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2004 JAN -8 PM 3:05
T.R.A. DOCKET ROOM

BEFORE THE TENNESSEE REGULATORY AUTHORITY
AT NASHVILLE, TENNESSEE

In Re: CARTWRIGHT CREEK UTILITY COMPANY, INC.'S PETITION for CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY to PROVIDE SEWER SERVICE.	**Docket No.** 04-00009

PETITION

Comes now Cartwright Creek Utility Company, Inc. ("Petitioner") and submits this Petition to the Tennessee Regulatory Authority ("TRA") to amend Petitioner's current Certificate of Public Convenience and Necessity ("CCN") to expand its existing sewer service to a portion of Williamson County, Tennessee pursuant to Tenn. Code Ann. § 65-4-201 and Section 1220-1-1, et seq. of the Rules of Tennessee Regulatory Authority Division of Practice and Procedure. In support of this Petition, Petitioner states as follows:

1. Cartwright Creek Utility Company, Inc. is a Tennessee corporation, licensed to do business in the State of Tennessee. Petitioner's principal address is 2033 Richard Jones Road, Nashville, Tennessee 37215. Attached as **Exhibit 1** and incorporated herein by reference is a Certificate of Good Standing regarding Petitioner issued by the Secretary of the State of Tennessee on December 30, 2003.

2. Petitioner was created to own and operate a sewage treatment plant and to provide sewer service. Petitioner is owned by Reese Smith, III (51%) and Steve Smith (49%). Reese Smith, III and Steve Smith are located at 2033 Richard Jones Road, Nashville, Tennessee 37215.

3. Petitioner was issued its original CCN on March 7, 1975 and has operated a sewage treatment plant within the Seventh Civil District of Williamson County since that time. A search of both Petitioner and the TRA's records revealed that due to the significant number of years that have passed since Petitioner constructed and began operation of the current facility, records of the original petition for CCN and issued CCN related to same have not been retained and are not available. However, attached as collective **Exhibit 2** and incorporated herein by reference is a letter from the State of Tennessee, Department of Public Health dated November 6, 1974 and a Certificate of Compliance from the Tennessee Water Quality Control Board dated November 6, 1974, which indicate that Petitioner will properly construct and operate the proposed sewage treatment plant. In addition, the TRA's current records contain Petitioner's 1996 petition for rate increase and agreed order regarding same, which contain the date the original CCN was issued as well as the current service area.

4. Also contained in the TRA's current records is Petitioner's most recent Tariff effective October 1, 1998. The 1998 Tariff contains a map of Petitioner's current service area boundary, which is attached as **Exhibit 3** and incorporated herein by reference.

5. Petitioner desires to expand its current facilities to become a sewer provider in planned growth area 5 ("PGA 5") of Williamson County, Tennessee. This area is contiguous to areas already serviced by Petitioner. Attached as **Exhibit 4** and incorporated herein by reference is a map showing the area proposed to be serviced by Petitioner. Initially, Petitioner proposes to apply its current rates to the proposed area. Attached as **Exhibit 5** and incorporated herein by reference is a copy of Petitioner's current rates as approved by the TRA.

6. In compliance with the applicable TRA rules, Petitioner files quarterly reports with the

TRA regarding its financial status. These reports evidence Petitioner's financial soundness and ability to conduct successfully the proposed service expansion, which is the subject of this Petition. Petitioner has sufficient and proven managerial, financial, and technical abilities and resources to provide the sewer service in the area sought to be certificated.

7. The area to which Petitioner seeks the CCN is not located within the boundaries of any municipality. No municipal utility, utility district, or other private sewer utility currently provides or has the authority to provide sewer service in this area. The area to be certificated receives water service from the Nolensville/College Grove Utility District. The Nolensville/College Grove Utility District does not provide sewer service.

8. Petitioner has officially informed the County Mayor for Williamson County, Rogers Anderson, and the appropriate representative of Nolensville/College Grove Utility District of its proposal. Attached as collective **Exhibit 6** and incorporated herein by reference is a letter dated December 5, 2003 from Rogers Anderson and a letter dated January 2, 2004 from Donald Scholes, attorney for Nolensville/College Grove Utility District, both of which indicate that public convenience and necessity require sewer service in PGA 5 and that neither Williamson County nor Nolensville/College Grove Utility District plan to provided sewer service in this area. Both letters indicate support of Petitioner's application to extend its service area to PGA 5.

9. The names and contact information of county and municipal officials who may potentially have an interest in the proceedings regarding this Petition are attached as collective **Exhibit 7** and incorporated herein by reference.

10. A public need for sanitary sewer service exists in the area sought to be certificated. The initial number of customers to be provided service is approximately two hundred twenty-five (225).

The projected number of customers to be serviced in the area sought to be certificated will be in excess of two thousand (2,000).

11. It is recognized by Petitioner that the TRA is the sole governmental entity which can grant this Petition for CCN. Petitioner will adhere to and abide by all applicable policies, rules, and orders of the TRA in the operation of the proposed sewer utility.

12. All cost and expenses associated with the engineering and construction of the infrastructure related to the proposed sewer utility shall be paid by the developers of the property within PGA 5. Attached as collective **Exhibit 8** and incorporated herein by reference is the proposed Design Development Report and Engineering Report dated August 2003 and the draft Sheaffer Modular Reclamation and Refuse System within the area sought to be certificated. Design Development Report and Engineering Report contains, among other things, information regarding the purpose and need for the project, site maps, construction cost estimates, five year return calculations, and performance data from other similar Sheaffer Systems.

WHEREFORE, Cartwright Creek Utility Company, Inc. prays that the Tennessee Regulatory Authority:

1. Grant its Petition to amend its current Certificate of Public Convenience and Necessity to expand its existing sewer service to provide sewer service within the geographic boundaries as set forth in this Petition; and

2. Approve the proposed engineering and construction plans submitted with this Petition.

This the 8th day of January, 2003.

Respectfully submitted,

Thomas V. White

Thomas V. White, B.P.R. No. 2727
T. Chad White, B.P.R. No. 21950
Tune, Entrekin, and White, P.C.
2100 AmSouth Center
315 Deaderick Street
Nashville, TN 37238-2100
615/244-2770 (Office)
615/244-2778 (Facsimile)

Attorneys for Cartwright Creek Utility Company, Inc.

Secretary of State
Division of Business Services
312 Eighth Avenue North
6th Floor, William R. Snodgrass Tower
Nashville, Tennessee 37243

ISSUANCE DATE: 12/30/2003
REQUEST NUMBER: 03364164A
TELEPHONE CONTACT: (615) 741-6488

CHARTER/QUALIFICATION DATE: 01/29/1974
STATUS: ACTIVE
CORPORATE EXPIRATION DATE: PERPETUAL
CONTROL NUMBER: 0005150
JURISDICTION: TENNESSEE

TO:
TUNE ENTREKIN & WHITE, P.C.
315 DEADERICK STREET

NASHVILLE, TN 37243

REQUESTED BY:
TUNE ENTREKIN & WHITE, P.C.
315 DEADERICK STREET

NASHVILLE, TN 37243

CERTIFICATE OF EXISTENCE

I, RILEY C DARNELL, SECRETARY OF STATE OF THE STATE OF TENNESSEE DO HEREBY CERTIFY THAT

"CARTWRIGHT CREEK UTILITY COMPANY, INC."

IS A CORPORATION DULY INCORPORATED UNDER THE LAW OF THIS STATE WITH DATE OF INCORPORATION AND DURATION AS GIVEN ABOVE;
THAT ALL FEES, TAXES, AND PENALTIES OWED TO THIS STATE WHICH AFFECT THE EXISTENCE OF THE CORPORATION HAVE BEEN PAID;
THAT THE MOST RECENT CORPORATION ANNUAL REPORT REQUIRED HAS BEEN FILED WITH THIS OFFICE; AND
THAT ARTICLES OF DISSOLUTION HAVE NOT BEEN FILED; AND
THAT ARTICLES OF TERMINATION OF CORPORATE EXISTENCE HAVE NOT BEEN FILED

FOR: REQUEST FOR CERTIFICATE ON DATE: 12/30/03

	FEES	
RECEIVED:	$20.00	$0.00
TOTAL PAYMENT RECEIVED:		$20.00

RECEIPT NUMBER: 00003398948
ACCOUNT NUMBER: 00002808

FROM:
TUNE ENTREKIN & WHITE (315 DEADERICK ST)
315 DEADERICK ST
2100 1ST AMER. CTR.
NASHVILLE, TN 37238-0000

Riley C Darnell

RILEY C. DARNELL
SECRETARY OF STATE

[illegible] DUNN
GOVERNOR

E[illegible] M.D., M.P.H.
COMMISSIONER

STATE OF TENNESSEE
DEPARTMENT OF PUBLIC HEALTH
NASHVILLE 37219

November 6, 1974

Cartwright Creek Utility Company, Incorporated
2033 Richard Jones Road
Nashville, Tennessee 37215

Re: Certificate of Compliance
Public Notice ORNOP-W, 74-60
Williamson County

Gentlemen:

In response to the above referenced Public Notice, the enclosed Certificate of Compliance has been issued to the Cartwright Creek Utility Company, Incorporated. The Certificate indicates that this Division has reasonable assurance that proper construction and operation of the proposed sanitary sewerage facilities will not violate applicable Water Quality Standards of the State of Tennessee.

Very truly yours,

V. Wayne McCoy

V. Wayne McCoy, Chief
Monitoring and Enforcement Section
Division of Water Quality Control

VWM:pam

Enclosure

ccs: Mr. Howard Boatman
Mr. Terry Cothron
Division of Sanitary Engineering
Mr. Michael E. Tant

CERTIFICATE OF COMPLIANCE

WITH THE

STANDARDS OF THE TENNESSEE DIVISION OF WATER QUALITY CONTROL

The materials submitted by Cartwright Creek Utility Company, Inc., Williamson County, Tennessee, hereinafter called "Applicant," for construction of a domestic wastewater treatment plant and for construction of an outfall line to convey the treated domestic wastewater to the Harpeth River at Mile 69.3 have been examined and reviewed by the Tennessee Department of Public Health, Division of Water Quality Control, hereinafter called "Agency." The undersigned hereby certifies the Agency has determined there is reasonable assurance that the proper construction and operation of the proposed facilities will not violate the applicable Water Quality Standards of the State of Tennessee.

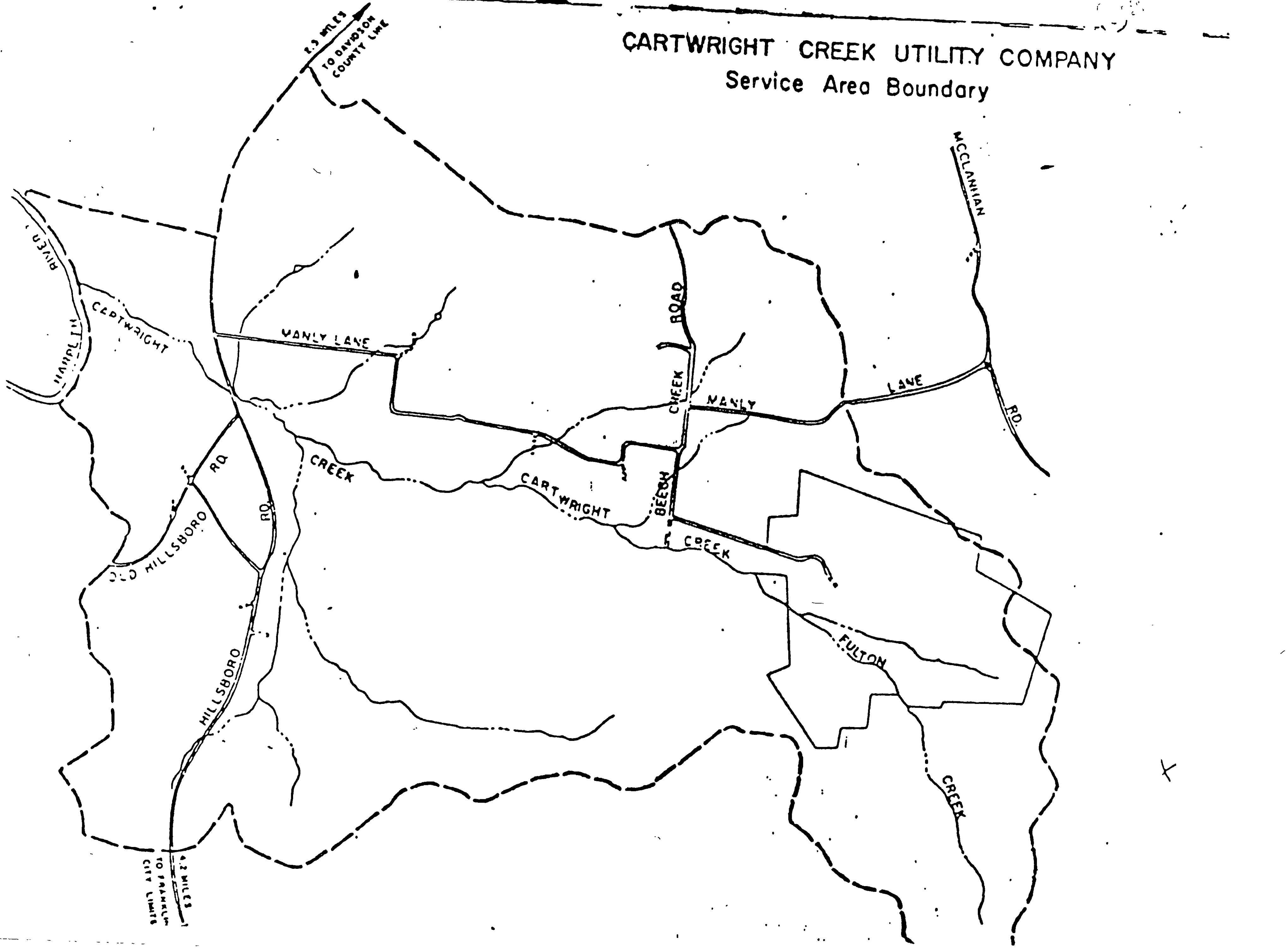
Tennessee Water Quality Control Board

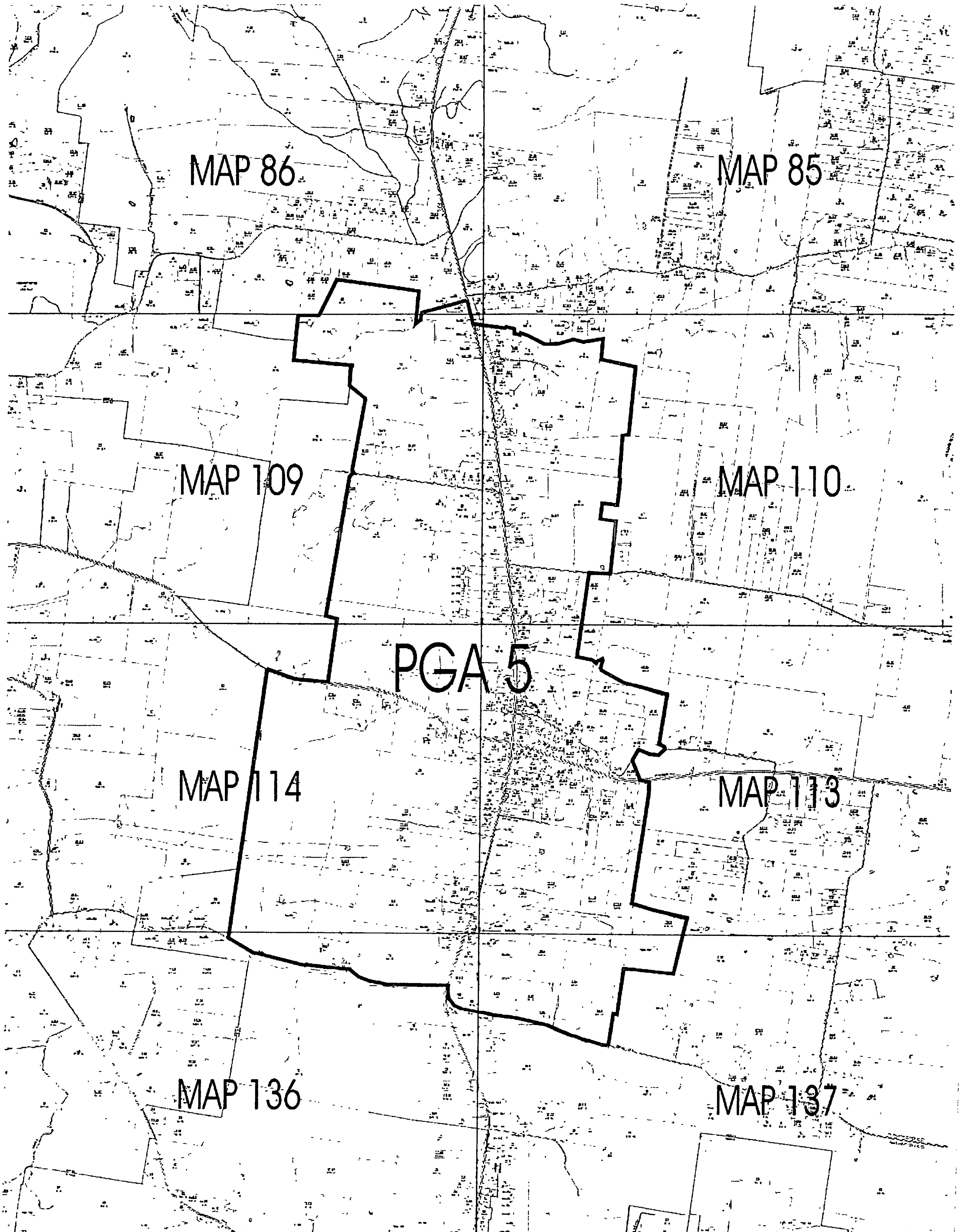
S. Leary Jones

S. Leary Jones
Technical Secretary

Date: November 6, 1974

CARTWRIGHT CREEK UTILITY COMPANY
Service Area Boundary




MAP 86
MAP 85
MAP 109
MAP 110
PGA 5
MAP 114
MAP 113
MAP 136
MAP 137

Cartwright Creek Utility Co.

2033 Richard Jones Road
Nashville, TN 37215

Our current tariff provides for a residential tap fee of $2,750, non-residential tap fee of $7.86 and "set" monthly sewer rates for customers to pay to have the right to use the sewer. These monthly rates are as follows:

<u>Residential:</u>

1 – Bedroom	$20.35
2 – Bedroom	$25.71
3 – Bedroom	$29.99
4 – Bedroom	$34.82
5 – Bedroom	$39.10

<u>Non – Residential:</u>

Charge per 1,000 gallons per month (actual or assumed flow)	$3.31
Minimum monthly charge	$6.00

WILLIAMSON COUNTY
Rogers C. Anderson, County Mayor
1320 West Main Street, Suite 125
Franklin, Tennessee 37064
(615) 790-5700, Fax (615) 790-5818

December 5, 2003

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Jason N. Scott, Controller
Cartwright Creek Utility Company
2033 Richard Jones Road
Nashville Tennessee 37215

RE: Request for Permission to Provide Sewer Services
PGA 5 - Williamson County

Dear Mr. Scott:

This correspondence is a revision of the correspondence dated November 18, 2003 in response to objections raised by Mr. Donald Scholes, Attorney for Nolensville/College Grove Utility District.

Pursuant to Tennessee Code Annotated, Section 7-82-201, et. seq. and Tennessee Code Annotated, Section 7-82-301 et. seq., as County Mayor, I have administered two public hearings concerning a request received from Cartwright Creek Utility Company to provide sewer services in the area commonly known and referred to as Planned Growth Area Five located in the Fifth District of Williamson County.

