IN THE TENNESSEE REGULATORY AUTHORITY
AT NASHVILLE, TENNESSEE

IN RE:	)	
	)	
PETITION OF TENNESSEE	)	
WASTEWATER SYSTEMS, INC., FOR	)	**DOCKET NO. 14-00136**
APPROVAL OF CAPITAL	)	
IMPROVEMENT SURCHARGES AND	)	
FINANCING ARRANGEMENTS	)	

SUPPLEMENT RESPONSE TO STAFF DATA REQUESTS AND TO DISCOVERY REQUESTS FROM THE CONSUMER ADVOCATE

Tennessee Wastewater Systems, Inc. ("TWSI") submits the following supplemental response to TRA Staff Data Requests I-24, I-25, I-44, I-45, I-60, I-61, I-80 and I-81 and to Question 24 of the Discovery Requests from the Consumer Advocate:

RESPONSE:

The most complete compilation of all communications between TWSI and TDEC can be found in the internal files of TDEC. TWSI does not have access to those files but will provide whatever permission may be needed to allow the TRA Staff and the Consumer Advocate to access those files.

In an effort to be responsive to the questions, TDEC has gone through its own files and pulled out all records of communications between TDEC and TWSI concerning the four treatment systems that are the subject of this docket.

All SOP-related filings are publicly available on TDEC's website under "Dataviewers" and "Water Resources Permits Dataviewers." One can access the SOP file for each of the four treatment facilities at issue in this case by entering the name of the

facility or the SOP number. (Maple Green, SOP-01028; Smoky Village, SOP-05033; Summit View, SOP-06035; Cedar Hill, SOP-05039).

Informal communications between TWSI and TDEC are not in those "Dataviewer" files but in the internal files kept by TDEC (the "Water Log"). All of those communications which TWSI has been able to locate are attached as "Supplemental Exhibit 1."

Respectfully submitted,

BRADLEY ARANT BOULT CUMMINGS LLP

By: _____

Henry Walker (B.P.R. No. 000272)
Bradley Arant Boult Cummings, LLP
1600 Division Street, Suite 700
Nashville, TN 37203
Phone: 615-252-2363
Email: hwalker@babc.com

Walker, Henry

From: Charles Hyatt [charles.hyatt@adenus.com]
Sent: Thursday, April 02, 2015 7:41 AM
To: Walker, Henry
Subject: FW: Cedar hill Submittal

From: Bob Pickney [mailto:bob.pickney @adenus.com]
Sent: Tuesday, March 31, 2015 10:08 AM
To: charles.hyatt@adenus.com
Subject: FW: Cedar hill Submittal

Adenus

Bob Pickney, P.E., Esquire

From: Brad Harris [mailto:Brad.Harris@tn.gov]
Sent: Wednesday, August 07, 2013 6:18 AM
To: Bob Pickney
Subject: RE: Cedar hill Submittal

Yes, we have it and are reviewing it now.

Brad

From: Bob Pickney [bob.pickney@adenus.com]
Sent: Tuesday, August 06, 2013 12:35 PM
To: Brad Harris
Cc: Sandra Dudley; Britton Dotson; Mike Thornton; 'Charles Hyatt'
Subject: Cedar hill Submittal

Brad,
I just wanted to confirm that you received the remediation plan last week – I need to move forward as soon as possible to schedule construction.
Thanks,
Bob

Adenus GROUP

Bob Pickney, P.E.
Adenus Group
www.adenus.com
(615)220-7160 - office
(615) 604-4712 - cell
(615) 220-7208 - fax

Walker, Henry

From: Charles Hyatt [charles.hyatt@adenus.com]
Sent: Thursday, April 02, 2015 7:40 AM
To: Walker, Henry
Subject: FW: Cedar Hill Enmergency Remediation

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, March 31, 2015 10:10 AM
To: charles.hyatt@adenus.com
Subject: FW: Cedar Hill Enmergency Remediation

Adenus
Bob Pickney, P.E., Esquire

From: Britton Dotson [mailto:Britton.Dotson@tn.gov]
Sent: Monday, June 03, 2013 7:11 AM
To: Bob Pickney; Sandra Dudley; Brad Harris; Ann Rochelle; Scotty Sorrells
Cc: 'Charles Hyatt'
Subject: RE: Cedar Hill Enmergency Remediation

We certainly understand the need to have the system operable as soon as practical. We need to meet at your earliest convenience to discuss the pre liner work. I anticipate a degree of over excavation and a well engineered base that will precede the liner; however, before we start in that direction TDEC needs to make sure that we consider the plan capable of adequately protecting groundwater from future releases.

