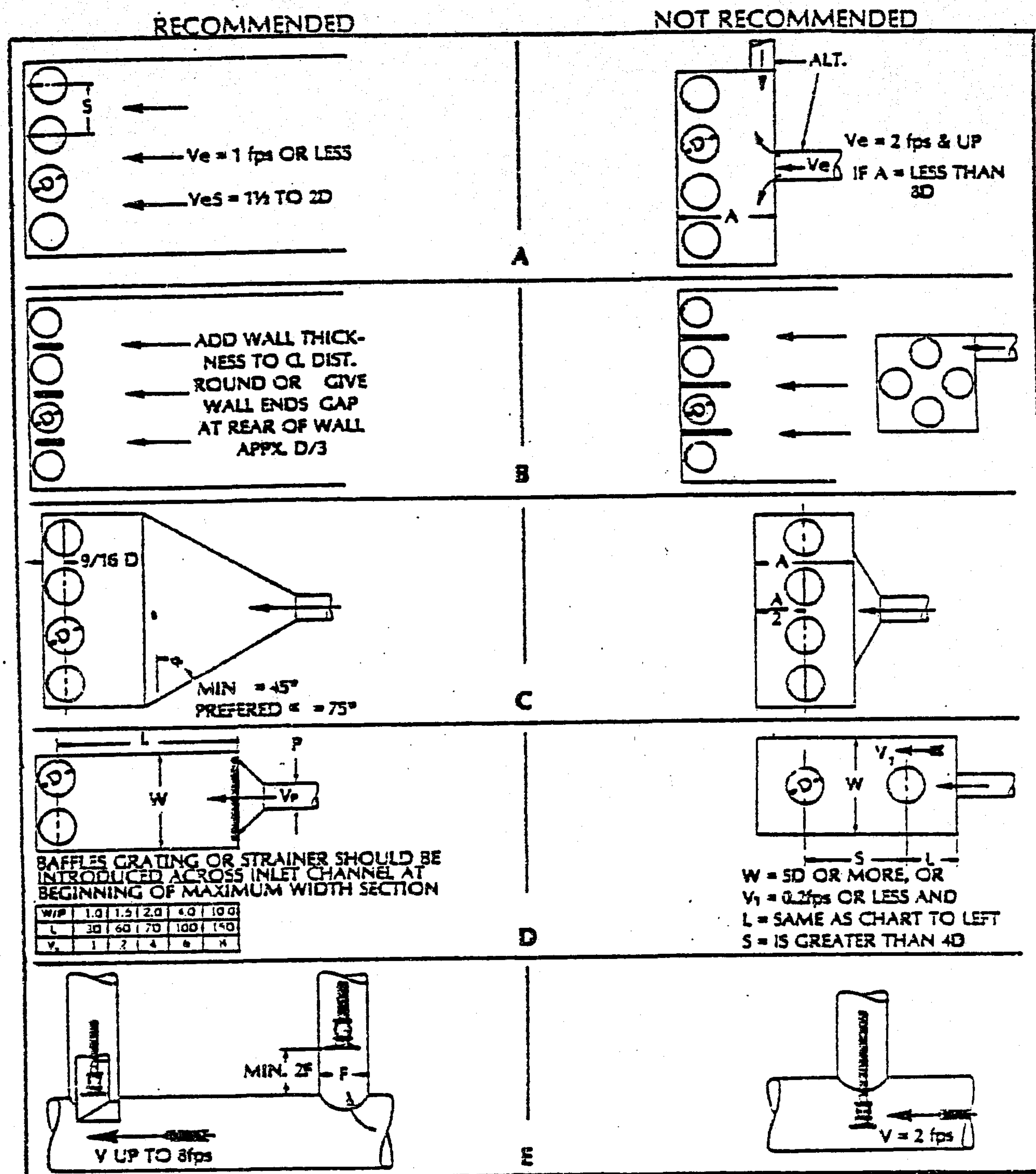


Figure VII-22
Sump Dimensions Versus Flow



NOTE: Figures apply to sumps for clear liquid. For fluid-solids mixtures refer to the pump manufacturer.

Figure VII-23

Multiple Pump Pits

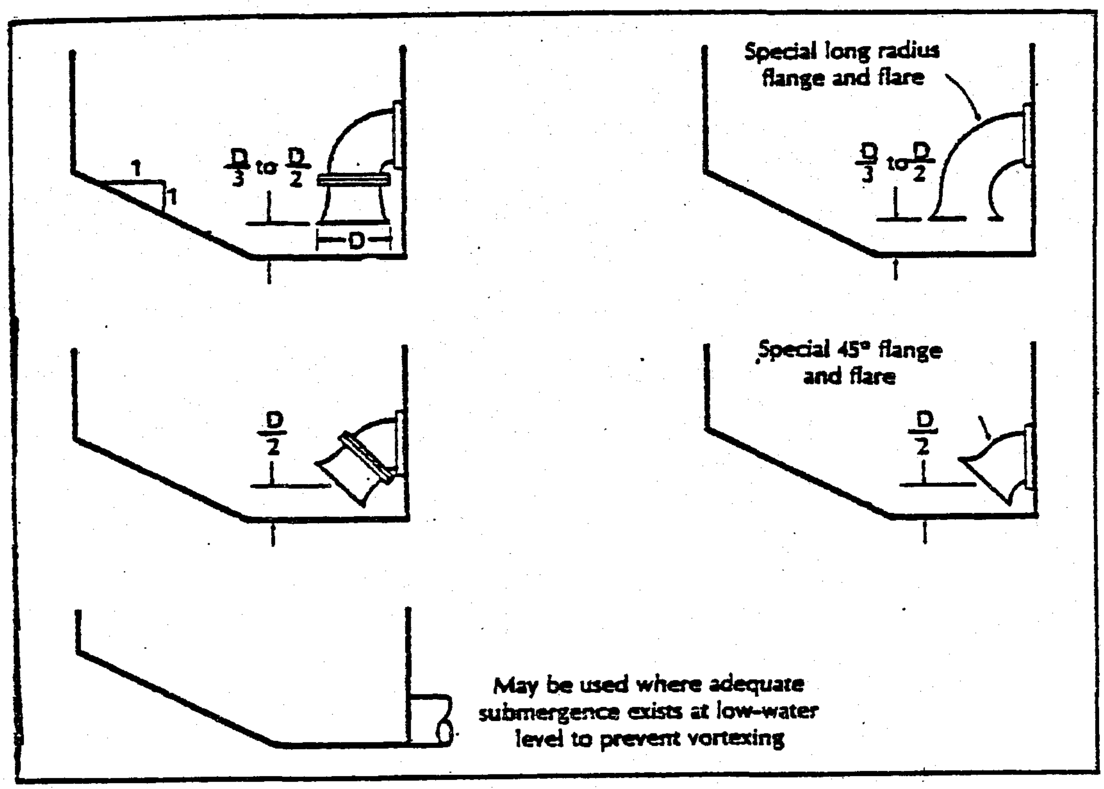


Figure VII-24
Pump Suction Connections to Wet Well

2) Floor - Floors of wet wells shall have a minimum slope of one to one to the pump intakes and shall have a smooth finish.

3) Access - The wet well shall be designed with adequate access for maintenance purposes. Access shall be provided from the exterior of the building only.

4) Ventilation - Ventilation shall be provided in all wet wells. Ventilation should be via blower, having sufficient capacity to provide a 2-minute air change based on the wet well volume below grade and above the minimum sewage level.

5) Pump Intake Design - The Hydraulic Institute standards gives recommended multiple pit layouts for centrifugal pump suctions. These are shown in Figures VII - 21, 22, and 23. In addition, pump suction connections to wet wells are shown in Figure VII - 24.

b. Dry Well Design - The size of the dry well depends primarily on the number and type of pumps selected. The dry well shall be deep enough that the pumps are self-priming at all starting levels unless self-priming pumps are being recommended. The pump setting shall be such that the pump's maximum suction lift is not exceeded.

Dry wells shall be well lighted and adequately ventilated. The dry well shall be positively ventilated with an exhaust system which provides 30 air changes per hour based upon dry well volume below grade.

The ventilation system may be continuous operated or intermittently operated. All intermittently operated ventilating equipment should be interconnected with the respective lighting system. Consideration should also be given to automatic controls where intermittent operation is used. Switches for operation of ventilation equipment should be marked and conveniently located.

Sufficient working clearances around pumps and other machinery shall be provided to assure ease in maintenance.

Consideration shall be given to cranes or hoists for removing pumps for maintenance and replacement.

The dry well shall be separated from the wet well by a water- and gas-tight wall with separate entrances provided to each.

Stairways or access ladders shall be provided in all underground dry wells.

A separate sump pump shall be provided in the dry wells to remove leakage or drainage. All floor and walkway surfaces shall have an adequate slope to a point of discharge.

3. Controls.

   a. Electrical Equipment - Electrical systems and components (e.g., motors, lights, cables, conduits, switchboxes, control circuits, etc.) in enclosed or partially enclosed spaces where flammable mixtures or gases occasionally may be present should comply to the National Electrical Code and OSHA requirements.

4. Pipe Velocities - The velocities of fluids generated by pumps shall be between 4 and 6 fps. In no case shall a velocity less than 2 fps at minimum flow be allowed.

5. Valves - Suitable shutoff valves shall be placed in suction and discharge lines of each pump. A check valve shall be placed on each discharge line, between the shutoff valve and the pump.

6. Flow Measurement - Suitable devices for measuring sewage flow should be provided at all pumping stations.

7. Cleanouts - Cleanouts should be located at strategic points in the piping system to allow line cleaning and system maintenance.

8. Sampling Taps - Sampling taps should be located at strategic points in the piping system for ease in acquiring samples for laboratory analysis.

O. DISINFECTION AND ODOR CONTROL.

1. Disinfection - All sewage treatment effluents which discharge in areas subject to public contact shall be disinfected by chlorination, ozonation, or other suitable means.

   a. Chlorination.

      1) Dose Requirements - The capacity of the chlorination equipment shall be of sufficient size to produce a total residual of 2.0 ppm in the final effluent. Table VII - 33 gives recommended chlorine dosages versus type of treatment.

Type of Treatment	Dosage (Based on average design flow)
Trickling Filter Effluent	15 ppm
Activated Sludge Effluent	8 ppm
Physical Chemical Effluent	10 ppm
Sand Filter Effluent	6 ppm

Table VII - 33

Recommended Chlorine Design Dosage vs. Type of Treatment

The chlorination equipment shall have a capacity greater than the highest expected dosage to be applied at any time. It shall be capable of operation under every prevailing hydraulic condition.

2) Feed Equipment.

a) Type - The use of equipment designed to feed chlorine gas in solution is recommended. Hypo-chlorinators will be acceptable on smaller installations.

b) Standby Equipment - Standby equipment of sufficient capacity should be available to replace the largest unit during shutdowns. Spare parts shall be available for all chlorinators to replace parts which are subject to wear and breakage.

c) Water Supply - An ample supply of water (potable or filtered effluent) shall be available for operating the chlorination equipment. Where a booster pump is required, consideration should be given to providing a standby pump.

3) Piping and Connections - Piping systems should be as simple as possible, especially selected and manufactured to be suitable for chlorine service with a minimum number of joints. Piping shall be well supported and protected against extreme temperature variations.

The standard weight and thickness of steel or wrought iron is suitable for use with DRY chlorine liquid or gas. Low pressure lines made of hard rubber, sarran-lined, rubber-lined, polyethylene, PVC, or Uscolite materials are satisfactory for wet chlorine or aqueous solutions of chlorine.

To prevent corrosion, all lines designed to handle dry chlorine shall be protected from the entrance of water or air containing water.

4) Housing.

a) Separation - If gas chlorination equipment and chlorine cylinders are to be in a building used for other purposes, a gas-tight partition shall separate this room from any other portion of the building. Doors to this room shall open only to the outside of the building, and shall be equipped with panic hardware. Such rooms shall be at ground level, and should permit easy access to all equipment. Storage area should be separated from the feed area.

b) Inspection Window - A clear glass, gas-tight window shall be installed in an exterior door or interior wall of the chlorinator room to permit the chlorinator to be viewed without entering the room.

c) Heat - Chlorinator rooms should be provided with a means of heating so that a temperature of at least 60°F can be maintained, but the room should be protected from excess heat. Cylinders should be kept at room temperature.

d) Exhaust Ventilation - Sufficient ventilation shall be provided to allow one complete air change in the chlorination room, every two minutes. The exhaust duct shall be located within 6 inches of the floor level. A louvered fresh air intake must be provided to serve as a make-up air supply when the exhaust fan is operating. This intake should be located in the ceiling or near ceiling level. The exhaust fan shall be wired to automatically activate when the light is turned to the "on" position. The light switch shall be located outside the room. As an additional safety factor, a pressure type switch should be located in the door to the chlorination room which will activate the exhaust fan automatically when the door is opened, in case the operator fails to turn on the light switch. The point of discharge shall be so located as not to contaminate the air inlet to any building or inhabited area.

On chlorination equipment which is wall or cylinder mounted, the vent hose shall be screened and shall discharge to the outside atmosphere and above grade.

e) Electrical Controls - The controls for the fans and lights shall be such that they will automatically operate when the door is opened and can also be manually operated from the outside without opening the door. All other electrical equipment shall be located outside the chlorine room. All switches should be properly identified.

5) Chlorine Supply.

a) Cylinders - The use of one-ton containers should be considered where the average daily chlorine consumption is over 150 lbs.

b) Tank Cars - At large installations consideration should be given to the use of tank cars, generally accompanied by gas evaporators.

c) Scales - Scales shall be provided at all plants using chlorine gas for weighing cylinders. Automatic switchover systems may be accepted as an alternative to weighing scales on smaller plants. At large plants, scales of the indicating and recording type are recommended. At least a platform scale shall be provided. Scales shall be of corrosion-resistant material.

d) Evaporators - Where manifolding of several cylinders will be required to evaporate sufficient chlorine, consideration should be given to the installation of gas evaporators.

e) Leak Detection and Controls - A bottle of ammonium hydroxide solution shall be available for detecting chlorine leaks. Consideration should also be given to the provision of caustic soda solution reaction tanks for absorbing the contents of leaking one-ton cylinders where such cylinders are in use. At large installations consideration should be given to the installation of automatic gas detection and related alarm equipment.

f) Safety Chains - Safety chains shall be provided at all gas chlorination installations where chlorination bottles are employed. The chains shall be installed to hold the bottles securely upright, both on the scales and in storage areas.

g) Leak Repair Kit - An emergency repair kit should be provided with the particular chlorine container to be used. Kits are available for all types: 100 lb. bottles, 150 lb. bottles, ton cylinders, and tank cars.

h) Posting - A poster giving chlorine handling instructions and precautions should be posted in a conspicuous place in the chlorination room. Detailed chlorine manuals are available from the various manufacturers and should be available for reference.

i) Outside Cover - Chlorination equipment located outside buildings shall be protected from the sun.

6) Gas Masks - At least 1 self-contained breathing apparatus in good operating condition of a type conforming to OSHA standards shall be available at all installations where chlorine gas is handled and shall be located outside and adjacent to any room where chlorine is used or stored. Instructions for using, testing, and replacing mask parts, including canisters shall be posted.

7) Dechlorination - Attention should be given to design of suitable dechlorination methods where aquatic life protection is required.

b. Ozonation.

1) Dose Requirements - The capacity of the ozonation equipment shall be of sufficient size to assure proper coliform discharge requirements.

Table VII - 34 gives recommended ozone dosage versus type of treatment.

Type of Treatment	Dosage (Based upon average design flow)
Activated Sludge Effluent	10 ppm
Sand Filter Effluent	7 ppm
Advanced Waste Treatment Effluent	7 ppm

Table VII - 34

Recommended Ozone Design Dosage vs. Type of Treatment

2) Equipment Requirements.

a) Ozone Generation Equipment - Ozone must be produced from air or oxygen by the reaction of an oxygen-containing feed gas in an electric discharge. Ozone generation shall be on-site with immediate application of the ozone to the waste stream.

The ozone generator may be of the plate or tube type. The equipment shall be equipped with adequate cooling water systems to dissipate heat produced during ozone generation.

b) Piping and Piping Appurtenances - All piping from the generator to the diffuser system shall be of an approved material which is corrosion resistant to ozone.

c) Dissolution System - Since the purpose of ozonation is to achieve a maximum oxidizing effect with minimum dose, a dissolution system shall be provided to divide the gas into fine bubbles as it mixes with the effluent. Acceptable methods include porous diffusers, venturi injectors, and emulsion turbines.

d) Handling of Process Off-Gases - Handling of off-gases from the ozone contact chamber should be a major design consideration.

Ozone produced by using oxygen as feed gas may contain more than 90 per cent oxygen in the off-gases released from the contact chamber. A suitable means of covering the chamber and recycling the oxygen to the ozonator may be economically feasible. The possibility of nitrogen build-up in the off-gases should be acknowledged and a suitable nitrogen gas removal system shall be included in the design.

c. Other Methods - Other methods of disinfection, such as iodination, x-radiation, γ-radiation, etc., may be proposed. Prior to use, sufficient data as to the technical feasibility and application shall be submitted to the Department for review and approval.

2. Contact Basin Design.

a. Design Criteria - Table VII - 35 gives recommended design criteria for the design of chlorine and ozone contact chambers.

b. General Structural Requirements.

1) Chemical Addition - The design of the contact tank should provide for the disinfectant solution through a diffuser which will uniformly distribute the solution into the path of flow of sewage or by flow directly into a rapid mix propeller for instantaneous and complete diffusion.

Mixing for at least 30 seconds should be maintained if mechanical mixing is not used.

2) Basin Channels - Basin channels may be under-over type or around-the-end serpentine type which shall be designed to prevent short circuiting and shall assure at least 80 to 90 per cent of the wastewater is retained in the basin for the specified retention time.

3) Dewatering and Desludging - Drains shall be provided in the tank for dewatering the contact basin and for removal of sludge by flushing or manual operation.

3. Odor Control.

a. Use Requirements - Several methods may be employed for odor control. In selection of the most feasible method, consideration should be given to using equipment employed elsewhere in the process, such as aeration, chlorination, etc.

b. Methods and Doses.

1) Chlorination - Chlorine is used in up-sewer, ahead of odor producing points in the plant. The design of chlorination odor control should be based upon 20 ppm chlorine dosage.

Parameter	Chlorine	Ozone
Retention Time (minutes at peak hourly flow or max. rate of pumpage)	15	5
Channel Velocity (fpm)	5 - 15	5 - 15

Table VII - 35

Recommended Design Criteria
Chlorine or Ozone Contact Chamber

Equipment design shall conform to the requirements of Section 0.1.a.

2) Ozonation - Ozone is used primarily at in-plant points since on-site ozone generation is required. In addition to applications in the waste stream, ozone may be mixed with off-gases from digesters and holding basins for odor control.

Dosages range from 15 ppm to 25 ppm and should be designed for the maximum dose requirements.

3) Aeration - Aeration at points upstream of odor production may be a feasible means of odor control. Retention times range from 10 to 45 minutes with air requirements ranging from 0.1 to 0.4 cubic feet per gallon of wastewater.

4) Chemical Addition - Deodorizing chemicals may be employed in areas where it is difficult to arrange aeration, chlorination, or ozonation. Chemicals may be employed directly in the waste stream or aspirated and sprayed over areas of odor production.

5) Lime Application - The use of lime in odor control is generally used on open sludge beds. Dose requirements depend upon digester operation and control, pH, alkalinity and volatile acids in the sludge.

6) Hydrogen Peroxide - Hydrogen peroxide is used primarily in up-sewer and ahead of odor producing points in the plant. The dose requirements range from 5 to 40 mg/l depending upon the location of the odor and the temperature of the waste.

It is recommended that no greater than 50 per cent hydrogen peroxide solution be used as feed. Where the Engineer is contemplating using 70 per cent solution, care should be taken to safely house the equipment and meet local fire codes.

P. EFFLUENT REUSE SYSTEMS.

Reuse of treated sewage effluents is encouraged. However, the potential public hazard caused by reusing effluents must be weighed carefully in the study of reuse methods. Additional treatment of the effluent may be required prior to reuse.

1. Domestic Irrigation - Domestic irrigation includes watering of playgrounds, parks, lawns, or other areas where the public may congregate and/or where children may play.

   a. Effluent Storage - Since wastewater flows at a continuous non-uniform rate and the frequency of irrigation and quantity of water used for irrigation vary, effluent storage should be provided.

      The requirements for effluent storage pond design are outlined in Section K of this Chapter.

   b. Effluent Quality Requirements - The Department's Rules and Regulations R9-20-400 place restrictions on the quality of effluent which may be used for domestic irrigation. Under this regulation, all waste effluents used for domestic irrigation shall contain not more than 10 mg/l BOD, 10 mg/l suspended solids, and 200 fecal coliform per 100 ml, based upon the arithmetic mean of 5 analyses over a 15-day period.

      To achieve this quality of effluent, a form of tertiary treatment will most likely be required.

   c. Water Demand - The water demand for domestic irrigation varies seasonally. As a rule of thumb, water demands range from 10,000 gpad in the summer to 1000 gpad in the winter.

   d. Distribution Systems - The distribution system for domestic irrigation shall be by spray irrigation. The nozzles should be of the non-clog type, if possible, and should be designed for easy maintenance.

      The spray nozzle shall be spaced so that the spray pattern is overlapping.

      Areas of potential puddling will not be permitted.

   e. Consideration should be given to providing buffer zones to allow for wind transport of the effluent aerosols.

   f. Monitoring Requirements - Plants employing effluent reuse systems shall monitor the effluent to assure compliance with Regulation R9-20-400. Monthly reports showing the effluent quality shall be sent to the Department.

g. Sprinkler Head Posting - Signs shall be posted on the irrigation area with the following statement: "Sprinklers Spraying Contaminated Water - Do Not Drink."

2. Agricultural Irrigation - The design and operation of an effluent reuse system via agricultural irrigation requires investigation of the following:

   a. Effluent Storage - Since wastewater flows at a continuous non-uniform rate and crop demand varies with season, the Engineer should give due consideration to effluent storage requirements. The requirements for storage pond design are outlined in Section K of this Chapter.

   b. Clogging of Soils and Irrigation Distribution Systems - Most of the suspended solids in raw wastewater are removed by proper treatment. However, effective filtration methods should be investigated to assure that soils and sprinklers or trickle irrigation systems will not plug.

      In heavy soils, organic matter may clog the capillary pores in the upper layer which will decrease infiltration. Deeper soil plugging will result in anaerobic conditions which will reduce soil permeability. In these cases, a regular means of breaking the surface crust and plowing the deeper layers may be required as standard operational procedure to improve and maintain soil permeability.

   c. Crop Demands - The amount of water required by the crop and the frequency of application will be the major criteria in designing the irrigation system. Technical Bulletin No. 169, "Consumptive Use of Water by Crops in Arizona," is recommended as reference for design of agricultural irrigation systems.

   d. Toxic Constitutents - Wastewater effluents may contain soluble constituents at concentrations toxic to plants. The following chemical constituents should be investigated and correlated with crop toxicity.

      1) chloride
      2) sodium
      3) zinc
      4) manganese
      5) hexavalent chromium
      6) cadmium
      7) nickel
      8) lead
      9) mercury
      10) organic acids
      11) phenols
      12) boron

      If such constituents exceed the recommended toxic limits for crops in question, suitable means shall be designed to dilute or reduce the concentration of the toxic constituent.

   e. Coliform Restrictions - The Department's Rules and Regulations R9-20-400 place restrictions on the quality of effluent which may be used for agricultural irrigation.

Irrigated Constituent	Maximum Allowable Coliform Count #/100 ml	
	Coliform Group	Fecal Coliform
Fibrous a forage crop not for human consumption	No limit	No limit
Orchard crop (indirect application) of effluent	No limit	No limit
Processed food crop	Single sample Monthly arithmetic average 5,000	Single sample Monthly arithmetic average 1,000
Orchard crops (direct application) of effluent	Single Sample 20,000 Monthly arithmetic average 5,000	Single Sample 4,000 Monthly arithmetic average 1,000
Food crops unprocessed	—	Arithmetic average of 5 samples over 15 days — 200

Table VII - 36

Maximum Coliform Concentrations for Agricultural Irrigation

Irrigated Constituent	Type of Treatment	Effluent Quality BOD_5mg/1	SSmg/l
Fibrous or forage crops not for human consumption	Secondary	30	30
Orchard crops (indirect application) of effluent	Secondary	30	30
Processed food crop	Secondary and disinfection	30	30
Orchard Crops (direct application) of effluent	Secondary and disinfection	30	30
Unprocessed food crop	Secondary, Tertiary, and disinfection	10	10

TABLE VII - 37

Effluent Quality Requirements for Agricultural Irrigation

Table VII - 36 summarizes the coliform requirements of the regulations.

f. Effluent Quality - R9-20-400 also gives effluent quality and monitoring requirements for agricultural irrigation. Table VII - 37 summarizes the type of waste treatment required and the effluent quality restrictions.

g. General Features.

1) Conveyance System - Conveyance of effluent to the irrigation should preferably be by gravity. Only when topography is unfavorable or where long conveyance distances are required should pumping be considered.

The storage pond shall be considered as an integral part of the conveyance system.

The requirements established in Section Q - Land Treatment also apply to agricultural irrigation.

Animal	Water Consumed (gpd)
Beef cattle, per head	7 - 12
Dairy cattle, per head	10 - 16
Horses, per head	8 - 10
Swine	3 - 5
Sheep and goats, per head	1 - 4
Chickens, per 100 birds	8 - 10
Turkeys, per 100 birds	10 - 15

Table VII - 38

Water Consumption by Livestock

2) Fence - The effluent storage pond shall be fenced to prevent public access. The fence shall be a minimum of 6 feet in height and shall be of sufficient strength to exclude livestock and other animals. Material of construction shall be chain link, wood, or block. All gates shall be of the lockable type.

3. Stock Watering - Stock and wildlife consume water in varying amounts, depending upon climate, type of diet, degree of exercise, and the salinity of the water available. Table VII - 38 tabulates some appropriate ranges of water consumption by livestock. Animals can tolerate higher salinities than man. Table VII - 39 shows the proposed safe limits of salinity for livestock.

When reusing sewage effluent for stock watering, the Engineer shall give careful consideration to the quality of the effluent, its affect upon the animals, and the potential for disease or chemical contamination of humans through animal consumption.

The Department's Rules and Regulations R9-20-400 requires minimum of secondary treatment for watering of farm animals other than producing dairy animals.

Animal	Threshold Salinity Concentrations (TDS, mg/1)
Poultry	2860
Swine	4290
Horses	6435
Dairy cattle	7150
Beef cattle	10000
Sheep (adult)	12000

Table VII - 39

Proposed Safe Limits of Salinity for Livestock

Watering of producing dairy animals requires secondary treatment and disinfection. The maximum monthly arithmetic average coliform count shall not exceed 5000/100 mg, and the maximum monthly arithmetic average fecal coliform count shall not exceed 1000/100 ml. Single sample limitations are 20,000/100 ml for coliform, and 4000/100 ml for fecal coliform.

4. Golf Course Irrigation - The use of effluent for golf course irrigation requires investigation of the following:

   a. Effluent Storage - Since wastewater flows at a continuous non-uniform rate and golf course irrigation pumping systems operate during daily or weekly intervals, storage ponds shall be required (in the form of lake systems) to provide for the periodic operation. The requirements for effluent pond design are outlined in Section K of this Chapter.

   b. Water Demand - The water demand for a golf course varies seasonally. As a rule of thumb, water demands range from 10,000 gpad in the summer to 1,000 gpad (once per week) in the winter, depending upon elevations and climatilogical conditions.

   c. Effluent Quality and Monitoring Requirements - The Department's Rules and Regulations R9-20-400 require a minimum of secondary treatment and disinfection for effluents used on golf courses in non-residential areas, and tertiary treatment and disinfection for effluents used on golf courses in residential areas.

      For residential areas, fenced golf courses which prevent children from playing on the links may be used as an alternative to tertiary treatment.

      Consideration should be given to providing buffer zones to allow for wind transport of the effluent aerosols.

   d. Posting - Signs shall be posted on the golf course with the following statement: "Sprinklers Spraying Contaminated Water - Do Not Drink."

5. Industrial Reuse - The quality of effluent required for industrial reuse varies from industry to industry and from process water to process water.

   "Water Quality Criteria," by McKee & Wolf is an excellent reference to use in designing industrial reuse systems.

6. Wetlands Marsh - Formation of a wetland marsh for the reuse of effluent incorporates physical, chemical, and biological principles in a common environment to yield a balanced ecosystem. The effluent marsh is stocked with fish and aquatic organisms, is a resting place and breeding area for fowl; and, provided with the proper land and vegetation balance, attracts a wildlife habitat.

a. Effluent Quality Requirements.

1) Bacteriological Quality - The fecal coliform content shall not exceed a geometric mean of 1000/100 ml nor shall more than 10 per cent of the samples during a 30-day period exceed 200/100 ml, based on a minimum of five samples during such periods.

2) pH - The pH shall remain within the limits of 6.5 and 8.6 at all times. The maximum change permitted as a result of the waste discharge shall not exceed 0.5 pH units.

3) Dissolved Oxygen - The discharge of wastes shall not lower the dissolved oxygen content below 4 mg/1 in the receiving body.

4) Temperature - The temperature of wastes discharged shall not interfere with wildlife use or aesthetic values.

5) Toxicity - The following limits shall not be exceeded for the lisited substances.

Substance	Limiting Concentration mg/1
Arsenic	0.05
Barium	0.5
Cadmium	0.01
Chromium (Hexavalent)	0.05
Copper	0.05
Cyanide	0.10
Lead	0.05
Mercury	0.005
Phenol	0.001
Selenium	0.01
Silver	0.05
Zinc	0.5

b. Ground Water Protection - Care shall be taken to assure that bacterial contamination, tastes, odors, turbidity, color, foaming, or a significant increase of mineral water quality of the underlying aquifiers which are used for public supply does not occur. Ground water monitoring may be required.

c. Physical/Biological Requirements - The marsh should be designed to meet the following requirements to allow optimum management and success of purpose:

1) The effluent source must not contain significant quantities of any harmful materials. (Discharge requirements discussed above provide for this need.)

2) Optimum waterfowl habitat conditions must be provided, i.e., sufficient nesting cover for upland and over-water nesters, adequate brood cover, minimum access for predators and sufficient loafing sites.

3) Water level manipulation must be timed so as not to affect nesting birds.

4) The effluent discharge to the marsh area should be disinfected, either by natural means, chlorination, or other acceptable methods.

5) Storage facilities may have to be provided in those situations where mechanical plants are discharging continuously, since it is not recommended that the marshes receive water during the winter.

6) Marsh may be a natural or artificial basin and it may be operated as a closed system (with all water loss through evaporation) or an open system, allowing periodic discharge into a natural water course.

7) If efficient nutrient removal is to take place in such a system, care must be taken to avoid creating a marsh with a large central area of open water. Depending upon the morphometry of the basin, various internal works such as cross dikes may have to be constructed to obtain relatively shallow water throughout the system, and thereby provide the maximum contact of water with the nutrient absorbing aquatic plants. The nutrient-rich water should result in prolific growth of aquatic plants and invertebrates; as a result, food will not be a limiting factor to water fowl production. In order to avoid other factors (e.g., nesting and loafing sites) limiting production, it is strongly recommended that internal work (loafing bars and islands) be included in the design.

8) About 25 per cent of the marsh area should be open water at a depth of 4 to 5 feet. Islands for upland nesting and loafing would cover approximately 10 per cent of the marsh area. Some 50 to 60 per cent of the area would consist of shallow water and emergent vegetation for brood cover and nesting habitat for over-water nesters. Maximum security from nest predation is provided by surrounding the complex with a continuous zone of water two feet deep and approximately 300 feet wide.

9) Annual discharge and reflooding in early spring is desirable to insure maximum uptake of nutrients during the growing season and provide as little disruption to nesting water fowl as possible.

10) Some method of detritus removal, either by conventional harvest methods, burning or some form of dredging should be considered to prevent "fill in" of the marsh area.

d. Other Engineering Requirements - There are several requirements which the Engineer should consider during design.

1) Protection against discharge or escape of reclaimed water from the marsh site should be considered. Sufficient water surface area must be provided so that the entire output of the treatment plant is taken up by evaporation during the months of maximum production of reclaimed water. Storage or alternate methods of disposal should be provided for use during months of low evaporation, if necessary.

2) The marsh land should be segmented, so that sections can be closed off for rehabilitation or other work under the management program. Additional surface area should be allowed for in the design of the marsh to compensate for such periodic closures or, as an alternative, reclaimed water storage facilities should be incorporated into the design of the marsh.

3) The wetlands should be located in an area of low soil permeability having a minimum soil mantle of three feet.

4) The site should be level to minimize earthwork and to a-low simulation of natural conditions as closely as possible.

5) The site should be protected from natural inflow of waters to increase its capacity for utilization of reclaimed water. In addition, the site must be safe from flooding by storms up to the 100-year frequency.

6) Facilities for delivery of reclaimed water to the wetlands marsh and for initial distribution into the marsh must be designed as all-weather components, capable of functioning during periods of freeze, as well as during normal weather.

7) The initial distribution system at the marsh area should be designed to permit operating personnel to select the area of the marsh to which the water will be delivered.

8) If it is found that the marsh land program cannot consumptively use all of the reclaimed water produced, either on an annual or a seasonal basis, alternative supplemental means of disposal/reclamation must be sought.

9) Soils and geological investigation should be undertaken to define unusual geology, faults, dikes, etc. which would govern site location.

10) Tabulation of existing wells that use the underlying aquifer and their water quality should be defined for background on future monitoring. Other ground water monitoring may be required.

11) Investigation of the effects of the system relative to proximity of inhabited areas should be considered.

Q. LAND TREATMENT.

The treatment of wastewater by land application can be applied to raw pretreated wastewater or effluents from secondary treatment processes.

There are three basic methods of applying raw waste or secondary effluents to land:

(1) slow rate (irrigation)
(2) rapid infiltration (infiltration-percolation)
(3) overland flow.

1. Design Criteria - Tables VII - 40 and VII - 41 show the recommended design criteria for the three basic methods of land treatment. More detailed design information and examples are given in the EPA Process Design Manual for Land Treatment of Municipal Wastewater.

   Preliminary investigative soils work shall be performed and submitted in report form evaluating the items listed in Table VII - 42.

2. Distribution - Distribution of the wastewater or effluent may be by fixed or moving sprinkling systems, ridge and furrow surface spreading, or border-strip irrigation.

3. Containment - All land disposal areas shall be designed to contain the effluent within the desired area.

   If overland flow is used, the system used to collect the effluent discharge shall be suitable to assure confined transport to the point of final disposal.

4. Buffer Zones - Consideration shall be given to providing buffer zones on the land area to absorb unusual flow variations.

5. Monitoring Requirements - The effluent stream should be monitored, especially when the land treatment area is used in conjunction with agricultural production.

   Ground water monitoring may be required and will be designated as required when the Department feels monitoring is necessary.

R. OTHER PROCESSES.

There are other processes which have application as advanced waste treatment processes and are generally applied to treated effluents.

1. Ion Exchange - Ion exchange is generally used in the advanced waste treatment field to remove organic nutrients, specially nitrogen and phosphorous compounds.

Feature	Principal processes		
	Slow rate	Rapid infiltration	Overland flow
Application techniques	Sprinkler or surface[a]	Usually surface	Sprinkler or surface
Annual application rate, ft	2 to 20	20 to 560	10 to 70
Field area required, acres[b]	56 to 560	2 to 56	16 to 110
Typical weekly application rate, in.	0.5 to 4	4 to 120	2.5 to 6[c] 6 to 16[d]
Minimum preapplication treatment provided in United States	Primary sedimentation[e]	Primary sedimentation	Screening and grit removal
Disposition of applied wastewater	Evapotranspiration and percolation	Mainly percolation	Surface runoff and evapotranspiration with some percolation
Need for vegetation	Required	Optional	Required

a. Includes ridge-and-furrow and border strip.

b. Field area in acres not including buffer area, roads, or ditches for 1 Mgal/d (43.8 L/s) flow.

c. Range for application of screened wastewater.

d. Range for application of lagoon and secondary effluent.

e. Depends on the use of the effluent and the type of crop.

Table VII - 40

Comparison of Design Features for Land Treatment Processes

Characteristics	Principal processes		
	Slow rate	Rapid infiltration	Overland flow
Slope	Less than 20% on cultivated land; less than 40% on noncultivated land	Not critical; excessive slopes require much earthwork	Finish slopes 2 to 8%
Soil permeability	Moderately slow to moderately rapid	Rapid (sands, loamy sands)	Slow (clays, silts, and soils with impermeable barriers)
Depth to groundwater	2 to 3 ft (minimum)	10 ft (lesser depths are acceptable where underdrainage is provided)	Not critical
Climatic restrictions	Storage often needed for cold weather and precipitation	None (possibly modify operation in cold weather)	Storage often needed for cold weather

Table XII - 41

Comparison of Site Characteristics for Land Treatment Processes

Wastewater Characteristics	Climate	Geology	Soils	Plant Cover	Topography	Application
Flow	Precipitation	Groundwater	Type	Indigenous to region	Slope	Method
Consistuent load	Evapotranspiration	Seasonal depth	Gradation	Nutrient-removal capability	Aspect of slope	Type of equipment
	Temperature	Quality	Infiltration/ permeability	Toxicity levels	Erosion hazard	Application rate
	Growing season	Points of discharge	Type and quantity of clay	Moisture and shade tolerance	Crop and farm management	Types of drainage
	Occurrence and depth of frozen ground	Bedrock Type Depth Permeability	Cation-exchange capacity	Marketability		
	Storage requirements		Phosphorus adsorption potential			
	Wind velocity and direction		Heavy metal adsorption potential			
			pH			
			Organic matter			

Table VII - 42

General Design Considerations For Land-Treatment Systems

In the general application, the ion exchange process should be preceded by carbon adsorption to reduce the organic load to the exchangers and decrease organic fowling of the resin beds.

a. Ammonia Removal - Ammonia removal may be accomplished using a porous cationic resin with the feed applied at approximately 3 gpm/ft^2. Regeneration is accomplished using a 10 per cent NaCl solution.

   Selective ion exchange has been used which employs a natural zeolite, which is selective in the presence of sodium, magnesium, and calcium ions. Hydraulic loading rates of 6 - 8 gpm/ft^2 of bed area is the normal operating procedure. Regeneration of the exhausted resin is accomplished with a lime slurry which reacts with the ammonium ions to give an alkaline aqueous ammonia solution. The ammonium solution is then taken to an airstripping tower and the regenerant is recycled to the zeolite bed.

b. Phosphate Removal - Typical organic resins used for anion exchange may be used for phosphate removal.

   In addition, consideration should be given to using activated alumina. Application rates are generally in the range of 3 - 4 gpm/ft^2. Regeneration is accomplished using 2.0 M NaOH solution for backwash.

   In all cases, it is recommended that pilot studies be administered to define design criteria and potential problem areas prior to final design.

2. Oxidation - Chemical oxidation in the advanced waste treatment process has application to:

   (1) remove ammonia in the effluent stream,
   (2) reduce the concentration of residual organics,
   (3) reduce the bacterial and viral content of the effluent. (See Section O.)

a. Chlorine - Chlorination has proven to be operationally dependable in removing ammonia nitrogen in the wastewater effluent.

   Theoretically, approximately 6.3 mg/l Cl_2 are required to remove 1.0 mg/l of ammonia. Actual experience shows requirements of 10 mg/l or greater of Cl_2 to remove 1.0 mg/l of ammonia. Best results occur with a reaction time of 2 hours, a temperature of 45 - 48°F, and a pH 7 - 9.

   Chlorination is also a dependable means of reducing organic concentration (BOD_5,COD) in the effluent. Dosages required for organic reduction can only be determined in the laboratory. Therefore, pilot testing should be undertaken to size the chlorination system.

b. Ozone - Ozone may be used in reducing the organic concentrations in wastewater treatment effluents. Since the reaction rate of ozone with organics is dependent upon the rate of ozone decomposition, which in turn varies with pH, pilot testing should be performed in designing ozonation systems used for oxidation of organics.

3. Reverse Osmosis - The reverse osmosis process may be used for inorganic and organic reduction in wastewater effluent streams prior to water reuse.

To assure an extended membrane service it will be necessary to pretreat the effluent prior to application of the reverse osmosis system. In addition, facilities should be provided for periodic cleaning of the membrane units.

a. Pretreatment - Since the principal cause of flux-decline of a reverse osmosis unit is generally attributed to organic or heavy metal fouling of the membrane, membrane hydrolysis, and membrane compaction, pretreatment is a necessity prior to reverse osmosis. The most frequently used pretreatment methods for wastewater effluents include:

1) pH Adjustment - Acidification of the feed stream reduces the rate of flux-decline by increasing the solubility of inorganic precipitates such as $CaCO_3$, $Mg(OH)_2$, or $CaSO_4$, and minimizes the hydrolysis of the reverse osmosis membranes. It is general practice to keep the pH of the feed below 7.5. In addition, it is important to control the temperature of the feed to between 70 - 80°F for reduction in membrane hydrolysis.

In any case, the manufacturers' recommendation should be considered for operating conditions related to pH and temperature.

2) Turbidity Control - Removal of excess turbidity may be achieved by clarification with chemical coagulants absorption. In all cases, the feed stream should not exhibit a turbidity greater than 1 and, preferably, less than .75 JTU.

Disinfection prior to the reverse osmosis following pretreatment is necessary to prevent slime growths on the membrane and/or prevent contamination of the equipment.

b. Membrane Cleaning - Table VII - 43 lists the methods of membrane cleaning that have been used and which may be considered to prolong membrane service.

c. Post Treatment - Post treatment of the permeate water may be necessary and may involve pH adjustment, degasification to remove carbon dioxide, and disinfection.

Technique	Method	Description
Physical	Mechanical	Foam-ball swabbing
	Hydrodynamical Reverse flow	Tangential velocity variation Turbulence promoters Depressure and use forced or osmotic reverse flow of product
	Air/water flushing	Daily 15 min depressurized flush
	Sonication	Regular ultrasonic cleaning with wetting agent
Chemical	Additives to feed	pH control to reduce hydrolysis and scale deposit 5 mg/gal of 5% sodium hyperchlorite at pH = 5 Friction-reducing additives (poly-etheleneglycol) soil dispersants (sodium silicate)
	Flushing with additives at low pressure	Complexing agents (EDTA, Sodium hexametaphosphate) Oxidizing agents (citric acid) Detergents (1% BIZ) Precoat (diatomaceous earth, Activated carbon, and surface-active agent) High concentraton of NaCl (18%)
	Membrane replacement -	*In situ* membrane replacement
	Inorganic membranes - Active	Encourage biogrowth to consume fouling film
	insoluble enzymes attached to membrane	Degradation of fouling film
	Proyelectrolyte membranes	Composite membranes or dynamic layer technique

Table VII - 43
Membrane Cleaning Techniques for Reverse Osmosis

The design of reverse osmosis system should be undertaken in conjunction with a reputable reverse osmosis manufacturer which has had prior experience in wastewater treatment applications. It is recommended that pilot studies be performed on pretreatment as well as reverse osmosis applications prior to final design.

4. Evapotranspiration - Evapotranspiration systems have application in effluent disposal of small waste treatment facilities. They generally provide a means of wastewater disposal in localities where site conditions preclude soil absorption, although they may be used in conjunction with soil absorption systems.

   a. Design Criteria - The surface area of the evapotranspiration bed shall be sized on a hydraulic loading rate shown in Figure VII - 25. Since localized conditions are not shown in Figure VII - 25, the Engineer shall make necessary adjustments based upon similar elevations.

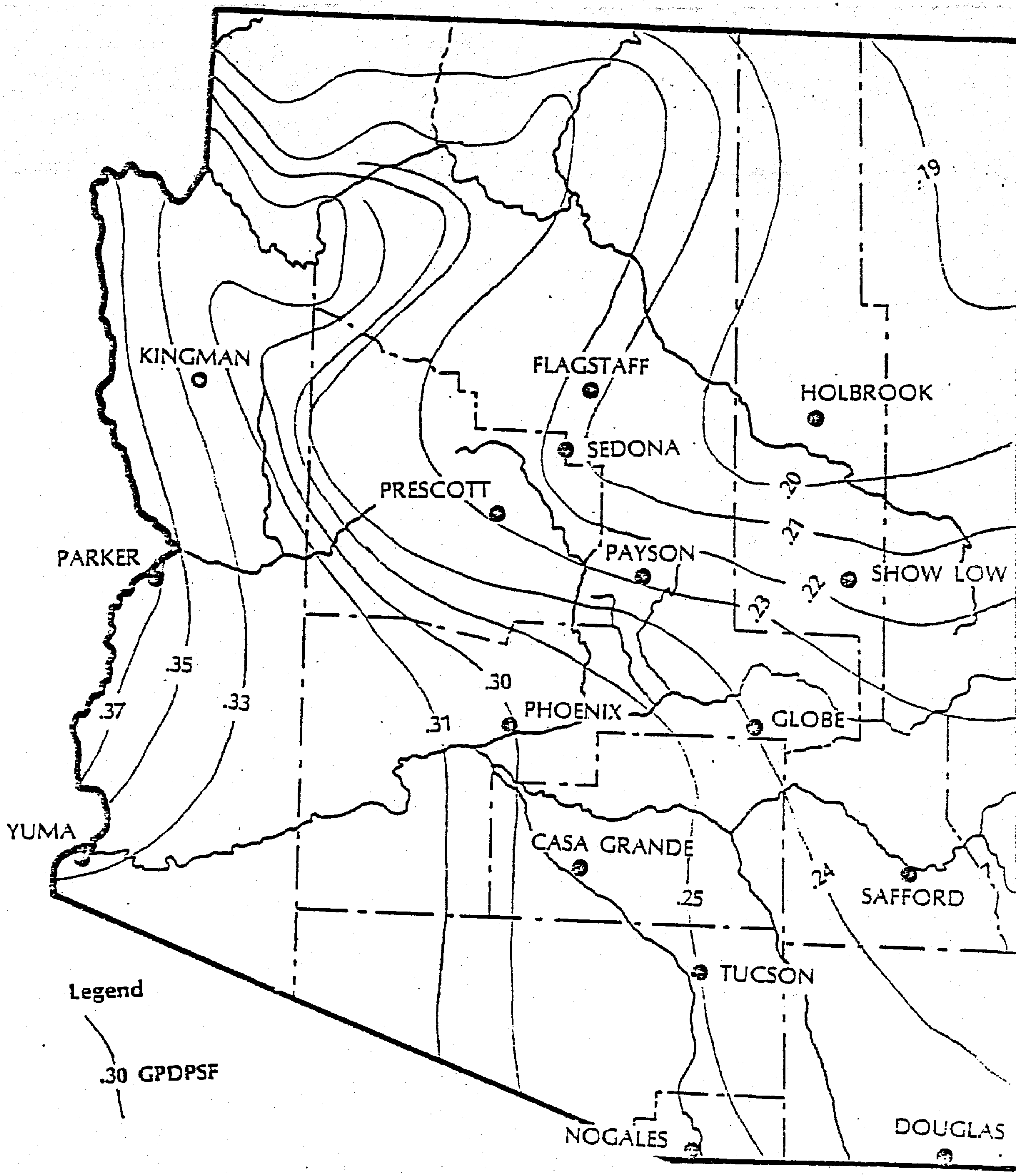


Figure VII - 25

Evapotranspiration Bed Application Criteria

	Minimum Distance, ft.
Well - Public Water Supply	100
- Private	50
Water Line	10
*Live Stream	100
Dry Wash	50
**Property Line	6
Building Foundation	10
Swimming Pools	10
Walks, Driveways	5

* 200 feet on water supply water sheds.

** Lots with individual wells require setbacks of 50 feet.

Table VII-44

Setback Requirements for Evapotranspiration Systems

b. Setbacks - The minimum setbacks allowed shall be as outlined in Table VII - 44.

c. Bed Construction.

1) The bed surface shall be slightly crowned to exclude rain water. Adjacent drainage shall be diverted around and away from the evapotranspiration bed.

2) The bed depth shall be between 3 feet and 5 feet, but not less than twice the maximum frost depth.

3) The media shall be placed as follows:

a) Bottom half shall be 3/4 - 4 inch diameter gravel. Perforated drain tiles shall lay level on the top of the gravel.

b) Pea gravel shall be placed on top of the gravel to within 15 inches of the bed surface.

c) Coarse sand shall be placed on top of the pea gravel to within 2 inches of the bed surface.

d) The bed shall be topped with 2 inches of top soil.

4) The distribution drain lines shall be perforated and shall be spaced no greater than 10 feet apart distributed across the bed area.

5) Serial or parallel loading of the drain lines is permitted.

6) The area may be planted with trees, flowers, or grass. However, vegetation should be selected to maximize evapotranspiration. The State Universities or the U. S. Department of Agriculture should be contacted for guidance.

7) Where evapotranspiration beds are placed on hillsides, concrete retaining walls or other suitable construction shall be installed to a depth of 2 feet below the bed bottom to prevent effluent from surfacing.

8) In areas where blasting is necessary, the soil and rock conditions and construction techniques may dictate use of bottom and/or side sealing.

9) Where sealing of the evapotranspiration bed is required, it is recommended that 20 mil minimum Hypalon or PVC liner be installed.

10) An evapotranspiration bed area equal to 100 per cent of the initial area shall be available for bed expansion. This space shall not be used for permanent structures.

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Chapter 8

LABORATORY EQUIPMENT AND CONTROL

ARIZONA DEPARTMENT OF HEALTH SERVICES

JULY 1978

CHAPTER VIII - LABORATORY EQUIPMENT AND CONTROL

1. pH
2. BOD
3. COD
4. Suspended Solids
5. Temperature
6. Coliform
7. Dissolved Oxygen
8. Chlorine Residual

D. LABORATORY DESIGN.

The three key words to any well-planned wastewater treatment plant laboratory are:

(1) Flexibility, which provides for changes in use requirements,
(2) Adaptability, for changes in occupancy requirements, and
(3) Expandability, for changes in space requirements.

The design of the laboratory facility should be performed with expectations of meeting future laboratory certification requirements. Smaller sewage treatment plants may not be able to support such a facility nor will it be necessary. As the size of the facility increases (above 100,000 gallons per day) careful design is encouraged to facilitate updating of the existing laboratory as laboratory certification requirements become mandatory.

1. Location - The laboratory should be located on ground level, easily accessible to all sampling points. In site selection, environmental control is an important consideration. It should be located away from vibrating machinery or equipment which might have adverse effects on the performance of laboratory instruments or the analyst. Optimum utilization of the laboratory is related to a pleasant, comfortable environment.

2. Equipment - Each laboratory should be equipped with the necessary equipment to perform the recommended laboratory analysis given in Table VIII - 1.

   Glassware, chemicals, and other miscellaneous appurtenances should be housed in lockable cabinets.

Table VIII-1
Process vs. Routine Control Tests

	pH	Temperature	BOD	COD	Dissolved Oxygen	Suspended Solids	Total Dissolved Solids	Grease	Settleable Solids	Volatile Solids	Sludge Volume Index	Alkalinity
Influent	●	●	●			●	●	●		●		
Primary Clarification												
a. Influent			●	●		●			●			
b. Effluent			●	●		●						
c. Underflow						●				●		
Aeration (Including Trickling Filter)	●	●		●	●	●	●		●	●	●	
Secondary Clarification												
a. Influent	●	●				●				●		
b. Effluent			●		●	●	●		●			
c. Underflow						●				●		
Thickeners												
a. Gravity												
1. Influent						●						
2. Effluent			○	●		●						
3. Underflow						●		●		●		
b. Flotation												
1. Influent						●						
2. Effluent			●	●		●						
3. Underflow						●		●		●		
Digesters *												
a. Anaerobic												
1. Influent	●	●		●				●		●		●
2. Supernatent	●	●		●								●
3. Sludge						●				●		●
b. Aerobic												
1. Influent						●				●		
2. Supernatent			●		●	●						
3. Sludge						●				●		●
Sludge Dewatering												
a. Influent	●					●		●				●
b. Supernatent (Filtrate or centrate)	●		●	●		●	●					
c. Dewatered sludge						●		●		●		

* Volitile acids should be included in anaerobic digestion analysis

Table VIII-1, continued.

	pH	Temperature	BOD	COD	Dissolved Oxygen	Suspended Solids	Total Dissolved Solids	Grease	Settleable Solids	Volatile Solids	Sludge Volume Index	Alkalinity
Sludge Incineration												
1. Influent						●		●		●		
Lagoon												
1. Influent	●	●	●			●	●	●	●			
2. Pond Content	●	●			●				●			●
3. Effluent	●	●	●		●	●	●		●			

Table VIII-1, continued.

Advanced Waste Treatment	pH	Temperature	BOD	COD	Suspended Solids	Total Dissolved Solids	NH_3	Organic Nitrogen	NO_3	PO_4
1. On Effluent from Biological treatment										
a. Ammonia air stripping										
1. Influent	●						●			
2. Effluent							●			
b. Filtration										
1. Influent			●	●	●		●		●	
2. Effluent			●	●	●		●		●	
3. Backwash					●					
c. Distillation										
1. Influent	●	●	●	●	●	●		●	●	●
2. Effluent			●	●	●	●		●	●	●
d. Flotation										
1. Influent	●			●			●		●	
2. Effluent					●		●		●	
3. Sludge			●		●					
e. Foam Fractionation										
1. Influent	●	●	●	●	●					
2. Effluent			●	●	●					
f. Reverse Osmosis										
1. Influent	●	●	●	●	●	●	●	●	●	●
2. Effluent			●	●	●	●	●	●	●	●
g. Carbon Adsorption										
1. Influent	●	●	●	●	●			●		
2. Effluent			●	●	●			●		
h. Ion Exchange										
1. Influent	●	●	●	●			●	●	●	●
2. Effluent			●	●						
i. Electrodialysis										
1. Influent	●	●				●	●		●	●
2. Effluent						●	●		●	●
j. Chemical Precipitation										
1. Influent	●	●	●	●	●	●	●	●		●
2. Effluent			●	●	●	●	●	●		●
3. Sludge					●					
k. Nitrification Denitrification										
1. Influent	●	●					●	●	●	
2. Effluent							●	●	●	

Table VIII-1, continued.

Advanced Waste Treatment	pH	Temperature	BOD	COD	Suspended Solids	Total Dissolved Solids	NH_3	Organic Nitrogen	NO_3	PO_4
2. Physical Chemical - Secondary Treatment										
a. Coagulation										
1. Influent	●	●	●	●	●	●	●	●	●	●
b. Sedimentation										
1. Influent	●	●			●					
2. Effluent			●	●	●	●	●	●	●	●
3. Sludge*					●					
c. Filtration										
1. Influent	●	●	●	●	●		●	●	●	●
2. Effluent			●	●	●		●	●	●	●
3. Backwash					●					
d. Carbon Adsorption										
1. Influent	●	●	●	●	●		●	●	●	●
2. Effluent			●	●	●			●		●

*Volatile solids should be included in sludge analysis.

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Chapter 9

INDUSTRIAL AND AGRICULTURAL WASTES

ARIZONA DEPARTMENT OF HEALTH SERVICES

JULY 1978

CHAPTER IX - INDUSTRIAL AND AGRICULATURAL WASTES

CHAPTER IX - INDUSTRIAL AND AGRICULTURAL WASTES

A. INTRODUCTION.

1. Discharge to Surface Waters - Wastewaters from industrial and agricultural operations which discharge into any waters of the State shall not degrade the water quality of the surface waters beyond the limits prescribed by the Water Quality Standards as set forth in the Department's Rules and Regulation R9-21 and shall require a Discharge Permit.

2. No Discharge - Wastewaters from industrial and agricultural operations which do not discharge to the State's surface waters and are generally disposed of by leachfield, injection, evaporation, percolation, or other such feasible methods shall not be detrimental to ground water quality and its present and potential use.

   Groundwaters which are used or have the potential of being used for drinking water supplies shall meet the standards for chemical quality as outlined in the Safe Drinking Water Act or any other applicable regulations. Effluent from land application which will degrade the quality of these water supplies must be treated to remove the potential of ground water quality degradation.

3. Discharge to Public Sewers - Wastewaters from industrial and agricultural operations which discharge into a public sewer shall be of such quality as to not cause toxicity to the public wastewater treatment process and to not degrade the water quality (surface or ground water) of the effluent receiving reservoir.

   In certain instances, public systems are portected by local ordinances which limit quantity and quality of industrial and agricultural wastewaters.

4. Reuse - Wastewaters from industrial and agricultural operations which are candidates for reuse shall be considered on an individual basis in accordance with the Department's Regulation R9-20-408.

   Industrial and agricultural wastes which recycle the total effluent stream as process water is not of concern to the Department provided the reuse does not create a health hazard.

   Each wastewater should be evaluated for its reuse acceptability based upon, but not limited to:

   a. The degree of public contact with reclaimed wastes and the effect of the water quality upon public health and welfare.

   b. The degree of potential contamination of the products or by-products being produced or handled in the industrial or agricultural operation.

B. APPROVING AUTHORITY.

All treatment works proposed or designed to treat industrial and agricultural wastewaters shall be reviewed and approved by the appropriate approving authority prior to commencement of construction.

1. Environmental Protection Agency - All industrial and agricultural operations requiring a Discharge Permit shall submit the necessary reports, plans, and specifications to EPA for review and approval.

   Operations requiring pretreatment prior to discharge to a public sewer may require review and approval by EPA. The owner or his representative should contact the Environmental Protection Agency regarding the requirements of such submittal.

2. State of Arizona - The Arizona Revised Statute 36-132 requires an application for approval to construct treatment works with engineering reports, plans, specifications, and all necessary information prior to construction of all waste treatment works and reclamation systems.

   Four (4) copies of the plan documents shall be submitted to the Department at least 30 days prior to the date upon which Department approval is desired.

3. County - Certain counties act as the review and enforcement arm of the Department. The Department should be contacted for a current listing of its delegated agencies.

4. Municipality or Sanitary District - In certain instances, especially where discharges to public sewers occur, a municipality or sanitary district may require review and approval of industrial and agricultural treatment works. The owner or his representative should contact the local agencies regarding requirements for submittal.

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Chapter 10

SAFETY

ARIZONA DEPARTMENT OF HEALTH SERVICES

JULY 1978

CHAPTER X - SAFETY

CHAPTER X - SAFETY

A. INTRODUCTION.

Adequate provision must be made to protect operators and visitors of sewerage systems from hazards. The Engineer should design treatment facilities and sewer systems with maximum consideration of accident prevention and should refer to the appropriate OSHA requirements and the WPCF Manual of Practice No. 8.

B. SYSTEM PROTECTION.

Sewage treatment plants, manhole covers, sewage pumping stations, and other appurtenances of the sewerage system which are accessible to the public shall be protected from public entrance by fencing, a lockable enclosure, or other suitable means to assure a "closed" entrance to unauthorized individuals.

C. PROCESS WATER.

All process water taps shall be painted red and marked with a visible sign - "Contaminated Water - Do Not Drink."

D. IN-PLANT SAFETY.

All details pertaining to mechanical equipment, structural features, etc. of the sewage treatment plant shall be designed using the Arizona Occupational Health and Safety Standards as adopted by the Industrial Commission of Arizona, Division of Occupational Safety and Health. Such items which should be examined are belt guards, moving part guards, stairway protection, walkway design, handrail requirements, grating requirements, and color coding.

Other items which should be considered are:

1. Non-Slip Floors - In areas where water will stand or where freezing conditions may occur, suitable provision shall be made to assure proper safety by providing non-slip floors or suitable means of safety assurance.

2. Pipe Color Coding - All exposed pipe of larger facilities are to be color coded to facilitate identification. The color scheme shall follow the recommendations of the American National Standards Institute, "Standard Scheme for the Identification of Piping Systems."

3. Manhole Step Spacing - Maximum manhole step spacing shall be between 12 to 18 inches. The manhole step shall be manufactured of non-corrosive material and shall be knurled to prevent slippage.

4. Safety Equipment - All safety equipment, such as body straps, shoes, hard hats, etc. shall conform to OSHA standards.

5. Masks, Cannisters, and Respirators - All breating devices shall conform to OSHA standards.

6. Gas Chlorination Facilities - The chlorination facilities shall conform to the safety design principles outlined in Chapter VII, Section O.

7. Anaerobic Digestion Facilities.

   a. Gas Collection, Piping, and Appurtenances.

      1) General - All portions of the gas system, including space above the tank liquid, storage facilities and piping must be so designed that under all normal operating conditions, including sludge withdrawal, the gas will be maintained under pressure. All enclosed areas where any gas leakage might occur should be adequately ventilated.

      2) Safety Equipment - All necessary safety facilities shall be included where gas is produced. Pressure and vacuum relief valves and flame traps, together with automatic safety shut-off valves, are essential.

      3) Gas Pipe and Condensate - Gas pipe shall be of adequate diameter and should slope to condensation traps at low points. The use of float control condensate traps is not permitted.

      4) Gas Utilization Equipment - Gas burning boilers, engines, etc. should be located at ground level and in well-ventilated rooms. Gas lines to these units must be provided with suitable flame traps.

   b. Boiler or Heat Exchanger Controls - The automatic controls provided shall automatically shut off the main gas supply in the event of pilot burner or electrical failure.

   c. Waste Gas Burner - This burner shall be located at least 25 feet away from any plant structure, if placed at ground level, or may be located on the roof of the control building, if sufficiently removed from the tanks.

   d. Electrical Fixtures - Electrical fixtures in enclosed places where gas may accumulate, should comply with the National Board of Fire Underwriters' specifications for hazardous conditions.

   e. Ventilation - Any underground enclosures connecting with digestion tanks or containing sludge, gas piping or gas equipment, shall be provided with forced ventilation.

      1) Wet Wells - Ventilation should be continuous and should provide at least 12 complete air changes per hour. For intermittent operation, at least 30 complete air changes per hour should be provided. Such ventilation shall be accomplished by introduction of fresh air into the wet well by mechanical means.

      2) Dry Wells - Ventilation may be either continuous or intermittent. For continuous operation, at least 6 complete air changes per hour should be provided. For intermittent operation, at least 30 air changes per hour should be provided.

f. Maintenance Provisions - Non-sparking tools, rubber soled shoes, safety harnesses, gas detectors for inflammable and toxic gases, and gas masks which conform to OSHA standards shall be provided.

8. Maintenance Signs - Equipment lockout signs and devices shall be provided at all facilities for use by maintenance crews.

E. ELECTRICAL.

Electrical design should conform to the National Electrical Code and local codes. Non-sparking equipment should be used where explosion hazards exist. The equipment should bear the seal of the National Underwriters.

Adequate lighting shall be provided in the buildings as well as on the ground and especially around units serviced by personnel during hours of darkness.

F. OVERHEAD CLEARANCE.

Overhead clearances of moving equipment and stationary structures shall be sufficient to eliminate potential hazards.

G. LABORATORY SAFETY.

All laboratories shall be provided with the necessary safety equipment (conforming to OSHA standards) to assure laboratory safety. Table X - 1 serves as a minimum guideline of items needed to assure laboratory safety.

Table X - 2 is a general design check list which will be helpful in checking design features for laboratory safety.

H. FIRST AID KITS.

A well-stocked first aid kit shall be placed in strategic places throughout the plant. All vehicles used in the sewerage system should be equipped with a well-stocked first aid kit.

I. FIRE EXTINGUISHERS.

Suitable fire extinguishers shall be provided at strategic locations throughout the plant and shall be attached in a manner such that quick and easy access is provided.

J. SEWER MAINTENANCE.

1. Portable Ventilators - Portable ventilators should be provided for each sewer maintenance crew. The ventilator should be used to reduce air contamination in manholes or wet wells to a safe environment for sewer maintenance crews.

I. Eye and Face Protection

Hazards	Protective Equipment
Splashing and spills Toxic fumes and gases Ruptures and explosions	Safety glasses, goggles Face shields Ventilating exhaust hoods Protective shields of shatterproof glass or plastic

II. Hand and Arm Protection

Hazards	Protective Equipment
Glass Burns Splashing Spilling	Protective shields Gloves: Asbestos - for handling hot objects Leather - for working with glass Heavy rubber - for corrosive chemicals Light rubber - where finger dexterity is required Cotton Canvas - for general light duty Moleskin mitts - for heavy duty; with sodium hydrocarbons Plastic-coated - for handling organic solvents and chlorinated hydrocarbons

III. Respiratory Protection

Treat every chemical as toxic. Odor is not a dependable guide.

Hazards	Protective Equipment
Gaseous Fumes generated by reaction Harmful dust	Gaseous chemicals Chemical-eartridge respirators Self-contained breathing apparatus Filter respirators Gas masks Supplied-air respirators

IV. Body Protection

Hazards	Protective Equipment
Explosion Fumes and gases Splashes and spills	Protective shields Ventilating exhaust hoods Aprons, coats, coveralls Rubber, plastic, coated glass fiber for water, moisture, mild acids and alkalis Natural rubber, plastic for strong acids and alkalis Synthetic rubber, plastic, coated glass fiber for solvents Asbestos, fire-resistant duck, insulated glass fiber for flame

Table X - 1

Laboratory - Personal Protection Checklist

I. Laboratory Layout

1. Adequate exits, aisles, stairways, etc.
2. Properly designed doors
3. Exhaust hoods
4. Ventilators
5. Lighting
6. Furniture arrangement
7. Storage facilities

II. Safety Equipment

1. Safety showers and eye baths
2. Fire extinguishing equipment
3. Personal protective equipment, safety glasses, face masks, gloves, aprons, respiratory equipment, etc.

III. Emergency Facilities

1. First Aid Kits and posted first Aid procedures for poisoning, burns, bleeding, unconsciousness, etc.
2. Posted phone number of physician and ambulance
3. Posted phone number of fire department
4. Posted charts of antidotes for poisoning
5. Stretchers

Table X - 2

A Checklist for General Laboratory Safety

2. Barricades - Barricades shall be provided at each manhole where a maintenance crew is at work for protection from traffic. The barricades should be easily visible from a distance of two hundred (200) feet.

3. Safety Equipment - The maintenance crews should be provided with the following minimum safety equipment:

   a. Safety shoes
   b. Gas detector
   c. Hard hat
   d. Body saddles attached to rope (in conformance with OSHA requirements)
   e. Gloves

engineering bulletin no. 11

Chapter 11

OPERATION AND MAINTENANCE MANUAL

ARIZONA DEPARTMENT OF HEALTH SERVICES

JULY 1978

CHAPTER XI - OPERATION AND MAINTENANCE MANUAL

CHAPTER XI - OPERATION AND MAINTENANCE MANUAL

A. INTRODUCTION.

Proper operation of new or modified sewerage works and improved operation of existing facilities are essential if effluent quality standards are to be met. In an effort to increase the probability of meeting effluent quality standards, it is mandatory that each sewerage works operator have access to an operation and maintenance manual which will act as a guide in all aspects related to the system operation and maintenance.

Therefore, the design Engineer shall submit four (4) copies of an operation and maintenance manual to the Department for review and approval prior to the issuance of a certificate to operate. Upon final acceptance of the manual by the Department, the Engineer shall furnish four (4) copies of the corrected manual to the Owner.

The Owner shall locate the operation and maintenance manual in a place accessible to the operator on the site of the sewage treatment works.

B. GENERAL REQUIREMENTS.

The operation and maintenance manual shall be designed for use by the operator. It should, therefore, be written on a reading level appropriate for the grade of operator necessary for the particular plant. Readability should be increased by use of short sentences, simplified vocabulary, etc. Use of illustrations is encouraged, especially where they can supplement involved instructions.

It is recommended that all manuals be in looseleaf form for expansion and updating purposes. If the manual is large, it is recommended that it be produced in at least two volumes. Manufacturers' manuals should be grouped together and should be cross-referenced to the main text, as appropriate. The manuals should be indexed and tabbed to simplify usage.

C. FORMAT REQUIREMENTS.

The operation and maintenance manual of all sewerage works shall contain, but not be limited to, the following sections.

1. Lift Stations - Each unit of the lift station shall be related to its function. Schematic diagrams shall be used to show the location of all valves, pumps, controls, etc. and how they relate to the overall station operation. Items which should be considered are:

   a. Pumps
   b. Level controls
   c. Valves and piping
   d. Ventilation equipment
   e. Dehumidifiers
   f. Sumps
   g. Bar screens or baskets

2. Plant Layout and Flow Pattern - The plant type and a description of the basic process will be required. Each unit of the plant shall be related to its function and to the other units included in the process. Schematic diagrams shall be used to show the location of all valves, pumps, controls, etc., and how they relate to the over-all operation. Additional diagrams shall contain enlarged details of the complicated piping areas.

Items which should be considered are:

a. Pumping
b. Pretreatment systems
c. Screening and comminution
d. Grit removal
e. Primary clarification
f. Aeration and re-aeration
g. Secondary sedimentation
h. Trickling filters
i. Sand filters
j. Sludge digestion
k. Sludge conditioning
l. Sludge disposal
m. Sludge drying beds
n. Gas control and use
o. Disinfection
p. Effluent reuse systems
q. Wastewater lagoons
r. Odor control systems
s. Chemical addition
t. Effluent polishing systems
u. Other processes

3. Expected Efficiency of the System and the Principal Design Criteria - A detailed outline of the expected treatment efficiency in removing the required discharge constituents shall be presented. Principal design criteria shall be given with unit sizes, retention times, loading rates, etc., for each part of the sewerage system.

4. Detailed Operational and Control Procedures - Routine procedures of operation and control shall be detailed as well as alternate methods and emergency procedures. The pipelines, valves, and controls should be clearly marked as referenced in the detailed operation procedures.

A description of the various controls with recommended settings sha be given as related to:

a. Manual controls
b. Automatic controls
c. Physical controls
d. Chemical controls
e. Biological controls
f. Industrial waste monitoring
g. Safety features

Pump calibration curves, chemical makeup charts and other graphical aids which assist the operator shall be included.

5. Laboratory Controls - A brief discussion of required laboratory tests, why these tests are required, interpretation of the test results, and sampling procedures shall be presented as applied to:

   a. Each unit of the process
   b. Monitoring of effluent and receiving waters
   c. Water quality standards

   Recommended laboratory testing manuals or books should be referenced with names and addresses of publishers.

6. Records - The operation and maintenance manual shall stress the importance of record keeping and graphing test results. Sample forms shall be enclosed which apply to:

   a. Process operations
   b. Laboratory analysis
   c. Reports required by the regulatory agencies
   d. Maintenance

7. Maintenance - The manual shall contain a detailed recommended maintenance schedule for all facets of sewerage system maintenance. These schedules shall be for:

   a. Normal equipment maintenance schedules as per manufacturer's recommendations
   b. Preventive maintenance summary schedules
   c. Special tools and equipment
   d. Housekeeping schedules, such as weed control, etc.

8. Trouble Shooting Guide - A trouble shooting guide shall be provided for each system unit (biological and mechanical) with a ready reference chart describing short-term and long-term solutions, and a brief description of the cause.

9. Safety Procedures - The operation and maintenance manual shall discuss safety procedures as related to:

   a. Sewers
   b. Electrical equipment
   c. Mechanical equipment
   d. Explosion and fire hazards
   e. Health Hazards
   f. Handling of chlorine and other hazardous chemicals
   g. Open tank hazards

   A list of recommended safety equipment shall be an integral part of the manual. It is recommended that the WPCF Manual of Practice No. 8 be used in conjunction with OSHA in addressing safety procedures.

10. Emergency Operating Plans and Procedures - The operation and maintenance manual for lift stations and treatment plants shall describe the effective automatic response for probable emergency situations which may be caused by the following:

a. Power Failure.

   1) entire plant
   2) treatment process
   3) pumping stations
   4) false alarms

b. Flood, hurricane, earthquake, fire, windstorms, freezing, explosions
c. Contamination of potable water supply
d. Hydraulic overloading, ruptures, and stoppages
e. By-passing
f. Equipment breakdowns and process failures
g. Failure of emergency warning equipment
h. Labor strikes
i. Spills of oils, toxic or hazardous materials into sewers or at treatment works
j. Personnel injury
k. Other types of emergency situations

A general response pattern shall be established for each type of emergency and should follow the general response actions of:

a. Early warning report
b. Investigation
c. Assess severity of the situation (including threat to public health, water supplies, etc.)
d. Determine response course of action and implement appropriate emergency plan.
e. Follow appropriate notification schedule (local-State-Federal) depending on type of emergency.

The operation and maintenance manual shall also contain an emergency readiness program. The manual shall describe the appropriate program for maintaining readiness by addressing the following:

a. Equipment and parts inventory and chemical supplies necessary to handle emergency.
b. Personnel training on emergency operating procedures.
c. Charts on location of facilities

   1) sewers
   2) pump stations
   3) sewer overflow points
   4) flow regulators, valves, and controls
   5) wastewater storage

d. Alert and response system for each type of emergency
e. Early warning systems where applicable to warn downstream water users of spills, etc.
f. Industrial waste monitoring and warning system within sewer networks to alert plant operators of spills and changes in waste consistency or hydraulic conditions that may adversely affect waste treatment.

11. Utilities - A map of all utilities showing key shut-off points shall be included in the manual for

    a. Electrical
    b. Gas
    c. Water
    d. Heat

12. Manufacturer's Equipment Data - Each manual shall contain data from equipment suppliers which contains

    a. Parts lists
    b. Assembly drawings
    c. Equipment trouble shooting guides
    d. List of recommended spare parts and instructions for ordering equipment.

13. Appendix - The appendix of the manual shall contain

    a. Schematics
    b. Valve indices
    c. Sample forms
    d. List of chemicals used in the plant and handling procedures
    e. List of chemicals used in the laboratory
    f. Effluent discharge permit and standards
    g. Detailed design criteria
    h. List of equipment suppliers with addresses and telephone numbers
    i. Suppliers' manuals
    j. Local ordinances
    k. Operator certification and staffing requirements
    l. Details for reporting spills

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LIST OF SYMBOLS

CHAPTER I - None

CHAPTER II - None

CHAPTER III

K_2, K_1 = reaction rate constants

Q = flow, MGD

T_2, T_1 = system temperatures, °C

θ = constants

CHAPTER IV

n = Manning's coefficient

P = population (thousands)

Q = capita flow, gpd

CHAPTER V

A, B, S, H, C, W = sump dimensions, inches

α = sump side wall entrance angle, degrees

c = Hazen-Williams' coefficient

D, d = pipe diameter, inches

ϕ = cycle time, minutes

F = diameter of pipe with pump intake, inches

J = number of joints in test pipe

L = maximum allowable leakage, gph

P_t = test pressure, psi

Q = flow, MGD

q = pump capacity, gpm

s = pipe head loss, ft/1000 ft

V_1 = velocity past intake, fps

V_e = sump entrance velocity, fps

V_c = stream flow velocity, fps

V_p = pipe velocity, fps

V_w = wet well capacity, gallons

v = velocity of pipe flow, fps

CHAPTER VI - None

CHAPTER VII

A = surface area of tank or basin, sf

BOD_L = ultimate BOD

β = minimum width of bar screen opening, inches

b = minimum width of bar screen opening, inches

C' = conversion factor

C_i = influent BOD, pounds

C_e = effluent BOD, pounds

D = media depth, ft

d = dispersion factor

d' = pond depth, ft

F = oxygenation factor

F' = influent flow rate, gpm

g = gravitational constant, 32.2 fpsps

h = head drop across bar screen, ft

K_T = removal rate constant, day^{-1}

L_a = BOD settled sewage, mg/l

L_o = BOD influent, mg/l

L_e = BOD effluent, mg/l

L_o' = organic loading, lb BOD/acre/day

M = BOD removal rate, lb/day

MLSS = mixed liquor suspended solids concentration, mg/l

N = recirculation ratio

P = ratio of total hours of sunshine to total possible hours of sunshine

PAS = fraction of total solids due to WAS

Q = flow rate of sewage, MGD

Q_h = hydraulic loading, gpm/sf

R = recycle flow rate

r = recirculation ratio

S_{avg} = solar radiation, cal/cm^2 - day

S_{in} = influent BOD, mg/l

S_m = BOD of mixture, mg/l

S_3 = BOD effluent from third cell, mg/l

CHAPTER VII (Contd.)

SLR = solids loading rate, lb/sf/day

T = design temperature, °C

t = retention time, days

V = velocity through clear space of bar screen, fps

V_1 = upstream velocity, fps

V_c = volume lagoon cell, gallons

V' = lagoon volume, gallons

V_r = minimum rising velocity, inches per minute

w = maximum width of bars facing the flow, inches

Y_{O_2} = oxygenation factor

C, m, n, k = constants

CHAPTER VIII - None

CHAPTER IX - None

CHAPTER X - None

CHAPTER XI - None

R-34

LITCHFIELD PARK SERVICE COMPANY
DOCKET NOS. SW-01428A-09-0103 AND W-01427A-09-0104
RESPONSE TO RUCO'S SIXTH SET OF DATA REQUESTS

October 22, 2009

Response provided by:

Title:

Company Name:

Address:

EXHIBIT
R-34
ADMITTED

Company Response Number: MJR 6.3

Q. Admit that the Company completed the design of the 8.2 mgd for the Palm Valley Water and Reclamation Facility. If denied, explain what aspects of the design of the PVWRF are left to complete.

OBJECTION: Because there is no such thing as the "8.2 mgd PVWRF", LPSCO cannot answer questions related to such project. LPSCO notes that there is an ADEQ permit, as well as MAAG 208 approval to expand the current 4.1 mgd PVWRF up to a maximum of 8.1 mgd. Moreover, the question contains a second fundamentally flawed premise – that the "design" of a wastewater treatment facility can only be "complete" or "incomplete". Obviously, this is not the case, as with the PVWRF, for which design, construction and permitting are "completed", but for which there can be further "design" of expansion or expansions up to a maximum expansion of 8.2 mgd pursuant to the existing permitting applicable to this plant site.

LITCHFIELD PARK SERVICE COMPANY
DOCKET NOS. SW-01428A-09-0103 AND W-01427A-09-0104
RESPONSE TO RUCO'S SIXTH SET OF DATA REQUESTS

October 22, 2009

Response provided by:

Title:

Company Name:

Address:

Company Response Number: MJR 6.4

Q. Specify the amounts placed into plant in service each year from the test year end in the previous rate case (Decision No. 65436) to September 30, 2008 for the design of the 4.1 mgd sewer project.

OBJECTION: This data request is "asked and answered" by virtue of the Company's previous response to Staff Data Request JMM 1.77 (provided to RUCO in response to RUCO Data Request 1.04) in which the Company supplied all of the relevant invoices for plant in rate base, and it is unduly burdensome to now ask the Company to provide information that RUCO already has or can obtain from information already in its possession.

LITCHFIELD PARK SERVICE COMPANY
DOCKET NOS. SW-01428A-09-0103 AND W-01427A-09-0104
RESPONSE TO RUCO'S SIXTH SET OF DATA REQUESTS

October 22, 2009

Response provided by:

Title:

Company Name:

Address:

Company Response Number: MJR 6.5

Q. Specify the amounts placed into plant in service each year from the test year end in the previous rate case (Decision No. 65436) to September 30, 2008 for the construction of the 4.1 mgd PVWRF sewer project.

OBJECTION: This data request is "asked and answered" by virtue of the Company's previous response to Staff Data Request JMM 1.77 (provided to RUCO in response to RUCO Data Request 1.04) in which the Company supplied all of the relevant invoices for plant in rate base, and it is unduly burdensome to now ask the Company to provide information that RUCO already has or can obtain from information already in its possession.

LITCHFIELD PARK SERVICE COMPANY
DOCKET NOS. SW-01428A-09-0103 AND W-01427A-09-0104
RESPONSE TO RUCO'S SIXTH SET OF DATA REQUESTS

October 22, 2009

Response provided by:

Title:

Company Name:

Address:

Company Response Number: MJR 6.6

Q. Specify the amounts placed into plant in service each year from the test year end in the previous rate case (Decision No. 65436) to September 30, 2008 for the design of 8.2 mgd PVWRF sewer project.

OBJECTION: Because there is no such thing as the "8.2 mgd PVWRF sewer project", LPSCO cannot answer questions related to such project. LPSCO notes that there is an ADEQ permit, as well as MAAG 208 approval to expand the current 4.1 mgd PVWRF up to a maximum of 8.1 mgd.