Please accept this letter as notification that after due diligence, consideration of all information provided to me, the support of the Williamson County Commissioners in the Fifth District, and the assertion from Nolensville/College Grove Utility District that it has no future plans of providing sewer services in the area at issue, I have concluded that the public convenience and necessity requires the additional services be provided. Therefore, I respectfully submit to you that the public convenience and necessity requires sewer services in this area and as such Cartwright Creek Utility Company's request should be granted and a certificate of convenience and necessity should be issued.

Sincerely,

Rogers Anderson
County Mayor

RCA/dg

E:\DIANE\letters\Cartwright-PGA5App-Rev.wpd

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ATTORNEYS AT LAW
227 SECOND AVENUE NORTH
FOURTH FLOOR
NASHVILLE, TENNESSEE 37201-1631

CECIL D. BRANSTETTER, SR.
C. DEWEY BRANSTETTER, JR.
RANDALL C. FERGUSON
R. JAN JENNINGS*
CARROL D. KILGORE
DONALD L. SCHOLES
JAMES G. STRANCH, III
JANE B. STRANCH

MARK A. MAYHEW
J. GERARD STRANCH, IV
JOE P. LENISKI, JR.

*ALSO ADMITTED IN GA

TELEPHONE
(615) 254-8801

FACSIMILE
(615) 255-5419

January 2, 2004

Mr. Tom White
Tune, Entrekin & White P.C.
AmSouth Center Suite 2100
Nashville, TN 37238

Re: Request of Cartwright Creek Utility Company, Inc. to Provide Sewer Service within the Boundaries of Nolensville/College Grove Utility District

Dear Tom:

I represent Nolensville/College Grove Utility District. The District provides water service within its boundaries in Williamson County, Tennessee. I understand that your client, Cartwright Creek Utility Company, Inc., plans to file an application for a certificate of public convenience and necessity with the Tennessee Regulatory Authority (TRA) to provide sewer service within Planned Growth Area 5 in Williamson County (PGA 5). PGA 5 is located within the District's boundaries.

Please be advised that the District does not plan to provide sewer service to PGA 5 and does not object to Cartwright Creek Utility Company, Inc. being granted a certificate by the TRA to provide sewer service to PGA 5. The District was aware of the recent request by your client to Rogers Anderson, Williamson County Mayor, for a determination that an additional sewer provider was needed within PGA 5. The District did not oppose your client's request before Mr. Anderson. The request to Mr. Anderson was necessary because the District is authorized to provide sewer service within its boundaries. Under T.C.A. § 7-82-301(a), the District is the exclusive provider of utility services within its boundaries until the public convenience and necessity requires additional service. Mr. Anderson has now made a finding that an additional sewer provider is necessary.

The District did operate a small sewer system within the City of Nolensville until 1998. In 1998 the District entered into an interlocal cooperation agreement with Metro and Brentwood to allow Metro and Brentwood to provide sewer service within the District's boundaries north of Nolensville. Metro took over the existing sewer plant the District was operating in Nolensville in 1998. Therefore, the District has not provided sewer service since 1998. PGA 5 is located south of Nolensville in an area not included in the interlocal cooperation agreement with Metro and Brentwood.

If I can provide further information to you on this issue, please let me know.

Sincerely yours,

Donald L. Scholes

DONALD L. SCHOLES

c: Charles Strasser

BKSJ File No.: 92-247

Williamson County

Area Code: 615
County Seat: Franklin 37064-3700
Cthse. hours: 8-4:30 Mon-Fri, closed Sat
Judicial district: 21st
Web: www.williamson-tn.org

County Executive Rogers Anderson 615-790-5700
1320 W Main St Ste 125, Franklin 37064-3700

Assessor Dennis Anglin 615-790-5708
1320 W Main St Ste 204, Franklin 37064-3700

Circuit Court Clerk Debbie M. Barrett 615-790-5454
Williamson County Cthse, 305 Public Square, Franklin 37064

Clerk & Master Elaine Beeler 615-790-5428
Williamson County Cthse, PO Box 1666, Franklin 37065-1666

County Attorney Jeffrey Dean Moseley 615-794-8850
306 Public Sq, Franklin 37064

Juvenile Court Clerk Brenda Hyden 615-790-5814
408 Century Ct, Franklin 37064

Register of Deeds Sadie Wade 615-790-5706
1320 W Main St Ste 201, Franklin 37064-3700

Trustee Joey Davis 615-790-5709
PO Box 648, Franklin 37065-0648

Sheriff Ricky Headley 615-790-5560
408 Century Ct, Franklin 37064-3934

County Clerk Elaine Anderson 615-790-5712
County Ct.,
1320 W Main St Ste 135, Franklin 37064-3700

Judge Lonnie Hoover 615-790-5455
Juv. & Gen. Sessions Ct., Div. 1,
100 Williamson County Cthse, 305 Public Square, Franklin 37064

Judge Alfred Leroy Nations 615-790-5455
Juv & Gen. Sessions Ct., Div. 2,
Williamson Co Cthse, 305 Public Sq Rm 100, Franklin 37064

Circuit Ct. Judge Russ Heldman 615-790-5426 FAX 790-4424
21st Judicial Dist., Div. 1,
305 Public Sq Rm 112, PO Box 1469, Franklin 37065-1469

Circuit Ct. Judge R. E. Lee Davies 615-790-5426 FAX 790-4424
21st Judicial Dist., Div. 2,
305 Public Sq, Williamson Co Cthse Rm 112, Franklin 37065

Circuit Ct. Judge Donald Paul Harris 615-790-5426 FAX 790-4424
21st Judicial Dist., Div. 3,
305 Public Sq Ste 112, PO Box 1469, Franklin 37065-1469

Circuit Ct Judge Timothy Lee Easter 615-790-5426 FAX 790-4424
21st Judicial Dist., Div. 4,
305 Public Sq Rm 112, PO Box 1469, Franklin 37065

Dist. Atty. Gen. Ronald L. Davis 615-794-7275 FAX 794-7299
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Williamson Co Cthse Ste G-6, PO Box 937, Franklin 37065-0937

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Williamson Co Cthse Ste G-6, PO Box 937, Franklin 37065-0937

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Asst. PD Trudy L. Bloodworth 615-790-5519 FAX 790-5524
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Asst. PD Douglas P. Nanney 615-790-5519 FAX 790-5524
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Judge Thomas Schlater 615-371-0160
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Judge Timothy Underwood 931-486-2252 FAX 486-0516
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Arrington

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Brentwood

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Anderson, Blackard, Gardner & Rankin; 155 Franklin Rd Ste 270, 37027-4646 615-377-9370 FAX 377-9616

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Baugh, John Lawrence; 017246; Claims Atty., State Volunteer Mutual Insurance Co.; PO Box 1065, 37024-1065; jbaugh@svmic.com; www.svmic.com 615-377-1999 FAX 370-1343

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Beasley, Tyson & Altshuler; 5205 Maryland Way Ste 320, 37027 615-373-2500 FAX 373-2574

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Brink, Stephen P.; 015998; Principal, First Southern Mortgage; 205 Powell Place, 37027; sbrink@1st-southern.com 615-726-2300 FAX 369-0721

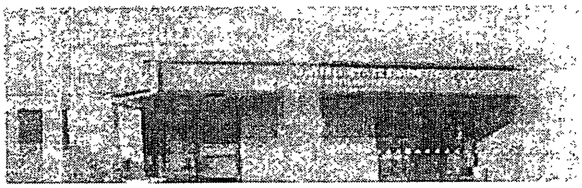
Brinton, Kathryn Goff; 010232; 5800 Cross Pointe Ln, 37027 615-221-4973

Brown, Bobby W.; 010388; 5114 Dorchester Cr, 37027; bwbrowncpa@juno.com 615-385-3158 FAX 369-3125

Bryant, Jeanne Barnes; 005835; COO, TN Receivers Office; 215 Centerview Dr Ste 100, 37027; JBTNRECV@bellsouth.net 615-370-0051 FAX 373-4336

Buchanan, Paul N.; 017697; 1526 Crockett Hills Blvd, 37027; pnbuchanan@yahoo.com 615-370-4503

Buck, David Reuben; 015382; Cisco Systems Inc.; 7000 Executive Center Dr #101, 37027; rbuck@cisco.com; www.cisco.com 615-221-2900



Nolensville, Tennessee

A great place to live

Nolensville Town Hall

7240 Nolensville Road, Suite 103
PO Box 547
Nolensville, TN 37135
Hours: Monday – Friday 8:00 a.m. – 4:00 p.m.
Phone – 615-776-3633
Fax - 615-776-3634
email: town.hall@nolensville-tn.com

Codes	Donald Swartz (Codes Enforcer)	615-776-6683
Planning / Engineering	Richard Woodroof (Town Engineer)	615-776-6683
Public Works	Lonnie Bowden, Wayne Morton, Bob Hayes	615-776-6682
Police	Jeff Goforth (Police Chief) Officers - George Poss, Paul Rigsby	615-776-6685
Municipal Court	Cindy Noel	615-776-6684
Town Recorder	Cindy Lancaster	615-776-6681
Mayor	Charles Knapper	615-776-6680

*email department name - department links are listed across top of page

Local Phone Numbers

City Hall	**776-3633**
City Hall fax	**776-3634**
Post Office	**776-2663**
Library	**776-5490**
Chamber of Commerce	**790-5326**
COC fax	**790-5337**
Nolensville Dispatch	**776-3695**
Nolensville Recreation Center	**776-2964**

County Phone Numbers

Burn Permits	**791-6200**
Health Department	**794-1542**
Driver's License	**790-5515**
Voter Registration	**790-5711**
Tax Office	**790-5709**
Williamson A M.	**771-5411**
Parks & Recreation	**790-5719**

Town Hall Office Hours and Holidays

New Residence Information:

- **Gas** - Atmos Energy
  - 888-824-3434
  - 800-556-5469 (emergency)
- **Electricity** - Middle Tennessee Electric
  - 794-3561
- **Water** - Nolensville/College Grove Utilities
  - 776-2511
- **Phone** - United Telephone
  - 779-2227
- **Sanitation** - Clean Earth Sanitation
  - 794-7599
- **Sanitation** - BFI
  - 242-0331
- **Cable** - Comcast
  - 244-5900

Population

3,099

Property Taxes (per $100 assessed value)

$0.04 + $2.91

News:

Council/Committee Nominations

Mutual Aid Agreement

Mill Creek bi-weekly progress #8

Mill Creek bi-weekly progress #7

Mill Creek bi-weekly progress #6

Municipal League budget bulletin

Town Hall is open Monday through Friday 8:00 a.m. till 4:00 p.m.

The following are Official Holidays and the Town Hall Office will be closed:

New Years Day
Martin Luther King Day
Presidents Day
Memorial Day
Independence Day
Labor Day
Veterans Day
Thanksgiving Day
Day after Thanksgiving
Christmas Eve
Christmas Day

State Shared tax cuts

Letter from the Mayor

Sewer trunk construction

City Departments & Services

Fairview City Hall

Learn More About City Hall

Office Hours. Monday - Friday 8am till 4 30pm
1874 Fairview Blvd.
P.O. Box 69
Fairview, TN 37062
TEL: (615) 799-2484
FAX: (615) 799-1383
Email. cityhall@fairview-tn org

Fairview Police Department

Learn More About Fairview Police Department

Police Chief: Terry Harris
1874 Fairview Blvd.
Fairview, TN 37062
TEL: (615) 799-2431
Emergency: Dial 911
Email: policechief@fairview-tn org

Fairview Fire Department

Learn More About Fairview Fire Department

Fire Chief: Keith Crowell
2234 Fairview Blvd
Fairview, TN 37062
TEL: (615) 799-0307
FAX: (615) 799-0701
Emergency: Dial 911
Email. firechief@fairview-tn org

Bowie Nature Park

Visit Bowie Park Website

Tel: (615) 799-5544
Parks Director: Wade Hooper
Park Naturalist: Melissa Bell
Email: bowiepark@fairview-tn org

Codes & Public Works Department

Learn More About Codes Department

Office Hours· Monday - Friday 8am till 4·30pm
Codes Enforcement Officer: Dwain Johnson
Associate Administrator Assistant: Kathy Haney
TEL: (615) 799-1585
Email codes@fairview-tn org

Today is
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Keep yoursel
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Fairview City Court

Learn More About City Court

Court is held on the 2nd & 4th Fridays of each month, @ 2:00 p.m.

Court Clerk: Dianne Trevett
TEL: (615) 799-2484
FAX: (615) 799-1383
Email courtclerk@fairview-tn org

Road & Streets Department

Learn More About Public Works

Office Hours Monday - Friday 8am till 4 30pm
Public Works Supervisor: Howard Bridges
TEL: (615) 799-0353
FAX: (615) 799-1383
Email· publicworks@fairview-tn org

Water Department

Learn More About Public Works

After Hours Emergencies: Call (615) 799-2484 Extension #71
Office Hours Monday - Friday 8am till 4.30pm
Public Works Supervisor: Howard Bridges
TEL: (615) 799-2484
FAX: (615) 799-1383
Email publicworks@fairview-tn org

New Service: Online applications are available by Clicking Here or at city hall A $75 non-refundable connection fee is required to establish service for homeowners A $125 non-refundable connection is required for renters

Wastewater Department

Learn More About Public Works

After Hours Emergencies: Call (615) 799-2484 Extension #73
Office Hours· Monday - Friday 8am till 4 30pm
Public Works Supervisor: Howard Bridges
TEL: (615) 799-0353
Treatment Plant Supervisor: Jason Daugherty
Wastewater Treatment Plant
7223 CCC Road • Fairview, TN 37062 • Tel: 799-8906
Email: publicworks@fairview-tn org

Local Utilities

BellSouth

Learn More About BellSouth

Service or Billing: (615) 557-6000
Repairs: (615) 557-6123
Online Customer Service Click Here

Middle Tennessee Electric Membership Corp.

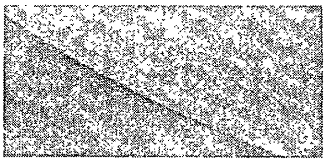
Office Hours 8am-4.30pm Monday-Friday
Learn More About MTEMC

MTEMC Franklin Office
P.O. Box 681709
Franklin, TN 37068
TEL: (615) 794-3561
FAX: (615) 794-1102
Emergencies/Outages: Call (615) 794-3561

Nashville Gas

Learn More About Nashville Gas

Nashville Gas Company
665 Mainstream Drive
Nashville, TN 37228
Service or Billing: (615) 734-0665
Emergency Response: (615) 734-1400
Email nashvillegas@piedmontng com



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Neighborhood Watch Program | Bowie Nature Park | Helpful Links | Employment

Fairview City Hall
7874 Fairview Blvd
P O Box 69 • Fairview, TN 37062
TEL (615) 799-2484 • FAX (615) 799-1383
EMAIL cityhall@fairview-tn org

Previous Page
Top Of Page

Quick Guide to City Services	
City Departments & Services	**Tel Number**
City Hall	(615) 799-2484
Codes & Public Works Department	(615) 799-1585
Fairview Chamber of Commerce	(615) 799-9290
Fairview City Court	(615) 799-2484
Fire Department (Emergency Dial 911)	(615) 799-0307
Police Department (Emergency Dial 911)	(615) 799-2431
Road & Streets Department	(615) 799-0353
Tax Office	(615) 799-2484
Wastewater Department	(615) 799-0353
Wastewater Treatment Plant	(615) 799-8906
Water Department	(615) 799-2484
Bowie Nature Park	(615) 799-5544
County & Regional Services	**Tel Number**
Animal Control	(615) 790-5590
Car Tags / Registration	(615) 790-5712
Crime Stoppers	(615) 794-4000
Dept Of Human Services	(615) 790-5500
Drug Task Force	(615) 790-2691
Health Department	(615) 794-1542
Poison Control	(615) 936-2034
Local Organizations	**Tel Number**
Fairview Chamber of Commerce	(615) 799-9290

CITY OF FRANKLIN
TENNESSEE

City Employment Opportunities

» Current Job Openings

City Officials

» Mayor
» City Administrator
» Aldermen
» Budget
» Municipal Code
» BOMA & Committees
» Planning Commission

Departments and Offices

» Department Directors
» Administration
» CableChannel 10
» City Court
» Codes Administration
» Engineering
» Finance
» Fire
» GIS
» Human Resources
» MIT
» Parks
» Planning
» Police
» Solid Waste
» Special Events & Projects
» Stormwater Management
» Streets
» Traffic Operations Center
» Water & Sewer

Quick Links

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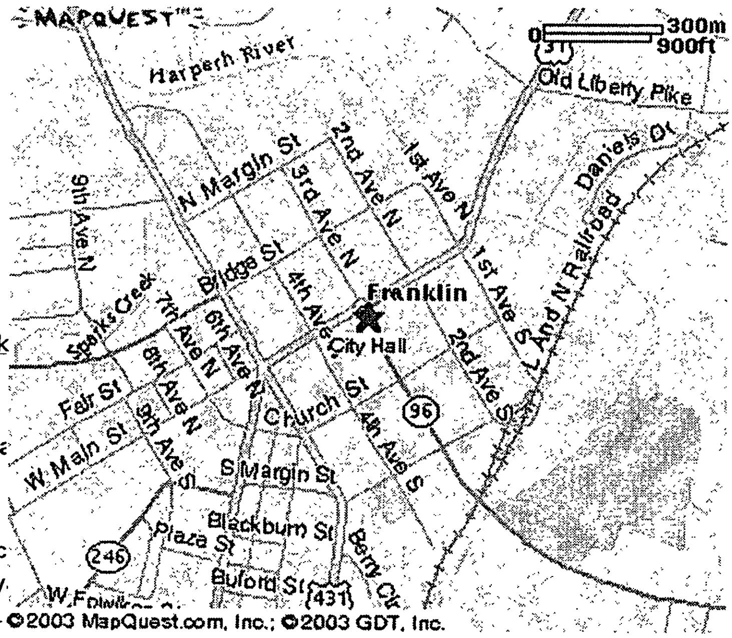
» City of Brentwood
» City of Fairview
» Convention & Visitors Bureau
» Cool Springs Conference Cntr.
» Emergency Preparedness
» FirstGov
» FirstGov for Kids
» Franklin Data Sheet
» Franklin Special School District
» Franklin Tomorrow

Today is Wednesday, January 7, 2004

CONTACT US

Address: 109 3rd Avenue South, Franklin, TN 37064
Phone: (615) 791-3217
Email: info@frank -gov.com



Administra Offices

- **Acc Pay** (61 791 -3227
- **Building Codes & Permits:** (615) 794-7012
- **Building Plumbing Mechanical Inspections:** (615) 591-5603
- **Business Tax and License:** (615) 791-3225
- **City Administrator:** (615) 791-3217
- **City Court:** (615) 794-5362
- **Engineering:** (615) 791-3218
- **Finance Department:** (615) 791-1457
- **Flood Zone:** (615) 794-7012
- **Human Resources:** (615) 791-3216
- **Insurance:** (615) 791-3223
- **Mayor:** (615) 791-3217
- **Parks Department:** (615) 794-2103
- **Payroll:** (615) 791-3228
- **Planning Department:** (615) 791-3212
- **Planning Department Development Bonds:** (615) 591-5631
- **Property Tax:** (615) 791-3226
- **Risk Manager:** (615) 791-3277
- **Special Projects Coordinator:** (615) 791-3268
- **Water and Sewer Billing:** (615) 794-4572

Fire Department

- **Fire or Emergency:** 911
- **Administrative Offices:** (615) 791-3270

- » Heritage Foundation
- » Local Weather
- » Metro Nashville Government
- » Nashville International Airport
- » Nashville Traffic Cameras
- » Property Tax Inquiry
- » Real-Time Traffic Map
- » Register to Vote
- » Tennessee Blue Book
- » Tennessee State Government
- » The Review Appeal
- » The TMA Group
- » Title VI Facts
- » Town of Nolensville
- » Town of Spring Hill
- » Williamson A.M.
- » Williamson Co. Government
- » Williamson Co. Public Library
- » Williamson Co. Schools
- » Williamson Medical Center
- » Williamson Works