Britton Dotson
Deputy Director, Water Quality Branch
Division of Water Resources
britton.dotson@tn.gov
(615) 532-0762

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Sunday, June 02, 2013 3:34 PM
To: Britton Dotson; Sandra Dudley
Cc: 'Charles Hyatt'
Subject: Cedar Hill Enmergency Remediation

Britton/Sandra,

I have equipment and personnel on the ground at the Cedar Hill Project. I need to fast track the coordination in order to have the system operable by the time schools re-open later this summer. If at all possible I would like to have someone to coordinate with during the planning and construction Phase that can help make decisions on the repair quickly. My initial thought is to convert the pond to two cells – only using one cell for the near future since the systems is grossly over sized for current needs and the foreseeable future growth. Then install a synthetic liner in the cell to be used. The big question in my mind is how much subsurface exploration we need to do prior to prepping for the liner. Assistance from anyone on your staff with this expertise in this area would be greatly appreciated.

Thanks,

Bob

Bob Pickney, P.E.
Adenus Group
www.adenus.com
(615)220-7160 - office
(615) 604-4712 - cell
(615) 220-7208 - fax

Walker, Henry

From: Charles Hyatt [charles.hyatt@adenus.com]
Sent: Thursday, April 02, 2015 7:41 AM
To: Walker, Henry
Subject: FW: Cedar Hill

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, March 31, 2015 10:09 AM
To: charles.hyatt@adenus.com
Subject: FW: Cedar Hill

Adenus
Bob Pickney, P.E., Esquire

From: Brad Harris [mailto:Brad.Harris@tn.gov]
Sent: Thursday, July 11, 2013 1:17 PM
To: Bob Pickney
Cc: Britton Dotson
Subject: RE: Cedar Hill

Thanks for the update.

Brad

From: Bob Pickney [bob.pickney@adenus.com]
Sent: Thursday, July 11, 2013 1:16 PM
To: Brad Harris
Cc: 'Charles. Hyatt'; 'Brian Carter'
Subject: Cedar Hill

Brad,
Just an update, the dye study is in process, and it is expected to be completed by the middle of August. The seimic study by TTL is in progress, and a final report should be ready in a few weeks. After these items are complete, I should be in a position to submit a final CAP. The dividing berm is also complete.
Bob

Adenus GROUP

Bob Pickney, P.E.
Adenus Group
www.adenus.com
(615)220-7160 - office
(615) 604-4712 - cell
(615) 220-7208 - fax

Walker, Henry

From: Charles Hyatt [charles.hyatt@adenus.com]
Sent: Thursday, April 02, 2015 7:41 AM
To: Walker, Henry
Subject: FW: Cedar Hill
Attachments: SOP-05039.CAP.LTR_signed.pdf

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, March 31, 2015 10:08 AM
To: charles.hyatt@adenus.com
Subject: FW: Cedar Hill

Adenus

Bob Pickney, P.E., Esquire

From: Brad Harris [mailto:Brad.Harris@tn.gov]
Sent: Wednesday, October 16, 2013 12:34 PM
To: bob.pickney@adenus.com
Cc: Britton Dotson
Subject: Cedar Hill

Bob,

What is the status of the revised CAP and dye trace results for Cedar Hill?

Thanks,
Brad

Brad C Harris P.E.
Division of Water Resources
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243
(615) 532-5367

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
William R. Snodgrass - Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243-1102

September 19, 2013

Mr. Bob Pickney, P.E.
Adenus Group, LLC
e-copy: bob.pickney@adenus.com
849 Aviation Parkway
Smyrna, TN 37167

Subject: Corrective Action Plan Review, SOP-05039
TN Wastewater Systems – Cedar Hill Treatment Facility
Cedar Hill, Robertson County, Tennessee

Mr. Pickney,

The DWR has reviewed the proposed remediation plan you submitted. While DWR largely agrees with the plan of action and the results from the TTL geophysical investigation the following points should be specifically addressed in a revised corrective action plan.

1. The information provided by the seismic refraction study has identified areas that warrant additional investigation. A representative from TTL should be present during the investigation to observe the test pits and interpret the results. The revised correction action plan should include a summary of both the observations and the result interpretations.

2. A report from TTL describing the results of the test pit excavations and recommendations for repair must be submitted to the DWR for consideration. If approved a representative from TTL must be present during the repair and must submit a report documenting the repairs.

3. A corrective action plan must include flow metering and recording sufficient to monitor the flow into the lagoon continuously to ensure accurate accounting of the wastewater entering the lagoon.

4. The CAP should also include the proposed liner specifications and requirements for geologic support describing the base material, thickness, geotechnical properties and installation process, liner manufacturer (GPI, Inc.) warranties and installation specifications. Installation must be certified by manufacturer or a qualified independent third party.

5. The CAP must also describe the capabilities of the existing water level monitoring system. A monitoring plan must be designed and established to evaluate the integrity of the lagoon. If the existing water level monitoring system is not sufficient to evaluate lagoon integrity, then the corrective action plan must include a system capable to meet this objective.