LITCHFIELD PARK SERVICE COMPANY
DOCKET NOS. SW-01428A-09-0103 AND W-01427A-09-0104
RESPONSE TO RUCO'S SIXTH SET OF DATA REQUESTS

October 22, 2009

Response provided by:

Title:

Company Name:

Address:

Company Response Number: MJR 6.7

Q. Specify the amounts placed into plant in service each year from the test year end in the previous rate case (Decision No. 65436) to September 30, 2008 for the construction of the 4.1 mgd PVWRF sewer project.

OBJECTION: This data request is "asked and answered" by virtue of the Company's previous response to Staff Data Request JMM 1.77 (provided to RUCO in response to RUCO Data Request 1.04) in which the Company supplied all of the relevant invoices for plant in rate base, and it is unduly burdensome to now ask the Company to provide information that RUCO already has or can obtain from information already in its possession.

LITCHFIELD PARK SERVICE COMPANY
DOCKET NOS. SW-01428A-09-0103 AND W-01427A-09-0104
RESPONSE TO RUCO'S SIXTH SET OF DATA REQUESTS

October XX, 2009

Response provided by:

Title:

Company Name:

Address:

Company Response Number: MJR 6.8

Q. Please provide the construction budget for the 4.1 mgd PVWRF sewer project.

RESPONSE:

8600-(2000-01)-36

DRAFT #1 2/27

Bonnie is this on excel?

LPSCo

$	12.20	Original Bid
	.85	Sales Taxes
	(.85)	Sales Taxes
	.42	Centrifuge for odor control and sludge processing efficiency
	.02	c/o Triton
	.06	Triton
	.07	Design
	.14	Site Work
	.09	Building Upgrades
	.15	Triton Accelerated Schedule
	.07	Triton Ace
	.02	Centrifuge for odor control and sludge processing efficiency
	.04	Computer System Upgrade
	.07	Electrical Redundancy
	.04	Red Instant Fans
	.04	County Required Redundancy Carbon Odor Control
	.06	APS Conduit
	.06	PERC Incentive
	.08	Additional Anticipated Costs
$	13.63 M	TOTAL

yes

1

PROJECT Budget

18,226,637

Sewer Plant

	Original Budget		Current Est.	
original quote	$ 12.2M		$ 13.6M ✓	– 13.5 ✓
sales taxes	$ .6M	12.8	.6 ✓	.6
SRS ~~Contingency~~	.4	13.2	INCLUDED ~~.4~~ – .020	
Park	.5	13.7	.4 ✓	.3
Contingency	.8	14.5	0	
Land	1.8	[illegible]	1.8 ✓	1.7
Off Sites Utilities	.9	[illegible]	1.1	1.1
Effluent System	.8	18.[illegible]	.2	.2
Permits ~~etc~~ OH etc	.4	[illegible]	.4	.3
	18.4		18.5	17.7
			18.4	

2

GEOFF APPLEYARD 602-274-2523

2/19/02

ORIGINAL QUOTE = 12,200 K ✓
SRS = 420 K ✓
SUB TOTAL = 12,620 K

LPSCo c/o

ESTIMATE w/o C.O.'s = 12,329
PERC/TRITON CO'S = 332
12,661

PROJECT w/o LPSCO CHANGE ORDERS IS RIGHT AT ORIGINAL QUOTE.

LPSCO HAS MADE THE FOLLOWING CHANGES TO ORIGINAL SCOPE:

- 235 K – SITE 9 BLD UPGRADES
- 277 K – ACCELERATED SCHEDULE/EARNED – (12 MO TO 9 MO)
- 271 K – INCREASED PLANT ELECTRICAL, MECHANICAL & CONTROL RELIABILITY
- 75 K – REMAINING CONTINGENCY

TOTAL 858 K – (HAD 770 K CONTINGENCY)

PROJECT WILL COST APPROX.

BASE WRF • 12,661 12.6
LPSCO CHANGES • 858
PARK • 338
LAND • 1742
EXCLUDED FROM ORIG. CONTRACT * PERMITS/ETC • 312
OFFSITES 1274
* SALES TAX 559
TOTAL 17,735 > 490 K UNDER BUDGET
PROJECT BUDGET 18,225

3

- BY AGREEMENT WE WOULD GIVE PETE 1/2 OF 238K & ALL IF THEY DID GOOD. — (I THINK THEY HAVE EARNED IT ALL —)
- THERE WOULD BE APPROX. 490 − 238 = 252 REMAINING IN BUDGET —

Dave

4

TOTAL P.01

GEOFF APPLEYARD.
274-2523

	Authorized Budget	Tom's Current Estimate	Estimate w/o LPSCO Changes	PERC/Triton Changes	LPSCO Changes	Remarks
System (12,217,600 +SRS)	12,617,405	6,164,654	6,164,654			6,031,040 + (153,614 SRS)
Concrete - Triton		2,818,493	2,818,493			2,552,107 + (266,386 SRS)
Design - PACE		1,580,100	1,580,100		450,000	I don't understand
Excavation & Backfill		358,000	358,000			
Site Work		306,460	306,460			450,000 - (143,540 site expansion) — How did the site expand?
Building (w/o LPSCO Upgrades)		916,900	916,900			1,008,900 - (92,000 upgrade)
Unassigned Contingency						
General Conditions		165,000	165,000			
Parc/Triton WRF Contract plus SRS	12,617,405	12,329,607	12,329,607		143,540	
Site Work		143,540			143,540	LPSCO increased site size
Building Upgrades		92,000			92,000 ok	LPSCO upgraded building
Excellerated Schedule - Triton		152,808			152,808 ok	LPSCO schedule decision ?
CO - Triton		200,000		200,000		Design problems — ?
CO - Triton - Design and Earned		128,000		63,000	65,000 ?	63 design, 65 earned
CO - Centrifuge		20,000			20,000 ok	LPSCO decision
CO - Computer Upgrade		41,000			41,000	LPSCO decision
CO - Redundant Electrical		75,323			75,323	LPSCO decision
CO - Redundant Fans - Scrubbers		42,934			42,934	LPSCO decision
CO - Redundant Carbon Odor Control		36,393			36,393	LPSCO decision
CO - EnCompass Electrical - APS Conduit		55,000			55,000	LPSCO decision
Excellerated Schedule PERC		60,000			60,000	LPSCO decision ?
Building Changes Elec 32 Tank Farm 88 Misc ERD 14+9		69,000		69,000		Design problems — ?
Anticipated Additional Project Costs		75,000			75,000 ?	LPSCO decision
Park	460,000	338,000		-112,000	-450,000 ?	Value engineering
Contingency LPSCO	770,000					
Sub Total	1,220,000	1,538,799		220,000	1,308,799	
WRF Construction Totals	13,837,405	13,868,405				
WRF Construction w/o LPSCO Changes			12,549,607			
Land	1,742,400	1,742,400				
Offsite Utilities	921,667	1,034,381				
APS Auto Transfer		40,200				
Effluent System/recharge	750,000	200,000				
Sub Total Offsites/Effluent	1,671,667	1,274,581				
Permits/Offsites	400,000	100,217				
Bonds & Insurance		100,156				
Other Soft Costs (Hendrick, Stensel)		62,200				
FFE		50,000				
Sub Total Permits/Offsites		312,573				
Sales Tax	574,945	886,000				
Project Total	18,228,837	17,737,959				
Estimated Remaining Project Dollars		488,878				
Estimated Cost per Gallon - PERC without land & offsites	3.89					
Estimated Cost per Gallon - Project	4.33					

what does this mean?

what was total

originally ≈ 700K

Why is this here

Where is the sales TAX

Are these MIXED up

Where is this coming from

Why is the park savings Triton/Perc?

56,000 APS conduit by Encompass ?

12.6
5.7
15.3

LITCHFIELD PARK SERVICE COMPANY
DOCKET NOS. SW-01428A-09-0103 AND W-01427A-09-0104
RESPONSE TO RUCO'S SIXTH SET OF DATA REQUESTS

October 22, 2009

Response provided by:

Title:

Company Name:

Address:

Company Response Number: MJR 6.9

Q. Please provide the construction budget for the 8.2 mgd PVWRF sewer project.

OBJECTION: Because there is no such thing as the "8.2 mgd PVWRF sewer project", LPSCO cannot answer questions related to such project. LPSCO notes that there is an ADEQ permit, as well as MAAG 208 approval to expand the current 4.1 mgd PVWRF up to a maximum of 8.1 mgd.

LITCHFIELD PARK SERVICE COMPANY
DOCKET NOS. SW-01428A-09-0103 AND W-01427A-09-0104
RESPONSE TO RUCO'S SIXTH SET OF DATA REQUESTS

October 22, 2009

Response provided by:

Title:

Company Name:

Address:

Company Response Number: MJR 6.10

Q. Please provide itemized accounts by month of payments made on the design and/or construction of the 4.1 mgd PVWRF sewer project from beginning to completion of the project or the end of the test year, whichever is later.

OBJECTION: This data request is "asked and answered" by virtue of the Company's previous response to Staff Data Request JMM 1.77 (provided to RUCO in response to RUCO Data Request 1.04) in which the Company supplied all of the relevant invoices for plant in rate base, and it is unduly burdensome to now ask the Company to provide information that RUCO already has or can obtain from information already in its possession.

LITCHFIELD PARK SERVICE COMPANY
DOCKET NOS. SW-01428A-09-0103 AND W-01427A-09-0104
RESPONSE TO RUCO'S SIXTH SET OF DATA REQUESTS

October 22, 2009

Response provided by:

Title:

Company Name:

Address:

Company Response Number: MJR 6.11

Q. Please provide itemized accounts by month of payments made on the design and/or construction of the 8.2 mgd PVWRF sewer project from the beginning to completion of the project or the end of the test year, whichever is later.

OBJECTION: Because there is no such thing as the "8.2 mgd PVWRF sewer project", LPSCO cannot answer questions related to such project. LPSCO notes that there is an ADEQ permit, as well as MAAG 208 approval to expand the current 4.1 mgd PVWRF up to a maximum of 8.1 mgd.

EXHIBIT
R-35
ADMITTED

ALGONQUIN WATER

CHANGE ORDER REQUEST

AGREEMENT:	Agreement dated August 9, 2006
PROJECT:	*Litchfield Park Sewer Company Palm Valley WRF Performance Improvements Design Project*
PARTIES:	Algonquin Water Services, LLC (Algonquin), and McBride Engineering Solutions, Inc. (MES)

TO:	Thomas D. Nichols P.E. (Algonquin)		c: MES File 0711
DATE:	September 4, 2007	CHANGE ORDER REQUEST NO #:	0711-3 (AWS Task Order No. 13)

DESCRIPTION OF SERVICES:

BACKGROUND: Algonquin Water Services has asked MES to provide additional professional services regarding the Litchfield Park Sewer Company Palm Valley WRF Performance Improvements Design Project. The additional services include managing and coordinating the programming subconsultant (Wunderlich-Malec) for the systems integration of some of the new and existing plant processes. It is expected that this will be the first of up to three change orders for the overall programming work. This part of the work will include the following:

UV System: Provide temporary programming and graphics to allow new 5MGD UV filter to act as primary UV filter while four existing 1.2 MGD UV filters act as emergency backup units; Provide programming and graphics to configure and operate second 5MGD UV filter to work with initial UV filter in a lead/lag configuration to provide necessary UV filtration. Existing units will remain as emergency backups; Provide programming to configure third 5MGD UV filter to work with initial two units in a lead/lag/standby configuration. Provide demolition of logic and graphics for existing 1.2MGD UV filters.

SBRs: Provide programming and graphics interface necessary to allow two new SBR units being provided by Jet Tech to work in conjunction with two existing SBR units currently operating on site; Determine programming considerations to ensure that all four units may be placed into operation at the same time while meeting operational criterion to be provided by others (i.e. only one SBR may be in Decant mode at any given time.); Provide programming and graphics to allow the operator to select SBR's into or out of service as required. Possible operating scenarios range from any two SBR's active, to any three SBR's active, to all four SBR's active; Work with Jet Tech to determine how to provide interface into new SBR's for controlling operating parameters such as modifying setpoints and enabling or disabling entire units.

Digesters/ATADs: Modify existing code and graphics to change existing ATADs and Digester to operate as sludge holding tanks; Modify wasting routine to allow any SBR to waste to any of the three sludge holding tanks either through operator selection or automatically based on tank levels.

Centrifuge: Work with new centrifuge vendor to provide graphics interface to allow remote control of centrifuge. Work with all interested parties to define scope of control/interface to be provided.

PREVIOUS CONTRACT AMOUNT:	$527,190	CHANGE ORDER:	$24,910	NEW CONTRACT AMOUNT:	$552,100

ESTIMATED SCHEDULE:

PROPOSED START DATE		August 28, 2007
MILESTONE:	TBD	
MILESTONE:	TBD	
PROPOSED PROJECT END DATE:		January 31, 2007

REQUESTED:
McBride Engineering Solutions, Inc.
Brian McBride
BY: Brian P. McBride, Principal
DATE: 9/12/07

APPROVED:
Algonquin Water Services, LLC
Robert Dodds
BY: Robert Dodds
DATE: September 11/07

BEFORE THE ARIZONA CORPORATION COMMISSION

KRISTIN K. MAYES
Chairman
GARY PIERCE
Commissioner
PAUL NEWMAN
Commissioner
SANDRA D. KENNEDY
Commissioner
BOB STUMP
Commissioner

IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WASTEWATER RATES AND CHARGES FOR UTILITY SERVICE BASED THEREON.	DOCKET NO. SW-01428A-09-0103
IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WATER RATES AND CHARGES FOR UTILITY SERVICE BASED THEREON.	DOCKET NO. W-01427A-09-0104

DIRECT

TESTIMONY

OF

PEDRO M. CHAVES

PUBLIC UTILITIES ANALYST III

UTILITIES DIVISION

ARIZONA CORPORATION COMMISSION

NOVEMBER 4, 2009

EXHIBIT
ALL-STATE LEGAL®
S-2
ADMITTED

TABLE OF CONTENTS

SCHEDULES

EXECUTIVE SUMMARY
LITCHFIELD PARK SERVICE COMPANY
DOCKET NOS. SW-01428A-09-0103 AND W-01427A-09-0104

On March 9, 2009, Litchfield Park Service Company ("LPSCO" or "Company") filed a general rate application for both its Water Division and Wastewater Division. The testimony of Mr. Pedro M. Chaves presents Staff's recommended rate design for both Divisions.

Water Division

The present rate design for the Water Division consists of an inverted two-tier and minimum monthly charges that generally increase by meter size. Fixed monthly charges also apply to construction water hydrants.

The Company proposes an inverted three-tier commodity rate for residential customers with 5/8 x 3/4-inch and 3/4-inch meters. An inverted two-tier commodity rate design is proposed for all other metered water customers with the exception of construction water for which a single tier commodity rate is proposed. A residential 3/4-inch meter customer consuming the median usage of 7,000 gallons per month under the Company's proposed rates would be billed $35.33, which is $20.04 more than the current $15.29 for a 131.07 percent increase.

Staff recommends an inverted three-tier commodity rate structure for 5/8 x 3/4-inch and 3/4-inch meters and an inverted two-tier rate structure for larger meters. The two-tier rate structure for larger meters is accomplished by eliminating the first tier rate applicable to smaller meters. Monthly minimum charges increase by meter size. The recommended rate structure conforms with those regularly adopted by the Commission in recent years. Staff's rate design recognizes the growing importance of managing water as a finite resource and encourages efficient water use. Staff's rate structure provides an economic benefit to customers that limit consumption.

Under Staff's proposed rate design, the typical 3/4-inch meter residential bill with median use of 7,000 gallons would increase by $4.71, or 30.80 percent, from $15.29 to $20.00.

Wastewater Division

The Company has ten customer classes for its wastewater division. All customers currently pay a monthly minimum charge, and two customer classes also pay a volumetric rate based on water consumption. The Company and Staff both recommend continuation of the existing rate structure with uniform increases to the monthly charges and volumetric charges. The average increases under the Company-proposed and Staff-recommended rates are 79.76 percent and 42.58 percent, respectively.

The Company's proposed rates would increase the monthly bill for a residential customer under the flat monthly fee rate by $22.02, or 80.96 percent, from $27.20 to $49.22. The Company's proposed rates would increase the monthly bill for a measured-service regular domestic customer consuming the median usage of 23,000 gallons per month by $62.70, or 80.90 percent, from $77.50 to $140.20.

Staff's recommended rates would increase the monthly bill for a residential customer under the flat monthly fee rate by $12.00, or 44.10 percent, from $27.20 to $39.20. Staff's recommended rates would increase the monthly bill for a measured service regular domestic customer consuming the median usage of 23,000 gallons per month by $34.18, or 44.10 percent, from $77.50 to $111.68.

INTRODUCTION

Q. Please state your name, occupation, and business address.

A. My name is Pedro M. Chaves. I am a Public Utilities Analyst employed by the Arizona Corporation Commission ("ACC" or "Commission") in the Utilities Division ("Staff"). My business address is 1200 West Washington Street, Phoenix, Arizona 85007.

Q. Briefly describe your responsibilities as a Public Utilities Analyst.

A. In my capacity as a Public Utilities Analyst, I perform studies to estimate the cost of capital component of the overall revenue requirement calculation in rate filings. I also analyze requests for financing authorization, analyze and examine accounting, financial, statistical and other information and prepare reports based on my analyses that present Staff's recommendations to the Commission on utility revenue requirements, rate design and other financial regulatory matters.

Q. Please describe your educational background and professional experience.

A. I am a graduate of Arizona State University where I received a Bachelor of Science degree in Global Business with a specialization in finance. My course of studies included classes in corporate and international finance, investments, accounting, statistics, and economics. I began employment as a Staff Public Utilities Analyst in December 2005. I have also attended the National Association of Regulatory Utility Commissioners' ("NARUC") Utility Rate School.

Q. What is the scope of your testimony in this case?

A. My testimony provides Staff's recommended rate designs for Litchfield Park Service Company's ("LPSCO" or "Company") Water and Wastewater Divisions in this case.

Q. Have you reviewed the rate design testimony submitted by the Company in this case?

A. Yes. I reviewed Company witness Mr. Thomas J. Bourassa's testimony pertaining to rate design.

SUMMARY OF TESTIMONY AND RECOMMENDATIONS

Q. Briefly summarize how your rate design testimony is organized.

A. Staff's rate design testimony is organized to present a discussion of the present rates, the Company's proposed rates, and Staff's recommended rates for LPSCO's Water and Wastewater Divisions. Schedules PMC-1 W and PMC-2 W are provided to further describe Staff's rate design for the Water Division; and Schedules PMC-1 WW and PMC-2 WW are provided to further describe Staff's rate design for the Wastewater Division.

WATER DIVISION

Present Rate Design

Q. Please provide an overview of the Company's existing rates.

A. The following is a general description of the present rate design. Details of the rate designs are presented on Staff Schedule PMC-1 W. The present rate design has minimum monthly charges that generally increase by meter size. For the most part, customers are distinguished by meter size of which there are ten. The ten meter sizes include residential, commercial, construction, and irrigation customers. In addition to the monthly minimum charge a two-tier commodity rate is applicable to most customers. However, construction customers pay a single-tier commodity rate.

The Company's Proposed Water Rate Design

Q. Please provide an overview of the Company's proposed rate design.

A. The Company's proposed rate design spreads the proposed rate increase across all the customer classes. The increase is accomplished by increasing both the monthly usage charges and the commodity charges.

Q. Does the Company propose changes to the structure of the rate design?

A. Yes. The Company proposes changes to the tier structure similar to rate designs adopted by the Commission in other rate cases. The Company proposes an inverted three-tier rate design for 5/8-inch and 5/8 x 3/4-inch residential classes. An inverted two-tier commodity rate design is proposed for all other metered water customers, with the exception of construction water, for which a single tier commodity rate is proposed.

Staff's Recommended Water Rate Design

Q. In addition to developing non-discriminatory rates that provide Staff's recommended revenue and other issues such as gradualism, revenue stability, and customer affordability, what policy objectives are reflected in Staff's recommended rates?

A. Staff's rate design recognizes the growing importance of managing water as a finite resource, as well as the increasing cost of water. The quantity of water resources available to Arizona and in LPSCO's service territories does not grow with population and customer base and the cost of developing, treating, and delivering it increases with diminishing supply and increased health and safety regulations. Staff recommends a rate design that encourages planners to design growth to efficiently use water.

Q. Please provide a description of Staff's recommended rate structure for the water systems.

A. Staff recommends a three-tier inverted block rate structure for the residential 5/8 x 3/4-inch and 3/4-inch meters with break-over points at 3,000 gallons and at 9,000 gallons. Staff recommends a two-tier inverted block rate structure for all other metered water customers with the exception of construction water for which a single tier commodity rate is proposed. The recommended break-over points increase with meter size as shown in Schedule PMC-1 W. Under the recommended rate design, the monthly bill at any usage level is higher for a larger meter than for a smaller meter.

Q. What is the basis for Staff's recommendation for the respective commodity break-over points?

A. Use of the break-over points Staff recommends serves two purposes. First, it supports the state-wide effort to improve water use efficiency. Second, an unintended but desirable characteristic of Staff's rate design is that it effectively serves as a supplementary life-line rate providing affordable water to customers willing to limit consumption to their basic needs. Providing affordable water in limited amounts is appropriate because water is the only utility commodity that is necessary for sustaining life.

Q. Did Staff prepare schedules showing the present, Company proposed, and Staff recommended monthly minimums and commodity rates for each rate class?

A. Yes. Staff Schedule PMC-1 W shows the present monthly minimum charges and commodity rates, the Company's proposed monthly minimum charges and commodity rates and Staff's recommended monthly minimum charges and commodity rates.

Q. Did Staff prepare a schedule showing a typical bill analysis under present rates, the Company's proposed rates, and Staff's recommended rates?

A. Yes. Staff Schedule PMC-2 W presents the average and median monthly typical bill using present rates, the Company's proposed rates and Staff's recommended rates.

Q. Did LPSCO propose any changes to its water system service charges?

A. No. The Company's proposed service charges are shown on the Company's Water Division Schedule H-3.

Q. What comment does Staff have regarding the Company's proposed service charges?

A. Staff agrees with the Company that its current service charges are appropriate and should remain unchanged.

Q. Did LPSCO propose any changes to its water system service line and meter installation charges?

A. Yes. The Company's proposed service line and meter installation charges are shown on the Water Division Schedule H-3.

Q. What is Staff's recommendation for water system service line and meter installation charges?

A. Staff recommends accepting the Company's proposed service line and meter installation charges because they comport with the determination of Staff witness Marlin Scott Jr. that the charges are within Staff's recommended range for these charges.

Q. What is Staff's recommendation for a construction water rate?

A. Staff recommends that all usage under this rate be charged at a rate of $2.68 per 1,000 gallons. The Company currently has a monthly usage charge of $100.00 for construction water. Staff recommends no monthly usage charge for construction water, since this class already pays the highest tier rate for all consumption. Staff further recommends meter deposits for construction customers equal to the meter portion of the service line and meter installation charges that are meter size dependent. This recommendation replaces the existing $1,500.00 deposit for all meter sizes.

WASTEWATER DIVISION

Present Rate Design

Q. Please provide an overview of the Company's existing rates.

A. The following is a general description of the present rate design. Details of the rate designs are presented on Staff Schedule PMC-1 WW. The Company has ten customer classes (approximately 14,500 customers) for its wastewater division. All customers presently pay a monthly minimum charge, and two customer classes (approximately 200 customers) also pay a volumetric rate based on water consumption.

The Company's Proposed Wastewater Rate Design

Q. Please provide an overview of the Company's proposed rate design.

A. The Company proposes a continuation of the existing rate structure with uniform increases to the monthly charges and volumetric charges. The Company proposes average increases of 79.76 percent. The Company's proposed rates would result in an 80.96 percent increase for the residential class, as seen on Schedule PMC-2 WW. The Company proposes no changes to service charges.

Staff's Recommended Wastewater Rate Design

Q. Please provide an overview of Staff's recommended rate design.

A. Staff recommends a continuation of the existing rate structure with uniform increases to the monthly charges and volumetric charges. Staff recommends average increases of 42.58 percent. Staff recommends no changes to service charges.

Q. Has Staff prepared a typical bill analysis to reflect the effects of its recommended rate changes to the residential class?

A. Yes. Staff's recommended rates would increase the monthly bill for a residential customer under the flat monthly fee rate by $12.00, or 44.10 percent, from $27.20 to $39.20, as shown in Schedule PMC-2 WW. Staff's recommended rates would increase the monthly bill for a measured service regular domestic customer consuming the median usage of 23,000 gallons per month by $34.18, or 44.10 percent, from $77.50 to $111.68, as shown in Schedule PMC-2 WW.

Q. Does this conclude your Direct Testimony?

A. Yes, it does.

WATER DIVISION RATE DESIGN

Monthly Usage Charge	Present Rates	Company Proposed	Staff Recommended
5/8 x3/4" Meter - All Classes	$ 6.75	$ 12.35	$ 10.00
3/4" Meter - All Classes	8.30	22.23	10.00
1" Meter - All Classes	14.60	37.05	32.00
1½" Meter - All Classes	28.60	74.10	53.00
2" Meter - All Classes	56.50	118.56	95.00
3" Meter - All Classes	NT	237.12	170.00
4" Meter - All Classes	132.00	370.50	340.00
6" Meter - All Classes	NT	741.00	680.00
8" Meter - All Classes	225.00	1,185.60	1,000.00
10" Meter - All Classes	330.00	1,704.30	1,600.00
12" Meter - All Classes	450.00	2,223.00	2,200.00
Construction Water - Hydrants	100.00	237.12	-
Commodity Rates			
5/8 x3/4" Meter (Residential)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 5,000 Gallons		$ 1.70	
5,001 to 15,000 Gallons		$ 2.30	
Over 15,000 Gallons		$ 3.05	
0 to 3,000 Gallons			$ 1.00
3,001 to 9,000 Gallons			$ 1.75
Over 9,000 Gallons			$ 2.68
3/4" Meter (Residential)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 5,000 Gallons		$ 1.70	
5,001 to 15,000 Gallons		$ 2.30	
Over 15,000 Gallons		$ 3.05	
0 to 3,000 Gallons			$ 1.00
3,001 to 9,000 Gallons			$ 1.75
Over 9,000 Gallons			$ 2.68
5/8 x3/4" and 3/4" Meter (Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 15,000 Gallons		$ 2.30	
Over 15,000 Gallons		$ 3.05	
0 to 10,000 Gallons			$ 1.75
Over 10,000 Gallons			$ 2.68
1" Meter (Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 40,000 Gallons		$ 2.30	
Over 40,000 Gallons		$ 3.05	
0 to 20,000 Gallons			$ 1.75
Over 20,000 Gallons			$ 2.68
1½" Meter (Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 90,000 Gallons		$ 2.30	
Over 90,000 Gallons		$ 3.05	
0 to 30,000 Gallons			$ 1.75
Over 30,000 Gallons			$ 2.68

WATER DIVISION RATE DESIGN

	Present Rates	Company Proposed	Staff Recommended
2" Meter (Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 140,000 Gallons		$ 2.30	
Over 140,000 Gallons		$ 3.05	
0 to 55,000 Gallons			$ 1.75
Over 55,000 Gallons			$ 2.68
3" Meter (Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 140,000 Gallons		$ 2.30	
Over 140,000 Gallons		$ 3.05	
0 to 100,000 Gallons			$ 1.75
Over 100,000 Gallons			$ 2.68
4" Meter (Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 440,000 Gallons		$ 2.30	
Over 440,000 Gallons		$ 3.05	
0 to 210,000 Gallons			$ 1.75
Over 210,000 Gallons			$ 2.68
6" Meter (Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 1,620,000 Gallons		$ 2.30	
Over 1,620,000 Gallons		$ 3.05	
0 to 430,000 Gallons			$ 1.75
Over 430,000 Gallons			$ 2.68
8" Meter (Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 1,620,000 Gallons		$ 2.30	
Over 1,620,000 Gallons		$ 3.05	
0 to 650,000 Gallons			$ 1.75
Over 650,000 Gallons			$ 2.68
10" Meter (Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 2,280,000 Gallons		$ 2.30	
Over 2,280,000 Gallons		$ 3.05	
0 to 950,000 Gallons			$ 1.75
Over 950,000 Gallons			2.68
12" Meter (Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 4,030,000 Gallons		$ 2.30	
Over 4,030,000 Gallons		$ 3.05	
0 to 1,600,000 Gallons			$ 1.75
Over 1,600,000 Gallons			$ 2.68
Construction Water			
All Gallons	$ 2.50	$ 3.05	$ 2.68

WATER DIVISION RATE DESIGN

	Present Rates			Company Proposed			Staff Recommended		
Service Line and Meter Installation Charges	Line	Meter	Total	Line	Meter	Total	Line	Meter	Total
5/8" x 3/4" Meter			$ 300	$ 385	$ 135	$ 520	$ 385	$ 135	$ 520
3/4" Meter			300	385	215	600	385	215	600
1" Meter			325	435	255	690	435	255	690
1½" Meter			500	470	465	935	470	465	935
2"			675	-	-	-	-	-	-
Over 2"			At Cost	-	-	-	-	-	-
2" Turbine Meter			NT	630	965	1,595	630	965	1,595
2" Compound Meter			NT	630	1,690	2,320	630	1,690	2,320
3" Turbine Meter			NT	805	1,470	2,275	805	1,470	2,275
3" Compound Meter			NT	845	2,265	3,110	845	2,265	3,110
4" Turbine Meter			NT	1,170	2,350	3,520	1,170	2,350	3,520
4" Compound Meter			NT	1,230	3,245	4,475	1,230	3,245	4,475
6" Turbine Meter			NT	1,730	4,545	6,275	1,730	4,545	6,275
6" Compound Meter			NT	1,770	6,280	8,050	1,770	6,280	8,050
8" & Larger			NT	At Cost	At Cost	At Cost	At Cost	At Cost	At Cost

Service Charges	Present Rates	Company Proposed	Staff Recommended
Establishment (a)	$ 20.00	$ 20.00	$ 20.00
Establishment (After Hours) (a)	40.00	40.00	40.00
Re-Establishment of Service (a)	(b)	(b)	(b)
Reconnection (Regular Hours) (a)	50.00	50.00	50.00
Reconnection (After Hours) (a)	65.00	65.00	65.00
Meter Test (If correct) (c)	25.00	25.00	25.00
Meter Re-Read (If correct)	5.00	5.00	5.00
NSF Check	25.00	25.00	25.00
Deferred Payment, Per Month	1.50%	1.50%	1.50%
Late Charge	(d)	(d)	(d)
Service Calls - Per Hour/After Hours (e)	40.00	40.00	40.00
Deposit Requirement	(f)	(f)	(f)
Deposit Interest	3.50%	3.50%	3.50%
* Hydrant Meter Deposit:			
5/8" x 3/4" Meter	$ 1,500.00	$ 1,500.00	$ 135.00
3/4" Meter	1,500.00	1,500.00	215.00
1" Meter	1,500.00	1,500.00	255.00
1½" Meter	1,500.00	1,500.00	465.00
2" Turbine Meter	1,500.00	1,500.00	965.00
2" Compound Meter	1,500.00	1,500.00	1,690.00
3" Turbine Meter	1,500.00	1,500.00	1,470.00
3" Compound Meter	1,500.00	1,500.00	2,265.00
4" Turbine Meter	1,500.00	1,500.00	2,350.00
4" Compound Meter	1,500.00	1,500.00	3,245.00
6" Turbine Meter	1,500.00	1,500.00	4,545.00
6" Compound Meter	1,500.00	1,500.00	6,280.00
8" & Larger	NT	At Cost	At Cost

NT = No Tariff
(a) Service charges for customers taking both water and sewer service are not duplicative.
(b) Minimum charge times number of months disconnected.
(c) $25 plus cost of test.
(d) Greater of $5.00 or 1.5% of unpaid balance.
(e) No charge for service calls during normal working hours.
(f) Per Rule R14-2-403(B): Residential - two times the average bill. Commercial - two and one-half times the average bill.
* Shall have a non-interest bearing deposit of the amount indicated, refundable in its entirety upon return of the meter in good condition and payment of final bill.

Litchfield Park Service Company
Docket Nos. W-01427A-09-0104 SW-01428A-09-0103
Test Year Ended September 31, 2008

Schedule PMC-2 W

Typical Bill Analysis
3/4" Residential

Company Proposed	Gallons		Present Rates		Proposed Rates		Dollar Increase	Percent Increase
Average Usage	9,537	$	18.64	$	41.17	$	22.53	120.86%
Median Usage	7,000		15.29		35.33	$	20.04	131.07%
Staff Recommended								
Average Usage	9,537	$	18.64	$	24.94	$	6.30	33.80%
Median Usage	7,000		15.29		20.00	$	4.71	30.80%

Present & Proposed Rates (Without Taxes)
3/4" Residential

Gallons Consumption		Present Rates		Company Proposed Rates	% Increase		Staff Recommended Rates	% Increase
-	$	8.30	$	22.23	167.83%	$	10.00	20.48%
1,000		9.17		23.93	160.96%		11.00	19.96%
2,000		10.04		25.63	155.28%		12.00	19.52%
3,000		10.91		27.33	150.50%		13.00	19.16%
4,000		11.78		29.03	146.43%		14.75	25.21%
5,000		12.65		30.73	142.92%		16.50	30.43%
6,000		13.97		33.03	136.44%		18.25	30.64%
7,000		15.29		35.33	131.07%		20.00	30.80%
8,000		16.61		37.63	126.55%		21.75	30.95%
9,000		17.93		39.93	122.70%		23.50	31.07%
9,537		18.64		41.17	120.86%		24.94	33.80%
10,000		19.25		42.23	119.38%		26.18	36.00%
11,000		20.57		44.53	116.48%		28.86	40.30%
12,000		21.89		46.83	113.93%		31.54	44.08%
13,000		23.21		49.13	111.68%		34.22	47.44%
14,000		24.53		51.43	109.66%		36.90	50.43%
15,000		25.85		53.73	107.85%		39.58	53.11%
16,000		27.17		56.03	106.22%		42.26	55.54%
17,000		28.49		58.33	104.74%		44.94	57.74%
18,000		29.81		60.63	103.39%		47.62	59.75%
19,000		31.13		62.93	102.15%		50.30	61.58%
20,000		32.45		65.23	101.02%		52.98	63.27%
25,000		39.05		76.73	96.49%		66.38	69.99%
30,000		45.65		88.23	93.27%		79.78	74.76%
35,000		52.25		99.73	90.87%		93.18	78.33%
40,000		58.85		111.23	89.01%		106.58	81.10%
45,000		65.45		122.73	87.52%		119.98	83.32%
50,000		72.05		134.23	86.30%		133.38	85.12%
75,000		105.05		191.73	82.51%		200.38	90.75%
100,000		138.05		249.23	80.54%		267.38	93.68%

WASTEWATER DIVISION RATE DESIGN

Monthly Usage Charge	Present	Company Proposed	Staff Recommended
Residential	$ 27.20	$ 49.22	$ 39.20
Multiple Unit Service - Per Unit / Month	25.25	45.69	36.39
Small Comm.	46.00	83.00	$ 66.29
Regular Domestic [1]	25.75	46.59	$ 37.11
Restaurants, Motels, Grocery, DC	25.75	46.59	$ 37.11
Wig. Resort/ Room	25.25	45.69	$ 36.39
Wig. Resort/ Main	1,000.00	1,809.50	$ 1,441.00
Element. School	680.00	1,230.46	$ 979.88
Mid. & High School	800.00	1,447.60	$ 1,152.80
Community College	1,240.00	2,243.78	$ 1,786.84
Effluent Sales [2]	Market	Market	Market

[1] Regular Domestic is a wastewater customer (including residential) that averages a minimum of 10,000 gallons of water usage per month during the months of December, January and February.
[2] Market Rate - Maximum effluent rate shall not exceed $430 per acre foot based on a potable water rate of $1.32 per thousand gallons and shall not be less than $ 0.88 per thousand gallons.

Commodity Charge (per 1,000 gallons of water)			
Regular Domestic	$ 2.25	$ 4.07	$ 3.24
Restaurants, Motels, Grocery, DC	3.00	5.43	4.32

WASTEWATER DIVISION RATE DESIGN

Service Charges	Present	Company Proposed	Staff Recommended
Establishment (a)	$ 20.00	$ 20.00	$ 20.00
Establishment (After Hours) (a)	$ 40.00	$ 40.00	$ 40.00
Re-Establishment of Service (a)	(b)	(b)	(b)
Reconnection (Regular Hours) (a)	50.00	50.00	50.00
Reconnection (After Hours) (a)	65.00	65.00	65.00
NSF Check	$ 25.00	$ 25.00	$ 25.00
Deferred Payment, Per Month	1.50%	1.50%	1.50%
Late Charge	(c)	(c)	(c)
Service Calls - Per Hour/After Hours (d)	40.00	40.00	40.00
Deposit Requirement	(e)	(e)	(e)
Deposit Interest	3.50%	3.50%	3.50%
Service Lateral Connection Charge- All Sizes	(f)	(f)	(f)
Main Extension Tariff	(g)	(g)	(g)

(a) Service charges for customers taking both water and sewer service are not duplicative.
(b) Minimum charge times number of months disconnected.
(c) Greater of $5.00 or 1.5% of unpaid balance.
(d) No charge for service calls during normal working hours.
(e) Per Rule R14-2-603B: Residential - two times the average bill.
Non-residential - two and one-half times the average bill.
(f) At cost. Customer/Developer shall install or cause to be installed all Service Laterals as a non-refundable contribution-in-aid of construction.
(g) All Main Extensions shall be completed at cost and shall be treated as non-refundable contribution-in-aid of construction.

Litchfield Park Service Company
Docket Nos. W-01427A-09-0104 SW-01428A-09-0103
Test Year Ended September 31, 2008

Schedule PMC-2 WW

Typical Bill Analysis

Residential

Company Proposed	Present Rates	Proposed Rates	Dollar Increase	Percent Increase
	$ 27.20	$ 49.22	$ 22.02	80.96%
Staff Recommended				
	27.20	39.20	$ 12.00	44.10%

Regular Domestic

Company Proposed	Gallons	Present Rates	Proposed Rates	Dollar Increase	Percent Increase
Average Usage	57,450	$ 155.01	$ 280.41	$ 125.40	80.90%
Median Usage	23,000	77.50	140.20	$ 62.70	80.90%
Staff Recommended					
Average Usage	57,450	$ 155.01	$ 223.37	$ 68.36	44.10%
Median Usage	23,000	77.50	111.68	$ 34.18	44.10%

BEFORE THE ARIZONA CORPORATION COMMISSION

KRISTIN K. MAYES
Chairman
GARY PIERCE
Commissioner
PAUL NEWMAN
Commissioner
SANDRA D. KENNEDY
Commissioner
BOB STUMP
Commissioner

IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WASTEWATER RATES AND CHARGES FOR UTILITY SERVICE BASED THEREON.	DOCKET NO. SW-01428A-09-0103
IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WATER RATES AND CHARGES FOR UTILITY SERVICE BASED THEREON.	DOCKET NO. SW-01428A-09-0104
IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY FOR APPROVAL (1) TO ISSUE EVIDENCE OF INDEBTEDNESS IN AN AMOUNT NOT TO EXCEED $1,755,000 IN CONNECTION WITH (A) THE CONSTRUCTION OF TWO RECHARGE WELL INFRASTRUCTURE IMPROVEMENTS AND (2) TO ENCUMBER ITS REAL PROPERTY AND PLANT AS SECURITY FOR SUCH INDEBTEDNESS	DOCKET NO. SW-01428A-09-0116

ALL-STATE LEGAL®
EXHIBIT
S-3
ADMITTED

IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY FOR APPROVAL (1) TO ISSUE EVIDENCE OF INDEBTEDNESS IN AN AMOUNT NOT TO EXCEED $1,170,000 IN CONNECTION WITH (A) THE CONSTRUCTION ON ONE 200KW ROOF MOUNTED SOLAR GENERATOR INFRASTRUCTURE IMPROVEMENTS AND (2) TO ENCUMBER ITS REAL PROPERTY AND PLANT AS SECURITY FOR SUCH INDEBTEDNESS

DOCKET NO. SW-01428A-09-0120

SURREBUTTAL

TESTIMONY

OF

PEDRO M. CHAVES

PUBLIC UTILITIES ANALYST III

UTILITIES DIVISION

ARIZONA CORPORATION COMMISSION

DECEMBER 17, 2009

TABLE OF CONTENTS

SURREBUTTAL SCHEDULES

EXECUTIVE SUMMARY
LITCHFIELD PARK SERVICE COMPANY
DOCKET NOS. SW-01428A-09-0103 ET AL.

The Surrebuttal Testimony of Staff witness Pedro M. Chaves addresses the following issues:

Water Division

Response to the Rebuttal Testimony of Applicant's witness Thomas J. Bourassa – The Company's conclusion that Staff's rate design produces approximately $800,000 less revenue than the revenue requirement is erroneous. Further, Staff responds to the Company's conclusion that Staff agrees entirely with the findings of the cost of service study.

Staff's Updated Rate Design – Staff's recommended rate design would generate Staff's recommended $11,781,312 revenue requirement. The typical 3/4-inch meter residential bill with median use of 7,000 gallons would increase by $5.23, or 34.21 percent, from $15.29 to $20.52.

Wastewater Division

Response to the Rebuttal Testimony of Applicant's witness Thomas J. Bourassa – The Company's conclusion that Staff's rate design produces approximately $120,000 less revenue than the revenue requirement is erroneous.

Staff's updated rate design – Staff's recommended rate design would generate Staff's recommended $9,398,625 revenue requirement. The typical residential bill would increase by $12.28, or 45.15 percent, from $27.20 to $39.48.

I. INTRODUCTION

Q. Please state your name, occupation, and business address.

A. My name is Pedro M. Chaves. I am a Public Utilities Analyst employed by the Arizona Corporation Commission ("ACC" or "Commission") in the Utilities Division ("Staff"). My business address is 1200 West Washington Street, Phoenix, Arizona 85007.

Q. Are you the same Pedro M. Chaves that filed Direct Testimony regarding rate design in this case?

A. Yes, I am.

Q. What matters are addressed in your rate design Surrebuttal Testimony?

A. This rate design Surrebuttal Testimony addresses comments contained in the Rebuttal Testimony of Litchfield Park Service Company's ("LPSCO" or "Company") Water and Wastewater Divisions witness Mr. Thomas J. Bourassa, regarding rate design. This Surrebuttal presents rates designed to generate Staff's Surrebuttal revenue requirement for LPSCO's Water and Wastewater Divisions (Surrebuttal Schedules PMC-1 W and PMC-1 WW, respectively). Staff also presents an updated typical billing analysis for LPSCO's Water and Wastewater Divisions (Surrebuttal Schedules PMC-2 W and PMC-2 WW, respectively).

Q. Please explain how Staff's rate design Surrebuttal Testimony is organized.

A. Staff's rate design Surrebuttal Testimony is presented in five sections. Section I is this introduction. Section II discusses the revenue requirement produced by Staff's rate design. Section III addresses cost of service. Section IV discusses Staff's updated rate design. Lastly, Section V contains Staff's recommendations.

II. REVENUE REQUIREMENT

Water Division

Q. What is Staff's response to the Company's assertion that Staff's rate design produces approximately $750,000 to $800,000 less revenue than its recommended revenue requirement?[1]

A. Staff's rate design does produce its revenue requirement. The primary reason for the approximately $800,000 discrepancy pertains to the treatment of 8-inch meter customers/billing determinants. Staff's billing determinants include 24 bills from the test year. The Company's billing determinants exclude these 24 bills.

Q. Why does LPSCO exclude the billing determinants for the 8-inch meter customers in calculation of the revenue generated by its rate design?

A. According to the Company, it had removed the revenues from the City of Goodyear (its only 8-inch meter customer during the test year) via its revenue annualization adjustment for purposes of determining the revenue requirement.[2]

Q. Does the Company continue to assume that the City of Goodyear will no longer be a customer?

A. No. LPSCO is now recognizing the City of Goodyear billing determinants; however, instead of treating those sales under its 8-inch meter tariff it recognizes the City of Goodyear sales under its newly proposed "Bulk Water" customer class with a proposed lower commodity rate.

[1] Rebuttal Testimony of Thomas J. Bourassa, Pages 51 and 52.
[2] Direct Testimony of Thomas J. Bourassa, Page 14.

Q. Does Staff continue to recommend treating the City of Goodyear as an 8-inch customer?

A. Yes, it does.

Wastewater Division

Q. What is Staff's response to the Company's assertion that Staff's rate design produces approximately $120,000 less revenue than its recommended revenue requirement?[3]

A. Staff's rate design does produce its revenue requirement. Staff reviewed its calculations and found no errors indicating that its rate design does not produce its revenue requirement. Staff has provided the Company with its calculations, and the Company has not identified any specific error in Staff's calculations.

III. COST OF SERVICE

Water Division

Q. Does Staff have any comments on Mr. Bourassa's assessment that Staff agrees entirely with the findings on the Company's Cost of Service Study ("COSS")?

A. Yes. As indicated below, while Staff utilized the Company's COSS findings as a guideline, COSS is only one of various factors considered in the development of a rate design.

Q. What is a COSS?

A. In simple terms, a COSS is an estimation of cost-causation by customer class, i.e., how much does it cost the utility to provide its service to each specific customer class. The reason for determining the costs incurred by the utility to serve each customer class is to assist in allocating the revenue requirement for each customer class.

[3] Rebuttal Testimony of Thomas J. Bourassa, Pages 59 and 60.

Q. Is rate design synonymous with COSS?

A. No. Rate design should not be mistaken with a COSS. As indicated above, a COSS is the assignment of costs to serve each customer class. Rate design involves developing the specific rates that generate the revenues from each customer class, taking into consideration the results of the COSS.

Q. Should the COSS be the only factor used when developing a rate design?

A. No. The COSS is only one of various factors considered in the development of a rate design.

Q. What other factors did Staff consider to develop its rate design?

A. In addition to using the results of the COSS as a general guideline, Staff also considered factors such as gradualism, promotion of efficient water usage and uniformity of rates among customer classes.

Q. How did Staff use the COSS as a guide in its rate design?

A. Staff utilized the COSS as a basic tool, starting point or first step in its rate design. However, Staff also used the other factors cited above to develop its rate design.

Q. In Staff's opinion, was it necessary in this case for Staff to perform an additional COSS?

A. No. First, LPSCO's costumer base is predominantly composed of residential (over 90 percent). Second, as indicated above, Staff employed the Company's COSS as a starting point in its rate design; however, Staff incorporated other important factors.

Yes 7 3,100

IV. UPDATED RATE DESIGN

Water Divison

Q. Has Staff updated its recommended rate design to reflect its Surrebuttal revenue requirement?

A. Yes. Staff's Surrebuttal rate design presented in Schedule PMC-1 W is revised to reflect Staff's $11,781,312 Surrebuttal revenue requirement.

Wastewater Division

Q. Has Staff updated its recommended rate design to reflect its Surrebuttal revenue requirement?

A. Yes. Staff's Surrebuttal rate design presented in Schedule PMC-1 WW is revised to reflect Staff's $9,398,625 Surrebuttal revenue requirement.

V. SUMMARY OF RECOMMENDATION

Water Division

Q. Please provide a brief summary of Staff's recommendation.

A. Staff recommends approval of its recommended rates shown in Schedule PMC-1 W.

Wastewater Division

Q. Please provide a brief summary of Staff's recommendation.

A. Staff recommends approval of its recommended rates shown in Schedule PMC-1 WW.

Q. Does your silence on any of the issues, matters or findings addressed in the testimony of any of the witnesses for LPSCO constitute your acceptance of their positions on such issues, matters or findings?

A. No. Staff limited its discussion to the specific issues outlined above. Staff's lack of response to any issue in this proceeding should not be construed as agreement with the Company's position in its Rebuttal Testimony; rather, where there is no response Staff relies on its original Direct Testimony.

Q. Does this conclude your Surrebuttal Testimony?

A. Yes, it does.

WATER DIVISION RATE DESIGN

Monthly Usage Charge		Present Rates	Company Proposed	Staff Recommended
5/8 x3/4" Meter - All Classes		$ 6.75	$ 10.32	$ 10.00
3/4" Meter - All Classes		8.30	26.32	10.00
1" Meter - All Classes		14.60	43.86	25.00
1½" Meter - All Classes		28.60	54.08	50.00
2" Meter - All Classes		56.50	66.56	80.00
3" Meter - All Classes		NT	133.12	160.00
4" Meter - All Classes		132.00	208.00	250.00
6" Meter - All Classes		NT	416.00	500.00
8" Meter - All Classes		225.00	499.20	825.00
10" Meter - All Classes		330.00	956.80	1,150.00
12" Meter - All Classes		450.00	1,248.00	2,150.00
Construction Water - Hydrants		100.00	By Meter Size	-
Commodity Rates				
5/8 x3/4" Meter	(Residential)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 3,000 Gallons			$ 1.22	$ 1.00
3,001 to 9,000 Gallons			$ 1.82	$ 1.88
Over 9,000 Gallons			$ 2.42	$ 2.88
3/4" Meter	(Residential)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 3,000 Gallons			$ 1.22	$ 1.00
3,001 to 9,000 Gallons			$ 1.82	$ 1.88
Over 9,000 Gallons			$ 2.42	$ 2.88
5/8 x3/4" and 3/4" Meter	(Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 10,000 Gallons			$ 1.82	$ 1.88
Over 10,000 Gallons			$ 2.42	$ 2.88
1" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 20,000 Gallons			$ 1.82	$ 1.88
Over 20,000 Gallons			$ 2.42	$ 2.88
1½" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 30,000 Gallons			$ 1.82	$ 1.88
Over 30,000 Gallons			$ 2.42	$ 2.88

WATER DIVISION RATE DESIGN

		Present Rates	Company Proposed	Staff Recommended
2" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 50,000 Gallons			$ 1.82	$ 1.88
Over 50,000 Gallons			$ 2.42	$ 2.88
3" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 120,000 Gallons			$ 1.82	$ 1.88
Over 120,000 Gallons			$ 2.42	$ 2.88
4" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 180,000 Gallons			$ 1.82	$ 1.88
Over 180,000 Gallons			$ 2.42	$ 2.88
6" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 360,000 Gallons			$ 1.82	$ 1.88
Over 360,000 Gallons			$ 2.42	$ 2.88
8" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 670,000 Gallons			$ 1.82	$ 1.88
Over 670,000 Gallons			$ 2.42	$ 2.88
10" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 940,000 Gallons			$ 1.82	$ 1.88
Over 940,000 Gallons			$ 2.42	2.88
12" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 1,248,000 Gallons			$ 1.82	$ 1.88
Over 1,248,000 Gallons			$ 2.42	$ 2.88
Construction Water				
All Gallons		$ 2.50	$ 2.42	$ 2.88

WATER DIVISION RATE DESIGN

	Present Rates			Company Proposed			Staff Recommended		
Service Line and Meter Installation Charges	Line	Meter	Total	Line	Meter	Total	Line	Meter	Total
5/8" x 3/4" Meter			$ 300	$ 385	$ 135	$ 520	$ 385	$ 135	$ 520
3/4" Meter			300	385	215	600	385	215	600
1" Meter			325	435	255	690	435	255	690
1½" Meter			500	470	465	935	470	465	935
2"			675	-	-	-	-	-	-
Over 2"			At Cost	-	-	-	-	-	-
2" Turbine Meter			NT	630	965	1,595	630	965	1,595
2" Compound Meter			NT	630	1,690	2,320	630	1,690	2,320
3" Turbine Meter			NT	805	1,470	2,275	805	1,470	2,275
3" Compound Meter			NT	845	2,265	3,110	845	2,265	3,110
4" Turbine Meter			NT	1,170	2,350	3,520	1,170	2,350	3,520
4" Compound Meter			NT	1,230	3,245	4,475	1,230	3,245	4,475
6" Turbine Meter			NT	1,730	4,545	6,275	1,730	4,545	6,275
6" Compound Meter			NT	1,770	6,280	8,050	1,770	6,280	8,050
8" & Larger			NT	At Cost	At Cost	At Cost	At Cost	At Cost	At Cost

Service Charges	Present Rates	Company Proposed	Staff Recommended
Establishment (a)	$ 20.00	$ 20.00	$ 20.00
Establishment (After Hours) (a)	40.00	40.00	40.00
Re-Establishment of Service (a)	(b)	(b)	(b)
Reconnection (Regular Hours) (a)	50.00	50.00	50.00
Reconnection (After Hours) (a)	65.00	65.00	65.00
Meter Test (if correct) (c)	25.00	25.00	25.00
Meter Re-Read (If correct)	5.00	5.00	5.00
NSF Check	25.00	25.00	25.00
Deferred Payment, Per Month	1.50%	1.50%	1.50%
Late Charge	(d)	(d)	(d)
Service Calls - Per Hour/After Hours (e)	40.00	40.00	40.00
Deposit Requirement	(f)	(f)	(f)
Deposit Interest	3.50%	3.50%	3.50%
* Hydrant Meter Deposit:			
5/8" x 3/4" Meter	$ 1,500.00	$ 1,500.00	$ 135.00
3/4" Meter	1,500.00	1,500.00	215.00
1" Meter	1,500.00	1,500.00	255.00
1½" Meter	1,500.00	1,500.00	465.00
2" Turbine Meter	1,500.00	1,500.00	965.00
2" Compound Meter	1,500.00	1,500.00	1,690.00
3" Turbine Meter	1,500.00	1,500.00	1,470.00
3" Compound Meter	1,500.00	1,500.00	2,265.00
4" Turbine Meter	1,500.00	1,500.00	2,350.00
4" Compound Meter	1,500.00	1,500.00	3,245.00
6" Turbine Meter	1,500.00	1,500.00	4,545.00
6" Compound Meter	1,500.00	1,500.00	6,280.00
8" & Larger	NT	At Cost	At Cost

NT = No Tariff
(a) Service charges for customers taking both water and sewer service are not duplicative.
(b) Minimum charge times number of months disconnected.
(c) $25 plus cost of test.
(d) Greater of $5.00 or 1.5% of unpaid balance.
(e) No charge for service calls during normal working hours.
(f) Per Rule R14-2-403(B): Residential - two times the average bill. Commercial - two and one-half times the average bill.
* Shall have a non-interest bearing deposit of the amount indicated, refundable in its entirety upon return of the meter in good condition and payment of final bill.

Typical Bill Analysis
3/4" Residential

Company Proposed	Gallons	Present Rates	Proposed Rates	Dollar Increase	Percent Increase
Average Usage	9,537	$ 18.64	$ 42.20	$ 23.56	126.41%
Median Usage	7,000	15.29	37.26	$ 21.97	143.69%
Staff Recommended					
Average Usage	9,537	$ 18.64	$ 25.83	$ 7.19	38.56%
Median Usage	7,000	15.29	20.52	$ 5.23	34.21%

Present & Proposed Rates (Without Taxes)
3/4" Residential

Gallons Consumption	Present Rates	Company Proposed Rates	% Increase	Staff Recommended Rates	% Increase
-	$ 8.30	$ 26.32	217.11%	$ 10.00	20.48%
1,000	9.17	27.54	200.33%	11.00	19.96%
2,000	10.04	28.76	186.45%	12.00	19.52%
3,000	10.91	29.98	174.79%	13.00	19.16%
4,000	11.78	31.80	169.95%	14.88	26.32%
5,000	12.65	33.62	165.77%	16.76	32.49%
6,000	13.97	35.44	153.69%	18.64	33.43%
7,000	15.29	37.26	143.69%	20.52	34.21%
8,000	16.61	39.08	135.28%	22.40	34.86%
9,000	17.93	40.90	128.11%	24.28	35.42%
9,537	18.64	42.20	126.41%	25.83	38.56%
10,000	19.25	43.32	125.04%	27.16	41.09%
11,000	20.57	45.74	122.36%	30.04	46.04%
12,000	21.89	48.16	120.01%	32.92	50.39%
13,000	23.21	50.58	117.92%	35.80	54.24%
14,000	24.53	53.00	116.06%	38.68	57.68%
15,000	25.85	55.42	114.39%	41.56	60.77%
16,000	27.17	57.84	112.88%	44.44	63.56%
17,000	28.49	60.26	111.51%	47.32	66.09%
18,000	29.81	62.68	110.27%	50.20	68.40%
19,000	31.13	65.10	109.12%	53.08	70.51%
20,000	32.45	67.52	108.07%	55.96	72.45%
25,000	39.05	79.62	103.89%	70.36	80.18%
30,000	45.65	91.72	100.92%	84.76	85.67%
35,000	52.25	103.82	98.70%	99.16	89.78%
40,000	58.85	115.92	96.98%	113.56	92.97%
45,000	65.45	128.02	95.60%	127.96	95.51%
50,000	72.05	140.12	94.48%	142.36	97.59%
75,000	105.05	200.62	90.98%	214.36	104.06%
100,000	138.05	261.12	89.15%	286.36	107.43%

WASTEWATER DIVISION RATE DESIGN

Monthly Usage Charge	Present	Company Proposed	Staff Recommended
Residential	$ 27.20	$ 48.21	$ 39.48
Multiple Unit Service - Per Unit / Month	25.25	44.76	$ 36.65
Small Comm. [1]	46.00	81.54	$ 66.77
Regular Domestic [2]	25.75	45.64	$ 37.38
Restaurants, Motels, Grocery, DC	25.75	45.64	$ 37.38
Wig. Resort/ Room	25.25	44.76	$ 36.65
Wig. Resort/ Main	1,000.00	1,772.50	$ 1,451.50
Element. School	680.00	1,205.30	$ 987.02
Mid. & High School	800.00	1,418.00	$ 1,161.20
Community College	1,240.00	2,197.90	$ 1,799.86
Effluent Sales [3]	Market	Market	Market

[1] Small commercial is a wastewater commercial customer that averages a maximum of 10,000 gallons of water usage per month.
[2] Regular Domestic is a wastewater commercial customer that averages a minimum of 10,000 gallons of 10,000 gallons of water usage per month.
[3] Market Rate - Maximum effluent rate shall not exceed $430 per acre foot based on a potable water rate of $1.32 per thousand gallons and shall not be less than $ 0.87 per thousand gallons.

Commodity Charge (per 1,000 gallons of water)	Present	Company Proposed	Staff Recommended
Regular Domestic	$ 2.25	$ 3.99	$ 3.27
Restaurants, Motels, Grocery, DC	3.00	5.32	4.35

WASTEWATER DIVISION RATE DESIGN

Service Charges	Present	Company Proposed	Staff Recommended
Establishment (a)	$ 20.00	$ 20.00	$ 20.00
Establishment (After Hours) (a)	$ 40.00	$ 40.00	$ 40.00
Re-Establishment of Service (a)	(b)	(b)	(b)
Reconnection (Regular Hours) (a)	50.00	50.00	50.00
Reconnection (After Hours) (a)	65.00	65.00	65.00
NSF Check	$ 25.00	$ 25.00	$ 25.00
Deferred Payment, Per Month	1.50%	1.50%	1.50%
Late Charge	(c)	(c)	(c)
Service Calls - Per Hour/After Hours (d)	40.00	40.00	40.00
Deposit Requirement	(e)	(e)	(e)
Deposit Interest	3.50%	3.50%	3.50%
Service Lateral Connection Charge- All Sizes	(f)	(f)	(f)
Main Extension Tariff	(g)	(g)	(g)

(a) Service charges for customers taking both water and sewer service are not duplicative.
(b) Minimum charge times number of months disconnected.
(c) Greater of $5.00 or 1.5% of unpaid balance.
(d) No charge for service calls during normal working hours.
(e) Per Rule R14-2-603B: Residential - two times the average bill.
Non-residential - two and one-half times the average bill.
(f) At cost. Customer/Developer shall install or cause to be installed all Service Laterals as a non-refundable contribution-in-aid of construction.
(g) All Main Extensions shall be completed at cost and shall be treated as non-refundable contribution-in-aid of construction.

Litchfield Park Service Company
Docket Nos. W-01427A-09-0104, SW-01428A-09-0103, et al.
Test Year Ended September 31, 2008

Schedule PMC-2 WW

Typical Bill Analysis

Residential

Company Proposed	Present Rates	Proposed Rates	Dollar Increase	Percent Increase
	$ 27.20	$ 48.21	$ 21.01	77.24%
Staff Recommended				
	27.20	39.48	$ 12.28	45.15%

WATER DIVISION RATE DESIGN

Monthly Usage Charge	Present Rates	Company Proposed	Staff Recommended
5/8 x3/4" Meter - All Classes	$ 6.75	$ 10.20	$ 10.00
3/4" Meter - All Classes	8.30	19.00	10.00
1" Meter - All Classes	14.60	31.67	25.00
1½" Meter - All Classes	28.60	69.67	50.00
2" Meter - All Classes	56.50	111.47	80.00
3" Meter - All Classes	NT	NT	160.00
4" Meter - All Classes	132.00	348.33	250.00
6" Meter - All Classes	NT	NT	500.00
8" Meter - All Classes	225.00	501.00	825.00
10" Meter - All Classes	330.00	960.00	1,150.00
12" Meter - All Classes but irrigation	450.00	1,500.00	2,150.00
12" Meter - Irrigation	450.00	960.00	2,150.00
Construction Water - Hydrants	100.00	By Meter Size	-
Commodity Rates			
5/8 x3/4" Meter (Residential)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 3,000 Gallons		$ 1.25	
3,001 to 10,000 Gallons		$ 1.80	
Over 10,000 Gallons		$ 2.40	
0 to 3,000 Gallons			$ 1.00
3,001 to 9,000 Gallons			$ 1.88
Over 9,000 Gallons			$ 2.88
3/4" Meter (Residential)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 15,000 Gallons		$ 1.90	
15,001 to 50,000 Gallons		$ 2.45	
Over 50,000 Gallons		$ 3.05	
0 to 3,000 Gallons			$ 1.00
3,001 to 9,000 Gallons			$ 1.88
Over 9,000 Gallons			$ 2.88
5/8 x3/4" and 3/4" Meter (Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 3,000 Gallons		$ 1.25	
3,001 to 10,000 Gallons		$ 1.80	
Over 10,000 Gallons		$ 2.40	
0 to 10,000 Gallons			$ 1.88
Over 10,000 Gallons			$ 2.88
1" Meter (Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 15,000 Gallons		$ 1.90	
15,001 to 100,000 Gallons		$ 2.45	
Over 100,000 Gallons		$ 3.30	
0 to 20,000 Gallons			$ 1.88
Over 20,000 Gallons			$ 2.88
1½" Meter (Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 90,000 Gallons		$ 2.75	
Over 90,000 Gallons		$ 3.47	
0 to 30,000 Gallons			$ 1.88
Over 30,000 Gallons			$ 2.88

EXHIBIT
S-4
admitted

WATER DIVISION RATE DESIGN

		Present Rates	Company Proposed	Staff Recommended
2" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 140,000 Gallons			$ 2.75	
Over 140,000 Gallons			$ 3.47	
0 to 50,000 Gallons				$ 1.88
Over 50,000 Gallons				$ 2.88
3" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 120,000 Gallons		NT	NT	$ 1.88
Over 120,000 Gallons		NT	NT	$ 2.88
4" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 180,000 Gallons			$ 2.75	$ 1.88
Over 180,000 Gallons			$ 3.47	$ 2.88
6" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 360,000 Gallons		NT	NT	$ 1.88
Over 360,000 Gallons		NT	NT	$ 2.88
8" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 670,000 Gallons			$ 2.75	$ 1.88
Over 670,000 Gallons			$ 3.47	$ 2.88
8" Meter	(Bulk resale only)			
All Gallons		NT	$ 1.50	NT
10" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 940,000 Gallons			$ 2.75	$ 1.88
Over 940,000 Gallons			$ 3.47	2.88
12" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 1,248,000 Gallons			$ 2.75	
Over 1,248,000 Gallons			$ 3.47	
0 to 1,248,000 Gallons				$ 1.88
Over 1,248,000 Gallons				$ 2.88
Construction Water				
All Gallons		$ 2.50	$ 3.47	$ 2.88

WATER DIVISION RATE DESIGN

	Present Rates			Company Proposed			Staff Recommended		
Service Line and Meter Installation Charges	Line	Meter	Total	Line	Meter	Total	Line	Meter	Total
5/8" x 3/4" Meter			$ 300	$ 385	$ 135	$ 520	$ 385	$ 135	$ 520
3/4" Meter			300	385	215	600	385	215	600
1" Meter			325	435	255	690	435	255	690
1½" Meter			500	470	465	935	470	465	935
2"			675	-	-	-	-	-	-
Over 2"			At Cost	-	-	-	-	-	-
2" Turbine Meter			NT	630	965	1,595	630	965	1,595
2" Compound Meter			NT	630	1,690	2,320	630	1,690	2,320
3" Turbine Meter			NT	805	1,470	2,275	805	1,470	2,275
3" Compound Meter			NT	845	2,265	3,110	845	2,265	3,110
4" Turbine Meter			NT	1,170	2,350	3,520	1,170	2,350	3,520
4" Compound Meter			NT	1,230	3,245	4,475	1,230	3,245	4,475
6" Turbine Meter			NT	1,730	4,545	6,275	1,730	4,545	6,275
6" Compound Meter			NT	1,770	6,280	8,050	1,770	6,280	8,050
8" & Larger			NT	At Cost	At Cost	At Cost	At Cost	At Cost	At Cost

Service Charges	Present Rates	Company Proposed	Staff Recommended
Establishment (a)	$ 20.00	$ 20.00	$ 20.00
Establishment (After Hours) (a)	40.00	40.00	40.00
Re-Establishment of Service (a)	(b)	(b)	(b)
Reconnection (Regular Hours) (a)	50.00	50.00	50.00
Reconnection (After Hours) (a)	65.00	65.00	65.00
Meter Test (if correct) (c)	25.00	25.00	25.00
Meter Re-Read (If correct)	5.00	5.00	5.00
NSF Check	25.00	25.00	25.00
Deferred Payment, Per Month	1.50%	1.50%	1.50%
Late Charge	(d)	(d)	(d)
Service Calls - Per Hour/After Hours (e)	40.00	40.00	40.00
Deposit Requirement	(f)	(f)	(f)
Deposit Interest	3.50%	3.50%	3.50%
* Hydrant Meter Deposit:			
5/8" x 3/4" Meter	$ 1,500.00	$ 1,500.00	$ 135.00
3/4" Meter	1,500.00	1,500.00	215.00
1" Meter	1,500.00	1,500.00	255.00
1½" Meter	1,500.00	1,500.00	465.00
2" Turbine Meter	1,500.00	1,500.00	965.00
2" Compound Meter	1,500.00	1,500.00	1,690.00
3" Turbine Meter	1,500.00	1,500.00	1,470.00
3" Compound Meter	1,500.00	1,500.00	2,265.00
4" Turbine Meter	1,500.00	1,500.00	2,350.00
4" Compound Meter	1,500.00	1,500.00	3,245.00
6" Turbine Meter	1,500.00	1,500.00	4,545.00
6" Compound Meter	1,500.00	1,500.00	6,280.00
8" & Larger	NT	At Cost	At Cost

NT = No Tariff
(a) Service charges for customers taking both water and sewer service are not duplicative.
(b) Minimum charge times number of months disconnected.
(c) $25 plus cost of test.
(d) Greater of $5.00 or 1.5% of unpaid balance.
(e) No charge for service calls during normal working hours.
(f) Per Rule R14-2-403(B): Residential - two times the average bill. Commercial - two and one-half times the average bill.
* Shall have a non-interest bearing deposit of the amount indicated, refundable in its entirety upon return of the meter in good condition and payment of final bill.

Typical Bill Analysis
3/4" Residential

Company Proposed	Gallons	Present Rates	Proposed Rates	Dollar Increase	Percent Increase
Average Usage	9,537	$ 18.64	$ 37.12	$ 18.48	99.16%
Median Usage	7,000	15.29	32.30	$ 17.01	111.25%
Staff Recommended					
Average Usage	9,537	$ 18.64	$ 25.83	$ 7.19	38.56%
Median Usage	7,000	15.29	20.52	$ 5.23	34.21%

Present & Proposed Rates (Without Taxes)
3/4" Residential

Gallons Consumption	Present Rates	Company Proposed Rates	% Increase	Staff Recommended Rates	% Increase
-	$ 8.30	$ 19.00	128.92%	$ 10.00	20.48%
1,000	9.17	20.90	127.92%	11.00	19.96%
2,000	10.04	22.80	127.09%	12.00	19.52%
3,000	10.91	24.70	126.40%	13.00	19.16%
4,000	11.78	26.60	125.81%	14.88	26.32%
5,000	12.65	28.50	125.30%	16.76	32.49%
6,000	13.97	30.40	117.61%	18.64	33.43%
7,000	15.29	32.30	111.25%	20.52	34.21%
8,000	16.61	34.20	105.90%	22.40	34.86%
9,000	17.93	36.10	101.34%	24.28	35.42%
9,537	18.64	37.12	99.16%	25.83	38.56%
10,000	19.25	38.00	97.40%	27.16	41.09%
11,000	20.57	39.90	93.97%	30.04	46.04%
12,000	21.89	41.80	90.95%	32.92	50.39%
13,000	23.21	43.70	88.28%	35.80	54.24%
14,000	24.53	45.60	85.89%	38.68	57.68%
15,000	25.85	47.50	83.75%	41.56	60.77%
16,000	27.17	49.95	83.84%	44.44	63.56%
17,000	28.49	52.40	83.92%	47.32	66.09%
18,000	29.81	54.85	84.00%	50.20	68.40%
19,000	31.13	57.30	84.07%	53.08	70.51%
20,000	32.45	59.75	84.13%	55.96	72.45%
25,000	39.05	72.00	84.38%	70.36	80.18%
30,000	45.65	84.25	84.56%	84.76	85.67%
35,000	52.25	96.50	84.69%	99.16	89.78%
40,000	58.85	108.75	84.79%	113.56	92.97%
45,000	65.45	121.00	84.87%	127.96	95.51%
50,000	72.05	133.25	84.94%	142.36	97.59%
75,000	105.05	209.50	99.43%	214.36	104.06%
100,000	138.05	285.75	106.99%	286.36	107.43%

BEFORE THE ARIZONA CORPORATION COMMISSION

KRISTIN K. MAYES
Chairman
GARY PIERCE
Commissioner
PAUL NEWMAN
Commissioner
SANDRA D. KENNEDY
Commissioner
BOB STUMP
Commissioner

IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WASTEWATER RATES AND CHARGES FOR UTILITY SERVICE BASED THEREON.	DOCKET NO. SW-01428A-09-0103
IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WATER RATES AND CHARGES FOR UTILITY SERVICE BASED THEREON.	DOCKET NO. W-01427A-09-0104

DIRECT TESTIMONY

OF

MARLIN SCOTT, JR

UTILITIES ENGINEER

UTILITIES DIVISION

ARIZONA CORPORATION COMMISSION

NOVEMBER 4, 2009

ALL-STATE LEGAL®
EXHIBIT
S-5
ADMITTED

TABLE OF CONTENTS

TABLE OF CONTENTS FOR EXHIBIT MSJ

EXHIBIT MSJ, Engineering Report for Wastewater Division

FIGURES

TABLE

ATTACHMENT

EXECUTIVE SUMMARY
LITCHFIELD PARK SERVICE COMPANY
DOCKET NOS. W-01427A-09-0104 AND SW-01428A-09-0103

WATER DIVISION

Conclusions

A. The Litchfield Park Service Company's ("Company") water system has a water loss of 9.3 percent which is within the acceptable limit of 10 percent.

B. The water system's current source and storage capacity are adequate to serve the present customer base and reasonable growth.

C. Maricopa County Environmental Services Department has reported the Company's water system has no major deficiencies and determined that this system is currently delivering water that meets water quality standards required by the Arizona Administrative Code, Title 18, Chapter 4.

D. The Company is located in the Arizona Department of Water Resources' Phoenix Active Management Area and reported the Company's system is in compliance with its requirements governing water providers and/or community water systems.

E. According to the Utilities Division Compliance Section, the Company had no delinquent Arizona Corporation Commission ("ACC") compliance issues.

F. Staff concludes that the requested Post-Test Year plant, adjusted to $1,885,770, is used and useful for provision of service to the customers.

G. The Company has an approved curtailment tariff that became effective on December 9, 2002.

H. The Company has an approved backflow prevention tariff that became effective on January 20, 1998.

Recommendations

1. Staff recommends that the Company's reported annual water testing expense of $28,365 be adopted for this proceeding.

2. Staff recommends the removal of the Litchfield Greens Booster Station at a cost of $78,879 from the plant-in-service because this booster station is not used and useful.

3. Staff recommends that the Company continue to use the Staff's recommended water depreciation rates by individual National Association of Regulatory Utility Commissioners ("NARUC") category as shown in Water Division Table J-1.

4. Staff recommends approval of the proposed charges as shown in Water Division's Table K-1, with separate installation charges for the service line and meter installations.

5. The Company requested a Water Hook-Up Fee ("HUF") Tariff starting at $1,800 for a 5/8 x 3/4-inch meter. Staff supports the concept of a HUF and recommends the adoption of the specific and updated tariff language contained in Attachment - Water HUF Tariff.

WASTEWATER DIVISION

Conclusions

A. The Company's Palm Valley Water Reclamation Facilities have adequate treatment capacity to serve the present customer base and reasonable growth.

B. The Arizona Department of Environmental Quality ("ADEQ") has reported the Company has no deficiencies and in compliance with ADEQ regulations.

C. According to the Utilities Division Compliance Section, the Company had no delinquent ACC compliance issues.

Recommendations

1. Staff recommends the removal of the three lift stations, totaling to $554,977, from the plant-in-service because these booster stations are not used and useful.

2. Staff recommends that the Company continue to use the Staff's recommended wastewater depreciation rates by individual NARUC category as shown in Wastewater Division Table H-1.

3. The Company has an existing Wastewater HUF Tariff that became effective on April 1, 2008. The Company requested to modify its Wastewater HUF Tariff to start at $1,800 per Equivalent Residential Unit. Staff supports the concept of a HUF and recommends the adoption of the specific and updated tariff language contained in Attachment - Wastewater HUF Tariff.

INTRODUCTION

Q. Please state your name, place of employment and job title.

A. My name is Marlin Scott, Jr. My place of employment is the Arizona Corporation Commission ("Commission" or "ACC"), Utilities Division, 1200 West Washington Street, Phoenix, Arizona 85007. My job title is Utilities Engineer.

Q. How long have you been employed by the Commission?

A. I have been employed by the Commission since November 1987.

Q. Please list your duties and responsibilities.

A. As a Utilities Engineer, specializing in water and wastewater engineering, my responsibilities include: the inspection, investigation, and evaluation of water and wastewater systems; preparing reconstruction cost new and/or original cost studies, cost of service studies and investigative reports; providing technical recommendations and suggesting corrective action for water and wastewater systems; and providing written and oral testimony on rate applications and other cases before the Commission.

Q. How many cases have you analyzed for the Utilities Division?

A. I have analyzed approximately 530 cases covering various responsibilities for the Utilities Division.

Q. Have you previously testified before this Commission?

A. Yes, I have testified in 77 proceedings before this Commission.

Q. What is your educational background?

A. I graduated from Northern Arizona University in 1984 with a Bachelor of Science degree in Civil Engineering Technology.

Q. Briefly describe your pertinent work experience.

A. Prior to my employment with the Commission, I was Assistant Engineer for the City of Winslow, Arizona, for about two years. Prior to that, I was a Civil Engineering Technician with the U.S. Public Health Service in Winslow for approximately six years.

Q. Please state your professional membership, registrations, and licenses.

A. I am a member of the National Association of Regulatory Utility Commissioners' Staff Subcommittee on Water.

PURPOSE OF TESTIMONY

Q. Were you assigned to provide the Utilities Division Staff ("Staff") engineering analysis and recommendation for the Litchfield Park Service Company ("Company") in this proceeding?

A. Yes. I reviewed the Company's application, reviewed responses to data requests, and inspected the water and wastewater systems on August 28, 2009 and September 2, 2009, respectively. This testimony and its attachment present Staff's engineering evaluation.

ENGINEERING REPORT

Q. Please describe the attached Engineering Report, Exhibit MSJ.

A. Exhibit MSJ presents the details and analyses of Staff's findings for the water and wastewater divisions, and is attached to this Direct Testimony. Exhibit MSJ contains the following water division major topics: (1) a description of the water system, (2) water use, (3) growth, (4) compliance with the rules of the Maricopa County Environmental Services Department, Arizona Department of Water Resources, and the Arizona Corporation Commission ("ACC"), (5) plant-in-service adjustments, (6) depreciation rates, (7) service line and meter installation charges, and (8) tariff filings. Exhibit MSJ also contains the following wastewater division major topics: (1) a description of the wastewater system, (2) wastewater flows, (3) growth, (4) compliance with the rules of the Arizona Department of Environmental Quality and the ACC, (5) plant-in-service adjustments, (6) depreciation rates, and (7) tariff filings.

My conclusions and recommendations from the Engineering Report are contained in the "Executive Summary", above.

Q. Does this conclude your Direct Testimony?

A. Yes, it does.

Engineering Report for
Litchfield Park Service Company
Docket No. W-01427A-09-0104 (Rates)

WATER DIVISION

November 4, 2009

A. LOCATION OF LITCHFIELD PARK SERVICE COMPANY ("COMPANY")

The Company is located in the Phoenix West Valley and provides water service to communities within the City of Litchfield Park, City of Goodyear, City of Avondale, and some unincorporated areas of Maricopa County. Figure A-1 shows the location of the Company within Maricopa County and Figure A-2 shows the approximate 20.6 square-miles of water certificated area.