Police Department

- **Emergency Only:** 911
- **Non-Emergency:** (615) 794-2513
- **Communications Division:** (615) 791-3233
- **Crimestoppers:** (615) 794-4000
- **Accreditation:** (615) 550-6805
- **Adminstrative Offices:** (615) 791-3238
- **Criminal Investigation Division:** (615) 791-3237
- **DARE Unit:** (615) 791-3261
- **Patrol Division:** (615) 791-3248
- **Records Division:** (615) 791-3234

Public Works

- **Wastewater Plant:** (615) 791-3240
- **Street Department:** (615) 791-3240
- **Solid Waste Department:** (615) 794-1516
- **Water and Sewer Maintenance:** (615) 794-4554
- **After Hours Emergency:** (615) 791-3260
- **Water Works Plant:** (615) 791-3260

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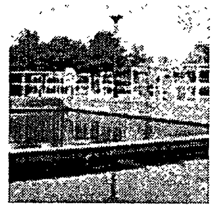
WATER AND SEWER



City of Franklin
Water and Sewer Department
109 3rd Avenue South
Franklin, TN 37064
Phone: (615) 794-4572
Fax: (615) 794-0882
Service: (615) 794-4554
After Hours: (615) 791-3260

Water and Sewer Director: Eddy Woodard
Assistant Water and Sewer Director: Chris Milton
Administrative Assistant: Carolyn Beech

2004 Franklin Municipal Planning Commission

Name	Contact	Appointment	Term
BILL CHATMAN 1149 Hunters Chase Drive Franklin, TN 37064	Mobile: (615) 390-1258 Res: (615) 794-8445	9/24/02	1/1/02 - 12/31/06
PETE FLAUGHER 1011 Buckworth Avenue Franklin, TN 37064	Office: (615) 790-2265 Ext. 236 Fax: (615) 794-8682 Res: (615) 794-3649	12/14/99	1/1/00 - 12/31/04
LYNN HALLUM Chairman 195 Sturbridge Drive Frankln, TN 37064	Office: (615) 790-3440 Fax: (615) 790-3441 Res.: (615) 790-7179 Email: hhallumme@yahoo.com	12/14/99	1/1/00 - 12/31/04
SCOTT HARRISON 365 Sims Lane Frankln, TN 37069	Office: (615) 777-3200 Fax: (615) 777-3203 Res.: (615) 794-6137	8/12/03	1/1/04 - 12/31/08
MIKE HATHAWAY 17113 Ambiance Way Frankln, TN 37067	Office: (615) 778-3159 Fax: (615) 778-2875 Res.: (615) 591-1706 Email: mike.hathaway@southernland.com	12/9/03	1/1/01 - 12/31/05
DAN KLATT Alderman 214 Third Avenue South Frankln, TN 37064	Office: (615) 595-1601 Fax: (615) 595-1603 Res.: (615) 794-0019 Email: klattman@comcast.net	12/9/03	1/1/01 - 12/31/05
ALMA McLEMORE 147 Flintlock Drive Franklin, TN 37064	Office: (615) 794-3588 Ext. 3817 Fax: (615) 794-1102 Res.: (615) 791-1294	12/9/03	1/1/01-12/31/05
TOM MILLER Mayor 1328 Carnton Lane Franklin, TN 37064	Office: (931) 550-6600 Fax: (615) 790-0469 Res.: (615) 790-8040 Email: tommiller@franklin-gov.com	12/9/03	Term of Office
ANN PETERSEN 400 Chesterfield Place Franklin, TN 37064	Office: (931) 540-2712 Fax: (615) 790-0314 Res.: (615) 794-6033 Email: jpeterson@comcast.net	5/14/02	1/1/02 - 12/31/06

Contact Information

E-Mail Us

Search

City of Brentwood Phone Numbers		
TOPIC	**DEPARTMENT**	**NUMBER**
Accident Reports	Police	371-0160
Blasting Complaints	Fire	371-0170
Brush Chipping	Public Works	371-0080
Building Permits Inspections	Codes	371-2204
Burning Permits	Fire	371-0170
Business License	Administration	371-0060
Complaints	Community Relations	371-0060
Concerts - Amphitheater	Community Relations	371-0060
Fire Department	Fire	371-0170
Fire Hydrants	Fire	371-0170
General Information	Administrative Offices	371-0060
Library	Library	371-0090
Parks Information Crockett Park Hotline Granny White Park Hotline Park Permits for Events Park Shelter/Pavilion Rentals	Parks & Recreation	371-2208 373-7752 373-8310 371-2208 371-2208
Planning and Zoning	Planning and Codes	371-2204
Police Department	Police	371-0160
Road Debris	Public Works	371-0080
Sewer Problems	Water and Sewer	371-0080
Street/Sidewalk Repair/Street Lights Out	Public Works	371-0080
Subdivision Regulations	Planning and Codes	371-2204

Water Main Breaks	Water and Sewer	371-0080
Water & Sewer Billing	Water and Sewer	371-0060
Weed Control	Planning and Codes	371-2204
Note: All telephone numbers in Brentwood, Williamson County and Nashville/Davidson County use area code (615).		

City Commission

Mayor Anne Dunn
1613 Covington Drive
(H) 370-3702
(F) 371-2246
(VM) 371-2281 ext. 242
dunna@brentwood-tn.org

Regina Smithson
541 Grand Oaks Drive
(H) 377-0115
(F) 371-2249
(VM) 371-2281 ext. 241
smithson@brentwood-tn.org

Joe Reagan
1611 Gordon Petty Drive
(H) 370-3730
(F) 371-2247
(VM) 371-2281 ext. 240
reaganj@brentwood-tn.org

Vice Mayor Joe Sweeney
9011 Hood Place
(H) 373-1546
(F) 371-2239
(VM) 371-2281 ext. 237
sweeneyj@brentwood-tn.org

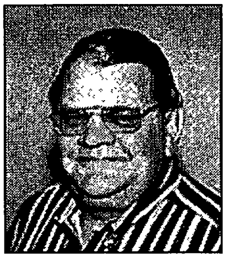
Robert L. Higgs
976 Mooreland Blvd
(H) 370-3874
(F) 371-2248
(VM) 371-2281 ext. 243
higgsb@brentwood-tn.org

The City Commission is the legislative and policy-making body of the City. It consists of 5 members elected at-large for 4-year, staggered terms. The Mayor and Vice Mayor are appointed by the City Commission for 2-year terms. Unless otherwise rescheduled, the City Commission meets on the second and fourth Mondays of each month at 7 p.m. at the Municipal Center, 5211 Maryland Way.

Administration

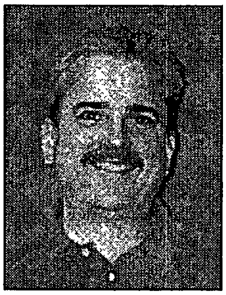
Mike Walker
City Manager
615-371-0060

Water Department



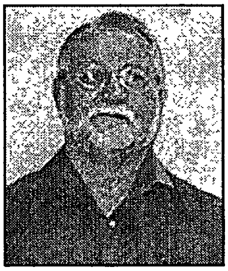
John Grissom
Public Works Director
615-371-0080

Planning and Codes

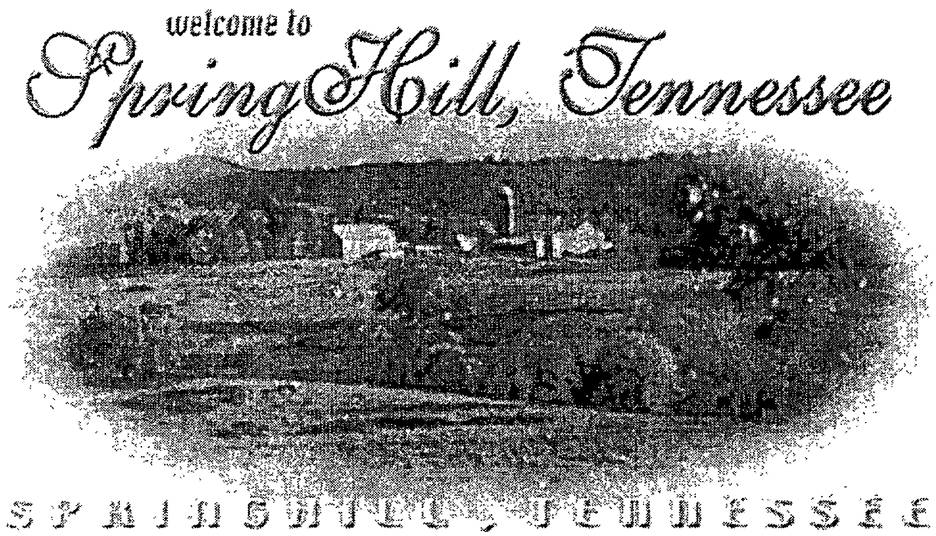


Joe Lassus
Planning Director
615-371-2204

Public Works



Ray Mize
Public Works Director
615-371-0080



(Click Here to Enter)

Spring Hill is located 30 miles South of Nashville, Tennessee and situated in Maury and Williamson Counties. Convenient to I-65 Interstate via Saturn Parkway, Spring Hill boasts of rich historical sites, lush farmland, businesses, industry and booming residential growth.

The City of Spring Hill welcomes your questions and comments. We are constantly striving to make all departments more accessible to the citizens of Spring Hill, so together we can make our community a better place to live.

Telephone:
(931) 486-2252

Fax:
(931)486-0516

Postal address:
PO Box 789
199 Town Center Pkwy
Spring Hill, TN 37174 USA

Electronic mail:
General Information
ken@springhilltn.org

If you have any comments concerning this website, please contact our Webmaster.

Last modified. July 24, 2000

Contact Us

Ray Williams, Mayor
Spring Hill, TN 37174
Office (931) 486-2252 ext 216,
Home (931) 486-3122

Ken York, City Administrator
Nashville, TN 37214
(931) 486-2252 ext 215

Reggie Pope, Police Chief
Thompson's Station, TN
37179
(931) 486-2252 ext 221

Shane Whitt
Waste Water Superintendent
Spring Hill, TN 37174
(931) 486-2252 ext 271

John McCord, Public Works
Director
Spring Hill, TN 37174
(931) 486-2252 ext 279

Andrew Hoover, City Attorney
Spring Hill, TN 37174

C. Clyde Farmer, Fire Chief
Spring Hill, TN 37174
(931) 486-2252 ext 270

Ferrell White, Building Official
Spring Hill, TN 37174
(931) 486-2252 ext 212

Tim Underwood, City Judge
Pulaski, TN 38478

Contact us at ken@springhilltn.org or (931) 486-2252

Design Development Report
And Engineering Report
Waterbridge Development
Sheaffer System
Williamson County, Tennessee

August, 2003

Presented To:
Waterbridge, LLC.

Prepared By:
SheafferInternational, LLC
800 Roosevelt Road
Suite B-200
Glen Ellyn, IL 60137
630-446-4080
www.sheafferinternational.com

Sheaffer
INTERNATIONAL, L.L.C

Enhancing Land and Water, Naturally

Introduction

Williamson County, Tennessee established regulations for wastewater treatment and land disposal systems in April 2000, and updated the regulations on January 13, 2003. To enable county government and staff to evaluate whether proposed systems will protect public health and safety, these regulations require preparation of this Design Development Report (DDR) and a Detailed Site Investigation Report (DSIR) for review by Williamson County.[1] In addition, the Tennessee Department of Environment and Conservation (TDEC) requires submittal of an Engineering Report, which addresses a similar range of subjects.[2] The Engineering Report is attached. The DSIR has been submitted under separate cover. Most of the information required by Williamson County in the DDR has been included in the Engineering Report. For this reason, we have attached the Engineering Report, and provided cross-references in this DDR for each topic for your convenience.

1.0 Site Description

1.1 Location Map

The Waterbridge Development is located southwest of the intersection of Nolensville Road and Osburn Road. The proposed location of the wastewater reclamation and reuse system is the northwest corner of the development site. A location map is provided as Figure 1 of the Engineering Report.

1.2 Climate

The climate of Williamson County is characterized in the Soil Survey of Williamson County, Tennessee[3] as "mild winters, warm summers, and abundant rainfall." Average daily minimum temperatures range from 31.3 (January) to 66.6° F (July.) Table 10 of the Engineering Report provides local monthly average rainfall data for a 31-year period.[4] Table 11 of the Engineering Report calculates the five-year return on this rainfall data. The five-year return is used as a basis for designing the system irrigation rates and area to be irrigated.[5]

---

[1] "Regulations for Wastewater Treatment and Land Disposal Systems"; Williamson County, Tennessee; April 12, 2000; Tables 1.9 and 1.9.1.

[2] "Design Criteria for Sewage Works", State of Tennessee, Department of Health and Environment, Division of Water Pollution Control, April 1989, Chapter 1.2.

[3] "Soil Survey, Williamson County Tennessee," USDA Soil Conservation Service in cooperation with The Tennessee Agricultural Experiment Station, Issued August 1964, Reissued 1987.

[4] National Climatic Data Center, Station #403280 in Franklin, Tennessee, 1970 – 2000.

[5] "Design Criteria", Chapter 16.7.4.

Potential Evapotranspiration (PET) is another important climatic variable for designing the irrigation system. We have utilized the helpful guidance from TDEC and calculations found in the Soils Survey to determine PET.[6,7] Both precipitation and PET are taken into account in the Engineering Report's Table 12: Maximum Hydraulic Loading Calculations.

1.3 Geology (including subsurface hydrology)

All of Williamson County is generally underlain by sedimentary rocks, which deviate only slightly from the horizontal. The proposed location of the reclamation and reuse system is in a physiographic province consisting of the terraces and bottomlands of the Harpeth River basin. The high stream terraces are located above the floodplain and are sloping and gently rolling. The bottomlands are generally flat to gently sloping. The soil types located on the site proposed for irrigation of reclaimed water are derived from the deposition of weathered limestone in upland areas. The soil types identified are consistent with Williamson County terraces and bottomlands.

Subsurface hydrogeology is addressed in DSIR (submitted separately). As a general matter, the geology and the development of soils have produced a groundwater table that flows primarily to the south/southwest.

1.4 Topography

The topography is nearly level and gently sloping. Slopes are less than 2%. Site topography is included in Figure 7.

1.5 Access

Primary site access is from Nolensville Road. A street network will be constructed within the development, and a service road will be added to cross Arrington Creek and provide access to the site. See Figure 7 for the location of the site access road.

1.6 Water Supply Wells within 1,500 feet of the facility

The current owners of property within 1,500 feet of the facility were identified through tax maps. Contacts with the Nolensville/College Grove Utility District resulted in the conclusion that all of the subject properties receive drinking water from the utility. A review of well logs on file with the Tennessee Department of Environment and Conservation did not identify any water supply wells within 1,500 feet of the facilities. Well logs for the general area indicate that any water supply wells which exist are generally deep, ranging from 105 feet to over a 1,000 feet, and are cased from the surface to a depth of 20 feet or more.

[6] "Design Criteria", Chapter 16.7.3.
[7] "Soils Survey", Page 141, Figure 36.

2.0 Scaled Drawing with 2 Foot Contours

The required drawing is enclosed as Figure 7. The drawing shows:

- The reclamation and reuse facilities
- Storage facilities (Storage of reclaimed water is included within Cell I and Cell II)
- Irrigation Areas, (primary and secondary)
- Buffer Zones
- Hand auger, test pit and soil boring locations
- Access roads and utilities
- Watercourses
- Drainage structures
- Flood elevations with 10-year, 50-year and 100-year flood plain elevation
- Residences and habitable structures within or adjacent to the site
- Wells within 500 feet of the site

3.0 Design Wastewater Characteristics

The wastewater treated by the SMRRS will be domestic wastewater exclusively.

3.1 Average and Daily Peak Flows

See Table 1 of the Engineering Report.

The following information is provided in Table 2 of the Engineering Report for influent wastewater and in Table 4 of the Engineering Report for reclaimed water. Since the proposed system is a new system, concentration values are based on published data and the performance of similar systems as noted in the tables.

3.2 Biochemical Oxygen Demand

3.3 Total Suspended Solids

3.4 Ammonia Nitrogen, Total Kjeldahl Nitrogen, Nitrate Plus Nitrite

3.5 Total Phosphorus

3.6 Chloride

3.7 Sodium Adsorption Ratio

3.8 Electrical Conductivity

3.9 Metals/Priority Pollutants

4.0 Water Balance and Determination of Design Wastewater Loading Rates for Each Disposal Field

TDEC guidance requires a consideration of climate, soils, and nutrient loading in establishing design wastewater loading rates. This information is then used to calculate a water balance for the system. The water balance evaluates whether land application rates and available storage are adequate. See Tables 10 – 15 of the Engineering Report for these calculations. The two-year water balance in Tables 14 and 15 of the Engineering Report show that the full design loading calculated in Table 13 of the Engineering Report will not be used in the operations of the irrigation system.

The site soils are characterized by a relatively permeable upper layer (topsoil and A horizon), followed by much less permeable clay subsoil. This clay layer generally follows the site terrain, which slopes towards Arrington Creek. The application rates are based on horizontal permeabilities in the topsoil and the A horizon. Irrigation will create a hydraulic head as water accumulates on the top of the clay subsoil. Water will then flow laterally downslope atop the clay subsoil and recharge Arrington Creek with cold, filtered, nutrient-deficient water.

5.0 Nitrogen Balance and Selection of Cover Crop and Management Scheme

The Nitrogen loading balance is included in Table 13 of the Engineering Report. A typical cover crop for an irrigation system of this design would be a wet prairie species native to Tennessee selected with an emphasis on phosphorus removal. Plants of this type develop deep root systems, which improve soil porosity and increase evapotranspiration rates. The cover crop selection and management scheme will be determined in the Detailed Design Phase of project planning, and will be designed according to TDEC's "Guidelines", Chapter 16.8.3. The selected plants will be harvested annually, or more frequently if necessary, and removed from the irrigation areas for use as mulch.

6.0 Background groundwater samples.

Background groundwater samples were collected from four monitoring wells, and tested for Sodium, Nitrate-N, Total Organic Carbon (TOC), Total Dissolved Solids (TDS) and Chloride. The results of these tests are reported in the DSIR, Appendix 1 - "Laboratory Test Results". The location of the test wells is indicated in the DSIR Appendix 5, Figure 2.

7.0 Phosphorus and Other Constituent Loading Rates

See Table 13 of the Engineering Report for Nitrogen Loading Rates. See Table 4 of the Engineering Report for Phosphorus loading rates. No other constituents of potential interest are known to exist.

8.0 Determination of Wetted Field Areas and Required Storage Volume

These calculations are included in the Engineering Report Section IX and Tables 14 and 15. The key outcome of the water balance calculations is that ample storage capacity is included in the system's conceptual design. This outcome validates both the sizing of the irrigation areas and the storage capacity.

9.0 Process Design for Pre-Application Treatment Facility

In addition to the information required by Williamson County within this section of the report, it is worthwhile to describe the systems' operations in some detail to provide a picture of the passage and transformation of wastewater through the reclamation and reuse process. Such a description may be found in the Engineering Report, Section VI. Figures 2 and 3 of the Engineering Report provide a Process Flow Diagram and a Schematic Flow Diagram, respectively.

9.1 Schematic of Pump Stations and Unit Processes

Figure 3 of the Engineering Report provides a Schematic Flow Diagram of the unit processes of the Sheaffer System.