6. TN Wastewater must demonstrate in the CAP that sufficient suitable soil area exists (by ownership or easement) for the permitted flow.

7. The CAP must propose a timeline to have an amended engineering report reflecting the modification of the lagoon and available suitable soils area submitted. The timeline must also speak to the submission of plans for the disposal area and expected installation of the disposal system.

We appreciate your attention to these points.

If you have questions, please contact the division at your local Field Office at 1-888-891-TDEC; or, at this office, please contact Brad Harris at (615) 532-0762 or by E-mail at *Brad.Harris@tn.gov*.

Sincerely,

Britton Dotson
Deputy Director

CBD/bch

Walker, Henry

From: Charles Hyatt [charles.hyatt@adenus.com]
Sent: Thursday, April 02, 2015 7:41 AM
To: Walker, Henry
Subject: FW: Cedar Hill

-----Original Message-----
From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, March 31, 2015 10:08 AM
To: charles.hyatt@adenus.com
Subject: FW: Cedar Hill

Bob Pickney, P.E., Esquire

Adenus Group, LLC | 849 Aviation Pkwy, Smyrna, TN 37167
Direct: +1 615.220.7160 | Toll Free: +1 888.4.ADENUS Ext: 160 | Mobile: 615.604.4712 | Fax: 615.220.7207

-----Original Message-----
From: Britton Dotson [mailto:Britton.Dotson@tn.gov]
Sent: Thursday, October 17, 2013 9:04 AM
To: Bob Pickney
Subject: Re: Cedar Hill

Can you send us a copy of the dye trace report?

Thanks

Sent from my iPhone

On Oct 17, 2013, at 8:59 AM, "Bob Pickney" <bob.pickney@adenus.com> wrote:

> Brad,
> We are working on the response for the revised CAP. The dye trace
> study has been completed, and we are analyzing the results.
> Thanks,
> Bob
>
> -----Original Message-----

> From: Brad Harris [mailto:Brad.Harris@tn.gov]
> Sent: Wednesday, October 16, 2013 12:34 PM
> To: bob.pickney@adenus.com
> Cc: Britton Dotson
> Subject: Cedar Hill
>
> Bob,
>
>
>
> What is the status of the revised CAP and dye trace results for Cedar
Hill?
>
>
>
> Thanks,
>
> Brad
>
>
>
>
>
>
>
> Brad C Harris P.E.
>
> Division of Water Resources
>
> William R. Snodgrass Tennessee Tower
>
> 312 Rosa L. Parks Avenue, 11th Floor
>
> Nashville, Tennessee 37243
>
> (615) 532-5367
>
>

Walker, Henry

From: Charles Hyatt [charles.hyatt@adenus.com]
Sent: Thursday, April 02, 2015 7:41 AM
To: Walker, Henry
Subject: FW: Smokey Village

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, March 31, 2015 10:03 AM
To: charles.hyatt@adenus.com
Subject: FW: Smokey Village

Adenus
Bob Pickney, P.E., Esquire

From: John West [mailto:John.West@tn.gov]
Sent: Friday, July 13, 2012 10:28 AM
To: bob.pickney@adenus.com
Subject: Smokey Village

Bob,
It was good talking to you today. Thank you for your frank discussion. Lets meet on the site next Thursday around 11 AM. I look forward to meeting Scott as well.
John West
865-594-5522

Walker, Henry

From: Charles Hyatt [charles.hyatt@adenus.com]
Sent: Thursday, April 02, 2015 7:41 AM
To: Walker, Henry
Subject: FW: Smokey Village

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, March 31, 2015 10:03 AM
To: charles.hyatt@adenus.com
Subject: FW: Smokey Village

Adenus

Bob Pickney, P.E., Esquire

From: Woody Smith [mailto:Woody.Smith@tn.gov]
Sent: Tuesday, January 15, 2013 2:53 PM
To: Bob Pickney
Cc: John West; Charles. Hyatt; Charles Pickney; Brian Carter
Subject: RE: Smokey Village

Agreed

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, January 15, 2013 3:42 PM
To: Woody Smith
Cc: John West; Charles. Hyatt; Charles Pickney; Brian Carter
Subject: Smokey Village

Woody,
I am close to completing the deal for the additional land at Smokey Village, I should have a signed contract in the next week or two. With your permission, I want to delay my response to you request until I get the signed contract for the land.
Thanks,
Bob

Walker, Henry

From: Charles Hyatt [charles.hyatt@adenus.com]
Sent: Thursday, April 02, 2015 7:41 AM
To: Walker, Henry
Subject: FW: Smokey Village

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, March 31, 2015 10:03 AM
To: charles.hyatt@adenus.com
Subject: FW: Smokey Village

Adenus

Bob Pickney, P.E., Esquire

From: Woody Smith [mailto:Woody.Smith@tn.gov]
Sent: Tuesday, March 19, 2013 8:39 AM
To: 'Bob Pickney'
Cc: Jason Mann
Subject: RE: Smokey Village

Thanks for the update on Smokey Village. That sounds good.