B. DESCRIPTION OF WATER SYSTEM

This water system was field inspected on August 28, 2009, by Arizona Corporation Commission ("ACC" or "Commission") Staff member Marlin Scott, Jr., in the accompaniment of Matthew Garlick and Joey Romo, representing the Company. The operation of this water system consists of 12 wells, three arsenic treatment systems, two storage tanks, three booster systems and a distribution system serving approximately 15,600 customers during the test year ending September 2008. A detailed plant facility description is as follows:

Table W-1. Well Data

Well Name	ADWR ID No.	Turbine Pumps	Flow, GPM	Casing Size & Depth	Meter Size	Arsenic Level
Town Well #1	55-583454	200-Hp	700	16" x 740'	12"	11.2 ppb
Town Well #2	55-611680	75-Hp	550	12" x 503'	8"	9.8 ppb
Town Well #4	55-611678	150-Hp	1,200	16" x 685'	12"	8.8 ppb
Town Well #5	55-611677	150-Hp	1,100	16" x 850'	12"	10.1 ppb
Town Well #6	55-533836	200-Hp	1,200	16" x 650'	12"	20.3 ppb
Airline Well #2	55-611724	250-HP	1,200	16" x 1100'	12"	6.7 ppb
Airline Well #4	55-611726	350-Hp	1,350	20" x 881'	8"	13.1 ppb
Airline Well #5	55-611727	300-Hp	1,350	16" x 810'	8"	46.6 ppb
Airline Well #9	55-611729	350-Hp	1,350	20" x 997'	8"	55.0 ppb
Airline Well #10	55-214539	150-Hp	700	16" x 700'	12"	9.6 ppb
Well 34C	55-611687	175-Hp (Submersible)	1,000	14" x 700'	8"	4.9 ppb
Well 20B	55-611717	200-Hp	1,400	20" x 1100'	12"	17.4 ppb
		TOTAL:	13,100 GPM			

Table W-2. Treatment Facilities

Location	Type of Treatment	Generators
Town Well Reservoir	4.5 MGD capacity arsenic treatment facilities using Bayoxide E33 disposable granular iron media for Town Wells #1, #2, and #6. Town Wells #4 and #5 are blended to the treated water.	Diesel generator – 645 kW
Airline Reservoir	8.4 MGD capacity arsenic treatment facilities using coagulation-filtration method for Airline Wells #4, #5 and #9.	Diesel generator – 1,250 kW
20B Arsenic Treatment Site, 15614 West Charles Blvd.	1,500 GPM capacity arsenic treatment facilities using Bayoxide E33 disposable granular iron media for Well 20B.	None
Wells – AL Well #2, AL Well #10, Well 34C and 20B treatment site.	Chlorination units	Diesel generator - 405 kW @ AL Well #2, AL Well #9, and AL Well #10

Table W-3. Storage Tanks

Capacity Million Gallons (MG)	Quantity (Each)	Location
6.3	1	@ Town Well Reservoir
4.3	1	@ Airline Reservoir
Total: 10.6 MG	2	

Table W-4A. Town Well Reservoir Booster System

BOOSTER SYSTEM AT TOWN WELL RESERVOIR					
Booster Pump Data	**BP-1**	**BP-2**	**BP-3**	**BP-4**	**BP-5**
Flow Rate – gpm	2,000	2,000	2,000	3,250	3,250
Horsepower	200	150	100	200	200
Discharge – Inches	12	12	10	12	12
Motor Type	Electric	Natural gas	Electric	Electric	Electric
Fixed or Variable Speed	Fixed	Fixed	Variable	Variable	Variable
Discharge Meters	1 – 10" Mag meter		1 - 10 " Venturi		
Year Installed	1966	1966	1972	1992	2000

Table W-4B. Airline Reservoir Booster System

BOOSTER SYSTEM AT AIRLINE RESERVOIR				
Booster Pump Data	**BP-1**	**BP-2**	**BP-3**	**BP-4**
Flow Rate – gpm	3,000	3,000	4,000	4,000
Horsepower	250	250	250	250
Discharge – Inches	16	16	16	16
Motor Type	Electric	Electric	Electric	Electric
Variable / Soft start Speed	Variable	Variable	Soft start	Soft start
Discharge Meters	1 – 30" Mag meter			
Year Installed	2008	2008	2008	2008

Table W-4C. 20B Treatment Site Booster System

BOOSTER SYSTEM AT 20B TREATMENT SITE		
Booster Pump Data	**BP-1**	**BP-2**
Flow Rate – gpm	1,500	1,500
Horsepower	50	50
Discharge – Inches	8	8
Pump Type	Centrifugal	Centrifugal
Variable Speed	Variable	Variable
Year Installed	April 2009	April 2009

Table W-5. Water Mains

MAINS		
Size	**Material**	**Length (feet)**
2"	PVC	842
3"	AC	1,739
4"	AC	19,100
6"	AC,CL,PVC	384,731
8"	AC,PVC	480,880
10"	AC	3,435
12"	AC,PVC	147,991
16"	DIP	56,996
20"	Steel Pipe	-
24"	Steel Pipe	-
30"	PVC	5,290
36"	Steel Pipe	255
42"	Steel Pipe	325
	Total:	1,101,584 feet or 208.6 miles

Table W-6. Customer Meters

Size	Quantity
5/8 x 3/4-inch	260
3/4-inch	9,108
1- inch	5,697
1-1/2-inch	187
2-inch	612
3-inch	39
4-inch	19
6-inch	-
8-inch	2
10-inch	1
Total:	15,925

Table W-7. Fire Hydrants

Size	Quantity
Standard	3,374

C. WATER USE

Water Sold

Based on the information provided by the Company, water use for the test year ending September 2008 is presented in Figure C-1. The customer consumption experienced a high monthly average water use of 827 gallons per day ("GPD") per connection in August and a low monthly average water use of 375 GPD per connection in January for an average annual use of 618 GPD per connection.

Non-Account Water

Non-account water should be 10 percent or less. The Company reported 3,888,217,000 gallons pumped and 3,524,767,000 gallons sold, resulting in a water loss of 9.3 percent. This 9.3 percent is within the acceptable limit of 10 percent.

System Analysis

The water system's current source capacity of 13,100 GPM and storage capacity of 10.6 million gallons is adequate to serve the present customer base and reasonable growth.

D. GROWTH

Figure D-1 depicts the customer growth using linear regression analysis. The number of service connections was obtained from annual reports submitted to the Commission. At the end of the test year September 2008, the Company had 15,577 customers and it is projected that this system could have approximately 22,000 customers by December 2013 as shown in Figure D-1.

E. MARICOPA COUNTY ENVIRONMENTAL SERVICES DEPARTMENT ("MCESD") COMPLIANCE

Compliance

On September 25, 2009, MCESD reported the Company's system, PWS #07-046, had no major deficiencies and determined that this system is currently delivering water that meets water quality standards required by the Arizona Administrative Code, Title 18, Chapter 4.

Water Testing Expense

The Company reported its water testing expense at $28,365 for the test year. Staff has reviewed the Company's reported expense amount and recommends that the Company's water testing expense of $28,365 be adopted for this proceeding.

F. ARIZONA DEPARTMENT OF WATER RESOURCES ("ADWR") COMPLIANCE

The water system is located in the Phoenix Active Management Area ("AMA"). ADWR has reported that this system is in compliance with its requirements governing water providers and/or community water systems.

G. ARIZONA CORPORATION COMMISSION ("ACC") COMPLIANCE

According to the Utilities Division Compliance Section, the Company had no delinquent ACC compliance issues.

H. PLANT NOT USED AND USEFUL

In 1988, the Company constructed and placed into service the Litchfield Greens Booster Station. This booster has not been in operation since May 2003. Through its field inspection and Company data responses, Staff found this booster station not used and useful with its corresponding data as follows:

Table H-1. Plant Not Used and Useful

Acct. No.	Litchfield Greens Booster Station Plant Items	Year	Original Cost
304	Structures & Improvements	1988	41,971
311	Electric Pumping Equipment	1988	31,158
339	Other Plant & Miscellaneous Equipment	1998	5,750
	Total:		**$78,879**

Therefore, Staff recommends the removal of the Litchfield Greens Booster Station at a cost of $78,879 from the plant-in-service because this booster station is not used and useful.

I. POST-TEST YEAR PLANT

In its application, the Company requested a post-test year ("PTY") plant adjustment in the amount of $1,866,965 for an arsenic treatment project for the Company's Well 20B. Through Company data responses, the Company provided the following updated cost:

Table I-1. Post-Test Year Plant

Acct. No.	Plant item	Cost
303	Land & Land Rights	372,446
304	Structures & Improvements	1,350,246
320	Water Treatment Equipment	159,838
339	Other Plant & Miscellaneous Equipment	3,240
	Total:	**$1,885,770**

The construction of this arsenic treatment project commenced on October 2008 and completed in January 2009. On January 30, 2009, MCESD issued a Certificate of Approval to Commence Operations to begin the facilities operation for the Validation and Commissioning Testing requirements. On June 24, 2009, MCESD issued the Certificate of Approval of Construction for this project. Based on these approvals, along with Staff's field inspection to confirm the plant operation, Staff concludes that the requested PTY item is used and useful for the provision of service to customers.

J. DEPRECIATION RATES

In the prior rate case, the Company adopted Staff's typical and customary water depreciation rates. These rates are presented in Table J-1 and it is recommended that the Company continue to use these depreciation rates by individual National Association of Regulatory Utility Commissioners category.

K. SERVICE LINE AND METER INSTALLATION CHARGES

The Company proposed changes to its service line and meter installation charges. The Company's proposed charges are similar to Staff's customary installation charges. Since the Company may at times install meters on existing service lines, it would be appropriate for some customers to only be charged for the meter installation. Therefore, Staff recommends approval of the proposed charges as shown in Table K-1, with separate installation charges for the service line and meter.

L. CURTAILMENT TARIFF

The Company has an approved curtailment tariff that became effective on December 9, 2002.

M. BACKFLOW PREVENTION TARIFF

The Company has an approved backflow prevention tariff that became effective on January 20, 1998.

N. WATER HOOK-UP FEE TARIFF

The Company currently does not have an approved Water Hook-Up Fee ("HUF") Tariff. In its rate application, the Company requested a Water HUF Tariff starting at $1,800 for a 5/8 x 3/4-inch meter. The proposed $1,800 is based on the Company's recent costs for well development, reservoir, and arsenic treatment facilities that totaled to $1,950 per service connection. The Company however selected a lesser amount of $1,800 to be adopted for its HUF Tariff.

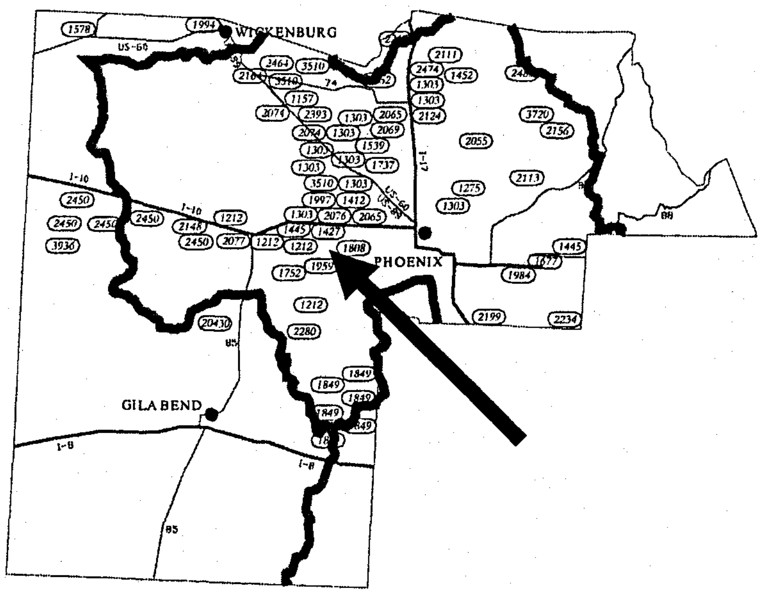
The Company also submitted its HUF Tariff that had different language than in Staff's updated HUF Tariff template. Staff has reviewed the Company's proposed language changes and will accept some of the Company's language changes that are shaded in the Tariff. Therefore, Staff recommends the adoption of the specific and updated tariff language contained in Attachment –Water HUF Tariff.

FIGURES

TABLES

ATTACHMENT

M A R I C O P A   C O U N T Y



- 1997 ADAMAN MUTUAL WATER COMPANY
- 1578 AGUILA WATER SERVICES, INC.
- 2077 ALLENVILLE WATER COMPANY, INC.
- 1303 ARIZONA-AMERICAN WATER COMPANY
- 1445 ARIZONA WATER COMPANY
- 2074 BEARDSLEY WATER COMPANY, INC.
- 1275 BERNEIL WATER COMPANY
- 1994 CABALLEROS WATER COMPANY, INC.
- 1452 CAVE CREEK WATER COMPANY
- 2113 CHAPARRAL CITY WATER COMPANY
- 2393 CHAPARRAL WATER COMPANY
- 3510 CIRCLE CITY WATER COMPANY L.L.C.
- 1752 CLEARWATER UTILITIES COMPANY, INC.
- 1984 DAIRYLAND WATER CORPORATION
- 2124 DESERT HILLS WATER COMPANY, INC.
- 3936 EAGLETAIL WATER COMPANY LC
- 1959 GRANDVIEW WATER COMPANY, INC.
- 20430 GREEN ACRES WATER, LLC
- 2234 H2O, INC.
- 2055 JAMES P. PAUL WATER COMPANY
- 2452 LAKE PLEASANT WATER COMPANY
- 1427 LITCHFIELD PARK SERVICE COMPANY
- 2267 MCADAMS WATER COMPANY
- 1849 MOBILE WATER COMPANY
- 2164 MORRISTOWN WATER COMPANY
- 1737 NEW RIVER UTILITY COMPANY
- 2199 PIMA UTILITY COMPANY
- 2464 PUESTA DEL SOL WATER COMPANY
- 1808 RIGBY WATER COMPANY
- 2156 RIO VERDE UTILITIES, INC.
- 1539 ROSE VALLEY WATER COMPANY
- 2111 SABROSA WATER COMPANY
- 2474 SHANGRI-LA ASSOCIATES, INC.
- 2280 SOUTH RAINBOW VALLEY WATER COOPERATIVE
- 2069 SUNRISE WATER COMPANY, INC.
- 2076 TIERRA BUENA WATER COMPANY
- 2483 TONTO HILLS UTILITY COMPANY
- 1677 TURNER RANCHES WATER & SANITATION COMPANY
- 1212 VALENCIA WATER COMPANY
- 1412 VALLEY UTILITIES WATER COMPANY, INC.
- 2148 VALLEY VIEW WATER COMPANY, INC.
- 2450 WATER UTILITY OF GREATER TONOPAH, INC.
- 3720 WATER UTILITY OF NORTHERN SCOTTSDALE, INC.
- 1157 WEST END WATER COMPANY
- 2065 WILHOIT WATER COMPANY, INC.

Figure A-1. Maricopa County Map

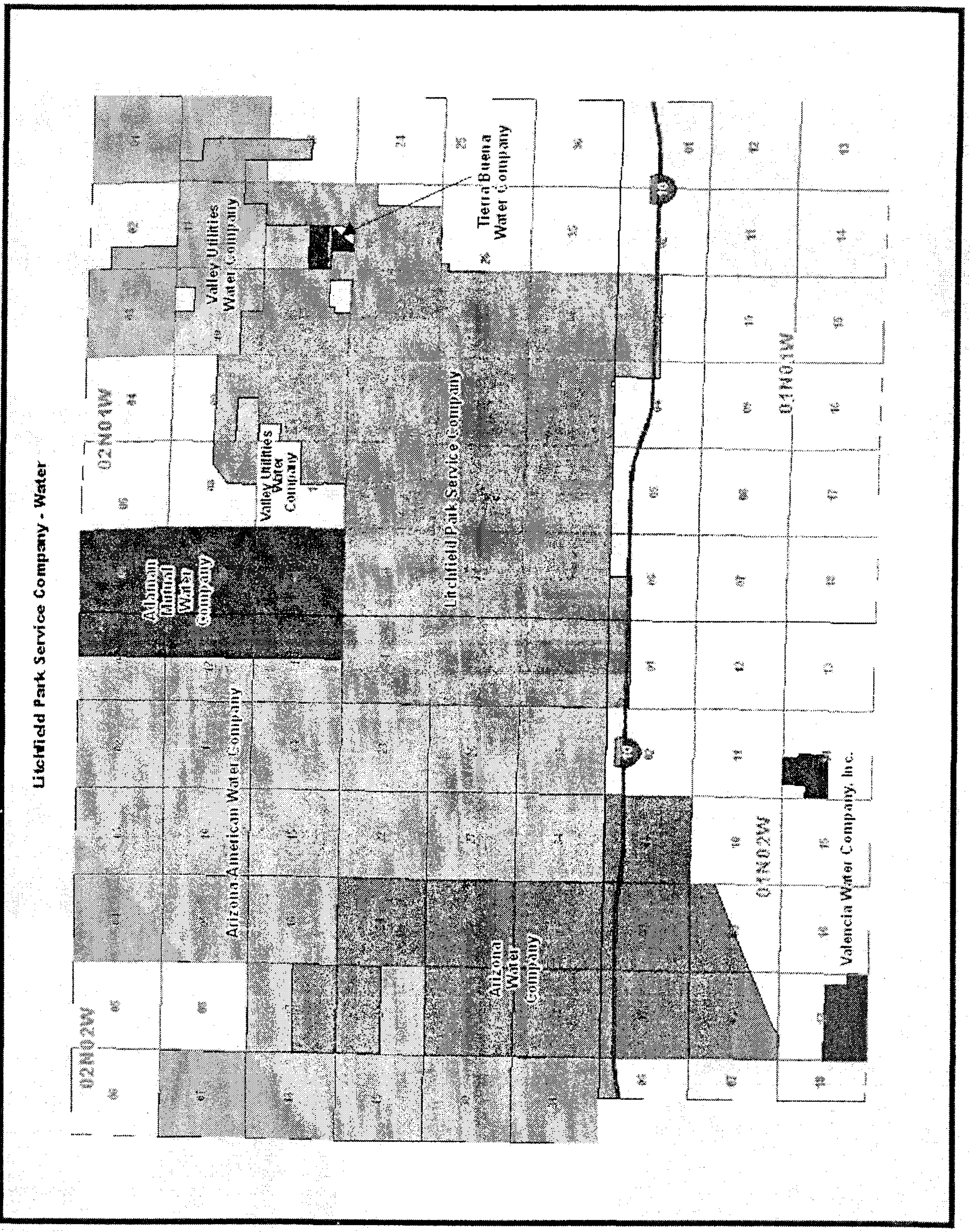


Figure A-2. Certificated Area

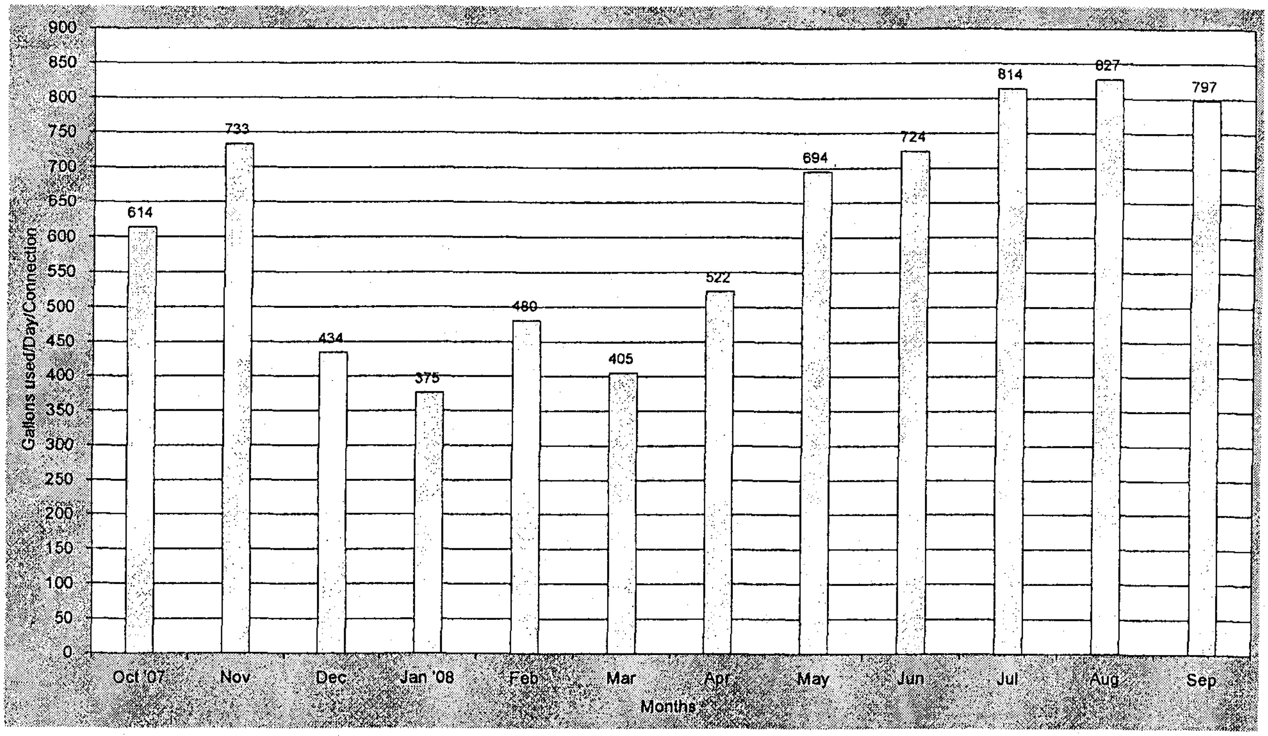


Figure C-1. Water System Use

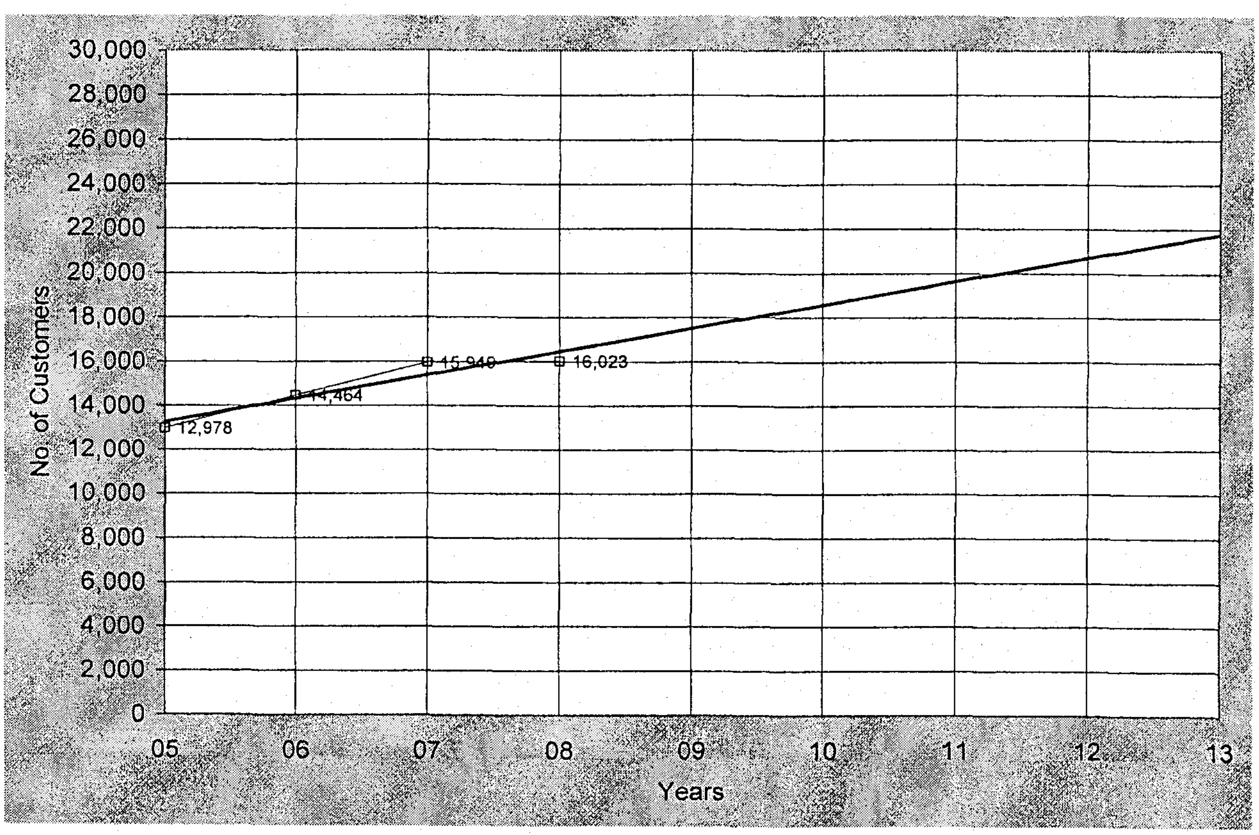


Figure D-1. Water System Growth

Table J-1. Water Depreciation Rates

NARUC Acct. No.	Depreciable Plant	Average Service Life (Years)	Annual Accrual Rate (%)
304	Structures & Improvements	30	3.33
305	Collecting & Impounding Reservoirs	40	2.50
306	Lake, River, Canal Intakes	40	2.50
307	Wells & Springs	30	3.33
308	Infiltration Galleries	15	6.67
309	Raw Water Supply Mains	50	2.00
310	Power Generation Equipment	20	5.00
311	Pumping Equipment	8	12.5
320	Water Treatment Equipment		
320.1	Water Treatment Plants	30	3.33
320.2	Solution Chemical Feeders	5	20.0
330	Distribution Reservoirs & Standpipes		
330.1	Storage Tanks	45	2.22
330.2	Pressure Tanks	20	5.00
331	Transmission & Distribution Mains	50	2.00
333	Services	30	3.33
334	Meters	12	8.33
335	Hydrants	50	2.00
336	Backflow Prevention Devices	15	6.67
339	Other Plant & Misc Equipment	15	6.67
340	Office Furniture & Equipment	15	6.67
340.1	Computers & Software	5	20.00
341	Transportation Equipment	5	20.00
342	Stores Equipment	25	4.00
343	Tools, Shop & Garage Equipment	20	5.00
344	Laboratory Equipment	10	10.00
345	Power Operated Equipment	20	5.00
346	Communication Equipment	10	10.00
347	Miscellaneous Equipment	10	10.00
348	Other Tangible Plant	---	---

NOTE: Acct. 348 – Other Tangible Plant may vary from 5% to 50%. The depreciation rate would be set in accordance with the specific capital items in this account.

Table K-1. Service Line and Meter Installation Charges

Meter Size	Current Total Charges	Proposed Service Line Charges	Proposed Meter Charges	**Proposed Total Charges**
5/8 x3/4-inch	N/T	$385	$135	$520
3/4-inch	$225	$385	$215	$600
1-inch	$300	$435	$255	$690
1-1/2-inch	$500	$470	$465	$935
2-inch	$675	-	-	-
Over 2-inch	At Cost	-	-	-
2-inch Turbine 2-inch Compound	N/T N/T	$630 $630	$965 $1,690	$1,595 $2,320
3-inch Turbine 3-inch Compound	N/T N/T	$805 $845	$1,470 $2,265	$2,275 $3,110
4-inch Turbine 4-inch Compound	N/T N/T	$1,170 $1,230	$2,350 $3,245	$3,520 $4,475
6-inch Turbine 6-inch Compound	N/T N/T	$1,730 $1,770	$4,545 $6,280	$6,275 $8,050
8-inch & Larger	N/T	At Cost	At Cost	At Cost

Note: N/T = No tariff.

TARIFF SCHEDULE

UTILITY: Litchfield Park Service Company - Water DECISION NO. ____________
DOCKET NO. 09-0104 EFFECTIVE DATE: ____________

WATER HOOK-UP FEE

I. Purpose and Applicability

The purpose of the off-site hook-up fees payable to Litchfield Park Service Company - Water Division ("the Company") pursuant to this tariff is to equitably apportion the costs of constructing additional off-site facilities necessary to provide water production, delivery, storage and pressure among all new service connections. These charges are applicable to all new service connections undertaken via Main Extension Agreements or requests for service not requiring a Main Extension Agreement entered into established after the effective date of this tariff. The charges are one-time charges and are payable as a condition to Company's establishment of service, as more particularly provided below.

II. Definitions

Unless the context otherwise requires, the definitions set forth in R-14-2-401 of the Arizona Corporation Commission's ("Commission") rules and regulations governing water utilities shall apply in interpreting this tariff schedule.

"Applicant" means any party entering into an agreement with Company for the installation of water facilities to serve new service connections, and may include Developers and/or Builders of new residential subdivisions and/or commercial and industrial properties.

"Company" means Litchfield Park Service Company - Water Division.

"Main Extension Agreement" means any agreement whereby an Applicant, Developer and/or Builder agrees to advance the costs of the installation of water facilities necessary to the Company to serve new service connections within a development, or installs such water facilities necessary to serve new service connections and transfers ownership of such water facilities to the Company, which agreement shall require the approval of the Commission pursuant to A.A.C. R-14-2-406, and shall have the same meaning as "Water Facilities Agreement" or "Line Extension Agreement."

"Off-site Facilities" means wells, storage tanks and related appurtenances necessary for proper operation, including engineering and design costs. Offsite facilities may also include booster pumps, pressure tanks, transmission mains and related appurtenances necessary for proper operation if these facilities are not for the exclusive use of the applicant and will benefit the entire water system.

"Service Connection" means and includes all service connections for single-family residential, commercial, industrial or other uses, regardless of meter size.

III. Water Hook-up Fee

For each new service connection, the Company shall collect an off-site hook-up fee derived from the following table:

OFF-SITE WATER HOOK-UP FEE TABLE		
METER SIZE	**SIZE FACTOR**	**TOTAL FEE**
5/8" x 3/4"	1	$1,800
3/4"	1.5	$2,700
1"	2.5	$4,500
1-1/2"	5	$9,000
2"	8	$14,400
3"	16	$28,800
4"	25	$45,000
6" or larger	50	$90,000

IV. Terms and Conditions

(A) Assessment of One Time Off-Site Hook-up Fee: The off-site hook-up fee may be assessed only once per parcel, service connection, or lot within a subdivision (similar to meter and service line installation charge).

(B) Use of Off-Site Hook-up Fee: Off-site hook-up fees may only be used to pay for capital items of off-site facilities, or for repayment of loans obtained to fund the cost of installation of off-site facilities. Off-site hook-up fees shall not be used to cover repairs, maintenance, or operational costs.

(C) Time of Payment:

1) For those requiring a Main Extension Agreement: In the event that the person or entity that will be constructing improvements ("Applicant", "Developer" or "Builder") is otherwise required to enter into a Main Extension Agreement, whereby the Applicant, Developer or Builder agrees to advance the costs of installing mains, valves, fittings, hydrants and other on-site improvements in order to extend service in accordance with R-

14-2-406(B), payment of the Hook-Up Fees required hereunder shall be made by the Applicant, Developer or Builder no later than within 15 calendar days after receipt of notification from the Company that the Utilities Division of the Arizona Corporation Commission has approved the Main Extension Agreement in accordance with R-14-2-406(M).

2) For those connecting to an existing main: In the event that the Applicant, Developer or Builder for service is not required to enter into a Main Extension Agreement, the Hook-Up Fee charges hereunder shall be due and payable at the time the meter and service line installation fee is due and payable.

(D) Off-Site Facilities Construction By Developer: Company and Applicant, Developer, or Builder may agree to construction of off-site facilities necessary to serve a particular development by Applicant, Developer or Builder, which facilities are then conveyed to Company. In that event, Company shall credit the total cost of such off-site facilities as an offset to off-site hook-up fees due under this Tariff. If the total cost of the off-site facilities constructed by Applicant, Developer or Builder and conveyed to Company is less than the applicable off-site hook-up fees under this Tariff, Applicant, Developer or Builder shall pay the remaining amount of off-site hook-up fees owed hereunder. If the total cost of the off-site facilities contributed by Applicant, Developer or Builder and conveyed to Company is more than the applicable off-site hook-up fees under this Tariff, Applicant, Developer or Builder shall be refunded the difference upon acceptance of the off-site facilities by the Company.

(E) Failure to Pay Charges; Delinquent Payments: The Company will not be obligated to make an advance commitment to provide or actually provide water service to any Developer, Builder or other applicant for service in the event that the Developer, Builder or other applicant for service has not paid in full all charges hereunder. Under no circumstances will the Company set a meter or otherwise allow service to be established if the entire amount of any payment due hereunder has not been paid.

(F) Large Subdivision Projects: In the event that the Applicant, Developer or Builder is engaged in the development of a residential subdivision containing more than 150 lots, the Company may, in its discretion, agree to payment of off-site hook-up fees in installments. Such installments may be based on the residential subdivision development's phasing, and should attempt to equitably apportion the payment of charges hereunder based on the Applicant's, Developer's or Builder's construction schedule and water service requirements.

(G) Off-Site Hook-Up Fees Non-refundable: The amounts collected by the Company as Hook-Up Fees pursuant to the off-site hook-up fee tariff shall be non-refundable contributions in aid of construction.

(H) Use of Off-Site Hook-Up Fees Received: All funds collected by the Company as off-site hook-up fees shall be deposited into a separate interest bearing trust account and used solely for the purposes of paying for the costs of installation of off-site facilities, including repayment of loans obtained for the installation of off-site facilities that will benefit the entire water system.

(I) Off-Site Hook-up Fee in Addition to On-site Facilities: The off-site hook-up fee shall be in addition to any costs associated with the construction of on-site facilities under a Main Extension Agreement.

(J) Disposition of Excess Funds: After all necessary and desirable off-site facilities are constructed utilizing funds collected pursuant to the off-site hook-up fees, or if the off-site hook-up fee has been terminated by order of the Arizona Corporation Commission, any funds remaining in the trust shall be refunded. The manner of the refund shall be determined by the Commission at the time a refund becomes necessary.

(K) Fire Flow Requirements: In the event the applicant for service has fire flow requirements that require additional facilities beyond those facilities whose costs were included in the off-site hook-up fee, and which are contemplated to be constructed using the proceeds of the off-site hook-up Fee, the Company may require the applicant to install such additional facilities as are required to meet those additional fire flow requirements, as a non-refundable contribution, in addition to the off-site hook-up fee.

(L) Status Reporting Requirements to the Commission: The Company shall submit a calendar year Off-Site Hook-Up Fee status report each January to Docket Control for the prior twelve (12) month period, beginning January 2011, until the hook-up fee tariff is no longer in effect. This status report shall contain a list of all customers that have paid the hook-up fee tariff, the amount each has paid, the physical location/address of the property in respect of which such fee was paid, the amount of money spent from the account, the amount of interest earned on the funds within the tariff account, and a list of all facilities that have been installed with the tariff funds during the 12 month period.

Engineering Report for
Litchfield Park Service Company
Docket No. SW-01428A-09-0103 (Rates)

<u>WASTEWATER DIVISION</u>

November 4, 2009

A. LOCATION OF LITCHFIELD PARK COMPANY ("COMPANY")

The Company is located in the Phoenix West Valley and provides wastewater service to communities within the City of Litchfield Park, City of Goodyear, City of Avondale, and some unincorporated areas of Maricopa County. Figure A-1 shows the location of the Company within Maricopa County and Figure A-2 shows the approximate 20.8 square-miles of wastewater certificated area.

B. DESCRIPTION OF WASTEWATER SYSTEM

The Company operates its Palm Valley Water Reclamation Facility ("WRF") and a collection system. This plant and its system was field inspected on September 2, 2009, by Arizona Corporation Commission ("ACC" or "Commission") Staff member Marlin Scott, Jr., in the accompaniment of Matthew Garlick and Ray Scott, representing the Company.

The operation of the Palm Valley WRF consists of a 4.1 million gallon per day ("MGD") sequential batch reactor ("SBR") treatment plant and wastewater collection system consisting of two collection lift stations, and approximately 319 miles of wastewater mains serving approximately 14,400 service laterals during the test year ending September 2008. The effluent from the WRF is pumped to golf courses for reuse. The wastewater system schematic is shown in Figures B-1 with detailed plant facility descriptions as follows:

Table WW-1. Water Reclamation Facility

Name	Plant Capacity	Location
Palm Valley WRF	4.1 MGD treatment plant consists of influent lift station, headworks with fine screens and grit removal, anoxic reactor/equalization tank and SBRs for nitrification/denitrification, disc-filters, ultraviolet disinfection system, aerobic sludge digesters, and sludge dewatering centrifuges. Amendments include installing new odor control systems, centrifuge, filter fee/effluent pumps, and ultraviolet system.	14222 West McDowell Road, Goodyear, Arizona

Table WW-2. Lift Stations

Lift Station No. and Name	No. of Pumps	Horsepower per Pump	Capacity per Pump (GPM)	Wet Well Capacity (gals.)
Lift Station No. 2 – Casitas Bonitas	2	20	350	2,500
Lift Station No. 3 - Sarival	3	47	1,050	30,000

Table WW-3. Structures

Location	Generators
Palm Valley WRF	Diesel generator – 1,500 kW
Lift Station #2– Casitas Bonitas	Diesel generator – 80 kW
Lift Station #3 - Sarival	Diesel generator – 125 kW

Table WW-4. Force Mains

Diameter	Material	Length (ft.)
10-inch	PVC	17,550
12-inch	PVC	6,100
8-inch	DIP	3,550
10-inch	DIP	3,925
12-inch	DIP	47
16-inch	DIP	5,200
24-inch	DIP	6,484
	Total:	42,856 ft. or 8.1 miles

Table WW-5. Collection Mains

Diameter	Material	Length (ft.)
4-inch	VCP/DIP/PVC	208,097
6-inch	VCP/DIP/PVC	4,667
8-inch	VCP/DIP/PVC	1,157,786
10-inch	VCP/DIP/PVC	70,196

12-inch	VCP/DIP/PVC	53,213
15-inch	VCP/DIP/PVC	85,886
18-inch	VCP/DIP/PVC	22,180
21-inch	VCP/DIP/PVC	23,016
24-inch	VCP/DIP/PVC	12,188
30-inch	VCP/DIP/PVC	3,663
	Total:	1,640,892 ft. or 310.8 miles

Table WW-6. Manholes

Size	Quantity
Standard	4,250
Drop	61

Table WW-7. Cleanouts

Quantity
170 each

* Table WW-8. Service Laterals & Customer Class

Lateral Size	Quantity		Customer Class	Units
4-inch	13,979		Residential	14,514
6-inch	353		HOA	815
8-inch	29		Multi-Units	1,846
10-inch	1		Commercial	373
			Resort	344
			Schools	9
Total:	14,362			17,901

* Note: The data in this table was provided by a Company data response on October 14, 2009.

C. WASTEWATER FLOWS

Wastewater Flows

Based on the information provided by the Company, wastewater flows for the test year ending September 2008 are presented in Figure C-1. For the average daily flows, November 2007 experienced the highest flow of 3,495,200 gallons per day ("GPD"). For the peak day flows, October 2007 had the highest flow when 4,158,000 gallons were treated in one day.

System Analysis

Staff concludes that the 4.1 MGD WRF capacity is adequate to serve the present customer base and reasonable growth.

D. GROWTH

Figure D-1 depicts the customer growth, per service laterals and customer units, using linear regression analysis. The number of service laterals and customer units were obtained from the Company. During the test year ending September 2008, the Company had approximately 14,400 service laterals and 17,900 customer units. It is projected that the Company could have approximately 15,500 service laterals and 20,500 customer units by year ending 2013.

E. ARIZONA DEPARTMENT OF ENVIRONMENTAL QUALITY ("ADEQ") COMPLIANCE

On March 3, 2009, ADEQ reported the Company's Palm Valley WRF, Inventory No. 100310, was in total compliance with ADEQ regulations.

F. ARIZONA CORPORATION COMMISSION ("ACC") COMPLIANCE

According to the Utilities Division Compliance Section, the Company had no delinquent ACC compliance issues.

G. PLANT NOT USED AND USEFUL

In the prior rate case, the Company did not own or operate a wastewater treatment plant. Instead, the wastewater was transported and treated at the City of Goodyear Wastewater Treatment Facilities. In this rate application, the Company has reported the addition of the Palm Valley WRF and the retirement of the Goodyear capacity.

Since the Company's wastewater operation has changed due to transporting wastewater to its own Palm Valley WRF, a number of lift stations were taken out of service. Through its field inspection and Company data responses, Staff found three lift stations no longer in operation and used and useful with their corresponding data as follows:

Table G-1. Plant Not Used and Useful

Acct. No.	Plant items	Year Placed into Service	Year Taken out of Service	Original Cost	Total Original Cost
354	Structures & Improvements				
	Wigwam Lift Station	1992	2002	190,628	
	Bullard Lift Station	1992	2002	122,785	
	Litchfield Greens Lift Station	1988	2007	75,421	
					388,834
361	Collection Sewer – Gravity				
	Wigwam Lift Station	1992	2002	14,289	
	Bullard Lift Station	1992	2002	3,238	
	Litchfield Greens Lift Station	1988	2007	1,203	
					18,730
371	Pumping Equipment				
	Wigwam Lift Station	1992	2002	48,852	
	Bullard Lift Station	1992	2002	43,069	
	Litchfield Greens Lift Station	1988	2007	12,071	
					103,992
389	Other Plant & Miscell. Equipment				
	Wigwam Lift Station	1992	2002	17,595	
	Bullard Lift Station	1992	2002	17,595	
	Litchfield Greens Lift Station	1988	2007	8,231	
					43,421
	Totals:			**$544,977**	**$554,977**

Therefore, Staff recommends the removal of the three lift stations, totaling to $554,977, from the plant-in-service because these booster stations are not used and useful.

H. DEPRECIATION RATES

In the prior rate case, the Company adopted Staff's typical and customary wastewater depreciation rates. These rates are presented in Table H-1 and it is recommended that the Company continue to use these depreciation rates by individual National Association of Regulatory Utility Commissioners category.

I. WASTEWATER HOOK-UP FEE TARIFF

The Company has an approved Wastewater Hook-Up Fee ("HUF") Tariff, starting at $2,450 per Equivalent Residential Unit ("EDU"), that became effective on April 1, 2008. In its rate application, the Company is requesting to modify its Wastewater HUF Tariff to begin at $1,800 per EDU. The proposed $1,800 is based on the Company's lower ($1,780 per EDU) and upper ($3,824 per EDU) estimates of per-gallon costs to build expansion capability at the existing Palm Valley WRF verses a new plant site. The Company selected the amount of $1,800 to be adopted for its HUF Tariff.

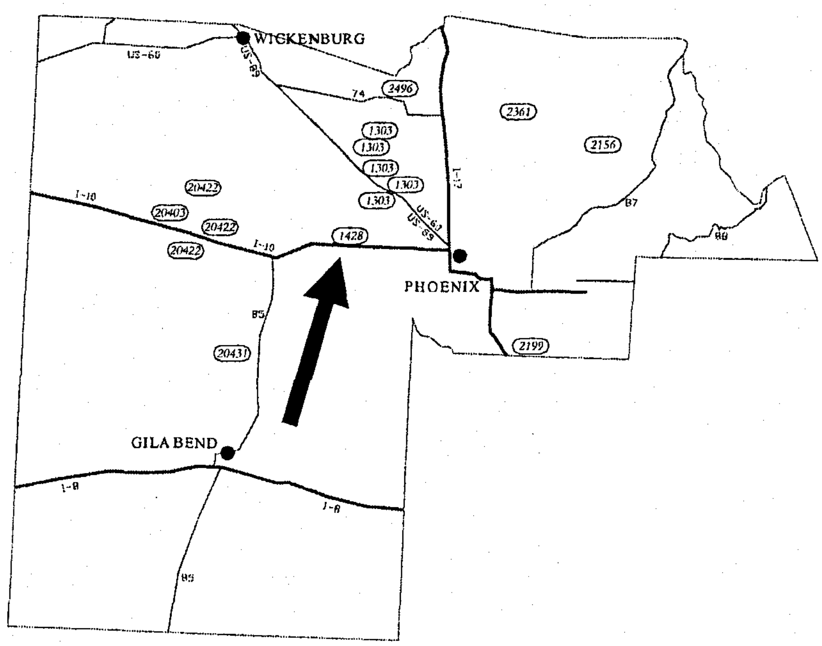
The Company also submitted its HUF Tariff that had different language than in Staff's updated HUF Tariff template. Staff has reviewed the Company's proposed language changes and will accept some of the Company's language changes that are shaded in the Tariff. Therefore, Staff recommends the adoption of the specific and updated tariff language contained in Attachment –Wastewater HUF Tariff.

FIGURES

TABLE

ATTACHMENT

MARICOPA COUNTY (SEWER)



1303	ARIZONA-AMERICAN WATER COMPANY	2496	LAKE PLEASANT SEWER COMPANY
20403	BALTERRA SEWER CORPORATION	1428	LITCHFIELD PARK SERVICE COMPANY
2361	BLACK MOUNTAIN SEWER CORPORATION	2199	PIMA UTILITY COMPANY
20431	GREEN ACRES SEWER, LLC	2156	RIO VERDE UTILITIES, INC.
20422	HASSAYAMPA UTILITY COMPANY, INC.		

Figure A-1. Maricopa County Map

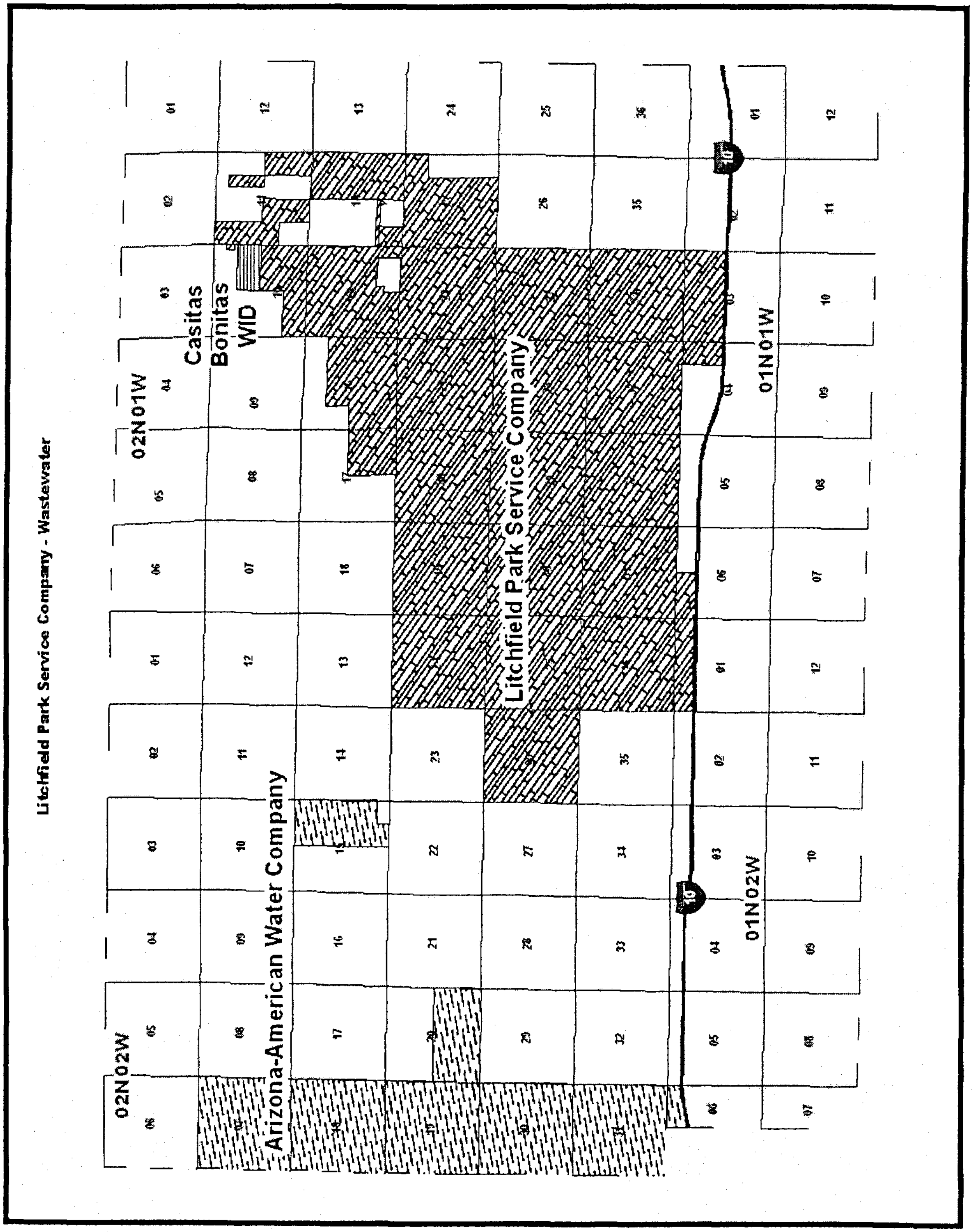


Figure A-2. Certificated Area

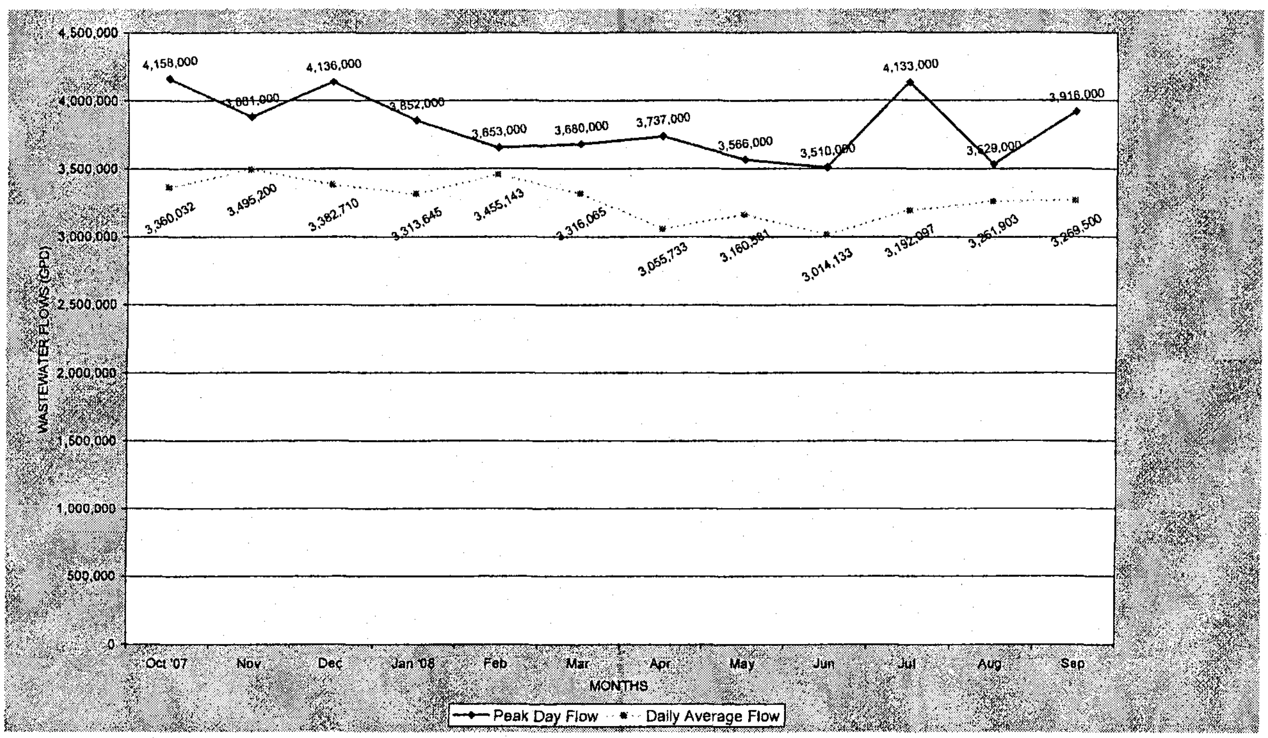


Figure C-1. Wastewater System Flows

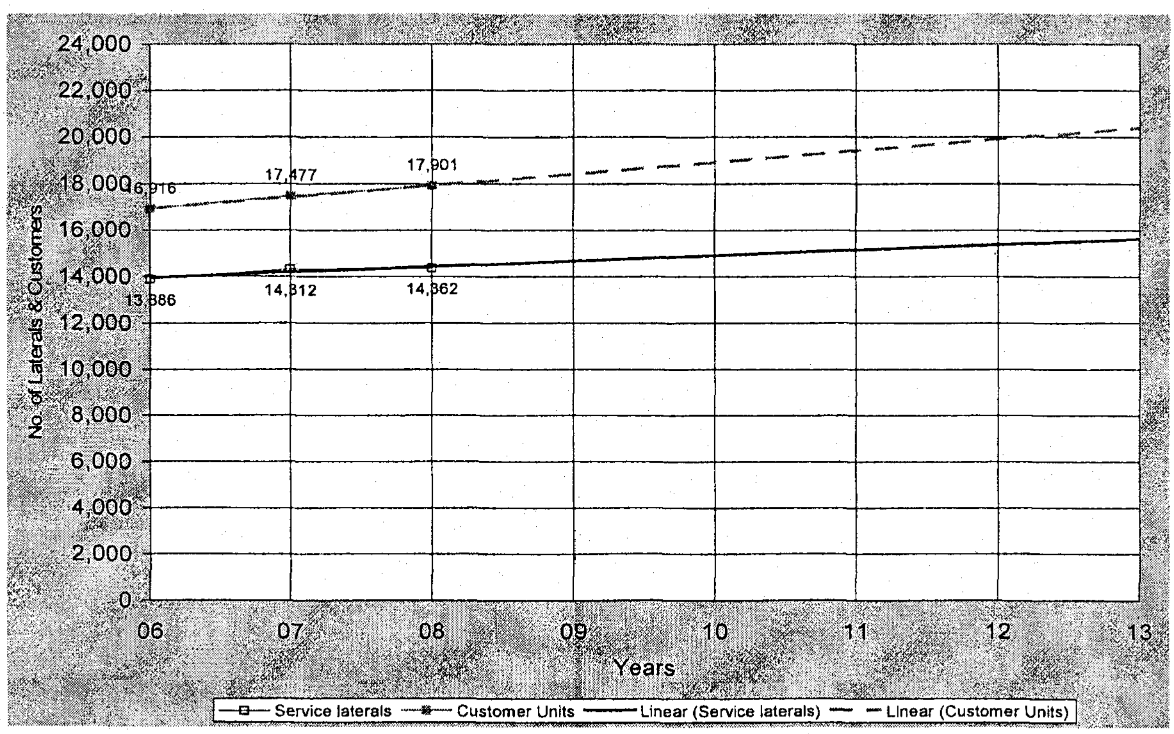


Figure D-1. Wastewater System Growth

Table H-1. Wastewater Depreciation Rates

NARUC Acct. No.	Depreciable Plant	Average Service Life (Years)	Annual Accrual Rate (%)
354	Structures & Improvements	30	3.33
355	Power Generation Equipment	20	5.00
360	Collection Sewers – Force	50	2.0
361	Collection Sewers- Gravity	50	2.0
362	Special Collecting Structures	50	2.0
363	Services to Customers	50	2.0
364	Flow Measuring Devices	10	10.00
365	Flow Measuring Installations	10	10.00
366	Reuse Services	50	2.00
367	Reuse Meters & Meter Installations	12	8.33
370	Receiving Wells	30	3.33
371	Pumping Equipment	8	12.50
374	Reuse Distribution Reservoirs	40	2.50
375	Reuse Transmission & Distribution System	40	2.50
380	Treatment & Disposal Equipment	20	5.0
381	Plant Sewers	20	5.0
382	Outfall Sewer Lines	30	3.33
389	Other Plant & Miscellaneous Equipment	15	6.67
390	Office Furniture & Equipment	15	6.67
390.1	Computers & Software	5	20.0
391	Transportation Equipment	5	20.0
392	Stores Equipment	25	4.0
393	Tools, Shop & Garage Equipment	20	5.0
394	Laboratory Equipment	10	10.0
395	Power Operated Equipment	20	5.0
396	Communication Equipment	10	10.0
397	Miscellaneous Equipment	10	10.0
398	Other Tangible Plant	----	----

NOTE: Acct. 398 – Other Tangible Plant may vary from 5% to 50%. The depreciation rate would be set in accordance with the specific capital items in this account.

TARIFF SCHEDULE

UTILITY: Litchfield Park Service Company – Wastewater DECISION NO. ________
DOCKET NO.: 09-0103 EFFECTIVE DATE: _____

WASTEWATER HOOK-UP FEE

I. Purpose and Applicability

The purpose of the off-site facilities hook-up fees payable to Litchfield Park Service Company – Wastewater Division ("the Company") pursuant to this tariff is to equitably apportion the costs of constructing additional off-site facilities to provide wastewater treatment and disposal facilities among all new service laterals. These charges are applicable to all new service laterals undertaken via Collection Main Extension Agreements, or requests for service not requiring a Collection Main Extension Agreement, entered into after the effective date of this tariff. The charges are one-time charges and are payable as a condition to Company's establishment of service, as more particularly provided below.

II. Definitions

Unless the context otherwise requires, the definitions set forth in R-14-2-601 of the Arizona Corporation Commission's ("Commission") rules and regulations governing sewer utilities shall apply interpreting this tariff schedule.

"Applicant" means any party entering into an agreement with Company for the installation of wastewater facilities to serve new service laterals, and may include Developers and/or Builders of new residential subdivisions, and industrial or commercial properties.

"Company" means Litchfield Park Service Company – Wastewater Division.

"Collection Main Extension Agreement" means an agreement whereby an Applicant, Developer and/or Builder agrees to advance the costs of the installation of wastewater facilities necessary to serve new service laterals, or install wastewater facilities to serve new service laterals and transfer ownership of such wastewater facilities to the Company, which agreement does not require the approval of the Commission pursuant to A.A.C. R-14-2-606, and shall have the same meaning as "Wastewater Facilities Agreement".

"Off-site Facilities" means the wastewater treatment plant, sludge disposal facilities, effluent disposal facilities and related appurtenances necessary for proper operation, including engineering and design costs. Offsite facilities may also include lift stations, force mains, transportation mains and related appurtenances necessary for proper operation if these facilities are not for the exclusive use of the applicant and benefit the entire wastewater system.

"Service Lateral" means and includes all service laterals for single-family residential, commercial, industrial or other uses.

III. Wastewater Hook-up Fee

For each new service lateral, the Company shall collect a Hook-Up Fee of $1,800 based on the Equivalent Residential Unit ("ERU") of 320 gallons per day. Commercial Applicants shall pay based on the total ERUs of their development calculated by dividing the estimated total daily wastewater capacity usage needed for service using standard engineering standards and criteria by the ERU factor of 320 gallons per day.

IV. Terms and Conditions

(A) Assessment of One Time Off-Site Facilities Hook-up Fee: The off-site facilities hook-up fee may be assessed only once per parcel, service lateral, or lot within a subdivision (similar to a service lateral installation charge).

(B) Use of Off-Site Facilities Hook-up Fee: Off-site facilities hook-up fees may only be used to pay for capital items of off-site facilities, or for repayment of loans obtained to fund the cost of installation of off-site facilities. Off-site hook-up fees shall not be used to cover repairs, maintenance, or operational costs.

(D) Time of Payment:

(1) In the event that the person or entity that will be constructing improvements ("Applicant", "Developer" or "Builder") is otherwise required to enter into a Collection Main Extension Agreement, payment of the fees required hereunder shall be made by the Applicant, Developer or Builder when operational acceptance is issued for the on-site wastewater facilities constructed to serve the improvement.

(2) In the event that the Applicant, Developer or Builder for service is not required to enter into a Collection Main Extension Agreement, the Hook-Up Fee charges hereunder shall be due and payable at the time wastewater service is requested for the property.

(E) Off-Site Facilities Construction by Developer: Company and Applicant, Developer, or Builder may agree to construction of off-site facilities necessary to serve a particular development by Applicant, Developer or Builder, which facilities are then conveyed to Company. In that event, Company shall credit the total cost of such off-site facilities as an offset to off-site hook-up fees due under this Tariff. If the total cost of the off-site facilities constructed by Applicant, Developer or Builder and conveyed to Company is less than the applicable off-site hook-up fees under this Tariff, Applicant, Developer or Builder shall pay the remaining amount of off-site hook-up fees owed hereunder. If the total cost of the off-site facilities contributed by Applicant, Developer or Builder and conveyed to Company is more than the applicable off-site hook-up fees under this Tariff, Developer or Builder shall be refunded the difference upon acceptance of the off-site facilities by the Company.

(F) <u>Failure to Pay Charges; Delinquent Payments</u>: The Company will not be obligated to make an advance commitment to provide or actually provide wastewater service to any Developer, Builder or other applicant for service in the event that the Developer, Builder or other applicant for service has not paid in full all charges hereunder. Under no circumstances will the Company connect service or otherwise allow service to be established if the entire amount of any payment has not been paid.

(F) <u>Off-Site Hook-Up Fees Non-refundable</u>: The amounts collected by the Company pursuant to the off-site facilities hook-up fee tariff shall be non-refundable contributions in aid of construction.

(G) <u>Use of Off-Site Hook-Up Fees Received</u>: All funds collected by the Company as off-site facilities hook-up fees shall be deposited into a separate account and bear interest and shall be used solely for the purposes of paying for the costs of installation of off-site facilities, including repayment of loans obtained for the installation of off-site facilities.

(H) <u>Off-Site Facilities Hook-up Fee in Addition to On-site Facilities</u>: The off-site facilities hook-up fee shall be in addition to any costs associated with the construction of on-site facilities under a Collection Main Extension Agreement.

(I) <u>Disposition of Excess Funds</u>: After all necessary and desirable off-site facilities are constructed utilizing funds collected pursuant to the off-site facilities hook-up fees, or if the off-site facilities hook-up fee has been terminated by order of the Arizona Corporation Commission, any funds remaining in the trust shall be refunded. The manner of the refund shall be determined by the Commission at the time a refund becomes necessary.

(J) <u>Status Reporting Requirements to the Commission</u>: The Company shall submit a calendar year Off-Site Facilities Hook-Up Fee status report each January to Docket Control for the prior twelve (12) month period, beginning January 2011, until the hook-up fee tariff is no longer in effect. This status report shall contain a list of all customers that have paid the hook-up fee tariff, the amount each has paid, the physical location/address of the property in respect of which such fee was paid, the amount of money spent from the account, the amount of interest earned on the funds within the tariff account, and an itemization of all facilities that have been installed using the tariff funds during the 12 month period.

BEFORE THE ARIZONA CORPORATION COMMISSION

KRISTIN K. MAYES
Chairman
GARY PIERCE
Commissioner
PAUL NEWMAN
Commissioner
SANDRA D. KENNEDY
Commissioner
BOB STUMP
Commissioner

IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WASTEWATER RATES AND CHARGES FOR UTILITY SERVICE BASED THEREON.	DOCKET NO. SW-01428A-09-0103
IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WATER RATES AND CHARGES FOR UTILITY SERVICE BASED THEREON.	DOCKET NO. W-01427A-09-0104
IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR AUTHORITY (1) TO ISSUE EVIDENCE OF INDEBTEDNESS IN AN AMOUNT OT TO EXCEED $1,755,000 IN CONNECTION WITH (A) THE CONSTRUCTION OF TWO RECHARGE WELL INFRASTRUCTURE IMPROVEMENTS AND (2) TO ENCUMBER ITS REAL PROPERTY AND PLANT AS SECURITY FOR SUCH INDEBTEDNESS.	DOCKET NO. W-01427A-09-0116

EXHIBIT
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S-6
ADMITTED

IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR AUTHORITY (1) TO ISSUE EVIDENCE OF INDEBTEDNESS IN AN AMOUNT OT TO EXCEED $1,170,000 IN CONNECTION WITH (A) THE CONSTRUCTION OF ONE 200 KW ROOF MOUNTED SOLAR GENERATOR INFRASTRUCTURE IMPROVEMENTS AND (2) TO ENCUMBER ITS REAL PROPERTY AND PLANT AS SECURITY FOR SUCH INDEBTEDNESS.

DOCKET NO. W-01427A-09-0120

SURREBUTTAL TESTIMONY

OF

MARLIN SCOTT, JR

UTILITIES ENGINEER

UTILITIES DIVISION

ARIZONA CORPORATION COMMISSION

DECEMBER 17, 2009

TABLE OF CONTENTS

EXECUTIVE SUMMARY
LITCHFIELD PARK SERVICE COMPANY
DOCKET NO. SW-01428A-09-0103, ET AL

Conclusion

A. Staff concludes that the Litchfield Park Service Company ("Company") financing applications for capital projects in the amount of $1,755,000 for a recharge well project and $1,170,000 for a solar project are appropriate and the cost estimates are reasonable.

Recommendation

1. Staff recommends that the Company file with Docket Control, as a compliance item in the docket, by June 30, 2011, a copy of the Certificate for Approval to Construct for the recharge well project.

INTRODUCTION

Q. Please state your name, place of employment and job title.

A. My name is Marlin Scott, Jr. My place of employment is the Arizona Corporation Commission ("Commission"), Utilities Division, 1200 West Washington Street, Phoenix, Arizona 85007. My job title is Utilities Engineer.

Q. Are you the same Marlin Scott, Jr. who submitted Direct Testimony on behalf of the Utilities Division?

A. Yes.

Q. What was the purpose of that testimony?

A. My Direct Testimony provided the Utilities Division Staff's ("Staff") engineering evaluations of Litchfield Park Service Company – Water and Wastewater Divisions ("Company") for the rate case proceedings.

PURPOSE OF SURREBUTTAL

Q. What is the purpose of your Surrebuttal Testimony?

A. At the time of Staff's Direct Testimony filing on November 4, 2009, I did not include the engineering memorandum for the financing applications for Docket Nos. W-01427A-09-0116 and W-0127A-09-0120. These financing cases were not consolidated with the rate cases until November 23, 2009. Although Staff Witness – Jeff Michlik provided a discussion of the financing applications in his Direct Testimony, beginning on Page 25, I did not include my engineering memorandum. The filing of this Surrebuttal Testimony will include my engineering memorandum for the financing cases.

Q. What is the conclusion and recommendation for the financing cases?

A. Staff concludes that the capital projects in the amount of $1,755,000 for a recharge well project and $1,170,000 for a solar project are appropriate and the cost estimates are reasonable.

Staff recommends that the Company file with Docket Control, as a compliance item in the docket, by June 30, 2011, a copy of the Certificate for Approval to Construct for the recharge well project.

Q. Does this conclude your Surrebuttal Testimony?

A. Yes.

MEMORANDUM

DATE: November 4, 2009

TO: Jeff Michlik
Public Utilities Analyst V
Utilities Division

FROM: Marlin Scott, Jr.
Utilities Engineer
Utilities Division

RE: Litchfield Park Service Company
Docket No. W-01427A-09-0116 (Financing for Recharge Wells)
Docket No. W-01427A-09-0120 (Financing for Solar Generator)

Introduction

On March 13, 2009, Litchfield Park Service Company ("Company") submitted two financing applications to assist in funding certain capital projects. One project, under Docket No. 09-0116 for the construction of two recharge wells, is estimated at $1,755,000 and another project, under Docket No. 09-0120 for the construction of a 200 kW roof mounted solar generator, is estimated at $1,170,000. The Company is requesting approval of funding for these two projects through the use of Water Infrastructure Financing Authority ("WIFA") indebtedness. The Company operates water and wastewater systems in Litchfield Park in Maricopa County.

Existing Systems

The existing water system consists of 12 wells (totaling 13,100 gallons per minute), two storage tanks (totaling 10.6 million gallons), three booster systems and a distribution system serving approximately 15,600 service connections.

The existing wastewater system consists of a 4.1 million gallon per day Water Reclamation Facility, two lift stations and a collection system serving approximately 14,400 service laterals.

Financing Applications

The Company is requesting WIFA financing approval in the amount of $1,755,000 for a recharge well project and $1,170,000 for a solar project with a cost breakdown for each capital project as follows:

A. Recharge Well Project:

1. Irrigation well purchases			$700,000
a. Well 19E – 20" casing x 1,218 feet			
b. Well 19D – 16" casing x 992 feet			
2. Wellhead upgrades			$400,000
a. Patch work	$25,000		
b. Modify well seal	$15,000		
c. Column, tube & shaft	$80,000		
d. Electrical pump	$50,000		
e. Electrical service	$100,000		
f. Vault structure	$60,000		
g. Control/SCADA	$40,000		
h. Fencing	$30,000		
3. Monitoring wells and samples			$140,000
a. For Aquifer Protection Permits			
4. Engineering			$40,000
5. Hydrogeology			$50,000
6. Permitting – MCESD			$5,000
7. Permitting – ADEQ/APP			$60,000
8. Permitting – ADWR			$35,000
9. Land purchase			$40,000
a. 0.057 acres per site			
10. Permitting – Goodyear			$60,000
11. Project management			$59,500
12. Contingency at 10%			$165,500

		Total:	$1,755,000

Since the proposed Recharge Well Project will be used to recharge effluent, Staff asked why the Company filed its application through the water side and not the wastewater side. In response to a Staff data request, the Company stated that according to WIFA, if the application were viewed as a wastewater project under the Clean Water Act, no funding would be available. However, if the project were viewed as a water-related project, funding could be made available.

B. Solar Project:

1. Design	$10,000
2. Solar panels	$750,000
a. 1000 panels with a 200 kW generator	
3. Inverters	$200,000
4. Electrical materials	$50,000
5. Labor	$50,000
6. General conditions	$10,000
7. Profit	$80,000

8. Contingency		$20,000
	Total:	$1,170,000

For the above Solar Project, the Company is proposing to construct a 200 kW solar roof mounted power generation facility and associated electrical work to be located on the roof of the Airline Reservoir in order to reduce operating costs.

Staff concludes that the above two capital projects are appropriate and the cost estimate for each project is reasonable.

Compliance

The Maricopa County Environmental Services Department has reported the Company's water system has no major deficiencies and determined that this system is currently delivering water that meets water quality standards required by the Arizona Administrative Code, Title 18, Chapter 4.

The Arizona Department of Environmental Quality ("ADEQ") has reported the Company's wastewater system was in total compliance with ADEQ regulations.

The Company is located in the Arizona Department of Water Resources' Phoenix Active Management Area and reported the Company's system is in compliance with its requirements governing water providers and/or community water systems.

The Utilities Division Compliance Section reported that the Company had no delinquent Commission compliance issues.

Conclusion/Recommendation

Staff concludes that the capital projects in the amount of $1,755,000 for a recharge well project and $1,170,000 for a solar project are appropriate and the cost estimates are reasonable. No "used and useful" determination of the proposed project items were made and no particular treatment should be inferred for rate making or rate base purposes in the future.

Staff recommends that the Company file with Docket Control, as a compliance item in the docket, by June 30, 2011, a copy of the Certificate for Approval to Construct for the recharge well project.

ORIGINAL

MEMORANDUM

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DOCUMENT CONTROL

EXHIBIT
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ADMITTED

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Arizona Corporation Commission
DOCKETED
OCT - 4 2006

DOCKETED BY	nR

TO: Docket Control
Arizona Corporation Commission

FROM: Ernest G. Johnson
Director
Utilities Division

DATE: October 4, 2006

RE: STAFF COMPLIANCE PER DECISION NO. 68923 (AUGUST 29, 2006) –IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY FOR A CAPACITY RESERVATION CHARGE TARIFF FOR ITS NEW WASTEWATER CERTIFICATE OF CONVENIENCE AND NECESSITY EXTENSION AREAS, DOCKET NO. SW-01428A-06-0444

Introduction

On July 5, 2006, Litchfield Park Service Company – Wastewater Division ("Company") filed for a Capacity Reservation Charge Tariff. This proposed tariff would apply only to new wastewater developments for which the Company would be required to seek an extension of its Certificate of Convenience and Necessity.

In Decision No. 68923, the Commission suspended this requested tariff filing for 90 days and further ordered Staff to report back to the Commission on its investigation of the odor problems at the Palm Valley Water Reclamation Facility ("WWTP").

Discussion

On September 15, 2006, Staff members; Marlin Scott, Jr., Engineering, and Lynn Combs, Consumer Services, visited the Company's WWTP, accompanied by Matthew Garlick, Company's Regional Operations Manager. Staff inspected the odor control equipment and toured the surrounding WWTP site. During this inspection, Staff detected odors, which Mr. Garlick described as a "skunky" smell.

It was noted during this inspection that the Company had installed a carbon adsorption unit (polisher) at the end of its wet chemical scrubber which was ready to begin operation as a pilot test to further reduce odors. This pilot operation began the afternoon of September 15th.

Staff was told that the original odor control equipment is undersized (possibly one-third the plant capacity) and would need to be upsized. Mr. Garlick stated that the solids handling building's bay doors were recently equipped with vertical plastic curtains in order to keep the odors from escaping outside the building and larger capacity blowers (odor controls) would be needed to produce a negative pressure to keep the odors inside the building.

Company's Plan of Action

<u>Polisher Installation</u>

Based on the polisher pilot test and its positive results, the Company has applied for an Approval To Construct from Maricopa County. On September 28, 2006, Maricopa County issued an Approval To Pre-Purchase Equipment for approval to procure a 16,000-cfm carbon adsorption unit to provide additional polishing of foul air following the chemical scrubbing unit. According to Mr. Garlick, this carbon adsorption unit installation is for Phase 1, a short-term solution to address the odor complaints. Phase 2, long-term solution, is currently under review for the ultimate fix – replacement of existing undersized odor control equipment – with an estimated construction schedule to begin the third quarter of 2007.

<u>Additional WWTP Capacity</u>

The Company hired another consulting firm to evaluate the options for increasing the WWTP capacity which include:

1. Expansion of the existing WWTP.
2. Construction of a new plant in the vicinity of the Sarival Lift Station.
3. Purchase of a portion of the City of Goodyear water reclamation facility.

According to the Company, a preliminary report for the scope of work was completed on September 18, 2006, and a final report will be available by October 16, 2006. According to the interim report, a decision for the final design report for additional capacity/odor control equipment will be made by the end of 2006. The additional capacity is planned to be commissioned in the first quarter of 2008.

Conclusions

On September 15, 2006, Staff and Mr. Garlick detected a "skunky" smell from the Company's WWTP. Based on the polisher pilot test and its positive results, the Company has applied for an Approval To Construct from Maricopa County for approval to procure a 16,000-cfm carbon adsorption unit to provide additional polishing of foul air following the chemical scrubbing unit. According to Mr. Garlick, this carbon adsorption unit installation is for Phase 1, a short-term solution to address the odor complaints. Phase 2, long-term solution, is currently under review for the ultimate fix – replacement of existing undersized odor control equipment – with an estimated construction schedule to begin the third quarter of 2007.

The Company hired a consulting firm to study the options for increasing the WWTP capacity.

Recommendation

Staff has reviewed the Company's proposed remedies and concurs. Staff recommends that the Company submit monthly reports in Docket No. SW-01428A-05-0022 regarding updated odor control and plant capacity activity until the addition of the new WWTP is completed.

EGJ:MSJ:tdp

Originator: Marlin Scott, Jr.

Service List For: Litchfield Park Service Company
Docket No. SW-01428A-06-0444

Mr. Richard L. Sallquist, Esq.
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MEMORANDUM

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AZ CORP COMMISSION
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Arizona Corporation Commission
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TO: Docket Control Center

FROM: Ernest G. Johnson EGJ
Director
Utilities Division

DATE: October 18, 2007

RE: LITCHFIELD PARK SERVICE COMPANY – WASTEWATER DIVISION FIELD AND OFFICE VISIT ON JULY 10, 2007 (DOCKET NO. SW-01428A-06-0444)

Introduction

On July 10, 2007, Staff members Marlin Scott, Jr. and Lynn Combs, conducted an unannounced site visit to Litchfield Park Service Company – Wastewater Division ("Company") for data collection regarding recent wastewater spills and odor issues at the Company's Palm Valley Water Reclamation Facility ("PVWRF").

Data Collection

On this day, Staff had discussions with Matthew Garlick, Algonquin Regional Operations Manager, and Clint Arndt, Company's Operations Manager. According to these two managers, the following is a chronology of the wastewater spills and fire incident:

Spill Nos. 1 & 2

June 20, 2007 – On this evening, a water leak behind Denny's restaurant was reported but upon the site inspection, sewage was found seeping out of a manhole. This 500 gallon spill was detained within the curb/gutters of the paved parking lot. The cause of this sewage overflow was due to; 1) one of the three disc filters at the PVWRF being clogged and 2) failure of the Supervisory Control and Data Acquisition ("SCADA") alarm system to notify the plant operators of high level flows into the PVWRF. The operators responded and inspected the filter operation, reset the filters and restored plant operations.

June 21, 2007 – Around mid-day, the SCADA system notified the plant operator of high level flows into the PVWRF. This SCADA alarm resulted in the finding of a 25,000 gallon spill from manholes behind the Denny's (same facility as June 20), Wendy's and Cracker Barrel restaurants and Palm Valley Hospital. Sewage was also spilled onto Litchfield Road from manholes in the street, estimated at 5,000 gallons to 7,000 gallons. This clean-up spill was assisted by the City of Goodyear ("City") that recovered an estimated 24,000 gallons of the spill. The cause of the spill was due to grease and oil build-up in the disc filters at the PVWRF.

Spill No. 3

June 23, 2007 – On this day, the SCADA system again notified the plant operator of abnormal flows into the PVWRF. This SCADA alarm resulted in the finding of a 500 gallon spill from a manhole again behind the same Denny's restaurant. This spill was again detained with the curb/gutter of the paved parking lot and the Company recovered all 500 gallons of the spill. The cause of this spill was due to a malfunction in the ultra-violet ("UV") equipment controls at the PVWRF.

Fire Incident

June 24, 2007 – On this day, a fire started at one of the five blowers in the blower room at the PVWRF and was put out by the fire sprinkler system. The fire was caused by the blower belt heating up. The PVWRF was placed off-line for approximately one hour. No spills occurred as a result of the plant shutdown.

Company's Responses/Actions

According to the Company, Spill No. 2 should not have happened. When the SCADA system notified the plant operator, the operator did not respond to the call. Although the disc filters were detected as being clogged, a visit to the PVWRF by the operator to reset the disc filter operation would have prevented this spill. For failure to respond to this call, the plant operator who did not respond to this incident was terminated.

For Spill No. 3, the UV equipment malfunction may have been caused by sabotage. The Company is currently investigating this incident. During this investigation, the Company also found that the coding in the SCADA dialing system had the number "9" (dial-out number) removed from the call-out number. As a result, the call-out was not reaching the plant operators' call numbers. The SCADA alarm system is currently being analyzed.

Due to the above possible sabotage and another incident (a person who appeared to be ready to climb the plant fence was seen and then fled), the Company has filed two police reports. The Company has also hired security personnel to patrol and check IDs before allowing visitors to enter the PVWRF property.

With the firing of one plant operator, the Company has also hired three new plant operators. Plant operators are now on-site at the PVWRF 24/7.

Commission Staff Notification

As a result of the June 2007 spills, Staff and the Company have implemented a reporting protocol for reporting accidents above and beyond what is required by Commission rules. According to the protocol, any future accidents will be reported by email and telephone calls to the Commission Consumer Service Section.

As for the fire incident on June 24th, Staff was properly notified of the fire incident as required by Commission rule. This Commission rule requires companies to report an incident if a serious injury is involved or if damage to company equipment above $5,000 is sustained.

Equipment for Spills

According to the Company, the Company has no vacuum truck to clean up the spills. If spills do occur, the Company barricades and chlorinates the spill site and contacts a sewer cleaning specialist for clean-up, mainly using a vacuum truck. These specialists can respond to a site in the Company's CC&N within 30 minutes.

In addition to the above, the City also has a vacuum truck that assists in emergency responses, if needed.

Violation of Commission Rules and Orders

Staff reviewed Commission rules and prior Commission decisions and did not find that the incidences or LPSCO's subsequent action violated any Commission rule or decisions. In addition, Staff is not aware of any violation of ADEQ or MCESD rules.

Plant Capacity

The current PVWRF plant capacity is 4.1 million gallons per day ("MGD"). For 2007, the highest average monthly flow of 3.6 MGD occurred in July and the highest peak day flow of 4.8 MGD also occurred in July. In November 2006, a peak day flow of 4.55 MGD was measured. Due to this November peak flow, the Company contracted with McBride Engineering that same month to evaluate the PVWRF plant capacity for alternatives to increase the capacity. The alternatives included; 1) increasing the existing PVWRF plant capacity by 1.0 million gallons, 2) constructing a new 2.0 MGD plant three miles west of PVWRF, and 3) possible interconnection with the City of Goodyear. Another consultant, Water Works Engineering, was hired in March 2007 to evaluate the permitting, land acquisition, and conceptual design of a new plant site.

Based on the July 2007 flows, an average daily flow of 226 gallons per day ("GPD") per service lateral and peak day flow of 300 GPD per service lateral is calculated. Using these calculated flows, the 4.1 MGD PVWRF could serve approximately 18,140 service laterals and 13,670 service laterals, respectively. As of July 2007, the Company had 16,080 service laterals. Although it appears that the plant capacity has insufficient capacity for peak day flows, the Company's Hydraulic Analysis section below indicates the 4.1 MGD plant capacity is capable of handling a peak hourly flow of approximately 6.48 MGD. Based on this analysis, the operating conditions for the 4.1 MGD PVWRF are sufficient at this time along with the Company's current evaluation of additional plant capacity.

Odor Controls

McBride Engineering was also contracted to evaluate the odor issues and recommended that an Ionstein Ion Exchange System ("Ionstein") be installed which will reduce the load on the existing scrubbers. This odor control system is expected to be installed on September 26, 2007 and will be operating as a pilot test from October 1 to October 7. If the pilot test results are positive, the below Project 5 – Additional chemical scrubbing capacity, would likely be eliminated.

In a Company response letter, dated June 12, 2007, to Commissioner Mayes' letter, dated May 29, 2007, the Company provided an anticipated project schedule to address the odor control issues. In addition, Staff attended the Company's Community Liaison Committee ("CLC") meeting on September 6, 2007, that provided the below updated project schedule by McBride Engineering:

Projects	Anticipated Schedule (6-12-07)	Updated Schedule (9-6-07)
1. Granular activated carbon scrubber addition (Phase 1)	Implemented	Implemented
2. Influent odor control measures	Implemented	Implemented
3. Temporary centrifuge installation	August 2007	Implemented
4. Permanent centrifuge installation	December 2007	December 2007
5. Additional chemical scrubbing capacity (Phase 2)	December 2007	December 2007
6. Aeration blower capacity enhancement	Implemented	Implemented
7. Solids building temporary A/C units	June 2007	October 2007
8. Full-scale ion exchange system pilot	July 2007	September 2007
9. Solids building permanent A/C units	August 2007	(Included w/ #7)
10. Removal of sludge digestion process	December 2007	December 2007

Although the Company's schedule indicates some of the projects have not met the anticipated schedule dates, the Company is still on schedule in resolving the complete odor control issues by December 2007.