The collection system layout and pump station schematics will be submitted for review and approval to Williamson County and TDEC in the Detailed Design Phase.

9.2 Basin Volumes, Loading Rates, and Hydraulic Detention Times

See Table 3 of the Engineering Report.

9.3 Capacity of All Pumps, Blowers and Other Mechanical Equipment, Including Pump Curves and Hydraulic Calculations for the Distribution System.

Calculations of aeration requirements, blower sizing and aerator requirements are included in Table 6 of the Engineering Report.

Calculations of pump capacity for the irrigation system are included in Table 7.

Pump curves for the irrigation pump and other design details will be submitted for review and approval to Williamson County and TDEC in the Detailed Design Phase.

9.4 Design Life of the Treatment and Disposal System

The design life of the wastewater reclamation and reuse system is 25 years. With proper maintenance and replacement of worn equipment, the system at age 25 will be prepared for an additional 25 years of design life.

10.0 Detailed Site Investigation Report

Submitted under separate cover.

11.0 Identify and Show the Back-up wastewater reuse site. Describe proposed uses.

The back-up wastewater reuse site (Secondary Irrigation Area) is shown in Figure 7. The site will remain as open space and will not be used for any purpose other than irrigation.

12.0 Detailed Construction Cost Estimate for the Wastewater Treatment and Disposal System.

Table 16 of the Engineering Report presents a Preliminary Detailed Construction Cost Estimate. Table 17 of the Engineering Report presents a Preliminary Operation & Maintenance Budget.

13.0 Description of The "back-up" System Proposed in Accordance with Williamson County Regulations.

The proposed wastewater reclamation and reuse system is simple, rugged, and reliable. These features are fully discussed in the Waterbridge Engineering Report in Section X. The system also contains features that provide redundancy, for example, there are backup air blowers provided. Each treatment cell contains aerators.

The reuse of reclaimed wastewater is not required on a daily basis because ample, excess storage capacity is provided. This means that irrigation equipment is not needed every day, and interruptions in service do not result in system failure.

Finally, the system is based on a daily design flow that is unlikely to ever be reached. This is due to the water saving features built into new homes and the control of infiltration and inflow provided by new collection lines. This means that the designed storage capacity and the calculated irrigation rates are unlikely to ever be reached.

In conclusion, the proposed reclamation and reuse system contains numerous features that provide redundancy.

14.0 Discuss Any Auxiliary Disposal Sites

No auxiliary disposal sites are proposed for consideration.

Engineering Report
Sheaffer System
Waterbridge Development
Williamson County, Tennessee

August, 2003

Presented To:
Waterbridge

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Enhancing Land and Water, Naturally

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Executive Summary

This engineering report is organized to follow the table of contents recommended by the Tennessee Department of Environment and Conservation (TDEC) in "Design Criteria for Sewage Works", April 1989, Chapter 1.2.

The purpose of the report is to establish the engineering basis for a Sheaffer Modular Reclamation and Reuse System (SMRRS) to service the proposed Waterbridge Development in Williamson County, Tennessee. Wastewater reclamation and storage will be provided in two deep aerated cells, followed by chlorination, to meet TDEC standards.

A separate Design Development Report (DDR) and Detailed Site Investigation Report (DSIR) have been prepared in accordance with "Regulations for Wastewater Treatment and Land Disposal Systems", April 12, 2000, Tables 1.9 and 1.9.1. The DDR is attached. The DSIR has been provided under separate cover.

The treated water will be reused to irrigate areas reserved in the development plan. A series of calculations are provided in the engineering report to establish appropriate irrigation rates for the intended land uses and other site-specific conditions.

All of the wastewater generated by the development will be reclaimed and reused within the Waterbridge Development. There will be no surface discharge to Arrington Creek. Adverse, off-site impacts will be avoided.

The design flow for the Waterbridge Development is 78,400 gallons per day (gpd) to provide service to 224 Equivalent Dwelling Units (EDUs) at 350 gpd per EDU. The SMRRS, with its long treatment and storage times is well-suited to handle fluctuations in daily flow and loadings. In addition, its operating characteristics (absence of odors, sludge and noise) make it an appropriate choice for a residential setting.

I. Purpose and Need for the Proposed Project

A Sheaffer Modular Reclamation and Reuse System (SMRRS) will be used to recycle the wastewater generated by the Waterbridge Development on Nolensville Road in Williamson County, Tennessee. The Waterbridge Development is a planned community on 283 acres located as shown in Figure 1. A SMRRS is appropriate for this project for several reasons:

- It does not create nuisance odors
- It does not generate sludge
- It uses available open space for irrigation of reclaimed water
- It does not discharge pollutants to surface waters
- It eliminates adverse impacts on surrounding landowners

II. Design Population with the Method of Determination

There is no current population on-site, and the design population is presented in Table 1. The concept plan for the development is based on a marketing study which predicts market demand. Accordingly, a layout was created with identified lot sizes, lot numbers, and corresponding housing stock. The estimates of flow per household unit are taken from the TDEC guidance on this topic, which specifies a flow rate of 100 gallons per person per day. Single family homes are assumed to have an average population of 3.5 persons; all of the housing proposed for the development will be single family homes. The flow estimates are expected to be overstated due to the following factors:

- All of the homes will be new construction and will require the installation of low-flow plumbing,
- All of the sewage collection lines will be new, and infiltration and inflow should not be noticeable, and
- The SMRRS functions as an equalization basin to accommodate fluctuations in daily flow, and averages daily flows over a 36-day period or longer.

III. Nature and extent of the area to be served, including immediate and probable future development

The Waterbridge Development consists of 283 acres in Williamson County, Tennessee. It is a planned residential development with no commercial or industrial land uses. The property is located on Nolensville Road, and includes a segment of Arrington Creek in the northwest section of the property. There are no future probable developments of the property, and no service is planned to be provided to other developments.

Table 1: Annual Average and Peak Flow Calculations

Type of Dwelling	Number of Units	Population		GPD Per Person	Average Daily Flows (GPD)
		Per Unit	Total		
Single Family	224	3.5	350	100	78,400
			Basis of Design Flow:		**78,400**
Total Average Daily Flow (gpd)	Population Equivalent (PE)	EDUs	Pop./EDU	Peak GPD[1]	Peak GPM
78,400	784	224	3.5	303,068	**210**
				Peak Factor	3.9

[1] Peak flows are determined using a peaking factor based on Harmon's Equation, $(18 + P)^{1/2} / (4 + P)^{1/2}$, where P = PE in thousands.

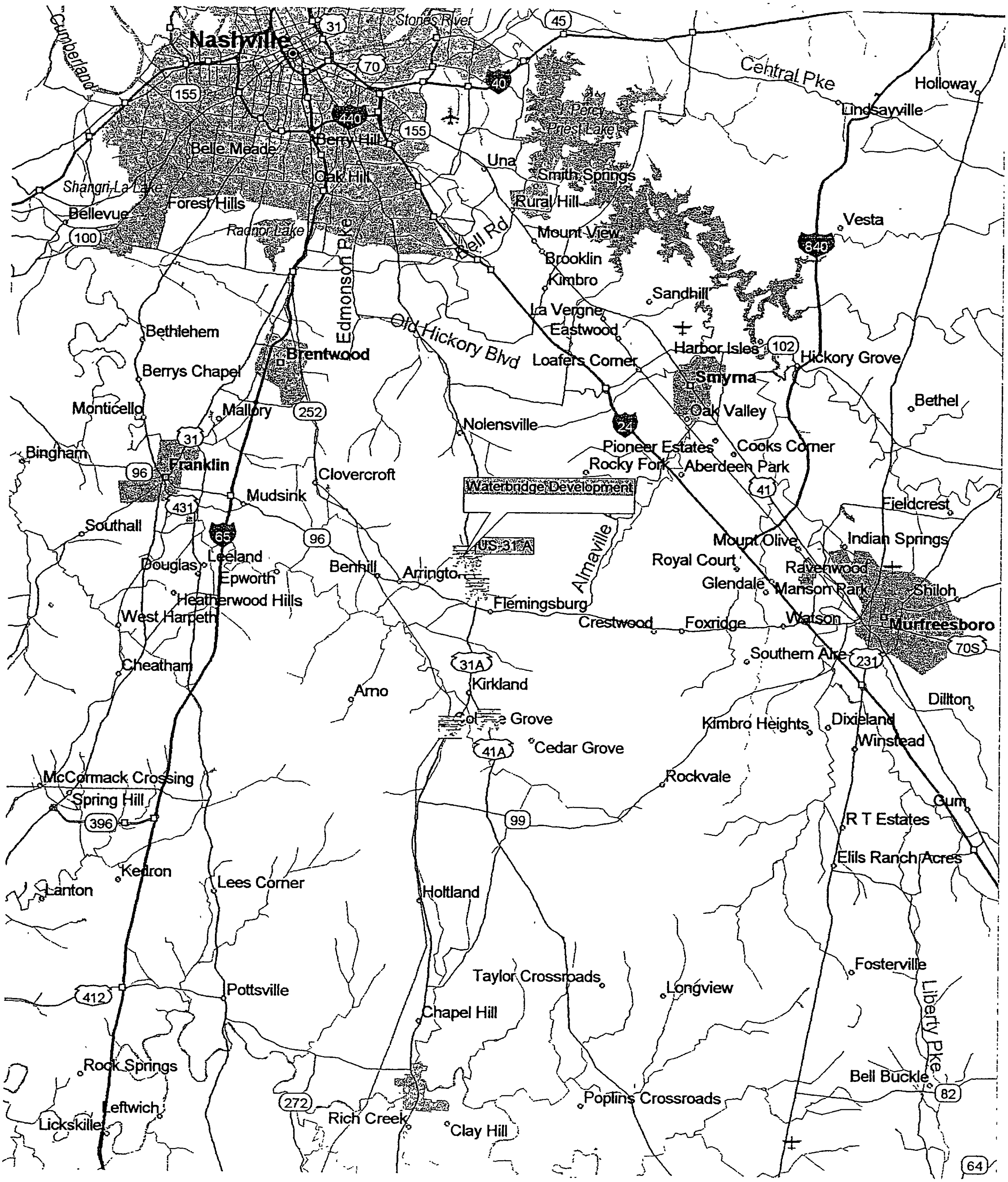
IV. Description of the existing collection and/or treatment system, including its condition and problems, renovation and rehabilitation or replacement requirements

There are no existing collection or treatment systems on site.

V. Present basis of design, including reliable measurements or analysis of flow and wastewater constituents and hydraulic, organic and solids loadings attributed to residential, commercial, and industrial users

Table 1 presents flows attributable to residential users and calculates peak flow conditions using the Harmon equation. There are no commercial or industrial users. Table 2 presents a calculation of loadings from the residential users. The BOD calculation is based on TDEC guidance, and values for TSS, Nitrogen, Phosphorus and other constituents are based on commonly cited values for the characteristics of domestic wastewater.

Waterbridge Development
Site Location Map



Sheaffer
INTERNATIONAL, L.L.C.

FIGURE 1
SITE LOCATION MAP

SMRRS ENGINEERING REPORT
WATERBRIDGE DEVELOPMENT
WILLIAMSON COUNTY, TENNESSEE

APRIL 2003

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Table 2: Wastewater Characteristics and Design Loading Rates

Parameter	Population Equivalent (PE)	Pounds/ PE/Day[1]	Loading Rate (lbs/day)	Flow (gpd)	Concentration (mg/L)[1]
BOD_5	784	0.170	133	78,400	204
TSS	784	0.220	172	78,400	264
Organic N	784	0.013	9.8	78,400	15
Ammonia N	784	0.021	16.4	78,400	25
TKN (Organic + Ammonia)	784	0.033	26.2	78,400	40
Nitrate	784	0	0	78,400	0
Nitrite	784	0	0	78,400	0
Total N	784	0.033	26.2	78,400	40
Total P	784	0.007	5.2	78,400	8
Chloride	784	0.042	32.7	78,400	50
Metals	784			78,400	Trace
Priority Pollutants	784			78,400	Trace

[1] Pounds/PE/Day and Concentrations are based on *Recommended Standards for Wastewater Facilities*, 1997, by the Great Lakes Mississippi Board of State and Provincial Public Health and Environmental Managers (also known as "The Ten States' Standards"). Additional data from Wastewater Engineering, Metcalf & Eddy, Table 3-16, 1991.

[2] Metals are reported in Metcalf & Eddy source as "trace quantities" and are reported in septage as consisting primarily of iron, zinc, and aluminum (Table 3-17).

[3] Priority Pollutants include heavy metals, and also include many synthetic organic compounds. Many volatile organic compounds are also considered priority pollutants, and their concentration in domestic wastewater is reported as 100 to 400 ug/l, which is a trace amount.

VI. Treatment process and schematic flow diagrams giving the plant unit design parameters

A process flow diagram is presented in Figure 2 and a schematic flow diagram is shown in Figure 3. Table 3 presents design parameters. Tables 4 and 5 present reclaimed water constituents and pollutant reduction calculations, respectively. Further details of aeration calculations are provided in Table 5.

The SMRRS provides 36 days of aerated treatment and 70 days of winter storage, followed by disinfection, before the reclaimed water is irrigated. Irrigation calculations, following TDEC guidance, indicate that designed storage will be adequate (see Section IX and Tables 10 – 15). The main components of the system contain three moving parts: the comminutor, blowers, and irrigation pump. Chlorine disinfection requires additional pumping. These processes are discussed in the following passages.

Grinder Pumps

Sewage is conveyed in a gravity collection system to pump stations equipped with grinder pumps. The grinder pumps macerate solids in the wastewater, and the pump station sends wastewater through a force main to the bottom of the head of Treatment Cell I. The grinding of wastewater solids into small particles facilitates thorough mixing in Cell I.

Aerated Treatment Cells

The treatment of the wastewater will be provided in two deep aerated treatment cells. Both of the cells provide an anaerobic (non-aerated) treatment zone underneath the deep, aerobic treatment zone. Space for winter storage is provided above the aerobic treatment zone. Either cell may be the primary treatment cell; a bypass manhole will be provided at the inlet. Under normal conditions, the influent is introduced at the base of Cell I (the anaerobic zone). It flows by gravity from Cell I slightly below the top of the aerobic zone to the base of Cell II (the anaerobic zone).

In the anaerobic zone, organic solids in the influent wastewater break down to CH_4 (methane), CO_2 (carbon dioxide), H_2S (hydrogen sulfide), N_2 (nitrogen gas), and H_2O (water). Inorganic solids accumulate in the anaerobic zone over time. Space for solids storage is provided at the base of the treatment cells for more than 40 years. See Table 6.

Compressed air blowers introduce air directly above the anaerobic zone through static tube aerators, creating the aerobic zone. The gases created through decomposition of solids in the anaerobic zone are soluble in the aerobic zone. This includes the odorous element of the decomposition, H_2S, which converts to the odorless form of SO_4 (sulfate) in the aerobic zone. Because no odorous components of wastewater decomposition are exposed to the atmosphere, there are no nuisance odors emitted from the system.

The aeration system is sized to routinely provide more than 2.0 pounds of Oxygen per pound of BOD. The deep cell and the large bubble aeration provide an oxygen transfer efficiency of more than 10 percent.

The wastewater moves laterally though the treatment cells in a plug-flow fashion. The soluble biodegradable organic materials in the influent are metabolized quickly into microbial cells, which are suspended solids. The oxidation of soluble gas released from the anaerobic zone is maximized in the aerated section of Cell I.

As the wastewater moves laterally through Cell I, heavier solids settle back into the anaerobic zone, where the conversion by digestion into soluble gases continues.

Figure 2: Process Flow Diagram

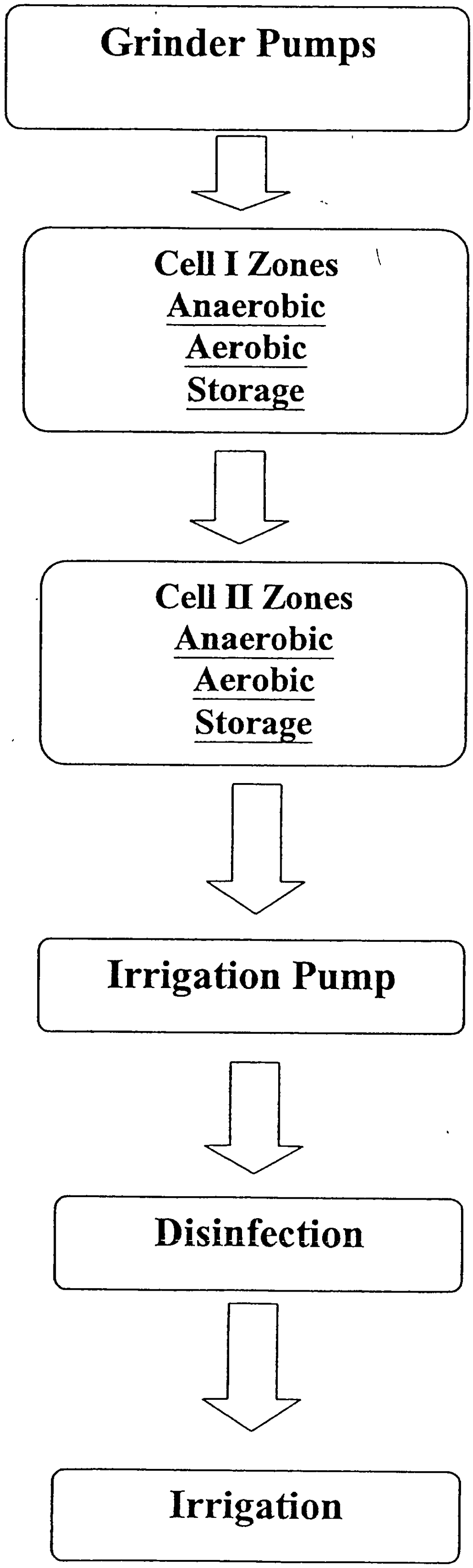

Table 3: Design Parameters

1. Wastewater flows and BOD$_5$ loading						
	Average flow	78,400	gpd	54	gpm	
	Average BOD$_5$ load	133	lbs/day			
	Peak hourly flow	303,068	gpd	210	gpm	
2. Comminutor						
	Maximum flow capacity			210	gpm (peak flow)	
3. Reclamation and Storage Cells						
		Cell I (gal)	**Cell I (days)**	**Cell II (gal)**	**Cell II (days)**	**Total (days)**
Treatment Capacity		1,881,600	24	940,800	12	36
Storage Capacity		1,646,400	21	3,841,600	49	70
Total Capacity		3,528,000		4,782,400		
Acre-feet Capacity		10.8		14.7		
Anaerobic Zone Depth		3		3		
Aerobic Zone Depth		18		18		
Freeboard		2		2		
Total Cell Depth		23		23		
Surface Acres		1.34		1.71		
Berm Slope (X :1)		3		3		
Total Acreage			5.41			
Includes Slope, Berms, Operations Building and Roads						
		Cell I		Cell II		
Aeration (scfm)		228		23		
No. of Static Tube Aerators		10		10		
Blower Size Required*		200	scfm (rounded)	# of blowers:	2	
4. Chlorination						
**Designed for landscape irrigation in the "Design & Permitting" Phase.*						
5. Irrigation Flow and Area						
Irrigation Season Length		325	Days		46	Weeks
Irrigation Design Load / Year		163.71	Acre Inches Per Acre		31,408,435	Gpy
Average Irrigation / Week		3.5	Acre Inches Per Acre		676,489	gal/week
Average Irrigation / Day		0.50	Acre Inches Per Acre		96,641	gpd
Acres Required		7.07	Acres			

The water from the top Cell I is next drained by gravity into the bottom of Cell II. Cell II provides the same combination of aerobic/anaerobic treatment, but at a different scale. In Cell II, the size and spacing of the aeration equipment is the same as Cell I to create a redundant treatment cell. In normal operations, only a few aerators will be used in Cell II.