We have of course been wondering how your facility at Black Bear resorts is faring in the fire. I hope they got as much rain as we got yesterday to help put it out. Let us know what you find out. Nobody can do anything I guess until the firefighters give the all clear.

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, March 19, 2013 8:38 AM
To: Woody Smith
Cc: 'Charles Hyatt'; 'Brian Carter'; 'Scottie Miller'
Subject: Smokey Village

Woody,
Just an update, we have closed on the land and the pits for the soil map have been completed – all indications are the soil is actually much better than I had expected. Kevin Davis should complete the soil map in the next week or two, and I will be I a position to move forward with the design. I have also met with the neighbors, and getting the easements should not be a problem.

FYI – we have no definite information on Black Bear at this time – we know there is damage, but we don't think our treatment systems have been imp[acted based on aerial views of the fire. If we have issues, we will let you know.
Thanks,
Bob

Bob Pickney, P.E.
Adenus Group
www.adenus.com
(615)220-7160 - office
(615) 604-4712 - cell
(615) 220-7208 - fax

Walker, Henry

From: Charles Hyatt [charles.hyatt@adenus.com]
Sent: Thursday, April 02, 2015 7:42 AM
To: Walker, Henry
Subject: FW: Summit View Appeal

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, March 31, 2015 10:01 AM
To: charles.hyatt@adenus.com
Subject: FW: Summit View Appeal

Bob Pickney, P.E., Esquire

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Monday, November 24, 2014 9:40 AM
To: 'Patrick Parker'
Subject: RE: Summit View Appeal

Thank you,
Bob

Bob Pickney, P.E., Esquire

From: Patrick Parker [mailto:Patrick.Parker@tn.gov]
Sent: Monday, November 24, 2014 8:56 AM
To: 'Bob Pickney'
Cc: George Bell
Subject: RE: Summit View Appeal

Bob,

It has been sent to APD which I think is what your talking about. I do not believe a ALJ has been assigned as yet.

Patrick

Patrick Parker
Tennessee Department of Environment and Conservation
Office of General Counsel
William R. Snodgrass Tennessee Tower, 2nd Floor
312 Rosa L Parks Avenue, Nashville, TN 37243
(615) 532-0129
patrick.parker@tn.gov

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Monday, November 24, 2014 7:51 AM
To: Patrick Parker
Subject: Summit View Appeal

Patrick,
I am trying to determine if TDEC has sent my appeal to the AG's office - WPC14-0092. Can you update me on the status of this appeal -
Thank You,
Bob

Adenus

Bob Pickney, P.E., Esquire

Walker, Henry

From: Charles Hyatt [charles.hyatt@adenus.com]
Sent: Thursday, April 02, 2015 7:42 AM
To: Walker, Henry
Subject: FW: TWSI Summit View Appeal

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, March 31, 2015 10:01 AM
To: charles.hyatt@adenus.com
Subject: FW: TWSI Summit View Appeal

Bob Pickney, P.E., Esquire

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, January 06, 2015 10:40 AM
To: 'Patrick Parker'
Subject: TWSI Summit View Appeal

Patrick,
I still have not heard anything on the WPC14-0092 appeal - can you update me?
Bob

Bob Pickney, P.E., Esquire

Walker, Henry

From: Charles Hyatt [charles.hyatt@adenus.com]
Sent: Thursday, April 02, 2015 7:42 AM
To: Walker, Henry
Subject: FW: TWSI Summit View Appeal

From: Bob Pickney [mailto:bob.pickney@adenus.com]
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Bob Pickney, P.E., Esquire

Walker, Henry

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From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, March 31, 2015 10:01 AM
To: charles.hyatt@adenus.com
Subject: FW: TWSI Summit View Appeal

Adenus
Bob Pickney, P.E., Esquire

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, January 06, 2015 1:26 PM
To: 'Patrick Parker'
Subject: RE: TWSI Summit View Appeal

Patrick,
That would be good.
Thanks,
Bob

Adenus
Bob Pickney, P.E., Esquire

NOTICE: This message is intended only for the addressee and may contain information that is privileged, confidential and/or attorney work product. If you are not the intended recipient, do not read, copy, retain or forward this message or any attachment. Please notify the sender immediately and delete all copies of the message and any attachments. Neither the transmission of this message or any attachment, nor any error in transmission, constitutes a waiver of any applicable legal privilege. To ensure compliance with requirements imposed by the IRS, we inform you that any U.S. federal tax advice contained in this communication (including any attachments) is not intended or written to be used, and cannot be used, for the purpose of avoiding penalties under the Internal Revenue Code.