As an additional note, during the Company's CLC meeting, the Camelot Homes commercial customer who was in the audience, stated that he has not smelled any odors from the PVWRF for about a month.

Hydraulic Analysis

As a result of these recent spills, the Company retained Narasimhan Consulting Services in early July 2007 to evaluate the hydraulics of the PVWRF and the collection system. This study analyzed the operating conditions of the Company's flow capabilities and concluded that the PVWRF hydraulic capacity is fully capable of handling a peak hourly flow of approximately 4,500 GPM or 6.48 MGD.

ADEQ and MCESD Compliance

On August 7, 2007, Staff emailed the Arizona Department of Environmental Quality ("ADEQ") and Maricopa County Environmental Services Department ("MCESD") to inquire about the compliance status of the Company. These agencies indicated that the Company is currently in compliance with their regulations from the status reports received on August 8, 2007.

In addition to MCESD's response on August 8, 2007, MCESD provided additional information as discussed below. According to MCESD, the Company has submitted a project involving a series of upgrades to the PVWRF. This new project is being done in a number of phases and breaks down as follows:

Phase 1:	Odor Control Upgrades (Pilot Testing)
Phase 2:	UV Disinfection System Upgrades
Phase 3:	Temporary Centrifuge System Upgrades
Phase 4:	Influent Screening Upgrades
Phase 5:	Tertiary Treatment Pump Stations Upgrades
Phase 6:	Solids Handling Upgrades
Phase 7:	Conversion of Digesters to Sequencing Batch Reactors
Phase 8:	Headworks Building Upgrades
Phase 9:	Solids Handling Building Upgrades
Phase 10:	Equalization Basin to Headworks Recycle Line

Construction of Phases 1, 2 and 3 were approved by the MCESD in July 2007 and the work is currently in progress. Phase 10 is currently operating using a temporary line and the construction of the permanent line is under construction. The other phases are scheduled to be submitted in the next 2 - 3 months for review. Most of the work being performed in Phases 1 - 10 is to increase reliability and add redundancy to the plant. It should be noted that the plant's treatment capacity is not being increased by these improvements.

Phase 1 is for pilot testing of a new ionization odor control system that would treat air in the buildings at the plant. It will not replace the wet/dry odor scrubbers that treat air from the process basins and at this point in time is considered to be an experimental system that is being evaluated via pilot testing.

Phase 2 is for a replacement UV Disinfection System since the old system is obsolete. Phase 3 is for a temporary centrifuge system to assist/replace the existing centrifuge system for approximately nine months until a new permanent centrifuge system can be installed under Phase 6.

Phase 10 will allow recycling of the influent water to the filters back to the headworks. This change is being implemented in response to the June 2007 wastewater spill which was caused by grease and oil getting past the sequencing batch reactors ("SBRs") and clogging the disc filters. The plant will now be able to recycle the wastewater from the SBRs back to the headworks which will allow the SBRs to reprocess this off-spec wastewater and hopefully prevent the filters from being clogged if this type of event reoccurs.

Phases 4 - 9 have not yet been submitted to the MCESD so details are preliminary and subject to change. Phase 7 is probably the most significant phase since two existing digesters at the plant will be converted to SBRs. This change will effectively double the number of SBRs at the plant from 2 to 4 which should help to increase operational reliability.

Complaint filings with the City

Staff has contacted the City to determine if any customers have filed any complaints with City. According to the City, there have been no complaints filed with the City.

Conclusion

Based on Staff's investigation, an enforcement action is not warranted at this time. Staff determined that there has been no violation of any Commission order or rule committed by the Company. Staff contacted other regulatory agencies to determine if there had been any other regulatory violation. MCESD indicated that the Company was in compliance, as well as ADEQ. Staff's investigation showed that in response to the spills, the Company took appropriate remedial action and has developed a reasonable plan to prevent such reoccurrences. Further, the investigation revealed that the Company has submitted plans to MCESD to upgrade the PVWRF. The Company has previously submitted its plan to address its odor problem. The Company appears to be active in addressing both its capacity and odor issues.

However, the fact remains that there were three spills in the span of three days, and as such, warrants a closer review of the Company and its operational practices. To that end, and pursuant to the authority granted by ARS Section 40-361 (B), Staff recommends the opening of a special docket. The purpose of this docket would be to continue to monitor and gather data concerning the operational practices of the Company and to stay apprised of any operational issues that could threaten public health and safety and/or violate Commission rules or relevant statutes.

EGJ:MSJ:lhm

Attachment: Company's July 19, 2007 Report to ADEQ

ATTACHMENT

LPSCO

LITCHFIELD PARK SERVICE COMPANY

12725 W. Indian School Rd.. Suite D-101. Avondale. Arizona 85323

July 19, 2007

Arizona Department of Environmental Quality
Water Quality Compliance Division
1110 West Washington
Phoenix, Arizona 85007

Attention: John Gibbons

RE: Summary of Litchfield Park Service Company - Wastewater Facility Incidents
June 20, 2007 through - June 24, 2007

This report presents a summary of the operational incidents that occurred during the period of June 20, 2007 through June 24, 2007 at the Palm Valley Water Reclamation Facility (WRF) and the sewer collection system immediately upstream of the WRF. The report is based on information gathered from Operations staff and on a review of plant operating data, regulatory reporting forms, and discussions with plant personnel. In addition, LPSCO retained Narasimhan Consulting Services (NCS) to review the hydraulics for the collection system and the WRF.

Currently, the WRF is a 4.1 MGD facility that utilizes a Sequential Batch Reactor (SBR) configuration. The main unit processes include an influent wet well and pump station, Anoxic Zone Tank, two SBR Tanks, Surge Tank, three Disc Filters, and UV disinfection. Five Kaeser electric blowers are used to supply air into the SBR process, and processing of the sludge is accomplished using digesters and centrifuges. The Plant is located on 14222 W. McDowell Road, 1/4 mile west of the intersection of Litchfield Road and McDowell Road in Goodyear, Arizona. Photos of the facility are included at the end of this report.

The following summarizes the events and causes for the incidents in chronological order:

On June 20, 2007 at 1824 hours, the first high level alarm occurred at the WRF's surge tank, a unit process that feeds the plant's filters. The SCADA system notified the Wastewater Division's on-call employee via cell phone. The operator acknowledged the alarm from the operator's cell phone but did not visit the site to address the issue. As a result, the tank level was maximized and the influent pumps could not deliver wastewater from the sewer to the WRF, thereby backing up the inlet sewer. At approximately 2204 hours, the on-call Water Distribution Operator was informed of a water leak behind Denny's restaurant, located south of McDowell

Road and on the west side of Litchfield Road, which is the lowest point in the collection system. Upon arrival of the first on-call Water Distribution Operator, sewage was found seeping from a manhole. The Water Distribution Operator attempted to notify the Wastewater Operator on-call. After several unsuccessful attempts, the Operations Manager was notified. At approximately 2230 hours, the Operations Manager arrived at the Palm Valley WRF and found that the overflow was due to high water levels at the Palm Valley WRF. The high levels noted were due to one of the three Disk Filters having faulted and going off-line, causing the two remaining filters to plug and influent flow to back up. The filters were reset and the plant was restored. The sewage spill was limited to less than 100 USG and was completely recovered. All of the areas affected were immediately barricaded and chlorinated during and after the overflow event. Operators worked all night to bring tank levels down; however, the operators were not able to decrease the tank levels sufficient to keep ahead of the morning high flows.

On June 21, 2007 at approximately 1100 hours, sewage started overflowing from manholes behind the Cracker Barrel Restaurant (across Litchfield Road from Denny's) and behind Denny's Restaurant. With the City of Goodyear's assistance, we immediately brought in four Vac Trucks, two 4000 gallon Tanker Trucks and seven 6,000 gallon Tanker Trucks. These overflows lasted for approximately 10-20 minutes at 60 minute intervals until approximately 1400 hours. The duration of the spill event was approximately three hours. All of the areas affected were immediately barricaded and chlorinated during and after the overflows, and the event was reported to the regulatory authorities as required. The entire clean up was completed at approximately 2000 hours.

On June 22, 2007 at approximately 2115 hours, the UV units at the Palm Valley WRF faulted out, which shut down effluent flow from the facility and caused the plant to back up. Due to communication problems, the SCADA alarm system did not contact the on-call staff. Upon investigation, it was discovered that the coding in the SCADA system was changed without authorization. This unauthorized change prevented the SCADA system from notifying the on-call employee of a possible incident. The coding has since been corrected by an outside consultant. Also, the need for on-call personnel has been eliminated as we now have 24/7 coverage at the WRF. In addition to the problem with the alarm system, there were minor problems with the XO and Procom telecommunications equipment not communicating with each other which prevented open telephone lines from operating for more than 1 minute at a time.

On June 23, 2007 at 0230 hours, the first Plant Operator arrived on site and found that the UV units had faulted out. The UV units were reset and plant flow was restored. Immediately thereafter, the Operator began to lower plant levels as quickly as possible. However, the morning's high surge arrived at the plant and, at approximately 1300 hours, sewage spilled from the manholes behind the Cracker Barrel Restaurant and behind Denny's Restaurant. This event lasted for approximately five minutes and spilled approximately 500 USG. LPSCO staff immediately barricaded the affected areas and brought in four Vac Trucks, two 4000 Tanker Trucks and four 6000 gallon Tanker Trucks. All of the affected areas were chlorinated during and after the overflow event. The event was also reported to the regulatory authorities as required. The entire clean up was completed at approximately 1600 hours.

The sewage spills that occurred on June 21, 2007 and June 23, 2007 amounted to approximately 25,000 USG. With the assistance of the Tanker and Vac Trucks, approximately 24,000 USG were recovered. The remaining 1,000 USG was lost to percolation and evaporation.

On June 24, 2007 at approximately 1115 hours, the fire alarm system at the Palm Valley WRF was activated. Upon checking the facility, the on duty Operator found the Blower Room completely engulfed in smoke with the sprinkler system activated. The on duty Operator called 911 to confirm that the Fire Department had been notified by the alarm system. Goodyear, Avondale and El Mirage firefighters arrived on scene between 1125 hours and 1130 hours. At 1135 hours, per the Fire Department's request, power to the facility was shut down for safety and fire suppression. The City of Goodyear was notified and assistance was requested to prevent any sewage overflows. Palm Valley WRF Operations staff started calling in Vac Trucks and Tanker Trucks to assist in moving sewage in case it became necessary. The water system pressure was also dropped a few p.s.i. in an attempt to lower influent flows to the Palm Valley WRF. At approximately 1215 hours, the Fire Department determined that the fire was isolated to one blower unit, and allowed the power to be turned on and the plant brought online. The Palm Valley WRF did not have any sewage overflows due to this event.

CONCLUSIONS AND SUMMARY OF CORRECTIVE ACTIONS TAKEN BY LPSCO TO PREVENT SPILLS

Based on LPSCO's investigation, the following corrective actions are being taken to ensure continued proper operation of the WRF.

1. All five blowers are operating properly and two new blowers have been installed recently to provide additional redundancy. This ensures operation of the SBR unit and will assist in the prevention of the surge tank and filters from failing.
2. An additional 12" return line from the surge tank to the headworks has been added on a temporary basis and a permanent installation is under design. This will allow cleaning of the surge tank to occur more easily and effectively. It will also decrease the solids load which is passed through the filters.
3. The current UV system was found to be prone to failures during voltage changes within the facility. LPSCO has purchased a new UV system, which is currently on site and being installed. The new system will be less sensitive to power fluctuations.
4. The employee who failed to respond to the first incident has been dismissed.
5. SCADA modifications and communications protocols are in place to improve notifications. New policies are being implemented to notify multiple personnel on alarms and to prevent human failure from causing sewer backups. LPSCO has also implemented 24 hour a day, 7 days of the week operations coverage, along with 24/7 security until such time as surveillance cameras can be installed.
6. LPSCO has ordered "Smart Manhole Covers" to alert operations in the event of rising manhole levels.
7. The sewer system hydraulics were analyzed and operating conditions indicate that the facility is fully capable of handling the peak flows, as discussed below.

HYDRAULIC ANALYSIS

An independent hydraulic analysis was conducted of the Palm Valley WRF by NCS assuming worst case conditions. A peak hourly flow of approximately 4,500 gpm entering the facility was analyzed. The worst case scenario considered for this analysis is when the Anoxic Reactor is full, the peak starts reaching the plant, and the influent pumps are off. Within approximately 40 minutes, the influent wet wells will hit the high level if no pumping occurs. However, the wet well pumps that pump into the Anoxic Reactor are capable of pumping up to 7,000 gpm (with 2 pumps on). This reduces the levels quickly.

It is assumed that when the peak flow occurs at the plant, the Anoxic Reactor is full but is within its normal operating range. The flow exiting the Anoxic Reactor using two pumps is approximately 10,000 gpm. This flow is higher than the influent pump station flow, so if the SBR tanks have sufficient capacity available, normal operations can be carried out and wastewater can be processed. Under normal operations, at least one SBR tank is available for filling, representing approximately 384,000 gallons of capacity per fill-cycle.

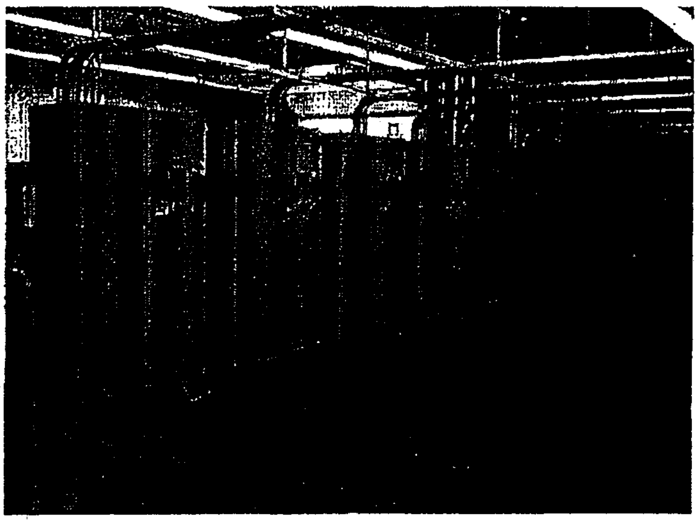
Based on an interview with plant operations, it was determined that the total volume contained in the SBRs can be removed out of the SBRs in approximately 30 to 40 minutes. Therefore, when the equipment operates as designed, operations can be sustained to capture the peak even with a peak hitting the plant when the SBRs begin to drain.

Beyond the Surge Tank, there is a filter pump with a capacity of up to 5,700 GPM with an available redundant pump. The total capacity of those VFD pumps is sufficient to manage the peak flow.

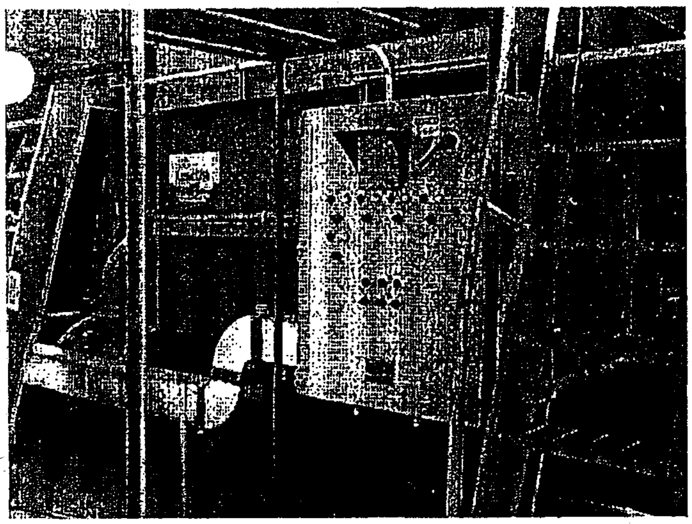
This analysis indicates that the plant is clearly capable of handling the peak hourly flows without surcharging the sewer when all equipment is in proper working order and human error is minimized.

Administration Building

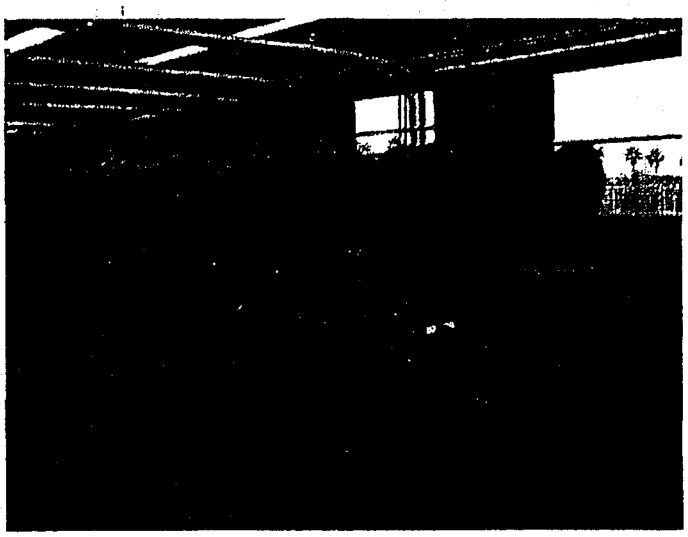
UV Control Room



Disk Filter



UV System



Sincerely,
Litchfield Park Service Company

Matthew Garlick

Cc: Marlin Scott, ACC
Gary Harmon, ADEQ

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MEMORANDUM

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AZ CORP COMMISSION
DOCKET CONTROL

Arizona Corporation Commission
DOCKETED
MAR 21 2008
DOCKETED BY

EXHIBIT
ADMITTED

TO: Docket Control

FROM: Ernest G. Johnson
Director
Utilities Division

DATE: March 21, 2008

RE: **COMPLIANCE FILING PER DECISION NO. 69165** - IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY FOR A CAPACITY RESERVATION CHARGE TARIFF FOR ITS NEW WASTEWATER CERTIFICATED OF CONVENIENCE AND NECESSITY EXTENSION AREAS, DOCKET NO. SW-01428A-06-0444

Introduction

On December 5, 2006, the Commission approved Decision No. 69165 for an Off-Site Facilities Hook-Up Fee Tariff for Litchfield Park Service Company – Wastewater Division ("Company"). Two of the Decision's orders were that:

The Company file with Docket Control as a compliance item, a copy of the Off-Site Facilities Hook-Up Fee Tariff within 30 days of a decision in this matter.

And

The Off-Site Facilities Hook-Up Fee Tariff not become effective until the Phase 1 carbon absorption unit has been installed and is operating and the odor problem has been resolved as verified by Commission Staff.

On February 25, 2008, the Company submitted a letter stating that the odor abatement program at its Palm Valley Water Reclamation Facility ("PVWRF") was completed and requested a Staff verification site visit in order for the Off-Site Hook-Up Fee Tariff to go into effect.

Chronology

On January 4, 2007, the Company docketed its Off-Site Facilities Hook-Up Fee Tariff within the 30 day timeframe of the decision. In this same filing, the Company acknowledged that the Tariff would become effective upon Commission Staff verifying the installation and operation of the Phase 1 carbon absorption unit.

On April 4, 2007, Maricopa County Environmental Services Department issued a Certificate of Approval of Construction for the Phase 1 carbon adsorption unit.

On June 13, 2007, the Company filed a response to Commissioner Mayes' May 29, 2007 letter regarding certain questions to the odor issues. Within the responses, the Company provided an engineering report prepared by McBride Engineering Solutions showing the current construction schedule for 10 odor control projects. Included with the filing, the Company provided an air monitoring report by Lambtech showing the fenceline hydrogen sulfide (H2S") tested on March 7, 2007, with concentrations ranging from 0.006 parts per million ("PPM") to 0.011 PPM. The regulation level for H2S is 0.030 PPM for 30 minutes.

On October 18, 2007, Staff filed a report regarding the Company's wastewater spills and odor issues. Within Staff's report, Staff provided an updated project schedule for the 10 odor control projects. It was noted in the report that although the Company's schedule indicated some of the projects have not met the anticipated schedule dates, the Company is still on schedule in resolving the complete odor control issues by December 2007.

On November 29, 2007, Staff attended the Community Liaison Committee ("CLC") meeting at the Company's PVWRF. At this meeting, Aerisa International Inc. ("Aerisa") presented its odor abatement technology, followed by a tour of the newly installed odor control system. (Aerisa produces and sells systems and equipment to prevent the dissemination of diseases caused by airborne contaminants.) This Aerisa system was installed as a pilot study. It was noted by all attendees that the Aerisa system had reduced the odors tremendously.

After the CLC meeting, the Company informed Staff that although the pilot study of the Aerisa system was scheduled for a few weeks, the Company would continue the pilot study for three more months to insure that the Aerisa system was actually working. After the three month period, the Company would then submit its notice of the odor abatement program completion and request for Staff's verification.

On January 18, 2008, the Company provided another air monitoring report by Lambtech showing the fenceline H2S tested on December 12, 2007, with concentrations ranging from 0.002 PPM to 0.004 PPM. This test was conducted during the pilot testing of the Aerisa system.

On March 5, 2008, Staff members; Dorothy Hains, Katrin Stukov, and Marlin Scott, Jr., conducted an on-site inspection of the Company's PVWRF to verify that the Phase 1 carbon adsorption unit had been installed and operating and the odor problem had been resolved. Staff toured the PVWRF and verified that the Phase 1 carbon adsorption unit was installed and operating. Staff took notice that all the odor abatement program projects were completed. Staff also noticed a "musty" smell (on plant property) during the tour, but contributed this smell due to the PVWRF being under construction to increase the plant capacity by 1.0 million gallons per day. Staff could not detect this smell outside the fenceline.

Conclusion/Recommendation

Having verified that the Company has installed the Phase 1 carbon adsorption unit and the odor problem has been resolved, Staff recommends that the Off-Site Hook-Up Fee Tariff be implemented and effective on April 1, 2008.

EGJ:MSJ:red

ORIGINATOR: Marlin Scott, Jr.

Service list for: Litchfield Park Service Company
Docket No. SW-01428A-06-0444

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EXHIBIT

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MEMORANDUM

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DOCKET CONTROL

Arizona Corporation Commission
DOCKETED
MAR 11 2009
DOCKETED BY

TO: Docket Control

FROM: Ernest G. Johnson
Director
Utilities Division

for

DATE: March 11, 2009

RE: IN THE MATTER OF THE INQUIRY INTO THE OPERATIONAL PRACTICES OF LITCHFIELD PARK SERVICE COMPANY, DOCKET NO. SW-01428A-07-0602

Introduction

On October 18, 2007, the Commission opened the above referenced docket. This docket was to provide the vehicle for Staff to gather information on and monitor the operational practices of the Litchfield Park Service Company – Wastewater Division ("Company").

On August 8, 2008, the Administrative Law Judge ("ALJ") issued a Procedural Order for Staff to file by August 15, 2008, an updated report indicating whether the docket should remain open or be administratively closed.

On August 14, 2008, Staff filed a memorandum indicating a recent site visit had been conducted and described on-going plant upgrades. Staff recommended that the docket remain open until the wastewater treatment plant construction upgrades had been completed and the necessary regulatory approvals had been issued. Staff concluded that it would update the docket once the upgrade conditions have been met.

On August 20, 2008, the ALJ issued a Procedural Order ordering that the docket remain open until the construction upgrades had been completed and approved after which Staff was to file a further update.

Staff's Filing Update

Construction Approval

On January 27, 2009, the Company submitted all of the Maricopa County Environmental Services Department ("MCESD") Certificates of Approval of Construction ("AOC") for the eleven plant construction upgrades related to the Company's Palm Valley Water Reclamation Facility ("PVWRF"). These eleven plant upgrades and the related AOC information are as follows:

Phases	Plant Upgrades	AOC Approval Dates
1	Odor control	August 28, 2008
2	Ultra-violet disinfection system	September 12, 2008 Revised January 15, 2009
3	Centrifuge system	August 22, 2008 Revised January 15, 2009
4	Influent screening	August 22, 2008
5	Tertiary treatment pump stations	August 22, 2008
6	Solids handling	August 22, 2008 Revised January 15, 2009
7	Conversion of digesters to sequencing batch reactors	December 31, 2008 Revised January 20, 2009
8	Headworks building	August 22, 2008
9	Solids handling building	August 22, 2008 Revised January 15, 2009
10	Equalization basin to headworks recycle line	August 22, 2008
11	Chemical systems additions	September 30, 2008

Aquifer Protection Permit

On September 30, 2008, the Arizona Department of Environmental Quality issued an Aquifer Protection Permit ("APP") Other Amendment for the Company to operate its PVWRF at 4.1 million gallons per day ("MGD"). With this approved APP Other Amendment, the Company can operate and maintain its PVWRF with the above eleven plant upgrades. The APP Other Amendment also permits the Company to construct its PVWRF up to 8.2 MGD.

Field Inspection

On February 5, 2009, Staff Engineer Marlin Scott, Jr., conducted a field visit to the Company's wastewater treatment plant. During this visit, Staff confirmed that all the plant upgrades were completed and in operation. Staff also did not detect any odors outside of the plant facilities and within the fenceline.

Treatment Capacity

The current PVWRF plant capacity is 4.1 MGD. In its review, Staff noticed discrepancies in the Company's Annual Reports related to the wastewater flow data. Staff has sent out a data request for additional information regarding these wastewater flows and additional treatment capacity. As of this date, the Company has not responded to Staff's data request.

Conclusion and Recommendation

Staff has confirmed that all the plant upgrades are completed, approved, and in operation.

Staff recommends that this docket remain open until the Company submits a response to Staff's data request for additional information regarding the wastewater flows and additional treatment capacity. Staff will then update this docket once the data request responses are received and reviewed by Staff.

EGJ:MSJ:red

Originator: Marlin Scott, Jr.

SERVICE LIST FOR: Litchfield Park Service Company
DOCKET NO. SW-01428A-07-0602

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Supplement to Testimony
For Marlin Scott, Jr.

Pretreatment Tariff

Introduction

A Pretreatment Tariff sets forth certain waste limitations and pretreatment standards that apply based on the class of commercial/industrial customer served by the Litchfield Park Service Company ("LPSCo"). Types of customer classes include dental offices, dry cleaners, food service establishments, photo imaging operations, RV parks, and pretreatment for industrial wastes. The tariff will govern the type and quality of waste discharged into the LPSCo's wastewater collection system and treated at its wastewater treatment facility.

Discussion

On August 25, 2008, the LPSCo filed a New Code of Practice Tariff ("Pretreatment Tariff") under Docket No. 08-0442. After several suspensions due to revisions and incomplete data, the statutory time allowed for processing this tariff expired, resulting in a Commission denial for this tariff filing in Decision No. 71177, dated June 30, 2009.

In Black Mountain Sewer Corporation's ("BMSC") rate case filing under Docket No. 08-0609, Staff recommended approval for a Pretreatment Tariff. This recommended BMSC tariff resembled LPSCo's unapproved tariff in Docket No. 08-0442.

Recommendation

Staff recommends that LPSCo file a Pretreatment Tariff that is similar to Staff's recommended BMSC tariff in Docket No. 08-0609 for Commission consideration and approval within 60 days of the effective date of an order in this proceeding.

BEFORE THE ARIZONA CORPORATION COMMISSION

KRISTIN K. MAYES
Chairman
GARY PIERCE
Commissioner
SANDRA D. KENNEDY
Commissioner
PAUL NEWMAN
Commissioner
BOB STUMP
Commissioner

IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WASTEWATER RATES AND CHARGES FOR UTILITY SERVICE BASED THEREON.	DOCKET NO. SW-01428A-09-0103
IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WATER RATES AND CHARGES FOR UTILITY SERVICE BASED THEREON.	DOCKET NO. W-01428A-09-0104

DIRECT

TESTIMONY

OF

JUAN C. MANRIQUE

PUBLIC UTILITIES ANALYST I

UTILITIES DIVISION

ARIZONA CORPORATION COMMISSION

NOVEMBER 4, 2009

EXHIBIT
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TABLE OF CONTENTS

SCHEDULES

EXECUTIVE SUMMARY
LITCHFIELD PARK SERVICE COMPANY
DOCKET NOS. SW-01428A-09-0103 & W-01427A-09-0104

The Direct Testimony of Staff witness Juan C. Manrique addresses the following issues:

Capital Structure – Staff recommends that the Commission adopt a capital structure for Litchfield Park Service Company ("Applicant") for this proceeding consisting of 17.2 percent debt and 82.8 percent equity.

Cost of Equity – Staff recommends that the Commission adopt a 9.2 percent return on equity ("ROE") for the Applicant. Staff's estimated ROE for the Applicant is based on cost of equity estimates for the sample companies ranging from 9.7 percent for the discounted cash flow method ("DCF") to 10.2 percent for the capital asset pricing model ("CAPM"). Staff's ROE recommendation includes a 0.8 percent downward adjustment to reflect a lower financial risk in the Applicant's capital structure compared to that of the sample companies.

Overall Rate of Return – Staff recommends that the Commission adopt an overall rate of return ("ROR") of 8.7 percent.

Mr. Bourassa's Testimony – The Commission should reject the Company's proposed 11.4 percent ROE for the following reasons:

1. Mr. Bourassa's DCF estimates rely exclusively on analysts forecasts. In addition. Mr. Bourassa's DCF constant growth analysis does not include dividend growth.

I. INTRODUCTION

Q. Please state your name, occupation, and business address.

A. My name is Juan C. Manrique. I am a Public Utilities Analyst employed by the Arizona Corporation Commission ("ACC" or "Commission") in the Utilities Division ("Staff"). My business address is 1200 West Washington Street, Phoenix, Arizona 85007.

Q. Briefly describe your responsibilities as a Public Utilities Analyst.

A. In my position as a Public Utilities Analyst, I perform studies to estimate the cost of capital component in rate filings to determine the overall revenue requirement and analyze requests for financing authorizations.

Q. Please describe your educational background and professional experience.

A. I graduated from Arizona State University and received a Bachelor of Science degree in Finance. My course of studies included courses in corporate and international finance, investments, accounting, statistics, and economics. I began employment as a Staff Public Utilities Analyst in October 2008. My professional experience includes two years as a Loan Officer with a homebuilder and as an Associate for an Investor Relations firm.

Q. What is the scope of your testimony in this case?

A. My testimony provides Staff's recommended capital structure, return on equity ("ROE") and overall rate of return ("ROR") for establishing the revenue requirements for Litchfield Park Service Company's ("LPSCO" or "Applicant") pending water division and wastewater division rate applications.

Q. Please provide a brief description of LPSCO.

A. LPSCO is an Arizona Corporation that is engaged in the business of providing public water and wastewater utility service in cities of Litchfield Park, Avondale, Goodyear and unincorporated areas of Maricopa County, Arizona.

Q. Please provide a brief description of LPSCO and its relation to affiliates.

A. LPSCO is owned by Algonquin Water Resources of America, Inc. ("AWRA"). AWRA is an indirect wholly owned subsidiary of Algonquin Power Income Fund which is publicly traded on the Toronto Stock Exchange. LPSCO is a sister company to other public service corporations regulated by the Commission including: Bella Vista Water Company, Black Mountain Sewer Corporation, Northern Sunrise Water Company, Southern Sunrise Water Company, Rio Rico Utilities, Inc. and Gold Canyon Sewer Company.

Q. Please explain the relevance of using six water companies as a proxy for the wastewater division of LPSCO.

A. While the provision of wastewater service is different from the provision of water service, water and wastewater utilities are subject to similar risk factors and regulatory oversight. Therefore, the sample water companies are an appropriate proxy for the wastewater division of LPSCO.

Summary of Testimony and Recommendations

Q. Briefly summarize how Staff's cost of capital testimony is organized.

A. Staff's cost of capital testimony is presented in ten sections. Section I is this introduction. Section II discusses the concept of weighted average cost of capital ("WACC"). Section III presents the concept of capital structure and presents Staff's recommended capital structure for LPSCO in this proceeding. Section IV discusses the concepts of return on equity ("ROE") and risk. Section V presents the methods employed by Staff to estimate LPSCO's ROE. Section VI presents the findings of Staff's ROE analysis. Section VII presents Staff's final cost of equity estimates for LPSCO. Section VIII presents Staff's ROR recommendation. Section IX presents Staff's comments on the Direct Testimony of the Applicant's witness, Mr. Thomas J. Bourassa. Finally, Section X presents the conclusions.

Q. Have you prepared any exhibits to accompany your testimony?

A. Yes. I prepared eight schedules (JCM-1 to JCM-9) that support Staff's cost of capital analysis.

Q. What is Staff's recommended rate of return for LPSCO?

A. Staff recommends an 8.7 percent overall ROR as shown in Schedule JCM-1. Staff's ROR recommendation is based on cost of equity estimates for LPSCO that range from 9.7 percent using the discounted cash flow method ("DCF") to 10.2 percent using the capital asset pricing model ("CAPM"). Staff's ROR recommendation reflects a 0.8 percent downward adjustment to the estimated ROE to account for a lower financial risk in the Applicant's capital structure compared to that of the sample companies

LPSCO's Proposed Overall Rate of Return

Q. Briefly summarize LPSCO's proposed capital structure, cost of debt, return on equity and overall rate of return for this proceeding.

A. Table 1 summarizes the Applicant's proposed capital structure, cost of debt, return on equity and overall rate of return in this proceeding:

Table 1

	Weight	Cost	Weighted Cost
Long-term Debt	17.5%	6.39%	1.1%
Common Equity	82.5%	12.5%	10.3%
Cost of Capital/ROR			**11.4%**

LPSCO is proposing an overall rate of return of 11.4 percent.

II. THE WEIGHTED AVERAGE COST OF CAPITAL

Q. Briefly explain the cost of capital concept.

A. The cost of capital is the opportunity cost of choosing one investment over others with equivalent risk. In other words, the cost of capital is the return that stakeholders expect for investing their financial resources in a determined business venture over another business venture.

Q. What is the overall cost of capital?

A. The cost of capital to a company issuing a variety of securities (i.e., stock and indebtedness) is an average of the cost rates on all issued securities adjusted to reflect the relative amounts for each security in the company's entire capital structure. Thus, the overall cost of capital is the weighted average cost of capital ("WACC").

Q. How is the WACC calculated?

A. The WACC is calculated by adding the weighted expected returns of a firm's securities. The WACC formula is:

Equation 1.

$$\text{WACC} = \sum_{i=1}^{n} W_i * r_i$$

In this equation, W_i is the weight given to the i^{th} security (the proportion of the i^{th} security relative to the portfolio) and r_i is the expected return on the i^{th} security.

Q. Can you provide an example demonstrating application of Equation 1?

A. Yes. For this example, assume that an entity has a capital structure composed of 60 percent debt and 40 percent equity. Also, assume that the embedded cost of debt is 6.0 percent and the expected return on equity, i.e. the cost of equity, is 10.5 percent. Calculation of the WACC is as follows:

WACC = (60% * 6.0%) + (40% * 10.5%)

WACC = 3.60% + 4.20%

WACC = 7.80%

The weighted average cost of capital in this example is 7.80 percent. The entity in this example would need to earn an overall rate of return of 7.80 percent to cover its cost of capital.

III. CAPITAL STRUCTURE

Background

Q. Please explain the capital structure concept.

A. The capital structure of a firm is the relative proportions of each type of security short-term debt, long-term debt (including capital leases), preferred stock and common stock that are used to finance the firm's assets.

Q. How is the capital structure expressed?

A. The capital structure of a company is expressed as the percentage of each component of the capital structure (capital leases, short-term debt, long-term debt, preferred stock and common stock) relative to the entire capital structure.

As an example, the capital structure for an entity that is financed by $20,000 of capital leases, $85,000 of long-term debt, $15,000 of preferred stock and $80,000 of common stock is shown in Table 2.

Table 2

Component			%
Capital Leases	$20,000	($20,000/$200,000)	10.0%
Long-Term Debt	$85,000	($85,000/$200,000)	42.5%
Preferred Stock	$15,000	($15,000/$200,000)	7.5%
Common Stock	$80,000	($80,000/$200,000)	40.0%
Total	$200,000		100%

The capital structure in this example is composed of 0.0 percent short-term debt, 10.0 percent capital leases, 42.5 percent long-term debt, 7.5 percent preferred stock and 40.0 percent common stock.

LPSCO's Capital Structure

Q. What capital structure does LPSCO propose?

A. The Applicant proposes a capital structure composed of 17.5 percent debt and 82.5 percent common equity.

Q. How does LPSCO's capital structure compare to capital structures of publicly traded water utilities?

A. The Applicant's capital structure is composed of 17.2 percent debt and 82.8 percent equity. Schedule JCM-4 shows the capital structures of six publicly traded water companies ("sample water companies") as of March 2009. The average capital structure for the sample water utilities is comprised of approximately 50.8 percent debt and 49.2 percent equity.

Staff's Capital Structure

Q. What is Staff's recommended capital structure for LPSCO?

A. Staff recommends a capital structure composed of 17.2 percent debt and 82.8 percent equity.

Q. Please explain the reason for the difference between Staff's capital structure and that of the Applicant.

A. Staff used the most recent capital structure submitted by LPSCO on October 14, 2009.

IV. RETURN ON EQUITY

Background

Q. Please define the term "cost of equity capital".

A. The cost of equity is the rate of return that investors expect to earn on their investment in a business entity given its risk. In other words, the cost of equity to the entity is the investors' expected rate of return on other investments of similar risk. As investors have a wide selection of stocks to choose from, they will choose stocks with similar risks but higher returns. Therefore, the market determines the entity's cost of equity.

Q. Is there a correlation between interest rates and the cost of equity?

A. Yes. The cost of equity tends to move in the same direction as interest rates. This relationship is part of the CAPM formula. The CAPM is a market based model employed by Staff for estimating the cost of equity. The CAPM is further discussed in Section V of this testimony.

Q. What has been the general trend of interest rates in recent years?

A. A chronological chart of interest rates is a good tool to show interest rate history and identify trends. Chart 1 graphs intermediate U.S. treasury rates from September 1999 to September 2009.

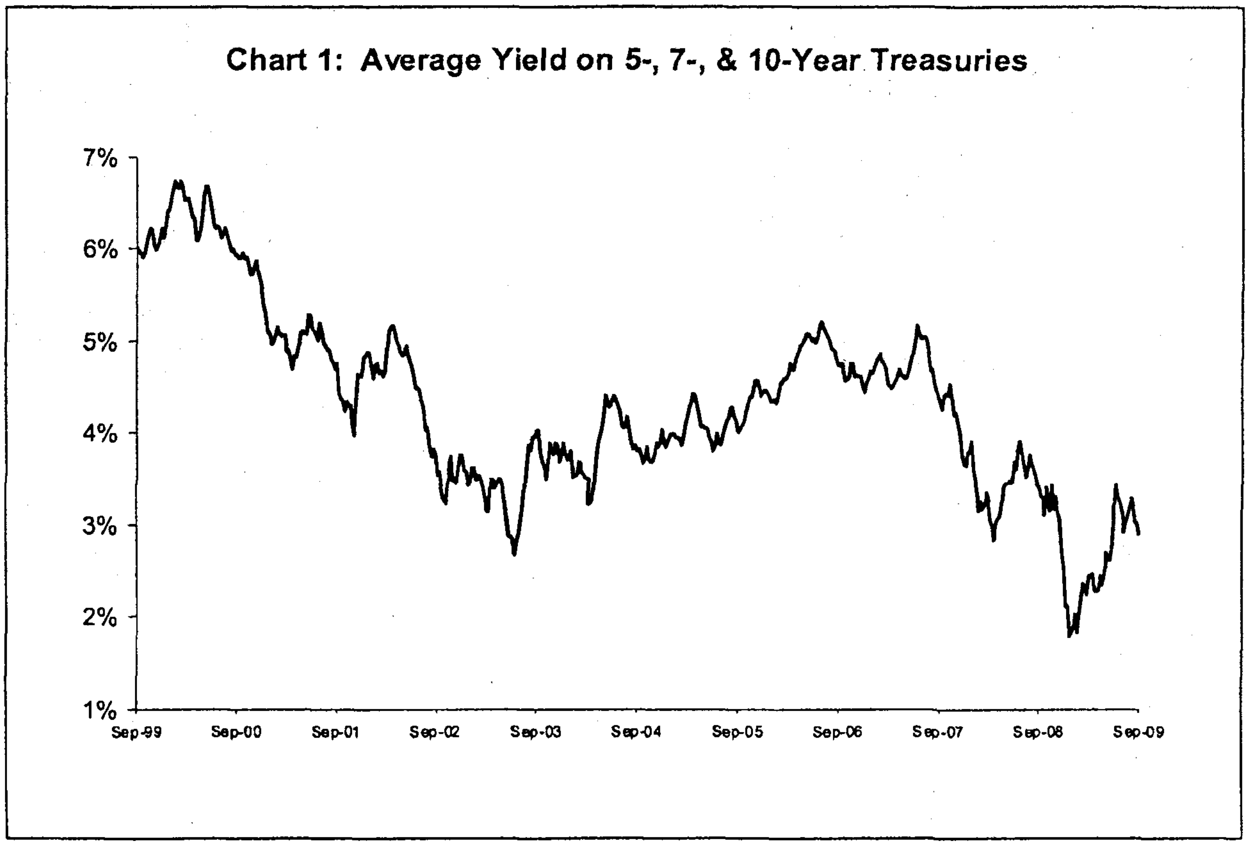
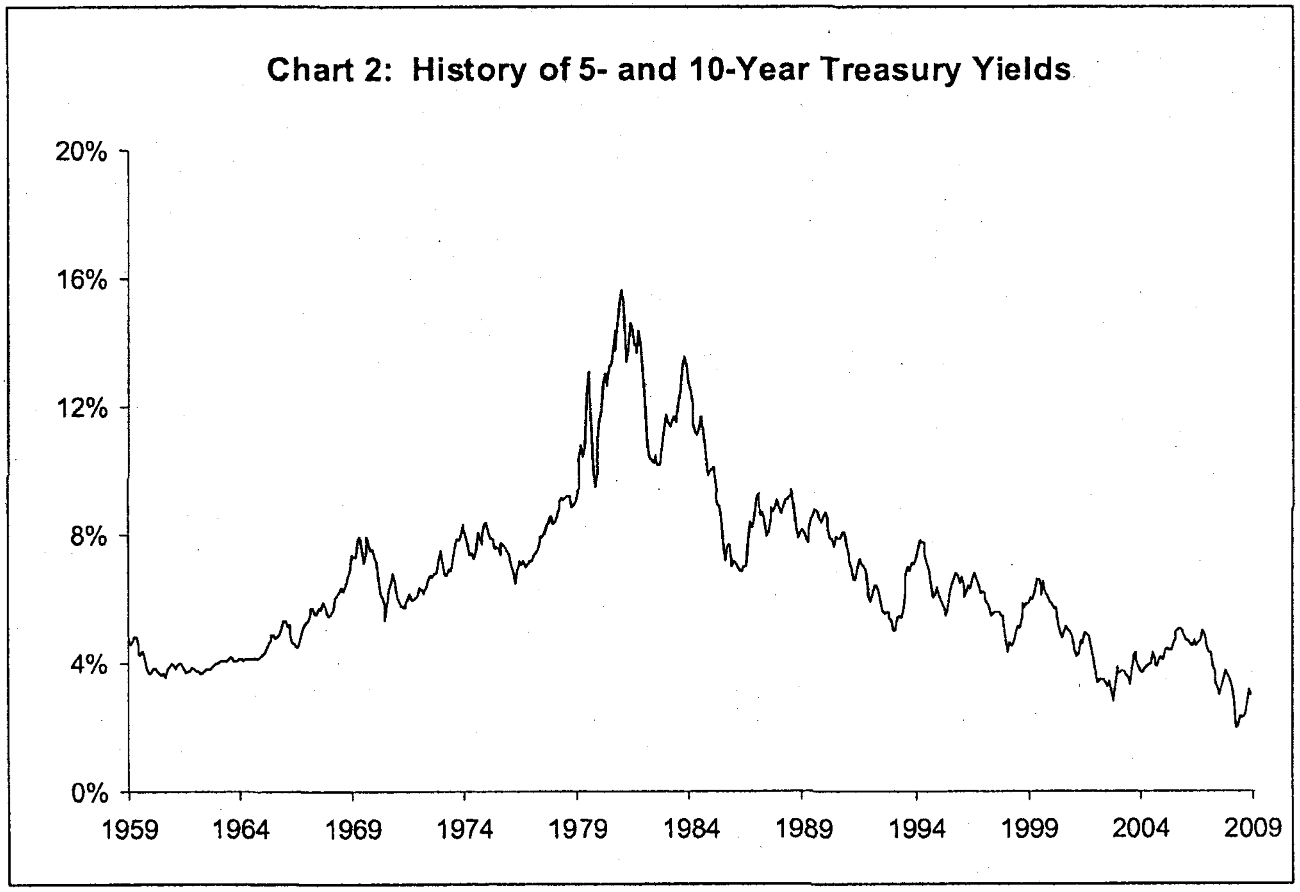


Chart 1 shows that intermediate interest rates trended downward from 2000 to mid-2003 then turned slightly upward until mid-2007 and have trended downward in the past two years.

Q. What has been the general trend in interest rates longer term?

A. U.S. Treasury rates from 1959 to present are shown in Chart 2. The chart shows that interest rates trended upward through the mid-1980s and have trended downward over the last 25 years.



Q. Do these trends suggest anything in terms of cost of equity?

A. Yes. As previously demonstrated, interest rates and cost of equity tend to move in the same direction; therefore cost of equity has declined in the past 25 years.

Q. Do actual returns represent the cost of equity?

A. No. The cost of equity represents investors' *expected* returns and not realized returns.

Q. Is there any information available that leads to an understanding of the relationship between the equity returns required for a regulated water utility and those required in the market as a whole?

A. Yes. A comparison of betas, a component of the CAPM discussed in Section V, for the water utility industry and the market provide insight into this relationship. The average beta (0.82)[1] for a water utility is lower than the theoretical average beta for all stocks (1.0). According to the CAPM formula, the cost of equity capital moves in the same direction as beta. Since the beta for the water utility industry is lower than the beta for the market, the implication is that the required return on equity for a regulated water utility is below the average required return on the market.

Risk

Q. Please define risk in relation to cost of capital.

A. Risk, as it relates to an investment, is the variability or uncertainty of the returns on a particular security. Investors are risk averse and require a greater potential return to invest in relatively greater risk opportunities, i.e., investors require compensation for taking on additional risk. Risk is generally separated into two components. Those components are market risk (systematic risk) and non-market risk (diversifiable risk or firm-specific risk).

Q. What is market risk?

A. Market risk or systematic risk is the risk of an investment that cannot be reduced through diversification. Market risk stems from factors that affect all securities such as recessions, war, inflation and high interest rates. Since these factors affect the entire market they cannot be eliminated through diversification. Market risk does not impact each security to

[1] See Schedule JCM-6

the same degree. The degree to which any security's returns is affected by the market can be measured using Beta. Beta reflects the business risk and the financial risk of a security.

Q. Please define business risk.

A. Business risk is the fluctuation of earnings inherent in a firm's operations and environment such as competition and adverse economic conditions that may impair its ability to provide returns on investment. Companies in the same or similar line of business tend to experience the same fluctuations in business cycles.

Q. Please define financial risk.

A. Financial risk is the fluctuation of earnings inherent in using debt financing by a firm that may impair its ability to provide adequate return. The more a company uses debt financing, the more the company becomes exposed to financial risk.

Q. Do business risk and financial risk affect the cost of equity?

A. Yes.

Q. Is a firm subject to any other risk?

A. Yes. Firms are also subject to unsystematic or firm-specific risk. Examples of unsystematic risk include losses caused by labor problems, nationalization of assets, loss of a big client or weather conditions. Investors can eliminate firm-specific risk by holding a diverse portfolio, thus, it is not of concern to diversified investors.

Q. How does LPSCO's financial risk compare to the sample water companies' financial risk from the perspective of an investor?

A. From an investor's perspective LPSCO's capital structure is less risky than the sample water companies. Schedule JCM-4 shows the capital structures of the six publicly traded water companies ("sample water companies") as of March 2009, as well as LPSCO's actual capital structure. As of March 2009, the sample water utilities were capitalized with approximately 50.8 percent debt and 49.2 percent equity, while LPSCO's actual capital structure consists of approximately 17.2 percent debt and 82.8 percent equity. Thus, LPSCO's shareholders bear less financial risk than the shareholders of the sample companies.

Q. Is firm-specific risk measured by beta?

A. No. Firm-specific risk is not measured by beta.

Q. Is the cost of equity affected by firm-specific risk?

A. No. Since firm-specific risk can be eliminated through diversification, it does not affect the cost of equity.

Q. Can investors expect additional returns for firm-specific risk?

A. No. Investors who hold diversified portfolios can eliminate firm-specific risk, and consequently do not require any additional return. Since investors who choose to be less than fully diversified must compete in the market with fully diversified investors, the former cannot expect to be compensated for unique risk.

V. ESTIMATING THE COST OF EQUITY

Introduction

Q. Did Staff directly estimate the cost of equity for LPSCO?

A. No. Since LPSCO is not a publicly traded company, Staff is unable to directly estimate LPSCO's cost of equity due to the unavailability of financial information. Instead, Staff uses an average of a representative sample group to reduce the sample error resulting from random fluctuations in the market due to the moment in time at which the information is gathered.

Q. What companies did Staff select as proxies or comparables for LPSCO?

A. Staff's sample consists of the following six publicly traded water utilities: American States Water, California Water, Connecticut Water Services, Middlesex Water, Aqua America and SJW Corp. These companies were chosen due to their being publicly traded and receiving the majority of their earnings from regulated operations.

Q. What models did Staff implement to estimate LPSCO's cost of equity?

A. Staff used two market-based models to estimate the cost of equity for LPSCO: the DCF model and the CAPM.

Q. Please explain why Staff chose the DCF and CAPM models.

A. Staff chose to use the DCF and CAPM models because they are widely recognized market based models and have been used extensively to estimate the cost of equity. An explanation of the DCF and CAPM models follows.

Discounted Cash Flow Model Analysis

Q. Please provide a brief summary of the theory upon which the DCF method of estimating the cost of equity is based.

A. The DCF method of stock valuation is based on the theory that the value of an investment is equal to the sum of the future cash flows generated from the aforementioned investment discounted to the present time. This method uses expected dividends, market price and dividend growth rate to calculate the cost of capital. Professor Myron Gordon pioneered the DCF method in the 1960s. The DCF method has become widely used to estimate the cost of equity for public utilities due to its theoretical merit and its simplicity. Staff used the financial information for the relevant six sample companies in the DCF model and averaged the results to determine an estimated cost of equity for the sample companies.

Q. Does Staff use more than one version of the DCF Model?

A. Yes. Staff uses two versions of the DCF model: the constant-growth DCF Model and the multi-stage or non-constant growth DCF. The constant-growth DCF Model assumes that an entity's dividends will grow indefinitely at the same rate. The multi-stage growth DCF model assumes the dividend growth rate will change at some point in the future.

<u>The Constant-Growth DCF</u>

Q. What is the mathematical formula used in Staff's constant-growth DCF analysis?

A. The constant-growth DCF formula used in Staff's analysis is:

Equation 2:

$$K = \frac{D_1}{P_0} + g$$

where: K = the cost of equity
D_1 = the expected annual dividend
P_0 = the current stock price
g = the expected infinite annual growth rate of dividends

Equation 2 assumes that the entity has a constant earnings retention rate and that its earnings are expected to grow at a constant rate. According to Equation 2, a stock with a current market price of $10 per share, an expected annual dividend of $0.45 per share and an expected dividend growth rate of 3.0 percent per year has a cost of equity to the entity of 7.5 percent reflected by the sum of the dividend yield ($0.45/ $10 = 4.5 percent) and the 3.0 percent annual dividend growth rate.

Q. How did Staff calculate the dividend yield component (D_1/P_0) of the constant-growth DCF formula?

A. Staff calculated the yield component of the DCF formula by dividing the expected annual dividend[2] (D_1) by the spot stock price (P_0) after the close of the market August 26, 2009, as reported by *MSN Money*.

[2] Value Line Summary & Index. 08-26-09

Q. Why did Staff use the September 30, 2009, spot price rather than a historical average stock price to calculate the dividend yield component of the DCF formula?

A. Current, rather than historic, market stock price is used in order to be consistent with finance theory, i.e., the efficient market hypothesis. The efficient market hypothesis asserts that the current stock price reflects all available information on a stock including investors' expectations of future returns. Use of a historical average of stock prices illogically discounts the most recent information in favor of less recent information. The latter is stale and is representative of underlying conditions that may have changed.

Q. How did Staff estimate the dividend growth (g) component of the constant-growth DCF model represented by Equation 2?

A. The dividend growth component used by Staff is determined by the average of six different estimation methods as shown in Schedule JCM-8. Staff calculated historical and projected growth estimates on dividend-per-share ("DPS")[3], earnings-per-share ("EPS")[4] and sustainable growth bases.

Q. Why did Staff examine EPS growth to estimate the dividend growth component of the constant-growth DCF model?

A. Historic and projected EPS growth are used because dividends are related to earnings. Dividend distributions may exceed earnings in the short run but cannot continue indefinitely. In the long term, dividend distributions are dependent on earnings.

Q. How did Staff estimate historical DPS growth?

A. Staff estimated historical DPS growth by calculating the average rate of growth in DPS of the sample water companies from 1998 to 2008. The results of that calculation are shown

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[3] Derived from information provided by *Value Line*
[4] Derived from information provided by *Value Line*

in Schedule JCM-5. Staff calculated an average historical DPS growth rate of 3.1 percent for the sample water utilities for the aforementioned period.

Q. How did Staff estimate the projected DPS growth?

A. Staff calculated an average of the projected DPS growth rates for the sample water utilities from *Value Line*. The average projected DPS growth rate is 4.3 percent as shown in Schedule JCM-5.

Q. How did Staff calculate the historical EPS growth rate?

A. Staff estimated historical EPS growth by calculating the average rate of growth in EPS of the sample water companies from 1998 to 2008. Staff calculated an average historical EPS growth rate of 3.4 percent for the sample water utilities for the aforementioned period as shown in Schedule JCM-5.

Q. How did Staff estimate the projected EPS growth?

A. Staff calculated an average of the projected EPS growth rates for the sample water utilities from *Value Line*. The average projected EPS growth rate is 9.7 percent as shown in Schedule JCM-5.

Q. How does Staff calculate its historical and projected sustainable growth rates?

A. Historical and projected sustainable growth rates are calculated by adding their respective retention growth rate terms (br) to their respective stock financing growth rate terms (vs) as shown in Schedule JCM-6.

Q. What is retention growth?

A. Retention growth is the growth in dividends due to the retention of earnings. The retention growth concept is based on the theory that dividend growth cannot be achieved unless the company retains and reinvests some of its earnings. The retention growth is used in Staff's calculation of sustainable growth shown in Schedule JCM-6.

Q. What is the formula for the retention growth rate?

A. The retention growth rate is the product of the retention ratio and the book/accounting return on equity. The retention growth rate formula is:

Equation 3:

$$\text{Retention Growth Rate} = br$$

where: b = the retention ratio (1 – dividend payout ratio)
r = the accounting/book return on common equity

Q. How did Staff calculate the average historical retention growth rate (br) for the sample water utilities?

A. Staff calculated the historical retention rates by averaging the retention rates for the sample water companies from 1999 to 2008. The historical average retention (br) growth for the sample water utilities is 3.0 percent as shown in Schedule JCM-6.

Q. How did Staff determine projected retention growth rate (br) for the sample water utilities?

A. Staff used the retention growth projections for the sample water utilities for the period 2012 to 2014 from *Value Line.* The projected average retention growth rate for the sample water utilities is 6.0 percent as shown in Schedule JCM-6.

Q. When can retention growth provide a reasonable estimate of future dividend growth?

A. The retention growth rate is a reasonable estimate of future dividend growth when the retention ratio is reasonably constant and the entity's market price to book value ("market-to-book ratio") is expected to be 1.0. The average retention ratio has been reasonably constant in recent years. However, the market-to-book ratio for the sample water utilities is 1.7, notably higher than 1.0, as shown in Schedule JCM-7.

Q. Is there any financial implication of a market-to-book ratio greater than 1.0?

A. Yes. A market-to-book ratio greater than 1.0 implies that investors expect an entity to earn an accounting/book return on its equity that exceeds its cost of equity. The relationship between required returns and expected cash flows is readily observed in the fixed securities market. For example, assume an entity contemplating issuance of bonds with a face value of $10 million at either 6 percent or 8 percent, and thus, paying annual interest of $600,000 or $800,000, respectively. Regardless of investors' required return on similar bonds, investors will be willing to pay more for the bonds if issued at 8 percent than if the bonds are issued at 6 percent. For example, if the current interest rate required by investors is 6 percent, then they would bid $10 million for the 6 percent bonds and more than $10 million for the 8 percent bonds. Similarly, if equity investors require a 9 percent return and expect an entity to earn accounting/book returns of 13 percent, the market will bid up the price of the entity's stock to provide the required return of 9 percent.

Q. How has Staff generally recognized a market-to-book ratio exceeding 1.0 in its cost of equity analyses in recent years?

A. Staff has assumed that investors expect the market-to-book ratio to remain greater than 1.0. Given that assumption, Staff has added a stock financing growth rate (vs) term to the retention ratio (br) term to calculate its historical and projected sustainable growth rates.

Q. Do the historical and projected sustainable growth rates Staff uses to develop its DCF cost of equity in this case continue to include a stock financing growth rate term?

A. Yes.

Q. What is stock financing growth?

A. Stock financing growth is the growth in an entity's dividends due to the sale of stock by that entity. Stock financing growth is a concept derived by Myron Gordon and discussed in his book *The Cost of Capital to a Public Utility*.[5] Stock financing growth is the product of the fraction of the funds raised from the sale of stock that accrues to existing shareholders (v) and the fraction resulting from dividing the funds raised from the sale of stock by the existing common equity (s).

Q. What is the mathematical formula for the stock financing growth rate?

A. The mathematical formula for stock financing growth is:

[5] Gordon, Myron J. *The Cost of Capital to a Public Utility*. MSU Public Utilities Studies, Michigan, 1974. pp 31-35.

Equation 4 :

$$\text{Stock Financing Growth} = vs$$

where : v = Fraction of the funds raised from the sale of stock that accrues to existing shareholders

s = Funds raised from the sale of stock as a fraction of the existing common equity

Q. How is the variable v presented above calculated?

A. Variable v is calculated as follows:

Equation 5 :

$$v = 1 - \left(\frac{\textit{book value}}{\textit{market value}}\right)$$

For example, assume that a share of stock has a $30 book value and is selling for $45. Then, to find the value of v, the formula is applied:

$$v = 1 - \left(\frac{30}{45}\right)$$

In this example, v is equal to 0.33.

Q. How is the variable s presented above calculated?

A. Variable s is calculated as follows:

Equation 6:

$$s = \frac{\text{Funds raised from the issuance of stock}}{\text{Total existing common equity before the issuance}}$$

For example, assume that an entity has \$150 in existing equity, and it sells \$30 of stock. Then, to find the value of s, the formula is applied:

$$s = \left(\frac{30}{150}\right)$$

In this example, s is equal to 20.0 percent.

Q. What is the *vs* term when the market-to-book ratio is equal to 1.0?

A. A market-to-book ratio equal to 1.0 reflects that investors expect an entity to earn a book/accounting return on their equity investment equal to the cost of equity. When the market-to-book ratio is equal to 1.0, none of the funds raised from the sale of stock by the entity accrues to the benefit of existing shareholders, i.e., the term v is equal to zero (0.0). Consequently, the vs term is also equal to zero (0.0). When stock financing growth is zero, dividend growth depends solely on the br term.

Q. What is the effect of the *vs* term when the market-to-book ratio is greater than 1.0?

A. A market-to-book ratio greater than 1.0 reflects that investors expect an entity to earn a book/accounting return on their equity investment greater than the cost of equity. Equation 5 shows that when the market-to-book ratio is greater than 1.0 the v term is also greater than zero. The excess by which new shares are issued and sold over book value per share of outstanding stock is a contribution that accrues to existing stockholders in the form of a higher book value. The resulting higher book value leads to higher expected earnings and dividends. Continued growth from the *vs* term is dependent upon the continued issuance and sale of additional shares at a price that exceeds book value per share.

Q. What *vs* estimate did Staff calculate from its analysis of the sample water utilities?

A. Staff estimated an average stock financing growth of 2.0 percent for the sample water utilities as shown in Schedule JCM-6.

Q. What would occur if an entity had a market-to-book ratio greater than 1.0 as a result of investors expecting earnings to exceed the cost of equity capital and the entity subsequently experienced newly authorized rates equal to its cost of equity capital?

A. Market pressure on the entity's stock price to reflect the change in future expected cash flows would cause the market-to-book ratio to move toward 1.0.

Q. Is inclusion of the vs term necessary if the average market-to-book ratio of the sample water utilities falls to 1.0 due to authorized ROEs equaling the cost of equity?

A. No. As discussed above, when the market-to-book ratio is equal to 1.0, none of the funds raised from the sale of stock by the entity accrues to the benefit of existing shareholders because the *v* term equals to zero, and consequently, the *vs* term also equals zero. When the market-to-book ratio equals 1.0, dividend growth depends solely on the *br* term. Staff's inclusion of the *vs* term assumes that the market-to-book ratio continues to exceed 1.0 and that the water utilities will continue to issue and sell stock at prices above book value with the effect of benefitting existing shareholders.

Q. What are Staff's historical and projected sustainable growth rates?

A. Staff's estimated historical sustainable growth rate is 5.1 percent based on an analysis of earnings retention for the sample water companies. Staff's projected sustainable growth rate is 9.0 percent based on retention growth projected by *Value Line*. Schedule JCM-6 presents Staff's estimates of the sustainable growth rate.

Q. What is Staff's expected infinite annual growth rate in dividends?

A. Staff's expected infinite annual growth rate in dividends is 5.8 percent which is the average of historical and projected dividends per share ("DPS"), earnings per share ("EPS"), and sustainable growth estimates. Staff's calculation of the expected infinite annual growth rate in dividends is shown in Schedule JCM-8.

Q. What is Staff's constant-growth DCF estimate for the sample utilities?

A. Staff's constant-growth DCF estimate is 9.3 percent as shown in Schedule JCM-3.

The Multi-Stage DCF

Q. Why did Staff implement the multi-stage DCF model to estimate LPSCO's cost of equity?

A. Staff generally uses the multi-stage DCF model to consider the assumption that dividends may not grow at a constant rate. The multi-stage DCF uses two stages of growth. The first stage is four years followed by the second constant growth stage.

Q. What is the mathematical formula for the multi-stage DCF?

A. The multi-stage DCF formula is shown in the following equation:

Equation 7:

$$P_0 = \sum_{t=1}^{n} \frac{D_t}{(1+K)^t} + \frac{D_n(1+g_n)}{K-g_n}\left[\frac{1}{(1+K)}\right]^n$$

Where: P_0 = current stock price
D_t = dividends expected during stage 1
K = cost of equity
n = years of non – constant growth
D_n = dividend expected in year n
g_n = constant rate of growth expected after year n

Q. What steps did Staff take to implement its multi-stage DCF cost of equity model?

A. First, Staff projected future dividends for each of the sample water utilities using near-term and long-term growth rates. Second, Staff calculated the rate (cost of equity) which equates the present value of the forecasted dividends to the current stock price for each of the sample water utilities. Lastly, Staff calculated an average of the individual sample company cost of equity estimates.

Q. How did Staff calculate near-term (stage-1) growth?

A. The stage-1 growth rate is based on *Value Lines's* projected dividends for the next twelve months, when available, and on the average dividend growth rate (5.8 percent) calculated in Staff's constant DCF analysis for the remainder of the stage.

Q. How did Staff estimate long-term (stage-2) growth?

A. Staff calculated the stage-2 growth rate using the arithmetic mean rate of growth in GDP from 1929 to 2008.[6] Using the GDP growth rate assumes that the water utility industry is expected to grow at the same rate as the overall economy.

Q. What is the historical GDP growth rate that Staff used to estimate stage-2 growth?

A. Staff used 6.7 percent to estimate the stage-2 growth rate.

Q. What is Staff's multi-stage DCF estimate for the sample utilities?

A. Staff's multi-stage DCF estimate is 10.1 percent as shown in Schedule JCM-3.

Q. What is Staff's overall DCF estimate for the sample utilities?

A. Staff's overall DCF estimate is 9.7 percent. Staff calculated the overall DCF estimate by averaging the constant growth DCF (9.3%) and multi-stage DCF (10.1%) estimates as shown in Schedule JCM-3.

Capital Asset Pricing Model

Q. Please describe the CAPM.

A. The CAPM is used to determine the prices of securities in a competitive market. The CAPM model describes the relationship between a security's investment risk and its market rate of return. Under the CAPM an investor requires the expected return of a security to equal the rate on a risk-free security plus a risk premium. If the investor's expected return does not meet or beat the required return, the investment is not economically justified. The model also assumes that investors will sufficiently diversify

[6] www.bea.doc.gov

their investments to eliminate any non-systematic or unique risk.[7] In 1990, Professors Harry Markowitz, William Sharpe, and Merton Miller earned the Nobel Prize in Economic Sciences for their contribution to the development of the CAPM.

Q. Did Staff use the same sample water utilities in its CAPM and DCF cost of equity estimation analyses?

A. Yes. Staff's CAPM cost of equity estimation analysis uses the same sample water companies as its DCF cost of equity estimation analysis.

Q. What is the mathematical formula for the CAPM?

A. The mathematical formula for the CAPM is:

Equation 8:

$$K = R_f + \beta (R_m - R_f)$$

where:

R_f = risk free rate
R_m = return on market
β = beta
$R_m - R_f$ = market risk premium
K = expected return

The equation shows that the expected return (K) on a risky asset is equal to the risk-free interest rate (R_f) plus the product of the market risk premium ("Rp") ($R_m - R_f$) multiplied by beta (β) where beta represents the riskiness of the investment relative to the market.

[7] The CAPM makes the following assumptions: 1) single holding period; 2) perfect and competitive securities market; 3) no transaction costs; 4) no restrictions on short selling or borrowing; 5) the existence of a risk-free rate; and 6) homogeneous expectations.

Q. What is the risk free rate?

A. The risk free rate is the rate of return of an investment with zero risk.

Q. How does Staff estimate the risk-free rate of interest in its historical market risk premium CAPM method?

A. Staff uses two calculations for estimates of the risk-free rate of interest. Staff uses the average of three (five-, seven-, and ten-year) intermediate-term U.S. Treasury securities' spot rates for its historical market risk premium CAPM cost of equity estimation, and the 30-year U.S. Treasury bond spot rate for its current market risk premium CAPM cost of equity estimation. U.S. Treasuries are largely verifiable and readily available.

Q. What does beta measure?

A. Beta measures the volatility, or systematic risk, of a security relative to the market. Since systematic risk cannot be diversified away, it is the only risk that is relevant when estimating a security's required return. Using a baseline market beta of 1.0, a security with a beta less than 1.0 will be less volatile than the market. A security with a beta greater than 1.0 will be more volatile than the market.

Q. How did Staff estimate LPSCO's beta?

A. Staff used the average of the *Value Line* betas for the sample water utilities as a proxy for LPSCO's beta. Schedule JCM-7 shows the *Value Line* betas for each of the sample water utilities. The 0.82 average beta for the sample water utilities is Staff's estimated beta for LPSCO. A security with a 0.82 beta has less volatility than the market.

Q. Please describe expected market risk premium ($R_m - R_f$)?

A. The expected market risk premium is the expected return on the market above the risk free rate. Simplified, it is the return an investor expects as compensation for market risk.

Q. What did Staff use for the market risk premium?

A. Staff uses two calculations for the market risk premium: 1) an historical market risk premium and 2) a current market risk premium.

Q. How did Staff calculate an estimate for the historical market risk premium?

A. Staff uses the intermediate-term government bond income returns published in the Ibbotson Associates' *Stocks, Bonds, Bills, and Inflation 2008 Yearbook* to calculate the historical market risk premium. Ibbotson Associates calculates the historical risk premium by averaging the historical arithmetic differences between the S&P 500 and the intermediate-term government bond income returns for the period 1926-2008. Staff's historical market risk premium estimate is 6.9 percent as shown in Schedule JCM-3.

Q. How did Staff calculate an estimate for the current market risk premium?

A. Staff solves equation 8 above to arrive at a market risk premium using a DCF derived expected return (K) of 13.68 (2.1 + 11.58[8]) percent using the expected dividend yield (2.1 percent over the next twelve months) and the annual per share growth rate (11.58 percent) that *Value Line* projects for all dividend-paying stocks under its review[9] along with the current long-term risk-free rate (30-year Treasury note at 4.03 percent) and the market's average beta of 1.0. Staff calculated the current market risk premium as 9.65.[10]

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[8] The three to five year price appreciation is 55%. $1.55^{0.25} - 1 = 11.58\%$
[9] October 2, 2009 issue date.
[10] 13.68% = 4.03% + (1) (9.65%)

Q. How are the historical market risk premium and current market risk premium estimates used?

A. Each is used to calculate a CAPM cost of equity estimate, i.e., Staff calculated an historical market risk premium CAPM cost of equity estimate and a current market risk premium CAPM cost of equity estimate.

Q. What is the result of Staff's historical market risk premium CAPM and current market risk premium cost of equity estimations for the sample utilities?

A. Staff's cost of equity estimates are 8.5 percent using the historical market risk premium CAPM and 11.9 using the current market risk premium CAPM.

Q. What is Staff's overall CAPM estimate for the sample utilities?

A. Staff's overall CAPM cost of equity estimate is 10.2 percent which is the average of the historical market risk premium CAPM (8.5 percent) and the current market risk premium CAPM (11.9 percent) estimates as shown in Schedule JCM-3.

VI. SUMMARY OF STAFF'S COST OF EQUITY ANALYSIS

Q. What is the result of Staff's constant-growth DCF analysis to estimate of the cost of equity to the sample water utilities?

A. Schedule JCM-3 shows the result of Staff's constant-growth DCF analysis. The result of Staff's constant-growth DCF analysis is as follows:

$$k = 3.5\% + 5.8\%$$

$$k = 9.3\%$$

Staff's constant-growth DCF estimate of the cost of equity to the sample water utilities is 9.3 percent.

Q. What is the result of Staff's multi-stage DCF analysis to estimate of the cost of equity for the sample utilities?

A. Schedule JCM-9 shows the result of Staff's multi-stage DCF analysis. The result of Staff's multi-stage DCF analysis is:

Company	**Equity Cost Estimate (k)**
American States Water	9.4%
California Water	9.7%
Aqua America	9.8%
Connecticut Water	10.8%
Middlesex Water	11.5%
SJW Corp	9.6%
Average	**10.1%**

Staff's multi-stage DCF estimate of the cost of equity for the sample water utilities is 10.1 percent.

Q. What is Staff's overall DCF estimate of the cost of equity for the sample utilities?

A. Staff's overall DCF estimate of the cost of equity for the sample utilities is 9.7 percent. Staff's overall DCF estimate was calculated by averaging Staff's constant growth DCF and Staff's multi-stage DCF estimates as shown in Schedule JCM-3.

Q. What is the result of Staff's historical market risk premium CAPM analysis to estimate of the cost of equity for the sample utilities?

A. Schedule JCM-3 shows the result of Staff's CAPM analysis using the historical risk premium estimate. The result is as follows:

k = 2.9% + 0.82 * 6.9%

k = 8.5%

Staff's CAPM estimate (using the historical market risk premium) of the cost of equity to the sample water utilities is 8.5 percent.

Q. What is the result of Staff's current market risk premium CAPM analysis to estimate the cost of equity for the sample utilities?

A. Schedule JCM-3 shows the result of Staff's CAPM Analysis using the current market risk premium estimate. The result is:

k = 4.0% + 0.82 * 9.6%

k = 11.9%

Staff's CAPM estimate (using the current market risk premium) of the cost of equity to the sample water utilities is 11.9 percent.

Q. What is Staff's overall CAPM estimate of the cost of equity for the sample utilities?

A. Staff's overall CAPM estimate for the sample utilities is 10.2 percent. Staff's overall CAPM estimate is the average of the historical market risk premium CAPM (8.5 percent) and the current market risk premium CAPM (11.9 percent) estimates as shown in Schedule JCM-3.

Q. Please summarize the results of Staff's cost of equity analysis for the sample utilities.

A. The following table shows the results of Staff's cost of equity analysis:

Table 2

Method	Estimate
Average DCF Estimate	9.7%
Average CAPM Estimate	10.2%
Overall Average	**10.0%**

Staff's average estimate of the cost of equity to the sample water utilities is 10.0 percent.

VII. FINAL COST OF EQUITY ESTIMATES FOR LPSCO

Q. Please compare LPSCO's capital structure to that of the six sample water companies.

A. The average capital structure for the sample water utilities is composed of 49.2 percent equity and 50.8 percent debt, as shown in Staff Schedule JCM-4. LPSCO's actual capital structure is composed of 82.8 percent equity and 17.2 percent debt. In this case, since LPSCO's capital structure is less leveraged than that of the average sample water utilities' capital structure, its stockholders bear less financial risk than the sample water utilities. Accordingly, LPSCO's cost of equity is lower than the sample water utilities.

Q. What method does Staff use to calculate the effect on the cost of equity capital of the different financial risks posed by LPSCO versus the sample companies?

A. Staff uses the methodology developed by Professor Robert Hamada of the University of Chicago, which incorporates capital structure theory with the CAPM, to estimate the effect of LPSCO's capital structure on its cost of equity. Staff calculated a financial risk adjustment for LPSCO of negative 80 basis points (0.8 percent) based on the Company's actual capital structure of 82.8 percent equity and 17.2 percent debt in order to reflect the

Company's actual financial risk. LPSCO's cost of equity adjusted for financial risk (9.2 percent) can be determined by subtracting this 0.8 percent financial risk adjustment from Staff's average estimate of the cost of equity to the sample water utilities (10.0 percent).

Q. Does Staff's 80 basis point downward financial risk adjustment to the cost of equity reflect the full downward measure to the cost of equity due to difference in financial risk in LPSCO's capital structure compared to the sample water utilities?

A. No. Staff calculated its recommended 80 basis point downward financial risk adjustment assuming that the sample companies had a capital structure comprised of 60 percent equity and 40 percent debt instead of the actual average capital structure for the sample companies and assuming that the Company's capital structure is composed of 82.8 percent equity and 17.2 percent debt. The calculated downward financial risk adjustment would have been greater than 80 basis points if measured using 82.8 percent equity for the Company's capital structure and the sample companies' actual average equity of 49.2 percent. Staff measured the financial risk adjustment assuming the 60 percent equity for the sample companies to recognize that a capital structure composed of 60 percent equity and 40 percent debt is reasonable even though it is less leveraged than that of the sample companies and to encourage the Company to maintain a healthy capital structure.

Q. What is Staff's ROE estimate for LPSCO?

A. Staff determined an ROE estimate of 10.0 percent for the Applicant based on cost of equity estimates for the sample companies ranging from 9.7 percent for the CAPM to 10.2 percent for the DCF. Staff recommends adoption of an 80 basis point downward financial risk adjustment to 9.2 percent.

VIII. RATE OF RETURN RECOMMENDATION

Q. What overall rate of return did Staff determine for LPSCO?

A. Staff determined a 8.7 percent ROR for the Applicant as shown in Schedule JCM-1 and the following table:

Table 3

	Weight	Cost	Weighted Cost
Long-term Debt	17.2%	6.4%	1.1%
Common Equity	82.8%	9.2%	7.6%
Overall ROR			**8.7%**

IX. STAFF RESPONSE TO APPLICANT'S COST OF CAPITAL WITNESS MR. THOMAS J. BOURASSA

Q. Please summarize Mr. Bourassa's analyses and recommendations.

A. Mr. Bourassa recommends a 12.5 percent ROE based on analyses for single and multi-stage DCF models, as well as historical and current market risk premium CAPM for the same sample of water companies selected by Staff. Mr. Bourassa also asserts that LPSCO faces additional risks not captured by the market models, such as regulatory and financial risk, and he concludes that 12.5 percent ROE presents a reasonable balance resulting from his analyses. Mr. Bourassa also proposes 11.02 percent for the overall ROR with a capital structure consisting of 82.5 percent equity and 17.5 percent debt.

Constant-Growth DCF

Q. Does Staff have any comments on Mr. Bourassa's sole reliance on analysts' forecasts to estimate DPS growth in his constant growth DCF estimates?

A. Yes. Generally, analysts' forecasts are known to be overly optimistic. Sole use of analysts' forecasts to calculate the growth in dividends (g), causes inflated growth, and consequently, inflated cost of equity estimates. Also, relying only on analysts' forecasts of earnings growth to forecast DPS is inappropriate because it assumes that investors do not look at other relevant information such as past dividend and earnings growth.

Q. Does Staff have any comments on the study cited by Mr. Bourassa, conducted by David A. Gordon, Myron J. Gordon and Lawrence I. Gould[11] that he asserts support exclusive use of analysts' forecasts in the DCF model?

A. Yes. The article cited by Mr. Bourassa does not conclude that investors ignore past growth when pricing stocks. Instead, the article describes more generally that methods exclusively using analysts' forecasts are "popular or attractive models" but does not support the conclusion that these forecasts should be used alone.

Q. Does Professor Gordon recommend relying exclusively on analysts' forecasts as the measure of growth in the DCF model?

A. No. Subsequent to the study cited by Mr. Bourassa,[12] Professor Gordon provided the keynote address at the 30th Financial Forum of the Society of Utility and Regulatory Financial Analysts, in which he stated:

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[11] Gordon, David A., Myron J. Gordon, Lawrence I. Gould. "Choice Among Methods of Estimating Share Yield." *The Journal of Portfolio Management*. Spring 1989. pp. 50-55. (Bourassa's direct testimony, page 36, footnote.)

[12] Ibid.

> *I understand that companies coming before regulatory agencies liked and advocated the high growth rates in security analyst forecasts for arriving at their cost of equity capital. Instead of rejecting these forecasts, I understand that FERC and other regulatory agencies have decided to compromise with them. In particular, in arriving at the cost of equity for company X, the FERC has decided to arrive at the growth rate in my dividend growth model by using an average of two growth rates. One is security analysts forecast of the short-term growth rate in earnings provided by IBES or Value Line and the other a more long run and typically lower figure such as the past growth in GNP.*
>
> *Such an average can be questioned on various grounds. However, my judgment is that between the short-term forecast alone and its average with the past growth rate in GNP,* ***the latter may be a more reasonable figure.***[13] (Emphasis added)

Simply stated, Professor Gordon would temper the typically higher analysts' forecasts with the typically lower GNP growth rate by averaging the two.

Q. How does Staff respond to Mr. Bourassa's statement, "Logically, in estimating future growth, financial institutions and analysts have taken into account all relevant historical information on a company as well as other more recent information. To the extent that past results provide useful indications of future growth prospects, analysts' forecasts would already incorporate that information."? (Bourassa's Direct Testimony, Page 28, line 2-6)

A. The appropriate growth rate to use in the DCF formula is the dividend growth rate expected by *investors*, not analysts. Therefore, while analysts may have considered historical measures of growth, it is reasonable to assume that investors rely to some extent on past growth as well. This calls for consideration of both analysts' forecasts as well as past growth.

[13] Gordon, M. J. Keynote Address at the 30th Financial Forum of the Society of Utility and Regulatory Financial Analysts. May 8, 1998. Transparency 3.

Q. **Does Staff have any other evidence to support its assertion that exclusive reliance on analysts' forecasts of earnings growth in the DCF model would result in inflated cost of equity estimates?**

A. Yes. Experts in the financial community have commented on the optimism in analysts' forecasts of future earnings.[14] A study cited by David Dreman in his book *Contrarian Investment Strategies: The Next Generation* found that *Value Line* analysts were optimistic in their forecasts by 9 percent annually, on average for the 1987 – 1989 period. Another study conducted by David Dreman found that between 1982 and 1997, analysts overestimated the growth of earnings of companies in the S&P 500 by 188 percent.