The reclamation cells will be constructed with an impervious clay liner (2 feet of compacted clay with an exfiltration rate of 1×10^{-7} cm per second) or an HDPE membrane liner to meet the requirements of the Tennessee Department of Environment and Conservation. Four groundwater monitoring wells will be installed; one upgradient and three down-gradient to demonstrate that groundwater quality is being protected.

The design of the deep, aerated reclamation cells is based on the design flow and loadings summarized in the tables presented above. Further engineering calculations for pollutant reduction can be found in Table 5.

Storage

The SMRRS provides flexibility to manage irrigation reuse through the construction of storage capacity. Storage capacity is incorporated into the two reclamation cells by providing excess aerobic volume. The storage volume is designed to hold reclaimed water throughout the longest non-irrigation period of any calendar year. This is determined using TDEC methods for assessing the climate record, irrigation practices, and storage needs (see Tables 10 – 15).

Disinfection

The reclaimed wastewater will be disinfected with sodium hypochlorite. As used in public water supply purification, chlorination destroys pathogens that may remain in the reclaimed water. Disinfection essentially eliminates fecal coliforms in the reclaimed water.

Sodium hypochlorite (12 percent solution) will be used with equipment capable of supplying a maximum dosage of 10 mg/L. Chlorine contact time will be 30 minutes.

At the design irrigation flow (40 hours per week) and a dosage rate of 6 mg/L for a 12 percent sodium hypochlorite solution, the average daily dosages are readily calculated. Chlorine contact will take place within an oversized pipeline delivering water to the irrigation areas. A chlorine residual monitoring station will be included to provide assurance that a chlorine residual is present after the 30 minutes of contact time.

Table 4: Reclaimed Water Constituent Concentrations and Loading

Parameter	Loading Rate (lbs/acre/year)	Flow (gpd)	Concentration (mg/L)[1]
BOD_5	82	78,400	2
TSS	338	78,400	10
Organic N	34	78,400	1
Ammonia N	17	78,400	0.5
TKN (Organic + Ammonia)	51	78,400	1.5
Nitrate	270	78,400	8
Nitrite	17	78,400	0.5
Total N	334	78,400	10
Total P	230	78,400	6.8
Magnesium [1]	338	78,400	10
Calcium [1]	7,364	78,400	218
Sodium [1]	405	78,400	12
Chloride [1]	777	78,400	23
TDS [1]	8,479	78,400	251
Electrical Conductivity [2]		0.39 mmho/cm	
Sodium Adsorption Ratio [3]		0.22	

[1] Data provided by Nolensville/College Grove Utility District; Fax to Sheaffer International, LLC; 5/30/03 for water supply sources; <10% well water and >90% surface water purchased from Smyrna.
[2] Formula is EC = TDS / 640; Wastewater Engineering, Metcalf & Eddy, Third Edition, 1992, p.1145.
[3] Formula for SAR from Wastewater Engineering, Metcalf & Eddy, Third Edition, 1992, p1148.

Table 5: Pollutant Reduction Calculations (mg/L)

Parameter	Influent	Cell 1	Cell 2	
Days [1]	NA	34.5	37	
BOD_5 [2]	204	23	2	
TSS [4]	264	40	10	
Total N [3]	40	20	10	
Total P [4]	8.4	7.5	6.8	

NA = Not Applicable N = Nitrogen P = Phosphorus

[1] Days includes 50% of storage days

[2] BOD_5 removal is calculated from the formula t = E/[2.3K(100-E)], where t = residence time in days, E = % BOD_5 removed in aerated cell, K = Reaction Coefficient, base 10. Assumed to be 0.10 at 60 F for domestic wastewater. This formula is taken from Recommended Standards for Sewage Works by the Great Lakes Upper Mississippi River Board of State Sanitary Engineers ("The Ten State Standards"), 1997.

[3] Total Nitrogen removal may be calculated from the formula $Cn_e = (Cn_i)e^{-0.0075(t)}$, where: Cn_e = Effluent Total Nitrogen Concentration, Cn_i = Influent Total Nitrogen Concentration, t_i = residence time in days. This formula for anaerobic decomposition is taken from EPA Process Design Manual for Land Treatment of Municipal Wastewater. System experience (see Appendix F) indicates that the long-term aerobic reclamation of wastewaters in the SMRRS further reduces Nitrogen levels through chemical oxidation, to approximately 50% after Cell I and 25% after Cell II.

[4] TSS and Total P stage concentrations are based on data from similar systems.

Irrigation

After undergoing the process described above, the reclaimed water is pumped out of Cell II, and piped to the irrigation site. Primary and secondary irrigation areas are provided.

The irrigation layout includes the acres needed to reuse the design flow. Solid set irrigation apparatus will be used to apply the reclaimed water.

Irrigation will be managed to prevent runoff, and will be limited by the capability of the soils to absorb, use, and recharge reclaimed water. No irrigation will take place on slopes >30%. (On-site slopes do not exceed 5%.) Irrigation will be limited to prevent ponding and runoff. The intent of the irrigation plan is to keep vegetation flourishing, and to manage the reclaimed water produced by the treatment system entirely within the soils on-site. Three hundred foot (300') buffers are delineated from property lines along with a 150-foot buffer from Arrington Creek and a 50-foot buffer from the drainage easement on the site (see Figure 7).[1]

Table 6: Aeration Calculations

	24 hrs/day			
	Cell I	**Cell II**	**Storage**	**Total**
Effective Treatment Days (Design detention + 50% of storage capacity)	35	37	Included in Cell I and Cell II	71
Removal Efficiency	88.8%	89.4%	0.0%	98.8%
Removal (lb/day BOD)	118	13	0	132
Rate (scf/lb BOD)	2,500	2,500	2,500	2,500
Rate (lb O2/lb BOD)	4.4	4.4	4.4	4.4
scf air req'd	295,717	33,301	0	329,017
scfm	205	23	0	228
Aerator capacity (20 scfm)				
Aerators Required	10	10		

VII. Solids handling and disposal options and recommendations

The SMRRS produces little solids because the system is designed to eliminate organic materials, rather than produce them. Calculations of solids accumulation are based on the inorganic

[1] The 300-foot buffer from property lines is per TDEC's Design Criteria for Sewage Works, Chapter 9.3.1.1a. The 150-foot buffer from Arrington Creek is per TDEC's Design Criteria, Table 16-3.

fraction present in domestic wastewater, and ample storage area is provided at the base of Cell I and Cell II for this purpose. A calculation of accumulation rates and available storage indicates that more than 40 years of storage will be available. An attached series of reports in Appendix A shows that at one SMRRS, which has been operating for 12 years, less than 5% of the storage capacity was consumed.

When necessary, the accumulated solids will be removed by floating dredge. If the solids were removed today, the two most likely destinations for the solids are landfilling or land application. However, regulatory standards for solid waste characterization and disposal are likely to change over the 25-year design period.

Table 7: Irrigation Pump Capacity Calculations

Irrigation Season Length	325 Days	46 Weeks
Average Irrigation / Week	3.5 Acre Inches Per Acre	676,489 gal/week
Average Irrigation / Day	0.50 Acre Inches Per Acre	96,641 gpd
Acres Required	7.07 Acres	
Maximum Irrigation/Month	23.0 Acre Inches Per Acre	
Maximum Irrigation/Week	5.4 Acre Inches Per Acre	1,029,924 gal/week
Average Irrigation/Day (5 day week)	1.07 Acre Inches Per Acre	205,985 gpd
Flow per 8-hour day		617,954 gpd
Irrigation Pump Capacity (40 hours/week of irrigation)	**429.1** Gallons/minute	

Table 8: Solids Reduction Calculations

PE	lb/PE/Day	Pounds (annual)	cubic yds. (@ 250 lbs./c.y.)	Yearly Prod (cu ft)	Accum/Yr (c.f. @ 90% vol. sol.)
784	0.22	62,955	504	13,598	1,360
	Solids Storage	Depth	Anaerobic Volume (Cu. Ft.)	Solids Storage (years)	
	Cell I	3	60,831	45	
	Cell II	3	90,505	67	
	TOTALS		151,336	111	

VIII. Flood conditions

Figure 4 shows the location of the 10, 50, and 100-year floodplains as determined onsite. The SMRRS will be located outside of the 100-year floodplain; the irrigation areas (both primary and secondary) will be located outside of the 10-year floodplain.

Table 8: Solids Reduction Calculations

PE	lb/PE/Day	Pounds (annual)	cubic yds. (@ 250 lbs./c.y.)	Yearly Prod (cu ft)	Accum/Yr (c.f. @ 90% vol. sol.)
784	0.22	62,955	504	13,598	1,360

	Solids Storage	Depth	Anaerobic Volume (Cu. Ft.)	Solids Storage (years)
	Cell I	3	60,831	45
	Cell II	3	90,505	67
	TOTALS		151,336	111

VIII. Flood conditions

Figure 4 shows the location of the 10, 50, and 100-year floodplains as determined onsite. The SMRRS will be located outside of the 100-year floodplain; the irrigation areas (both primary and secondary) will be located outside of the 10-year floodplain.

IX. Soil and geologic conditions

A Detailed Site Investigation Report (DSIR), prepared by AMEC, Inc., has been submitted under separate cover to provide the following information.

- Soil tests performed sufficient to provide moisture and compaction data for construction of berms and liner, along with a calculation of permeabilities at 90% and 95% Proctor density.

- Borings for representative subsurface conditions. A minimum of 10 feet below the bottom footing grade of major structures is recommended. (There are no major structures proposed.)

- Boring logs or schematic drawings indicating changes of soil types and/or refusal depths.

- Unsuitable soil conditions must be identified and correction or removal contingencies shall be provided.

- Karst features must be noted with an evaluation of surface water drainage.

- Where rock is encountered above the bottom footing grade of structures, representative core data shall be provided to 5 feet below grade. Weathered rock conditions shall be indicated along with mud seams or weathered bedding planes.

- Domestic potable wells within 1000 feet of a plant shall be located along with land use of the surrounding area (residential, agricultural, industrial).

- Perched water tables shall be noted with construction contingencies provided.

The Soils Survey of Williamson County, Tennessee provides useful information for the selection of locations for the SMRRS and related irrigation areas. Table 9 summarizes the soil types and their characteristics. Figure 5 shows the placement of different soil types on the site. An extra high density soils map is included in the preliminary AMEC soils study to further refine the soils map.

Table 9: Site Soil Characteristics

Symbol	Soil Name	Depth to bedrock	Seasonal high water table	Soil Profile, Permeability & Texture		
				Profile	Permeability (in/hr.)	Texture
CaA	Captina Silt Loam (phosphatic)	3' to 10'	1.5' to 3.0' perched	0-10"	0.8 - 2.5	Silt loam
				10-24"	0.8 - 2.5	Silty clay loam
				24-48"	>0.2	Silty clay loam
				48-72"	<0.2-2.5	Silty clay loam, clay, or gravelly silty clay loam
Me	Melvin Silt Loam (phosphatic)	3' to 10'	1.5' to 3.0' perched	0-24"	0.8 -5.0	Silt Loam
				24 - 60"	0.2-2.5	Silty clay loam
Eg	Egan Silt Loam (phosphatic)	2' to 10'	1' to 3'	0-24"	0.8 - 2.5	Silt Loam
				20 - 72"	0.2 - 0.8	Silty clay loam or clay
Lp	Lindside Silt Loam (phosphatic)	2' to 10'	0' to 3'	0-40"	0.8-2.5	Silt loam or loam
				40-60"	0.2-2.5	Silt loam or silty clay
La	Lanton Silt Loam (phosphatic)	2' to 6'	1' to 3'	0-12"	0.8-2.5	Silt Loam or silty clay loam
				12-60"	0.2-2.5	Silty clay loam or clay

Hu	Huntington silt loam (phospatic)	3' to 10'	3' to 10' or more	0-12"	0.8 - 2.5	Silt loam or loam
				12-80"	0.8 - 2.5	Silty clay loam or gravelly silt loam
Rb	Robertsville Silt Loam (phosphatic)	3' to 10'	0' to 2'	0-10"	0.8-2.5	Silt loam
				10-20"	0.2-0.8	Silt loam, silty clay loam, or clay
				20-60"	<0.2	Silty clay or clay
Du	Dunning silt loam (phosphatic)	2' to 6'	0' to 2'	0-12"	0.8-2.5	Silt loam or silty clay loam
				12-60"	0.2-2.5	Silty clay loam or clay
HeB2 & HeC2	Hampshire-Colbert Silt Loam (2% to 5% slopes; HeB2) (5% to 12% slopes; HeC2) eroded	1.5' to 5'	10' or more	0-10"	0.8-2.5	Silt loam
				10-40"	<0.2	Clay
InD3	Inman Silty Clay Loam (12 to 20% slopes), severely eroded	1' to 3'	10' or more	0-20"	<0.2	Silty Clay or Clay
ImE	Inman Silt Loam (20 to 30% slopes)	1.5' to 4'	10' or more	0-6"	0.2-0.8	Silt loam
				6-24"	<0.2	Silty loam or clay
CkE	Culleoka Silt Loam (20 to 35% slopes)	3' to 10'	20' or more	0-12"	0.8-2.5	Silt loam or loam
				12-48"	0.8-5.0	Clay loam
				48-72"	0.2-5.0	Flaggy clay loam

HnC2	Hicks Silt Loam (5-12% slopes), eroded	2' to4'	15' or more	0-6"	0.8-5.0	Silt loam or loam
				6-36"	0.8-5.0	Silty clay loam or loam
StC2	Stiversville Silt Loam (5 to 12% slopes), eroded	2.5' to 5'	15' or more	0-8"	0.8-5.0	Silt loam
				8-24""	0.8-5.0	Silty clay loam or clay loam
				24-48"	2.5-5.0	Clay loam
MbB2	Maury Silt Loam (2 to 5% slopes), eroded	3' to 8'	10' or more	0-10"	0.8-2.5	Silt loam
				10- 30"	0.8-2.5	Silty clay loam
				30-60"	0.2-0.8	Silty clay or clay

IX.1 Determination of Irrigation Flow Rates

TDEC guidance provides example calculations for land application systems. One important factor in these equations is the limiting permeabilities in the soil column in the areas selected for irrigation. Table 9 indicates the soil permeabilities indicated in the Williamson County Soils Survey. The Detailed Soil Investigation Report (DSIR) contains detailed soil permeabilities for the site. The irrigation system is proposed to function through a combination of water outputs related to evaporation, evapotranspiration, and vertical and lateral permeabilities. The proposed average application rate of 2.85 inches/week falls well within the range of expected hydraulic and nutrient limitations. Tables 12 - 15 provide irrigation loading and water balance calculations. These tables were derived using the guidance provided by TDEC in "Design Criteria for Sewage Works" (Design Criteria), Chapter 16 and Appendix A. The following paragraphs describe these calculations in more detail.

Hydraulic Loading

Table 12 calculates the maximum allowable monthly hydraulic load to the site irrigation areas. The days available for irrigation in each month was taken directly from the example report provided by TDEC in Appendix A (page 3). The hydraulic load is equal to potential evapotranspiration (PET) + percolation – precipitation (see TDEC's Design Criteria equation 16-2.

The PET provided was taken from the Soils Survey of Williamson County, Figure 36, Page 141. The Soils Survey data were derived using the Thornthwaite method for determining PET over a 30-year period of record. TDEC advocates this method in the Design Criteria Chapter 16.7.3.

Precipitation data was provided by the National Climatic Data Center (NCDC) for the period 1970-2000. The monthly average rainfall for this period of record is provided in Table 10. The precipitation numbers provided in Table 12 were derived using TDEC's Design Criteria Chapter 16.7.4.a., the five-year return method. The five year return calculation is tabulated in Table 11.

Percolation data is taken directly from TDEC's Design Criteria Appendix A, Table A-4. The data assumes that the limiting soil permeability is 0.3 inches/hour or greater. Actual permeabilities for the soils in the irrigation areas were tested as part of the DSIR. The results can be found in Appendix 1 of the DSIR, and indicate that all soils exceed 0.3 in/hr.[2]

Nitrogen Loading

Table 13 calculates the maximum allowable monthly nitrogen load to the site irrigation areas. As in Table 12 for hydraulic loading, Table 13 utilizes the days available for irrigation provided by TDEC's Design Criteria, Appendix A. Using TDEC's Design Criteria equation 16-5, the maximum monthly irrigation allowed by nitrogen load limitation (Lwn) is equal to:

$$Lwn = \frac{Cp(Pr\text{-}PET) + U(4.424)}{(1\text{-}f)(Cn) - Cp}$$

Where:

[2] The Dunning soil series was tested to be less than 0.3 in/hr, but this series is not present in the proposed irrigation areas.

Table 8: Monthly Average Rainfall (inches) for Franklin, Tennessee 1970 - 2000 Sorted for Highest Annual Rainfall

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total Annual
1979	8.53	4.21	4.66	8.06	12.60	3.93	4.54	5.83	10.39	3.43	7.41	4.57	78.16
1973	3.91	4.03	12.58	8.35	6.95	4.78	6.43	1.84	3.95	3.61	8.83	3.48	68.74
1989	5.84	8.57	6.97	3.52	5.00	11.30	3.78	2.12	5.26	5.59	4.96	2.30	65.21
1975	4.95	5.85	15.25	2.54	4.26	2.53	1.83	3.54	5.82	5.93	2.69	5.28	60.47
1974	10.18	3.72	3.47	4.65	5.1	9.48	1.69	2.88	8.33	1.5	5.46	3.78	60.24
1982	6.88	5.81	3.21	4.41	6.12	1.68	7.00	5.05	3.39	2.06	5.32	8.38	59.31
1994	5.40	6.25	10.20	6.31	4.04	4.03	3.24	5.40	2.86	3.99	4.85	2.66	59.23
1977	2.54	3.39	5.85	6.20	3.05	7.53	4.81	3.96	6.87	4.35	6.04	3.50	58.09
1998	4.81	5.36	3.86	7.37	3.75	10.93	7.06	2.79	0.88	1.82	1.40	8.06	58.09
1972	5.64	2.87	5.09	2.79	3.01	1.14	12.71	2.32	2.52	4.49	5.46	9.92	57.96
1995	5.25	1.93	4.30	4.51	12.20	3.19	5.90	3.87	4.10	5.21	4.43	2.49	57.38
1990	3.51	8.44	4.47	1.74	3.82	1.45	6.09	1.27	2.81	4.29	4.36	13.82	56.07
1997	6.16	3.52	10.14	2.33	6.40	7.19	2.76	3.14	4.95	2.58	3.20	3.35	55.72
1991	2.85	5.88	6.01	5.38	4.86	3.68	4.14	3.79	2.40	3.89	1.74	10.82	55.44
1984	1.32	2.58	6.24	8.55	12.15	0.54	6.33	5.94	0.64	NA	7.45	3.69	55.43
1983	3.00	2.87	4.00	7.12	13.05	3.48	0.68	NA	0.91	3.15	8.93	7.92	55.11
1996	4.79	2.60	5.10	5.08	4.02	3.13	7.31	1.93	4.95	2.72	5.33	6.91	53.87
1992	2.61	3.93	5.46	2.17	5.19	7.59	6.40	3.61	5.19	1.51	4.81	3.31	51.78
1978	4.06	0.89	5.05	2.14	6.86	1.08	4.41	6.75	0.93	3.09	4.30	11.71	51.27
1986	0.47	5.21	3.86	1.06	3.95	4.43	2.37	4.44	6.70	4.02	10.33	4.29	51.13
1976	6.02	3.53	6.22	1.40	5.53	4.71	3.38	4.73	3.69	7.31	1.38	1.75	49.65
1970	1.02	5.02	4.22	6.66	4.37	7.11	3.92	2.45	2.75	4.11	2.73	4.48	48.84
1980	4.09	1.80	9.90	4.11	8.74	2.56	6.94	1.59	2.66	1.38	2.76	1.81	48.34
1981	1.57	4.37	4.26	3.29	3.11	6.21	5.65	4.37	3.77	2.78	2.18	4.53	46.09
1993	2.68	3.08	5.75	4.45	5.45	2.55	1.10	4.51	3.09	1.28	3.30	7.84	45.08
1988	4.29	3.14	2.66	4.45	2.31	0.00	3.83	2.85	5.01	2.00	8.34	6.18	45.06
2000	4.18	3.92	4.15	7.64	7.06	2.21	2.20	2.86	2.81	0.25	6.84	NA	44.12
1985	2.08	3.38	3.73	3.84	2.79	3.56	3.05	6.24	3.33	2.54	6.42	1.33	42.29
1971	3.03	5.58	3.71	3.12	4.73	1.1	6.23	3.17	2.06	2.6	1.26	5.16	41.75
1987	2.40	5.13	3.02	1.72	1.17	3.19	4.11	3.11	4.45	0.59	5.63	7.01	41.53
1999	8.58	3.49	4.11	2.91	3.07	4.29	3.20	1.62	1.57	1.83	2.95	2.88	40.50
Average	4.28	4.20	5.73	4.45	5.64	4.21	4.62	3.60	3.84	3.13	4.87	5.44	54.00
% Avg	7.9%	7.8%	10.6%	8.2%	10.4%	7.8%	8.5%	6.7%	7.1%	5.8%	9.0%	10.1%	100.0%
5-Yr Return	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: National Climatic Data Center Station #403280 in Franklin, Tennessee, 1970-2000.
Five year return on 30 year rainfall record used, per TDEC "Design Criteria for Sewage Works", 16.7.4.