From: Patrick Parker [mailto:Patrick.Parker@tn.gov]
Sent: Tuesday, January 06, 2015 12:48 PM
To: 'Bob Pickney'
Subject: RE: TWSI Summit View Appeal

Bob,

It has been assigned to ALJ Ann Johnson. I have not heard from her to schedule a scheduling conference. Do you want me to contact her to see if we can get one scheduled.?

Patrick

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, January 06, 2015 10:40 AM
To: Patrick Parker
Subject: TWSI Summit View Appeal

** This is an EXTERNAL email. Please exercise caution. DO NOT open attachments or click links from unknown senders or unexpected email - OIR-Security **

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Adenus

Bob Pickney, P.E., Esquire

Walker, Henry

From: Charles Hyatt [charles.hyatt@adenus.com]
Sent: Thursday, April 02, 2015 7:41 AM
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Subject: FW: Cedar hill

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, March 31, 2015 10:09 AM
To: charles.hyatt@adenus.com
Subject: FW: Cedar hill

Adenus
Bob Pickney, P.E., Esquire

From: Brad Harris [mailto:Brad.Harris@tn.gov]
Sent: Thursday, June 20, 2013 9:54 AM
To: Bob Pickney
Cc: Britton Dotson
Subject: RE: Cedar hill

Ok...thanks

From: Bob Pickney [bob.pickney@adenus.com]
Sent: Thursday, June 20, 2013 9:58 AM
To: Brad Harris
Subject: Cedar hill

Brad,
Just an update – I expect that Crawford Hydrology Laboratory will begin the dye trace study the first of next week. I also have under contract TTL to make recommendations concerning the liner installation and testing. TTL wants to complete a seismic refraction test before making any final recommendations. I want their recommendations before submitting a CAP. Also the separation berm will be complete this week. All effluent is contained in the upper section of the pond. Depending on timing of reports/approvals we probably will not achieve my original goad of installation of the liner prior to start of school. If you have any question, just let me know.
Thanks,
Bob

Adenus GROUP

Bob Pickney, P.E.
Adenus Group
www.adenus.com
(615)220-7160 - office
(615) 604-4712 - cell
(615) 220-7208 - fax

Walker, Henry

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Adenus
Bob Pickney, P.E., Esquire

Walker, Henry

From: Charles Hyatt [charles.hyatt@adenus.com]
Sent: Thursday, April 02, 2015 7:42 AM
To: Walker, Henry
Subject: FW: Summit View Appeal
Attachments: WPC14-0092 Tennessee Wastewater Systems Inc. Case Tracking Sheet.pdf

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Tuesday, March 31, 2015 10:00 AM
To: charles.hyatt@adenus.com
Subject: FW: Summit View Appeal

Email to Patrick Parker

Adenus

Bob Pickney, P.E., Esquire

From: Patrick Parker [mailto:Patrick.Parker@tn.gov]
Sent: Monday, November 24, 2014 8:56 AM
To: 'Bob Pickney'
Cc: George Bell
Subject: RE: Summit View Appeal

Bob,

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Patrick Parker
Tennessee Department of Environment and Conservation
Office of General Counsel
William R. Snodgrass Tennessee Tower, 2nd Floor
312 Rosa L Parks Avenue, Nashville, TN 37243
(615) 532-0129
patrick.parker@tn.gov

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

From: Bob Pickney [mailto:bob.pickney@adenus.com]
Sent: Monday, November 24, 2014 7:51 AM
To: Patrick Parker
Subject: Summit View Appeal

Patrick,
I am trying to determine if TDEC has sent my appeal to the AG's office - WPC14-0092. Can you update me on the status of this appeal -
Thank You,
Bob

Adenus
Bob Pickney, P.E., Esquire

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
William R. Snodgrass - Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243-1102

September 19, 2013

Mr. Bob Pickney, P.E.
Adenus Group, LLC
e-copy: bob.pickney@adenus.com
849 Aviation Parkway
Smyrna, TN 37167

Subject: Corrective Action Plan Review, SOP-05039
TN Wastewater Systems – Cedar Hill Treatment Facility
Cedar Hill, Robertson County, Tennessee

Mr. Pickney,

The DWR has reviewed the proposed remediation plan you submitted. While DWR largely agrees with the plan of action and the results from the TTL geophysical investigation the following points should be specifically addressed in a revised corrective action plan.

1. The information provided by the seismic refraction study has identified areas that warrant additional investigation. A representative from TTL should be present during the investigation to observe the test pits and interpret the results. The revised correction action plan should include a summary of both the observations and the result interpretations.

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6. TN Wastewater must demonstrate in the CAP that sufficient suitable soil area exists (by ownership or easement) for the permitted flow.

7. The CAP must propose a timeline to have an amended engineering report reflecting the modification of the lagoon and available suitable soils area submitted. The timeline must also speak to the submission of plans for the disposal area and expected installation of the disposal system.