Also, Burton Malkiel of Princeton University studied the one-year and five-year earnings forecasts made by some of the most respected names in the investment business. His results showed that the five-year estimates of professional analysts, when compared with actual earnings growth rates, were much worse than the predictions from several naïve forecasting models, such as the long-run rate of growth of national income. In the following excerpt from Professor Malkiel's book A Random Walk Down Wall Street, he discusses the results of his study:

> *When confronted with the poor record of their five-year growth estimates,* ***the security analysts honestly, if sheepishly, admitted that five years ahead is really too far in advance to make reliable projections.*** *They protested that although long-term projections are admittedly important, they really ought to be judged on their ability to project earnings changes one year ahead. Believe it or not, it turned out that their one-year forecasts were even worse than their five-year projections.*
>
> *The analysts fought back gamely. They complained that it was unfair to judge their performance on a wide cross section of industries, because earnings for high-tech firms and various "cyclical" companies are*

[14] See Seigel, Jeremy J. Stocks for the Long Run. 2002. McGraw-Hill. New York. p. 100. Dreman, David. *Contrarian Investment Strategies: The Next Generation*. 1998. Simon & Schuster. New York. pp. 97-98. Malkiel, Burton G. *A Random Walk Down Wall Street*. 2003. W.W. Norton & Co. New York. p. 175.
Testimony of Professors Myron J. Gordon and Lawrence I. Gould, consultant to the Trial Staff (Common Carrier Bureau), FCC Docket 79-63, p. 95.

> ***notoriously hard to forecast. "Try us on utilities," one analyst confidently asserted. At the time they were considered among the most stable group of companies because of government regulation. So we tried it and they didn't like it. Even the forecasts for the stable utilities were far off the mark.***[15] (Emphasis added)

Q. Are investors aware of the problems related to analysts' forecasts?

A. Yes. In addition to books, there are numerous published articles appearing in *The Wall Street Journal* and other financial publications that cast doubt as to how accurate research analysts are in their forecasts.[16] Investors, being keenly aware of these inherent biases in forecasts, will use other methods to assess future growth.

Q. Should DPS growth be considered in a DCF analysis?

A. Yes. As previously stated on section V of this testimony, the current market price of a stock is equal to the present value of all expected future dividends, not future earnings. Professor Jeremy Siegel from the Wharton School of Finance stated:

> *Note that the price of the stock is always equal to the present value of all future dividends and not the present value of future earnings. Earnings not paid to investors can have value only if they are paid as dividends or other cash disbursements at a later date. Valuing stock as the present discounted value of future earnings is manifestly wrong and greatly overstates the value of the firm.*[17]

In other words, investors pay attention to earnings as long as they are paid as dividends. Earnings can easily be overstated. If investors do not receive dividends or other cash disbursement at a later date, then such earnings are meaningless.

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[15] Malkiel, Burton G. A Random Walk Down Wall Street. 2003. W.W. Norton & Co. New York. p. 175
[16] See Smith, Randall & Craig, Suzanne. "Big Firms Had Research Ploy: Quiet Payments Among Rivals." *The Wall Street Journal*. April 30, 2003. Brown, Ken. "Analysts: Still Coming Up Rosy." *The Wall Street Journal*. January 27, 2003. p. C1. Karmin, Craig. "Profit Forecasts Become Anybody's Guess." *The Wall Street Journal*. January 21, 2003. p. C1. Gasparino, Charles. "Merrill Lynch Investigation Widens." *The Wall Street Journal*. April 11, 2002. p. C4. Elstein, Aaron. "Earnings Estimates Are All Over the Map." *The Wall Street Journal*. August 2, 2001. p. C1. Dreman, David. "Don't Count on those Earnings Forecasts." *Forbes*. January 26, 1998. p. 110.
[17] Seigel, Jeremy J. Stocks for the Long Run. 2002. McGraw-Hill. New York. P. 93.

Multi-Stage DCF

Q. Does Staff have any comments on Mr. Bourassa's sole reliance on forecasted earnings growth for the near-term ("Stage -1 growth") in his multi-stage DCF?

A. Yes. As previously discussed, exclusive reliance on forecasted earnings growth for the near-term (Stage-1 growth) is inappropriate since analysts forecasts of earnings growth are known to be overly optimistic. Reliance on forecasted earnings growth, to the exclusion of historic EPS and historical and projected DPS, likely results in inflated cost of equity estimates.

Firm-Specific Risk

Q. What is Staff's response to Mr. Bourassa's contention that the market data provided by the sample water utilities does not capture all of the market risk associated with LPSCO due to Arizona regulatory requirements use of historical test years and limited out of period adjustment recognition?[18]

A. The examples cited by Mr. Bourassa are examples of firm-specific or unique risks. Existence of firm-specific risk does not necessarily indicate that a company has more total risk than others as all companies have firm-specific risks. Moreover, as previously discussed, the market does not compensate investors for firm-specific risk because it can be eliminated through diversification.

[18] Direct Testimony of Thomas J. Bourassa, LPSCO Sewer Corporation, Docket No. SW-01428A-09-0103 & W-01427A-09-0104, page 18 lines 16-17

Q. Does Staff have a response to Mr. Bourassa's assertion that LPSCO is not comparable to the six publicly traded water utilities in the sample group due to a difference in size?[19]

A. The Commission has previously ruled that firm size does not warrant recognition of a risk premium. In Decision No. 64282, dated December 28, 2001, for Arizona Water, the Commission stated "We do not agree with the Company's proposal to assign a risk premium to Arizona Water based on its size relative to other publicly traded water utilities…" In Decision No. 64727, dated April 17, 2002, for Black Mountain Gas, the Commission agreed with Staff that "the 'firm size phenomenon' does not exist for regulated utilities, and that therefore there is no need to adjust for risk for small firm size in utility rate regulation."

X. CONCLUSION

Q. Please summarize Staff's recommendations.

A. Staff recommends that the Commission adopt a capital structure for LPSCO in this proceeding composed of 17.2 percent debt and 82.8 percent equity.

Staff also recommends that the Commission adopt an 8.7 percent ROR for the Applicant, based on Staff's cost of equity estimates that range from 9.7 percent to 10.2 percent for the sample companies and to reflect an 80 basis point downward financial risk adjustment.

Q. Does this conclude your Direct Testimony?

A. Yes, it does.

---

[19] Direct Testimony of Thomas J. Bourassa, LPSCO Sewer Corporation, Docket No. SW-01428A-09-0103 & W-01427A-09-0104, page 21 lines 11-13

Litchfield Park Service Company Cost of Capital Calculation
Capital Structure
And Weighted Average Cost of Capital
Staff Recommended and Company Proposed

[A]	[B]	[C]	[D]
Description	Weight (%)	Cost	Weighted Cost
Staff Recommended Structure			
Debt	17.2%	6.4%	1.1%
Common Equity	82.8%	9.2%	7.6%
Weighted Average Cost of Capital			**8.7%**
Company Proposed Structure			
Debt	17.5%	6.4%	1.1%
Common Equity	82.5%	12.5%	10.3%
Weighted Average Cost of Capital			**11.4%**

[D] : [B] x [C]
Supporting Schedules: JCM-3 and JCM-4.

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Litchfield Park Service Company Cost of Capital Calculation
Final Cost of Equity Estimates
Sample Water Utilities

[A]	[B]		[C]		[D]		[E]
DCF Method			D_1/P_0[1]	+	g[2]	=	k
Constant Growth DCF Estimate			3.5%	+	5.8%	=	9.3%
Multi-Stage DCF Estimate						=	10.1%
Average of DCF Estimates							**9.7%**
CAPM Method	Rf	+	β[5]	x	(Rp)	=	k
Historical Market Risk Premium[3]	2.9%	+	0.82	x	6.9% [6]	=	8.5%
Current Market Risk Premium[4]	4.0%	+	0.82	x	9.6% [7]	=	11.9%
Average of CAPM Estimates							**10.2%**
					Average		**10.0%**
					Financial risk adjustment		-0.8%
					Total		**9.2%**

1 MSN Money and Value Line

2 Schedule JCM-8

3 Risk-free rate (Rf) for 5, 7, and 10 year Treasury rates from the U.S. Treasury Department at www.ustreas.gov

4 Risk-free rate (Rf) for 30 Year Treasury bond rate from the U.S. Treasury Department at www.ustreas.gov

5 Value Line

6 Historical Market Risk Premium (Rp) calculated from Ibbotson Associates SBBI 2009 Yearbook data

7 Testimony

Litchfield Park Service Company Cost of Capital Calculation
Average Capital Structure of Sample Water Utilities

[A]	[B]	[C]	[D]
Company	Debt	Common Equity	Total
American States Water	53.3%	46.7%	100.0%
California Water	44.7%	55.3%	100.0%
Aqua America	54.9%	45.1%	100.0%
Connecticut Water	50.6%	49.4%	100.0%
Middlesex Water	52.7%	47.3%	100.0%
SJW Corp	48.4%	51.6%	100.0%
Average Sample Water Utilities	**50.8%**	**49.2%**	**100.0%**
LPSCO - Actual Capital Structure	**17.2%**	**82.8%**	**100.0%**

Source:
Sample Water Companies from Value Line

Litchfield Park Service Company Cost of Capital Calculation
Growth in Earnings and Dividends
Sample Water Utilities

[A]	[B]	[C]	[D]	[E]
Company	Dividends Per Share 1998 to 2008 DPS[1]	Dividends Per Share Projected DPS[1]	Earnings Per Share 1998 to 2008 EPS[1]	Earnings Per Share Projected EPS[1]
American States Water	1.8%	5.1%	3.7%	10.9%
California Water	0.9%	2.8%	2.7%	6.9%
Aqua America	7.0%	5.0%	6.2%	11.4%
Connecticut Water	1.3%	No Projection	1.0%	No Projection
Middlesex Water	2.1%	No Projection	2.9%	No Projection
SJW Corp	5.5%	No Projection	3.0%	No Projection
Average Sample Water Utilities	**3.1%**	**4.3%**	**3.4%**	**9.7%**

1 Value Line

Litchfield Park Service Company Cost of Capital Calculation
Sustainable Growth
Sample Water Utilities

[A]	[B]	[C]	[D]	[E]	[F]
Company	Retention Growth **1999 to 2008** br	Retention Growth Projected br	Stock Financing Growth vs	Sustainable Growth **1999 to 2008** br + vs	Sustainable Growth Projected br + vs
American States Water	3.0%	6.3%	1.4%	4.5%	7.7%
California Water	2.0%	6.1%	4.1%	6.1%	10.2%
Aqua America	4.8%	5.7%	3.5%	8.3%	9.2%
Connecticut Water	2.6%	No Projection	0.8%	3.4%	No Projection
Middlesex Water	1.4%	No Projection	2.2%	3.6%	No Projection
SJW Corp	4.5%	No Projection	0.1%	4.6%	No Projection
Average Sample Water Utilities	**3.0%**	**6.0%**	**2.0%**	**5.1%**	**9.0%**

[B]: Value Line
[C]: Value Line
[D]: Value Line and MSN Money
[E]: [B]+[D]
[F]: [C]+[D]

Litchfield Park Service Company Cost of Capital Calculation
Selected Financial Data of Sample Water Utilities

[A]	[B]	[C]	[D]	[E]	[F]	[G]
Company	Symbol	Spot Price 9/30/2009	Book Value	Mkt To Book	*Value Line* Beta β	Raw Beta βraw
American States Water	AWR	**36.18**	18.59	1.9	**0.80**	0.67
California Water	CWT	**38.94**	21.01	1.9	**0.80**	0.67
Aqua America	WTR	**17.64**	9.18	1.9	**0.65**	0.45
Connecticut Water	CTWS	**22.39**	12.61	1.8	**0.85**	0.75
Middlesex Water	MSEX	**15.08**	10.88	1.4	**0.80**	0.67
SJW Corp	SJW	**22.85**	14.68	1.6	**1.00**	0.97
Average				**1.7**	**0.82**	**0.70**

[C]: Msn Money

[D]: Value Line

[E]: [C] / [D]

[F]: Value Line

[G]: (-0.35 + [F]) / 0.67

Litchfield Park Service Company Cost of Capital Calculation
Calculation of Expected Infinite Annual Growth in Dividends
Sample Water Utilities

[A]	[B]
Description	g
DPS Growth - Historical[1]	3.1%
DPS Growth - Projected[1]	4.3%
EPS Growth - Historical[1]	3.4%
EPS Growth - Projected[1]	9.7%
Sustainable Growth - Historical[2]	5.1%
Sustainable Growth - Projected[2]	9.0%
Average	**5.8%**

1 Schedule JCM-5

2 Schedule JCM-6

Litchfield Park Service Company Cost of Capital Calculation
Multi-Stage DCF Estimates
Sample Water Utilities

[A]	[B]	[C]	[D]	[E]	[F]	[H]	[I]
Company	Current Mkt. Price (P_o)[1] 9/30/2009	Projected Dividends[2] (Stage 1 growth) (D_t) d1	d2	d3	d4	Stage 2 growth[3] (g_n)	Equity Cost Estimate (K)[4]
American States Water	36.2	1.01	1.07	1.13	1.20	6.7%	9.4%
California Water	38.9	1.21	1.28	1.36	1.44	6.7%	9.7%
Aqua America	17.6	0.56	0.60	0.63	0.67	6.7%	9.8%
Connecticut Water	22.4	0.94	1.00	1.05	1.11	6.7%	10.8%
Middlesex Water	15.1	0.74	0.78	0.83	0.88	6.7%	11.5%
SJW Corp	22.9	0.68	0.72	0.76	0.80	6.7%	9.6%

Average **10.1%**

$$P_0 = \sum_{t=1}^{n} \frac{D_t}{(1+K)^t} + \frac{D_n(1+g_n)}{K-g_n}\left[\frac{1}{(1+K)}\right]^n$$

Where: P_0 = current stock price
D_t = dividends expected during stage 1
K = cost of equity
n = years of non – constant growth
D_n = dividend expected in year n
g_n = constant rate of growth expected after year n

1 [B] see Schedule JCM-7
2 Derived from Value Line Information
3 Average annual growth in GDP 1929 - 2008 in current dollars.
4 Internal Rate of Return of Projected Dividends

BEFORE THE ARIZONA CORPORATION COMMISSION

KRISTIN K. MAYES
Chairman
GARY PIERCE
Commissioner
SANDRA D. KENNEDY
Commissioner
PAUL NEWMAN
Commissioner
BOB STUMP
Commissioner

IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WATER AND WASTEWATER RATES AND CHARGES FOR UTILITY SERVICE BASED THEREON	)	DOCKET NOS. SW-01428A-09-0103 W-01427A-09-0104

SURREBUTTAL

TESTIMONY

OF

JUAN C. MANRIQUE

PUBLIC UTILITIES ANALYST I

UTILITIES DIVISION

ARIZONA CORPORATION COMMISSION

DECEMBER 17, 2009

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SCHEDULES

EXECUTIVE SUMMARY
LITCHFIELD PARK SERVICE COMPANY
DOCKET NOS. SW-01428A-09-0103 AND
W-01427A-09-0104

The Surrebuttal Testimony of Staff witness Juan C. Manrique addresses the following issues:

Capital Structure – Staff recommends that the Arizona Corporation Commission ("Commission") adopt a capital structure for Litchfield Park Service Company ("LPSCO" or "Applicant") for this proceeding consisting of 17.2 percent debt and 82.8 percent equity.

Cost of Equity – Staff recommends that the Commission adopt a 9.2 percent return on equity ("ROE") for the Applicant. Staff's estimated ROE for the Applicant is based on cost of equity estimates for the sample companies ranging from 9.8 percent for the discounted cash flow method ("DCF") to 10.1 percent for the capital asset pricing model ("CAPM"). Staff's ROE recommendation includes a 0.8 percent downward adjustment to reflect a lower financial risk in the Applicant's capital structure compared to that of the sample companies.

Overall Rate of Return – Staff recommends that the Commission adopt an overall rate of return ("ROR") of 8.7 percent.

Response to the Rebuttal Testimony of Applicant's witness Mr. Thomas J. Bourassa – The Commission should reject the Company's proposals to allow for a firm size adjustment, to selectively eliminate inputs in Staff's cost of equity estimation with unfavorable outputs resulting in an imbalance in Staff's cost of equity estimation, and to rely exclusively on analyst's forecasts for DCF estimates.

I. INTRODUCTION

Q. Please state your name, occupation, and business address.

A. My name is Juan C. Manrique. I am a Public Utilities Analyst employed by the Arizona Corporation Commission ("ACC" or "Commission") in the Utilities Division ("Staff"). My business address is 1200 West Washington Street, Phoenix, Arizona 85007.

Q. Are you the same Juan C. Manrique who filed direct testimony in this case?

A. Yes, I am.

Q. What is the purpose of your Surrebuttal Testimony in this rate proceeding?

A. The purpose of my Surrebuttal Testimony in this rate proceeding is to report on Staff's updated cost of capital analysis with its recommendations regarding Litchfield Park Service Corporation's ("LPSCO" or "Applicant") cost of capital and to respond to the cost of capital portion of the Rebuttal Testimony of LPSCO's witness Mr. Thomas J. Bourassa ("Mr. Bourassa's Rebuttal").

Q. Please explain how Staff's Surrebuttal Testimony is organized.

A. Staff's Surrebuttal Testimony is presented in four sections. Section I is this introduction. Section II discusses Staff's updated cost of capital analysis. Section III presents Staff's comments on Mr. Bourassa's Rebuttal. Lastly, Section IV presents Staff's recommendations.

II. COST OF EQUITY AND OVERALL RATE OF RETURN

Q. Did Staff update its analysis concerning the Applicant's cost of equity ("COE") since it filed its Direct Testimony?

A. Yes. Staff updated its analysis to include the most updated data available.

Q. What is Staff's updated COE?

A. Staff's updated analysis resulted in no change to its recommended COE. Staff continues to recommend a COE of 9.2 percent.

Q. What is Staff recommending for LPSCO's COE?

A. Staff is recommending a COE of 9.2 percent derived from its updated cost of equity estimated range from 9.8 percent to 10.1 percent with a downward financial risk adjustment of 80 basis points (0.8 percent).

Q. Did Staff update its analysis concerning the Applicant's overall rate of return?

A. Yes.

Q. What is Staff's updated overall rate of return?

A. Staff's updated overall rate of return remains 8.7 percent.

Q. What is Staff recommending for LPSCO's overall rate of return?

A. Staff is recommending an overall rate of return of 8.7 percent. Staff's recommendation is based on a COE of 9.2 percent, a cost of debt at 6.4 percent and a capital structure of 82.8 percent equity and 17.2 percent debt, as shown on Surrebuttal Schedule JCM-1.

III. RESPONSE TO THE REBUTTAL TESTIMONY OF THE APPLICANT'S COST OF CAPITAL WITNESS

Mr. Bourassa's Rebuttal

Q. Does Staff have a response to Mr. Bourassa's citation that "[i]n Chapter 7 of Morningstar's Ibbotson SBBI 2009 Valuation Yearbook, for example, Ibbotson reports that when betas are properly estimated, betas are larger for smaller companies than for larger companies"[1]?

A. Yes. It is generally understood that smaller companies tend to have higher betas than larger companies due to larger variations in earnings, thus making the smaller companies more risky. However, the Ibbotson report pertains to a broad spectrum of stocks that are not specific to the utilities industry. A utility industry specific study[2] to determine whether the firm size phenomenon exists in the public utility industry concluded that there is no need to adjust for firm size in utility rate regulation. Also, much of the higher variance in small stocks has been attributed to the "January effect" that is expected to have a larger impact on smaller stocks than larger stocks because smaller stocks are less likely to be in the portfolios of tax-exempt institutional investors and pension funds.

Q. Does Staff agree with Mr. Bourassa then that LPSCO should receive a higher cost of equity estimate because of its smaller size through a "small firm risk premium"[3]?

A. No. Company size is a firm-specific risk which can be eliminated through diversification. Consequently, fully diversified investors, like LPSCO's Parent Company (Algonquin Power Income Fund) would not expect additional compensation due to firm size.

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[1] Mr. Bourassa's Rebuttal, page 5-6, lines 21-22 and 1-2, respectively.
[2] Wong, Annie. "Utility Stocks and the Size Effect: An Empirical Analysis." *Journal of the Midwest Finance Association. 1993. pp. 95-101.*
[3] Mr. Bourassa's Rebuttal, page 6 line 18

Q. What is Staff's response to Mr. Bourassa's criticism of Staff's use of the Hamada risk adjustment on book value of equity since Professor Hamada developed his method using market values?[4]

A. Staff acknowledges that the Hamada methodology was developed using market values of equity for estimating a financial risk adjustment. However, Staff believes that the use of book values to estimate a financial risk adjustment is prudent and reasonable.

Q. Please respond to Mr. Bourassa's argument that "...Staff's historical DPS growth rates produce indicated costs of equity *below* the cost of debt for 3 of the 6 publicly traded water utilities in Staff's water proxy group – one as low as 3.9 percent."[5]

A. Staff uses a balanced approach to cost of equity model which takes into account both high and low outcomes. Mr. Bourassa suggests that inputs that have outcomes that produce unfavorable results should be selectively eliminated. Such selective exclusions are inconsistent with the fundamental concept of Staff's cost of equity estimation model to include a balance among inputs.

Q. Does Staff have a response to Mr. Bourassa's assertion that "[i]f investors rely on analysts' growth rate forecasts, those are the forecasts of relevance to the determination of equity costs"[6]?

A. Yes. Mr. Bourassa makes this assertion as if the *only* factor investors look at is analysts' growth rates. Investors do rely on analysts forecasts as one factor in investment decisions; however, other factors such as historical data also factor into investors' investment decisions.

[4] Mr. Bourassa's Rebuttal, page 8 lines 11-18
[5] Mr. Bourassa's Rebuttal, page 13, lines 6-8
[6] Mr. Bourassa's Rebuttal, page 11, lines 16-18

IV. STAFF RECOMMENDATIONS

Q. What are Staff's recommendations for LPSCO's cost of capital?

A. Staff makes the following recommendations for LPSCO's cost of capital:

1. Staff recommends a capital structure of 17.2 percent debt and 82.8 percent equity.
2. Staff recommends a cost of debt of 6.4 percent.
3. Staff recommends a cost of equity of 9.2 percent.
4. Staff recommends an overall rate of return of 8.7 percent.

Q. Does this conclude your Testimony?

A. Yes, it does.

Litchfield Park Service Company Cost of Capital Calculation
Capital Structure
And Weighted Average Cost of Capital
Staff Recommended and Company Proposed

[A]	[B]	[C]	[D]
Description	Weight (%)	Cost	Weighted Cost
Staff Recommended Structure			
Debt	17.2%	6.4%	1.1%
Common Equity	82.8%	9.2%	7.6%
Weighted Average Cost of Capital			**8.7%**
Company Proposed Structure			
Debt	17.9%	6.4%	1.1%
Common Equity	82.1%	12.0%	9.9%
Weighted Average Cost of Capital			**11.0%**

[D] : [B] x [C]
Supporting Schedules: JCM-3 and JCM-4.

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Litchfield Park Service Company Cost of Capital Calculation
Final Cost of Equity Estimates
Sample Water Utilities

[A]	[B]		[C]		[D]		[E]
DCF Method			D_1/P_0 [1]	+	g [2]	=	k
Constant Growth DCF Estimate			3.6%	+	5.8%	=	9.4%
Multi-Stage DCF Estimate						=	10.2%
Average of DCF Estimates							**9.8%**
CAPM Method	Rf	+	β [5]	x	(Rp)	=	k
Historical Market Risk Premium[3]	2.7%	+	0.80	x	6.9% [6]	=	8.3%
Current Market Risk Premium[4]	4.3%	+	0.80	x	9.4% [7]	=	11.8%
Average of CAPM Estimates							**10.1%**
					Average		**10.0%**
					Financial risk adjustment		-0.8%
					Total		**9.2%**

1 MSN Money and Value Line

2 Schedule JCM-8

3 Risk-free rate (Rf) for 5, 7, and 10 year Treasury rates from the U.S. Treasury Department at www.ustreas.gov

4 Risk-free rate (Rf) for 30 Year Treasury bond rate from the U.S. Treasury Department at www.ustreas.gov

5 Value Line

6 Historical Market Risk Premium (Rp) calculated from Ibbotson Associates SBBI 2009 Yearbook data

7 Testimony

Litchfield Park Service Company Cost of Capital Calculation
Average Capital Structure of Sample Water Utilities

[A]	[B]	[C]	[D]
Company	Debt	Common Equity	Total
American States Water	48.4%	51.6%	100.0%
California Water	47.9%	52.1%	100.0%
Aqua America	52.7%	47.3%	100.0%
Connecticut Water	50.7%	49.3%	100.0%
Middlesex Water	53.2%	46.8%	100.0%
SJW Corp	48.6%	51.4%	100.0%
Average Sample Water Utilities	**50.2%**	**49.8%**	**100.0%**
LPSCO - Actual Capital Structure	**17.2%**	**82.8%**	**100.0%**

Source:
Sample Water Companies from Value Line

Litchfield Park Service Company Cost of Capital Calculation
Growth in Earnings and Dividends
Sample Water Utilities

[A]	[B]	[C]	[D]	[E]
Company	Dividends Per Share 1998 to 2008 DPS[1]	Dividends Per Share Projected DPS[1]	Earnings Per Share 1998 to 2008 EPS[1]	Earnings Per Share Projected EPS[1]
American States Water	1.8%	4.6%	3.7%	10.9%
California Water	0.9%	2.8%	2.7%	6.9%
Aqua America	7.0%	5.0%	6.2%	11.4%
Connecticut Water	1.3%	No Projection	1.0%	No Projection
Middlesex Water	2.1%	No Projection	2.9%	No Projection
SJW Corp	5.5%	No Projection	3.0%	No Projection
Average Sample Water Utilities	**3.1%**	**4.1%**	**3.4%**	**9.7%**

1 Value Line

Litchfield Park Service Company Cost of Capital Calculation
Sustainable Growth
Sample Water Utilities

[A]	[B]	[C]	[D]	[E]	[F]
Company	Retention Growth **1999 to 2008** br	Retention Growth Projected br	Stock Financing Growth vs	Sustainable Growth **1999 to 2008** br + vs	Sustainable Growth Projected br + vs
American States Water	3.0%	6.4%	1.4%	4.4%	7.8%
California Water	2.0%	6.1%	4.1%	6.1%	10.2%
Aqua America	4.8%	5.7%	3.8%	8.5%	9.4%
Connecticut Water	2.6%	No Projection	0.8%	3.4%	No Projection
Middlesex Water	1.4%	No Projection	2.8%	4.2%	No Projection
SJW Corp	4.5%	No Projection	0.1%	4.5%	No Projection
Average Sample Water Utilities	**3.0%**	**6.1%**	**2.2%**	**5.2%**	**9.1%**

[B]: Value Line
[C]: Value Line
[D]: Value Line and MSN Money
[E]: [B]+[D]
[F]: [C]+[D]

Litchfield Park Service Company Cost of Capital Calculation
Selected Financial Data of Sample Water Utilities

[A]	[B]	[C]	[D]	[E]	[F]	[G]
Company	Symbol	Spot Price 12/2/2009	Book Value	Mkt To Book	*Value Line* Beta β	Raw Beta βraw
American States Water	AWR	**33.77**	17.80	1.9	**0.80**	0.67
California Water	CWT	**37.19**	20.21	1.8	**0.75**	0.60
Aqua America	WTR	**16.85**	8.26	2.0	**0.65**	0.45
Connecticut Water	CTWS	**23.28**	12.67	1.8	**0.85**	0.75
Middlesex Water	MSEX	**16.91**	10.98	1.5	**0.80**	0.67
SJW Corp	SJW	**21.43**	14.84	1.4	**0.95**	0.90
Average				**1.8**	**0.80**	**0.67**

[C]: Msn Money

[D]: Value Line

[E]: [C] / [D]

[F]: Value Line

[G]: (-0.35 + [F]) / 0.67

Litchfield Park Service Company Cost of Capital Calculation
Calculation of Expected Infinite Annual Growth in Dividends
Sample Water Utilities

[A]	[B]
Description	g
DPS Growth - Historical[1]	3.1%
DPS Growth - Projected[1]	4.1%
EPS Growth - Historical[1]	3.4%
EPS Growth - Projected[1]	9.7%
Sustainable Growth - Historical[2]	5.2%
Sustainable Growth - Projected[2]	9.1%
Average	**5.8%**

1 Schedule JCM-5

2 Schedule JCM-6

Litchfield Park Service Company Cost of Capital Calculation
Multi-Stage DCF Estimates
Sample Water Utilities

[A]	[B]	[C]	[D]	[E]	[F]	[H]	[I]
Company	Current Mkt. Price (P_o)[1] 12/2/2009	Projected Dividends[2] (Stage 1 growth) (D_t) d_1	d_2	d_3	d_4	Stage 2 growth[3] (g_n)	Equity Cost Estimate (K)[4]
American States Water	33.8	1.06	1.12	1.18	1.25	6.7%	9.7%
California Water	37.2	1.23	1.30	1.38	1.46	6.7%	9.9%
Aqua America	16.9	0.57	0.60	0.64	0.68	6.7%	10.0%
Connecticut Water	23.3	0.93	0.98	1.03	1.09	6.7%	10.6%
Middlesex Water	16.9	0.75	0.79	0.84	0.89	6.7%	11.0%
SJW Corp	21.4	0.69	0.73	0.77	0.81	6.7%	9.8%
						Average	**10.2%**

$$P_0 = \sum_{t=1}^{n} \frac{D_t}{(1+K)^t} + \frac{D_n(1+g_n)}{K-g_n}\left[\frac{1}{(1+K)}\right]^n$$

Where: P_0 = current stock price
D_t = dividends expected during stage 1
K = cost of equity
n = years of non – constant growth
D_n = dividend expected in year n
g_n = constant rate of growth expected after year n

1 [B] see Schedule JCM-7
2 Derived from Value Line Information
3 Average annual growth in GDP 1929 - 2008 in current dollars.
4 Internal Rate of Return of Projected Dividends

BEFORE THE ARIZONA CORPORATION COMMISSION

KRISTIN K. MAYES
Chairman
GARY PIERCE
Commissioner
PAUL NEWMAN
Commissioner
SANDRA D. KENNEDY
Commissioner
BOB STUMP
Commissioner

IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WATER RATES, AND CHARGES FOR UTILITY SERVICE BASED THEREON, AND APPROVAL OF ASSOCIATED FINANCINGS	DOCKET NO. W-01427A-09-0104 DOCKET NO. W-01427A-09-0116 DOCKET NO. W-01427A-09-0120

DIRECT

TESTIMONY

OF

JEFFREY M. MICHLIK

PUBLIC UTILITIES ANALYST V

UTILITIES DIVISION

ARIZONA CORPORATION COMMISSION

NOVEMBER 4, 2009

ALL-STATE LEGAL®
EXHIBIT
S-14
ADMITTED

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SCHEDULES

EXECUTIVE SUMMARY
LITCHFIELD PARK SERVICE COMPANY
WATER DIVISION
DOCKET NOS. W-01427A-09-0104, W-01427A-09-0116, AND W-01427A-09-0120

Litchfield Park Service Company – Water Division ("LPSCO or Company") is an Arizona "C" Corporation. Its principal place of business is 12725 W. Indian School Road, Suite D-101, Avondale, Arizona. The Company is engaged in the business of providing water utility services in its certificated areas in portions of Pinal County, Arizona. The Company served approximately 15,600 water customers during the test year ended September 30, 2008. The Company's current rates were approved in Decision No. 65436, dated December 9, 2002.

Rate Application:

The Company proposes rates that would increase operating revenue by $7,508,146 to produce operating revenue of $13,983,149 resulting in operating income of $4,327,196, or a 115.96 percent increase over test year revenue of $6,475,003. The Company also proposes a fair value rate base ("FVRB") of $37,924,592, which is its original cost rate base ("OCRB"), and an 11.41 percent rate of return on the FVRB.

Staff recommends rates that would increase operating revenue by $5,328,747 to produce operating revenue of $11,803,750 resulting in operating income of $3,237,982, or an 82.30 percent increase over adjusted test year revenue of $6,475,003. Staff recommends an OCRB of $37,218,182 which is its FVRB, and an 8.70 percent rate of return on the FVRB.

Financings:

The Company submitted two financing applications to assist in funding certain capital projects. One project, under Docket No. 09-0116 for the construction of two recharge wells, is estimated at $1,755,000 and another project, under Docket No. 09-0120 for the construction of a 200 kW roof mounted solar generator, is estimated at $1,170,000. The Company is requesting approval of funding for these two projects through the use of Water Infrastructure Financing Authority ("WIFA") indebtedness. Staff recommends approval of these financing requests.

INTRODUCTION

Q. Please state your name, occupation, and business address.

A. My name is Jeffrey M. Michlik. I am a Public Utilities Analyst V employed by the Arizona Corporation Commission ("ACC" or "Commission") in the Utilities Division ("Staff"). My business address is 1200 West Washington Street, Phoenix, Arizona 85007.

Q. Briefly describe your responsibilities as a Public Utilities Analyst V.

A. In my capacity as a Public Utilities Analyst V, I analyze and examine accounting, financial, statistical and other information and prepare reports based on my analyses that present Staff's recommendations to the Commission on utility revenue requirements, rate design and other matters. I also provide expert testimony on these same issues.

Q. Please describe your educational background and professional experience.

A. In 2000, I graduated from Idaho State University, receiving a Bachelor of Business Administration Degree in Accounting and Finance, and I am a Certified Public Accountant with the Arizona State Board of Accountancy. I have attended the National Association of Regulatory Utility Commissioners' ("NARUC") Utility Rate School, which presents general regulatory and business issues.

I joined the Commission as a Public Utilities Analyst in May of 2006. Prior to employment with the Commission, I worked four years for the Arizona Office of the Auditor General as a Staff Auditor, and one year in public accounting as a Senior Auditor.

Q. What is the scope of your testimony in this case?

A. I am presenting Staff's analysis and recommendations regarding Litchfield Park Service Company's ("LPSCO" or "Company") application for a permanent increase in its rates and charges for water utility service within Maricopa County, Arizona. I am presenting testimony and schedules addressing rate base, operating revenues and expenses, revenue requirement, and financings. Staff witness Pedro Chavez is presenting Staff's rate design. Staff witness Juan Manrique is presenting Staff's cost of capital. Mr. Marlin Scott Jr. is presenting Staff's engineering analysis and related recommendations.

Q. What is the basis of your testimony in this case?

A. I performed a regulatory audit of the Company's application and records. The regulatory audit consisted of examining and testing financial information, accounting records, and other supporting documentation and verifying that the accounting principles applied were in accordance with the Commission-adopted NARUC Uniform System of Accounts ("USOA").

BACKGROUND

Q. Please review the background of this application.

A. The Company is an Arizona "C" Corporation. Its principal place of business is 12725 W. Indian School Road, Suite D-101, Avondale, Arizona. The Company is engaged in the business of providing water utility services in its certificated areas in portions of Maricopa County, Arizona. The Company served approximately 15,600 water customers during the test year ended September 30, 2008. The Company's current rates were approved in Decision No. 65436, dated December 9, 2002.

The Company is a wholly owned subsidiary of Algonquin Water Resources. Algonquin Water Resources is the Company's only shareholder. Algonquin Water Resources is a wholly-owned subsidiary of Algonquin Power Income Fund[1] (Algonquin Water Resources and Algonquin Power Income Fund are collectively referred to as "Algonquin").

In addition to LPSCO, Algonquin owns seven other companies located in Arizona: Black Mountain Sewer Company, Gold Canyon Sewer Company, Rio Rico Utilities, Inc., Entrada Del Oro Sewer Company, Northern Sunrise Water Company, Inc., Southern Sunrise Water Company, Inc., and Bella Vista Water Company. Algonquin has a contract to manage and operate Black Mountain. Algonquin also owns and/or operates utility systems in Illinois and Texas.

CONSUMER SERVICES

Q. Please provide a brief history of customer complaints received by the Commission regarding the Company. Additionally, please discuss customer responses to the Company's proposed rate increase.

A. A review of the Commission's Consumer Services database for the Company from January 1, 2006, to October 14, 2009, revealed the following for the Water Division:

2006 – Two complaints (one new service and one disconnect). 2007 – Three complaints (one deposit, one disconnect and one new service). 2008 – Three complaints (one billing, one new service and one quality of service). 2009 – Four complaints (two billing, one new service and one construction), and thirty-six opinions (rate case all opposed). All complaints have been resolved and closed except one which recently completed the mediation process.

[1] Algonquin Power Income Fund is an investment trust that owns or has interests in 71 companies in the United States and Canada, including 41 hydroelectric facilities, 5 natural gas cogeneration facilities, and 15 water and sewer facilities.

COMPLIANCE

Q. Please provide a summary of the compliance status of the Company.

A. A check of the ACC's Compliance database indicates that there are currently no delinquencies for the Company.

SUMMARY OF FILING, RECOMMENDATIONS, AND ADJUSTMENTS.

Q. Please summarize the Company's proposals in this filing.

A. The Company proposes rates that would increase operating revenues by $7,508,146 to produce operating revenue of $13,983,149 resulting in operating income of $4,327,196, or a 115.96 percent increase over test year revenue of $6,475,003. The Company also proposes a fair value rate base ("FVRB") of $37,924,592 which is its original cost rate base ("OCRB"), and an 11.41 percent rate of return on the FVRB.

Q. Please summarize Staff's recommendations.

A. Staff recommends rates that would increase operating revenue by $5,328,747 to produce operating revenue of $11,803,750 resulting in operating income of $3,237,982, or an 82.30 percent increase over adjusted test year revenue of $6,475,003. Staff recommends an OCRB of $37,218,182 which is its FVRB, and an 8.70 percent rate of return on the FVRB.

Q. What test year did the Company use in this filing?

A. The Company's rate filing is based on the twelve months ended September 30, 2008 ("test year").

Q. Please summarize the rate base adjustments addressed in your testimony.

A. My testimony addresses the following issues:

<u>Post-Test Year Plant</u> – This adjustment increases Post-Test Year Plant by $18,805 to reflect the Company's updated cost of Post-Test Year Plant.

<u>Plant Not Used and Useful</u> – This adjustment decreases Plant in Service by $78,879 to remove plant that was deemed not used and useful, and the associated funding sources in the amount of $16,565.

<u>Accumulated Depreciation</u> – This adjustment decreases accumulated depreciation by $35,223 based upon the adjustments Staff made to plant in service.

<u>Customer Deposits</u> – This adjustment increases customer deposits by $166,998 to include customer deposits.

<u>Deferred Income Taxes</u> – This adjustment increases Deferred Income Taxes by $314,036 to reverse the Company's pro-forma adjustment.

<u>Unamortized Debt Issuance Costs</u> – This adjustment removes Unamortized Debt Issuance Costs in the amount of $134,528.

<u>Deferred Regulatory Assets</u> – This adjustment removes Deferred Regulatory Assets in the amount of $82,561 to reflect Commission Decision No. 69912, dated September 27, 2007.

Q. Please summarize the operating revenue and expense adjustments addressed in your testimony.

A. My testimony addresses the following issues:

Corporate Expense Allocation – This adjustment decreases operating expenses by $250,182 to remove costs incurred related to the unregulated affiliate's business operations.

Rate Case Expense – This adjustment decreases rate case expense by $28,000 to reflect Staff's normalization over 5 years.

Meals and Entertainment Expense – This adjustment removes expenses in the amount of $827 for meals and entertainment.

Bad Debt Expense – This adjustment increases bad debt expenses by $5,284 to reflect the Staff's normalization of bad debt expense.

Depreciation Expense – This adjustment decreases expenses by $100,905 to adjust depreciation based on Staff's plant in service numbers.

Property Tax Expense – This adjustment decreases expenses by $116,358 to adjust property taxes to Staff's adjusted test year amount.

Income Tax Expense – This adjustment increases expenses by $198,423 to adjust income taxes to Staff's adjusted test year amount.

RATE BASE – WATER DIVISION

Fair Value Rate Base

Q. Did the Company prepare a schedule showing the elements of Reconstruction Cost New Rate Base?

A. No, the Company did not. The Company's filing treats the OCRB the same as the FVRB.

Rate Base Summary

Q. Please summarize Staff's adjustments to the Company's Water rate base shown on Schedules JMM-W3 and JMM-W4.

A. Staff's adjustments to the Company's rate base resulted in a net decrease of $706,410, from $37,924,592 to $37,218,182. This decrease was primarily due to: (1) removal of plant that was not serving customers during the test year, (2) related adjustment to accumulated depreciation, (3) adjustment to customer deposits, (4) adjustment to deferred income taxes, (5) adjustment to deferred assets, and (6) removal of unamortized debt issuance costs.

Rate Base Adjustment No. 1 – Water Division, Post-Test Year Plant

Q. Did Staff make an adjustment to post-test year plant?

A. Yes.

Q. What adjustment did Staff make?

A. Staff identified $18,805 as additional costs of the post-test year arsenic treatment project, as shown on Schedule JMM-W5.

Q. Doesn't Staff typically recommend disallowance of post test year plant?

A. Staff evaluates post-test year plant on a case by case basis, evaluating the facts and circumstances of each case. Largely because of its importance to the public health, in the past, Staff has recommended that post-test year plant related to arsenic treatment receive recognition in rate base.

Q. Why did Staff increase the amount of post-test year plant by $18,805?

A. Marlin Scott, Jr., Staff's Engineer, inspected the entire system and identified additional costs that the Company has incurred in relation to the arsenic treatment project (See Staff Engineering Report, Section I, Post Test Year Plant).

Q. What is Staff's recommendation?

A. Staff recommends increasing post-test year plant by $18,805 from $1,866,965 to $1,885,770, as shown on Schedules JMM-W4 and JMM-W5.

Rate Base Adjustment No. 2 – Water Division, Plant Not Used and Useful

Q. Did Staff make an adjustment to plant that was not used and useful?

A. Yes.

Q. What adjustment did Staff make?

A. Staff identified $78,879 in plant that was not used and useful as shown on Schedule JMM-W6.

Q. Why did Staff make this adjustment?

A. Marlin Scott, Jr., Staff's Engineer, inspected the entire system and identified certain individual plant items that were not serving customers during the test year (See Staff Engineering Report, Section H, Plant Not Used and Useful).

Q. What is Staff's recommendation?

A. Staff recommends decreasing plant in service by $78,879, from $73,731,815 to $73,671,740 to remove all plant from rate base that was not used and useful and the associated funding sources; Advances in Aid of Construction in the amount of $8,677, from $24,583,673 to $24,574,996 and Contributions in Aid of Construction in the amount of $7,888, from $3,104,068 to $3,096,180, as shown on Schedules JMM-W4 and JMM-W6.

Rate Base Adjustment No. 3 – Water Division, Accumulated Depreciation

Q. Did Staff make an adjustment to Accumulated Depreciation?

A. Yes.

Q. Why did Staff make this adjustment?

A. Staff adjusted accumulated depreciation to reflect the Staff recommended plant balances adjusted to remove not used and useful plant.

Q. What is Staff's recommendation?

A. Staff recommends decreasing accumulated depreciation by $35,223, from $9,107,141 to $9,071,918, as shown on Schedules JMM-W4 and JMM-W7.

Rate Base Adjustment No. 4 – Water Division, Customer Deposits

Q. Did Staff make an adjustment to customer deposits?

A. Yes.

Q. What adjustment did Staff make?

A. Staff ~~decreased~~ increased Customer Deposits by $166,998.

Q. Why did Staff make this adjustment?

A. Based on Staff data request JMM 1.56, Staff identified Customer Deposits in the test year that were not included in the rate application. Specifically, the Company only included customer meter deposits and no other Customer Deposits.

Q. What is Staff's recommendation?

A. Staff recommends increasing Customer Deposits by $166,998 from $68,685 to $235,683 as shown on Schedules JMM-W4 and JMM-W8.

Rate Base Adjustment No. 5 – Water Division, Deferred Income Taxes and Credits

Q. Did Staff make an adjustment to plant for Deferred Income Taxes and Credits?

A. Yes.

Q. What adjustment did Staff make?

A. Staff reversed the Company's pro-forma adjustment.

Q. What are pro-forma adjustments?

A. Pro-forma adjustments are adjustments to actual test year results and balances to obtain a normal or more realistic relationship between revenues, expenses and rate base.

Q. Does the Company's adjustment provide a normal or more realistic relationship between revenues, expenses and rate base?

A. No. It is one-sided as it only includes elimination of the current liability in the future; it does not take into account the Company's future tax returns that may increase or decrease the deferred tax liability account.

Q. What is a deferred tax liability?

A. A deferred tax liability represents the increase in taxes payable in ***future years*** as a result of taxable temporary differences existing at the end of the current year.

Q. Will this taxable temporary difference reverse out at some future date?

A. Yes, however we do not know at what date, so it is not known and measurable.

Q. What is Staff's recommendation?

A. Staff recommends reversal of the Company's adjustment by increasing Deferred Income Taxes by $314,036, from $21,451 to $335,487, as shown on Schedules JMM-W4 and JMM-W9.

Q. Does Staff have any other comments on the Company's Deferred Income Taxes and Credits?

A. Yes.

Q. Was Staff able to verify the amount of Deferred Income Taxes and Credits of $335,487 before the pro-forma adjustment?

A. No. Staff attempted to do so in data requests JMM 1.55, JMM 2.3, JMM 9.1 and JMM 9.2. The Company was unwilling or unable to provide Staff with this documentation.

Rate Base Adjustment No. 6 – Water Division, Unamortized Debt Issuance Costs

Q. Did Staff make an adjustment to Unamortized Debt Issuance Costs?

A. Yes.

Q. What adjustment did Staff make?

A. Staff removed the Unamortized Debt Issuance Costs.

Q. Why did Staff disallow the inclusion of Unamortized Debt Issuance Costs in rate base?

A. Debt issuance costs are a "below the line" expense, similar to interest and, thus, should be paid from the return on rate base portion of the ratepayer charges. The unamortized debt issuance costs are therefore attributed to the shareholders and do not require an outlay of cash by the shareholders. Consequently, from a ratemaking standpoint, shareholders should not earn a return on such costs and the costs should not be included in rate base.

Q. Do you have a Commission authoritative reference?

A. Yes. In Decision No. 71308, the Commission agreed that Unamortized Debt Issuance Costs should not be included in rate base.

Q. What is Staff's recommendation?

A. Staff recommends decreasing Unamortized Debt Issuance Costs by $134,528, from $134,528 to zero, as shown on Schedules JMM-W4 and JMM-W10.

Rate Base Adjustment No. 7 – Water Division, Deferred Regulatory Assets

Q. Did Staff make an adjustment to Deferred Regulatory Assets?

A. Yes.

Q. What adjustment did Staff make?

A. Staff removed the Deferred Regulatory Assets.

Q. Can you provide some background regarding the Deferred Regulatory Asset Costs?

A. Yes. On December 28, 2006, the Company filed a request asking for an accounting order that would authorize deferral of LPSCO's costs incurred in connection with the Company's response to the potential groundwater contamination. The requested costs include, but are not limited to: 1) litigation costs related to defending the Company against lawsuits; 2) litigation costs related to seeking restitution from polluters/contaminators; 3) increases in operation and maintenance costs from alternative (replacement) water sources; 4) capital costs of acquiring and/or constructing alternative (replacement) sources of water; 5) capital costs and/or operating expenses to treat contaminated water supplies; 6) settlement costs and/or amounts received as a result of settlements with polluters/contaminators; and 7) punitive damages received as the result of litigation against polluters/contaminators.

In Decision No. 69912, dated September 27, 2007, the Commission approved LPSCO's request for an accounting order authorizing the deferral of costs associated with efforts to address the potential contamination of its water supply.

Q. If the Company deferred its legal and water testing costs pursuant to an approved Accounting order, why is Staff removing these costs?

A. Per Decision No. 69912, dated September 27, 2007, Findings of Fact No. 11 expressly states that "the Company will pursue restitution from the party or parties responsible for the potential contamination of LPSCO's water supplies." Further in the ordering paragraph it states "that Litchfield Park Service Company shall actively assert the legal remedies available to them from the party or parties responsible for the potential water contamination of their water supplies."

In data request JMM 7- 2, Staff asked what the Company has done to date to seek legal remedies from the party or parties responsible for the potential water contamination?

Q. What was the Company's response?

A. The Company responded:

> *LPSCO's increased water testing costs were done as a precaution and for the protection of the customers, in light of the advance of TCE that could impact its wells. LPSCO believes that this is the proper thing for a utility to do in circumstances such as these. Since there has not yet been damage to the wells, the PRP most likely does not have the obligation to pay. However, LPSCO will again approach the PRP (and EPA) and see if they will begin paying for future increased testing.*

Q. Has the Company taken any legal steps to recover fees association with increased water testing costs?

A. No.

Q. Is it fair and equitable to have ratepayers pay a return on these deferred costs?

A. No. The Company should recover these costs from the superfund polluter and not from rate payers, as stated in the Commission Decision.

Q. What is Staff's recommendation?

A. Staff recommends decreasing the Deferred Regulatory Costs by $82,561 from $82,561 to zero, as shown on Schedules JMM-W4 and JMM-W11. However, Staff recommends that the Company continue to track these costs separately.

OPERATING INCOME – WATER DIVISION

Operating Income Summary

Q. What are the results of Staff's analysis of test year revenues, expenses, and operating income?

A. Staff's analysis resulted in adjusted test year operating revenues of $6,475,003, operating expenses of $6,465,330 and operating income of $9,673, as shown on Schedules JMM-W12 and JMM-W13. Staff made seven adjustments to operating expenses.

Operating Income Adjustment No. 1 – Water Division, Corporate Expense Allocation

Q. What is the Algonquin Power Income Fund ("Fund" or "APIF")?

A. The Algonquin Power Income Fund, the ultimate parent of LPSCO, is an unregulated company whose primary business activity is the acquisition and ownership of generation and infrastructure companies through security investments. At year-end 2007, APIF consisted of four main divisions as follows:

	2007 Divisions	
	Types of Facilities in Divisions	**No. of Facilities**
1	Hydroelectric	41
2	Cogeneration – Equity Interest Only	2
	Cogeneration – Own/Operate	3
3	Alternative Fuels – Equity Interest Only	3
	Alternative Fuels – Own/Operate	5
4	Infrastructure (Water & Sewer)	17
	Total Number of Facilities	**71**

Q. Please describe the position of LPSCO within APIF's organizational structure.

A. According to the organizational chart provided in response to a Staff data request, Algonquin Power Income Fund owns Algonquin Holdco, who in turn, owns Algonquin Power Fund Canada, who in turn, owns Algonquin Power Income Fund, who in turn, owns Algonquin Power Fund America, who in turn, owns Algonquin Water Resources of America, who in turn, owns LPSCO.

Q. **What is the primary goal of cost allocation between an unregulated affiliate and a regulated affiliate?**

A. The primary goal is the fair distribution of costs between the unregulated and regulated affiliate through proper allocations.

Q. **What effect does improperly allocated costs have on rate payers?**

A. When costs incurred primarily for the benefit of an unregulated affiliate's business are improperly identified and allocated as overhead/common costs, then costs of the unregulated affiliate are shifted to the captive customers of the regulated utility. This cost shifting results in the captive customers of the regulated utility subsidizing the business operations of the unregulated affiliate and this harms customers by creating artificially higher rates. The costs of a regulated utility, such as LPSCO, should only include those costs that would have been incurred on a "stand-alone basis."

Q. **What is the definition of "stand-alone basis"?**

A. "Stand-alone basis" means reflecting costs as if the regulated utility had produced the service by itself. This helps to ensure that any subsidization of the unregulated business by the captive utility customers is eliminated.

Q. **What is the amount of expense that was allocated from the APIF unregulated business operations to LPSCO during the test year?**

A. LPSCO was allocated $518,441 during the test year, of which $250,979 was allocated to the water division and $267,462 was allocated to the wastewater division.

Q. How was the allocation to LSPCO made?

A. First, $3.95 million in expenses from the unregulated affiliate were allocated to the infrastructure division based on a single allocation factor of 26.98 percent.[2] Those costs were then allocated to each company within the infrastructure division based upon customer count.

Q. Did Staff review the amounts comprising the $3.95 million of expenses allocated from the unregulated affiliate to LPSCO?

A. Yes.

Q. Does Staff agree that all of the $3.95 million in costs are costs that should be allocated?

A. No, Staff does not. Staff reviewed the underlying invoices for the costs and determined that the Company did not identify the costs as direct costs (i.e., costs that can be identified with a particular service) or indirect costs (costs that cannot be identified with a particular service) consistent with the NARUC Guidelines for Cost Allocation and Affiliate Transactions. These guidelines require that the costs primarily attributable to a business operation should be, to the extent appropriate, directly assigned to that business operation.

Q. What portion of the $3.95 million did Staff determine was attributable to (i.e., direct costs of) APIF or an affiliate?

A. Based upon review of the actual supporting invoices provided by the Company, Staff determined that almost all of the costs were obviously attributable to the operations of the APIF or one of its affiliates, therefore Staff assigned 90 percent of the costs to APIF. The

[2] This factor is based on the number of infrastructure facilities to total facilities.

remaining ten percent recognizes that the other affiliates receive a benefit from the common costs, and therefore, should be allocated a percentage greater than zero.

Q. Does Staff agree that all of the $3.95 million of expenses allocated from the unregulated affiliate are allowable costs?

A. No, Staff does not. As shown on schedule JMM-14, Page 2, Staff identified $191,828 in unallowable costs. For example, Staff identified $68,350 for charitable contributions, $5,066 for season tickets for hockey games, $3,500 for Superbowl tickets, $16,864 for gold watches and clocks; and $33,000 for IRS taxes and penalties related to the affiliate's unregulated business operations.

Q. Does Staff agree with the Company's calculation of the factor to allocate common costs?

A. No, Staff does not.

Q. What allocation formula did the Company use to allocate common costs?

A. The Company used the following formula: 17 utilities / 63 total facilities = 26.98%.

Q. Does Staff agree with the number of total facilities that the Company used in its formula?

A. No, Staff does not. Staff attempted to match the number used in the formula to the information in the 2007 Algonquin Power Income Fund Annual Reports; however, the numbers did not agree. The information in the 2007 annual reports is as follows:

Line No	Type of Facility	Year-End 2007
1	Hydroelectric	41
2	Cogeneration – Equity Interest Only	2
3	Cogeneration – Own/Operate	3
4	Alternative Fuels – Equity Interest Only	3
5	Alternative Fuels – Own/Operate	5
6	Infrastructure (Water & Sewer)	17
7	**Total Number of Facilities**	**71**
8	**Allocation Percentage (1 / L7)**	**1.41%**

Q. What data does Staff recommend the Company use for its common cost allocation formula?

A. Staff recommends that the year-end information per the Algonquin Power annual report be used to determine the number of total facilities.

Q. Did Staff prepare a schedule of its recommended common costs and allocation factor?

A. Yes, Staff's calculations are shown on Schedule JMM-W14.

Q. What is Staff's recommendation?

A. Staff recommends decreasing corporate allocation expense by $250,182, from $2,382,976 to $2,132,794, as shown on Schedules JMM-W13 and JMM-W14.

Operating Income Adjustment No. 2 – Water Division, Rate Case Expense

Q. Did Staff make an adjustment to rate case expense?

A. Yes.

Q. Why did Staff make this adjustment?

A. Staff typically normalizes rate case expense over a three to five year period. The Company has not been in for a rate case in close to nine years, so Staff recommends normalizing the rate case expense over five years.

Q. What is Staff's recommendation?

A. Staff recommends decreasing rate case expense by $28,000, from $70,000 to $42,000, as shown on Schedules JMM-W13 and JMM-W15.

Operating Income Adjustment No. 3 – Water Division, Meals and Entertainment Expense

Q. Did Staff make an adjustment Meals and Entertainment expense?

A. Yes.

Q. What adjustment did Staff make?

A. Staff's adjustment decreased Meals and Entertainment Expense by $827.

Q. Why did Staff make this adjustment?

A. Meals and Entertainment are not necessary to the provision of water services.

Q. What is Staff's recommendation?

A. Staff recommends decreasing miscellaneous expense by $827, from $81,664 to $80,837, as shown on Schedules JMM-W13 and JMM-W16.

Operating Income Adjustment No. 4 – Water Division, Bad Debt Expense

Q. Did Staff make an adjustment to bad debt expense?

A. Yes.

Q. Why did Staff make this adjustment?

A. Bad Debt expenses for the water division were abnormally low in the test year and "between" years. As a result Staff normalized this amount over a three-year period.

Q. What is Staff's recommendation?

A. Staff recommends increasing bad debt expense by $5,284 from $3,264 to $8,548 to better reflect the Company's ongoing level of bad debt expense. Please see Schedules JMM-W13 and JMM-W17.

Operating Income Adjustment No.5 – Water Division, Depreciation Expense

Q. Did Staff make an adjustment to depreciation expense?

A. Yes.

Q. What adjustment did Staff make?

A. As a result of adjustments made to plant in service, Staff also adjusted the associated depreciation expense.

Q. What is Staff's recommendation?

A. Staff's adjustment decreases depreciation expense by $100,905 from $2,291,982 to $2,191,077. Please see Schedule JMM-W13 and JMM-W18 for Staff's calculation.

Operating Income Adjustment No. 6 – Water Division, Property Tax

Q. Did Staff make an adjustment to property tax?

A. Yes.

Q. What adjustment does Staff recommend for test year property tax expense?

A. Staff's adjustment decreased property tax expense by $116,358, from $373,338 to $256,980, for test year expenses based upon Staff's adjusted test year revenues. Please see Schedule JMM-W13 and Column A on Schedule JMM-W19.

Q. What does Staff recommend for property tax expense on a going-forward basis?

A. Staff recommends increasing property tax expense by $71,012, from $256,980 to $327,992, based upon Staff's recommended revenues. Please see Schedule JMM-W12 and Column B on Schedule JMM-W19.

Operating Income Adjustment No .7 – Water Division, Income Tax

Q. Did Staff make an adjustment to Income Tax?

A. Yes.

Q. Why did Staff make this adjustment?

A. Staff's adjustment reflects Staff's calculation of the income tax expense based upon Staff's adjusted test year taxable income, as shown on Schedule JMM-W20.

Q. What is Staff's recommendation?

A. Staff recommends increasing test year Income Tax Expense by $198,423 from negative $449,705 to negative $251,282, as shown on Schedules JMM-W13 and JMM-W20.

OTHER MATTERS

Low Income Tariff

Q. Is the Company proposing a low income tariff?

A. Yes, this low income tariff is similar to the one devised for Chaparral City Water Company ("Chaparral"), Docket No. W-02113A-07-0551.

Q. Please describe the proposal.

A. The Company is proposing that customers meeting the necessary qualifications would receive a 15 percent discount off their water bill.

Q. Did the Company provide an example of how the low income tariff would work?

A. No. However, since the Company claims it is similar to the low income tariff approved in the Chaparral case, Staff assumes it works the same way. In that case, Chaparral stated, "Based on the existing bill for a median usage on a ¾-inch meter currently at $24.94, the low income program would result in a reduction of $3.74," or 15 percent.

Q. What would be the primary factor in determining ratepayer eligibility for this program?

A. The primary factor would be the combined gross income of all persons living in the household.

Q. How are the Company's gross annual house hold income limits determined?

A. The Company's proposed income guidelines are based on 150 percent of the 2008 federal poverty guidelines.

Q. Would these income guidelines be updated every year?

A. Yes.

Q. What are the draw backs to a low income tariff?

A. All non-participants will subsidize the low income households in the Company's service area.

Q. How will this be accomplished?

A. Through a separate surcharge on the non-participant's bills identified as a "Low Income Assistance Charge."

Q. Are there any other fees that would be included in this surcharge?

A. Yes, the Company proposes to include a 10 percent fee for administration and carrying costs.

Q. What is Staff's recommendation?

A. Staff recommends approval of the low income tariff.

HOOK-UP FEES

Q. Does the Company currently have hook-up fees?

A. Yes, but only for its Wastewater Division.

Q. Is the Company proposing hook-up fees for its Water Division in this case?

A. Yes.

Q. Is Staff recommending hook-up fees for the Company's Water Division?

A. Yes, a complete analysis can be found in Staff's Engineering Report.

FINANCINGS

Introduction

On March 13, 2009, LPSCO submitted two financing applications to assist in funding certain capital projects. One project, under Docket No. W-01427A-09-0116 for the construction of two recharge wells, is estimated at $1,755,000 and another project, under Docket No. W-01427A-09-0120 for the construction of a 200 kW roof mounted solar generator, is estimated at $1,170,000. The Company is requesting approval of funding for these two projects through the use of Water Infrastructure Financing Authority ("WIFA") indebtedness with the Commission.

Public Notice

As of the date of this filing the Company has not provided notice to its customers of the proposed financings.

Purpose and Terms of the Proposed Financing

The purpose of the first long-term debt financing is to construct two recharge wells for the purpose of recharging effluent. This will aid in replenishment of the underlying aquifer within LPSCO's certificated service area as well as aid in disposal of excess effluent in an environmentally responsible manner.

The purpose of the second long-term debt financing is to construct one 200 kW roof mounted solar generator for the purposes of generating electrical power. This will aid in lower electrical demands placed on the utility and further reduce rates while aiding in meeting Arizona Public Service renewable energy replenishment requirements.

Staff examined the construction plans and estimated costs of the two projects and found them to be reasonable and appropriate. A complete discussion of the construction projects and costs are discussed in the attached Engineering Report.

Financial Analysis

Staff has determined that the two projects are reasonable and appropriate and has completed a financial analysis to ensure that the Company will have the wherewithal to finance the new solar project and recharge well.

Staff's analysis is based on the test year adjusted financial statements dated September 30, 2008, and on its recommended rates. The financial analysis shown on Schedule JMM-W21 presents selected financial information form the financial statements, the pro forma effect of the proposed $2,925,000 debt amount. Schedule JMM-W21 also shows the debt service coverage ("DSC") and the times interest earned ("TIER") ratio.

Interest and Debt Service Coverage

Staff also examined the effects of the proposed financing on the Company's TIER and DSC.

DSC represents the number of times internally generated cash (i.e. earnings before interest, income tax, depreciation and amortization expenses) cover required principle and interest payments on debt. A DSC greater than 1.0 means operating cash flow is sufficient to cover debt obligations.

TIER represents the number of times earnings before income tax expense covers interest expense on debt. A TIER greater than 1.0 means that operating income is greater than interest expense. A TIER less than 1.0 is not sustainable in the long term but does not necessarily mean that debt obligations cannot be met in the short term.

The Company's TIER and DSC resulting from Staff's recommended revenue requirement and fully drawing both loans in the amount of $2,925,000 results in a pro forma TIER and DSC of 5.58 and 5.94, respectively. The pro forma TIER and DSC show that LPSCO would have adequate cash flows to meet all obligations including the proposed debt.

CONCLUSIONS AND RECOMMENDATIONS

Staff concludes that the capital projects in the amount of $1,755,000 for a recharge well project and $1,170,000 for a solar project are appropriate and the cost estimates are reasonable. No "used and useful" determination of the proposed project items were made and no particular treatment should be inferred for rate making or rate base purposes in the future.

Staff recommends that the Company file with Docket Control, as a compliance item in the docket, by December 31, 2010, a copy of the Certificate for Approval to Construct for the recharge well project.

Q. Does this conclude your Direct Testimony?

A. Yes, it does.

Litchfield Park Service Company - Water Division
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Schedule JMM-W1

REVENUE REQUIREMENT

LINE NO.	DESCRIPTION	(A) COMPANY FAIR VALUE	(B) STAFF FAIR VALUE
1	Adjusted Rate Base	$ 37,924,592	$ 37,218,182
2	Adjusted Operating Income (Loss)	$ (282,890)	$ 9,673
3	Current Rate of Return (L2 / L1)	-0.75%	0.03%
4	Required Rate of Return	11.41%	8.70%
5	Required Operating Income (L4 * L1)	$ 4,327,196	$ 3,237,982
6	Operating Income Deficiency (L5 - L2)	$ 4,610,086	$ 3,228,309
7	Gross Revenue Conversion Factor	1.6286	1.6506
8	Required Revenue Increase (L7 * L6)	$ 7,508,146	**$ 5,328,747**
9	Adjusted Test Year Revenue	$ 6,475,003	$ 6,475,003
10	Proposed Annual Revenue (L8 + L9)	$ 13,983,149	$ 11,803,750
11	Required Increase in Revenue (%)	115.96%	82.30%

References:
Column (A): Company Schedule A-1
Column (B): Staff Schedules JMM-W3 and JMM-W12

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Schedule JMM-W2

GROSS REVENUE CONVERSION FACTOR

LINE NO.	DESCRIPTION	(A)	(B)	(C)	(D)
	Calculation of Gross Revenue Conversion Factor:				
1	Revenue	100.0000%			
2	Uncollecible Factor (Line 11)	0.0000%			
3	Revenues (L1 - L2)	100.0000%			
4	Combined Federal and State Income Tax and Property Tax Rate (Line 23)	39.4171%			
5	Subtotal (L3 - L4)	60.5829%			
6	**Revenue Conversion Factor (L1 / L5)**	1.650631			
	Calculation of Uncollecttible Factor:				
7	Unity	100.0000%			
8	Combined Federal and State Tax Rate (Line 23)	38.5989%			
9	One Minus Combined Income Tax Rate (L7 - L8)	61.4011%			
10	Uncollectible Rate	0.0000%			
11	Uncollectible Factor (L9 * L10)	0.0000%			
	Calculation of Effective Tax Rate:				
12	Operating Income Before Taxes (Arizona Taxable Income)	100.0000%			
13	Arizona State Income Tax Rate	6.9680%			
14	Federal Taxable Income (L12 - L13)	93.0320%			
15	Applicable Federal Income Tax Rate (Line 55)	34.0000%			
16	Effective Federal Income Tax Rate (L14 x L15)	31.6309%			
17	Combined Federal and State Income Tax Rate (L13 +L16)		38.5989%		
	Calculation of Effective Property Tax Factor				
18	Unity	100.0000%			
19	Combined Federal and State Income Tax Rate (L17)	38.5989%			
20	One Minus Combined Income Tax Rate (L18-L19)	61.4011%			
21	Property Tax Factor (JMM-W18, L27)	1.3326%			
22	Effective Property Tax Factor (L20*L21)		0.8182%		
23	Combined Federal and State Income Tax and Property Tax Rate (L17+L22)			39.4171%	
24	Required Operating Income (Schedule JMM-W1, Line 5)	$ 3,237,982			
25	AdjustedTest Year Operating Income (Loss) (Schedule JMM-W11, Line 35)	9,673			
26	Required Increase in Operating Income (L24 - L25)		$ 3,228,309		
27	Income Taxes on Recommended Revenue (Col. [E], L52)	$ 1,778,145			
28	Income Taxes on Test Year Revenue (Col. [B], L52)	(251,282)			
29	Required Increase in Revenue to Provide for Income Taxes (L27 - L28)		2,029,427		
30	Recommended Revenue Requirement (Schedule JMM-W1, Line 10)	$ 11,803,750			
31	Uncollectible Rate (Line 10)	0.0000%			
32	Uncolllectible Expense on Recommended Revenue (L30*L31)	$ -			
33	Adjusted Test Year Uncollectible Expense	$ -			
34	Required Increase in Revenue to Provide for Uncollectible Exp. (L32-L33)		-		
35	Property Tax with Recommended Revenue (JMM-W11, Col B, L31)	$ 327,992			
36	Property Tax on Test Year Revenue (JMM-W18, Col A, L17)	256,980			
37	Increase in Property Tax Due to Increase in Revenue (L35-L36)		71,012		
38	Total Required Increase in Revenue (L26 + L29 + L34 + L37)		$ 5,328,747		

LINE NO.	*Calculation of Income Tax:*	Test Year		Staff Recommended
39	Revenue (Schedule JMM-W11, Col. [C], Line 5 & Sch. JMM-W1, Col. [D] Line 1C	$ 6,475,003	$ 5,328,747	$ 11,803,750
40	Operating Expenses Excluding Income Taxes	$ 6,716,612		$ 6,787,624
41	Synchronized Interest (L56)	$ 409,400		$ 409,400
42	Arizona Taxable Income (L39 - L40 - L41)	$ (651,009)		$ 4,606,726
43	Arizona State Income Tax Rate	6.9680%		6.9680%
44	Arizona Income Tax (L42 x L43)	$ (45,362)		$ 320,997
45	Federal Taxable Income (L42 - L44)	$ (605,647)		$ 4,285,730
46	Federal Tax on First Income Bracket ($1 - $50,000) @ 15%	$ (7,500)		$ 7,500
47	Federal Tax on Second Income Bracket ($51,001 - $75,000) @ 25%	$ (6,250)		$ 6,250
48	Federal Tax on Third Income Bracket ($75,001 - $100,000) @ 34%	$ (8,500)		$ 8,500
49	Federal Tax on Fourth Income Bracket ($100,001 - $335,000) @ 39%	$ (91,650)		$ 91,650
50	Federal Tax on Fifth Income Bracket ($335,001 -$10,000,000) @ 34%	$ (92,020)		$ 1,343,248
51	Total Federal Income Tax	$ (205,920)		$ 1,457,148
52	Combined Federal and State Income Tax (L44 + L51)	$ (251,282)		$ 1,778,145
53	Applicable Federal Income Tax Rate [Col. [E], L51 - Col. [B], L51] / [Col. [E], L45 - Col. [B], L45]			34.0000%
	Calculation of Interest Synchronization:			
54	Rate Base (Schedule JMM-W3, Col. (C), Line 17	$ 37,218,182		
55	Weighted Average Cost of Debt (Schedule JMM-W19)	1.1000%		
56	Synchronized Interest (L45 X L46)	$ 409,400		

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Schedule JMM-W3

RATE BASE - ORIGINAL COST

LINE NO.		(A) COMPANY AS FILED	(B) STAFF ADJUSTMENTS	Adj. No.	(C) STAFF AS ADJUSTED
1	Plant in Service	$ 73,731,815	$ (60,075)	1,2	$ 73,671,740
2	Less: Accumulated Depreciation	9,107,141	(35,223)	3	9,071,918
3	Net Plant in Service	$ 64,624,674	$ (24,852)		$ 64,599,822
	LESS:				
4	Contributions in Aid of Construction (CIAC)	$ 3,104,068	$ (7,888)		$ 3,096,180
5	Less: Accumulated Amortization	860,706	-		$ 860,706
6	Net CIAC	2,243,362	(7,888)		$ 2,235,474
7	Advances in Aid of Construction (AIAC)	24,583,673	(8,677)		24,574,996
8	Customer Deposits	68,685	166,998	4	235,683
9	Deferred Income Tax Credits	21,451	314,036	5	335,487
	ADD:				
9	Unamortized Debt Issuance Costs	134,528	(134,528)	6	-
10	Deffered Regulatory Assets	82,561	(82,561)	7	-
11	**Original Cost Rate Base**	$ 37,924,592	$ (706,410)		$ 37,218,182

References:
Column [A]: Company as Filed
Column [B]: Schedule JMM-W4
Column (C): Column (A) + Column (B)

Litchfield Park Service Company - Wastewater Division
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Schedule JMM-W4

SUMMARY OF ORIGINAL COST RATE BASE ADJUSTMENTS

LINE NO.	ACCT. NO.	DESCRIPTION	[A] COMPANY AS FILED	[B] ADJ #1 Post-Test Year Plant Ref: Sch JMM-W5	[C] ADJ #2 Plant Not Used And Useful Ref: Sch JMMW-6	[D] ADJ #3 Accumulated Depreciation Ref: Sch JMMW-7	[E] ADJ #4 Customer Deposits Ref: Sch JMMW-8	[F] ADJ #5 Deferred Income Taxes Ref: Sch JMMW-9	[G] ADJ #6 Unamortized Finance Charges Ref: Sch JMMW-10	[H] ADJ #7 Deferred Reg. Asset Ref: Sch JMMW-11	[H] STAFF ADJUSTED
		PLANT IN SERVICE:									
1											
2	301	Organization Cost	$ 100	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 100
3	302	Franchise Cost	-	-	-	-	-	-	-	-	-
4	303	Land and Land Rights	1,284,595	-	-	-	-	-	-	-	1,284,595
5	304	Structures and Improvements	24,698,293	-	(41,971)	-	-	-	-	-	24,656,322
6	305	Collecting and Impounding Res.	-	-	-	-	-	-	-	-	-
7	306	Lake River and Other Intakes	-	-	-	-	-	-	-	-	-
8	307	Wells and Springs	2,382,102	-	-	-	-	-	-	-	2,382,102
9	308	Infiltration Galleries and Tunnels	-	-	-	-	-	-	-	-	-
10	309	Supply Mains	-	-	-	-	-	-	-	-	-
11	310	Power Generation Equipment	202,269	-	-	-	-	-	-	-	202,269
12	311	Electric Pumping Equipment	948,213	-	(31,158)	-	-	-	-	-	917,055
13	320	Water Treatment Equipment	1,337,824	-	-	-	-	-			1,337,824
14	320	Water Treatment Plant	-	-	-	-	-	-			-
15	330	Distribution Reservoirs & Standpipe	430,644	-	-	-	-	-	-	-	430,644
16	331	Transmission and Distribution Mains	28,929,171	-	-	-	-	-	-	-	28,929,171
17	333	Services	4,249,744	-	-	-	-	-			4,249,744
18	334	Meters	4,138,752	-	-	-	-	-			4,138,752
19	335	Hydrants	2,055,781	-	-	-	-	-	-	-	2,055,781
20	336	Backflow Prevention Devices	38,387	-	-	-	-	-	-	-	38,387
21	339	Other Plant and Miscellaneous Equipment	265,281	-	(5,750)	-	-	-	-	-	259,531
22	340	Office Furniture and Fixtures	551,757	-	-	-	-	-	-	-	551,757
23	341	Transportation Equipment	177,165	-	-	-	-	-	-	-	177,165
24	342	Stores Equipment	31,711	-	-	-	-	-	-	-	31,711
25	343	Tools and Work Equipment	23,350	-	-	-	-	-	-	-	23,350
26	344	Laboratory Equipment	-	-	-	-	-	-	-	-	-
27	345	Power Operated Equipment	-	-	-	-	-	-	-	-	-
28	346	Communications Equipment	119,710	-	-	-	-	-	-	-	119,710
29	347	Miscellaneous Equipment	-	-	-	-	-	-	-	-	-
30	348	Other Tangible Plant	-	-	-	-	-	-	-	-	-
31		Total Plant in Service - Actual	71,864,850	-	-	-	-	-	-	-	71,785,970
32		Post Test-Year Plant	1,866,965	18,805							1,885,770
33		Total Plant in Service	$ 73,731,815	$ -	$ (78,879)	$ -	$ -	$ -	$ -	$ -	$ 73,671,740
34		Less: Accumulated Depreciation	9,107,141	-	-	(35,223)	-	-	-	-	9,071,918
35			-	-	-	-	-	-	-	-	-
36		Net Plant in Service	$ 64,624,674	$ -	$ (78,879)	$ 35,223	$ -	$ -	$ -	$ -	$ 64,599,822
37											
38		*LESS:*									
39		Contributions in Aid of Construction (CIAC)	$ 3,104,068	$ -	$ (7,888)	$ -	$ -	$ -	$ -	$ -	$ 3,096,180
40		Less: Accumulated Amortization	860,706	-	-	-	-	-	-	-	860,706
41		Net CIAC (L25 - L26)	2,243,362	-	(7,888)	-	-	-	-	-	2,235,474
42		Advances in Aid of Construction (AIAC)	24,583,673	-	(8,677)	-	-	-	-	-	24,574,996
43		Customer Deposits	68,685	-	-	-	166,998	-	-	-	235,683
44		Deferred Income Taxes	21,451	-	-	-	-	314,036	-	-	335,487
45			-	-							-
46											-
47		*ADD:*									
48		Unamortized Debt Issuance Costs	134,528	-	-	-	-	-	(134,528)	-	-
49		Deffered Regulatory Assets	82,561	-	-	-	-	-	-	(82,561)	-
50											
51		**Original Cost Rate Base**	$ 37,924,592	$ -	$ (62,314)	$ 35,223	$ (166,998)	$ (314,036)	$ (134,528)	$ (82,561)	$ 37,218,182

RATE BASE ADJUSTMENT NO. 1 - POST-TEST YEAR PLANT

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Post-Test Year Plant	$ 1,866,965	$ 18,805	$ 1,885,770

Based on Staff Engineering Report Table I-1.