Table 9: Precipitation 5-Year Return

Year	Total Annual	Rank	Probability	Recurrence
1979	78.16	1	3.13	32.0
1973	68.74	2	6.25	16.0
1989	65.21	3	9.38	10.7
1975	60.47	4	12.50	8.0
1974	60.24	5	15.63	6.4
1982	59.31	6	18.75	5.3
1994	59.23	7	21.88	4.6
1977	58.09	8	25.00	4.0
1998	58.09	9	28.13	3.6
1972	57.96	10	31.25	3.2
1995	57.38	11	34.38	2.9
1990	56.07	12	37.50	2.7
1997	55.72	13	40.63	2.5
1991	55.44	14	43.75	2.3
1984	55.43	15	46.88	2.1
1983	55.11	16	50.00	2.0
1996	53.87	17	53.13	1.9
1992	51.78	18	56.25	1.8
1978	51.27	19	59.38	1.7
1986	51.13	20	62.50	1.6
1976	49.65	21	65.63	1.5
1970	48.84	22	68.75	1.5
1980	48.34	23	71.88	1.4
1981	46.09	24	75.00	1.3
1993	45.08	25	78.13	1.3
1988	45.06	26	81.25	1.2
2000	44.12	27	84.38	1.2
1985	42.29	28	87.50	1.1
1971	41.75	29	90.63	1.1
1987	41.53	30	93.75	1.1
1999	40.50	31	96.88	1.0
Average	54.00			
% Avg	100.0%			
5-Yr Return	**66.57**			

Five year return is the average of the five highest annual precipitation for the 31-year record.
Probability = (100*Rank) / (N +1)
Recurrence = 1/(Probability/100)

Table 10: Maximum Hydraulic Loading Calculations

Month	Days Available	PET (inches)	Precip (inches)	Percolation (inches)	Hydraulic Loading (Lwh) (inches)
January	10	0.6	5.27	7.20	2.53
February	20	0.7	5.18	14.40	9.92
March	31	1.0	7.06	22.32	16.26
April	30	2.1	5.48	21.60	18.22
May	31	3.8	6.95	22.32	19.17
June	30	5.5	5.19	21.60	21.91
July	31	6.4	5.69	22.32	23.03
August	31	5.6	4.44	22.32	23.48
September	30	4.2	4.73	21.60	21.07
October	31	2.3	3.86	22.32	20.76
November	30	1.4	6.01	21.60	16.99
December	20	1.0	6.71	14.40	8.69
TOTALS	**325**	**34.6**	**66.57**	**234.00**	**202.03**

Saturated Vertical + Horizontal Permeability (in./hour):	> 0.3

Table 8 is based on TDEC's "Design Criteria for Sewage Works" (Design Criteria), April 1989, Table A-4.

Days available based on TDEC's Design Criteria Appendix A Page 3.

PET (potential evapotranspiration) based on Soils Survey of Williamson County, Figure 36, Page 141, which used the Thornthwaite method over a 30-year period of record, per TDEC's Guidelines 16.7.3

Precip based on National Climatic Data Center EPA Model-3 for Station #403280 in Franklin, Tennessee, 1970 - 2000 using the Five year return method recommended by TDEC's Design Criteria 16.7.4.a.

Percolation based on Days Available * 0.3 hydraulic conductivity (in/hr) * 24 hours/day * 10%

Hydraulic Loading (Lwh) = (PET + Percolation) - Precipitation

The permeability of all soils series to be irrigated was tested to be >0.3 in/hr. See the DSIR.

Table 11: Determination of Maximum Allowable Monthly Hydraulic Wastewater Loading Comparing Infiltration and Nitrogen Loading Rates

Month	Days Available	PET	% Use	lbs. use	Nitrate Loading (in/acre/month)	Hydraulic Loading (in/acre/month)	Design Loading (in/acre/month)
January	10	0.6	1%	2	5.16	2.53	2.53
February	20	0.7	2%	4	6.42	9.92	6.42
March	31	1.0	4%	8	10.51	16.26	10.51
April	30	2.1	8%	16	14.03	18.22	14.03
May	31	3.8	12%	24	19.51	19.17	19.17
June	30	5.5	15%	30	20.99	21.91	20.99
July	31	6.4	17%	34	23.50	23.03	23.03
August	31	5.6	15%	30	20.30	23.48	20.30
September	30	4.2	12%	24	17.41	21.07	17.41
October	31	2.3	8%	16	12.57	20.76	12.57
November	30	1.4	4%	8	9.35	16.99	9.35
December	20	1.0	2%	4	7.40	8.69	7.40
TOTALS	**325**	**34.6**	**100%**	**200**	**167.14**	**202.03**	**163.71**

Percolate Nitrogen (mg/l):		5
Effluent Nitrogen (mg/l):		15
	f:	25%

Table 9 is based on TDEC's "Design Criteria for Sewage Works" (Design Criteria), 1989, Table A-5.

Pounds Use and % Use are taken directly from TDEC's Design Criteria Appendix A Table A-5, which assumes 200 pounds crop nitrogen uptake/acre/year.

Nitrate Loading is determined using TDEC's Design Criteria, Section 16.8.2, Equation 16-5: Lwn = (Cp(Pr - PET) + U(4.424)) / ((1 - f)(Cn) - Cp) Where:

Lwn = allowable monthly hydraulic loading rate based on nitrogen inches/month.

Cp = nitrogen concentration in the percolating wastewater, mg/l. TDEC usually uses 10 mg/l. With the Sheaffer system, we anticipate 5 mg/l. See Appendix C of this Engineering Report for reference site data.

Pr = Five-year return monthly precipitation, inches/month (See Table 8).

PET = potential evapotranspiration, inches/month (See Table 8).

U = nitrogen uptake by crop, pounds/acre/month.

Cn = nitrogen concentration in applied wastewater, mg/l (after losses in preapplication treatment).

f = fraction of applied nitrogen removed by denitrification and volatilization.

Solving for the above equation, A = ((28.616 + 2.79)*36.83) / 163.71 = 7.07 acres

IX.3 Storage Volume Calculation and Water Balance

Tables 14 and 15 provide calculations for determining the storage volume of the Sheaffer System and provide a water balance. These tables are based on TDEC's Design Criteria, Appendix A, Table A-7, as indicated in the following explanation of variables.

Precipitation is taken from Table 13. The method used for determining precipitation have already been detailed in the Hydraulic and Nutrient Loading sections of this report.

Potential evapotranspiration (PET %) was taken from Table 13 for each month and converted to a percentage of the annual total PET. The resulting PET % was then used to allocate the 20 inches of evaporation recommended by TDEC's Design Criteria, Appendix A, Storage volume calculation, Step 2. Seepage was assumed to be zero.

The previous section, on irrigation area acreage calculation, provided a formula for calculating the Total Water to Storage, utilizing system influent flow, precipitation, evaporation, and seepage. Converting the Total Water to Storage to acre-inches allows a comparison to be made with the maximum irrigation flow (Lwd) on a monthly basis. Thus a Water Balance may be created, tracking influent flows vs effluent flows to ensure that adequate storage capacity is maintained at all times. In Table 14, the "Potential Cumulative Storage, Acre Inches" column makes this comparison, assuming the maximum irrigation flow. Note that the resulting values for July – November are all negative, and the value for December is zero. This indicates that the Waterbridge SMRRS will irrigate less than the maximum allowable amount (163.71 inches) in order to retain adequate water in the cells for the full, design treatment time.

We next present a potential operating scenario, to approximate what actual irrigation flows might be desirable. Table 15 includes columns for an Actual Irrigation Flow, Acre Inches, an Actual Storage Volume, Acre Inches, and also an Actual Available Storage Volume, in Acre Inches. Finally, the table provides a column that compares the Actual Available Storage Volumes for each month to the Waterbridge SMRRS Total Storage Capacity. If the actual available storage volume is zero or less, the storage capacity would be exceeded and the column would report "YES".

Note that the Actual Cumulative Storage Volume values are all positive, indicating that irrigation flows have not exhausted the capacity of fully treated, reclaimed water. The Actual vs Total comparison column indicates "NO" for every month, meaning that the storage volume has not been exceeded. Thus, this is one viable operating scenario for the Waterbridge SMRRS.

Figure 6 shows the location and direction of all residences, commercial development, and water supplies within 1/2 mile of the proposed treatment system and irrigation areas. This figure was provided by Williamson County based on GPS data. In addition, the Nolensville Utility District has confirmed that all residences in proximity to the site are connected to a public water supply. No residential housing is located within 500 feet of the proposed reclamation system or irrigation areas.

Table 12: Water Balance and Storage Reservoir Evaluation

Month	Pr inches	ET %	Evap. Inches	Seepage, Inches	Water loss or gain, in	Water loss or gain (Vm), MG	Influent, MG	Total Water to Storage, MG	Total Water to Storage, Acre Inches	Max Irrigation (Lwd), Acre Inches	Difference, Acre Inches (J-K)	Potential Storage Volume, acre inches
Jan	5.27	1.7%	0.35	0.00	4.93	0.30	2.43	2.73	14.21	2.53	11.68	11.68
Feb	5.18	2.0%	0.40	0.00	4.78	0.29	2.20	2.48	12.94	6.42	6.52	18.20
Mar	7.06	2.9%	0.58	0.00	6.48	0.39	2.43	2.82	14.69	10.51	4.18	22.38
Apr	5.48	6.1%	1.21	0.00	4.27	0.26	2.35	2.61	13.59	14.03	-0.44	21.95
May	6.95	11.0%	2.20	0.00	4.75	0.28	2.43	2.71	14.15	19.17	-5.02	16.93
Jun	5.19	15.9%	3.18	0.00	2.01	0.12	2.35	2.47	12.89	20.99	-8.10	8.83
Jul	5.69	18.5%	3.70	0.00	1.99	0.12	2.43	2.55	13.29	23.03	-9.74	-0.91
Aug	4.44	16.2%	3.24	0.00	1.20	0.07	2.43	2.50	13.04	20.30	-7.26	-8.17
Sep	4.73	12.1%	2.43	0.00	2.31	0.14	2.35	2.49	12.98	17.41	-4.43	-12.61
Oct	3.86	6.6%	1.33	0.00	2.53	0.15	2.43	2.58	13.46	12.57	0.89	-11.72
Nov	6.01	4.0%	0.81	0.00	5.20	0.31	2.35	2.66	13.88	9.35	4.53	-7.19
Dec	6.71	2.9%	0.58	0.00	6.13	0.37	2.43	2.80	14.58	7.40	7.19	0.00
Yr 1	66.57	100.0%	20.00	0.00	46.57	2.79	28.62	31.41	163.71	163.71		
Jan	5.27	1.7%	0.35	0.00	4.93	0.30	2.43	2.73	14.21	2.53	11.68	11.68
Feb	5.18	2.0%	0.40	0.00	4.78	0.29	2.20	2.48	12.94	6.42	6.52	18.20
Mar	7.06	2.9%	0.58	0.00	6.48	0.39	2.43	2.82	14.69	10.51	4.18	22.38
Apr	5.48	6.1%	1.21	0.00	4.27	0.26	2.35	2.61	13.59	14.03	-0.44	21.95
May	6.95	11.0%	2.20	0.00	4.75	0.28	2.43	2.71	14.15	19.17	-5.02	16.93
Jun	5.19	15.9%	3.18	0.00	2.01	0.12	2.35	2.47	12.89	20.99	-8.10	8.83
Jul	5.69	18.5%	3.70	0.00	1.99	0.12	2.43	2.55	13.29	23.03	-9.74	-0.91
Aug	4.44	16.2%	3.24	0.00	1.20	0.07	2.43	2.50	13.04	20.30	-7.26	-8.17
Sep	4.73	12.1%	2.43	0.00	2.31	0.14	2.35	2.49	12.98	17.41	-4.43	-12.61
Oct	3.86	6.6%	1.33	0.00	2.53	0.15	2.43	2.58	13.46	12.57	0.89	-11.72
Nov	6.01	4.0%	0.81	0.00	5.20	0.31	2.35	2.66	13.88	9.35	4.53	-7.19
Dec	6.71	2.9%	0.58	0.00	6.13	0.37	2.43	2.80	14.58	7.40	7.19	0.00
Yr 2	66.57	100.0%	20.00	0.00	46.57	2.79	28.62	31.41	163.71	163.71		

Table 10 is based on TDEC's "Design Criteria for Sewage Works", 1989, Table A-7

Precipitation (inches) is taken from Table 8.

Evaporation is assumed to be 20 inches/year, per TDEC's Design Criteria, Appendix A, Storage Calculation Step 2., and appropriated for each month according to the monthly PET in Table 8.

Seepage is assumed to be 0 inches/year. The Waterbridge SMRRS will have a compacted soil liner designed per TDEC's Design Criteria Section 9.4.1.1.

Water loss or gain = Precip - Evap - Seepage

Total water to storage = Influent wastewater + net water loss or gain

Actual Available Storage is determined as of the end of each month.

Table 13: Example Actual Irrigation Scenario

Month	Total Water to Storage, Acre Inches	Actual Irrigation (Lwd), Acre Inches	Actual Difference, Acre Inches (J - N)	Actual Storage Volume, Acre Inches	Actual Available Storage, acre inches	Is Actual > Total Capacity?
Jan	14.21	0.00	14.21	14.21	187.90	NO
Feb	12.94	0.00	12.94	27.14	174.96	NO
Mar	14.69	2.00	12.69	39.84	162.27	NO
Apr	13.59	5.00	8.59	48.43	153.68	NO
May	14.15	10.00	4.15	52.58	149.52	NO
Jun	12.89	15.00	-2.11	50.47	151.63	NO
Jul	13.29	20.00	-6.71	43.76	158.34	NO
Aug	13.04	20.00	-6.96	36.81	165.30	NO
Sep	12.98	15.00	-2.02	34.79	167.32	NO
Oct	13.46	10.00	3.46	38.25	163.86	NO
Nov	13.88	5.00	8.88	47.13	154.98	NO
Dec	14.58	0.00	14.58	61.71	140.39	NO
Yr 1	163.71	102.00			202.11	Total Storage Capacity, inches
Jan	14.21	2.00	12.21	73.92	128.19	NO
Feb	12.94	5.00	7.94	81.86	120.25	NO
Mar	14.69	8.00	6.69	88.55	113.56	NO
Apr	13.59	10.00	3.59	92.14	109.96	NO
May	14.15	15.00	-0.85	91.30	110.81	NO
Jun	12.89	15.00	-2.11	89.18	112.92	NO
Jul	13.29	20.00	-6.71	82.48	119.63	NO
Aug	13.04	20.00	-6.96	75.52	126.59	NO
Sep	12.98	15.00	-2.02	73.50	128.61	NO
Oct	13.46	10.00	3.46	76.96	125.15	NO
Nov	13.88	8.00	5.88	82.84	119.26	NO
Dec	14.58	6.00	8.58	91.43	110.68	NO
Yr 2	163.71	134.00				

Data demonstrating anticipated seepage rates of the proposed pond bottom at the maximum water surface elevation included in the DSIR Section 3.5 and Appendix 1.

Figure 7 shows the location of the SMRRS and related irrigation areas including elevations and contours.

X. Alternative solutions and the rationale for recommending the chosen alternative, considering economics of operations and effectiveness

At the outset of this discussion, it is worthwhile to state that the SMRRS eliminates the nuisance conditions associated with conventional wastewater treatment plants or other systems containing anaerobic or facultative lagoons. This is primarily due to design features that eliminate the direct exposure of wastewater to the air, keep cell contents well-mixed, and minimize the generation of solids. An expanded discussion follows:

1. <u>**No Nuisance Odors**</u> – No nuisance odors will be detected from the facility by neighboring residents. When standing next to the treatment facilities, the experience is similar to standing next to a lake.
2. <u>**No Frequent Sludge Handling**</u> – The SMRRS is designed to eliminate --not grow – sludge in the reclamation process. Instead, organic matter is completely consumed, leaving a small fraction of residual solids to accumulate. The large size of the reclamation cells and the slow rate of accumulation means that routine solids removal and treatment can be limited to once every forty years or longer.
3. <u>**No Nuisance Noise**</u> – The SMRRS design limits moving parts and, consequently, operating headaches. System moving parts include pumps, comminutor (for macerating waste matter), blowers, and disinfectio equipment, and irrigation rigs/sprinklers. Of these, only the blowers present a potential noise problem. To address this concern, Sheaffer selects blowers and enclosures for the aeration system specifically designed to minimize noise, while not losing treatment efficiency.
4. <u>**No River Discharge of Wastewater**</u> – The federal Clean Water Act Amendments of 1972 set a goal that streams and waterways are no longer to be considered part of our nation's wastewater treatment system. Thirty years later, this vision has yet to be fully realized. EPA and state environmental agencies, however, continue to slowly tighten restrictions on wastewater river discharge permits ("NPDES" permits), raising the costs of wastewater treatment in the process. In contrast, the Sheaffer system was designed with the Clean Water Act in mind. It takes "pollutants" in treated wastewater out of our rivers and streams and instead places them on golf courses and other open spaces, where they become resources that keep open spaces green and allow crops to flourish.

TDEC suggests that he following items be considered when selecting a facility location:

1) **Proximity to residential areas.** The benign nature of the SMRRS allows it to be placed in close proximity to residential areas. However, the selected location provides a 300 foot setback from private property boundaries, and no residential properties are located with 500 feet of the reclamation system or irrigation areas.

2) **Direction of prevailing winds.** The absence of odors makes a consideration of prevailing winds moot, however, prevailing winds are from the west south west.

3) **Necessary routing to provide accessibility by all weather roads.** All weather roads can be readily provided, and a routing is shown on the site plan.

4) **Area available for expansion.** The Waterbridge Development is a planned unit development, and no expansion is anticipated, nor would service be provided to adjacent properties without securing necessary approvals.

5) **Local zoning requirements.** Approvals have been or will be obtained for development of the site at the desired density and layout. Local officials are well informed of the proposal to develop on-site wastewater reclamation and reuse. Close coordination is being maintained with Williamson County, Tennessee.