We appreciate your attention to these points.

If you have questions, please contact the division at your local Field Office at 1-888-891-TDEC; or, at this office, please contact Brad Harris at (615) 532-0762 or by E-mail at *Brad.Harris@tn.gov*.

Sincerely,

Britton Dotson
Deputy Director

CBD/bch

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
OFFICE OF GENERAL COUNSEL
CASE TRACKING HEARING SCHEDULE

CASE NUMBER	RESPONDENT(S) or CASE NAME
WPC14-0092	Tennessee Wastewater Systems, Inc.
DOCKET NUMBER	**DIVISION/COUNTY**
04.30-128350J	WPC/Sevier

Location Of Hearing **Date of Hearing** **Hearing Time** () Board (x) ALJ Alone
Nashville Room, 3rd Floor
William R. Snodgrass Tn Tower
Nashville, TN 37243

CASE DESCRIPTION:

Is a Judge Required: (x) YES () NO **Is a Court Reporter Required:** (x) YES () NO

If "YES" Court Reporter Name:

Hearing Time (estimate): **Name of Board:**

Respondent/Defendant Name, Address, Phone Number:

Division Contact Person:
Dana Waits

Respondent/Defendant Attorney Name, Address, Phone Number:
Robert J. Pickney
849 Aviation Parkway
Smyrna, TN 37167
(615) 604-4712

OGC Attorney Name:
George Bell and Patrick Parker
Office of General Counsel
William R. Snodgrass TN Tower
312 Rosa L. Parks Avenue, 2nd Floor
Nashville, Tennessee 37243
Phone: (615) 532-0131

SITE NAME and address:

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION
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Is a Judge Required: (x) YES () NO **Is a Court Reporter Required:** (x) YES () NO

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Nashville, Tennessee 37243
Phone: (615) 532-0131

SITE NAME and address:

Roy Denney

From: Brian Carter <brian.carter@adenus.com>
Sent: Saturday, February 1, 2014 6:32 PM
To: 'Mike Thornton'
Cc: 'Charles Hyatt'; 'Bob Pickney'; 'Roy Denney'
Subject: Maple Green Bypass report
Attachments: Maple Green Bypass Report 2-1-2014.pdf; _Certification_.htm

Mike,

Please find attached the bypass report for the Maple Green Lagoon in Robertson County. Crews are onsite along with TWRA and TDEC representatives.

Thank You,

Adenus Utilities Group

Brian Carter
Operations & Maintenance Manager
Adenus Utilities Group
615.220.7179(v)
615.220.7207(f)

Wastewater Collection System Overflow
Or Treatment Unit Bypass
Report Form

System Name:	Maple Green Lagoon
County:	Robertson
Date & Time Reported To WPC:	2-1-2014 / 4:00 pm
System Contact:	Brian Carter
Title:	Maintenance Manager
Phone Number(s):	615-220-7200
Location — Cause — Corrective Action	
Location of Pump Station, Manhole, Other:	Coopertown, TN
Date & Time Overflow or Bypass of Treatment Units Began:	2-1-2014 / 5:00 am
Date & Time Overflow / Bypass Ended:	2-1-2014 / 7:00 pm
Estimated Volume:	7.0 million gallons
Treatment Unit(s) Bypassed:	
Cause of Overflow or Bypass:	Void collapse
Corrective Action or Repairs:	Immediately started constructing berm to hold influent away from void collapse. Rerouting influent to safe side of berm.
Time & Date Completed, or Estimated:	8:00 pm / 2-2-2014
Volume Contained or Recovered:	100,00 gallons
Potential Impact	
Wastewater Entered Stream:	Yes
Name of Stream:	Millers Creek
Stream Conditions Observed:	Muddy
Fish or Aquatic Life Killed:	None Noted by TWRA
Distance of Impact:	Not known
Actions Taken to Minimize Health Hazards or Impact to Water Quality:	
Cleanup, Disinfection of Area:	
Public Notified, Signs Posted, or Access Restricted:	
Stream Sampling Conducted:	
Comments:	TWRA and TDEC representatives onsite along with TNWW personnel on 2-1-2014.
Person Preparing Report & Date Prepared:	Brian Carter / 2-1-2014

Roy Denney

From: Britton Dotson <Britton.Dotson@tn.gov>
Sent: Wednesday, February 19, 2014 2:45 PM
To: Penny, William (william.penny@stites.com); roy.denney@adenus.com
Cc: Sandra Dudley; Brad Harris
Subject: Draft Letter

Brad and I have been working on a letter in support of the Maple Green facility. We have forwarded it to Sandra for her review and anticipate having it to you in the morning.