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Schedule JMM-W6

RATE BASE ADJUSTMENT NO. 2 - PLANT NOT USED AND USEFUL

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	304	Structures & Improvements	$ 24,698,293	$ (41,971)	$ 24,656,322
2	311	Electric Pumping Equipment	948,213	(31,158)	917,055
3	339	Other Plant & Miscellaneous Equipment	265,281	(5,750)	259,531
4			$ 25,911,787	$ (78,879)	25,832,908
5					
6		Based on Staff Engineering Report Table H-1.			
7					

LINE NO.	DESCRIPTION	[A] COMPANY AIAC & CIAC AS FILED	[B] STAFF ADJUSTMENTS	[C] STAFF AS ADJUSTED
12	Advances in Aid of Construction (AIAC)	$ 24,583,673	$ (8,677)	$ 24,574,996
13				
14	Contributions in Aid of Construction (CIAC)	$ 3,104,068	$ (7,888)	$ 3,096,180

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Schedule JMM-W7

RATE BASE ADJUSTMENT NO. 3 - ACCUMULATED DEPRECIATION

LINE NO.	DESCRIPTION	[A] COMPANY AS FILED	[B] STAFF ADJUSTMENTS	[C] STAFF AS ADJUSTED
1	Accumulated Depreciation	$ 9,107,141	$ (35,223)	$9,071,918

References:
Column [A]: Company Application
Column [B]: Testimony JMM
Column [C]: Column [A] + Column [B]

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Schedule JMM-W8

RATE BASE ADJUSTMENT NO. 4 - CUSTOMER DEPOSITS

			[A]	[B]	[C]
LINE NO.	ACCT NO.	DESCRIPTION	COMPANY PROPOSED	STAFF ADJUSTMENTS	STAFF RECOMMENDED
1		Customer Deposits	$ 68,685	$ 166,998	$ 235,683

Staff Calculation:

8600-2-0100-20-2117-0000 Hydrant Meter Deposits	$ 85,200
8600-2-0000-20-2113-0000 Customer Deposits	73,568
8600-2-0000-20-2112-0002 Customer Security Deposits	8,230
	$ 166,998

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Schedule JMM-W9

RATE BASE ADJUSTMENT NO. 5 - DEFERRED INCOME TAXES

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Deferred Income Taxes	$ 21,451	$ 314,036	$ 335,487

To Remove Deferred Income Taxes

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Schedule JMM-W10

RATE BASE ADJUSTMENT NO. 6 - UNAMORTIZED DEBT ISSUANCE COSTS

			[A]	[B]	[C]
LINE NO.	ACCT NO.	DESCRIPTION	COMPANY PROPOSED	STAFF ADJUSTMENTS	STAFF RECOMMENDED
1		Unamortized Debt Issuance Costs	$ 134,528	$ (134,528)	$ -

To Remove Unamortized Debt Issuance Costs

<u>REFERENCES:</u>
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

Litchfield Park Service Company - Water Division
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Schedule JMM-W11

RATE BASE ADJUSTMENT NO. 7 - DEFERRED REGULATORY ASSETS

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Deferred Regulatory Assets	$ 82,561	$ (82,561)	$ -

To remove Deferred Regulatory Assets

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Schedule JMM-W12

OPERATING INCOME STATEMENT - ADJUSTED TEST YEAR AND STAFF RECOMMENDED

LINE NO.	DESCRIPTION	[A] COMPANY ADJUSTED TEST YEAR AS FILED	[B] STAFF TEST YEAR ADJUSTMENTS	Adj. No.	[C] STAFF TEST YEAR AS ADJUSTED	[D] STAFF PROPOSED CHANGES	[E] STAFF RECOMMENDED
1	*REVENUES:*						
2	Metered Water Sales	$ 6,347,481	$ -		$ 6,347,481	$ 5,328,747	$ 11,676,228
3	Water Sales-Unmetered	-	-		-	-	-
4	Other Operating Revenue	127,522	-		127,522	-	127,522
5	Intentionally Left Blank	-	-		-	-	-
6	**Total Operating Revenues**	$ 6,475,003	$ -		$ 6,475,003	$ 5,328,747	$ 11,803,750
7							
8	*OPERATING EXPENSES:*						
9	Salaries and Wages	$ -	$ -		$ -	$ -	$ -
10	Purchased Wastewater Treatment	5,011	-		5,011	-	5,011
11	Sludge Removal Expense	1,013,811	-		1,013,811	-	1,013,811
12	Purchased Power	58,147	-		58,147	-	58,147
13	Fuel for Power Production	503,278	-		503,278	-	503,278
14	Chemicals	44,001	-		44,001	-	44,001
15	Materials & Supplies	-	-		-	-	-
16	Contractural Services, Legal&Engr	12,469	-		12,469	-	12,469
17	Contractural Sevices - Other	2,382,976	(250,182)	1	2,132,794	-	2,132,794
18	Contractural Services - Testing	14,317	-		14,317	-	14,317
19	Equipment Rental	28,365	-		28,365	-	28,365
20	Rents - Building	10,647	-		10,647	-	10,647
21	Transportation	151,879	-		151,879	-	151,879
22	General Liability Insurance	95,469	-		95,469	-	95,469
23	Insurance - Other	3,319	-		3,319	-	3,319
24	Regulatory Commission/Rate Case Expense	63,662	-		63,662	-	63,662
25	Miscellaneous Expense	70,000	(28,000)	2	42,000	-	42,000
26	Bad Debt Expense	81,664	(827)	3	80,837	-	80,837
27	Bad Debt Expense	3,264	5,284	4	8,548	-	8,548
28	Depreciation Expense	2,291,982	(100,905)	5	2,191,077	-	2,191,077
29	Depreciation	-	-		-	-	-
30	Taxes other than Income	-	-		-	-	-
31	Property Taxes	373,338	(116,358)	6	256,980	71,012	327,992
32	Income Taxes	(449,705)	198,423	7	(251,282)	2,029,427	1,778,145
33	Intentionally Left Blank	-	-		-	-	-
34	**Total Operating Expenses**	$ 6,757,893	$ (292,564)		$ 6,465,330	$ 2,100,439	$ 8,565,768
35	**Operating Income (Loss)**	$ (282,890)	$ 292,564		$ 9,673	$ 3,228,309	$ 3,237,982

References:
Column (A): Company Schedule C-1
Column (B): Schedule JMM-W12 JMM-W13
Column (C): Column (A) + Column (B)
Column (D): Schedules JMM-W18 and JMM-W19
Column (E): Column (C) + Column (D)

Litchfield Park Service Company - Water Division
Docket No. W-01427A-09-0104
Test Year Ended September 30, 2008

Schedule JMM-W13

SUMMARY OF OPERATING INCOME STATEMENT ADJUSTMENTS - TEST YEAR

LINE NO.	DESCRIPTION	[A] COMPANY AS FILED	[B] Corporate Expense Allocation ADJ #1	[C] Rate Case Expense ADJ #2	[D] Meals and Ent. Expense ADJ #3	[E] Bad Debt Expense ADJ #4	[F] Depreciation Expense ADJ #5	[G] Property Tax Expense ADJ #6	[H] Income Tax Expense ADJ #8	[I] STAFF ADJUSTED
			Ref: Sch JMM-W13	Ref: Sch JMM-W14	Ref: Sch JMM-W15	Ref: Sch JMM-W16	Ref: Sch JMM-W17	Ref: Sch JMM-W18	Ref: Sch JMM-W19	
1	*REVENUES:*									
2	Metered Water Sales	$6,347,481	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,347,481
3	Water Sales-Unmetered	-	-	-	-	-	-	-	-	-
4	Other Operating Revenue	127,522	-	-	-	-	-	-	-	127,522
5	Intentionally Left Blank	-	-	-	-	-	-	-	-	-
6	Total Operating Revenues	$6,475,003	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,475,003
7										
8	*OPERATING EXPENSES:*									
9	Salaries and Wages	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
10	Purchased Water	5,011	-	-	-	-	-	-	-	5,011
11	Purchased Power	1,013,811	-	-	-	-	-	-	-	1,013,811
12	Fuel for Power Production	58,147	-	-	-	-	-	-	-	58,147
13	Chemicals	503,278	-	-	-	-	-	-	-	503,278
14	Repairs and Maintenance	44,001	-	-	-	-	-	-	-	44,001
15	Office Supplies and Expense	-	-	-	-	-	-	-	-	-
16	Outside Services	12,469	-	-	-	-	-	-	-	12,469
17	Outside Services - Other	2,382,976	(250,182)	-	-	-	-	-	-	2,132,794
18	Outside Services - Legal	14,317	-	-	-	-	-	-	-	14,317
19	Water Testing	28,365	-	-	-	-	-	-	-	28,365
20	Rents	10,647	-	-	-	-	-	-	-	10,647
21	Transportation Expenses	151,879	-	-	-	-	-	-	-	151,879
22	Insurance - General Liability	95,469	-	-	-	-	-	-	-	95,469
23	Insurance - Health and Life	3,319	-	-	-	-	-	-	-	3,319
24	Regulatory Commission Expenese	63,662	-	-	-	-	-	-	-	63,662
25	Regulatory Commission Expense	70,000	-	(28,000)	-	-	-	-	-	42,000
26	Miscellaneous Expense	81,664	-	-	(827)	-	-	-	-	80,837
27	Bad Debt Expense	3,264	-	-	-	5,284	-	-	-	8,548
28	Depreciation Expense	2,291,982	-	-	-	-	(100,905)	-	-	2,191,077
29	Amortization of CIAC	-	-	-	-	-	-	-	-	-
30	Taxes Other than Income	-	-	-	-	-	-	-	-	-
31	Property Taxes	373,338	-	-	-	-	-	(116,358)	-	256,980
32	Income Taxes	(449,705)	-	-	-	-	-	-	198,423	(251,282)
33	Intentionally Left Blank	-	-	-	-	-	-	-	-	-
34	Total Operating Expenses	$6,757,893	$ (250,182)	$ (28,000)	$ (827)	$ 5,284	$ (100,905)	$ (116,358)	$ 198,423	$ 6,465,330
35	Operating Income (Loss)	$ (282,890)	$ 250,182	$ 28,000	$ 827	$ (5,284)	$ 100,905	$ 116,358	$ (198,423)	$ 9,673

OPERATING INCOME ADJUSTMENT NO. 1 - EXPENSE ALLOCATIONS FROM UNREGULATED AFFILIATE

DESCRIPTION	[A] COMPANY AS FILED	[B] STAFF ADJUSTMENTS (Col C - Col A)	[C] STAFF AS ADJUSTED
Contractural Services - Other	$ 2,357,032	$ -	$ 2,357,032
Corporate Expense Allocation	250,979	(250,182)	797
Total Contractural Services - Other	$ 2,382,976	$ (250,182)	$ 2,357,829

COSTS TO BE ALLOCATED TO LPSCO

[D] [E] Description	[F] Amount	[G] Unallowable Costs	[H] Direct Costs of Unregulated Affiliate(s)	[I] Allowable Common Costs Allocated to All 71 Companies	[J] Allocation[5] %	[K] Costs to be Allocated to LPSCO (Col I x Col J)
Rent	$ 430,739	$ -	$ (430,739)	$ -	1.41%	$ -
Audit[1]	$ 507,000	$ -	$ (456,300)	$ 50,700	1.41%	$ 714.08
Tax Services[2]	$ 265,000	$ -	$ (238,500)	$ 26,500	1.41%	$ 373.24
Legal-General[3]	$ 300,000	$ -	$ (284,400)	$ 15,600	1.41%	$ 219.72
Other Professional Services	$ 455,000	$ -	$ (455,000)	$ -	1.41%	$ -
Management Fee	$ 636,619	$ -	$ (636,619)	$ -	1.41%	$ -
Unit Holder Communications	$ 314,100	$ -	$ (314,100)	$ -	1.41%	$ -
Trustee Fees	$ 204,000	$ -	$ (204,000)	$ -	1.41%	$ -
Office Costs	$ 254,100	$ (46,186)	$ (207,914)	$ -	1.41%	$ -
Licenses/Fees and Permits	$ 305,000	$ (145,642)	$ (159,358)	$ -	1.41%	$ -
Escrow and Transfer Fees	$ 75,000	$ -	$ (75,000)	$ -	1.41%	$ -
Depreciation Expense[4]	$ 204,242	$ -	$ (183,818)	$ 20,424	1.41%	$ 287.66
	$ 3,950,800	$ (191,828)	$ (3,645,748)	$ 113,224		$ 1,594.71
					Water	$ 797.35
					Waste Water	$ 797.35
						$ 1,594.71

Foot Note 1: Audit - As the parent company's lenders require the APIF to have annual financial audits, Staff assigned the majority of the cost (i.e., 90 percent) to APIF and the remaining 10 percent to its 71 companies/interests.

Foot Note 2: Tax Services - Given the tax complexity of the APIF's many holdings and transactions, Staff assigned the majority of the cost (i.e., 90 percent) to APIF and the remaining 10 percent to its 71 companies/interests.

Foot Note 3: Legal, General - Staff reviewed the legal invoices and found that the very large majority of the legal invoices pertained to the APIF.

Foot Note 4: Depreciation Expense - Given that most of APIF's plant costs benefit primarily APIF, Staff assigned the majority of the cost (i.e., 90 percent) to APIF and the remaining 10 percent to its 71 companies/interests.

Foot Note 5: Allocation Percentage - Calculated as follows: 1 / 71 companies = 1.41%.

References:
Column A: Company Schedule
Column B: Testimony JMM
Column C: Column [A] + Column [B]

Litchfield Park Service Company - Water Division
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Test Year Ended September 30, 2008

LINE NO.			
1	Category	Description of Unallowable Cost	Amount
2	Office Fees and Expenses	Wind Analysis & Planning Software	$15,056
3	Office Fees and Expenses	Gold Watches and Clocks	$16,864
4	Office Fees and Expenses	Pilsner Beer Glasses	$5,700
5	Office Fees and Expenses	Leafs-Raptors Season Tickets	$5,066
6	Office Fees and Expenses	Super Bowl XLII Tickets	$3,500
7		**Subtotal for Office Expenses**	**$46,186**
8			
9	Licenses and Fees	Donation - Wind Project Develop	$25,000
10	Licenses and Fees	Donation - Water Project in Africa	$25,000
11	Licenses and Fees	Donation - Cancer Society	$13,350
12	Licenses and Fees	Donation - Multiple Myeloma	$5,000
13	Licenses and Fees	Wind Development	$7,887
14	Licenses and Fees	U.S. Trustee	$9,375
15	Licenses and Fees	St. Leon Wind Energy	$12,556
16	Licenses and Fees	Algonquin Power Fund Inc Taxes	$6,891
17	Licenses and Fees	Algonquin Power Fund Inc Taxes	$6,794
18	Licenses and Fees	Tax Ruling Request for KMS America & Subs	$10,000
19	Licenses and Fees	Algonquin Power Fund Inc Taxes	$23,789
20		**Subtotal for Licenses & Fees**	**$145,642**

Litchfield Park Service Company - Water Division
Docket No. W-01427A-09-0104
Test Year Ended September 30, 2008

Schedule JMM-W15

OPERATING INCOME ADJUSTMENT NO. 2 - RATE CASE EXPENSE

LINE NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	Rate Case Expense	$ 70,000	$ (28,000)	$ 42,000

Staff Calculation:

Estimated Rate Case Cost	$ 210,000
Normalized Over Five Years	5
	42,000

References:
Column (A), Company Schedule C-1
Column (B): Testimony JMM
Column (C): Column (A) + Column (B)

Litchfield Park Service Company - Water Division
Docket No. W-01427A-09-0104
Test Year Ended September 30, 2008

Schedule JMM-W16

OPERATING INCOME ADJUSTMENT NO. 3 - MEALS AND ENTERTAINMENT

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	775.00	Miscellaneous Expense	$ 81,664	$ (827)	$ 80,837

References:
Column (A), Company Schedule C-1
Column (B): Testimony JMM
Column (C): Column (A) + Column (B)

Litchfield Park Service Company - **Water Division**
Docket No. W-01427A-09-0104
Test Year Ended September 30, 2008

Schedule JMM-W17

OPERATING INCOME ADJUSTMENT NO. 4 - BAD DEBT

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Bad Debt Expense	$ 3,264	$ 5,284	$ 8,548

Staff Calculation:	
Test Year	$3,264
2007	1,898
2006	20,483
	$25,645
Normalized over 3 years	3
	$ 8,548

References:
Column (A), Company Schedule C-1
Column (B): Testimony JMM
Column (C): Column (A) + Column (B)

Litchfield Park Service Company - Water Division
Docket No. W-01427A-09-0104
Test Year Ended September 30, 2008

Schedule JMM-W18

OPERATING INCOME ADJUSTMENT NO. 5 - DEPRECIATION EXPENSE ON TEST YEAR PLANT

LINE NO.	ACCT NO.	DESCRIPTION	[A] PLANT In SERVICE Per Staff	[B] NonDepreciable or Fully Depreciated PLANT	[C] DEPRECIABLE PLANT (Col A - Col B)	[D] DEPRECIATION RATE	[E] DEPRECIATION EXPENSE (Col C x Col D)
1	301	Organization Cost	$ 100	$ 100	$ -	0.00%	$ -
2	302	Franchise Cost	$ -	$ -	$ -	0.00%	$ -
3	303	Land and Land Rights	$ 1,284,595	$ 1,284,595	$ -	0.00%	$ -
4	304	Structures and Improvements	$ 24,656,322	$ -	$ 24,656,322	3.33%	$ 821,056
5	305	Collecting and Impounding Res.	$ -	$ -	$ -	2.50%	$ -
6	306	Lake River and Other Intakes	$ -	$ -	$ -	2.50%	$ -
7	307	Wells and Springs	$ 2,382,102	$ -	$ 2,382,102	3.33%	$ 79,324
8	308	Infiltration Galleries and Tunnels	$ -	$ -	$ -	6.67%	$ -
9	309	Supply Mains	$ -	$ -	$ -	2.00%	$ -
10	310	Power Generation Equipment	$ 202,269	$ -	$ 202,269	5.00%	$ 10,113
11	311	Electric Pumping Equipment	$ 917,055	$ -	$ 917,055	12.50%	$ 114,632
12	320	Water Treatment Equipment	$ 1,337,824	$ -	$ 1,337,824	3.33%	$ 44,550
13	320	Water Treatment Plant	$ -	$ -	$ -	3.33%	$ -
14	330	Distribution Reservoirs & Standpipe	$ 430,644	$ -	$ 430,644	2.22%	$ 9,560
15	331	Transmission and Distribution Mains	$ 28,929,171	$ -	$ 28,929,171	2.00%	$ 578,583
16	333	Services	$ 4,249,744	$ -	$ 4,249,744	3.33%	$ 141,516
17	334	Meters	$ 4,138,752	$ -	$ 4,138,752	8.33%	$ 344,758
18	335	Hydrants	$ 2,055,781	$ -	$ 2,055,781	2.00%	$ 41,116
19	336	Backflow Prevention Devices	$ 38,387	$ -	$ 38,387	6.67%	$ 2,560
20	339	Other Plant and Miscellaneous Equipment	$ 259,531	$ -	$ 259,531	6.67%	$ 17,311
21	340	Office Furniture and Fixtures	$ 551,757	$ -	$ 551,757	6.67%	$ 36,802
22	341	Transportation Equipment	$ 177,165	$ -	$ 177,165	20.00%	$ 35,433
23	342	Stores Equipment	$ 31,711	$ -	$ 31,711	4.00%	$ 1,268
24	343	Tools and Work Equipment	$ 23,350	$ -	$ 23,350	5.00%	$ 1,168
25	344	Laboratory Equipment	$ -	$ -	$ -	10.00%	$ -
26	345	Power Operated Equipment	$ -	$ -	$ -	5.00%	$ -
27	346	Communications Equipment	$ 119,710	$ -	$ 119,710	10.00%	$ 11,971
28	347	Miscellaneous Equipment	$ -	$ -	$ -	10.00%	$ -
29	348	Other Tangible Plant	$ -	$ -	$ -	10.00%	$ -
30		Total Plant	$ 71,785,970	$ 1,284,695	$ 70,501,275		$ 2,291,721
31							
32		Composite Depreciation Rate (Depr Exp / Depreciable Plant):	3.25%				
33		CIAC:	$ 3,096,180				
34		Amortization of CIAC (Line 32 x Line 33):	$ 100,645				
35							
36		Depreciation Expense Before Amortization of CIAC:	$ 2,291,721				
37		Less Amortization of CIAC:	$ 100,645				
38		**Test Year Depreciation Expense - Staff:**	**$ 2,191,077**				
39		Depreciation Expense - Company:	$ 2,291,982				
40		**Staff's Total Adjustment:**	**$ (100,905)**				

References:
Column [A]: Schedule JMM-W4
Column [B]: From Column [A]
Column [C]: Column [A] - Column [B]
Column [D]: Engineering Staff Report
Column [E]: Column [C] x Column [D]

Litchfield Park Service Company - Water Division
Docket No. W-01427A-09-0104
Test Year Ended September 30, 2008

Schedule JMM-W19

6

OPERATING INCOME ADJUSTMENT #~~12~~ - Property Tax Expense

LINE NO.	Property Tax Calculation	[A] STAFF AS ADJUSTED	[B] STAFF RECOMMENDED
1	Staff Adjusted Test Year Revenues	$ 6,475,003	$ 6,475,003
2	Weight Factor	2	2
3	Subtotal (Line 1 * Line 2)	12,950,006	$ 12,950,006
4	Staff Recommended Revenue, Per Schedule JMM-W1	6,475,003	$ 11,803,750
5	Subtotal (Line 4 + Line 5)	19,425,009	24,753,756
6	Number of Years	3	3
7	Three Year Average (Line 5 / Line 6)	6,475,003	$ 8,251,252
8	Department of Revenue Mutilplier	2	2
9	Revenue Base Value (Line 7 * Line 8)	12,950,006	$ 16,502,504
10	Plus: 10% of CWIP -	-	-
11	Less: Net Book Value of Licensed Vehicles	94,101	$ 94,101
12	Full Cash Value (Line 9 + Line 10 - Line 11)	12,855,905	$ 16,408,403
13	Assessment Ratio	21.0%	21.0%
14	Assessment Value (Line 12 * Line 13)	2,699,740	$ 3,445,765
15	Composite Property Tax Rate (Per Company Schedule)	9.5187%	9.5187%
16			$ -
17	Staff Test Year Adjusted Property Tax (Line 14 * Line 15)	$ 256,980	
18	Company Proposed Property Tax	373,338	
19			
20	Staff Test Year Adjustment (Line 16-Line 17)	$ (116,358)	
21	Property Tax - Staff Recommended Revenue (Line 14 * Line 15)		$ 327,992
22	Staff Test Year Adjusted Property Tax Expense (Line 16)		$ 256,980
23	Increase in Property Tax Expense Due to Increase in Revenue Requirement		$ 71,012
24			
25	Increase to Property Tax Expense		$ 71,012
26	Increase in Revenue Requirement		5,328,747
27	Increase to Property Tax per Dollar Increase in Revenue (Line19/Line 20)		1.332618%

Litchfield Park Service Company - Water Division
Docket No. W-01427A-09-0104
Test Year Ended September 30, 2008

Schedule JMM-W20

OPERATING INCOME ADJUSTMENT NO. ~~18~~ 7 - TEST YEAR INCOME TAXES

LINE NO.	DESCRIPTION		
1			
2			
3			
4	*Calculation of Income Tax:*		Test Year
5	Revenue (Schedule JMM-11)	$	6,475,003
6	Operating Expenses Excluding Income Taxes	$	6,716,612
7	Synchronized Interest (L17)	$	409,400
8	Arizona Taxable Income (L1 - L2 - L3)	$	(651,009)
9	Arizona State Income Tax Rate		6.9680%
10	Arizona Income Tax (L4 x L5)	$	(45,362)
11	Federal Taxable Income (L4 - L6)	$	(605,647)
12	Federal Tax on First Income Bracket ($1 - $50,000) @ 15%	$	(7,500)
13	Federal Tax on Second Income Bracket ($51,001 - $75,000) @ 25%	$	(6,250)
14	Federal Tax on Third Income Bracket ($75,001 - $100,000) @ 34%	$	(8,500)
15	Federal Tax on Fourth Income Bracket ($100,001 - $335,000) @ 39%	$	(91,650)
16	Federal Tax on Fifth Income Bracket ($335,001 -$10,000,000) @ 34%	$	(92,020)
17	Total Federal Income Tax	$	(205,920)
18	Combined Federal and State Income Tax (L44 + L51)	$	(251,282)
19			
20			
21	*Calculation of Interest Synchronization:*		
22	Rate Base (Schedule JMM-W4)	$	37,218,182
23	Weighted Average Cost of Debt		1.10%
24	Synchronized Interest (L16 x L17)	$	409,400
25			
26			
27	Income Tax - Per Staff	$	(251,282)
28	Income Tax - Per Company	$	(449,705)
29	**Staff Adjustment**	$	**198,423**

Litchfield Park Service Company - Water Division
Docket No. W-01427A-09-0104
Test Year Ended September 30, 2008

Schedule JMM-W21

FINANCIAL ANALYSIS

Selected Financial Information
Pro forma Includes Immediate Effects of the Proposed Long-term Debt

	[A] 9/30/2008 Test Year Operating Results Without Loan		[B] 11/4/2009 With Staff Recommended Operating Income and Staff Recommended Loan Amount of $2,925,000 Pro Forma	
1 Operating Income/(Loss)	$ 9,673		$ 3,237,982	
2 Depreciation Expense	2,191,077		2,191,077	
3 Income Tax Expense	(251,282)		1,778,145	
4 Interest Expense	747,446	**Note 1**	898,983	**Note 3**
5 Principal Repayment	230,000	**Note 2**	314,982	**Note 4**
TIER & DSC Calculation				
TIER				
6 [1+3] ÷ [4]	-0.32		5.58	
DSC				
7 [1+2+3] ÷ [4+5]	**1.99**		**5.94**	

Note 1: This information was taken from the Company's 2008 annual report:

1999 IDA Loan Interest	$ 256,782
2001 IDA Loan Interest	490,664
Total	$ 747,446

Note 2: This information was taken from the Company's 2008 annual report:

1999 IDA Loan Principle	$ 170,000
2001 IDA Loan Principle	60,000
Total	$ 230,000

Note 3: This pro-forma information is based on a 20 year WIFA loan at 5.25 percent annual interest:

Total Interest of Old Loans	$ 747,446
Interest on New Loans	151,537
	$ 898,983

Note 4: This pro-forma information is based on a 20 year WIFA loan at 5.25 percent annual interest:

Total Principle of Old Loans	$ 230,000
Principle on New Loans	84,982
	$ 314,982

BEFORE THE ARIZONA CORPORATION COMMISSION

KRISTIN K. MAYES
Chairman
GARY PIERCE
Commissioner
PAUL NEWMAN
Commissioner
SANDRA D. KENNEDY
Commissioner
BOB STUMP
Commissioner

IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WATER RATES, AND CHARGES FOR UTILITY SERVICE BASED THERON, AND APPROVAL OF ASSOCIATED FINANCINGS	DOCKET NO. W-01427A-09-0104 DOCKET NO. W-01427A-09-0116 DOCKET NO. W-01427A-09-0120

WATER

SURREBUTTAL

TESTIMONY

OF

JEFFREY M. MICHLIK

PUBLIC UTILITIES ANALYST V

UTILITIES DIVISION

ARIZONA CORPORATION COMMISSION

DECEMBER 17, 2009

ALL-STATE LEGAL®
EXHIBIT
S-15
ADMITTED

Table of Contents

SURREBUTTAL SCHEDULES

EXECUTIVE SUMMARY
LITCHFIELD PARK SERVICE COMPANY
WATER DIVISION
DOCKET NOS. W-01427A-09-0104, W-01427A-09-0116, AND W-01427A-09-0120

As compared to Direct Testimony, Staff's Surrebuttal position decreases its recommended revenue requirement by $22,438, from $11,803,750 to $11,781,312. Staff recommends revised rates that would increase operating revenues from test year by $4,902,602 to produce operating revenues of $11,781,312 resulting in operating income of $3,234,150 or a 71.27 percent increase over test year revenues of $6,878,710. Staff also recommends a revised FVRB of $37,174,137.

Revenue Requirement

Staff recommends its revised revenue requirement, revised revenue increase, and revised percentage of revenue increase.

Rate Base

Staff recommends a revised rate base, and responds to Litchfield Park Service Company's ("LPSCO" or "Company") comments to Staff's customer security deposits, and further comments on why Staff continues to recommend disallowance of the Company's deferred regulatory assets.

Income Statement

Staff recommends revised operating income, and responds to the Company's comments on corporate expense allocation expense. Based on new information, Staff now recommends disallowance of employee bonuses.

Financings

Staff has updated its financing numbers to reflect the changes made in its Surrebuttal Testimony.

INTRODUCTION

Q. Please state your name, occupation, and business address.

A. My name is Jeffrey M. Michlik. I am a Public Utilities Analyst V employed by the Arizona Corporation Commission ("ACC" or "Commission") in the Utilities Division ("Staff"). My business address is 1200 West Washington Street, Phoenix, Arizona 85007.

Q. Are you the same Jeffrey M. Michlik who filed Direct Testimony in this case?

A. Yes, I am.

Q. What is the purpose of your Surrebuttal Testimony in this proceeding?

A. The purpose of my Surrebuttal Testimony in this proceeding is to respond, on behalf of Staff, to the Rebuttal Testimony of Litchfield Park Service Company's ("LPSCO" or "Company") witnesses, Mr. Thomas J. Bourassa and Mr. Greg Sorensen, regarding revenue requirement, rate base, and operating revenues and expenses.

Q. Did you attempt to address every issue the Company raised in its Rebuttal Testimony?

A. No. Staff limited its discussion to the specific issues as outlined below. Staff's lack of response to any issue in this proceeding should not be construed as agreement with the Company's position in its Rebuttal Testimony; rather, where there is no response, Staff relies on its original Direct Testimony.

Q. Please explain how Staff's Surrebuttal Testimony is organized.

A. Staff's Surrebuttal Testimony is generally organized to present issues that Mr. Bourassa and Mr. Sorensen present in their Rebuttal Testimonies.

REVENUE REQUIREMENT

Q. Has Staff reviewed Mr. Bourassa's and Mr. Sorensen's Rebuttal Testimony regarding revenue requirement for the Water Division?

A. Yes.

Q. Has Staff revised its recommendations from its direct testimony?

A. Yes. As compared to DIRECT TESTIMONY, Staff's Surrebuttal position decreases its recommended revenue requirement by $22,438, from $11,803,750 to $11,781,312. This decrease reflects Staff's Surrebuttal adjustments as discussed herein.

Q. Please summarize the proposed and recommended revenue requirement, revenue increase, and percentage increase.

A. The proposed and recommended revenue requirement, revenue increase, and percentage increase are as follows:

	Revenue Requirement	Revenue Increase	Percentage Increase
Company-Direct	$13,983,149	$7,508,146	115.96 percent
Staff-Direct	$11,803,750	$5,328,747	81.82 percent
RUCO-Direct	$10,923,684	$4,044,974	58.80 percent
Company-Rebuttal	$13,637,738	$6,759,028	98.26 percent
Staff-Surrebuttal	$11,781,312	$4,902,602	71.27 percent

RATE BASE

Q. Has Staff reviewed Mr. Bourassa's and Mr. Sorensen's Rebuttal Testimony regarding rate base for the Water Division?

A. Yes.

Q. Has Staff revised its recommendations from its direct testimony?

A. Yes. As compared to Direct Testimony, Staff's Surrebuttal position decreases its recommended rate base by $44,045, from $37,218,182 to $37,174,137. This decrease reflects Staff's Surrebuttal adjustments as discussed herein.

Q. Would Staff please identify each party's respective rate base recommendations?

A. Yes. The rate bases proposed and recommended by all parties in the case are as follows:

	OCRB	FVRB
Company-Direct	$37,924,592	$37,924,592
Staff-Direct	$37,218,182	$37,218,182
RUCO-Direct	$37,222,878	$37,222,878
Company-Rebuttal	$37,502,569	$37,502,569
Staff-Surrebuttal	$37,174,137	$37,174,137

Q. Are there any adjustments to plant in service that Staff did not make in Direct Testimony, but would like to make now for the Water Division?

A. Yes.

Q. Please provide a summary of adjustments that you have accepted from the Company and/or RUCO, and on which schedule the adjustments have been made.

A. Staff has made the following adjustments to rate base for the Water Division:

Plant-in-Service

Staff has added $21,000 to account no. 301 organization cost, as shown on Surrebuttal Schedule JMM-W7. Based on review of supporting documentation, Staff has accepted the Company's and RUCO's adjustment.

Staff has capitalized expenses in the amount of $1,114 for Account No. 307 Wells and Springs, and $8,600 for Account No. 331 Distribution Mains, as shown on Surrebuttal Schedule JMM-W7. Based on review of supporting documentation, Staff has accepted the Company's and RUCO's adjustment.

Staff has removed $7,072 related to office rent that was included in Account No. 307 Wells and Springs, as shown on Surrebuttal Schedule JMM-W7. Based on review of supporting documentation, Staff has accepted the Company's and RUCO's adjustment.

Accumulated Depreciation

Staff adjusted accumulated depreciation to reflect Plant-In-Service that has been fully depreciated in the amount of $78,879, accumulated depreciation of Capitalized Plant in the amount of $119, and the removal of accumulated depreciation related to the removal of the office rent in the amount of $1,449. See Surrebuttal Schedule JMM-W8. Staff made these adjustments to accumulated depreciation based on review of the Company's Rebuttal Testimony.

Reclassification of Advances-in-aid of Construction to Customer Meter Deposits

Staff removed $2,238,022 from Advances-In-Aid of Construction and reclassified this amount as customer meter deposits. See Surrebuttal Schedule JMM-W9. Based on review of the Company's rebuttal testimony, Staff has accepted the Company's adjustment.

Deferred Income Taxes and Credits

Staff increased deferred income taxes and credits to the Company's proposed amount of $448,160. See Surrebuttal Schedule JMM-W10. Based on review of the Company's Rebuttal Testimony, Staff has accepted the Company's adjustment.

Q. Please review the remaining contested issues related to rate base for the Water Division.

A. Certainly.

Security Deposits

Q. Does Staff still believe security deposits should be included in rate base?

A. Yes. By definition customer security deposits are customer deposits.

Q. What do customer deposits represent?

A. Customer deposits represent funds received from ratepayers as security against potential losses arising from failure to pay for service. These funds are similar in nature to customer advances for construction. Both represent a liability to repay the funds received either after a specified period or upon satisfaction of certain requirements. Like customer advances, the deposits are available to the utility for use in support of its rate base investment.

Q. Does Staff include customer deposits in rate base?

A. Yes.

Accumulated Deferred Income Taxes

Q. Has Staff determined its final position regarding the issue of deferred income taxes?

A. Staff is still reviewing Mr. Bourassa's proposal and rebuttal adjustment for this item. While Staff agrees with the methodology used by Mr. Bourassa, Staff believes that the substantiation for the underlying calculations warrants an in-depth review and analysis. Staff is provisionally including the Company's adjustment pending completion of its analysis.

Deferred Regulatory Assets

Q. Has Staff changed its position regarding the Company's deferred regulatory assets related to potential contamination of the Company's wells?

A. No. Staff continues to recommend exclusion of the assets from the Company's rate base.

Q. Does Staff believe that the increased water testing costs and legal costs were unnecessary or unreasonable?

A. No. These costs were incurred as part of the Company's efforts to monitor the groundwater for possible contamination from the TCE plume and therefore benefit the ratepayers by enhancing customer safety.

Q. Has the Company sought recovery of these expenses from the party or parties responsible for the potential contamination of their water supplies?

A. No. The Company's responses to a series of data requests indicate that the Company has taken no legal action against the responsible party and, in fact, has not even asked the responsible party for reimbursement of these costs.

Q. How does Staff recommend these costs be treated at this time?

A. Staff believes that the Company should continue to defer these costs until a future rate case. The Company stated in its data responses that it would initiate legal action against the responsible party when any well-site contamination occurs. At this time, it is unknown whether or not the Company's well-site may eventually be contaminated or whether the Company will have any of the costs recovered. It is premature to pass these costs on to the ratepayers and, therefore, Staff recommends that the costs continue to be deferred.

OPERATING INCOME

Q. Are there any adjustments to plant in service that Staff did not make in Direct Testimony, but would like to make now for the Water Division?

A. Yes.

Q. Please provide a summary of adjustments that you have accepted from the Company and/or RUCO, and on which schedules the adjustments have been made.

A. Staff has made the following adjustments to operating income for the Water Division:

Revenue Annualization for the City of Goodyear

Staff has added $403,707 to test year metered water revenues, as shown on Surrebuttal Schedule JMM-W15. Based on review of supporting documentation, Staff has accepted the Company's and RUCO's adjustment.

Fuel for Purchased Power

Staff has removed $20,309 from fuel for power production, as shown on Surrebuttal Schedule JMM-W16. Based on review of the Company's Rebuttal Testimony, Staff has accepted the Company's adjustment.

Chemical Expense

Staff has removed $305 from chemical expense, as shown on Surrebuttal Schedule JMM-W17. Based on review of supporting documentation, Staff has accepted the Company's and RUCO's adjustment.

Capitalized Expenses

Staff has removed $9,714 in capitalized expenses and $3,191 in unnecessary expenses from outside services, as shown on Surrebuttal Schedule JMM-W18. Based on review of supporting documentation, Staff has accepted the Company's and RUCO's adjustment.

Depreciation Expense

Staff has recalculated its amortization of contributions using a specific rate rather than a composite rate, as shown on Surrebuttal Schedule JMM-W22. Based on review of the Company's Rebuttal Testimony, Staff has accepted the Company's adjustment.

Q. Please review the remaining contested issues related to operating income for the Water Division.

A. Certainly.

Corporate Expense Allocation

Q. How does the Algonquin Power Income Fund ("Fund" or "APIF") produce income for its shareholders?

A. The Fund, according to its 2008 annual report, produces earnings for its shareholders through a diversified portfolio of renewable energy and utility assets.

Q. What was the APIF's business strategy?

A. The Fund's 2008 annual report states the following concerning its business strategy:

> *Algonquin's business strategy is to maximize long term unitholder value by strengthening its position as a strong renewable energy and infrastructure company.* ***The Company is focused on growth in cash flow and earnings*** *in the business segments in which it operates.* (emphasis added)

Q. What was the APIF's income for 2008?

A. The APIF generated $57 million in income before taxes according to its 2008 audited financial statements.

Q. Does Staff agree with the Company's statement that "APIF incurs the central office cost for the benefit of its subsidiary businesses" and "but for the subsidiary businesses, APIF would not have central offices costs . . . ." (Bourassa Rebuttal, page 33, lines 19 through 33)?

A. No, Staff does not. The APIF is an unregulated for-profit business that incurs costs primarily for the benefit of its shareholders. Making a profit is the ultimate reason any for-profit company incurs expenses. The Fund is focused on "*growth in cash flow and earnings*" as evidenced from its business strategy. Since shareholders seek a profit and the APIF incurs expenses (e.g. central office costs) in order to generate that profit, it is obvious that the central office costs are incurred primarily for the benefit of the shareholders rather than for LPSCO as the Company indicates. The central office costs would have been incurred even if the Fund did not own LPSCO because the central office costs were incurred to make a profit for the shareholders and not to operate LPSCO. The benefit to LPSCO is only incidental.

Q. Please comment on the Company's statement that the Company only owns 63 companies and not 71 as stated in the Staff Report.

A. According to the Company's financial report, the Company has interest in the other eight companies, and accordingly it generates expenses from them. Therefore, Staff included them in its calculation.

Employee Bonus Expense

Q. Since the time of filing Direct Testimony, are there any adjustments that Staff would like to make in its Surrebuttal filing?

A. Yes. Staff recommends that $52,954 be removed for employee bonuses. Of that amount, Staff recommends $26,477 be allocated to water and $26,477 be allocated to wastewater based on Staff's allocation of corporate expenses.

Q. Why is Staff making this adjustment now?

A. Upon reviewing the Company's response to a later data request regarding bonuses, Staff determined that this amount had been incurred for performance incentives paid to employees, which Staff believes should not be passed on to the ratepayers.

Q. What is Staff recommending?

A. Staff recommends removing $26,477 from contractual services, as shown on Surrebuttal Schedule JMM-W18.

FINANCINGS

Q. Has Staff updated its times interest earned ratio and debt service coverage ratio, to reflect the adjustments Staff has made to in its Surrebuttal Testimony?

A. Yes, the updated calculations are shown in Schedule JMM-W25.

Q. Does this conclude your Surrebuttal Testimony?

A. Yes.

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Surrebuttal Schedule JMM-W1

REVENUE REQUIREMENT

LINE NO.	DESCRIPTION	(A) COMPANY FAIR VALUE	(B) STAFF FAIR VALUE
1	Adjusted Rate Base	$ 37,924,592	$ 37,174,137
2	Adjusted Operating Income (Loss)	$ (282,890)	$ 258,240
3	Current Rate of Return (L2 / L1)	-0.75%	0.69%
4	Required Rate of Return	11.41%	8.70%
5	Required Operating Income (L4 * L1)	$ 4,327,196	$ 3,234,150
6	Operating Income Deficiency (L5 - L2)	$ 4,610,086	$ 2,975,910
7	Gross Revenue Conversion Factor	1.6286	1.6474
8	Required Revenue Increase (L7 * L6)	$ 7,508,146	**$ 4,902,602**
9	Adjusted Test Year Revenue	$ 6,475,003	$ 6,878,710
10	Proposed Annual Revenue (L8 + L9)	$ 13,983,149	$ 11,781,312
11	Required Increase in Revenue (%)	115.96%	71.27%

References:
Column (A): Company Schedule A-1
Column (B): Staff Schedules JMM-W3 and JMM-W13

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Surrebuttal Schedule JMM-W2

GROSS REVENUE CONVERSION FACTOR

LINE NO.	DESCRIPTION	(A)	(B)	(C)	(D)
	Calculation of Gross Revenue Conversion Factor:				
1	Revenue	100.0000%			
2	Uncollecible Factor (Line 11)	0.0000%			
3	Revenues (L1 - L2)	100.0000%			
4	Combined Federal and State Income Tax and Property Tax Rate (Line 23)	39.2994%			
5	Subtotal (L3 - L4)	60.7006%			
6	**Revenue Conversion Factor (L1 / L5)**	1.647430			
	Calculation of Uncollecttible Factor:				
7	Unity	100.0000%			
8	Combined Federal and State Tax Rate (Line 23)	38.4795%			
9	One Minus Combined Income Tax Rate (L7 - L8)	61.5205%			
10	Uncollectible Rate	0.0000%			
11	Uncollectible Factor (L9 * L10)	0.0000%			
	Calculation of Effective Tax Rate:				
12	Operating Income Before Taxes (Arizona Taxable Income)	100.0000%			
13	Arizona State Income Tax Rate	6.9680%			
14	Federal Taxable Income (L12 - L13)	93.0320%			
15	Applicable Federal Income Tax Rate (Line 55)	33.8717%			
16	Effective Federal Income Tax Rate (L14 x L15)	31.5115%			
17	Combined Federal and State Income Tax Rate (L13 +L16)		38.4795%		
	Calculation of Effective Property Tax Factor				
18	Unity	100.0000%			
19	Combined Federal and State Income Tax Rate (L17)	38.4795%			
20	One Minus Combined Income Tax Rate (L18-L19)	61.5205%			
21	Property Tax Factor (JMM-W18, L27)	1.3326%			
22	Effective Property Tax Factor (L20*L21)		0.8198%		
23	Combined Federal and State Income Tax and Property Tax Rate (L17+L22)			39.2994%	
24	Required Operating Income (Schedule JMM-W1, Line 5)	$ 3,234,150			
25	AdjustedTest Year Operating Income (Loss) (Schedule JMM-W11, Line 35)	258,240			
26	Required Increase in Operating Income (L24 - L25)		$ 2,975,910		
27	Income Taxes on Recommended Revenue (Col. [E], L52)	$ 1,776,041			
28	Income Taxes on Test Year Revenue (Col. [B], L52)	(85,318)			
29	Required Increase in Revenue to Provide for Income Taxes (L27 - L28)		1,861,359		
30	Recommended Revenue Requirement (Schedule JMM-W1, Line 10)	$ 11,781,312			
31	Uncollectible Rate (Line 10)	0.0000%			
32	Uncolllectible Expense on Recommended Revenue (L30*L31)	$ -			
33	Adjusted Test Year Uncollectible Expense	$ -			
34	*Required Increase in Revenue to Provide for Uncollectible Exp. (L32-L33)*		-		
35	Property Tax with Recommended Revenue (JMM-W11, Col B, L31)	$ 338,453			
36	Property Tax on Test Year Revenue (JMM-W18, Col A, L17)	273,120			
37	Increase in Property Tax Due to Increase in Revenue (L35-L36)		65,333		
38	Total Required Increase in Revenue (L26 + L29 + L34 + L37)		$ 4,902,602		

LINE NO.	*Calculation of Income Tax:*	Test Year		Staff Recommended
39	Revenue (Schedule JMM-W11, Col. [C], Line 5 & Sch. JMM-W1, Col. [D] Line 1C	$ 6,878,710	$ 4,902,602	$ 11,781,312
40	Operating Expenses Excluding Income Taxes	$ 6,705,788		$ 6,771,121
41	Synchronized Interest (L56)	$ 408,916		$ 408,916
42	Arizona Taxable Income (L39 - L40 - L41)	$ (235,994)		$ 4,601,275
43	Arizona State Income Tax Rate	6.9680%		6.9680%
44	Arizona Income Tax (L42 x L43)	$ (16,444)		$ 320,617
45	Federal Taxable Income (L42 - L44)	$ (219,550)		$ 4,280,658
46	Federal Tax on First Income Bracket ($1 - $50,000) @ 15%	$ (7,500)		$ 7,500
47	Federal Tax on Second Income Bracket ($51,001 - $75,000) @ 25%	$ (6,250)		$ 6,250
48	Federal Tax on Third Income Bracket ($75,001 - $100,000) @ 34%	$ (8,500)		$ 8,500
49	Federal Tax on Fourth Income Bracket ($100,001 - $335,000) @ 39%	$ (46,624)		$ 91,650
50	Federal Tax on Fifth Income Bracket ($335,001 -$10,000,000) @ 34%	$ -		$ 1,341,524
51	Total Federal Income Tax	$ (68,874)		$ 1,455,424
52	Combined Federal and State Income Tax (L44 + L51)	$ (85,318)		$ 1,776,041
53	Applicable Federal Income Tax Rate [Col. [E], L51 - Col. [B], L51] / [Col. [E], L45 - Col. [B], L45]			33.8717%

LINE NO.	*Calculation of Interest Synchronization:*	
54	Rate Base (Schedule JMM-W3, Col. (C), Line 17	$ 37,174,137
55	Weighted Average Cost of Debt (Schedule JMM-W19)	1.1000%
56	Synchronized Interest (L45 X L46)	$ 408,916

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Surrebuttal Schedule JMM-W3

RATE BASE - ORIGINAL COST

LINE NO.		(A) COMPANY AS FILED	(B) STAFF ADJUSTMENTS	Adj. No.	(C) STAFF AS ADJUSTED
1	Plant in Service	$ 73,731,815	$ (36,433)	1,2,3	$ 73,695,382
2	Less: Accumulated Depreciation	9,107,141	(80,209)	4	9,026,932
3	Net Plant in Service	$ 64,624,674	$ 43,776		$ 64,668,450
	LESS:				
4	Contributions in Aid of Construction (CIAC)	$ 3,104,068	$ (7,888)	2	$ 3,096,180
5	Less: Accumulated Amortization	860,706	-		$ 860,706
6	Net CIAC	2,243,362	(7,888)		$ 2,235,474
7	Advances in Aid of Construction (AIAC)	24,583,673	(2,246,699)	5	22,336,974
8	Customer Deposits	68,685	2,405,020	5	2,473,705
9	Deferred Income Tax Credits	21,451	426,709	6	448,160
	ADD:				
9	Unamortized Debt Issuance Costs	134,528	(134,528)	7	-
10	Deffered Regulatory Assets	82,561	(82,561)	8	-
11	**Original Cost Rate Base**	$ 37,924,592	$ (750,455)		$ 37,174,137

References:
Column [A]: Company as Filed
Column [B]: Schedule JMM-W4
Column (C): Column (A) + Column (B)

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Surrebuttal Schedule JMM-W4

SUMMARY OF ORIGINAL COST RATE BASE ADJUSTMENTS

LINE NO.	ACCT. NO.	DESCRIPTION	[A] COMPANY AS FILED	[B] ADJ #1 Post-Test Year Plant Ref: Sch JMM-W5	[C] ADJ #2 Plant Not Used And Useful Ref: Sch JMMW-6	[D] ADJ #3 Company Rebuttal Adjustments to Plant Ref: Sch JMMW-7	[E] ADJ #4 Accumulated Depreciation Ref: Sch JMMW-8	[F] ADJ #5 Customer Deposits Ref: Sch JMMW-9	[G] ADJ #6 Deferred Income Taxes Ref: Sch JMMW-10	[H] ADJ #7 Unamortized Finance Charges Ref: Sch JMMW-11	[H] ADJ #8 Deferred Asset Ref: Sch JMMW-12	[H] STAFF ADJUSTED
		PLANT IN SERVICE:										
1												
2	301	Organization Cost	$ 100	$ -	$ -	$ 21,000	$ -	$ -	$ -	$ -	$ -	$ 21,100
3	302	Franchise Cost	-	-	-	-	-	-	-	-	-	-
4	303	Land and Land Rights	1,284,595	-	-	-	-	-	-	-	-	1,284,595
5	304	Structures and Improvements	24,698,293	-	(41,971)	-	-	-	-	-	-	24,656,322
6	305	Collecting and Impounding Res.	-	-	-	-	-	-	-	-	-	-
7	306	Lake River and Other Intakes	-	-	-	-	-	-	-	-	-	-
8	307	Wells and Springs	2,382,102	-	-	(5,958)	-	-	-	-	-	2,376,144
9	308	Infiltration Galleries and Tunnels	-	-	-	-	-	-	-	-	-	-
10	309	Supply Mains	-	-	-	-	-	-	-	-	-	-
11	310	Power Generation Equipment	202,269	-	-	-	-	-	-	-	-	202,269
12	311	Electric Pumping Equipment	948,213	-	(31,158)	-	-	-	-	-	-	917,055
13	320	Water Treatment Equipment	1,337,824	-	-	-	-	-				1,337,824
14	320	Water Treatment Plant	-	-	-	-	-	-				-
15	330	Distribution Reservoirs & Standpipe	430,644	-	-	-	-	-	-	-	-	430,644
16	331	Transmission and Distribution Mains	28,929,171	-	-	8,600	-	-	-	-	-	28,937,771
17	333	Services	4,249,744	-	-	-	-	-				4,249,744
18	334	Meters	4,138,752	-	-	-	-	-				4,138,752
19	335	Hydrants	2,055,781	-	-	-	-	-	-	-	-	2,055,781
20	336	Backflow Prevention Devices	38,387	-	-	-	-	-	-	-	-	38,387
21	339	Other Plant and Miscellaneous Equipment	265,281	-	(5,750)	-	-	-	-	-	-	259,531
22	340	Office Furniture and Fixtures	551,757	-	-	-	-	-	-	-	-	551,757
23	341	Transportation Equipment	177,165	-	-	-	-	-	-	-	-	177,165
24	342	Stores Equipment	31,711	-	-	-	-	-	-	-	-	31,711
25	343	Tools and Work Equipment	23,350	-	-	-	-	-	-	-	-	23,350
26	344	Laboratory Equipment	-	-	-	-	-	-	-	-	-	-
27	345	Power Operated Equipment	-	-	-	-	-	-	-	-	-	-
28	346	Communications Equipment	119,710	-	-	-	-	-	-	-	-	119,710
29	347	Miscellaneous Equipment	-	-	-	-	-	-	-	-	-	-
30	348	Other Tangible Plant	-	-	-	-	-	-	-	-	-	-
31		Total Plant in Service - Actual	71,864,850	-	-	-	-	-	-	-	-	71,809,612
32		Post Test-Year Plant	1,866,965	18,805								1,885,770
33		Total Plant in Service	$ 73,731,815	$ -	$ (78,879)	$ 23,642	$ -	$ -	$ -	$ -	$ -	$ 73,695,382
34		Less: Accumulated Depreciation	9,107,141	-	-	-	(80,209)	-	-	-	-	9,026,932
35			-	-	-	-	-	-	-	-	-	-
36		Net Plant in Service	$ 64,624,674	$ -	$ (78,879)	$ 23,642	$ 80,209	$ -	$ -	$ -	$ -	$ 64,668,450
37												
38		LESS:										
39		Contributions in Aid of Construction (CIAC)	$ 3,104,068	$ -	$ (7,888)	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,096,180
40		Less: Accumulated Amortization	860,706	-	-	-	-	-	-	-	-	860,706
41		Net CIAC (L25 - L26)	2,243,362	-	(7,888)	-	-	-	-	-	-	2,235,474
42		Advances in Aid of Construction (AIAC)	24,583,673	-	(8,677)	-	-	(2,238,022)	-	-	-	22,336,974
43		Customer Deposits	68,685	-	-	-	-	2,405,020	-	-	-	2,473,705
44		Deferred Income Taxes	21,451	-	-	-	-	-	426,709	-	-	448,160
45			-	-								-
46												
47		ADD:										
48		Unamortized Debt Issuance Costs	134,528	-	-	-	-	-	-	(134,528)	-	-
49		Deffered Regulatory Assets	82,561	-	-	-	-	-	-	-	(82,561)	-
50												
51		Original Cost Rate Base	$ 37,924,592	$ -	$ (62,314)	$ 23,642	$ 80,209	$ (166,998)	$ (426,709)	$ (134,528)	$ (82,561)	$ 37,174,137

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Surrebuttal Schedule JMM-W5

RATE BASE ADJUSTMENT NO. 1 - POST-TEST YEAR PLANT

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Post-Test Year Plant	$ 1,866,965	$ 18,805	$ 1,885,770

Based on Staff Engineering Report Table I-1.

<u>REFERENCES:</u>
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Surrebuttal Schedule JMM-W6

RATE BASE ADJUSTMENT NO. 2 - PLANT NOT USED AND USEFUL

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	304	Structures & Improvements	$ 24,698,293	$ (41,971)	$ 24,656,322
2	311	Electric Pumping Equipment	948,213	(31,158)	917,055
3	339	Other Plant & Miscellaneous Equipment	265,281	(5,750)	259,531
4			$ 25,911,787	$ (78,879)	25,832,908
5					
6		Based on Staff Engineering Report Table H-1.			
7					

LINE NO.	DESCRIPTION	[A] COMPANY AIAC & CIAC AS FILED	[B] STAFF ADJUSTMENTS	[C] STAFF AS ADJUSTED
12	Advances in Aid of Construction (AIAC)	$ 24,583,673	$ (8,677)	$ 24,574,996
13				
14	Contributions in Aid of Construction (CIAC)	$ 3,104,068	$ (7,888)	$ 3,096,180

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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RATE BASE ADJUSTMENT NO. 3 - COMPANY REBUTTAL ADJUSTMENTS TO PLANT IN SERVICE THAT STAFF ACCEPTS

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	301	Organization Costs	$ 100	$ 21,000	$ 21,100
2	307	Wells and Springs	2,382,102	(5,958)	2,376,144
3	331	Distribution Mains	28,929,171	8,600	28,937,771
4			$ 31,311,273	$ 23,642	31,334,915
5					
6	307	Wells and Springs - Hydro Controls and Pump Systems		$ 1,114	
7	307	Wells and Springs - Suncor Development Company (2002)		(7,072)	
				$ (5,958)	

REFERENCES:
Column [A]: Company Filing
Column [B]: Surrebuttal Testimony JMM
Column [C]: Column [A] + Column [B]

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Surrebuttal Schedule JMM-W8

RATE BASE ADJUSTMENT NO. 4 - ACCUMULATED DEPRECIATION

LINE NO.	DESCRIPTION		[A] COMPANY AS FILED	[B] STAFF ADJUSTMENTS	[C] STAFF AS ADJUSTED
1	Accumulated Depreciation		$ 9,107,141	$ (80,209)	$9,071,918
	A/D Plant Retirements				
	304	Structures and improvements	$ (41,971)		
	311	Electric Pumping Equipment	(31,158)		
	339	Other Plant and Miscellaneous Equipment	(5,750)		
			$ (78,879)		
	A/D on Capitalized Plant				
	307	Wells and Springs	$ 54		
	331	Transmission and Distribution Mains	65		
			$ 119		
	A/D on Removed Capitalized Office Rent				
	307	Wells and Springs	$ (1,449)		

References:
Column [A]: Company Application
Column [B]: Surrebuttal Testimony JMM
Column [C]: Column [A] + Column [B]

Litchfield Park Service Company - Water Division
Docket No. W-01427A-09-0104
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Surrebuttal Schedule JMM-W9

RATE BASE ADJUSTMENT NO. 5 - CUSTOMER DEPOSITS

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Customer Deposits	$ 68,685	$ 2,405,020	$ 2,473,705

Staff Calculation:

8600-2-0100-20-2117-0000 Hydrant Meter Deposits	$ 85,200
8600-2-0000-20-2113-0000 Customer Deposits	73,568
8600-2-0000-20-2112-0002 Customer Security Deposits	8,230
	$ 166,998
Company reclass of AIAC	$ 2,238,022

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Advances in Aid of Construction (AIAC)	$ 24,583,673	$ (2,238,022)	$ 22,345,651

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct and Surrebuttal Testimony JMM
Column [C]: Column [A] + Column [B]

Litchfield Park Service Company - Water Division
Docket No. WS-2987-08-0180
Test Year Ended: December 31, 2007

Surrebuttal Schedule JMM-W10

RATE BASE ADJUSTMENT NO. 6 - DEFERRED INCOME TAXES

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Deferred Income Taxes	$ 21,451	$ 426,709	$ 448,160

Staff accepts Company's rebuttal position

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

Litchfield Park Service Company - Water Division
Docket No. WS-2987-08-0180
Test Year Ended: December 31, 2007

Surrebuttal Schedule JMM-W11

RATE BASE ADJUSTMENT NO. 7 - UNAMORTIZED DEBT ISSUANCE COSTS

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Unamortized Debt Issuance Costs	$ 134,528	$ (134,528)	$ -

To Remove Unamortized Debt Issuance Costs

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

Litchfield Park Service Company - Water Division
Docket No. WS-2987-08-0180
Test Year Ended: December 31, 2007

Surrebuttal Schedule JMM-W12

RATE BASE ADJUSTMENT NO. 8 - DEFERRED REGULATORY ASSETS

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Deferred Regulatory Assets	$ 82,561	$ (82,561)	$ -

To remove Deferred Regulatory Assets

<u>REFERENCES:</u>
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

Litchfield Park Service Company - Water Division
Docket No. W-01427A-09-0104
Test Year Ended September 30, 2008

Surrebuttal Schedule JMM-W13

OPERATING INCOME STATEMENT - ADJUSTED TEST YEAR AND STAFF RECOMMENDED

LINE NO.	DESCRIPTION	[A] COMPANY ADJUSTED TEST YEAR AS FILED	[B] STAFF TEST YEAR ADJUSTMENTS	Adj. No.	[C] STAFF TEST YEAR AS ADJUSTED	[D] STAFF PROPOSED CHANGES	[E] STAFF RECOMMENDED
1	*REVENUES:*						
2	Metered Water Sales	$ 6,347,481	$ 403,707	1	$ 6,751,188	$ 4,902,602	$ 11,653,790
3	Water Sales-Unmetered	-	-		-	-	-
4	Other Operating Revenue	127,522	-		127,522	-	127,522
5	Intentionally Left Blank	-	-		-	-	-
6	**Total Operating Revenues**	$ 6,475,003	$ 403,707		$ 6,878,710	$ 4,902,602	$ 11,781,312
7							
8	*OPERATING EXPENSES:*						
9	Salaries and Wages	$ -	$ -		$ -	$ -	$ -
10	Purchased Wastewater Treatment	5,011	-		5,011	-	5,011
11	Sludge Removal Expense	1,013,811	-		1,013,811	-	1,013,811
12	Purchased Power	58,147	(20,309)	2	37,838	-	37,838
13	Fuel for Power Production	503,278	(305)	3	502,973	-	502,973
14	Chemicals	44,001	-		44,001	-	44,001
15	Materials & Supplies	-	-		-	-	-
16	Contractural Services, Legal&Engr	12,469	-		12,469	-	12,469
17	Contractural Sevices - Other	2,382,976	(289,564)	4	2,093,412	-	2,093,412
18	Contractural Services - Testing	14,317	-		14,317	-	14,317
19	Equipment Rental	28,365	-		28,365	-	28,365
20	Rents - Building	10,647	-		10,647	-	10,647
21	Transportation	151,879	-		151,879	-	151,879
22	General Liability Insurance	95,469	-		95,469	-	95,469
23	Insurance - Other	3,319	-		3,319	-	3,319
24	Regulatory Commission Expense	63,662	-		63,662	-	63,662
25	Regulatory Commission Expense - Rate Case	70,000	(28,000)	5	42,000	-	42,000
26	Misceallenous Exp	81,664	(827)	6	80,837	-	80,837
27	Bad Debt Expense	3,264	5,284	7	8,548	-	8,548
28	Depreciation Expense	2,291,982	(67,873)	8	2,224,109	-	2,224,109
29	Depreciation	-	-		-	-	-
30	Taxes other than Income	-	-		-	-	-
31	Property Taxes	373,338	(100,218)	9	273,120	65,333	338,453
32	Income Taxes	(449,705)	364,387	10	(85,318)	1,861,359	1,776,041
33	Intentionally Left Blank	-	-		-	-	-
34	**Total Operating Expenses**	$ 6,757,893	$ (137,424)		$ 6,620,470	$ 1,926,692	$ 8,547,162
35	**Operating Income (Loss)**	$ (282,890)	$ 541,131		$ 258,240	$ 2,975,910	$ 3,234,150

References:
Column (A): Company Schedule C-1
Column (B): Schedule JMM-W14
Column (C): Column (A) + Column (B)
Column (D): Schedules JMM-W23 and JMM-W24 JMM - W 1
Column (E): Column (C) + Column (D)

Litchfield Park Service Company - Water Division
Docket No. W-01427A-09-0104
Test Year Ended September 30, 2008

Surrebuttal Schedule JMM-W14

SUMMARY OF OPERATING INCOME STATEMENT ADJUSTMENTS - TEST YEAR

LINE NO.	DESCRIPTION	[A] COMPANY AS FILED	[B] Revenue Annulization Goodyear ADJ #1	[C] Normalize Fuel for Purchased Power ADJ #2	[D] Chemicals Expense ADJ #3	[E] Outside Service Expense ADJ #4	[F] Rate Case Expense ADJ #5	[G] Meals and Ent. Expense ADJ #6	[H] Bad Debt Expense ADJ #7	[I] Depreciation Expense ADJ #8	[J] Property Tax Expense ADJ #9	[K] Income Tax Expense ADJ #10	[L] STAFF ADJUSTED
			Ref: Sch JMM-W15	Ref: Sch JMM-W16	Ref: Sch JMM-W17	Ref: Sch JMM-W18	Ref: Sch JMM-W19	Ref: Sch JMM-W20	Ref: Sch JMM-W21	Ref: Sch JMM-W22	Ref: Sch JMM-W23	Ref: Sch JMM-W24	
1	*REVENUES:*												
2	Metered Water Sales	$ 6,347,481	$ 403,707	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,751,188
3	Water Sales-Unmetered	-	-	-	-	-	-	-	-	-	-	-	-
4	Other Operating Revenue	127,522	-	-	-	-	-	-	-	-	-	-	127,522
5	Intentionally Left Blank	-	-	-	-	-	-	-	-	-	-	-	-
6	**Total Operating Revenues**	$ 6,475,003	$ 403,707	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,878,710
7													
8	*OPERATING EXPENSES:*												
9	Salaries and Wages	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
10	Purchased Water	5,011	-	-	-	-	-	-	-	-	-	-	5,011
11	Purchased Power	1,013,811	-	-	-	-	-	-	-	-	-	-	1,013,811
12	Fuel for Power Production	58,147	-	(20,309)	-	-	-	-	-	-	-	-	37,838
13	Chemicals	503,278	-	-	(305)	-	-	-	-	-	-	-	502,973
14	Repairs and Maintenance	44,001	-	-	-	-	-	-	-	-	-	-	44,001
15	Office Supplies and Expense	-	-	-	-	-	-	-	-	-	-	-	-
16	Outside Services	12,469	-	-	-	-	-	-	-	-	-	-	12,469
17	Outside Services - Other	2,382,976	-	-	-	(289,564)	-	-	-	-	-	-	2,093,412
18	Outside Services - *Legal*	14,317	-	-	-	-	-	-	-	-	-	-	14,317
19	Water Testing	28,365	-	-	-	-	-	-	-	-	-	-	28,365
20	Rents	10,647	-	-	-	-	-	-	-	-	-	-	10,647
21	Transportation Expenses	151,879	-	-	-	-	-	-	-	-	-	-	151,879
22	Insurance - General Liability	95,469	-	-	-	-	-	-	-	-	-	-	95,469
23	Insurance - Health and Life	3,319	-	-	-	-	-	-	-	-	-	-	3,319
24	Regulatory Commission Expenese	63,662	-	-	-	-	-	-	-	-	-	-	63,662
25	Regulatory Commission Expense - Rate Case	70,000	-	-	-	-	(28,000)	-	-	-	-	-	42,000
26	Miscellaneous Expense	81,664	-	-	-	-	-	(827)	-	-	-	-	80,837
27	Bad Debt Expense	3,264	-	-	-	-	-	-	5,284	-	-	-	8,548
28	Depreciation Expense	2,291,982	-	-	-	-	-	-	-	(67,873)	-	-	2,224,109
29	Amortization of CIAC	-	-	-	-	-	-	-	-	-	-	-	-
30	Taxes Other than Income	-	-	-	-	-	-	-	-	-	-	-	-
31	Property Taxes	373,338	-	-	-	-	-	-	-	-	(100,218)	-	273,120
32	Income Taxes	(449,705)	-	-	-	-	-	-	-	-	-	364,387	(85,318)
33	Intentionally Left Blank	-	-	-	-	-	-	-	-	-	-	-	-
34	**Total Operating Expenses**	$ 6,757,893	$ -	$ (20,309)	$ (305)	$ (289,564)	$ (28,000)	$ (827)	$ 5,284	$ (67,873)	$ (100,218)	$ 364,387	$ 6,620,470
35	**Operating Income (Loss)**	$ (282,890)	$ 403,707	$ 20,309	$ 305	$ 289,564	$ 28,000	$ 827	$ (5,284)	$ 67,873	$ 100,218	$ (364,387)	$ 258,240

Litchfield Park Service Company - Water Division
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Surrebuttal Schedule JMM-W15

OPERATING INCOME ADJUSTMENT NO. 1 - REVENUE ANNUALIZATION CITY OF GOODYEAR

LINE NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	Metered Water Sales	$ 6,347,481	$ 403,707	$ 6,751,188

Company has agreed to increased Metered Water Sales by $403,707.

REFERENCES:
Column [A]: Company Filing
Column [B]: Surrebuttal Testimony JMM
Column [C]: Column [A] + Column [B]

Litchfield Park Service Company - Water Division
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Surrebuttal Schedule JMM-W16

OPERATING INCOME ADJUSTMENT NO. 2 - NORMALIZE FUEL FOR POWER PRODUCTION

LINE NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	Fuel for Power Production	$ 58,147	$ (20,309)	$ 37,838

Company has agreed to reduce its Fuel for Power Production by $20,309.

REFERENCES:
Column [A]: Company Filing
Column [B]: Surrebuttal Testimony JMM
Column [C]: Column [A] + Column [B]

OPERATING INCOME ADJUSTMENT NO. 3 - CHEMICAL EXPENSES

LINE NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	Chemicals	$ 503,278	$ (305)	$ 502,973

Company has agreed to reduce its Fuel for Power Production by $305.

REFERENCES:
Column [A]: Company Filing
Column [B]: Surrebuttal Testimony JMM
Column [C]: Column [A] + Column [B]

OPERATING INCOME ADJUSTMENT NO. 4 - OUTSIDE SERVICE EXPENSE

DESCRIPTION	[A] COMPANY AS FILED	[B] STAFF ADJUSTMENTS (Col C - Col A)	[C] STAFF AS ADJUSTED
Contractural Services - Other	$ 2,357,032	$ (39,382)	$ 2,317,650
Corporate Expense Allocation	250,979	(250,182)	797
Total Contractural Services - Other	$ 2,382,976	$ (289,564)	$ 2,318,447
Expenses Company has agreed to reduce in its rebuttal testimony:			
Capitalized Expenses	$ 9,714		
Remove Unnecessary Expenses	3,191		
	$ 12,905		
Staff adjustment:			
Remove Bonuses	$ 26,477		
Total	$ 39,382		

COSTS TO BE ALLOCATED TO LPSCO

[D] [E] Description	[F] Amount	[G] Unallowable Costs	[H] Direct Costs of Unregulated Affiliate(s)	[I] Allowable Common Costs Allocated to All 71 Companies	[J] Allocation[5] %	[K] Costs to be Allocated to LPSCO (Col I x Col J)
Rent	$ 430,739	$ -	$ (430,739)	$ -	1.41%	$ -
Audit[1]	$ 507,000	$ -	$ (456,300)	$ 50,700	1.41%	$ 714.08
Tax Services[2]	$ 265,000	$ -	$ (238,500)	$ 26,500	1.41%	$ 373.24
Legal-General[3]	$ 300,000	$ -	$ (284,400)	$ 15,600	1.41%	$ 219.72
Other Professional Services	$ 455,000	$ -	$ (455,000)	$ -	1.41%	$ -
Management Fee	$ 636,619	$ -	$ (636,619)	$ -	1.41%	$ -
Unit Holder Communications	$ 314,100	$ -	$ (314,100)	$ -	1.41%	$ -
Trustee Fees	$ 204,000	$ -	$ (204,000)	$ -	1.41%	$ -
Office Costs	$ 254,100	$ (46,186)	$ (207,914)	$ -	1.41%	$ -
Licenses/Fees and Permits	$ 305,000	$ (145,642)	$ (159,358)	$ -	1.41%	$ -
Escrow and Transfer Fees	$ 75,000	$ -	$ (75,000)	$ -	1.41%	$ -
Depreciation Expense[4]	$ 204,242	$ -	$ (183,818)	$ 20,424	1.41%	$ 287.66
	$ 3,950,800	$ (191,828)	$ (3,645,748)	$ 113,224		$ 1,594.71
					Water	$ 797.35
					Waste Water	$ 797.35
						$ 1,594.71

Foot Note 1: Audit - As the parent company's lenders require the APIF to have annual financial audits, Staff assigned the majority of the cost (i.e., 90 percent) to APIF and the remaining 10 percent to its 71 companies/interests.

Foot Note 2: Tax Services - Given the tax complexity of the APIF's many holdings and transactions, Staff assigned the majority of the cost (i.e., 90 percent) to APIF and the remaining 10 percent to its 71 companies/interests.

Foot Note 3: Legal, General - Staff reviewed the legal invoices and found that the very large majority of the legal invoices pertained to the APIF.

Foot Note 4: Depreciation Expense - Given that most of APIF's plant costs benefit primarily APIF, Staff assigned the majority of the cost (i.e., 90 percent) to APIF and the remaining 10 percent to its 71 companies/interests.

Foot Note 5: Allocation Percentage - Calculated as follows: 1 / 71 companies = 1.41%.

References:
Column A: Company Schedule
Column B: Testimony JMM
Column C: Column [A] + Column [B]

LINE NO.	Category	Description of Unallowable Cost	Amount
1	Category	Description of Unallowable Cost	Amount
2	Office Fees and Expenses	Wind Analysis & Planning Software	$15,056
3	Office Fees and Expenses	Gold Watches and Clocks	$16,864
4	Office Fees and Expenses	Pilsner Beer Glasses	$5,700
5	Office Fees and Expenses	Leafs-Raptors Season Tickets	$5,066
6	Office Fees and Expenses	Super Bowl XLII Tickets	$3,500
7		**Subtotal for Office Expenses**	**$46,186**
8			
9	Licenses and Fees	Donation - Wind Project Develop	$25,000
10	Licenses and Fees	Donation - Water Project in Africa	$25,000
11	Licenses and Fees	Donation - Cancer Society	$13,350
12	Licenses and Fees	Donation - Multiple Myeloma	$5,000
13	Licenses and Fees	Wind Development	$7,887
14	Licenses and Fees	U.S. Trustee	$9,375
15	Licenses and Fees	St. Leon Wind Energy	$12,556
16	Licenses and Fees	Algonquin Power Fund Inc Taxes	$6,891
17	Licenses and Fees	Algonquin Power Fund Inc Taxes	$6,794
18	Licenses and Fees	Tax Ruling Request for KMS America & Subs	$10,000
19	Licenses and Fees	Algonquin Power Fund Inc Taxes	$23,789
20		**Subtotal for Licenses & Fees**	**$145,642**

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Surrebuttal Schedule JMM-W19

OPERATING INCOME ADJUSTMENT NO. 5 - RATE CASE EXPENSE

LINE NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	Rate Case Expense	$ 70,000	$ (28,000)	$ 42,000

Staff Calculation:

Estimated Rate Case Cost	$ 210,000
Normalized Over Five Years	5
	42,000

References:
Column (A), Company Schedule C-1
Column (B): Testimony JMM
Column (C): Column (A) + Column (B)

Litchfield Park Service Company - Water Division
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Surrebuttal Schedule JMM-W20

OPERATING INCOME ADJUSTMENT NO. 6 - MEALS AND ENTERTAINMENT

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	775.00	Miscellaneous Expense	$ 81,664	$ (827)	$ 80,837

References:
Column (A), Company Schedule C-1
Column (B): Testimony JMM
Column (C): Column (A) + Column (B)

Litchfield Park Service Company - Water Division
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Surrebuttal Schedule JMM-W21

OPERATING INCOME ADJUSTMENT NO. 7 - BAD DEBT

			[A]	[B]	[C]
LINE NO.	ACCT NO.	DESCRIPTION	COMPANY PROPOSED	STAFF ADJUSTMENTS	STAFF RECOMMENDED
1		Bad Debt Expense	$ 3,264	$ 5,284	$ 8,548

Staff Calculation:	
Test Year	$3,264
2007	1,898
2006	20,483
	$25,645
Normalized over 3 years	3
	$ 8,548

References:
Column (A), Company Schedule C-1
Column (B): Testimony JMM
Column (C): Column (A) + Column (B)

Litchfield Park Service Company - Water Division
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Surrebuttal Schedule JMM-W22

OPERATING INCOME ADJUSTMENT NO. 8 - DEPRECIATION EXPENSE ON TEST YEAR PLANT

LINE NO.	ACCT NO.	DESCRIPTION	[A] PLANT In SERVICE Per Staff	[B] NonDepreciable or Fully Depreciated PLANT	[C] DEPRECIABLE PLANT (Col A - Col B)	[D] DEPRECIATION RATE	[E] DEPRECIATION EXPENSE (Col C x Col D)
1	301	Organization Cost	$ 21,100	$ 100	$ 21,000	0.00%	$ -
2	302	Franchise Cost	$ -	$ -	$ -	0.00%	$ -
3	303	Land and Land Rights	$ 1,284,595	$ 1,284,595	$ -	0.00%	$ -
4	304	Structures and Improvements	$ 24,656,322	$ -	$ 24,656,322	3.33%	$ 821,056
5	305	Collecting and Impounding Res.	$ -	$ -	$ -	2.50%	$ -
6	306	Lake River and Other Intakes	$ -	$ -	$ -	2.50%	$ -
7	307	Wells and Springs	$ 2,376,144	$ -	$ 2,376,144	3.33%	$ 79,126
8	308	Infiltration Galleries and Tunnels	$ -	$ -	$ -	6.67%	$ -
9	309	Supply Mains	$ -	$ -	$ -	2.00%	$ -
10	310	Power Generation Equipment	$ 202,269	$ -	$ 202,269	5.00%	$ 10,113
11	311	Electric Pumping Equipment	$ 917,055	$ -	$ 917,055	12.50%	$ 114,632
12	320	Water Treatment Equipment	$ 1,337,824	$ -	$ 1,337,824	3.33%	$ 44,550
13	320	Water Treatment Plant	$ -	$ -	$ -	3.33%	$ -
14	330	Distribution Reservoirs & Standpipe	$ 430,644	$ -	$ 430,644	2.22%	$ 9,560
15	331	Transmission and Distribution Mains	$ 28,937,771	$ -	$ 28,937,771	2.00%	$ 578,755
16	333	Services	$ 4,249,744	$ -	$ 4,249,744	3.33%	$ 141,516
17	334	Meters	$ 4,138,752	$ -	$ 4,138,752	8.33%	$ 344,758
18	335	Hydrants	$ 2,055,781	$ -	$ 2,055,781	2.00%	$ 41,116
19	336	Backflow Prevention Devices	$ 38,387	$ -	$ 38,387	6.67%	$ 2,560
20	339	Other Plant and Miscellaneous Equipment	$ 259,531	$ -	$ 259,531	6.67%	$ 17,311
21	340	Office Furniture and Fixtures	$ 551,757	$ -	$ 551,757	6.67%	$ 36,802
22	341	Transportation Equipment	$ 177,165	$ -	$ 177,165	20.00%	$ 35,433
23	342	Stores Equipment	$ 31,711	$ -	$ 31,711	4.00%	$ 1,268
24	343	Tools and Work Equipment	$ 23,350	$ -	$ 23,350	5.00%	$ 1,168
25	344	Laboratory Equipment	$ -	$ -	$ -	10.00%	$ -
26	345	Power Operated Equipment	$ -	$ -	$ -	5.00%	$ -
27	346	Communications Equipment	$ 119,710	$ -	$ 119,710	10.00%	$ 11,971
28	347	Miscellaneous Equipment	$ -	$ -	$ -	10.00%	$ -
29	348	Other Tangible Plant	$ -	$ -	$ -	10.00%	$ -
30		Total Plant	$ 71,809,612	$ 1,284,695	$ 70,524,917		$ 2,291,695
31							
32		Less: Amortization of Contributions					
33	311	Electric Pumping Equipment	$ 15,219			12.50%	$ (1,902)
34	331	Transmission and Distribution Mains	$ 2,854,613			2.00%	$ (57,092)
35	333	Services	$ 151,402			3.33%	$ (5,042)
36	334	Meters	$ 29,899			8.33%	$ (2,491)
37	335	Hydrants	$ 52,935			2.00%	$ (1,059)
38			$ 3,104,068				$ (67,586)
39							
41		Total Depreciation Expense					$ 2,224,109
42							
43		Depreciation Expense - Company					$ 2,291,982
44							
45		Staff's Adjustment to Depreciation Expense					$ (67,873)
46							

References:
Column [A]: Schedule JMM-W4
Column [B]: From Column [A]
Column [C]: Column [A] - Column [B]
Column [D]: Engineering Staff Report
Column [E]: Column [C] x Column [D]

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Surrebuttal Schedule JMM-W23

OPERATING INCOME ADJUSTMENT NO. 9 - PROPERTY TAX EXPENSE

LINE NO.	Property Tax Calculation	[A] STAFF AS ADJUSTED	[B] STAFF RECOMMENDED
1	Staff Adjusted Test Year Revenues	$ 6,878,710	$ 6,878,710
2	Weight Factor	2	2
3	Subtotal (Line 1 * Line 2)	13,757,420	$ 13,757,420
4	Staff Recommended Revenue, Per Schedule JMM-W1	6,878,710	$ 11,781,313
5	Subtotal (Line 4 + Line 5)	20,636,130	25,538,733
6	Number of Years	3	3
7	Three Year Average (Line 5 / Line 6)	6,878,710	$ 8,512,911
8	Department of Revenue Mutilplier	2	2
9	Revenue Base Value (Line 7 * Line 8)	13,757,420	$ 17,025,822
10	Plus: 10% of CWIP -	-	-
11	Less: Net Book Value of Licensed Vehicles	94,101	$ 94,101
12	Full Cash Value (Line 9 + Line 10 - Line 11)	13,663,319	$ 16,931,721
13	Assessment Ratio	21.0%	21.0%
14	Assessment Value (Line 12 * Line 13)	2,869,297	$ 3,555,661
15	Composite Property Tax Rate (Per Company Schedule)	9.5187%	9.5187%
16			$ -
17	Staff Test Year Adjusted Property Tax (Line 14 * Line 15)	$ 273,120	
18	Company Proposed Property Tax	373,338	
19			
20	Staff Test Year Adjustment (Line 16-Line 17)	$ (100,218)	
21	Property Tax - Staff Recommended Revenue (Line 14 * Line 15)		$ 338,453
22	Staff Test Year Adjusted Property Tax Expense (Line 16)		$ 273,120
23	Increase in Property Tax Expense Due to Increase in Revenue Requirement		$ 65,333
24			
25	Increase to Property Tax Expense		$ 65,333
26	Increase in Revenue Requirement		4,902,603
27	Increase to Property Tax per Dollar Increase in Revenue (Line19/Line 20)		1.332618%

OPERATING INCOME ADJUSTMENT NO. 10 - TEST YEAR INCOME TAXES

LINE NO.	DESCRIPTION		
1			
2			
3			
4	*Calculation of Income Tax:*		Test Year
5	Revenue (Schedule JMM-11)	$	6,878,710
6	Operating Expenses Excluding Income Taxes	$	6,705,788
7	Synchronized Interest (L17)	$	408,916
8	Arizona Taxable Income (L1 - L2 - L3)	$	(235,994)
9	Arizona State Income Tax Rate		6.9680%
10	Arizona Income Tax (L4 x L5)	$	(16,444)
11	Federal Taxable Income (L4 - L6)	$	(219,550)
12	Federal Tax on First Income Bracket ($1 - $50,000) @ 15%	$	(7,500)
13	Federal Tax on Second Income Bracket ($51,001 - $75,000) @ 25%	$	(6,250)
14	Federal Tax on Third Income Bracket ($75,001 - $100,000) @ 34%	$	(8,500)
15	Federal Tax on Fourth Income Bracket ($100,001 - $335,000) @ 39%	$	(46,624)
16	Federal Tax on Fifth Income Bracket ($335,001 -$10,000,000) @ 34%	$	-
17	Total Federal Income Tax	$	(68,874)
18	Combined Federal and State Income Tax (L44 + L51)	$	(85,318)
19			
20			
21	*Calculation of Interest Synchronization:*		
22	Rate Base (Schedule JMM-W4)	$	37,174,137
23	Weighted Average Cost of Debt		1.10%
24	Synchronized Interest (L16 x L17)	$	408,916
25			
26			
27	Income Tax - Per Staff	$	(85,318)
28	Income Tax - Per Company	$	(449,705)
29	**Staff Adjustment**	**$**	**364,387**

FINANCIAL ANALYSIS

Selected Financial Information
Pro forma Includes Immediate Effects of the Proposed Long-term Debt

	[A] *9/30/2008 Test Year Operating Results* *Without Loan*		[B] *11/4/2009 With Staff Recommended Operating Income and Staff Recommended Loan Amount of $2,925,000* *Pro Forma*	
1 Operating Income/(Loss)	$ 258,240		$ 3,234,150	
2 Depreciation Expense	2,224,109		2,224,109	
3 Income Tax Expense	(85,318)		1,776,041	
4 Interest Expense	747,446	**Note 1**	898,983	**Note 3**
5 Principal Repayment	230,000	**Note 2**	314,982	**Note 4**
TIER & DSC Calculation				
TIER				
6 [1+3] ÷ [4]	0.23		5.57	
DSC				
7 [1+2+3] ÷ [4+5]	**2.45**		**5.96**	

Note 1: This information was taken from the Company's 2008 annual report:

1999 IDA Loan Interest	$ 256,782
2001 IDA Loan Interest	490,664
Total	$ 747,446

Note 2: This information was taken from the Company's 2008 annual report:

1999 IDA Loan Principle	$ 170,000
2001 IDA Loan Principle	60,000
Total	$ 230,000

Note 3: This pro-forma information is based on a 20 year WIFA loan at 5.25 percent annual interest:

Total Interest of Old Loans	$ 747,446
Interest on New Loans	151,537
	$ 898,983

Note 4: This pro-forma information is based on a 20 year WIFA loan at 5.25 percent annual interest:

Total Principle of Old Loans	$ 230,000
Principle on New Loans	84,982
	$ 314,982

BEFORE THE ARIZONA CORPORATION COMMISSION

KRISTIN K. MAYES
Chairman
GARY PIERCE
Commissioner
PAUL NEWMAN
Commissioner
SANDRA D. KENNEDY
Commissioner
BOB STUMP
Commissioner

IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WASTEWATER RATES AND CHARGES FOR UTILITY SERVICES BASED THEREON	)))))))))	DOCKET NO. SW-01428A-09-0103

DIRECT

TESTIMONY

OF

JEFFREY M. MICHLIK

PUBLIC UTILITIES ANALYST V

UTILITIES DIVISION

ARIZONA CORPORATION COMMISSION

NOVEMBER 4, 2009

ALL-STATE LEGAL®
EXHIBIT
S-10
ADMITTED

TABLE OF CONTENTS

SCHEDULES

EXECUTIVE SUMMARY
LITCHFIELD PARK SERVICE COMPANY
DOCKET NO. SW-01428A-09-0103

Litchfield Park Service Company – Wastewater Division ("LPSCO or Company") is an Arizona "C" Corporation. Its principal place of business is 12725 W. Indian School Road, Suite D-101, Avondale, Arizona. The Company is engaged in the business of providing wastewater utility services in its certificated areas in portions of Pinal County, Arizona. The Company served approximately 14,600 wastewater customers during the test year ended September 30, 2008. The Company's current rates were approved in Decision No. 65436, dated December 9, 2002.