6) **Local soil characteristics, geology and topography available to minimize pumping.** These factors are considered and discussed above. The wastewater collection system will be designed by others, and will consider topography as a factor to minimize pumping.

7) **Compatibility of treatment process with the present and planned future land use, including noise, potential odors, air quality, and anticipated sludge processing and disposal techniques.** As indicated, no additional land development is planned for the site. The remaining issues are addressed above.

8) **Appropriate measures shall be taken to minimize adverse impacts.** The primary purpose of the design of the SMRRS is to minimize adverse impacts.

Two locations for the SMRRS were evaluated:

1. A site in the north central section of the site, was examined because this location was unsuitable for development and would provide a central location for acceptance of wastewater from the development. Approximately 5.8 net acres are needed for the SMRRS, and the SMRRS could fit in this location. Several factors would make this area expensive to use:

   - In this location, fill would be needed from other portions of the site in order to construct the SMRRS. There is a 60 foot difference in elevations from north to south, and extensive fill would be need to create a flat bottomed cell and to construct a large downslope berm. The SMRRS cells are commonly constructed with identical high water levels to assure that Cell II is not overtopped by flows from Cell I. A stepped arrangement of cells would be possible, however, control measures would be needed to assure that Cell II was not overfilled. This could be done with valve controlled outlets, or by pumping from Cell I to Cell II.

- Soils in area contain silts and clays useful for construction of berms, however, depths to bedrock range from 1 foot to 10 feet below ground surface, and the steeper elevations in this area have soil depths averaging 3 feet below ground surface. This implies that insufficient soils would be available within this area for the needed fill.

2. A second site in the northwest section of the property was also evaluated and is recommended for consideration. This site is in an area of gently sloping topography and site soils have depths to bedrock ranging from 10 to 15 feet. Deep, fine-grained soils are available to provide suitable materials for construction of stable berms. The area is also characterized by soils suitable for irrigation.

The treatment works structures, electrical and mechanical equipment shall be protected from physical damage by the maximum 100-year flood. Treatment works shall remain fully operational during the 100-year flood. Flood plain regulations of State and Federal agencies were considered, and the SMRRS will not be located in the 100-year floodplain.

The property developers considered other alternatives for the site, specifically STEP systems, conventional septic tanks and leach fields, "package plants" which would discharge to Arrington Creek, and the construction of a lengthy interceptor sewer to convey wastewater to existing wastewater treatment plants. None of these options provide the benefits of the SMRRS. The following items were considered in the selection of the type of treatment:

1. **Present and future effluent [treatment] requirements.** A land application system providing a level of treatment which exceeds TDEC's current requirements substantially reduces the possibility of system modifications necessary to meet new standards.

2. **Location and local topography of the plant site.** Ample acreage is available to construct the SMRRS and the associated irrigation areas.

3. **The effects of industrial wastes likely to be encountered.** No industrial wastewaters will be generated on-site, or accepted into the SMRRS.

4. **Ultimate disposal of sludge.** Sludge generation and management is a constant headache at conventional wastewater treatment plants. Septic systems also need periodic removal of sludges. The active aeration in the SMRRS converts organic material to constituent components and gasses. Removal and management of accumulated solids will occur far into the future, beyond the design life of the system. At that time, the solids will need to be characterized and a decision made in conjunction with TDEC to determine ultimate disposal (or reuse) options.

5. **System capital costs.** Capital costs are comparable to conventional wastewater treatment plants, and lower than the costs of septic systems or the construction of an interceptor sewer. (See Table 16.)

6. **System operating and maintenance costs and basic energy requirements.** The SMRRS is simple to operate and maintain. The primary responsibility of the operator is equipment maintenance. The SMRRS operates automatically 95% of the time. There are increased energy requirements compared with other alternatives because the SMRRS functions on the basis of extensive, daily aeration in deep cells. Blowers capable of providing air deep within the cells will consume more electricity than surface aerators or aeration within a shallow lagoon. However, deep, well-aerated cells are essential to produce the benefits outlined above. (See Table 17.)

7. **Existing unit process performance and capacity.** There are no existing units on the site.

8. **Process complexity governing operating personnel requirements.** The SMRRS is a simple system. There are only six moving parts in the SMRRS Network. These include:

   - The comminutor at the pump station
   - The pumps at the pump station
   - The blowers at the SMRRS
   - The pumps used for chlorine injection
   - The irrigation pumps at the irrigation pump station
   - The irrigation sprinklers

   There are no complicated pieces of equipment that require constant attention and adjustment by an operator. In contrast, the equipment in the SMRRS primarily functions in an automatic mode without direct operator input. This is true of the comminutor and the pumps at the pump station. The remaining pieces of equipment may be operated using controls and timers to adjust to system needs for aeration or irrigation. The irrigation rigs can be operated remotely. The primary function of the operator is equipment maintenance, data collection and analysis, and setting the timing for irrigation events.

   The critical piece of equipment is the pump station, and redundancy is provided in the pumps and the backup power. Backup blowers are also provided. Due to the long detention times in the SMRRS, the temporary loss of electrical power at the SMRRS is not critical. The treatment cells will not become anaerobic for days after aeration is suspended. Also the irrigation system is designed to operate on a periodic basis, so there is no need for irrigation to occur daily during the irrigation season. All of the equipment will be equipped with autodialers for use in case of equipment malfunction.

9. **Environmental impact on present and future adjacent land use.** The environmental impacts of the SMRRS are designed to be positive. The primary benefit is the absence of a point source discharge. Nutrients and water are recycled in the SMRRS, rather than discharged into surface waters.

10. **The plant design shall provide the necessary flexibility to perform satisfactorily within the expected range of waste characteristics and volume.** The SMRRS functions well as an equalization basin to balance flow and loading characteristics. The long detention times allow extended treatment of incoming flows and loads.

XI. Mass balances including loadings to each unit process and operation, including all recycle and sidestream flows. Maximum, minimum, and average flow; BOD and suspended solids loadings; and maximum, minimum, and average nutrient loadings, especially nitrogen for plants with considerable industrial loadings where appropriate or where nutrient removal is employed

There are no industrial loadings to the SMRRS. The remaining questions of mass balance are addressed in tables above.

XII. Consistency with all applicable areawide projects, drainage basins, service areas, comprehensive, and metropolitan area plans; e.g. 208, and 303(e) plans

The proposal and design is consistent with Williamson County plans and regulations.

Table 16: Pre-design Construction Cost Estimate

I. Reclamation System				
Earthwork				
Excavation	22,446	cy	$2.50	$56,114
Compacted Liner	5,593	cy	$3.00	$16,780
Earthwork Subtotal				**$72,894**
Blowers, pipes, aerators				
a. aerators/piping	21.0	each	$1,000	$21,000
b. Air headers & supports	1	LS	$25,000	$25,000
c. Water piping, valves, flow monitors, manholes	1	LS	$40,000	$40,000
d. Blowers: equipment, installation, controls, & electrical	2	each	$20,000	$40,000
e. Blower Shed	400	sf	$50	$20,000
Blowers, pipes, aerators Subtotal				**$146,000**
Fencing	1,703	lf	$12.50	**$21,293**
Roads and E & S Control	1	LS	$20,000	**$20,000**
Reclamation System Sub-Total				**$260,186**
II. Irrigation System				
a. Chlorination equip. & installation	1	LS	$15,000	$15,000
Disinfection sub-total				**$15,000**
b. Pumps, Piping				
1. Building and pump to irrigation	1	LS	$15,000	$15,000
2. Piping from SMRRS to irrigation areas	2,000	lf	$12.50	$25,000
3. Irrigation sprinklers	17.5	acres	$5,000	$87,747
4. Irrigation Controls & Electrical	1	LS	$15,000	$15,000
Disinfection, Pumps, Piping Subtotal				**$157,747**
Monitoring Wells	4	each	$2,000	**$8,000**
Irrigation System Subtotal				**$180,747**

III. Sewage Connection	22,000	lf	28.50	627,000
1. Waterbridge Collection System	~~20,000~~	lf	$28.50	~~$570,000~~
2. Manholes	50	each	$2,000.00	$100,000
3. Pump Stations	2	each	$7,800.00	$15,600
4. Force Main	2,000	lf	$28.50	~~$57,000~~
5. Stream Crossing	150	lf	$150.00	$22,500 ok
6. Connection to force main @ SMRRS	1	LS	$10,000	$10,000 ok
Subtotal				**$775,100**
Construction subtotal				**$1,216,033**
Contingency (10%)				$121,603
Construction Total				**$1,337,637**
Design & Permit Application (SMRRS)	1	LS	$92,000	**$92,000**
Design & Permit Application (Collection System)	1	LS	$68,000	**$68,000**
Construction Observation (SMRRS)	4%		$450,933	**$18,037**
Construction Observation (Collection System)	4%		$765,100	**$30,604**
Geotech	1	LS	$36,000	**$36,000**
Construction Management	8%		$1,337,637	**$107,011**
CONSTRUCTION TOTAL				**$1,582,278**
Financing				
Debt Service Reserve (10% of Bond Amount)	**10%**		$1,242,000	$124,200
Cost of Issuance, Including Letter of Credit and Underwriting	**1.5%**		$1,242,000	$18,630
Capitalized Interest (5% @ 9 mo.)	**3.800%**		$1,242,000	$47,196

CONSTRUCTION FUND AMOUNT	**$1,772,304**

Dwelling Units	224
$/Dwelling Unit (including collection system)	$7,912

Table 17: Pre-design Operations and Maintenance Cost Estimate

Sheaffer International, L.L.C.

MODULAR RECLAMATION & REUSE SYSTEM

Operation & Maintenance Cost Estimates

Design Average Daily Flow (gallons per day) = 78,400

Design Annual Flow (in 000s) = 28,616

	Items	Amount
1	Energy/Electrical Power	$1,470
2	Supplies	$3,000
3	Labor (0.5 workyear)	$22,500
4	Maintenance Reserve-2% of Equip.	$4,000
5	Monitoring Tests	$3,200
6	Taxes	$2,000
7	Insurance	$3,000
	Total Annual Cost	**$39,170**
	$ Per 1,000 gallons	**$1.37**

APPENDIX A

Reports of Solids Accumulation
At
A Similar SMRRS in Illinois

Impact Assessment of June 4-5, 2002 Construction Sedimentation Runoff to Wynstone SMRRS Cell I

Prepared For:

Wynstone Property Owners Association
Mr. Steve Wilkins, Manager

Prepared By:

Sheaffer International, L.L.C.

August 19, 2002

Background

The Wynstone Sheaffer Modular Reclamation and Reuse System (SMRRS) is a 189,000 gallon per day design flow facility. The system was first permitted in July 1987. Operations began that same year.

In June 2002, as part of ongoing development expansion construction, a stockpile was placed next to the fence bordering the SMRRS area to the north. The fence, approximately eight feet high with a six-inch gap between the bottom of the fence and the top of the berm, bordered the ten-foot wide berm along the north side of Cell I. The fill pile extended along this fence for approximately 160 feet. (See attached Figures 1 and 2). An extensive rain event from June 4 to 5, 2002 caused a portion of the fill pile to erode and flow underneath the fence onto the berm and into Cell I.[1]

Sheaffer International, L.L.C. was retained by the Wynstone Property Owners Association (POA) to determine the amount and location of this material contained in the cell, and, should it be necessary to remove any material, to determine the method and budget to do so.

Resources

On Wednesday, August 7, 2002, Mr. Nathan Hinch and Mr. Larry LeDay of Sheaffer International, L.L.C., along with Mr. Steve Elliott of McHenry Analytical Laboratories, Inc. conducted an on-site evaluation of the material accumulated at the bottom of Cell I. Figure 1 provides a drawing of sample locations. Table 1 provides sampling and test results at these locations. Samples were collected at 17 locations throughout Cell I using a "sludge judge". Of these samples, 13 were collected in the portion of Cell I in the vicinity of the presumed runoff path. Silty material was found at only two of these locations, numbers six (6) and seven (7). The silty material at location 6 was noted in the field to be a lighter color than the other samples, similar to the color of the material in the stock pile. However, a "discolored water", or highly watery, black liquid was identified at most locations.

Of the 17 samples collected from the bottom of the cell with the sludge judge, 12 were bottled and stored under EPA standard methods by Mr. Elliott and tested for Total Phosphorus. Total Phosphorus was recommended by McHenry Analytical Laboratories as a useful indicator test to distinguish the lagoon solids from material that settled in the lagoon from the fill pile runoff. Of the 12 samples, 10 were of the "discolored water" and 2 were silty material. The results of the phosphorus testing are listed in Table 1, and the laboratory certificates are attached as Exhibit B.

[1] Exhibit A is the National Weather Service's Record of River and Climatological Observations for Barrington, Illinois Station 3SW for the month of June 2002. Note that the station recorded 0.01 inches of rain on June 3 and 2.68 inches on June 4, observed from 8:00 pm on the 3rd to 8 pm on the 4th (a 24-hour period). Another 1.10 inches of rain was recorded on June 5, occurring between 7:00 and 11:00 am and for brief periods around 2:00 pm and 5:00 pm.

The grey, silty material sampled at location seven (7) was tested at 680 mg/kg Total Phosphorus. The test results from the discolored water samples ranged from 210 – 750 mg/kg, and averaged 532 mg/kg. The average of only the discolored water samples collected from the area most impacted by the runoff (locations 1-14) is 508 mg/kg. There does not appear to be a significant difference in the amount of phosphorus in the samples collected from the area most impacted by the runoff when compared to the rest of the cell. For comparison purposes, a common range of values for total phosphorus in sludge collected from a municipal sewage treatment plant would be from 5,000 to 15,000 mg/kg.

Findings

The samples collected from the bottom of Cell I using the sludge judge method indicate that there is very little solid material present at the bottom of Cell I, as shown in Table 1. Only one sample location (No. 6) indicated the presence of silty material that could be associated with the eroded stockpile material.

This suggests that the majority of the material running off from the stockpile would have been contained on the ten-foot wide, gravel access road along the top of the berm. This material would contain most of the settled solids, which would tend to be caught by the rough gravel surface of the access road. Wynstone operators noted that a few inches of stockpile material had to be removed from the access road following the rain event. An estimated 10 – 15% of the runoff material, primarily consisting of fine-grained, suspended matter, would have crossed the berm and entered Cell I.

Based on operator observation and sampling results, it is estimated that a maximum of 10 cubic yards of runoff material entered Cell I. Of this, the majority of the material remained suspended in and disbursed through Cells I and II. Wynstone system operators noted an increased cloudiness of the irrigated reclaimed water for a period following the runoff event.

A small portion of material likely remained in Cell I and accumulated on the bottom as silt. Silty material was detected at sample locations 6 and 7 (see Figures 1 and 2), amounting to 0.25 and 0.17 inches in depth at both locations, respectively. However, no accumulated silt was detected in any other sample locations presumed affected by the runoff material.

The silty material from sample location 6 was tested for total phosphorus. No significant difference in phosphorus was noted between this and the other samples. During the two months between the rain event and this sampling protocol, it is likely that the settled runoff material mixed sufficiently with the solids in Cell I to make phosphorus levels nearly uniform, yet retain a texture distinction at sample location 6.

Sample location 17 in the northeast corner was the only other site where compacted solids were found in Cell I. Six inches of solids have accumulated at this location. There was no evidence of color difference in the sample compared with all of the samples. The material at this location, therefore, consists of sewage solids rather than being the gray silty stockpile material. This finding supports operator observations that nearly all of the eroded stockpile material entering Cell I during the storms of June 4 and 5 remained suspended in the water.

An inestimable amount of the runoff material from the stockpile remained in suspension and eventually passed through both cells and was irrigated. As an example, 6 cubic yards of runoff material would add approximately 200 ppm Total Suspended Solids (TSS) to Cell I. These TSS will either be reduced through the aeration process, settled out to the bottom of the cell, or passed through to irrigation of the golf course.

Conclusion

The Wynstone SMRRS was designed to provide up to 20 years of solids storage at the bottom of the reclamation cells before any solids would need to be removed. The site evaluation conducted on August 7, 2002 indicated that this goal is achievable and that another 10 – 20 years could be added to that figure. The amount of silt retained in Cell I from the runoff material will not significantly affect this forecast. Therefore, it is not necessary to have any of the material removed from Cell I at this time.

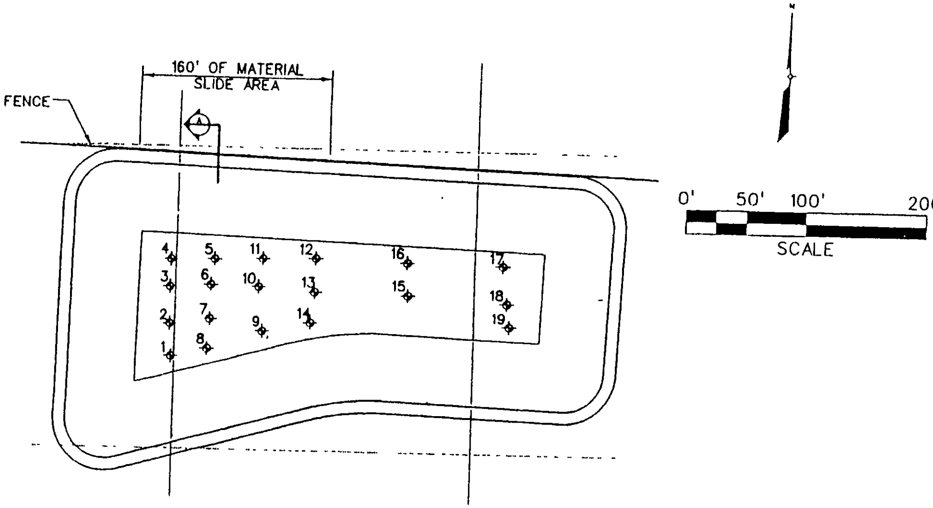

FIGURE 1 CELL 1 SAMPLE LOCATIONS

LEGEND:

SAMPLE TEST NUMBERS AND LOCATIONS

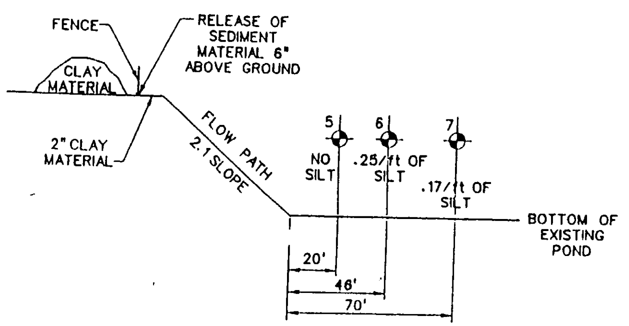

FIGURE 2 CROSS SECTION A THRU CELL 1
SCALE: NTS

TABLE 1 WYNSTONE CELL 1 BOTTOM SOLIDS SAMPLE RESULTS

Test Location	Line Number	Time Sample Collected	Water Depth (ft)	Total Discolored Depth (ft)	Discolored Water Depth (ft)	"Muddy" Solids Depth (ft)	Visual Notes	Sample Collected?	Phosphorus (mg/kg)	Notes
1	1	9 25	15	1	1	0	ND	yes	220	Near influent pipe location
2	1	9 40	16	2	2	0	ND	yes	510	
3	1	9 50	21	3	3	0	ND	yes	630	
4	1	9 55	14	2 5	2.5	0	ND	yes	630	
5	2	10 05	21	2 5	2 5	0	ND	yes	710	
6	2	10 15	21 5	2 5	2 25	0 25	See Note [1] Below	yes (2)	500 680[2]	Collected separate samples for loose and compacted solids
7	2	10 20	21	2.5	2 33	0 17	T	no	not sampled	
8	2	10 28	13 6	2	2	0	ND	no	not sampled	
9	3	10 35	14	0	0	0	ND	no	not sampled	
10	3	10 38	20	2	2	0	ND	no	not sampled	
11	3	10 43	20	1	1	0	ND	yes	700	
12	4	10 53	20	3	3	0	ND	yes	460	
13	4	10 59	20	1 5	1 5	0	ND	no	not sampled	
14	4	11 05	11 5	1 5	1 5	0	ND	yes	210	
15	5	11 10	21	2	2	0	ND	no	not sampled	
16	6	11 18	20	0 5	0 6	0	ND	no	not sampled	
17	6	11.24	20	1 5	1	0 5	T	yes (2)	750 240[2]	Collected separate samples for loose and compacted solids
18	6	11 33	20	0	0	0	ND	no	not sampled	Near Outlet Pipe to Cell II
19	6	11 36	20	0	0	0	ND	no	not sampled	Near Outlet Pipe to Cell II

ND = No color or texture difference could be distinguished in the solids collected at this location.
T = A difference in texture was noted (compacted vs loose), but no difference in color was noted
[1] At location 6, the compacted solids were noted to appear clayey and lighter in color than the loose solids
Discolored Water = Black watery mixture of a maximum of 1% solids
"Muddy" Solids = Thick, muddy solids
Total Discolored Depth = Discolored Water Depth + "Muddy" Solids Depth
[2] "Discolored water" sample results are listed first followed by "muddy" solids sample results.