Britton Dotson
Deputy Director, Water Quality Branch
Division of Water Resources
britton.dotson@tn.gov
(615) 532-0774

Roy Denney

From: Robert Odette <Robert.Odette@tn.gov>
Sent: Friday, April 25, 2014 10:25 AM
To: 'roy.denney@adenus.com'
Cc: Brad Harris; Fali Kapadia
Subject: Maple Green

Good Morning Roy,

Sorry to be late getting back to you, but I've been under the weather for the last couple of days.

In response to your email (copied below), I do not believe that we have a discrepancy in units, at least in the equations we've been using. I've gone back and checked my references and all of the equations and site area notations are in feet, million gallons per acre and not in cubic feet per day. There may be other references that provide a basis for design for FWS-CW using cubic feet per day, but I have not seen one.

I have used EPA Manuals, Metcalf & Eddy and WEF MOP-FD-16 and communication with Jim Watson, formerly with TVA.

When we last met I provided my hand written notes and calculation using the EPA equation for As = [Q x ln(Co/Ce)] /Kt x y x n

Using your values:

Q = 35,000
Co = 150
Ce = 30
Kt (20) = 0.678
y = 2.5
n = 0.7

Using the Kt at 20 degrees C yielded an As of 47,493 SF. However, this is too high a temperature for Middle Tennessee—using Kt at 1 degree C of 0.339, yielded an As = 94,986 SF

This Kt value is consistent with an example in Metcalf & Eddy at 6 degrees C, where the Kt (6) was shown as 0.36.

I believe that the design for a FWS-CW in Middle Tennessee should use a temperature of around freezing. Thus, a Kt of approximately 0.339 would be acceptable.

The surface area for the proposed Maple Green FWS-CW needs to be approximately 100,000 SF.

Jim Watson said size should be in the range of 50-100 acres per one million gallons per day. For a design flow of 35,000 GPD that translates to a surface area of 76,230 to 152,460 SF.

WEF MOP-FD-16 (Natural Systems for Wastewater Treatment) on page 385, provided some case histories of FWS-CWs as follows:

1. Orlando, FL - 61 ac/MGD
2. Lakeland, FL - 95 ac/MGD
3. Vermontville, MI – 115 ac/MGD

Using these areas for a 35,000 GPD design the area required would be:

93,000 SF
144,837 SF, and
175,329 SF

The temperatures used probably account for the differences in areas, obviously, Florida is much warmer than Michigan—Tennessee is somewhere in the middle, but these case histories substantiate that the FWS-CW surface area for the Maple Green projects needs to be in the vicinity of 100,000 SF.

Hope this helps—take care,

Bob O'

Robert G. O'Dette, M.S., P.E.
Division of Water Resources
Tennessee Department of Environment and Conservation
William R. Snodgrass Tennessee Tower, 11th Floor
312 Rosa L. Parks Avenue
Nashville, TN 37243-1102
Office: (615) 532-0625
Direct: (615) 253-5319
Fax: (615) 532-0686

****

Bob,

I'd like to discuss the sizing calculations for Maple Green. We have a discrepancy in units. For some reason the sources I have recommend using cuft per day for the Q, flow value, not gpd. I think this resolves the balance of our number issues. Would you mind looking that over? If you can call to discuss tomorrow, I'll be in and out of cell phone reception but I will certainly call you back. My cell is 615-691-2913. If So I'd love to get the rest of the information over to TDEC soon to expedite the TRA hearing.

Thank you,

Roy

Adenus
Roy Denney, P.E.

Roy Denney

From: Brad Harris <Brad.Harris@tn.gov>
Sent: Tuesday, May 6, 2014 10:01 AM
To: Roy Denney
Cc: Robert Odette
Subject: RE: Maple Green

Yes we have. Bob and I will try to call you later in the day. I am covered up right now. Send me a number that would work. We'll shoot for 1:30pm.

Check your math in the example calc. We would also like you to verify the current obligations for the system?

Brad

From: Roy Denney [mailto:roy.denney@adenus.com]
Sent: Tuesday, May 06, 2014 9:40 AM
To: Brad Harris
Subject: Maple Green

Brad,
Have you had the opportunity to look over the letter and documentation I sent you on the 28th?

Regards,

Roy

Roy Denney

From: Brad Harris <Brad.Harris@tn.gov>
Sent: Tuesday, May 6, 2014 10:51 AM
To: Roy Denney
Subject: RE: Maple Green

How many connections (existing and future) are involved with Oak Pointe?

Brad

From: Roy Denney [mailto:roy.denney@adenus.com]
Sent: Tuesday, May 06, 2014 10:40 AM
To: Brad Harris
Cc: Robert Odette
Subject: RE: Maple Green

615-691-2913 will be the best number to reach me. I have a meeting at 2:00PM today.

Currently the site serves,
Providence Baptist Church, Robertson County EMS #5, Coopertown Middle School,148 connections at Oak Pointe Subdivision, P&C Corner Market, Pizza Hut, Sudden Service BP, and a Mapco Express.