Rate Application:

The Company proposes rates that would increase operating revenues by $4,991,601 to produce operating revenue of $11,347,975 resulting in operating income of $3,228,677, or a 78.53 percent increase over test year revenue of $6,356,374. The Company also proposes a fair value rate base ("FVRB") of $28,296,903 which is its original cost rate base ("OCRB"), and a 11.41 percent rate of return on the FVRB.

Staff recommends rates that would increase operating revenue by $2,841,618 to produce operating revenue of $9,197,992 resulting in operating income of $2,390,091, or a 44.71 percent increase over adjusted test year revenue of $6,356,374. Staff recommends an OCRB of $27,472,314 which is its FVRB, and an 8.70 percent rate of return on the FVRB.

INTRODUCTION

Q. Please state your name, occupation, and business address.

A. My name is Jeffrey M. Michlik. I am a Public Utilities Analyst V employed by the Arizona Corporation Commission ("ACC" or "Commission") in the Utilities Division ("Staff"). My business address is 1200 West Washington Street, Phoenix, Arizona 85007.

Q. Briefly describe your responsibilities as a Public Utilities Analyst V.

A. In my capacity as a Public Utilities Analyst V, I analyze and examine accounting, financial, statistical and other information and prepare reports based on my analyses that present Staff's recommendations to the Commission on utility revenue requirements, rate design and other matters. I also provide expert testimony on these same issues.

Q. Please describe your educational background and professional experience.

A. In 2000, I graduated from Idaho State University, receiving a Bachelor of Business Administration Degree in Accounting and Finance, and I am a Certified Public Accountant with the Arizona State Board of Accountancy. I have attended the National Association of Regulatory Utility Commissioners' ("NARUC") Utility Rate School, which presents general regulatory and business issues.

I joined the Commission as a Public Utilities Analyst in May of 2006. Prior to employment with the Commission, I worked four years for the Arizona Office of the Auditor General as a Staff Auditor, and one year in public accounting as a Senior Auditor.

Q. What is the scope of your testimony in this case?

A. I am presenting Staff's analysis and recommendations regarding Litchfield Park Service Company's ("LPSCO" or "Company") application for a permanent increase in its rates and charges for wastewater utility service within Maricopa County, Arizona. I am presenting testimony and schedules addressing rate base, operating revenues and expenses, and revenue requirement. Staff witness Pedro Chavez is presenting Staff's rate design. Staff witness Juan Manrique is presenting Staff's cost of capital. Mr. Marlin Scott Jr. is presenting Staff's engineering analysis and related recommendations.

Q. What is the basis of your testimony in this case?

A. I performed a regulatory audit of the Company's application and records. The regulatory audit consisted of examining and testing financial information, accounting records, and other supporting documentation and verifying that the accounting principles applied were in accordance with the Commission-adopted NARUC Uniform System of Accounts ("USOA").

BACKGROUND

Q. Please review the background of this application.

A. The Company is an Arizona "C" Corporation. Its principal place of business is 12725 W. Indian School Road, Suite D-101, Avondale, Arizona. The Company is engaged in the business of providing wastewater utility services in its certificated areas in portions of Maricopa County, Arizona. The Company served approximately 14,600 wastewater customers during the test year ended September 30, 2008. The Company's current rates were approved in Decision No. 65436, dated December 9, 2002.

The Company is a wholly owned subsidiary of Algonquin Water Resources. Algonquin Water Resources is the Company's only shareholder. Algonquin Water Resources is a wholly owned subsidiary of Algonquin Power Income Fund[1] (Algonquin Water Resources and Algonquin Power Income Fund are collectively referred to as "Algonquin").

In addition to LPSCO, Algonquin owns seven other companies located in Arizona: Black Mountain Sewer Company, Gold Canyon Sewer Company, Rio Rico Utilities, Inc., Entrada Del Oro Sewer Company, Northern Sunrise Water Company, Inc., Southern Sunrise Water Company, Inc., and Bella Vista Water Company. Algonquin has a contract to manage and operate Black Mountain. Algonquin also owns and/or operates utility systems in Illinois and Texas.

CONSUMER SERVICES

Q. Please provide a brief history of customer complaints received by the Commission regarding the Company. Additionally, please discuss customer responses to the Company's proposed rate increase.

A. A review of the Commission's Consumer Services database for the Company from January 1, 2006, through October 14, 2009, revealed the following for the Wastewater Division:

2006 – Five complaints (one billing, one service, one quality of service, two disconnect/termination), zero inquiries, and zero opinions. 2007 – Six complaints (one deposit, three quality of service, one disconnect/termination, one rates/tariffs), two inquiries (service, quality of service), and three opinions (quality of service). 2008 – Zero complaints, inquiries or opinions. Three complaints (one billing, two quality of service),

[1] Algonquin Power Income Fund is an investment trust that owns or has interests in 71 companies in the United States and Canada, including 41 hydroelectric facilities, 5 natural gas cogeneration facilities, and 15 water and sewer facilities.

zero inquiries, and thirteen opinions, (rate case all opposed). All complaints and inquiries have been resolved and closed.

COMPLIANCE

Q. Please provide a summary of the compliance status of the Company.

A. A check of the ACC's Compliance database indicates that there are currently no delinquencies for the Company.

SUMMARY OF FILING, RECOMMENDATIONS, AND ADJUSTMENTS

Q. Please summarize the Company's proposals in this filing.

A. The Company proposes rates that would increase operating revenues by $4,991,601 to produce operating revenue of $11,347,975 resulting in operating income of $3,228,677, or a 78.53 percent increase over test year revenue of $6,356,374. The Company also proposes a fair value rate base ("FVRB") of $28,296,903 which is its original cost rate base ("OCRB"), and an 11.41 percent rate of return on the FVRB.

Q. Please summarize Staff's recommendations.

A. Staff recommends rates that would increase operating revenue by $2,841,618 to produce operating revenue of $9,197,992 resulting in operating income of $2,390,091, or a 44.71 percent increase over adjusted test year revenue of $6,356,374. Staff recommends an OCRB of $27,472,314 which is its FVRB, and an 8.70 percent rate of return on the FVRB.

Q. What test year did the Company use in this filing?

A. The Company's rate filing is based on the twelve months ended September 30, 2008 ("test year").

Q. Please summarize the rate base adjustments addressed in your testimony.

A. My testimony addresses the following issues:

Plant Not Used and Useful – This adjustment decreases Plant in Service by $554,977 to remove plant that was deemed not used and useful, and the associated funding sources in the amount $110,995.

Transfer of Plant – This adjustment removes Plant in the amount of $38,625, and accumulated depreciation in the amount of $11,148.

Accumulated Depreciation – This adjustment decreases accumulated depreciation by $182,696 based upon the adjustments Staff made to plant in service.

Customer Deposits – This adjustment increases customer deposits by $81,798 to include customer deposits.

Deferred Income Taxes – This adjustment increases Deferred Income Taxes by $319,500 to reverse the Company's pro-forma adjustment.

Unamortized Debt Issuance Costs – This adjustment removes Unamortized Debt Issuance Costs in the amount of $134,528.

Q. Please summarize the operating revenue and expense adjustments addressed in your testimony.

A. My testimony addresses the following issues:

Materials and Supplies – This adjustment removes $5,975 for beverages that were included in materials and supplies expense.

Corporate Expense Allocation – This adjustment decreases operating expenses by $266,665 to remove costs incurred related to the unregulated parent's business operations.

Rate Case Expense – This adjustment decreases rate case expense by $28,000 to reflect Staff's normalization over five years.

Meals and Entertainment Expense – This adjustment removes expenses in the amount of $494 for meals and entertainment.

Bad Debt Expense – This adjustment decreases bad debt expenses by $21,791 to reflect the Staff's normalization of bad debt expense.

Depreciation Expense – This adjustment decreases expenses by $264,954 to adjust depreciation based on Staff's plant in service numbers.

Property Tax Expense – This adjustment decreases expenses by $225,740 to adjust property taxes to Staff's adjusted test year amount.

Income Tax Expense – This adjustment increases expenses by $321,964 to adjust income taxes to Staff's adjusted test year amount.

RATE BASE – WASTEWATER DIVISION

Fair Value Rate Base

Q. Did the Company prepare a schedule showing the elements of Reconstruction Cost New Rate Base?

A. No, the Company did not. The Company's filing treats the OCRB the same as the FVRB.

Rate Base Summary

Q. Please summarize Staff's adjustments to the Company's rate base shown on Schedules JMM-WW3 and JMM-WW4.

A. Staff's adjustments to the Company's rate base resulted in a net decrease of $824,589, from $28,296,903 to $27,472,314. This decrease was primarily due to: (1) removal of plant that was not serving customers during the test year, (2) transfer of plant, (3) adjustment to accumulated depreciation, (4) adjustment to customer deposits, (5) adjustment to deferred income taxes, and (6) removal of unamortized debt issuance costs.

Rate Base Adjustment No. 1 – Wastewater Division, Plant Not Used and Useful

Q. Did Staff make an adjustment to plant that was not used and useful?

A. Yes.

Q. What adjustment did Staff make?

A. Staff identified $554,977 in plant that was not used and useful as shown on Schedule JMM-WW5.

Q. Why did Staff make this adjustment?

A. Marlin Scott, Jr., Staff's Engineer, inspected the entire system and identified certain individual plant items that were not serving customers during the test year (See Staff Engineering Report, Section H, Plant Not Used and Useful).

Q. What is Staff's recommendation?

A. Staff recommends decreasing plant in service by $554,997, from $60,394,260 to $59,839,283 to remove all plant from rate base that was not used and useful and the associated funding sources; Advances in Aid of Construction in the amount of $16,649 from $7,006,208 to $6,989,559 and Contributions in Aid of Construction in the amount of $94,346 from $18,737,132 to $18,642,786, as shown on Schedules JMM-WW4 and JMM-WW5.

Rate Base Adjustment No. 2 – Wastewater Division, Transfer of Plant

Q. Did Staff make an adjustment to remove a plant item from plant in service that was transferred to another Company?

A. Yes.

Q. Why did Staff make this adjustment?

A. Based on Staff data request JMM 6-2, the Company indicated that an odor control unit had been transferred from LPSCO to Black Mountain Sewer Company.

Q. What is Staff's recommendation?

A. Staff recommends decreasing plant in service by $38,625, from $59,839,283 to $59,800,658, by removing the odor control unit; and the associated accumulated depreciation by $11,148, from $8,475,991 to $8,464,843, as shown on Schedules JMM-WW4 and JMM-WW6.

Rate Base Adjustment No. 3 – Wastewater Division, Accumulated Depreciation

Q. Did Staff make an adjustment to Accumulated Depreciation?

A. Yes.

Q. Why did Staff make this adjustment?

A. Staff adjusted accumulated depreciation to reflect the Staff-recommended plant balances adjusted to remove not used and useful plant.

Q. What is Staff's recommendation?

A. Staff recommends decreasing accumulated depreciation by $182,696, from $8,464,843 to $8,282,147, as shown on Schedules JMM-WW4 and JMM-WW7.

Rate Base Adjustment No. 4 – Wastewater Division, Customer Deposits

Q. Did Staff make an adjustment to customer deposits?

A. Yes.

Q. What adjustment did Staff make?

A. Staff increased Customer Deposits by $81,798.

Q. Why did Staff make this adjustment?

A. Based on the Company's response to Staff data request JMM 1.56, Staff identified Customer Deposits in the test year that were not included in the rate application.

Specifically, the Company only included customer meter deposits and no other Customer Deposits.

Q. What is Staff's recommendation?

A. Staff recommends increasing Customer Deposits by $81,798, from $68,685 to $150,483 as shown on Schedules JMM-WW4 and JMM-WW8.

Rate Base Adjustment No. 5 – Wastewater Division, Deferred Income Taxes and Credits

Q. Did Staff make an adjustment to plant for Deferred Income Taxes and Credits?

A. Yes.

Q. What adjustment did Staff make?

A. Staff reversed the Company's pro-forma adjustment.

Q. What are pro-forma adjustments?

A. Pro-forma adjustments are adjustments to actual test year results and balances to obtain a normal or more realistic relationship between revenues, expenses and rate base.

Q. Does the Company's adjustment provide a normal or more realistic relationship between revenues, expenses and rate base?

A. No. It is one-sided, as it only includes elimination of the current liability in the future; it does not take into account the Company's future tax returns that may increase or decrease the deferred tax liability account.

Q. What is a deferred tax liability?

A. A deferred tax liability represents the increase in taxes payable in future years as a result of taxable temporary differences existing at the end of the current year.

Q. Will this taxable temporary difference reverse out at some future date?

A. Yes, however we do not know at what date, so it is not known and measurable.

Q. What is Staff's recommendation?

A. Staff recommends reversal of the Company's adjustment by increasing Deferred Income Taxes by $319,500, from $15,987 to $335,487, as shown on Schedules JMM-WW4 and JMM-WW9.

Q. Does Staff have any other comments on the Company's Deferred Income Taxes and Credits?

A. Yes.

Q. Was Staff able to verify the amount of Deferred Income Taxes and Credits of $335,487 before the pro-forma adjustment?

A. No. Staff attempted to do so in data requests JMM 1.55, JMM 2.3, JMM 9.1 and JMM 9.2. The Company was either unwilling or unable to provide Staff with this documentation.

Rate Base Adjustment No. 6 – Wastewater Division, Unamortized Debt Issuance Costs

Q. Did Staff make an adjustment to Unamortized Debt Issuance Costs?

A. Yes.

Q. What adjustment did Staff make?

A. Staff removed the Unamortized Debt Issuance Costs.

Q. Why did Staff disallow the Unamortized Debt Issuance Costs from being included in rate base?

A. Debt issuance costs are a "below the line" expense, similar to interest and, thus, should be paid from the return on rate base portion of the ratepayer charges. The unamortized debt issuance costs are therefore attributed to the shareholders and do not require an outlay of cash by the shareholders. Consequently, from a ratemaking standpoint, shareholders should not earn a return on such costs and the costs should not be included in rate base.

Q. Do you have a Commission authoritative reference?

A. Yes. In Decision No. 71308, the Commission agreed that Unamortized Debt Issuance Costs should not be included in rate base.

Q. What is Staff's recommendation?

A. Staff recommends decreasing Unamortized Debt Issuance Costs by $134,528, from $134,528 to zero, as shown on Schedules JMM-WW4 and JMM-WW10.

OPERATING INCOME – WASTEWATER DIVISION

Operating Summary

Q. What are the results of Staff's analysis of test year revenues, expenses, and operating income?

A. Staff's analysis resulted in adjusted test year operating revenues of $6,356,374, operating expenses of $5,700,941 and operating income of $655,433, as shown on Schedules JMM-WW11 and JMM-WW12. Staff made eight adjustments to operating expenses.

Operating Income Adjustment No. 1 – Wastewater Division, Materials and Supplies

Q. Did Staff make an adjustment to materials and supplies?

A. Yes.

Q. What adjustment did Staff make and why?

A. To remove beverage expenses that were included in materials and supplies expense in the amount of $5,975.

Q. What is Staff's recommendation?

A. Staff recommends decreasing materials and supplies expense by $5,975, form $75,579 to $69,604, as shown in Schedules JMM-WW12 and JMM-WW13.

Operating Income Adjustment No. 2 – Wastewater Division, Corporate Expense Allocation

Q. What is the Algonquin Power Income Fund ("Fund" or "APIF")?

A. The Algonquin Power Income Fund, the ultimate parent of LPSCO, is an unregulated company whose primary business activity is the acquisition and ownership of generation and infrastructure companies through security investments. At year-end 2007, APIF consisted of four main divisions as follows:

	2007 Divisions	
	Types of Facilities in Divisions	**No. of Facilities**
1	Hydroelectric	41
2	Cogeneration – Equity Interest Only	2
	Cogeneration – Own/Operate	3
3	Alternative Fuels – Equity Interest Only	3
	Alternative Fuels – Own/Operate	5
4	Infrastructure (Water & Sewer)	17
	Total Number of Facilities	**71**

Q. Please describe the position of LPSCO within APIF's organizational structure.

A. According to the organizational chart provided in response to a Staff data request, Algonquin Power Income Fund owns Algonquin Holdco, who in turn, owns Algonquin Power Fund Canada, who in turn, owns Algonquin Power Income Fund, who in turn, owns Algonquin Power Fund America, who in turn, owns Algonquin Water Resources of America, who in turn, owns LPSCO.

Q. What is the primary goal of cost allocation between an unregulated affiliate and a regulated affiliate?

A. The primary goal is the fair distribution of costs between the unregulated and regulated affiliate through proper allocations.

Q. What is the effect of improperly allocated costs on rate payers?

A. When costs incurred primarily for the benefit of an unregulated affiliate's business are improperly identified and allocated as overhead/common costs, then costs of the unregulated affiliate are shifted to the captive customers of the regulated utility. This cost shifting results in the captive customers of the regulated utility subsidizing the business operations of the unregulated affiliate and this harms customers by creating artificially higher rates. The costs of a regulated utility, such as LPSCO, should only include those costs that would have been incurred on a "stand-alone basis."

Q. What is the definition of "stand-alone basis"?

A. "Stand-alone basis" means reflecting costs as if the regulated utility had produced the service by itself. This helps to ensure that any subsidization of the unregulated business by the captive utility customers is eliminated.

Q. What is the amount of expense that was allocated from the APIF unregulated business operations to LPSCO during the test year?

A. LPSCO was allocated $518,441 during the test year, of which $250,979 was allocated to the water division and $267,462 was allocated to the wastewater division.

Q. How was the allocation to LSPCO made?

A. First, $3.95 million in expenses from the unregulated affiliate were allocated to the infrastructure division based on a single allocation factor of 26.98 percent.[2] Those costs were then allocated to each company within the infrastructure division based upon customer count.

Q. Did Staff review the amounts comprising the $3.95 million of expenses allocated from the unregulated affiliate to LPSCO?

A. Yes.

Q. Does Staff agree that all of the $3.95 million in costs are costs that should be allocated?

A. No, Staff does not. Staff reviewed the underlying invoices for the costs and determined that the Company did not identify the costs as direct costs (i.e., costs that can be identified with a particular service) or indirect costs (costs that cannot be identified with a particular service) consistent with the NARUC Guidelines for Cost Allocation and Affiliate Transactions. These guidelines require that the costs primarily attributable to a business operation should be, to the extent appropriate, directly assigned to that business operation.

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[2] This factor is based on the number of infrastructure facilities to total facilities.

Q. What portion of the $3.95 million did Staff determine was attributable to (i.e., direct costs of) APIF or an affiliate?

A. Based upon review of the actual supporting invoices provided by the Company, Staff determined that almost all of the costs were obviously attributable to the operations of the APIF or one of its affiliates, therefore, Staff assigned 90 percent of the costs to APIF. The remaining ten percent recognizes that the other affiliates receive a benefit from the common costs, and therefore, should be allocated a percentage greater than zero.

Q. Does Staff agree that all of the $3.95 million of expenses allocated from the unregulated affiliate are allowable costs?

A. No, Staff does not. As shown on schedule JMM-WW14, Page 2, Staff identified $191,828 in unallowable costs. For example, Staff identified $68,350 for charitable contributions, $5,066 for season tickets for hockey games, $3,500 for Superbowl tickets, $16,864 for gold watches and clocks; and $33,000 for IRS taxes and penalties related to the affiliate's unregulated business operations.

Q. Does Staff agree with the Company's calculation of the factor to allocate common costs?

A. No, Staff does not.

Q. What allocation formula did the Company use to allocate common costs?

A. The Company used the following formula: 17 utilities / 63 total facilities = 26.98%.

Q. **Does Staff agree with the number of total facilities that the Company used in its formula?**

A. No, Staff does not. Staff attempted to match the number used in the formula to the information in the 2007 Algonquin Power Income Fund Annual Reports; however, the numbers did not agree. The information in the 2007 annual reports is as follows:

Line No	**Type of Facility**	**Year-End 2007**
1	Hydroelectric	41
2	Cogeneration – Equity Interest Only	2
3	Cogeneration – Own/Operate	3
4	Alternative Fuels – Equity Interest Only	3
5	Alternative Fuels – Own/Operate	5
6	Infrastructure (Water & Sewer)	17
7	**Total Number of Facilities**	**71**
8	**Allocation Percentage (1 / L7)**	**1.41%**

Q. **What data does Staff recommend the Company use for its common cost allocation formula?**

A. Staff recommends that the year-end information per the Algonquin Power annual report be used to determine the number of total facilities.

Q. **Did Staff prepare a schedule of its recommended common costs and allocation factor?**

A. Yes, Staff's calculations are shown on Schedule JMM-WW14.

Q. **What is Staff's recommendation?**

A. Staff recommends decreasing other contracted services expense by $266,665, from $2,719,118 to $2,452,453, as shown on Schedules JMM-WW12 and JMM-WW14.

Operating Income Adjustment No. 3 – Wastewater Division, Rate Case Expense

Q. Did Staff make an adjustment to rate case expense?

A. Yes.

Q. Why did Staff make this adjustment?

A. Staff typically normalizes rate case expense over a three to five year period. The Company has not been in for a rate case in close to nine years, so Staff recommends normalizing the rate case expense over five years.

Q. What is Staff's recommendation?

A. Staff recommends decreasing rate case expense by $28,000, from $70,000 to $42,000, as shown on Schedules JMM-WW12 and JMM-WW15.

Operating Income Adjustment No. 4 – Wastewater Division, Meals and Entertainment Expense

Q. Did Staff make an adjustment Meals and Entertainment expense?

A. Yes.

Q. What adjustment did Staff make?

A. Staff's adjustment decreased Meals and Entertainment Expense by $494.

Q. Why did Staff make this adjustment?

A. Meals and Entertainment are not necessary to the provision of water services.

Q. What is Staff's recommendation?

A. Staff recommends decreasing miscellaneous expense by $494, from $36,656 to $36,162, as shown on Schedules JMM-WW12 and JMM-WW16.

Operating Income Adjustment No. 5 – Wastewater Division, Bad Debt Expense

Q. Did Staff make an adjustment to bad debt expense?

A. Yes.

Q. Why did Staff make this adjustment?

A. Bad Debt expenses for the wastewater division were abnormally high in the test year and "between" years. As a result Staff normalized this amount over a three-year period for the wastewater divisions.

Q. What is Staff's recommendation?

A. Staff recommends decreasing bad debt expense by $21,791, from $43,889 to $22,098 to better reflect the Company's ongoing level of bad debt expense. Please see Schedules JMM-WW12 and JMM-WW17.

Operating Income Adjustment No.6 – Wastewater Division, Depreciation Expense

Q. Did Staff make an adjustment to depreciation expense?

A. Yes.

Q. What adjustment did Staff make?

A. As a result of adjustments made to plant in service, Staff also adjusted the associated depreciation expense.

Q. What is Staff's recommendation?

A. Staff's adjustment decreases depreciation expense by $264,954, from $1,550,237 to $1,285,283. Please see Schedules JMM-WW12 and JMM-WW18 for Staff's calculation.

Operating Income Adjustment No. 7 – Wastewater Division, Property Tax

Q. Did Staff make an adjustment to property tax?

A. Yes.

Q. What adjustment does Staff recommend for test year property tax expense?

A. Staff's adjustment decreased property tax expense by $225,740, from $336,629 to $110,889, for test year expenses based upon Staff's adjusted test year revenues. Please see Schedule JMM-WW12 and Column A on Schedule JMM-WW19.

Q. What does Staff recommend for property tax expense on a going-forward basis?

A. Staff recommends increasing property tax expense by $16,493, from $110,889 to $127,382, based upon Staff's recommended revenues. Please see Schedule JMM-WW11 and Column B on Schedule JMM-WW19.

Operating Income Adjustment No .8 – Wastewater Division, Income Tax

Q. Did Staff make an adjustment to Income Tax?

A. Yes.

Q. Why did Staff make this adjustment?

A. Staff's adjustment reflects Staff's calculation of the income tax expense based upon Staff's adjusted test year taxable income, as shown on Schedule JMM-WW20.

Q. What is Staff's recommendation?

A. Staff recommends increasing test year Income Tax Expense by $321,964, from negative $99,906 to $222,058, as shown on Schedules JMM-WW11 and JMM-WW20.

OTHER MATTERS

Low Income Tariff

Q. Is the Company proposing a low income tariff?

A. Yes, this low income tariff is similar to the one devised for Chaparral City Water Company ("Chaparral"), Docket No. W-02113A-07-0551.

Q. Please describe the proposal?

A. The Company is proposing that customers meeting the necessary qualifications would receive a 15 percent discount off their water bill.

Q. Did the Company provide an example of how the low income tariff would work?

A. No. However, since the Company claims it is similar to the low income tariff approved in the Chaparral case, Staff assumes it works the same way. In that case, Chaparral stated, "Based on the existing bill for a median usage on a 3/4-inch meter currently at $24.94, the low income program would result in a reduction of $3.74," or 15 percent.

Q. What would be the primary factor in determining ratepayer eligibility for this program?

A. The primary factor would be the combined gross income of all persons living in the household.

Q. How are the Company's gross annual house hold income limits determined?

A. The Company's proposed income guidelines are based on 150 percent of the 2008 federal poverty guidelines.

Q. Would these income guidelines be updated every year?

A. Yes.

Q. What are the draw backs to a low income tariff?

A. All non-participants will subsidize the low income households in the Company's service area.

Q. How will this be accomplished?

A. Through a separate surcharge on the non-participant's bills identified as a "Low Income Assistance Charge."

Q. Are there any other fees that would be included in this surcharge?

A. Yes, the Company proposes to include a 10 percent fee for administration and carrying costs.

Q. What is Staff's recommendation?

A. Staff recommends approval of the low income tariff.

Q. Does this conclude your Direct Testimony?

A. Yes, it does.

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Schedule JMM-WW1

REVENUE REQUIREMENT

LINE NO.	DESCRIPTION	(A) COMPANY FAIR VALUE	(B) STAFF FAIR VALUE
1	Adjusted Rate Base	$ 28,296,903	$ 27,472,314
2	Adjusted Operating Income (Loss)	$ 163,778	$ 655,433
3	Current Rate of Return (L2 / L1)	0.58%	2.39%
4	Required Rate of Return	11.41%	8.70%
5	Required Operating Income (L4 * L1)	$ 3,228,677	$ 2,390,091
6	Operating Income Deficiency (L5 - L2)	$ 3,064,899	$ 1,734,658
7	Gross Revenue Conversion Factor	1.6286	1.6381
8	Required Revenue Increase (L7 * L6)	$ 4,991,601	**$ 2,841,618**
9	Adjusted Test Year Revenue	$ 6,356,374	$ 6,356,374
10	Proposed Annual Revenue (L8 + L9)	$ 11,347,975	$ 9,197,992
11	Required Increase in Revenue (%)	78.53%	44.71%

References:
Column (A): Company Schedule A-1
Column (B): Staff Schedules JMM-W3 and JMM-W11

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Schedule JMM-WW2

GROSS REVENUE CONVERSION FACTOR

LINE NO.	DESCRIPTION	(A)	(B)	(C)	(D)
	Calculation of Gross Revenue Conversion Factor:				
1	Revenue	100.0000%			
2	Uncollecible Factor (Line 11)	0.0000%			
3	Revenues (L1 - L2)	100.0000%			
4	Combined Federal and State Income Tax and Property Tax Rate (Line 23)	38.9553%			
5	Subtotal (L3 - L4)	61.0447%			
6	**Revenue Conversion Factor (L1 / L5)**	1.638143			
	Calculation of Uncollecttible Factor:				
7	Unity	100.0000%			
8	Combined Federal and State Tax Rate (Line 23)	38.5989%			
9	One Minus Combined Income Tax Rate (L7 - L8)	61.4011%			
10	Uncollectible Rate	0.0000%			
11	Uncollectible Factor (L9 * L10)	0.0000%			
	Calculation of Effective Tax Rate:				
12	Operating Income Before Taxes (Arizona Taxable Income)	100.0000%			
13	Arizona State Income Tax Rate	6.9680%			
14	Federal Taxable Income (L12 - L13)	93.0320%			
15	Applicable Federal Income Tax Rate (Line 55)	34.0000%			
16	Effective Federal Income Tax Rate (L14 x L15)	31.6309%			
17	Combined Federal and State Income Tax Rate (L13 +L16)		38.5989%		
	Calculation of Effective Property Tax Factor				
18	Unity	100.0000%			
19	Combined Federal and State Income Tax Rate (L17)	38.5989%			
20	One Minus Combined Income Tax Rate (L18-L19)	61.4011%			
21	Property Tax Factor (JMM-WW18, L27)	0.5804%			
22	Effective Property Tax Factor (L20*L21)		0.3564%		
23	Combined Federal and State Income Tax and Property Tax Rate (L17+L22)			38.9553%	
24	Required Operating Income (Schedule JMM-WW1, Line 5)	$ 2,390,091			
25	AdjustedTest Year Operating Income (Loss) (Schedule JMM-WW11, Line 34)	655,433			
26	Required Increase in Operating Income (L24 - L25)		$ 1,734,658		
27	Income Taxes on Recommended Revenue (Col. [E], L52)	$ 1,312,524			
28	Income Taxes on Test Year Revenue (Col. [B], L52)	222,058			
29	Required Increase in Revenue to Provide for Income Taxes (L27 - L28)		1,090,466		
30	Recommended Revenue Requirement (Schedule JMM-WW1, Line 10)	$ 9,197,992			
31	Uncollectible Rate (Line 10)	0.0000%			
32	Uncolllectible Expense on Recommended Revenue (L30*L31)	$ -			
33	Adjusted Test Year Uncollectible Expense	$ -			
34	Required Increase in Revenue to Provide for Uncollectible Exp. (L32-L33)		-		
35	Property Tax with Recommended Revenue (JMM-WW18, Col B, L18)	$ 127,382			
36	Property Tax on Test Year Revenue (JMM-WW18, Col A, L17)	110,889			
37	Increase in Property Tax Due to Increase in Revenue (L35-L36)		16,493		
38	Total Required Increase in Revenue (L26 + L29 + L34 + L37)		$ 2,841,618		
		Test Year		Staff Recommended	
	Calculation of Income Tax:				
39	Revenue (Schedule JMM-11, Col. [C], Line 5 & Sch. JMM-1, Col. [D] Line 10)	$ 6,356,374	$ 2,841,618	$ 9,197,992	
40	Operating Expenses Excluding Income Taxes	$ 5,478,883		$ 5,495,377	
41	Synchronized Interest (L56)	$ 302,195		$ 302,195	
42	Arizona Taxable Income (L39 - L40 - L41)	$ 575,295		$ 3,400,420	
43	Arizona State Income Tax Rate	6.9680%		6.9680%	
44	Arizona Income Tax (L42 x L43)	$ 40,087		$ 236,941	
45	Federal Taxable Income (L42 - L44)	$ 535,209		$ 3,163,479	
46	Federal Tax on First Income Bracket ($1 - $50,000) @ 15%	$ 7,500		$ 7,500	
47	Federal Tax on Second Income Bracket ($51,001 - $75,000) @ 25%	$ 6,250		$ 6,250	
48	Federal Tax on Third Income Bracket ($75,001 - $100,000) @ 34%	$ 8,500		$ 8,500	
49	Federal Tax on Fourth Income Bracket ($100,001 - $335,000) @ 39%	$ 91,650		$ 91,650	
50	Federal Tax on Fifth Income Bracket ($335,001 -$10,000,000) @ 34%	$ 68,071		$ 961,683	
51	Total Federal Income Tax	$ 181,971		$ 1,075,583	
52	Combined Federal and State Income Tax (L44 + L51)	$ 222,058		$ 1,312,524	
53	Applicable Federal Income Tax Rate [Col. [E], L51 - Col. [B], L51] / [Col. [E], L45 - Col. [B], L45]			34.0000%	
	Calculation of Interest Synchronization:				
54	Rate Base (Schedule JMM-3)	$ 27,472,314			
55	Weighted Average Cost of Debt (Schedule JMM-WW19)	1.1000%			
56	Synchronized Interest (L45 X L46)	$ 302,195			

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Schedule JMM-WW3

RATE BASE - ORIGINAL COST

LINE NO.		(A) COMPANY AS FILED	(B) STAFF ADJUSTMENTS	Adj. No.	(C) STAFF AS ADJUSTED
1	Plant in Service	$ 60,394,260	$ (593,602)	1,2	$ 59,800,658
2	Less: Accumulated Depreciation	8,475,991	(193,844)	3	8,282,147
3	Net Plant in Service	$ 51,918,269	$ (399,758)		$ 51,518,511
	LESS:				
4	Contributions in Aid of Construction (CIAC)	$ 18,737,132	$ (94,346)	1	$ 18,642,786
5	Less: Accumulated Amortization	2,072,117	-		$ 2,072,117
6	Net CIAC	16,665,015	(94,346)		$ 16,570,669
7	Advances in Aid of Construction (AIAC)	7,006,208	(16,649)	1	6,989,559
8	Customer Deposits	68,685	81,798	4	150,483
9	Deferred Income Tax Credits	15,987	319,500	5	335,487
	ADD:				
9	Unamortized Debt Issuance Costs	134,528	(134,528)		-
10	Cash Working Capital	-	-		-
11	**Original Cost Rate Base**	$ 28,296,903	$ (824,589)		$ 27,472,314

References:
Column [A]: Company as Filed
Column [B]: Schedule JMM-WW4
Column (C): Column (A) + Column (B)

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Schedule JMM-WW4

SUMMARY OF ORIGINAL COST RATE BASE ADJUSTMENTS

LINE NO.	ACCT. NO.	DESCRIPTION	[A] COMPANY AS FILED	[B] ADJ #1 Plant Not Used and Useful Ref: Sch JMM-WW5	[C] ADJ #2 Transfer of Plant Ref: Sch JMM-WW6	[D] ADJ #3 Accumulated Depreciation Ref: Sch JMM-WW7	[E] ADJ #4 Customer Deposits Ref: Sch JMM-WW8	[F] ADJ #5 Deferred Taxes Ref: Sch JMM-WW9	[G] ADJ #6 Unamortized Debt Issuance Costs Ref: Sch JMM-WW10	[G] STAFF ADJUSTED
		PLANT IN SERVICE:								
1										
2	351	Organization	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3	352	Franchises	-	-	-	-	-	-	-	-
4	353	Land and Land Rights	1,783,426	-	-	-	-	-	-	1,783,426
5	354	Structures and Improvements	19,319,421	(388,834)	-	-	-	-	-	18,930,587
6	355	Power Generation Equipment	543,670	-	-	-	-	-	-	543,670
7	360	Collection Services - Force	1,161,105	-	-	-	-	-	-	1,161,105
8	361	Collection Services - Gravity	23,113,391	(18,730)	-	-	-	-	-	23,094,661
9	362	Special Collecting Structures	-	-	-	-	-	-	-	-
10	363	Services to Customers	-	-	-	-	-	-	-	-
11	364	Flow Measuring Devices	47,019	-	-	-	-	-	-	47,019
12	365	Flow Measuring Installations	-	-	-	-	-	-	-	-
13	366	Reuse Services	3,789,468	-	-	-	-	-		3,789,468
14	367	Reuse Meters and Installations	52,331	-	-	-	-	-		52,331
15	370	Receiving Wells	860,393	-	-	-	-	-		860,393
16	371	Effluent Pumping Equipment	1,858,411	(103,992)	-	-	-	-	-	1,754,419
17	374	Reuse Trans. And Dist. System	62,825	-	-	-	-	-		62,825
18	375	Resuse T&D	414,315	-	-	-	-	-		414,315
19	380	*Treatment and Disposal Equipment*	5,469,478	-	(38,625)	-	-	-	-	5,430,853
20	381	Plant Sewers	47,788	-	-	-	-	-	-	47,788
21	382	Outfall Sewer Lines	343,681	-	-	-	-	-	-	343,681
22	389	Other Plant & Misc. Equipment	644,609	(43,421)	-	-	-	-	-	601,188
23	390	Office Furniture & Equipment	198,772	-	-	-	-	-	-	198,772
24	391	Transportation Equipment	26,078	-	-	-	-	-	-	26,078
25	392	Stores Equipment	8,968	-	-	-	-	-	-	8,968
26	393	Tools, Shop & Garage Equipment	56,167	-	-	-	-	-	-	56,167
27	394	Labratory Equipment	173,948	-	-	-	-	-	-	173,948
28	395	Power Operated Equipment	-	-	-	-	-	-	-	-
29	396	Communication Equipment	418,996	-	-	-	-	-	-	418,996
30	398	Other Tangible Plant	-	-	-	-	-	-	-	-
31			-	-	-	-	-	-	-	-
32										
33		Total Plant in Service	$ 60,394,260	$ (554,977)	$ (38,625)	$ -	$ -	$ -	$ -	$ 59,800,658
34		Less: Accumulated Depreciation	8,475,991	-	(11,148)	(182,696)	-	-	-	8,282,147
35			-	-	-	-	-	-	-	-
36		Net Plant in Service (L59 - L 60)	$ 51,918,269	$ (554,977)	$ (27,477)	$ 182,696	$ -	$ -	$ -	$ 51,518,511
37										
38		*LESS:*								
39		Contributions in Aid of Construction (CIAC)	$ 18,737,132	$ (94,346)	$ -	$ -	$ -	$ -	$ -	$ 18,642,786
40		Less: Accumulated Amortization	2,072,117	-	-	-	-	-	-	2,072,117
41		Net CIAC (L25 - L26)	16,665,015	(94,346)	-	-	-	-	-	16,570,669
42		Advances in Aid of Construction (AIAC)	7,006,208	(16,649)	-	-	-	-	-	6,989,559
43		Customer Deposits	68,685	-	-	-	81,798	-	-	150,483
44		Deferred Income Taxes	15,987	-	-	-	-	319,500	-	335,487
45			-	-	-	-	-	-		-
46										
47		*ADD:*								
48		Unamortized Debt Issuance Costs	134,528	-	-	-	-	-	(134,528)	-
49		Cash Working Capital	-	-	-	-	-	-	-	-
50										
51		Original Cost Rate Base	$ 28,296,903	$ (443,982)	$ (27,477)	$ 182,696	$ (81,798)	$ (319,500)	$ (134,528)	$ 27,472,314

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Schedule JMM-WW5

RATE BASE ADJUSTMENT NO. 1 - PLANT NOT USED AND USEFUL

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	354	Structures & Improvements	$ 19,319,421	$ (388,834)	$ 18,930,587
2	361	Collection Sewer - Gravity	23,113,391	(18,730)	23,094,661
3	371	Pumping Equipment	1,858,411	(103,992)	1,754,419
4	389	Other Plant & Miscellaneous Equipment	644,609	(43,421)	601,188
5			$ 44,935,832	$ (554,977)	$ 44,380,855
6					
7		Based on Staff Engineering Report Table G-1.			
8					

LINE NO.	DESCRIPTION	[A] COMPANY AIAC & CIAC AS FILED	[B] STAFF ADJUSTMENTS	[C] STAFF AS ADJUSTED
13	Advances in Aid of Construction (AIAC)	$ 7,006,208	$ (16,649)	$ 6,989,559
14				
15	Contributions in Aid of Construction (CIAC)	$ 18,737,132	$ (94,346)	$ 18,642,786

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Schedule JMM-WW6

RATE BASE ADJUSTMENT NO. 2 - TRANSFER OF PLANT

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Plant in Service	$ 59,839,283	$ (38,625)	$ 59,800,658
2					
3			[A]	[B]	[C]
4			COMPANY		
5			AIAC & CIAC	STAFF	STAFF
6		DESCRIPTION	AS FILED	ADJUSTMENTS	AS ADJUSTED
7		Accumulated Depreciation	$ 8,475,991	$ (11,148)	$ 8,464,843
8					
9					

<u>REFERENCES:</u>
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Schedule JMM-WW7

RATE BASE ADJUSTMENT NO. 3 - ACCUMULATED DEPRECIATION

		[A]	[B]	[C]
LINE NO.	DESCRIPTION	COMPANY AS FILED	STAFF ADJUSTMENTS	STAFF AS ADJUSTED
1	Accumulated Depreciation	$ 8,464,843	$ (182,696)	$ 8,282,147

References:
Column A: Company Schedule B-2, Page 1
Column B: Column [C] - Column [A]
Column [C]: Column [A] + Column [B]

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Schedule JMM-WW8

RATE BASE ADJUSTMENT NO. 4 - CUSTOMER DEPOSITS

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Customer Deposits	$ 68,685	$ 81,798	$ 150,483
2					
3	Staff Calculation:				
4	8600-2-0000-20-2113-0000 Customer Deposits		73,568		
5	8600-2-0000-20-2112-0002 Customer Security Deposits		8,230		
			$ 81,798		

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Schedule JMM-WW9

RATE BASE ADJUSTMENT NO. 5 - DEFERRED INCOME TAXES

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Deferred Income Taxes	$ 15,987	$ 319,500	$ 335,487

To reverse the Company's pro-forma adjustment.

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Schedule JMM-WW10

RATE BASE ADJUSTMENT NO. 6 - UNAMORTIZED DEBT ISSUANCE COSTS

			[A]	[B]	[C]
LINE NO.	ACCT NO.	DESCRIPTION	COMPANY PROPOSED	STAFF ADJUSTMENTS	STAFF RECOMMENDED
1		Unamortized Debt Issuance Costs	$ 134,528	$ (134,528)	$ -

To Remove Unamortized Debt Issuance Costs.

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Schedule JMM-WW11

OPERATING INCOME STATEMENT - ADJUSTED TEST YEAR AND STAFF RECOMMENDED

LINE NO.	DESCRIPTION	[A] COMPANY ADJUSTED TEST YEAR AS FILED	[B] STAFF TEST YEAR ADJUSTMENTS	Adj. No.	[C] STAFF TEST YEAR AS ADJUSTED	[D] STAFF PROPOSED CHANGES	[E] STAFF RECOMMENDED
1	*REVENUES:*						
2	Flat Rate Revenues	$ 6,164,589	$ -		$ 6,164,589	$ 2,841,618	$ 9,006,207
3	Measured Revenues	92,030	-		92,030	-	92,030
4	Other Wastwater Revenues	99,755	-		99,755	-	99,755
5	Intentionally Left Blank	-	-		-	-	-
6	**Total Operating Revenues**	$ 6,356,374	$ -		$ 6,356,374	$ 2,841,618	$ 9,197,992
7							
8	*OPERATING EXPENSES:*						
9	Salaries and Wages	$ -	$ -		$ -	$ -	$ -
10	Purchased Wastewater Treatment	1,205	-		1,205	-	1,205
11	Sludge Removal Expense	267,554	-		267,554	-	267,554
12	Purchased Power	632,064	-		632,064	-	632,064
13	Fuel for Power Production	2,076	-		2,076	-	2,076
14	Chemicals	279,749	-		279,749	-	279,749
15	Materials & Supplies	75,579	(5,975)	1	69,604	-	69,604
16	Contractural Services, Legal&Engr	24,084	-		24,084	-	24,084
17	Contractural Sevices - Other	2,719,118	(266,665)	2	2,452,453	-	2,452,453
18	Contractural Services - Testing	33,348	-		33,348	-	33,348
19	Equipment Rental	78,309	-		78,309	-	78,309
20	Rents - Building	18,976	-		18,976	-	18,976
21	Transportation	69,551	-		69,551	-	69,551
22	General Liability Insurance	32,133	-		32,133	-	32,133
23	Insurance - Other	2,213	-		2,213	-	2,213
24	Reg Commission Expense	19,133	-	3	19,133	-	19,133
25	Reg Commission Expense - Rate Case	70,000	(28,000)	4	42,000	-	42,000
26	Miscellaneous Expense	36,656	(494)	5	36,162	-	36,162
27	Bad Debt Expense	43,889	(21,791)		22,098	-	22,098
28	Intentionally Left Blank	-	-		-	-	-
29	Depreciation	1,550,237	(264,954)	6	1,285,283	-	1,285,283
30	Taxes other than Income	-	-		-	-	-
31	Property Taxes	336,629	(225,740)	7	110,889	16,493	127,382
32	Income Taxes	(99,906)	321,964	8	222,058	1,090,466	1,312,524
33	Intentionally Left Blank	-	-		-	-	-
34	**Total Operating Expenses**	$ 6,192,596	$ (491,656)		$ 5,700,941	$ 1,106,960	$ 6,807,901
35	**Operating Income (Loss)**	$ 163,778	$ 491,656		$ 655,433	$ 1,734,658	$ 2,390,091

References:
Column (A): Company Schedule C-1
Column (B): Schedule ~~MEM-13~~ JM – WW12
Column (C): Column (A) + Column (B)
Column (D): Schedules ~~MEM-1 and~~ MEM-2 JMM-WW1, JMM-WW19, JM-WW20
Column (E): Column (C) + Column (D)

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Schedule JMM-WW12

SUMMARY OF OPERATING INCOME STATEMENT ADJUSTMENTS - TEST YEAR

LINE NO.	DESCRIPTION	[A] COMPANY AS FILED	[B] Materials and Supplies Expense ADJ #1 Ref: Sch JMM-WW13	[C] Corporate Expense Allocation ADJ #2 Ref: Sch JMM-WW14	[D] Rate Case Expense ADJ #3 Ref: Sch JMM-WW15	[E] Meals and Ent. Expense ADJ #4 Ref: Sch JMM-WW16	[F] Bad Debt Expense ADJ #5 Ref: Sch JMM-WW17	[G] Depreciation Expense ADJ #6 Ref: Sch JMM-WW18	[H] Property Tax Expense ADJ #7 Ref: Sch JMM-WW19	[I] Income Tax Expense ADJ #8 Ref: Sch JMM-WW20	[J] STAFF ADJUSTED
1	*REVENUES:*										
2	Flat Rate Revenues	$ 6,164,589	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,164,589
3	Measured Revenues	92,030	-	-	-	-	-	-	-	-	92,030
4	Other Wastwater Revenues	99,755	-	-	-	-	-	-	-	-	99,755
5	Intentionally Left Blank	-	-	-	-	-	-	-	-	-	-
6	**Total Operating Revenues**	$ 6,356,374	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,356,374
7											
8	*OPERATING EXPENSES:*										
9	Salaries and Wages	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
10	Purchased Wastewater Trmnt	1,205	-	-	-	-	-	-	-	-	1,205
11	Sludge Removal Expense	267,554	-	-	-	-	-	-	-	-	267,554
12	Purchased Power	632,064	-	-	-	-	-	-	-	-	632,064
13	Fuel for Power Production	2,076	-	-	-	-	-	-	-	-	2,076
14	Chemicals	279,749	-	-	-	-	-	-	-	-	279,749
15	Materials & Supplies	75,579	(5,975)	-	-	-	-	-	-	-	69,604
16	Contractural Services, Legal&Engr	24,084	-	-	-	-	-	-	-	-	24,084
17	Contractural Sevices - Other	2,719,118	-	(266,665)	-	-	-	-	-	-	2,452,453
18	Contractural Services - Testing	33,348	-	-	-	-	-	-	-	-	33,348
19	Equipment Rental	78,309	-	-	-	-	-	-	-	-	78,309
20	Rents - Building	18,976	-	-	-	-	-	-	-	-	18,976
21	Transportation	69,551	-	-	-	-	-	-	-	-	69,551
22	General Liability Insurance	32,133	-	-	-	-	-	-	-	-	32,133
23	Insurance - Other	2,213	-	-	-	-	-	-	-	-	2,213
24	Reg Commission Expense	19,133	-	-	-	-	-	-	-	-	19,133
25	Reg Commission Expense - Rate Case	70,000	-	-	(28,000)	-	-	-	-	-	42,000
26	Miscellaneous Expense	36,656	-	-	-	(494)	-	-	-	-	36,162
27	Bad Debt Expense	43,889	-	-	-	-	(21,791)	-	-	-	22,098
28	Intentionally Left Blank	-	-	-	-	-	-	-	-	-	-
29	Depreciation	1,550,237	-	-	-	-	-	(264,954)	-	-	1,285,283
30	Taxes other than Income	-	-	-	-	-	-	-	-	-	-
31	Property Taxes	336,629	-	-	-	-	-	-	(225,740)	-	110,889
32	Income Taxes	(99,906)	-	-	-	-	-	-	-	321,964	222,058
33	Intentionally Left Blank	-	-	-	-	-	-	-	-	-	-
34	**Total Operating Expenses**	$ 6,192,596	$ (5,975)	$ (266,665)	$ (28,000)	$ (494)	$ (21,791)	$ (264,954)	$ (225,740)	$ 321,964	$ 5,700,941
35	**Operating Income (Loss)**	$ 163,778	$ 5,975	$ 266,665	$ 28,000	$ 494	$ 21,791	$ 264,954	$ 225,740	$ (321,964)	$ 655,433

Litchfield Park Service Company - Wastewater Division
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Test Year Ended September 30, 2008

Schedule JMM-WW13

OPERATING INCOME ADJUSTMENT NO. 1 - MATERIALS AND SUPPLIES

LINE NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	Materials and Supplies	$ 75,579	$ (5,975)	$ 69,604

References:
Column (A), Company Schedule C-1
Column (B): Testimony JMM
Column (C): Column (A) + Column (B)

OPERATING INCOME ADJUSTMENT NO. 2 - EXPENSE ALLOCATIONS FROM UNREGULATED AFFILIATE

DESCRIPTION	[A] COMPANY AS FILED	[B] STAFF ADJUSTMENTS (Col C - Col A)	[C] STAFF AS ADJUSTED
Contractural Services - Other	$ 2,451,656	$ -	$ 2,451,656
Corporate Expense Allocation	267,462	(266,665)	797
Total Contractural Services - Other	$ 2,719,118	$ (266,665)	$ 2,452,453

[D] [E] Description	[F] Amount	[G] Unallowable Costs (Sch JMM-6, P2)	[H] Direct Costs of Unregulated Affiliate(s)	[I] Allowable Common Costs Allocated to All 71 Companies	[J] Allocation[5] %	[K] Costs to be Allocated to LPSCO (Col I x Col J)
COSTS TO BE ALLOCATED TO LPSCO						
Rent	$ 430,739	$ -	$ (430,739)	$ -	1.41%	$ -
Audit[1]	$ 507,000	$ -	$ (456,300)	$ 50,700	1.41%	$ 714.08
Tax Services[2]	$ 265,000	$ -	$ (238,500)	$ 26,500	1.41%	$ 373.24
Legal-General[3]	$ 300,000	$ -	$ (284,400)	$ 15,600	1.41%	$ 219.72
Other Professional Services	$ 455,000	$ -	$ (455,000)	$ -	1.41%	$ -
Management Fee	$ 636,619	$ -	$ (636,619)	$ -	1.41%	$ -
Unit Holder Communications	$ 314,100	$ -	$ (314,100)	$ -	1.41%	$ -
Trustee Fees	$ 204,000	$ -	$ (204,000)	$ -	1.41%	$ -
Office Costs	$ 254,100	$ (46,186)	$ (207,914)	$ -	1.41%	$ -
Licenses/Fees and Permits	$ 305,000	$ (145,642)	$ (159,358)	$ -	1.41%	$ -
Escrow and Transfer Fees	$ 75,000	$ -	$ (75,000)	$ -	1.41%	$ -
Depreciation Expense[4]	$ 204,242	$ -	$ (183,818)	$ 20,424	1.41%	$ 287.66
	$ 3,950,800	$ (191,828)	$ (3,645,748)	$ 113,224		$ 1,594.71
					Water	$ 797.35
					Waste Water	$ 797.35
						$ 1,594.71

Foot Note 1: Audit - As the parent company's lenders require the APIF to have annual financial audits, Staff assigned the majority of the cost (i.e., 90 percent) to APIF and the remaining 10 percent to its 71 companies/interests.

Foot Note 2: Tax Services - Given the tax complexity of the APIF's many holdings and transactions, Staff assigned the majority of the cost (i.e., 90 percent) to APIF and the remaining 10 percent to its 71 companies/interests.

Foot Note 3: Legal, General - Staff reviewed the legal invoices and found that the very large majority of the legal invoices pertained to the APIF.

Foot Note 4: Depreciation Expense - Given that most of APIF's plant costs benefit primarily APIF, Staff assigned the majority of the cost (i.e., 90 percent) to APIF and the remaining 10 percent to its 71 companies/interests.

Foot Note 5: Allocation Percentage - Calculated as follows: 1 / 71 companies = 1.41%.

References:
Column A: Company Schedule
Column B: Testimony
Column C: Column [A] + Column [B]

Litchfield Park Service Company - Wastewater Division
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LINE NO.			
1	**Category**	**Description of Unallowable Cost**	**Amount**
2	Office Fees and Expenses	Wind Analysis & Planning Software	$15,056
3	Office Fees and Expenses	Gold Watches and Clocks	$16,864
4	Office Fees and Expenses	Pilsner Beer Glasses	$5,700
5	Office Fees and Expenses	Leafs-Raptors Season Tickets	$5,066
6	Office Fees and Expenses	Super Bowl XLII Tickets	$3,500
7		**Subtotal for Office Expenses**	**$46,186**
8			
9	Licenses and Fees	Donation - Wind Project Develop	$25,000
10	Licenses and Fees	Donation - Water Project in Africa	$25,000
11	Licenses and Fees	Donation - Cancer Society	$13,350
12	Licenses and Fees	Donation - Multiple Myeloma	$5,000
13	Licenses and Fees	Wind Development	$7,887
14	Licenses and Fees	U.S. Trustee	$9,375
15	Licenses and Fees	St. Leon Wind Energy	$12,556
16	Licenses and Fees	Algonquin Power Fund Inc Taxes	$6,891
17	Licenses and Fees	Algonquin Power Fund Inc Taxes	$6,794
18	Licenses and Fees	Tax Ruling Request for KMS America & Subs	$10,000
19	Licenses and Fees	Algonquin Power Fund Inc Taxes	$23,789
20		**Subtotal for Licenses & Fees**	**$145,642**

Litchfield Park Service Company - Wastewater Division
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Schedule JMM-WW15

OPERATING INCOME ADJUSTMENT NO. 3 - RATE CASE EXPENSE

		[A]	[B]	[C]
LINE NO.	DESCRIPTION	COMPANY PROPOSED	STAFF ADJUSTMENTS	STAFF RECOMMENDED
1	Rate Case Expense	$ 70,000	$ (28,000)	$ 42,000

Staff Calculation:

Estimated Rate Case Cost	$	210,000
Normalized Over Five Years		5
		42,000

References:
Column (A), Company Schedule C-1
Column (B): Testimony JMM
Column (C): Column (A) + Column (B)

Litchfield Park Service Company - Wastewater Division
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Schedule JMM-WW16

OPERATING INCOME ADJUSTMENT NO. 4 - MEALS AND ENTERTAINMENT

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	775.00	Miscellaneous Expense	$ 36,656	$ (494)	$ 36,162

References:
Column (A), Company Schedule C-1
Column (B): Testimony JMM
Column (C): Column (A) + Column (B)

Litchfield Park Service Company - Wastewater Division
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OPERATING INCOME ADJUSTMENT NO. 5 - BAD DEBT

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Bad Debt Expense	$ 43,889	$ (21,791)	$ 22,098

Staff Calculation:	
Test Year	$43,889
2007	19,632
2006	2,773
	$66,294
Normalized over 3 years	3
	$ 22,098

References:
Column (A), Company Schedule C-1
Column (B): Testimony JMM
Column (C): Column (A) + Column (B)

Litchfield Park Service Company - Wastewater Division
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Schedule JMM-WW18

OPERATING INCOME ADJUSTMENT NO. 6 - DEPRECIATION EXPENSE ON TEST YEAR PLANT

LINE NO.	ACCT NO.	DESCRIPTION	[A] PLANT In SERVICE Per Staff	[B] NonDepreciable or Fully Depreciated PLANT	[C] DEPRECIABLE PLANT (Col A - Col B)	[D] DEPRECIATION RATE	[E] DEPRECIATION EXPENSE (Col C x Col D)
1	351	Organization	$ -	$ -	$ -	0.00%	$ -
2	352	Franchises	$ -	$ -	$ -	0.00%	$ -
3	353	Land and Land Rights	$ 1,783,426	$ 1,783,426	$ -	0.00%	$ -
4	354	Structures and Improvements	$ 18,930,587	$ -	$ 18,930,587	3.33%	$ 630,389
5	355	Power Generation Equipment	$ 543,670	$ -	$ 543,670	5.00%	$ 27,184
6	360	Collection Services - Force	$ 1,161,105	$ -	$ 1,161,105	2.00%	$ 23,222
7	361	Collection Services - Gravity	$ 23,094,661	$ -	$ 23,094,661	2.00%	$ 461,893
8	362	Special Collecting Structures	$ -	$ -	$ -	2.00%	$ -
9	363	Services to Customers	$ -	$ -	$ -	2.00%	$ -
10	364	Flow Measuring Devices	$ 47,019	$ -	$ 47,019	10.00%	$ 4,702
11	365	Flow Measuring Installations	$ -	$ -	$ -	10.00%	$ -
12	366	Reuse Services	$ 3,789,468	$ -	$ 3,789,468	2.00%	$ 75,789
13	367	Reuse Meters and Installations	$ 52,331	$ -	$ 52,331	8.33%	$ 4,359
14	370	Receiving Wells	$ 860,393	$ -	$ 860,393	3.33%	$ 28,651
15	371	Effluent Pumping Equipment	$ 1,754,419	$ -	$ 1,754,419	12.50%	$ 219,302
16	374	Reuse Trans. And Dist. System	$ 62,825	$ -	$ 62,825	2.50%	$ 1,571
17	375	Reuse T&D	$ 414,315	$ -	$ 414,315	2.50%	$ 10,358
18	380	Treatment and Disposal Equipment	$ 5,430,853	$ -	$ 5,430,853	5.00%	$ 271,543
19	381	Plant Sewers	$ 47,788	$ -	$ 47,788	5.00%	$ 2,389
20	382	Outfall Sewer Lines	$ 343,681	$ -	$ 343,681	3.33%	$ 11,445
21	389	Other Plant & Misc. Equipment	$ 601,188	$ -	$ 601,188	6.67%	$ 40,099
22	390	Office Furniture & Equipment	$ 198,772	$ -	$ 198,772	6.67%	$ 13,258
23	391	Transportation Equipment	$ 26,078	$ -	$ 26,078	20.00%	$ 5,216
24	392	Stores Equipment	$ 8,968	$ -	$ 8,968	4.00%	$ 359
25	393	Tools, Shop & Garage Equipment	$ 56,167	$ -	$ 56,167	5.00%	$ 2,808
26	394	Labratory Equipment	$ 173,948	$ -	$ 173,948	10.00%	$ 17,395
27	395	Power Operated Equipment	$ -	$ -	$ -	5.00%	$ -
28	396	Communication Equipment	$ 418,996	$ -	$ 418,996	10.00%	$ 41,900
29	398	Other Tangible Plant	$ -	$ -	$ -	10.00%	$ -
30		Total Plant	$ 59,800,658	$ 1,783,426	$ 58,017,232		$ 1,893,831
31							
32		Composite Depreciation Rate (Depr Exp / Depreciable Plant):	3.26%				
33		CIAC:	$ 18,642,786				
34		Amortization of CIAC (Line 32 x Line 33):	$ 608,548				
35							
36		Depreciation Expense Before Amortization of CIAC:	$ 1,893,831				
37		Less Amortization of CIAC:	$ 608,548				
38		**Test Year Depreciation Expense - Staff:**	**$ 1,285,283**				
39		Depreciation Expense - Company:	$ 1,550,237				
40		**Staff's Total Adjustment:**	**$ (264,954)**				

References:
Column [A]: Schedule JMM-WW4
Column [B]: From Column [A]
Column [C]: Column [A] - Column [B]
Column [D]: Engineering Staff Report
Column [E]: Column [C] x Column [D]

Litchfield Park Service Company - Wastewater Division
Docket No. WS-01428A-09-0103
Test Year Ended September 30, 2008

Schedule JMM-WW19

OPERATING INCOME ADJUSTMENT #7 - Property Tax Expense

LINE NO.	Property Tax Calculation	STAFF AS ADJUSTED	STAFF RECOMMENDED
1	Staff Adjusted Test Year Revenues	$ 6,356,374	$ 6,356,374
2	Weight Factor	2	2
3	Subtotal (Line 1 * Line 2)	12,712,748	$ 12,712,748
4	Staff Recommended Revenue, *Per Schedule JMM-WW1*	6,356,374	$ 9,197,992
5	Subtotal (Line 4 + Line 5)	19,069,122	21,910,740
6	Number of Years	3	3
7	Three Year Average (Line 5 / Line 6)	6,356,374	$ 7,303,580
8	Department of Revenue Mutilplier	2	2
9	Revenue Base Value (Line 7 * Line 8)	12,712,748	$ 14,607,160
10	Plus: 10% of CWIP -	39,301	39,301
11	Less: Net Book Value of Licensed Vehicles	15,573	$ 15,573
12	Full Cash Value (Line 9 + Line 10 - Line 11)	12,736,476	$ 14,630,888
13	Assessment Ratio	21.0%	21.0%
14	Assessment Value (Line 12 * Line 13)	2,674,660	$ 3,072,486
15	Composite Property Tax Rate (Per Company Schedule C-2)	4.1459%	4.1459%
16			
17	Staff Test Year Adjusted Property Tax (Line 14 * Line 15)	$ 110,889	
18	Company Proposed Property Tax	336,629	
19			
20	Staff Test Year Adjustment (Line 17-Line 18)	$ (225,740)	
21	Property Tax - Staff Recommended Revenue (Line 14 * Line 15)		$ 127,382
22	Staff Test Year Adjusted Property Tax Expense (Line 17)		$ 110,889
23	Increase in Property Tax Expense Due to Increase in Revenue Requirement		$ 16,493
24			
25	Increase to Property Tax Expense		$ 16,493
26	Increase in Revenue Requirement		2,841,618
27	Increase to Property Tax per Dollar Increase in Revenue (Line25/Line 26)		0.580426%

Litchfield Park Service Company - Wastewater Division
Docket No. WS-01428A-09-0103
Test Year Ended September 30, 2008

Schedule JMM-WW20

OPERATING INCOME ADJUSTMENT NO. 8 - TEST YEAR INCOME TAXES

LINE NO.	DESCRIPTION		
	Calculation of Income Tax:		Test Year
1	Revenue (Schedule CSB-11)	$	6,356,374
2	Operating Expenses Excluding Income Taxes	$	5,478,883
3	Synchronized Interest (L17)	$	302,195
4	Arizona Taxable Income (L1 - L2 - L3)	$	575,295
5	Arizona State Income Tax Rate		6.9680%
6	Arizona Income Tax (L4 x L5)	$	40,087
7	Federal Taxable Income (L4 - L6)	$	535,209
8	Federal Tax on First Income Bracket ($1 - $50,000) @ 15%	$	7,500
9	Federal Tax on Second Income Bracket ($51,001 - $75,000) @ 25%	$	6,250
10	Federal Tax on Third Income Bracket ($75,001 - $100,000) @ 34%	$	8,500
11	Federal Tax on Fourth Income Bracket ($100,001 - $335,000) @ 39%	$	91,650
12	Federal Tax on Fifth Income Bracket ($335,001 -$10,000,000) @ 34%	$	68,071
13	Total Federal Income Tax	$	181,971
14	Combined Federal and State Income Tax (L44 + L51)	$	222,058
15			
16			
17	*Calculation of Interest Synchronization:*		
18	Rate Base (Schedule JMM-WW4)	$	27,472,314
19	Weighted Average Cost of Debt		1.10%
20	Synchronized Interest (L16 x L17)	$	302,195
21			
22			
23	Income Tax - Per Staff	$	222,058
24	Income Tax - Per Company	$	(99,906)
25	**Staff Adjustment**	**$**	**321,964**

BEFORE THE ARIZONA CORPORATION COMMISSION

KRISTIN K. MAYES
Chairman
GARY PIERCE
Commissioner
PAUL NEWMAN
Commissioner
SANDRA D. KENNEDY
Commissioner
BOB STUMP
Commissioner

IN THE MATTER OF THE APPLICATION OF LITCHFIELD PARK SERVICE COMPANY, AN ARIZONA CORPORATION, FOR A DETERMINATION OF THE FAIR VALUE OF ITS UTILITY PLANTS AND PROPERTY AND FOR INCREASES IN ITS WASTEWATER RATES AND CHARGES FOR UTILITY SERVICE BASED THERON.	DOCKET NO. WS-01428A-09-0103

WASTEWATER

SURREBUTTAL

TESTIMONY

OF

JEFFREY M. MICHLIK

PUBLIC UTILITIES ANALYST V

UTILITIES DIVISION

ARIZONA CORPORATION COMMISSION

DECEMBER 17, 2009

ALL-STATE LEGAL®
EXHIBIT
S-17
ADMITTED

TABLE OF CONTENTS

SURREBUTTAL SCHEDULES

EXECUTIVE SUMMARY
LITCHFIELD PARK SERVICE COMPANY
WASTEWATER DIVISION
DOCKET NOS. WS-01427A-09-0103

As compared to direct testimony, Staff's surrebuttal position increases its recommended revenue requirement by $200,633, from $9,197,992 to $9,398,625. Staff recommends revised rates that would increase operating revenues from test year by $3,042,251 to produce operating revenues of $9,398,625 resulting in operating income of $2,423,991 or a 47.86 percent increase over test year revenues of $6,356,374. Staff also recommends a revised FVRB of $27,861,961.

Revenue Requirement:

Staff recommends its revised revenue requirement, revised revenue increase, and revised percentage of revenue increase.

Rate Base:

Staff recommends a revised rate base, and responds to Litchfield Park Service Company's ("LPSCO" or "Company") comments to Staff's customer security deposits.

Income Statement:

Staff recommends revised operating income, and responds to the Company's comments on corporate expense allocation expense. Based on new information, Staff now recommends disallowance of employee bonuses.

INTRODUCTION

Q. Please state your name, occupation, and business address.

A. My name is Jeffrey M. Michlik. I am a Public Utilities Analyst V employed by the Arizona Corporation Commission ("ACC" or "Commission") in the Utilities Division ("Staff"). My business address is 1200 West Washington Street, Phoenix, Arizona 85007.

Q. Are you the same Jeffrey M. Michlik who filed Direct Testimony in this case?

A. Yes, I am.

Q. What is the purpose of your Surrebuttal Testimony in this proceeding?

A. The purpose of my Surrebuttal Testimony in this proceeding is to respond, on behalf of Staff, to the Rebuttal Testimony of Litchfield Park Service Company's ("LPSCO" or "Company") witnesses, Mr. Thomas J. Bourassa and Mr. Greg Sorensen, regarding revenue requirement, rate base, and operating revenues and expenses.

Q. Did you attempt to address every issue the Company raised in its Rebuttal Testimony?

A. No. Staff limited its discussion to the specific issues as outlined below. Staff's lack of response to any issue in this proceeding should not be construed as agreement with the Company's position in its Rebuttal Testimony; rather, where there is no response, Staff relies on its original Direct Testimony.

Q. Please explain how Staff's Surrebuttal Testimony is organized.

A. Staff's Surrebuttal Testimony is generally organized to present issues that Mr. Bourassa and Mr. Sorensen present in their Rebuttal Testimonies.

REVENUE REQUIREMENT

Q. Has Staff reviewed Mr. Bourassa's and Mr. Sorensen's Rebuttal Testimony regarding revenue requirement for the Wastewater Division?

A. Yes.

Q. Has Staff revised its recommendations from its Direct Testimony?

A. Yes. As compared to Direct Testimony, Staff's Surrebuttal position increases its recommended revenue requirement by $200,633, from $9,197,992 to $9,398,625. This decrease reflects Staff's Surrebuttal adjustments as discussed herein.

Q. Please summarize the proposed and recommended revenue requirement, revenue increase, and percentage increase.

A. The proposed and recommended revenue requirement, revenue increase, and percentage increase are as follows:

	Revenue Requirement	Revenue Increase	Percentage Increase
Company-Direct	$11,347,975	$4,991,601	78.53 percent
Staff-Direct	$9,197,992	$2,841,618	44.71 percent
RUCO-Direct	$8,169,592	$1,810,405	28.47 percent
Company-Rebuttal	$11,132,993	$4,776,618	75.15 percent
Staff-Surrebuttal	$9,398,625	$3,042,251	47.86 percent

RATE BASE

Q. Has Staff reviewed Mr. Bourassa's and Mr. Sorensen's Rebuttal Testimony regarding rate base for the Wastewater Division?

A. Yes.

Q. Has Staff revised its recommendations from its Direct Testimony?

A. Yes. As compared to Direct Testimony, Staff's Surrebuttal position increases its recommended rate base by $389,647, from $27,472,314 to $27,861,961. This increase reflects Staff's Surrebuttal adjustments as discussed herein.

Q. Would Staff please identify each party's respective rate base recommendations?

A. Yes. The rate bases proposed and recommended by all parties in the case are as follows:

	OCRB	FVRB
Company-Direct	$28,296,903	$28,296,903
Staff-Direct	$27,472,314	$27,472,314
RUCO-Direct	$21,248,950	$21,248,950
Company-Rebuttal	$28,034,855	$28,034,855
Staff-Surrebuttal	$27,861,961	$27,861,961

Q. Are there any adjustments to plant in service that Staff did not make in Direct Testimony, but would like to make now for the Wastewater Division?

A. Yes.

Q. Please provide a summary of adjustments that you have accepted from the Company and/or RUCO, and on which schedules the adjustments have been made.

A. Staff has made the following adjustments to rate base for the Wastewater Division:

Plant-in-Service

Staff has capitalized expenses in the amount of $3,725 for Account No. 354 Structures and Improvements, $5,004 for Account No. 355 Power Generation Equipment, $6,394 for Account No. 371 Pumping Equipment, and $2,000 for Account No. 389 Other Plant and Miscellaneous Equipment, as shown on Surrebuttal Schedule JMM-WW7. Staff made these adjustments to accumulated depreciation based on review of the Company's Rebuttal Testimony.

Accumulated Depreciation

Staff adjusted accumulated depreciation to reflect plant-in-service that has been fully depreciated in the amount of $554,977, and accumulated depreciation of capitalized plant in the amount of $491, as shown on Surrebuttal Schedule JMM-WW8. Based on review of the Company's Rebuttal Testimony, Staff has adjusted accumulated depreciation.

Deferred Income Taxes and Credits

Staff decreased deferred income taxes and credits to the Company's proposed amount of $335,020, as shown on Surrebuttal Schedule JMM-WW10.

Q. Please review the remaining contested issues related to the rate base for the Wastewater Division.

A. Certainly.

Security Deposits

Q. Does Staff still believe security deposits should be included in rate base?

A. Yes. By definition customer security deposits are customer deposits.

Q. What do customer deposits represent?

A. Customer deposits represent funds received from ratepayers as security against potential losses arising from failure to pay for service. These funds are similar in nature to customer advances for construction. Both represent a liability to repay the funds received either after a specified period or upon satisfaction of certain requirements. Like customer advances, the deposits are available to the utility for use in support of its rate base investment.

Q. Does Staff include customer deposits in rate base?

A. Yes.

Accumulated Deferred Income Taxes

Q. The Company mentions that Staff agrees with its methodology for calculating deferred income taxes; please comment on this.

A. Staff is still reviewing Mr. Bourassa's proposal and rebuttal adjustment for this item. While Staff agrees with the methodology used by Mr. Bourassa, Staff believes that the substantiation for the underlying calculations warrants an in-depth review and analysis. Staff is provisionally including the Company's adjustment pending completion of its analysis.

OPERATING INCOME

Q. Are there any adjustments to plant in service that Staff did not make in Direct Testimony, but would like to make now for the Wastewater Division?

A. Yes.

Q. Please provide a summary of adjustments that you have accepted from the Company and/or RUCO, and on which schedules the adjustments have been made.

A. Staff has made the following adjustments to operating income for the Wastewater Division:

Removal of Aerotek Contractual Services

Staff has removed $42,200 for contractual services costs (Aerotek) that were actually incurred by Black Mountain Sewer Company, as shown on Surrebuttal Schedule JMM-WW15. Based on review of the Company's Rebuttal Testimony, Staff has accepted the Company's adjustment.

Capitalized Expenses

Staff has removed $17,124 in capitalized expenses and $3,128 in unnecessary expenses from outside services, as shown on Surrebuttal Schedule JMM-WW15. Based on review of supporting documentation, Staff has accepted the Company's and RUCO's adjustment.

Rate Case Expense

Staff has removed $1,136 from regulatory commission expense, as shown on Surrebuttal Schedule JMM-WW19. Based on review of supporting documentation, Staff has accepted the Company's and RUCO's adjustment.

Depreciation Expense

Staff has recalculated its amortization of contributions using a specific rate rather than a composite rate, as shown on Surrebuttal Schedule JMM-WW19. Based on review of the Company's Rebuttal Testimony, Staff has accepted the Company's adjustment.

Q. Please review the remaining contested issues related to operating income for the Wastewater Division.

A. Certainly.

Corporate Expense Allocation

Q. How does the Algonquin Power Income Fund ("Fund" or "APIF") produce income for its shareholders?

A. The Fund, according to its 2008 annual report, produces earnings for its shareholders through a diversified portfolio of renewable energy and utility assets.

Q. What was the APIF's business strategy?

A. The Fund's 2008 annual report states the following concerning its business strategy:

> *Algonquin's business strategy is to maximize long term unitholder value by strengthening its position as a strong renewable energy and infrastructure company.* ***The Company is focused on growth in cash flow and earnings*** *in the business segments in which it operates.* (emphasis added)

Q. What was the APIF's income for 2008?

A. The APIF generated $57 million in income before taxes according to its 2008 audited financial statements.

Q. Does Staff agree with the Company's statement that "APIF incurs the central office cost for the benefit of its subsidiary businesses" and "but for the subsidiary businesses, APIF would not have central offices costs . . . ." (Bourassa Rebuttal, page 33, lines 19 through 33)?

A. No, Staff does not. The APIF is an unregulated for-profit business that incurs costs primarily for the benefit of its shareholders. Making a profit is the ultimate reason any for-profit company incurs expenses. The Fund is focused on "*growth in cash flow and earnings*" as evidenced from its business strategy. Since shareholders seek a profit and the APIF incurs expenses (e.g. central office costs) in order to generate that profit, it is obvious that the central office costs are incurred primarily for the benefit of the shareholders rather than for LPSCO as the Company indicates. The central office costs would have been incurred even if the Fund did not own LPSCO because the central office costs were incurred to make a profit for the shareholders and not to operate LPSCO. The benefit to LPSCO is only incidental.

Q. Please comment on the Company's statement that the Company only owns 63 companies and not 71 as stated in the Staff report.

A. According to the Company's financial report, the Company has interest in the other eight companies, and accordingly it generates expenses from them, and that's why Staff included them in its calculation.

Employee Bonus Expense

Q. Since the time of filing Direct Testimony, are there any adjustments that Staff would like to make in its Surrebuttal filing?

A. Yes. Staff recommends that $52,954 be removed for employee bonuses. Of that amount, Staff recommends $26,447 be allocated to water and $26,447 be allocated to wastewater based on Staff's allocation of corporate expenses.

Q. Why is Staff making this adjustment now?

A. Upon reviewing the Company's response to a later data request regarding bonuses, Staff determined that this amount had been incurred for performance incentives paid to employees, which Staff believes should not be passed on to the ratepayers.