NOTE:
ALL LOCATIONS ARE APPROXIMATE

Sheaffer
INTERNATIONAL LLC

FIGURES 1, 2
SHEAFFER MODULAR RECLAMATION & REUSE SYSTEM
WYNSTONE DEVELOPMENT
SOLIDS TESTING LOCATIONS - CELL1
AUG. 7 02
wynsludt dgn

Impact Assessment of June 4-5, 2002 Construction Sedimentation Runoff to Wynstone SMRRS Cell I

Dissolved Oxygen Addendum

Prepared For:

Wynstone Property Owners Association
Mr. Steve Wilkins, Manager

Prepared By:

Sheaffer International, L.L.C.

August 30, 2002

Background

This is an addendum to the "Impact Assessment of June 4-5, 2002 Construction Sedimentation Runoff to Wynstone SMRRS Cell I", prepared for the Wynstone Property Owners Association (POA) by Sheaffer International, L.L.C. on August 19, 2002. This addendum fulfills the remaining scope of work from the June 27, 2002 proposal, including:

1. Collection of Dissolved Oxygen (DO) measurements
2. Description of solids removal methods and a budget for removing solids (sinking fund) at a projected future date.
3. Operating adjustments to enhance phosphorus removal, if needed.
4. Adjustments in aeration operations based on the DO sampling.

On Tuesday, August 27, 2002, Nathan Hinch, Larry LeDay, and Robert McGowan of Sheaffer International, L.L.C., along with Mr. Steve Elliott of McHenry Analytical Laboratories, conducted an on-site evaluation of the DO levels throughout Cell I. Figure 3 depicts the sample locations and aeration pattern. DO readings were taken at each of 13 locations, at depth intervals of five feet. The readings are listed in Table 2.

Dissolved Oxygen / Aeration Performance Findings

The readings ranged from 2.5 mg/l to 4.0 mg/l at all locations at all depths, except for the readings taken just off the cell bottom. All readings less than 3.0 mg/l not taken just off the cell bottom were collected from the sampling line nearest to the cell influent pipe and outside of the aeration grid. This area of the cell had duckweed coverage, which likely indicated both an area of lesser mixing and potentially higher oxygen demand from the system influent.

Figure 3 indicates the general aeration pattern and the sample locations. Samples were generally collected between the aeration lines to ensure adequate mixing. The results of samples collected near aeration lines did not vary significantly from those collected in areas further from aerators. The northeast corner of the cell, where the highest accumulation of solids was detected, did not exhibit a decrease in oxygen when compared to the rest of the cell. This indicates that the aeration is adequately mixing aerated water, even in this corner of the cell.

Solids Removal Plan and Budget

As was indicated in the August 19, 2002 Impact Assessment, no removal of solids is necessary at this time. Though the Wynstone SMRRS was designed to provide 20 years of solids storage, the Assessment revealed that another 20 years could be added to that figure, based on sampling in Cell I. The cell was designed to hold approximately 26,900 ft^3 of solids (1 foot depth across cell), of which an estimated 433 ft^3, or 1.6%, is presently stored. Of this, an estimated 315 ft^3, or 73%, is located in the northeast corner of the cell (at the outflow end, across from the crossover pipe to Cell II). Solids sample #17 was taken in this corner of the cell, and found 6 inches of solids present, or half of the one-foot design capacity. If the accumulation continues at this rate, this corner of the cell will reach its design capacity in 17-20 years. At that time, Wynstone POA may wish to pursue one of three options:

1) Remove the solids from only this corner of the cell
2) Remove the solids from the entire cell, even though capacity will likely remain in the rest of the cell.
3) Redistribute the accumulated solids in the northeast corner of the cell to the opposite end of the cell. This will allow additional time before solids will need to be removed, and provide opportunity for Wynstone POA staff to gain experience pumping solids, before an actual removal event.

A nominal sinking fund for future solids redistribution, removal and disposal could be considered. An estimate of the removal and disposal cost in 20 years would be $60,000 (rental and operation of a floating sludge dredge, material testing and drying, temporary storage site preparation, hauling to certified disposal site) excluding inflation. Over a period of 20 years, a sinking fund of $2,300 annually at an interest rate of 3% would amass this amount. This amounts to about $6 per year per home. These estimations are based on current regulatory conditions and cannot predict future changes in regulated requirements for solids disposal. Considering the relatively small amount of solids accumulation, we recommend remeasuring the accumulation in five years. If at that time noticeable accumulation has taken place, particularly in the northeast corner of the cell, a sinking fund could be established. Because the current accumulation is minimal, we do not recommend starting a sinking fund at this time.

Conclusion

This Addendum to the August 19, 2002 Impact Assessment has determined the following:

1. Dissolved Oxygen is relatively uniform throughout the cell. This indicates effective aeration mixing.
2. No solids removal is necessary at this time. Due to the minimal accumulation, we recommend remeasuring the solids in five years before establishing a sinking fund.
3. Due to the minimal solids accumulation, no operational change is necessary at this time to improve phosphorus removal.
4. The Dissolved Oxygen in the cell is sufficient to provide aerobic treatment as the system was designed. The uniformity of the readings throughout the cell indicates effective mixing. For these reasons, no operational changes are necessary at this time to address aeration needs.

LEGEND:

- SAMPLE TEST NUMBERS AND LOCATIONS
- ⊕ EXISTING AERATOR LOCATIONS

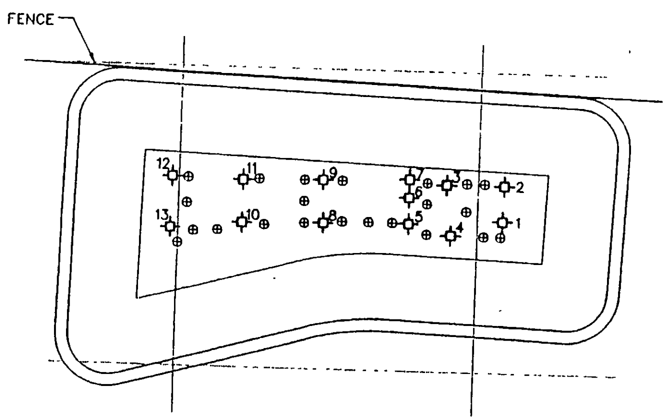

FIGURE 3 CELL 1 D. O. SAMPLE LOCATIONS

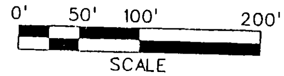

TABLE 2 WYNSTONE CELL 1 DISSOLVED OXYGEN TEST RESULTS

Test Location	Line Number	Time Sample Collected	Water Depth (ft)	DO at 5 feet	DO at 10 feet	DO at 15 feet	DO at 20 feet	DO at 25 feet	DO 6-12 Inches off bottom	Notes
1	1	9 20	Not Reached	4 00	4 00	3 95	3 90	3 30	NA	
2	1	9 30	23	3 90	3 90	3 95	3 90	NA	0 50	Near Cell II Effluent Pipe
3	2	9 45	25	3 95	3 93	3 90	3 95	3 95	NA	
4	2	9 50	22	4 00	3 95	3 85	3 85	NA	0 50	
5	2	10 00	25 5	3 70	3 65	3 75	3 75	3 60	3 60	
6	3	10 10	26	3 80	3 70	3 65	3 60	3 50	NA	
7	3	10 15	17	3 95	3 90	3 85	NA	NA	3 02	
8	4	10 25	23	3 95	3 93	3 85	3 75	NA	3 70	
9	4	10 30	23	3 55	3 45	3 45	3 44	NA	3 39	
10	5	10 40	23	3 02	3 02	3 02	3 15	NA	3 01	
11	5	10 45	21	3 05	3 15	3 15	3 15	NA	3 15	
12	6	10 52	22	2 64	2 60	2 55	2 55	NA	NA	In Duckweed covered area
13	6	11 00	18	2 85	2 75	2 75	NA	NA	2 75	Near Influent pipe location

NA = Test not available at this depth at this location

NOTE:
ALL LOCATIONS ARE APPROXIMATE

Sheaffer INTERNATIONAL LLC

FIGURE 3

SHEAFFER MODULAR RECLAMATION & REUSE SYSTEM

WYNSTONE DEVELOPMENT

DISSOLVED OXYGEN TESTING LOCATIONS - CELL1

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APPENDIX B

Performance Data from Other, Similar Sheaffer Systems

Table 2: The Chancellory SMRRS, Itasca, Illinois
BOD_5 (mg/L) Test Results

Date	Raw Influent	Influent / Cell II Reduction	Cell II	Cell II / Storage Reduction	Influent / Storage Reduction	Storage	Storage / Sprinkler Reduction	Sprinkler	Total Reduction
1981	307.0	43.9%	172.1			ND		2.0	99.3%
1983	275.3	93.5%	17.8	5.7%	99.3%	2.0	-1.3%	5.5	98.0%
1985	150.4	68.0%	48.2	28.1%	96.0%	6.0	2.7%	2.0	98.7%
1986	288.2	89.8%	29.5			ND		0.9	99.7%
1987	223.2	81.8%	40.7	13.8%	95.5%	10.0		ND	
1988	181.0	89.1%	19.8	5.4%	94.5%	10.0	4.4%	2.0	98.9%
1989	182.5	91.5%	15.5	5.2%	96.7%	6.0	3.0%	0.6	99.7%
1990	143.8	91.4%	12.4	3.2%	94.6%	7.8	4.7%	1.0	99.3%
1991	272.7	95.2%	13.0	1.2%	96.4%	9.7	3.2%	1.0	99.6%
1992	323.2	95.4%	15.0	1.6%	97.0%	9.8		<5.0	98.5%
1993	136.5	83.9%	22.0	15.0%	98.9%	1.5	-8.4%	13.0	90.5%
1995	172.0	75.6%	42.0	22.1%	97.7%	<4	0.0%	<4	97.7%
1997	117.5	78.3%	25.5	15.3%	93.6%	7.5	1.3%	6.0	94.9%
1998	180.0	92.8%	13.0	6.1%	98.8%	2.1	0.6%	<1.0	99.4%
Average	211.0	83.6%	34.8	10.2%	96.6%	6.6	1.0%	3.4	98.0%

Table 4: The Chancellory SMRRS, Itasca, Illinois
TKN (mg/L) Test Results

Date	Raw Influent	Influent / Cell II Reduction	Cell II	Cell II / Storage Reduction	Influent / Storage Reduction	Storage	Storage / Sprinkler Reduction	Sprinkler	Total Reduction
1981	21.4	NA	ND	NA	NA	ND		ND	
1983	40.8	78.4%	8.8		78.4%	ND	14.5%	2.9	92.89%
1985	37.1	76.8%	8.6	15.6%	92.5%	2.8	4.0%	1.3	96.50%
1986	31.5	87.9%	3.8		87.9%	ND		ND	
1987	46.5	48.2%	24.1	47.5%	95.7%	2.0		ND	
1988	28.8	53.8%	13.3	26.7%	80.6%	5.6	11.5%	2.3	92.01%
1989	30.1	56.8%	13.0	17.9%	74.8%	7.6	8.3%	5.1	83.06%
1990	17.1	-8.2%	18.5	25.7%	17.5%	14.1	24.6%	9.9	42.11%
1991	10.7	-84.1%	19.7	36.4%	-47.7%	15.8	26.2%	13.0	-21.50%
1992	59.1	77.5%	13.3	8.6%	86.1%	8.2	-0.7%	8.6	85.45%
1993	38.7	46.0%	20.9	42.1%	88.1%	4.6	-2.8%	5.7	85.27%
1995	30.2	89.7%	3.1	-4.3%	85.4%	4.4	6.6%	2.4	92.05%
1997	43.9	76.5%	10.3	17.0%	93.5%	2.9	2.6%	1.8	96.01%
1998	21.0	-228.6%	69.0	285.7%	57.1%	9.0	14.3%	6.0	71.43%
Average	**32.6**	**29%**	**17.4**	**47%**	**68%**	**7.0**	**10%**	**5.4**	**74%**

Table 2: Reduction in Pollution Parameters: Saddlebrook Farms

Test 1: October 1999

Parameter	Raw Influent	Cell I Inlet	Cell I Outlet	Cell II Inlet	Cell II Outlet	Irrigation Water	Reduction
Fecal Coliform (CFU/100 ml)	11,000,000	17,400	18,700	4,850	4,550	0	100%
Total Suspended Solids (mg/L)	95.00	6.00	7.20	20.00	20.00	16.00	83%
Total Volatile Suspended Solids (mg/L)	74.00	4.00	4.00	6.40	6.00	5.60	92%
BOD5 (mg/L)	150.00	14.00	16.00	7.40	7.20	<1.0	100%
Nitrogen Kjeldahl as N (mg/L)	32.00	10.00	10.00	3.00	3.00	3.00	91%
Ammonia as N (mg/L)	19.90	7.48	6.90	1.13	1.07	1.25	94%
Nitrate as N (mg/L)	0.33	0.66	0.68	2.48	2.45	2.44	NA
Phosphorus, Total (mg/L)	3.96	3.95	3.85	3.51	3.50	3.58	10%

Test 2: November 1999

Parameter	Raw Influent	Cell I Inlet	Cell I Outlet	Cell II Inlet	Cell II Outlet	Irrigation Water	Reduction
Fecal Coliform (CFU/100 ml)	8,000,000	29,600	30,600	3,280	2,880	1	99.99%
Total Suspended Solids (mg/L)	72.00	12.00	11.00	20.00	14.00	15.00	79%
Total Volatile Suspended Solids (mg/L)	54.00	5.20	4.00	5.60	5.60	4.80	81%
BOD5 (mg/L)	130.00	15.00	13.00	9.50	9.40	<1.00	99.99%
Nitrogen Kjeldahl as N (mg/L)	45.00	11.00	10.00	6.00	4.00	5.00	89%
Ammonia as N (mg/L)	24.40	8.45	8.32	3.71	3.64	3.57	85%
Nitrate as N (mg/L)	<0.30	0.79	0.79	2.00	2.00	2.09	NA
Phosphorus, Total (mg/L)	4.75	4.01	3.96	3.92	5.32	3.86	19%

Test 3: June 2000

Parameter	Raw Influent	Cell I Inlet	Cell I Outlet	Cell II Inlet	Cell II Outlet	Irrigation Water	Reduction
Fecal Coliform (CFU/100 ml)	2,600,000	9,500	10,300	3,110	490	0*	100%
Total Suspended Solids (mg/L)	43.30	6.70	6.70	7.30	6.70	9.30	79%
Total Volatile Suspended Solids (mg/L)	38.00	5.00	5.50	6.50	6.00	6.50	83%
BOD5 (mg/L)	95.00	24.00	24.00	11.00	12.00	NA*	NA
Nitrogen Kjeldahl as N (mg/L)	35.00	16.00	16.00	3.00	2.00	2.00	94%
Ammonia as N (mg/L)	13.20	13.20	13.40	0.45	0.44	0.43	97%
Nitrate as N (mg/L)	0.60	1.76	1.47	8.93	8.87	8.96	NA
Phosphorus, Total (mg/L)	3.38	4.02	3.90	3.84	3.89	3.87	NA

Test 4: October 2000

Parameter	Raw Influent	Cell I Inlet	Cell I Outlet	Cell II Inlet	Cell II Outlet	Irrigation Water	Reduction
Fecal Coliform (CFU/100 ml)	10,300,000	35,900	37,700	3,560	3,940	0	100%
Total Suspended Solids (mg/L)	65.00	32.00	32.50	31.50	28.00	24.50	62%
Total Volatile Suspended Solids (mg/L)	52.00	13.00	12.00	14.00	13.00	11.00	79%
BOD5 (mg/L)	110.00	20.00	14.00	22.00	22.00	15.00	86%
Nitrogen Kjeldahl as N (mg/L)	40.00	13.00	13.00	8.60	8.60	6.60	84%
Ammonia as N (mg/L)	26.50	10.20	9.95	5.79	5.61	4.68	82%
Nitrate as N (mg/L)	<0.020	0.94	0.94	1.80	1.90	2.70	NA
Phosphorus, Total (mg/L)	4.90	4.10	3.90	3.60	3.70	3.70	24%

* Irrigation line was not purged for the June 6, 2000 test. Fecal Coliform was retested after purging the line on June 19 resulting in the level indicated.
Source: McHenry Analytical Water Laboratory, Inc., McHenry, Illinois.

Reduction in Pollution Parameters at the Wynstone SMRRS

Test 1: April 1997

Parameter	Raw Influent	Cell I Outlet	Cell II Outlet	Pumphouse (before chlorination)	Irrigation after chlorination
Number of samples tested	0	0	0	0	4
Fecal Coliform (CFU/100 ml)	NA	NA	NA	NA	0
Total Suspended Solids (mg/L)	NA	NA	NA	NA	26
Total Residual Chlorine (mg/L)	NA	NA	NA	NA	0.10
BOD5 (mg/L)	NA	NA	NA	NA	12.10

Test 2: Sep - Dec 1997

Parameter	Raw Influent	Cell I Outlet	Cell II Outlet	Pumphouse (before chlorination)	Irrigation after chlorination
Number of samples tested	0	0	0	6	5
Fecal Coliform (CFU/100 ml)	NA	NA	NA	NA	33
Total Suspended Solids (mg/L)	NA	NA	NA	65	60
Total Residual Chlorine (mg/L)	NA	NA	NA	NA	0.80
BOD5 (mg/L)	NA	NA	NA	3.27	2.28
Nitrate as N (mg/L)	NA	NA	NA	4.27	5.13
Phosphorus, Total (mg/L)	NA	NA	NA	1.10	1.10

Test 3: October 2000

Parameter	Raw Influent	Cell I Outlet	Cell II Outlet	Pumphouse (before chlorination)	Irrigation after chlorination
Number of samples tested	1	1	1	1	0
Fecal Coliform (CFU/100 ml)	610,000	14,700	140	200	NA
Total Suspended Solids (mg/L)	72	14	8	17.50	NA
COD (mg/L)	130	37	24	23	NA
BOD5 (mg/L)	52	12	2.10	2.30	NA
Nitrogen Kjeldahl as N (mg/L)	14	3	1.70	1.70	NA
Ammonia as N (mg/L)	14.90	0.34	0	0.15	NA
Nitrate/Nitrite as N (mg/L)	0	4.30	5.64	5.64	NA
Phosphorus, Total (mg/L)	1.70	2.50	1.40	1.50	NA