Q. What is Staff recommending?

A. Staff recommends removing $26,477 from contractual services, as shown on Surrebuttal Schedule JMM-WW15.

Q. Does this conclude your Surrebuttal Testimony?

A. Yes.

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Surrebuttal Schedule JMM-WW1

REVENUE REQUIREMENT

LINE NO.	DESCRIPTION		(A) COMPANY FAIR VALUE		(B) STAFF FAIR VALUE
1	Adjusted Rate Base	$	28,296,903	$	27,861,961
2	Adjusted Operating Income (Loss)	$	163,778	$	566,857
3	Current Rate of Return (L2 / L1)		0.58%		2.03%
4	Required Rate of Return		11.41%		8.70%
5	Required Operating Income (L4 * L1)	$	3,228,677	$	2,423,991
6	Operating Income Deficiency (L5 - L2)	$	3,064,899	$	1,857,134
7	Gross Revenue Conversion Factor		1.6286		1.6381
8	Required Revenue Increase (L7 * L6)	$	4,991,601	**$**	**3,042,251**
9	Adjusted Test Year Revenue	$	6,356,374	$	6,356,374
10	Proposed Annual Revenue (L8 + L9)	$	11,347,975	$	9,398,625
11	Required Increase in Revenue (%)		78.53%		47.86%

References:
Column (A): Company Schedule A-1
Column (B): Staff Schedules JMM-W3 and JMM-W12

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Surrebuttal Schedule JMM-WW2

GROSS REVENUE CONVERSION FACTOR

LINE NO.	DESCRIPTION	(A)	(B)	(C)	(D)
	Calculation of Gross Revenue Conversion Factor:				
1	Revenue	100.0000%			
2	Uncollecible Factor (Line 11)	0.0000%			
3	Revenues (L1 - L2)	100.0000%			
4	Combined Federal and State Income Tax and Property Tax Rate (Line 23)	38.9553%			
5	Subtotal (L3 - L4)	61.0447%			
6	**Revenue Conversion Factor (L1 / L5)**	1.638143			
	Calculation of Uncollecttible Factor:				
7	Unity	100.0000%			
8	Combined Federal and State Tax Rate (Line 23)	38.5989%			
9	One Minus Combined Income Tax Rate (L7 - L8)	61.4011%			
10	Uncollectible Rate	0.0000%			
11	Uncollectible Factor (L9 * L10)	0.0000%			
	Calculation of Effective Tax Rate:				
12	Operating Income Before Taxes (Arizona Taxable Income)	100.0000%			
13	Arizona State Income Tax Rate	6.9680%			
14	Federal Taxable Income (L12 - L13)	93.0320%			
15	Applicable Federal Income Tax Rate (Line 55)	34.0000%			
16	Effective Federal Income Tax Rate (L14 x L15)	31.6309%			
17	Combined Federal and State Income Tax Rate (L13 +L16)		38.5989%		
	Calculation of Effective Property Tax Factor				
18	Unity	100.0000%			
19	Combined Federal and State Income Tax Rate (L17)	38.5989%			
20	One Minus Combined Income Tax Rate (L18-L19)	61.4011%			
21	Property Tax Factor (JMM-WW18, L27)	0.5804%			
22	Effective Property Tax Factor (L20*L21)		0.3564%		
23	Combined Federal and State Income Tax and Property Tax Rate (L17+L22)			38.9553%	
24	Required Operating Income (Schedule JMM-WW1, Line 5)	$ 2,423,991			
25	AdjustedTest Year Operating Income (Loss) (Schedule JMM-WW11, Line 34)	566,857			
26	Required Increase in Operating Income (L24 - L25)		$ 1,857,134		
27	Income Taxes on Recommended Revenue (Col. [E], L52)	$ 1,331,140			
28	Income Taxes on Test Year Revenue (Col. [B], L52)	163,681			
29	Required Increase in Revenue to Provide for Income Taxes (L27 - L28)		1,167,459		
30	Recommended Revenue Requirement (Schedule JMM-WW1, Line 10)	$ 9,398,625			
31	Uncollectible Rate (Line 10)	0.0000%			
32	Uncolllectible Expense on Recommended Revenue (L30*L31)	$ -			
33	Adjusted Test Year Uncollectible Expense	$ -			
34	Required Increase in Revenue to Provide for Uncollectible Exp. (L32-L33)		-		
35	Property Tax with Recommended Revenue (JMM-WW18, Col B, L18)	$ 128,547			
36	Property Tax on Test Year Revenue (JMM-WW18, Col A, L17)	110,889			
37	Increase in Property Tax Due to Increase in Revenue (L35-L36)		17,658		
38	Total Required Increase in Revenue (L26 + L29 + L34 + L37)		$ 3,042,251		

LINE NO.	DESCRIPTION	Test Year		Staff Recommended
	Calculation of Income Tax:			
39	Revenue (Schedule JMM-11, Col. [C], Line 5 & Sch. JMM-1, Col. [D] Line 10)	$ 6,356,374	$ 3,042,251	$ 9,398,625
40	Operating Expenses Excluding Income Taxes	$ 5,625,836		$ 5,643,494
41	Synchronized Interest (L56)	$ 306,482		$ 306,482
42	Arizona Taxable Income (L39 - L40 - L41)	$ 424,056		$ 3,448,649
43	Arizona State Income Tax Rate	6.9680%		6.9680%
44	Arizona Income Tax (L42 x L43)	$ 29,548		$ 240,302
45	Federal Taxable Income (L42 - L44)	$ 394,508		$ 3,208,347
46	Federal Tax on First Income Bracket ($1 - $50,000) @ 15%	$ 7,500		$ 7,500
47	Federal Tax on Second Income Bracket ($51,001 - $75,000) @ 25%	$ 6,250		$ 6,250
48	Federal Tax on Third Income Bracket ($75,001 - $100,000) @ 34%	$ 8,500		$ 8,500
49	Federal Tax on Fourth Income Bracket ($100,001 - $335,000) @ 39%	$ 91,650		$ 91,650
50	Federal Tax on Fifth Income Bracket ($335,001 -$10,000,000) @ 34%	$ 20,233		$ 976,938
51	Total Federal Income Tax	$ 134,133		$ 1,090,838
52	Combined Federal and State Income Tax (L44 + L51)	$ 163,681		$ 1,331,140
53	Applicable Federal Income Tax Rate [Col. [E], L51 - Col. [B], L51] / [Col. [E], L45 - Col. [B], L45]			34.0000%

LINE NO.	DESCRIPTION	(A)
	Calculation of Interest Synchronization:	
54	Rate Base (Schedule JMM-3)	$ 27,861,961
55	Weighted Average Cost of Debt (Schedule JMM-WW19)	1.1000%
56	Synchronized Interest (L45 X L46)	$ 306,482

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Surrebuttal Schedule JMM-WW3

RATE BASE - ORIGINAL COST

LINE NO.		(A) COMPANY AS FILED	(B) STAFF ADJUSTMENTS	Adj. No.	(C) STAFF AS ADJUSTED
1	Plant in Service	$ 60,394,260	$ (576,104)	1,2,3	$ 59,818,156
2	Less: Accumulated Depreciation	8,475,991	(565,526)	4	7,910,465
3	Net Plant in Service	$ 51,918,269	$ (10,578)		$ 51,907,691
	LESS:				
4	Contributions in Aid of Construction (CIAC)	$ 18,737,132	$ (94,346)	1	$ 18,642,786
5	Less: Accumulated Amortization	2,072,117	-		$ 2,072,117
6	Net CIAC	16,665,015	(94,346)		$ 16,570,669
7	Advances in Aid of Construction (AIAC)	7,006,208	(16,649)	1	6,989,559
8	Customer Deposits	68,685	81,798	5	150,483
9	Deferred Income Tax Credits	15,987	319,033	6	335,020
	ADD:				
9	Unamortized Debt Issuance Costs	134,528	(134,528)	7	-
10	Cash Working Capital	-	-		-
11	**Original Cost Rate Base**	$ 28,296,903	$ (434,942)		$ 27,861,961

References:
Column [A]: Company as Filed
Column [B]: Schedule JMM-WW4
Column (C): Column (A) + Column (B)

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SUMMARY OF ORIGINAL COST RATE BASE ADJUSTMENTS

LINE NO.	ACCT. NO.	DESCRIPTION	[A] COMPANY AS FILED	[B] ADJ #1 Plant Not Used and Useful Ref: Sch JMM-WW5	[C] ADJ #2 Transfer of Plant Ref: Sch JMM-WW6	[D] ADJ #3 Company Rebuttal Adjustments to Plant Ref: Sch JMM-WW7	[E] ADJ #4 Accumulated Depreciation Ref: Sch JMM-WW8	[F] ADJ #5 Customer Deposits Ref: Sch JMM-WW9	[G] ADJ #6 Deferred Taxes Ref: Sch JMM-WW10	[H] ADJ #7 Unamortized Debt Issuance Costs Ref: Sch JMM-WW11	[I] STAFF ADJUSTED
1		PLANT IN SERVICE:									
2	351	Organization	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
3	352	Franchises	-	-	-	-	-	-	-	-	-
4	353	Land and Land Rights	1,783,426	-	-	-	-	-	-	-	1,783,426
5	354	Structures and Improvements	19,319,421	(388,834)	-	3,725	-	-	-	-	18,934,312
6	355	Power Generation Equipment	543,670	-	-	5,004	-	-	-	-	548,674
7	360	Collection Services - Force	1,161,105	-	-	-	-	-	-	-	1,161,105
8	361	Collection Services - Gravity	23,113,391	(18,730)	-	-	-	-	-	-	23,094,661
9	362	Special Collecting Structures	-	-	-	-	-	-	-	-	-
10	363	Services to Customers	-	-	-	-	-	-	-	-	-
11	364	Flow Measuring Devices	47,019	-	-	-	-	-	-	-	47,019
12	365	Flow Measuring Installations	-	-	-	-	-	-	-	-	-
13	366	Reuse Services	3,789,468	-	-	-	-	-			3,789,468
14	367	Reuse Meters and Installations	52,331	-	-	-	-	-			52,331
15	370	Receiving Wells	860,393	-	-	-	-	-	-	-	860,393
16	371	Effluent Pumping Equipment	1,858,411	(103,992)	-	6,394	-	-	-	-	1,760,813
17	374	Reuse Trans. And Dist. System	62,825	-	-	-	-	-			62,825
18	375	Resuse T&D	414,315	-	-	-	-	-			414,315
19	380	Treatment and Disposal Equipment	5,469,478	-	(38,250)	-	-	-	-	-	5,431,228
20	381	Plant Sewers	47,788	-	-	-	-	-	-	-	47,788
21	382	Outfall Sewer Lines	343,681	-	-	-	-	-	-	-	343,681
22	389	Other Plant & Misc. Equipment	644,609	(43,421)	-	2,000	-	-	-	-	603,188
23	390	Office Furniture & Equipment	198,772	-	-	-	-	-	-	-	198,772
24	391	Transportation Equipment	26,078	-	-	-	-	-	-	-	26,078
25	392	Stores Equipment	8,968	-	-	-	-	-			8,968
26	393	Tools, Shop & Garage Equipment	56,167	-	-	-	-	-	-	-	56,167
27	394	Labratory Equipment	173,948	-	-	-	-	-	-	-	173,948
28	395	Power Operated Equipment	-	-	-	-	-	-	-	-	-
29	396	Communication Equipment	418,996	-	-	-	-	-	-	-	418,996
30	398	Other Tangible Plant	-	-	-	-	-	-	-	-	-
31			-	-	-	-	-	-	-	-	-
32											
33		Total Plant in Service	$ 60,394,260	$ (554,977)	$ (38,250)	$ 17,123	$ -	$ -	$ -	$ -	$ 59,818,156
34		Less: Accumulated Depreciation	8,475,991	-	(11,040)	-	(554,486)	-	-	-	7,910,465
35			-	-	-	-	-	-	-	-	-
36		Net Plant in Service (L59 - L 60)	$ 51,918,269	$ (554,977)	$ (27,210)	$ 17,123	$ 554,486	$ -	$ -	$ -	$ 51,907,691
37											
38		LESS:									
39		Contributions in Aid of Construction (CIAC)	$ 18,737,132	$ (94,346)	$ -	$ -	$ -	$ -	$ -	$ -	$ 18,642,786
40		Less: Accumulated Amortization	2,072,117	-	-	-	-	-	-	-	2,072,117
41		Net CIAC (L25 - L26)	16,665,015	(94,346)	-	-	-	-	-	-	16,570,669
42		Advances in Aid of Construction (AIAC)	7,006,208	(16,649)	-	-	-	-	-	-	6,989,559
43		Customer Deposits	68,685	-	-	-	-	81,798	-	-	150,483
44		Deferred Income Taxes	15,987	-	-	-	-	-	319,033	-	335,020
45			-	-	-	-	-	-			-
46											
47		ADD:									
48		Unamortized Debt Issuance Costs	134,528	-	-	-	-	-	-	(134,528)	-
49		Cash Working Capital	-	-	-	-	-	-	-		-
50											
51		Original Cost Rate Base	$ 28,296,903	$ (443,982)	$ (27,210)	$ 17,123	$ 554,486	$ (81,798)	$ (319,033)	$ (134,528)	$ 27,861,961

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Surrebuttal Schedule JMM-WW5

RATE BASE ADJUSTMENT NO. 1 - PLANT NOT USED AND USEFUL

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	354	Structures & Improvements	$ 19,319,421	$ (388,834)	$ 18,930,587
2	361	Collection Sewer - Gravity	23,113,391	(18,730)	23,094,661
3	371	Pumping Equipment	1,858,411	(103,992)	1,754,419
4	389	Other Plant & Miscellaneous Equipment	644,609	(43,421)	601,188
5			$ 44,935,832	$ (554,977)	$ 44,380,855
6					
7		Based on Staff Engineering Report Table G-1.			
8					

LINE NO.	DESCRIPTION	[A] COMPANY AIAC & CIAC AS FILED	[B] STAFF ADJUSTMENTS	[C] STAFF AS ADJUSTED
9				
10				
11				
12				
13	Advances in Aid of Construction (AIAC)	$ 7,006,208	$ (16,649)	$ 6,989,559
14				
15	Contributions in Aid of Construction (CIAC)	$ 18,737,132	$ (94,346)	$ 18,642,786

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Surrebuttal Schedule JMM-WW6

RATE BASE ADJUSTMENT NO. 2 - TRANSFER OF PLANT

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Plant in Service	$ 59,839,283	$ (38,250)	$ 59,801,033
2					

LINE NO.	DESCRIPTION	[A] COMPANY AIAC & CIAC AS FILED	[B] STAFF ADJUSTMENTS	[C] STAFF AS ADJUSTED
3				
4				
5				
6				
7	Accumulated Depreciation	$ 8,475,991	$ (11,040)	$ 8,464,951
8				
9				

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Surrebuttal Schedule JMM-WW7

RATE BASE ADJUSTMENT NO. 3 - COMPANY ADJUSTMENTS TO PLANT THAT STAFF ACCEPTS

			[A]	[B]	[C]
LINE NO.	ACCT NO.	DESCRIPTION	COMPANY AS FILED	STAFF ADJUSTMENTS	STAFF AS ADJUSTED
1	354	Structures and Improvements	$ 19,319,421	$ 3,725	$ 19,323,146
2	355	Power Generation Equipment	543,670	5,004	548,674
3	371	Pumping Equipment	1,858,411	6,394	1,864,805
4	389	Other Plant & Misc. Equipment	644,609	2,000	646,609
			$ 22,366,111	$ 17,123	$ 22,383,234

354	Dean Fence and Gate	$ 3,725
355	Loftin Equipment Co.	$ 5,004
371	Precision Electric	$ 1,530
371	Precision Electric	4,864
		$ 6,394
389	Keogh Engineering	$ 1,450
389	Keogh Engineering	550
		$ 2,000

References:
Column [A]: Company Filing
Column [B]: Surrebuttal Testimony JMM
Column [C]: Column [A] + Column [B]

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Surrebuttal Schedule JMM-WW8

RATE BASE ADJUSTMENT NO. 4 - ACCUMULATED DEPRECIATION

LINE NO.	DESCRIPTION		[A] COMPANY AS FILED	[B] STAFF ADJUSTMENTS	[C] STAFF AS ADJUSTED
1	Accumulated Depreciation		$ 8,464,843	$ (554,486)	$ 8,282,147
	A/D Plant Retirements				
	354	Structures and improvements	$ (388,834)		
	361	Collection Sewer - Gravity	(18,730)		
	371	Pumping Equipment	(103,992)		
	339	Other Plant and Miscellaneous Equipment	(43,421)		
			$ (554,977)		
	A/D on Capitalized Plant				
	354	Structures and Improvements	$ 47		
	355	Power Generation	94		
	371	Pumping Equipment	300		
	389	Other Sewer Plant and Equipment	50		
			$ 491		

References:
Column [A]: Company Filing
Column [B]: Surrebuttal Testimony JMM
Column [C]: Column [A] + Column [B]

RATE BASE ADJUSTMENT NO. 5 - CUSTOMER DEPOSITS

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Customer Deposits	$ 68,685	$ 81,798	$ 150,483
2					
3	Staff Calculation:				
4	8600-2-0000-20-2113-0000 Customer Deposits		73,568		
5	8600-2-0000-20-2112-0002 Customer Security Deposits		8,230		
			$ 81,798		

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Surrebuttal Schedule JMM-WW10

RATE BASE ADJUSTMENT NO. 6 - DEFERRED INCOME TAXES

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Deferred Income Taxes	$ 15,987	$ 319,033	$ 335,020

To reverse the Company's pro-forma adjustment.

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Surrebuttal Schedule JMM-WW11

RATE BASE ADJUSTMENT NO. 7 - UNAMORTIZED DEBT ISSUANCE COSTS

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Unamortized Debt Issuance Costs	$ 134,528	$ (134,528)	$ -

To Remove Unamortized Debt Issuance Costs.

REFERENCES:
Column [A]: Company Filing
Column [B]: Direct Testimony JMM
Column [C]: Column [A] + Column [B]

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Surrebuttal Schedule JMM-WW12

OPERATING INCOME STATEMENT - ADJUSTED TEST YEAR AND STAFF RECOMMENDED

LINE NO.	DESCRIPTION	[A] COMPANY ADJUSTED TEST YEAR AS FILED	[B] STAFF TEST YEAR ADJUSTMENTS	Adj. No.	[C] STAFF TEST YEAR AS ADJUSTED	[D] STAFF PROPOSED CHANGES	[E] STAFF RECOMMENDED
1	*REVENUES:*						
2	Flat Rate Revenues	$ 6,164,589	$ -		$ 6,164,589	$ 3,042,251	$ 9,206,840
3	Measured Revenues	92,030	-		92,030	-	92,030
4	Other Wastwater Revenues	99,755	-		99,755	-	99,755
5	Intentionally Left Blank	-	-		-	-	-
6	**Total Operating Revenues**	$ 6,356,374	$ -		$ 6,356,374	$ 3,042,251	$ 9,398,625
7							
8	*OPERATING EXPENSES:*						
9	Salaries and Wages	$ -	$ -		$ -	$ -	$ -
10	Purchased Wastewater Treatment	1,205	-		1,205	-	1,205
11	Sludge Removal Expense	267,554	-		267,554	-	267,554
12	Purchased Power	632,064	-		632,064	-	632,064
13	Fuel for Power Production	2,076	-		2,076	-	2,076
14	Chemicals	279,749	-		279,749	-	279,749
15	Materials & Supplies	75,579	(5,975)	1	69,604	-	69,604
16	Contractural Services, Legal&Engr	24,084	-		24,084	-	24,084
17	Contractural Sevices - Other	2,719,118	(355,594)	2	2,363,524	-	2,363,524
18	Contractural Services - Testing	33,348	-		33,348	-	33,348
19	Equipment Rental	78,309	-		78,309	-	78,309
20	Rents - Building	18,976	-		18,976	-	18,976
21	Transportation	69,551	-		69,551	-	69,551
22	General Liability Insurance	32,133	-		32,133	-	32,133
23	Insurance - Other	2,213	-		2,213	-	2,213
24	Reg Commission Expense	19,133	(1,136)	3	17,997	-	17,997
25	Reg Commission Expense - Rate Case	70,000	(28,000)	3	42,000	-	42,000
26	Miscellaneous Expense	36,656	(494)	4	36,162	-	36,162
27	Bad Debt Expense	43,889	(21,791)	5	22,098	-	22,098
28	Intentionally Left Blank	-	-		-	-	-
29	Depreciation	1,550,237	(27,936)	6	1,522,301	-	1,522,301
30	Taxes other than Income	-	-		-	-	-
31	Property Taxes	336,629	(225,740)	7	110,889	17,658	128,547
32	Income Taxes	(99,906)	263,587	8	163,681	1,167,459	1,331,140
33	Intentionally Left Blank	-	-		-	-	-
34	**Total Operating Expenses**	$ 6,192,596	$ (403,080)		$ 5,789,517	$ 1,185,117	$ 6,974,634
35	**Operating Income (Loss)**	$ 163,778	$ 403,080		$ 566,857	$ 1,857,134	$ 2,423,991

References:
Column (A): Company Schedule C-1
Column (B): Schedule JMM-WW13
Column (C): Column (A) + Column (B)
Column (D): Schedules JMM-WW20 and JMM-WW21, JMM - WW 1
Column (E): Column (C) + Column (D)

Litchfield Park Service Company - Wastewater Division
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Surrebuttal Schedule JMM-WW13

SUMMARY OF OPERATING INCOME STATEMENT ADJUSTMENTS - TEST YEAR

LINE NO.	DESCRIPTION	[A] COMPANY AS FILED	[B] Materials and Supplies Expense ADJ #1	[C] Outside Service Expense ADJ #2	[D] Rate Case Expense ADJ #3	[E] Meals and Ent. Expense ADJ #4	[F] Bad Debt Expense ADJ #5	[G] Depreciation Expense ADJ #6	[H] Property Tax Expense ADJ #7	[I] Income Tax Expense ADJ #8	[J] STAFF ADJUSTED
			Ref: Sch JMM-WW14	Ref: Sch JMM-WW15	Ref: Sch JMM-WW16	Ref: Sch JMM-WW17	Ref: Sch JMM-WW18	Ref: Sch JMM-WW19	Ref: Sch JMM-WW20	Ref: Sch JMM-WW21	
1	*REVENUES:*										
2	Flat Rate Revenues	$ 6,164,589	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,164,589
3	Measured Revenues	92,030	-	-	-	-	-	-	-	-	92,030
4	Other Wastwater Revenues	99,755	-	-	-	-	-	-	-	-	99,755
5	Intentionally Left Blank	-	-	-	-	-	-	-	-	-	-
6	**Total Operating Revenues**	$ 6,356,374	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,356,374
7											
8	*OPERATING EXPENSES:*										
9	Salaries and Wages	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
10	Purchased Wastewater Trmnt	1,205	-	-	-	-	-	-	-	-	1,205
11	Sludge Removal Expense	267,554	-	-	-	-	-	-	-	-	267,554
12	Purchased Power	632,064	-	-	-	-	-	-	-	-	632,064
13	Fuel for Power Production	2,076	-	-	-	-	-	-	-	-	2,076
14	Chemicals	279,749	-	-	-	-	-	-	-	-	279,749
15	Materials & Supplies	75,579	(5,975)	-	-	-	-	-	-	-	69,604
16	Contractural Services, Legal&Engr	24,084	-	-	-	-	-	-	-	-	24,084
17	Contractural Sevices - Other	2,719,118	-	(355,594)	-	-	-	-	-	-	2,363,524
18	Contractural Services - Testing	33,348	-	-	-	-	-	-	-	-	33,348
19	Equipment Rental	78,309	-	-	-	-	-	-	-	-	78,309
20	Rents - Building	18,976	-	-	-	-	-	-	-	-	18,976
21	Transportation	69,551	-	-	-	-	-	-	-	-	69,551
22	General Liability Insurance	32,133	-	-	-	-	-	-	-	-	32,133
23	Insurance - Other	2,213	-	-	-	-	-	-	-	-	2,213
24	Reg Commission Expense	19,133	-	-	(1,136)	-	-	-	-	-	17,997
25	Reg Commission Expense - Rate Case	70,000	-	-	(28,000)	-	-	-	-	-	42,000
26	Miscellaneous Expense	36,656	-	-	-	(494)	-	-	-	-	36,162
27	Bad Debt Expense	43,889	-	-	-	-	(21,791)	-	-	-	22,098
28	Intentionally Left Blank	-	-	-	-	-	-	-	-	-	-
29	Depreciation	1,550,237	-	-	-	-	-	(27,936)	-	-	1,522,301
30	Taxes other than Income	-	-	-	-	-	-	-	-	-	-
31	Property Taxes	336,629	-	-	-	-	-	-	(225,740)	-	110,889
32	Income Taxes	(99,906)	-	-	-	-	-	-	-	263,587	163,681
33	Intentionally Left Blank	-	-	-	-	-	-	-	-	-	-
34	**Total Operating Expenses**	$ 6,192,596	$ (5,975)	$ (355,594)	$ (29,136)	$ (494)	$ (21,791)	$ (27,936)	$ (225,740)	$ 263,587	$ 5,789,517
35	**Operating Income (Loss)**	$ 163,778	$ 5,975	$ 355,594	$ 29,136	$ 494	$ 21,791	$ 27,936	$ 225,740	$ (263,587)	$ 566,857

Litchfield Park Service Company - Wastewater Division
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Surrebuttal Schedule JMM-WW14

OPERATING INCOME ADJUSTMENT NO. 1 - MATERIALS AND SUPPLIES

LINE NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	Materials and Supplies	$ 75,579	$ (5,975)	$ 69,604

References:
Column (A), Company Schedule C-1
Column (B): Testimony JMM
Column (C): Column (A) + Column (B)

OPERATING INCOME ADJUSTMENT NO. 2 - OUTSIDE SERVICE EXPENSE

DESCRIPTION	[A] COMPANY AS FILED	[B] STAFF ADJUSTMENTS (Col C - Col A)	[C] STAFF AS ADJUSTED
Contractural Services - Other	$ 2,451,656	$ (88,929)	$ 2,362,727
Corporate Expense Allocation	267,462	(266,665)	797
Total Contractural Services - Other	$ 2,719,118	$ (355,594)	$ 2,363,524

Expenses Company has agreed to reduce in its rebuttal testimony:	
Contractual Service Aerotek	$ 42,200
Remove Capitalized Expenses	17,124
Remove Unnecessary Expenses	3,128
	62,452
Staff adjustment:	
Remove Bonuses	26,477
	$ 88,929

COSTS TO BE ALLOCATED TO LPSCO

[D] [E] Description	[F] Amount	[G] Unallowable Costs (Sch JMM-6, P2)	[H] Direct Costs of Unregulated Affiliate(s)	[I] Allowable Common Costs Allocated to All 71 Companies	[J] Allocation[5] %	[K] Costs to be Allocated to LPSCO (Col I x Col J)
Rent	$ 430,739	$ -	$ (430,739)	$ -	1.41%	$ -
Audit[1]	$ 507,000	$ -	$ (456,300)	$ 50,700	1.41%	$ 714.08
Tax Services[2]	$ 265,000	$ -	$ (238,500)	$ 26,500	1.41%	$ 373.24
Legal-General[3]	$ 300,000	$ -	$ (284,400)	$ 15,600	1.41%	$ 219.72
Other Professional Services	$ 455,000	$ -	$ (455,000)	$ -	1.41%	$ -
Management Fee	$ 636,619	$ -	$ (636,619)	$ -	1.41%	$ -
Unit Holder Communications	$ 314,100	$ -	$ (314,100)	$ -	1.41%	$ -
Trustee Fees	$ 204,000	$ -	$ (204,000)	$ -	1.41%	$ -
Office Costs	$ 254,100	$ (46,186)	$ (207,914)	$ -	1.41%	$ -
Licenses/Fees and Permits	$ 305,000	$ (145,642)	$ (159,358)	$ -	1.41%	$ -
Escrow and Transfer Fees	$ 75,000	$ -	$ (75,000)	$ -	1.41%	$ -
Depreciation Expense[4]	$ 204,242	$ -	$ (183,818)	$ 20,424	1.41%	$ 287.66
	$ 3,950,800	$ (191,828)	$ (3,645,748)	$ 113,224		$ 1,594.71
					Water	$ 797.35
					Waste Water	$ 797.35
						$ 1,594.71

Foot Note 1: Audit - As the parent company's lenders require the APIF to have annual financial audits, Staff assigned the majority of the cost (i.e., 90 percent) to APIF and the remaining 10 percent to its 71 companies/interests.

Foot Note 2: Tax Services - Given the tax complexity of the APIF's many holdings and transactions, Staff assigned the majority of the cost (i.e., 90 percent) to APIF and the remaining 10 percent to its 71 companies/interests.

Foot Note 3: Legal, General - Staff reviewed the legal invoices and found that the very large majority of the legal invoices pertained to the APIF.

Foot Note 4: Depreciation Expense - Given that most of APIF's plant costs benefit primarily APIF, Staff assigned the majority of the cost (i.e., 90 percent) to APIF and the remaining 10 percent to its 71 companies/interests.

Foot Note 5: Allocation Percentage - Calculated as follows: 1 / 71 companies = 1.41%.

References:
Column A: Company Schedule
Column B: Testimony
Column C: Column [A] + Column [B]

LINE NO.	Category	Description of Unallowable Cost	Amount
1	**Category**	**Description of Unallowable Cost**	**Amount**
2	Office Fees and Expenses	Wind Analysis & Planning Software	$15,056
3	Office Fees and Expenses	Gold Watches and Clocks	$16,864
4	Office Fees and Expenses	Pilsner Beer Glasses	$5,700
5	Office Fees and Expenses	Leafs-Raptors Season Tickets	$5,066
6	Office Fees and Expenses	Super Bowl XLII Tickets	$3,500
7		**Subtotal for Office Expenses**	**$46,186**
8			
9	Licenses and Fees	Donation - Wind Project Develop	$25,000
10	Licenses and Fees	Donation - Water Project in Africa	$25,000
11	Licenses and Fees	Donation - Cancer Society	$13,350
12	Licenses and Fees	Donation - Multiple Myeloma	$5,000
13	Licenses and Fees	Wind Development	$7,887
14	Licenses and Fees	U.S. Trustee	$9,375
15	Licenses and Fees	St. Leon Wind Energy	$12,556
16	Licenses and Fees	Algonquin Power Fund Inc Taxes	$6,891
17	Licenses and Fees	Algonquin Power Fund Inc Taxes	$6,794
18	Licenses and Fees	Tax Ruling Request for KMS America & Subs	$10,000
19	Licenses and Fees	Algonquin Power Fund Inc Taxes	$23,789
20		**Subtotal for Licenses & Fees**	**$145,642**

Litchfield Park Service Company - Wastewater Division
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Surrebuttal Schedule JMM-WW16

OPERATING INCOME ADJUSTMENT NO. 3 - RATE CASE EXPENSE AND REGULATORY COMMISSION EXPEN[S]

		[A]	[B]	[C]
LINE NO.	DESCRIPTION	COMPANY PROPOSED	STAFF ADJUSTMENTS	STAFF RECOMMENDED
1	Rate Case Expense	$ 70,000	$ (28,000)	$ 42,000

Staff Calculation:

Estimated Rate Case Cost	$ 210,000
Normalized Over Five Years	5
	42,000

		[A]	[B]	[C]
LINE NO.	DESCRIPTION	COMPANY PROPOSED	STAFF ADJUSTMENTS	STAFF RECOMMENDED
1	Regulatory Commission Expense	$ 19,133	$ (1,136)	$ 17,997

References:
Column (A), Company Schedule C-1
Column (B): Direct and Surrebuttal Testimony JMM
Column (C): Column (A) + Column (B)

Litchfield Park Service Company - Wastewater Division
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Surrebuttal Schedule JMM-WW17

OPERATING INCOME ADJUSTMENT NO. 4 - MEALS AND ENTERTAINMENT

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1	775.00	Miscellaneous Expense	$ 36,656	$ (494)	$ 36,162

References:
Column (A), Company Schedule C-1
Column (B): Testimony JMM
Column (C): Column (A) + Column (B)

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Surrebuttal Schedule JMM-WW18

OPERATING INCOME ADJUSTMENT NO. 5 - BAD DEBT

LINE NO.	ACCT NO.	DESCRIPTION	[A] COMPANY PROPOSED	[B] STAFF ADJUSTMENTS	[C] STAFF RECOMMENDED
1		Bad Debt Expense	$ 43,889	$ (21,791)	$ 22,098

Staff Calculation:	
Test Year	$43,889
2007	19,632
2006	2,773
	$66,294
Normalized over 3 years	3
	$ 22,098

References:
Column (A), Company Schedule C-1
Column (B): Testimony JMM
Column (C): Column (A) + Column (B)

Litchfield Park Service Company - Wastewater Division
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Surrebuttal Schedule JMM-WW19

OPERATING INCOME ADJUSTMENT NO. 6 - DEPRECIATION EXPENSE ON TEST YEAR PLANT

LINE NO.	ACCT NO.	DESCRIPTION	[A] PLANT In SERVICE Per Staff	[B] NonDepreciable or Fully Depreciated PLANT	[C] DEPRECIABLE PLANT (Col A - Col B)	[D] DEPRECIATION RATE	[E] DEPRECIATION EXPENSE (Col C x Col D)
1	351	Organization	$ -	$ -	$ -	0.00%	$ -
2	352	Franchises	$ -	$ -	$ -	0.00%	$ -
3	353	Land and Land Rights	$ 1,783,426	$ 1,783,426	$ -	0.00%	$ -
4	354	Structures and Improvements	$ 18,934,312	$ -	$ 18,934,312	3.33%	$ 630,513
5	355	Power Generation Equipment	$ 548,674	$ -	$ 548,674	5.00%	$ 27,434
6	360	Collection Services - Force	$ 1,161,105	$ -	$ 1,161,105	2.00%	$ 23,222
7	361	Collection Services - Gravity	$ 23,094,661	$ -	$ 23,094,661	2.00%	$ 461,893
8	362	Special Collecting Structures	$ -	$ -	$ -	2.00%	$ -
9	363	Services to Customers	$ -	$ -	$ -	2.00%	$ -
10	364	Flow Measuring Devices	$ 47,019	$ -	$ 47,019	10.00%	$ 4,702
11	365	Flow Measuring Installations	$ -	$ -	$ -	10.00%	$ -
12	366	Reuse Services	$ 3,789,468	$ -	$ 3,789,468	2.00%	$ 75,789
13	367	Reuse Meters and Installations	$ 52,331	$ -	$ 52,331	8.33%	$ 4,359
14	370	Receiving Wells	$ 860,393	$ -	$ 860,393	3.33%	$ 28,651
15	371	Effluent Pumping Equipment	$ 1,760,813	$ -	$ 1,760,813	12.50%	$ 220,102
16	374	Reuse Trans. And Dist. System	$ 62,825	$ -	$ 62,825	2.50%	$ 1,571
17	375	Reuse T&D	$ 414,315	$ -	$ 414,315	2.50%	$ 10,358
18	380	Treatment and Disposal Equipment	$ 5,431,228	$ -	$ 5,431,228	5.00%	$ 271,561
19	381	Plant Sewers	$ 47,788	$ -	$ 47,788	5.00%	$ 2,389
20	382	Outfall Sewer Lines	$ 343,681	$ -	$ 343,681	3.33%	$ 11,445
21	389	Other Plant & Misc. Equipment	$ 603,188	$ -	$ 603,188	6.67%	$ 40,233
22	390	Office Furniture & Equipment	$ 198,772	$ -	$ 198,772	6.67%	$ 13,258
23	391	Transportation Equipment	$ 26,078	$ -	$ 26,078	20.00%	$ 5,216
24	392	Stores Equipment	$ 8,968	$ -	$ 8,968	4.00%	$ 359
25	393	Tools, Shop & Garage Equipment	$ 56,167	$ -	$ 56,167	5.00%	$ 2,808
26	394	Labratory Equipment	$ 173,948	$ -	$ 173,948	10.00%	$ 17,395
27	395	Power Operated Equipment	$ -	$ -	$ -	5.00%	$ -
28	396	Communication Equipment	$ 418,996	$ -	$ 418,996	10.00%	$ 41,900
29	398	Other Tangible Plant	$ -	$ -	$ -	10.00%	$ -
30		Total Plant	$ 59,818,156	$ 1,783,426	$ 58,034,730		$ 1,895,156
31							
32		Less: Amortization of Contributions					
33	361	Collection Sewers Gravity	$ 18,642,786			2.00%	$ (372,856)
39							
40		Total Depreciation Expense					$ 1,522,301
41							
42		Depreciation Expense - Company					$ 1,550,237
43							
44		Staff's Adjustment to Depreciation Expense					$ (27,936)

References:
Column [A]: Schedule JMM-WW4
Column [B]: From Column [A]
Column [C]: Column [A] - Column [B]
Column [D]: *Engineering Staff Report*
Column [E]: Column [C] x Column [D]

Litchfield Park Service Company - Wastewater Division
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Surrebuttal Schedule JMM-WW20

OPERATING INCOME ADJUSTMENT No. 7 - Property Tax Expense

LINE NO.	Property Tax Calculation	STAFF AS ADJUSTED	STAFF RECOMMENDED
1	Staff Adjusted Test Year Revenues	$ 6,356,374	$ 6,356,374
2	Weight Factor	2	2
3	Subtotal (Line 1 * Line 2)	12,712,748	$ 12,712,748
4	Staff Recommended Revenue, Per Schedule JMM-WW1	6,356,374	$ 9,398,625
5	Subtotal (Line 4 + Line 5)	19,069,122	22,111,373
6	Number of Years	3	3
7	Three Year Average (Line 5 / Line 6)	6,356,374	$ 7,370,458
8	Department of Revenue Mutilplier	2	2
9	Revenue Base Value (Line 7 * Line 8)	12,712,748	$ 14,740,915
10	Plus: 10% of CWIP -	39,301	39,301
11	Less: Net Book Value of Licensed Vehicles	15,573	$ 15,573
12	Full Cash Value (Line 9 + Line 10 - Line 11)	12,736,476	$ 14,764,643
13	Assessment Ratio	21.0%	21.0%
14	Assessment Value (Line 12 * Line 13)	2,674,660	$ 3,100,575
15	Composite Property Tax Rate (Per Company Schedule C-2)	4.1459%	4.1459%
16			
17	Staff Test Year Adjusted Property Tax (Line 14 * Line 15)	$ 110,889	
18	Company Proposed Property Tax	336,629	
19			
20	Staff Test Year Adjustment (Line 17-Line 18)	$ (225,740)	
21	Property Tax - Staff Recommended Revenue (Line 14 * Line 15)		$ 128,547
22	Staff Test Year Adjusted Property Tax Expense (Line 17)		$ 110,889
23	Increase in Property Tax Expense Due to Increase in Revenue Requirement		$ 17,658
24			
25	Increase to Property Tax Expense		$ 17,658
26	Increase in Revenue Requirement		3,042,251
27	Increase to Property Tax per Dollar Increase in Revenue (Line25/Line 26)		0.580426%

Litchfield Park Service Company - Wastewater Division
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Surrebuttal Schedule JMM-WW21

OPERATING INCOME ADJUSTMENT NO. 8 - TEST YEAR INCOME TAXES

LINE NO.	DESCRIPTION		
	Calculation of Income Tax:		Test Year
1	Revenue (Schedule CSB-11)	$	6,356,374
2	Operating Expenses Excluding Income Taxes	$	5,625,836
3	Synchronized Interest (L17)	$	306,482
4	Arizona Taxable Income (L1 - L2 - L3)	$	424,056
5	Arizona State Income Tax Rate		6.9680%
6	Arizona Income Tax (L4 x L5)	$	29,548
7	Federal Taxable Income (L4 - L6)	$	394,508
8	Federal Tax on First Income Bracket ($1 - $50,000) @ 15%	$	7,500
9	Federal Tax on Second Income Bracket ($51,001 - $75,000) @ 25%	$	6,250
10	Federal Tax on Third Income Bracket ($75,001 - $100,000) @ 34%	$	8,500
11	Federal Tax on Fourth Income Bracket ($100,001 - $335,000) @ 39%	$	91,650
12	Federal Tax on Fifth Income Bracket ($335,001 -$10,000,000) @ 34%	$	20,233
13	Total Federal Income Tax	$	134,133
14	Combined Federal and State Income Tax (L44 + L51)	$	163,681
15			
16			
17	*Calculation of Interest Synchronization:*		
18	Rate Base (Schedule JMM-WW4)	$	27,861,961
19	Weighted Average Cost of Debt		1.10%
20	Synchronized Interest (L16 x L17)	$	306,482
21			
22			
23	Income Tax - Per Staff	$	163,681
24	Income Tax - Per Company	$	(99,906)
25	**Staff Adjustment**	**$**	**263,587**

ACCOUNTING FOR PUBLIC UTILITIES

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1998

Current Through:
RELEASE NO. 15, OCTOBER 1998

MATTHEW BENDER

Louisiana Public Service Commission permitted Gulf States Utilities Company to include the unamortized cost of an abandoned nuclear project in its rate base. The Louisiana Commission based its decision on the fact that no evidence existed to show imprudence or negligence on the part of the utility in initiating the particular construction project.[29]

While rate base treatment may be denied, the question remains as to the proper method to eliminate the costs accumulated before the cancellation. Amortization to cost of service is usually allowed where the utility can demonstrate:

(1) The initial decision to develop the project was prudent and in the best interests of its customers.

(2) Factors that could not be initially foreseen have resulted in the necessity to cancel the project.

(3) The utility has taken appropriate steps both to cancel the project as soon as the course of action was found necessary and to minimize additional losses.

[e] Customer Deposits

Customer deposits generally represent funds received from ratepayers as security against potential losses arising from failure to pay for service. These funds are similar in nature to customer advances for construction (see § 4.04[7], above). Both represent a liability to repay the funds received either after a specified period or upon satisfaction of certain requirements. Like customer advances, the deposits are available to the utility for use in support of its rate base investment.

The alternative methods of treating customer deposits for ratemaking purposes also parallel treatment of customer advances. If no interest accrual is required on the funds, the deposits represent a cost-free source of capital commonly deducted from the rate base. If customer deposits are interest bearing, two options are available. The liability may be deducted from the rate base with the associated interest included as a component of cost of service, or the liability may be included in the capital structure for purposes of calculating the allowed rate of return (in which case there is no rate base reduction).

[f] Merchandising Property

As a general rule, merchandising property is excluded from the rate base, because it is not used and useful in rendering utility service. On rare occasions, however, commissions have made exceptions under the premise that appliance merchandising tends to promote the sale of utility services. In those cases where

[29] Re Gulf States Util Co, 40 PUR4th 593 (La 1980).

UNIFORM SYSTEM OF ACCOUNTS FOR CLASS A WATER UTILITIES

1996

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Price: $25.00

235. Customer Deposits

This account shall include all amounts deposited with the utility by customers as security for the payment of bills.

236. Accrued Taxes

A. This account shall be credited with the amount of taxes accrued during the accounting period with corresponding debits being made to the appropriate accounts for tax charges. Such credits may be based upon estimates, but from time to time during the year as the facts become known, the amount of the periodic credits shall be adjusted so as to include as nearly as can be determined in each year the taxes applicable thereto. Any amount representing a prepayment of taxes applicable to a period subsequent to the date of the balance sheet, shall be shown under account 162 - Prepayments.

B. If accruals for taxes are found to be insufficient or excessive, correction therefor shall be made through current tax accruals. However, if such corrections are so large as to seriously distort current expenses, see Accounting Instruction 8.

C. Accruals for taxes shall be based upon the net amounts payable after credit for any discounts, ~~but shall~~ not include any amounts for interest on tax deficiencies or refunds. Interest received on refund shall be credited to account 419 - Interest and Dividend Income, and interest paid on deficiencies shall be charged to account 427.5 - Interest Expense - Other.

D. The records supporting the entries to this account shall be kept so as to show for each class of taxes, the amount accrued, the basis for the accrual, the accounts to which charged, and the amount of tax paid.

E. The following subaccounts may be maintained:

236.1 Accrued Taxes, Utility Operating Income
- 236.11 Accrued Taxes, Taxes Other Than
- 236.12 Accrued Taxes, Income Taxes

236.2 Accrued Taxes, Other Income and Deductions

237. Accrued Interest

A. This account shall include the amount of interest accrued but not matured on all liabilities of the utility not including, however, interest which is added to the principal of the debt on which incurred. Supporting records shall be maintained so as to show the amount of interest accrued on each obligation.

ARIZONA CORPORATION COMMISSION
UTILITIES DIVISION

ANNUAL REPORT MAILING LABEL – MAKE CHANGES AS NECESSARY

L

W-01427A
Litchfield Park Service Company – Water
12725 W. Indian School Rd. Suite D101
Avondale, AZ 85392

RECEIVED
APR 2 0 2009

ANNUAL REPORT

FOR YEAR ENDING

12	31	2008

EXHIBIT
S-20
ADMITTED

FOR COMMISSION USE

ANN06	07

4-20-09

COMPANY INFORMATION

Company Name (Business Name) **Litchfield Park Service Company**

Mailing Address **12725 W. Indian School Rd. Suite D101**
(Street)

Avondale	**Arizona**	**85392**
(City)	(State)	(Zip)

(623) 935-9367	**(623) 935-1020**	
Telephone No. (Include Area Code)	Fax No. (Include Area Code)	Pager/Cell No. (Include Area Code)

Email Address

Local Office Mailing Address **12725 W. Indian School Rd. Suite D101**
(Street)

Avondale	**Arizona**	**85392**
(City)	(State)	(Zip)

(623) 935-9367	**(623) 935-1020**	
Local Office Telephone No. (Include Area Code)	Fax No. (Include Area Code)	Pager/Cell No. (Include Area Code)

Email Address

MANAGEMENT INFORMATION

Management Contact: **Greg Sorensen** **V.P.**
(Name) (Title)

12725 W. Indian School Rd., Suite D101	**Avondale**	**AZ**	**85392**
(Street)	(City)	(State)	(Zip)

(623) 298-3753	**(623) 935-1020**	
Telephone No. (Include Area Code)	Fax No. (Include Area Code)	Pager/Cell No. (Include Area Code)

Email Address

On Site Manager: **Bob Dodds** **General Manger**
(Name)

12725 W. Indian School Rd. Suite D101	**Avondale**	**Arizona**	**85392**
(Street)	(City)	(State)	(Zip)

(623) 935-9367	**(623) 935-1020**	
Telephone No. (Include Area Code)	Fax No. (Include Area Code)	Pager/Cell No. (Include Area Code)

Email Address

☒ **Please mark this box if the above address(es) have changed or are updated since the last filing.**

Statutory Agent: C T Corporation System
(Name)

3225 N Central Ave	Phoenix	AZ	85012
(Street)	(City)	(State)	(Zip)

(602) 277-4792		
Telephone No. (Include Area Code)	Fax No. (Include Area Code	Pager/Cell No. (Include Area Code)

Attorney: Richard Sallquist @ Sallquist & Drummond, P.C.
(Name)

4500 South Lake Shore Drive, Suite 339	Tempe,	AZ	85282
(Street)	(City)	(State)	(Zip)

(602) 224-9222	(480) 345-0412	
Telephone No. (Include Area Code)	Fax No. (Include Area Code)	Pager/Cell No. (Include Area Code)

☐ **Please mark this box if the above address(es) have changed or are updated since the last filing.**

OWNERSHIP INFORMATION

Check the following box that applies to your company:

- ☐ **Sole Proprietor (S)**
- ☒ **C Corporation (C) (Other than Association/Co-op)**
- ☐ **Partnership (P)**
- ☐ **Subchapter S Corporation (Z)**
- ☐ **Bankruptcy (B)**
- ☐ **Association/Co-op (A)**
- ☐ **Receivership (R)**
- ☐ **Limited Liability Company**
- ☐ **Other (Describe)**__________

COUNTIES SERVED

Check the box below for the county/ies in which you are certificated to provide service:

☐ APACHE	☐ COCHISE	☐ COCONINO
☐ GILA	☐ GRAHAM	☐ GREENLEE
☐ LA PAZ	☒ MARICOPA	☐ MOHAVE
☐ NAVAJO	☐ PIMA	☐ PINAL
☐ SANTA CRUZ	☐ YAVAPAI	☐ YUMA
☐ STATEWIDE		

COMPANY NAME
Litchfield Park Service Company (Water)

UTILITY PLANT IN SERVICE

Acct. No.	DESCRIPTION	Original Cost (OC)	Accumulated Depreciation (AD)	O.C.L.D. (OC less AD)
301	Organization			
302	Franchises			
303	Land and Land Rights	916,693		916,693
304	Structures and Improvements	23,887,647	346,950	23,540,697
307	Wells and Springs	2,392,741	646,067	1,746,673
311	Pumping Equipment	968,534	608,034	360,501
320	Water Treatment Equipment	1,313,499	248,794	1,064,705
330	Distribution Reservoirs and Standpipes	435,705	94,687	341,017
331	Transmission and Distribution Mains	29,653,374	3,695,045	25,958,329
333	Services	4,426,063	917,649	3,508,414
334	Meters and Meter Installations	4,145,435	1,852,498	2,292,936
335	Hydrants	2,147,484	356,501	1,790,983
336	Backflow Prevention Devices	38,387	8,397	29,991
339	Other Plant and Misc. Equipment	469,693	91,829	377,865
340	Office Furniture and Equipment	552,157	126,547	425,611
341	Transportation Equipment	177,165	67,296	109,869
343	Tools, Shop and Garage Equipment	55,062	7,957	47,105
344	Laboratory Equipment			
345	Power Operated Equipment			
346	Communication Equipment	123,801	23,763	100,038
347	Miscellaneous Equipment			
348	Other Tangible Plant			
				0
	TOTALS	71,703,441	9,092,015	62,611,426

This amount goes on the Balance Sheet Acct. No. 108

COMPANY NAME
Litchfield Park Service Company (Water)

CALCULATION OF DEPRECIATION EXPENSE FOR CURRENT YEAR

Acct. No.	DESCRIPTION	Original Cost (1)	Depreciation Percentage (2)	Depreciation Expense (1x2)
301	Organization			0
302	Franchises			0
303	Land and Land Rights	916,693		0
304	Structures and Improvements	23,887,647		245,965
307	Wells and Springs	2,392,741		74,683
311	Pumping Equipment	968,534		110,948
320	Water Treatment Equipment	1,313,499		63,227
330	Distribution Reservoirs and Standpipes	435,705		9,186
331	Transmission and Distribution Mains	29,653,374		568,925
333	Services	4,426,063		133,409
334	Meters and Meter Installations	4,145,435		337,383
335	Hydrants	2,147,484		41,446
336	Backflow Prevention Devices	38,387		2,423
339	Other Plant and Misc. Equipment	469,693		24,913
340	Office Furniture and Equipment	552,157		27,837
341	Transportation Equipment	177,165		18,358
343	Tools, Shop and Garage Equipment	55,062		2,291
344	Laboratory Equipment			0
345	Power Operated Equipment			0
346	Communication Equipment	123,801		6,197
347	Miscellaneous Equipment			0
348	Other Tangible Plant			0
	Less: CIAC Amortization			(100,887)
	TOTALS	71,703,441		1,566,305

This amount goes on Comparative Statement of Income and Expense Acct. No. 403.

Half-year convention used on asset additions.

COMPANY NAME
Litchfield Park Service Company (Water)

BALANCE SHEET

Acct. No.	ASSETS	BALANCE AT BEGINNING OF YEAR	BALANCE AT END OF YEAR
	CURRENT AND ACCRUED ASSETS		
131	Cash	$ 705,743	$ 914,359
134	Working Funds		
135	Temporary Cash Investments		
141	Customer Accounts Receivable	410,661	380,068
146	Notes/Receivables from Associated Companies		
151	Plant Material and Supplies		
162	Prepayments	371,372	375,234
174	Miscellaneous Current and Accrued Assets	214,176	215,004
	TOTAL CURRENT AND ACCRUED ASSETS	**$ 1,701,953**	**$ 1,884,665**
	FIXED ASSETS		
101	Utility Plant in Service	$ 42,834,115	$ 71,703,441
103	Property Held for Future Use		
105	Construction Work in Progress	9,017,342	2,624,365
108	Accumulated Depreciation - Utility Plant	7,424,822	9,092,015
121	Non-Utility Property		
122	Accumulated Depreciation - Non Utility		
	TOTAL FIXED ASSETS	$ 44,426,635	$ 65,235,791
	TOTAL ASSETS	**$ 46,128,587**	**$ 67,120,456**

NOTE: The Assets on this page should be equal to Total Liabilities and Capital on the following page.

COMPANY NAME
Litchfield Park Service Company (Water)

BALANCE SHEET (CONTINUED)

Acct. No.	LIABILITIES	BALANCE AT BEGINNING OF YEAR	BALANCE AT END OF YEAR
	CURRENT LIABILITES		
231	Accounts Payable	$ 195,606	$ 88,605
232	Notes Payable (Current Portion)	115,000	120,000
234	Notes/Accounts Payable to Associated Companies	498,264	(584,042)
235	Customer Deposits	188,385	181,581
236	Accrued Taxes	145,115	150,802
237	Accrued Interest	84,406	91,687
241	Miscellaneous Current and Accrued Liabilities	390,995	798,335
	TOTAL CURRENT LIABILITIES	$ 1,617,770	$ 846,969
	LONG-TERM DEBT (Over 12 Months)		
224	Long-Term Notes and Bonds	$ 5,634,650	$ 5,520,098
	DEFERRED CREDITS		
251	Unamortized Premium on Debt		
252	Advances in Aid of Construction	22,782,182	27,835,376
255	Accumulated Deferred Investment Tax Credits		
271	Contributions in Aid of Construction	10,192,337	11,343,809
272	Less: Amortization of Contributions	1,320,180	1,536,654
281	Accumulated Deferred Income Tax	335,487	335,487
	TOTAL DEFERRED CREDITS	$ 31,989,826	$ 37,978,018
	TOTAL LIABILITIES	$ 39,242,247	$ 44,345,085
	CAPITAL ACCOUNTS		
201	Common Stock Issued	$ 759,326	$ 759,326
211	Paid in Capital in Excess of Par Value	10,784,090	22,125,982
215	Retained Earnings	(4,657,076)	(109,938)
218	Proprietary Capital (Sole Props and Partnerships)		
	TOTAL CAPITAL	$ 6,886,341	$ 22,775,370
	TOTAL LIABILITIES AND CAPITAL	**$ 46,128,587**	**$ 67,120,455**

COMPANY NAME

Litchfield Park Service Company (Water)

COMPARATIVE STATEMENT OF INCOME AND EXPENSE

Acct. No.	OPERATING REVENUES	PRIOR YEAR	CURRENT YEAR
461	Metered Water Revenue	$ 6,530,082	$ 6,753,869
460	Unmetered Water Revenue		
474	Other Water Revenues	140,415	151,084
	TOTAL REVENUES	$ 6,670,497	$ 6,904,953
	OPERATING EXPENSES		
601	Salaries and Wages		
610	Purchased Water	6,793	2,153
615	Purchased Power	885,281	883,165
618	Chemicals	162,833	402,707
620	Repairs and Maintenance	48,188	41,302
621	Office Supplies and Expense		
630	Outside Services	2,224,698	3,010,083
635	Water Testing	65,107	40,668
641	Rents	15,910	13,244
650	Transportation Expenses	78,786	144,371
657	Insurance - General Liability	118,216	84,815
659	Insurance - Health and Life		
666	Regulatory Commission Expense - Rate Case		
675	Miscellaneous Expense	134,226	152,736
403	Depreciation Expense	1,140,179	1,566,305
408	Taxes Other Than Income		
408.11	Property Taxes	149,292	104,798
409	Income Tax	806,532	806,532
	TOTAL OPERATING EXPENSES	$ 5,836,040	$ 7,252,879
	OTHER INCOME/EXPENSE		
419	Interest and Dividend Income	$ 7,788	$ 45,732
421	Non-Utility Income		
426	Miscellaneous Non-Utility Expenses		
427	Interest Expense	382,308	376,614
	TOTAL OTHER INCOME/EXP	$ (374,520)	$ (330,883)
	NET INCOME/(LOSS)	$ 459,936	$ (678,809)

Litchfield Park Service Company

Arsenic results on all systems

Well	Results
TW1A	16 PPB
TW2	19 PPB
TW4	2 PPB
TW5	5 PPB
TW6	20 PPB
9AL	40 PPB
5AL	45 PPB
4AL-FUTURE	14 PPB
20B	18 PPB

COMPANY NAME	Litchfield Park Service Company

SUPPLEMENTAL FINANCIAL DATA
Long-Term Debt

	LOAN #1	LOAN #2	LOAN #3	LOAN #4
Date Issued	04/01/1999	06/01/2001		
Source of Loan	IDA	IDA		
ACC Decision No.	61655	63775		
Reason for Loan	Capital Expansion	Capital Expansion		
Dollar Amount Issued	$5,335,000	$7,500,000	$	$
Amount Outstanding	$4,180,000	$7,290,000	$	$
Date of Maturity	10/01/2023	10/01/2031		
Interest Rate	5.88%	6.70%	%	%
Current Year Interest	$256,782	$490,664	$	$
Current Year Principle	$170,000	$60,000	$	$

Meter Deposit Balance at Test Year End $1,910,906

Meter Deposits Refunded During the Test Year $448,791

COMPANY NAME	Litchfield Park Service Company

WATER COMPANY PLANT DESCRIPTION

WELLS

ADWR ID Number*	Pump Horsepower	Pump Yield (gpm)	Casing Depth (Feet)	Casing Diameter (Inches)	Meter Size (inches)	Year Drilled
55-611687	150	1000	700	14	8	
55-611724	250	1200	800	16	12	
55-214539	150	700	700	16	12	2007
55-583454	200	700	740	16"	12"	2001
55-611680	75	550	503	12"	12"	1961
55-611678	150	1200	685	16"	12"	1966
55-611677	150	1100	850	16"	12"	1972
55-533836	200	1200	650	16"	12"	1992
55-611727	300	1350	810	16"	12"	1965
55-611729	350	1350	997	20"	12"	1960
55-611726	350	1350		20"	12"	1962
55-611717	200	1400	1100	20"	12"	1962

* Arizona Department of Water Resources Identification Number

OTHER WATER SOURCES

Name or Description	Capacity (gpm)	Gallons Purchased or Obtained (in thousands)
N/A		

BOOSTER PUMPS		FIRE HYDRANTS	
Horsepower	Quantity	Quantity Standard	Quantity Other
100 HP	1	3385	
150 HP	1		
200 HP	3		
250 HP	4		

STORAGE TANKS		PRESSURE TANKS	
Capacity	Quantity	Capacity	Quantity
6.3 MGD	1	N/A	
4.3 MGD	1		

COMPANY NAME	Litchfield Park Service Company

WATER COMPANY PLANT DESCRIPTION (CONTINUED)

MAINS

Size (in inches)	Material	Length (in feet)
2	DIP	842
3	DIP	1,739
4	DIP	19,100
6	DIP	384,731
8	DIP	486,546
10	DIP	3,435
12	DIP	156,494
16	DIP	55,996
24	DIP	
30	DIP	5,290
36	DIP	255
42	DIP	325

CUSTOMER METERS

Size (in inches)	Quantity
5/8 X ¾	260
3/4	9207
1	5697
1 1/2	187
2"	612
3"	39
4"	19
8"	2
10"	1

For the following three items, list the utility owned assets in each category.

TREATMENT EQUIPMENT:
Water Treatment –Sodium Hypochloride Generation as dinfection Water Treatment –Arsenic removal systems located at well site 20B Town well reservoir and airline reservoir

STRUCTURES:
Booster Pump Building, Fence, Walls for Wells & Airline Reservoir Pump Buldings & Chlorine Injection Buldings

OTHER:
N/A

COMPANY NAME: Litchfield Park Service Company.	
Name of System	**ADEQ Public Water System Number (if applicable)**

WATER USE DATA SHEET BY MONTH FOR CALENDAR YEAR 2008

MONTH/YEAR	NUMBER OF CUSTOMERS	GALLONS SOLD (Thousands)	GALLONS PUMPED (Thousands)	GALLONS PURCHASED (Thousands)
JANUARY	15,904	178,466,800	218,433,711	
FEBRUARY	16,006	178,466,800	198,491,515	
MARCH	16,030	192,260,056	267,289,979	
APRIL	16,023	240,929,704	318,720,856	
MAY	16,122	333,751,116	375,011,086	
JUNE	16,167	336,720,300	412,108,640	
JULY	16,191	393,251,884	425,164,445	
AUGUST	16,273	401,310,576	429,761,099	
SEPTEMBER	15,925	387,571,220	368,879,866	
OCTOBER	16,404	318,691,980	379,542,439	
NOVEMBER	15,995	351,582,496	298,344,128	
DECEMBER	16,023	246,079,156	221,562,734	
	TOTALS →	3,559,082,088	3,913,310,498	

What is the level of arsenic for each well on your system? **See next page** **mg/l**
(If more than one well, please list each separately.)

If system has fire hydrants, what is the fire flow requirement? 1500 GPM for 2 hrs

If system has chlorination treatment, does this treatment system chlorinate continuously?
(X) Yes ( ) No

Is the Water Utility located in an ADWR Active Management Area (AMA)?
(X) Yes ( ) No

Does the Company have an ADWR Gallons Per Capita Per Day (GPCPD) requirement?
(X) Yes ( ) No

If yes, provide the GPCPD amount:____172 GPCPD

Note: If you are filing for more than one system, please provide separate data sheets for each system.

COMPANY NAME Litchfield Park Service Company **YEAR ENDING 12/31/2008**

PROPERTY TAXES

Amount of actual property taxes paid during Calendar Year 2008 was: $ **513,911**

Attach to this annual report proof (e.g. property tax bills stamped "paid in full" or copies of cancelled checks for property tax payments) of any and all property taxes paid during the calendar year.

If no property taxes paid, explain why.

VERIFICATION
AND
SWORN STATEMENT
Taxes

RECEIVED
2 8 2009
... Utilities

VERIFICATION

STATE OF ARIZONA	COUNTY OF (COUNTY NAME) MARICOPA
I, THE UNDERSIGNED	NAME (OWNER OR OFFICIAL) TITLE Greg Sorensen, V.P.
OF THE	COMPANY NAME Litchfield Park Service Company.

DO SAY THAT THIS ANNUAL UTILITY PROPERTY TAX AND SALES TAX REPORT TO THE ARIZONA CORPORATION COMMISSION

FOR THE YEAR ENDING

MONTH	DAY	YEAR
12	31	2008

HAS BEEN PREPARED UNDER MY DIRECTION, FROM THE ORIGINAL BOOKS, PAPERS AND RECORDS OF SAID UTILITY; THAT I HAVE CAREFULLY EXAMINED THE SAME, AND DECLARE THE SAME TO BE A COMPLETE AND CORRECT STATEMENT OF BUSINESS AND AFFAIRS OF SAID UTILITY FOR THE PERIOD COVERED BY THIS REPORT IN RESPECT TO EACH AND EVERY MATTER AND THING SET FORTH, TO THE BEST OF MY KNOWLEDGE, INFORMATION AND BELIEF.

SWORN STATEMENT

I HEREBY ATTEST THAT ALL PROPERTY TAXES FOR SAID COMPANY ARE CURRENT AND PAID IN FULL.

I HEREBY ATTEST THAT ALL SALES TAXES FOR SAID COMPANY ARE CURRENT AND PAID IN FULL.

OFFICIAL SEAL
LINDA A. BYRD
Notary Public - State of Arizona
MARICOPA COUNTY
My Comm. Expires July 22, 2011

SIGNATURE OF OWNER OR OFFICIAL

623-298-3753
TELEPHONE NUMBER

SUBSCRIBED AND SWORN TO BEFORE ME

A NOTARY PUBLIC IN AND FOR THE COUNTY OF — COUNTY NAME: Maricopa

THIS 14th DAY OF — MONTH April 2009

(SEAL)

Linda A Byrd
SIGNATURE OF NOTARY PUBLIC

MY COMMISSION EXPIRES July 22, 2011

COMPANY NAME Litchfield Park Service Company **YEAR ENDING 12/31/2008**

INCOME TAXES

For this reporting period, provide the following:

Federal Taxable Income Reported	Unable to isolate due to Consolidated Return filed
Estimated or Actual Federal Tax Liability	__________
State Taxable Income Reported	Unable to isolate due to Consolidated Return filed
Estimated or Actual State Tax Liability	__________

Amount of Grossed-Up Contributions/Advances:

Amount of Contributions/Advances	N/A
Amount of Gross-Up Tax Collected	N/A
Total Grossed-Up Contributions/Advances	N/A

Decision No. 55774 states, in part, that the utility will refund any excess gross-up funds collected at the close of the tax year when tax returns are completed. Pursuant to this Decision, if gross-up tax refunds are due to any Payer or if any gross-up tax refunds have already been made, attach the following information by Payer: name and amount of contribution/advance, the amount of gross-up tax collected, the amount of refund due to each Payer, and the date the Utility expects to make or has made the refund to the Payer.

CERTIFICATION

The undersigned hereby certifies that the Utility has refunded to Payers all gross-up tax refunds reported in the prior year's annual report. This certification is to be signed by the President or Chief Executive Officer, if a corporation; the managing general partner, if a partnership; the managing member, if a limited liability company or the sole proprietor, if a sole proprietorship.

[signature]	4/14/09
SIGNATURE	**DATE**
Greg Sorensen	Director of Operations
PRINTED NAME	**TITLE**

VERIFICATION
AND
SWORN STATEMENT
Intrastate Revenues Only

VERIFICATION

STATE OF ARIZONA	**COUNTY OF MARICOPA**
I, THE UNDERSIGNED	NAME (OWNER OR OFFICIAL) TITLE Greg Sorensen, VP
OF THE	COMPANY NAME Litchfield Park Service Company

DO SAY THAT THIS ANNUAL UTILITY REPORT TO THE ARIZONA CORPORATION COMMISSION

FOR THE YEAR ENDING

MONTH	DAY	YEAR
12	31	2008

HAS BEEN PREPARED UNDER MY DIRECTION, FROM THE ORIGINAL BOOKS, PAPERS AND RECORDS OF SAID UTILITY; THAT I HAVE CAREFULLY EXAMINED THE SAME, AND DECLARE THE SAME TO BE A COMPLETE AND CORRECT STATEMENT OF BUSINESS AND AFFAIRS OF SAID UTILITY FOR THE PERIOD COVERED BY THIS REPORT IN RESPECT TO EACH AND EVERY MATTER AND THING SET FORTH, TO THE BEST OF MY KNOWLEDGE, INFORMATION AND BELIEF.

SWORN STATEMENT

IN ACCORDANCE WITH THE REQUIREMENT OF TITLE 40, ARTICLE 8, SECTION 40-401, ARIZONA REVISED STATUTES, IT IS HEREIN REPORTED THAT THE GROSS OPERATING REVENUE OF SAID UTILITY DERIVED FROM ARIZONA INTRASTATE UTILITY OPERATIONS DURING CALENDAR YEAR 2008 WAS:

Arizona Intrastate Gross Operating Revenues Only ($)
$ 7,486,440

(THE AMOUNT IN BOX ABOVE INCLUDES $ 581,487 IN SALES TAXES BILLED, OR COLLECTED)

****REVENUE REPORTED ON THIS PAGE MUST INCLUDE SALES TAXES BILLED OR COLLECTED. IF FOR ANY OTHER REASON, THE REVENUE REPORTED ABOVE DOES NOT AGREE WITH TOTAL OPERATING REVENUES ELSEWHERE REPORTED, ATTACH THOSE STATEMENTS THAT RECONCILE THE DIFFERENCE. (EXPLAIN IN DETAIL)**

Greg Sorensen
SIGNATURE OF OWNER OR OFFICIAL

623 298 3753
TELEPHONE NUMBER

SUBSCRIBED AND SWORN TO BEFORE ME

A NOTARY PUBLIC IN AND FOR THE COUNTY OF COUNTY NAME Maricopa

THIS 14th **DAY OF** MONTH April , 2009

(SEAL)

OFFICIAL SEAL
LINDA A. BYRD
Notary Public - State of Arizona
MARICOPA COUNTY
My Comm. Expires July 22, 2011

Linda A. Byrd
SIGNATURE OF NOTARY PUBLIC

MY COMMISSION EXPIRES July 22, 2011

VERIFICATION
AND
SWORN STATEMENT
RESIDENTIAL REVENUE
INTRASTATE REVENUES ONLY

VERIFICATION

STATE OF ARIZONA — **COUNTY OF MARICOPA**

I, THE UNDERSIGNED — NAME (OWNER OR OFFICIAL) Greg Sorensen — TITLE V.P.

OF THE — COMPANY NAME Litchfield Park Service Company

DO SAY THAT THIS ANNUAL UTILITY REPORT TO THE ARIZONA CORPORATION COMMISSION

	MONTH	DAY	YEAR
FOR THE YEAR ENDING	12	31	2008

HAS BEEN PREPARED UNDER MY DIRECTION, FROM THE ORIGINAL BOOKS, PAPERS AND RECORDS OF SAID UTILITY; THAT I HAVE CAREFULLY EXAMINED THE SAME, AND DECLARE THE SAME TO BE A COMPLETE AND CORRECT STATEMENT OF BUSINESS AND AFFAIRS OF SAID UTILITY FOR THE PERIOD COVERED BY THIS REPORT IN RESPECT TO EACH AND EVERY MATTER AND THING SET FORTH, TO THE BEST OF MY KNOWLEDGE, INFORMATION AND BELIEF.

SWORN STATEMENT

IN ACCORDANCE WITH THE REQUIREMENTS OF TITLE 40, ARTICLE 8, SECTION 40-401.01, ARIZONA REVISED STATUTES, IT IS HEREIN REPORTED THAT THE GROSS OPERATING REVENUE OF SAID UTILITY DERIVED FROM ARIZONA INTRASTATE UTILITY OPERATIONS RECEIVED FROM RESIDENTIAL CUSTOMERS DURING CALENDAR YEAR 2008 WAS:

ARIZONA INTRASTATE GROSS OPERATING REVENUES

$ 4,591,844

(THE AMOUNT IN BOX AT LEFT INCLUDES $ 356,658 IN SALES TAXES BILLED, OR COLLECTED)

***RESIDENTIAL REVENUE REPORTED ON THIS PAGE MUST INCLUDE SALES TAXES BILLED.**

Greg Sorensen
SIGNATURE OF OWNER OR OFFICIAL

623 298 3753
TELEPHONE NUMBER

SUBSCRIBED AND SWORN TO BEFORE ME

A NOTARY PUBLIC IN AND FOR THE COUNTY OF

THIS 14th **DAY OF**

NOTARY PUBLIC NAME Linda A Byrd
COUNTY NAME Maricopa
MONTH April ,20 09

(SEAL)

OFFICIAL SEAL
LINDA A. BYRD
Notary Public - State of Arizona
MARICOPA COUNTY
My Comm. Expires July 22, 2011

MY COMMISSION EXPIRES July 22, 2011

X Linda A Byrd
SIGNATURE OF NOTARY PUBLIC

WATER DIVISION RATE DESIGN

Monthly Usage Charge	Present Rates	Company Proposed	Staff Recommended
5/8 x3/4" Meter - All Classes	$ 6.75	$ 10.20	$ 12.00
3/4" Meter - All Classes	8.30	19.00	12.00
1" Meter - Residential	14.60	31.67	22.50
1" Meter - All Classes	14.60	31.67	25.00
1½" Meter - All Classes	28.60	69.67	50.00
2" Meter - All Classes	56.50	111.47	80.00
3" Meter - All Classes	NT	NT	160.00
4" Meter - All Classes	132.00	348.33	250.00
6" Meter - All Classes	NT	NT	500.00
8" Meter - All Classes	225.00	501.00	825.00
10" Meter - All Classes	330.00	960.00	1,150.00
12" Meter - All Classes but irrigation	450.00	1,500.00	2,150.00
12" Meter - Irrigation	450.00	960.00	2,150.00
Construction Water - Hydrants	100.00	By Meter Size	-
Commodity Rates			
5/8 x3/4" Meter (Residential)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 3,000 Gallons		$ 1.25	
3,001 to 10,000 Gallons		$ 1.80	
Over 10,000 Gallons		$ 2.40	
0 to 3,000 Gallons			$ 1.00
3,001 to 9,000 Gallons			$ 1.88
Over 9,000 Gallons			$ 2.88
3/4" Meter (Residential)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 15,000 Gallons		$ 1.90	
15,001 to 50,000 Gallons		$ 2.45	
Over 50,000 Gallons		$ 3.05	
0 to 3,000 Gallons			$ 1.00
3,001 to 9,000 Gallons			$ 1.88
Over 9,000 Gallons			$ 2.88
1" Meter (Residential)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 15,000 Gallons		$ 1.90	
15,001 to 100,000 Gallons		$ 2.45	
Over 100,000 Gallons		$ 3.05	
0 to 4,000 Gallons			$ 1.00
4,001 to 13,000 Gallons			$ 1.88
Over 13,000 Gallons			$ 2.88
5/8 x3/4" and 3/4" Meter (Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 3,000 Gallons		$ 1.25	
3,001 to 10,000 Gallons		$ 1.80	
Over 10,000 Gallons		$ 2.40	
0 to 10,000 Gallons			$ 1.88
Over 10,000 Gallons			$ 2.88
1" Meter (Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons	$ 0.87		
Over 5,000 Gallons	$ 1.32		
0 to 15,000 Gallons		$ 1.90	
15,001 to 100,000 Gallons		$ 2.45	
Over 100,000 Gallons		$ 3.30	
0 to 20,000 Gallons			$ 1.88
Over 20,000 Gallons			$ 2.88

WATER DIVISION RATE DESIGN

		Present Rates	Company Proposed	Staff Recommended
1½" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 90,000 Gallons			$ 2.75	
Over 90,000 Gallons			$ 3.47	
0 to 30,000 Gallons				$ 1.88
Over 30,000 Gallons				$ 2.88
2" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 140,000 Gallons			$ 2.75	
Over 140,000 Gallons			$ 3.47	
0 to 50,000 Gallons				$ 1.88
Over 50,000 Gallons				$ 2.88
3" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 120,000 Gallons		NT	NT	$ 1.88
Over 120,000 Gallons		NT	NT	$ 2.88
4" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 180,000 Gallons			$ 2.75	$ 1.88
Over 180,000 Gallons			$ 3.47	$ 2.88
6" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 360,000 Gallons		NT	NT	$ 1.88
Over 360,000 Gallons		NT	NT	$ 2.88
8" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 670,000 Gallons			$ 2.75	$ 1.88
Over 670,000 Gallons			$ 3.47	$ 2.88
8" Meter	(Bulk resale only)			
All Gallons		NT	$ 1.50	NT
10" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 940,000 Gallons			$ 2.75	$ 1.88
Over 940,000 Gallons			$ 3.47	2.88
12" Meter	(Residential, Commercial, Industrial, Irrigation)			
0 to 5,000 Gallons		$ 0.87		
Over 5,000 Gallons		$ 1.32		
0 to 1,248,000 Gallons			$ 2.75	
Over 1,248,000 Gallons			$ 3.47	
0 to 1,248,000 Gallons				$ 1.88
Over 1,248,000 Gallons				$ 2.88
Construction Water				
All Gallons		$ 2.50	$ 3.47	$ 2.88

WATER DIVISION RATE DESIGN

	Present Rates			Company Proposed			Staff Recommended		
Service Line and Meter Installation Charges	Line	Meter	Total	Line	Meter	Total	Line	Meter	Total
5/8" x 3/4" Meter			$ 300	$ 385	$ 135	$ 520	$ 385	$ 135	$ 520
3/4" Meter			300	385	215	600	385	215	600
1" Meter			325	435	255	690	435	255	690
1½" Meter			500	470	465	935	470	465	935
2"			675	-	-	-	-	-	-
Over 2"			At Cost	-	-	-	-	-	-
2" Turbine Meter			NT	630	965	1,595	630	965	1,595
2" Compound Meter			NT	630	1,690	2,320	630	1,690	2,320
3" Turbine Meter			NT	805	1,470	2,275	805	1,470	2,275
3" Compound Meter			NT	845	2,265	3,110	845	2,265	3,110
4" Turbine Meter			NT	1,170	2,350	3,520	1,170	2,350	3,520
4" Compound Meter			NT	1,230	3,245	4,475	1,230	3,245	4,475
6" Turbine Meter			NT	1,730	4,545	6,275	1,730	4,545	6,275
6" Compound Meter			NT	1,770	6,280	8,050	1,770	6,280	8,050
8" & Larger			NT	At Cost	At Cost	At Cost	At Cost	At Cost	At Cost

Service Charges	Present Rates	Company Proposed	Staff Recommended
Establishment (a)	$ 20.00	$ 20.00	$ 20.00
Establishment (After Hours) (a)	40.00	40.00	40.00
Re-Establishment of Service (a)	(b)	(b)	(b)
Reconnection (Regular Hours) (a)	50.00	50.00	50.00
Reconnection (After Hours) (a)	65.00	65.00	65.00
Meter Test (if correct) (c)	25.00	25.00	25.00
Meter Re-Read (If correct)	5.00	5.00	5.00
NSF Check	25.00	25.00	25.00
Deferred Payment, Per Month	1.50%	1.50%	1.50%
Late Charge	(d)	(d)	(d)
Service Calls - Per Hour/After Hours (e)	40.00	40.00	40.00
Deposit Requirement	(f)	(f)	(f)
Deposit Interest	3.50%	3.50%	3.50%
* Hydrant Meter Deposit:			
5/8" x 3/4" Meter	$ 1,500.00	$ 1,500.00	$ 135.00
3/4" Meter	1,500.00	1,500.00	215.00
1" Meter	1,500.00	1,500.00	255.00
1½" Meter	1,500.00	1,500.00	465.00
2" Turbine Meter	1,500.00	1,500.00	965.00
2" Compound Meter	1,500.00	1,500.00	1,690.00
3" Turbine Meter	1,500.00	1,500.00	1,470.00
3" Compound Meter	1,500.00	1,500.00	2,265.00
4" Turbine Meter	1,500.00	1,500.00	2,350.00
4" Compound Meter	1,500.00	1,500.00	3,245.00
6" Turbine Meter	1,500.00	1,500.00	4,545.00
6" Compound Meter	1,500.00	1,500.00	6,280.00
8" & Larger	NT	At Cost	At Cost

NT = No Tariff
(a) Service charges for customers taking both water and sewer service are not duplicative.
(b) Minimum charge times number of months disconnected.
(c) $25 plus cost of test.
(d) Greater of $5.00 or 1.5% of unpaid balance.
(e) No charge for service calls during normal working hours.
(f) Per Rule R14-2-403(B): Residential - two times the average bill. Commercial - two and one-half times the average bill.
* Shall have a non-interest bearing deposit of the amount indicated, refundable in its entirety upon return of the meter in good condition and payment of final bill.

Litchfield Park Service Company
Docket Nos. W-01427A-09-0104, SW-01428A-09-0103 et al.
Test Year Ended September 31, 2008

Hearing Schedule PMC-4 W

Typical Bill Analysis
1" Residential

Company Proposed	Gallons	Present Rates	Proposed Rates	Dollar Increase	Percent Increase
Average Usage	14,556	$ 31.56	$ 59.33	$ 27.76	87.96%
Median Usage	10,000	25.55	50.67	$ 25.12	98.32%
Staff Recommended					
Average Usage	14,556	$ 31.56	$ 47.90	$ 16.34	51.76%
Median Usage	10,000	25.55	37.78	$ 12.23	47.87%

Present & Proposed Rates (Without Taxes)
1" Residential

Gallons Consumption	Present Rates	Company Proposed Rates	% Increase	Staff Recommended Rates	% Increase
-	$ 14.60	$ 31.67	116.92%	$ 22.50	54.11%
1,000	15.47	33.57	117.00%	23.50	51.91%
2,000	16.34	35.47	117.07%	24.50	49.94%
3,000	17.21	37.37	117.14%	25.50	48.17%
4,000	18.08	39.27	117.20%	26.50	46.57%
5,000	18.95	41.17	117.26%	28.38	49.76%
6,000	20.27	43.07	112.48%	30.26	49.28%
7,000	21.59	44.97	108.29%	32.14	48.87%
8,000	22.91	46.87	104.58%	34.02	48.49%
9,000	24.23	48.77	101.28%	35.90	48.16%
10,000	25.55	50.67	98.32%	37.78	47.87%
11,000	26.87	52.57	95.65%	39.66	47.60%
12,000	28.19	54.47	93.22%	41.54	47.36%
13,000	29.51	56.37	91.02%	43.42	47.14%
14,000	30.83	58.27	89.00%	46.30	50.18%
14,556	31.56	59.33	87.96%	47.90	51.76%
15,000	32.15	60.17	87.15%	49.18	52.97%
16,000	33.47	62.62	87.09%	52.06	55.54%
17,000	34.79	65.07	87.04%	54.94	57.92%
18,000	36.11	67.52	86.98%	57.82	60.12%
19,000	37.43	69.97	86.94%	60.70	62.17%
20,000	38.75	72.42	86.89%	63.58	64.08%
25,000	45.35	84.67	86.70%	77.98	71.95%
30,000	51.95	96.92	86.56%	92.38	77.82%
35,000	58.55	109.17	86.46%	106.78	82.37%
40,000	65.15	121.42	86.37%	121.18	86.00%
45,000	71.75	133.67	86.30%	135.58	88.96%
50,000	78.35	145.92	86.24%	149.98	91.42%
75,000	111.35	207.17	86.05%	221.98	99.35%
100,000	144.35	268.42	85.95%	293.98	103.66%

Typical Bill Analysis
3/4" Residential

Company Proposed	Gallons	Present Rates	Proposed Rates	Dollar Increase	Percent Increase
Average Usage	9,537	$ 18.64	$ 37.12	$ 18.48	99.16%
Median Usage	7,000	15.29	32.30	$ 17.01	111.25%
Staff Recommended					
Average Usage	9,537	$ 18.64	$ 27.83	$ 9.19	49.29%
Median Usage	7,000	15.29	22.52	$ 7.23	47.29%

Present & Proposed Rates (Without Taxes)
3/4" Residential

Gallons Consumption	Present Rates	Company Proposed Rates	% Increase	Staff Recommended Rates	% Increase
-	$ 8.30	$ 19.00	128.92%	$ 12.00	44.58%
1,000	9.17	20.90	127.92%	13.00	41.77%
2,000	10.04	22.80	127.09%	14.00	39.44%
3,000	10.91	24.70	126.40%	15.00	37.49%
4,000	11.78	26.60	125.81%	16.88	43.29%
5,000	12.65	28.50	125.30%	18.76	48.30%
6,000	13.97	30.40	117.61%	20.64	47.75%
7,000	15.29	32.30	111.25%	22.52	47.29%
8,000	16.61	34.20	105.90%	24.40	46.90%
9,000	17.93	36.10	101.34%	26.28	46.57%
9,537	18.64	37.12	99.16%	27.83	49.29%
10,000	19.25	38.00	97.40%	29.16	51.48%
11,000	20.57	39.90	93.97%	32.04	55.76%
12,000	21.89	41.80	90.95%	34.92	59.52%
13,000	23.21	43.70	88.28%	37.80	62.86%
14,000	24.53	45.60	85.89%	40.68	65.84%
15,000	25.85	47.50	83.75%	43.56	68.51%
16,000	27.17	49.95	83.84%	46.44	70.92%
17,000	28.49	52.40	83.92%	49.32	73.11%
18,000	29.81	54.85	84.00%	52.20	75.11%
19,000	31.13	57.30	84.07%	55.08	76.94%
20,000	32.45	59.75	84.13%	57.96	78.61%
25,000	39.05	72.00	84.38%	72.36	85.30%
30,000	45.65	84.25	84.56%	86.76	90.05%
35,000	52.25	96.50	84.69%	101.16	93.61%
40,000	58.85	108.75	84.79%	115.56	96.36%
45,000	65.45	121.00	84.87%	129.96	98.56%
50,000	72.05	133.25	84.94%	144.36	100.36%
75,000	105.05	209.50	99.43%	216.36	105.96%
100,000	138.05	285.75	106.99%	288.36	108.88%