Roy

From: Brad Harris [mailto:Brad.Harris@tn.gov]
Sent: Tuesday, May 6, 2014 10:01 AM
To: Roy Denney
Cc: Robert Odette
Subject: RE: Maple Green

Yes we have. Bob and I will try to call you later in the day. I am covered up right now. Send me a number that would work. We'll shoot for 1:30pm.

Check your math in the example calc. We would also like you to verify the current obligations for the system?

Brad

From: Roy Denney [mailto:roy.denney@adenus.com]
Sent: Tuesday, May 06, 2014 9:40 AM
To: Brad Harris
Subject: Maple Green

Brad,
Have you had the opportunity to look over the letter and documentation I sent you on the 28th?

Regards,

Roy

Roy Denney

From: Brad Harris <Brad.Harris@tn.gov>
Sent: Tuesday, May 6, 2014 12:21 PM
To: Roy Denney
Cc: Robert Odette
Subject: RE: Maple Green

Roy,

Can we try 9:00am in the morning instead of this afternoon?

Thanks,
Brad

From: Roy Denney [mailto:roy.denney@adenus.com]
Sent: Tuesday, May 06, 2014 12:01 PM
To: Brad Harris
Subject: Re: Maple Green

144 customers currently. 168 plated lots but the developer defaulted so there appears to be no urgency to developing. Found the error on the math. We can make the cells 10 feet longer.

Sent from my iPhone

On May 6, 2014, at 10:51 AM, Brad Harris <Brad.Harris@tn.gov> wrote:

> How many connections (existing and future) are involved with Oak Pointe?
>
> Brad
>
> **From:** Roy Denney [mailto:roy.denney@adenus.com]
> **Sent:** Tuesday, May 06, 2014 10:40 AM
> **To:** Brad Harris
> **Cc:** Robert Odette
> **Subject:** RE: Maple Green
>
> 615-691-2913 will be the best number to reach me. I have a meeting at 2:00PM today.
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> Providence Baptist Church, Robertson County EMS #5, Coopertown Middle School,148 connections at Oak Pointe Subdivision, P&C Corner Market, Pizza Hut, Sudden Service BP, and a Mapco Express.
>
> Roy
>
> **From:** Brad Harris [mailto:Brad.Harris@tn.gov]
> **Sent:** Tuesday, May 6, 2014 10:01 AM
> **To:** Roy Denney

Cc: Robert Odette
Subject: RE: Maple Green

Yes we have. Bob and I will try to call you later in the day. I am covered up right now. Send me a number that would work. We'll shoot for 1:30pm.

Check your math in the example calc. We would also like you to verify the current obligations for the system?

Brad

From: Roy Denney [mailto:roy.denney@adenus.com]
Sent: Tuesday, May 06, 2014 9:40 AM
To: Brad Harris
Subject: Maple Green

Brad,
Have you had the opportunity to look over the letter and documentation I sent you on the 28th?

Regards,

Roy

Roy Denney

From: Robert Odette <Robert.Odette@tn.gov>
Sent: Thursday, May 8, 2014 7:51 AM
To: 'Roy Denney'
Cc: Brad Harris
Subject: RE: WEF fifth edition
Attachments: WEF_MOP-FD-16.pdf

Good Morning Roy:

Thanks for sending the reference from the fifth edition--their design example used a depth of 2 feet (0.6 meters). However, I would also like to see what the fifth edition did with Table 9.20 that was in the third edition (see attached). Table 9.20 shows a design water depth of between 0.1 and 0.6 meters. Please note that the third edition also states that design depths are typically 20 inches (0.5 meters). As I understand the equation, the depth is the "average" water depth throughout the year.

Additionally, does the fifth addition have a similar chart to 9.1 which shows actual FWS-CWs across the country. The two in Florida are for nutrient removal, but the one in Michigan is a converted land treatment site--in each of these three case histories, the equivalent size for a 35,000 GPD design would be about 100,000 SF which is consistent with the information given to us by Jim Watson (formerly with TVA). Brad may have other questions but I would like to see examples of FWS-CW that are designed and built that are sized in the equivalent range of your design for Maple Green.

Thanks much--take care,

Bob O'
Robert G. O'Dette, M.S., P.E.
Division of Water Resources
Tennessee Department of Environment and Conservation William R. Snodgrass Tennessee Tower, 11th Floor
312 Rosa L. Parks Avenue
Nashville, TN 37243-1102
Office: (615) 532-0625
Direct: (615) 253-5319
Fax: (615) 532-0686

-----Original Message-----
From: Roy Denney [mailto:roy.denney@adenus.com]
Sent: Wednesday, May 07, 2014 2:50 PM
To: Brad Harris; Robert Odette
Subject: WEF fifth edition

Brad and Bob,

I haven't pulled up the other references, but you said you had the EPA citing and here is the latest from WEF actually referring to 0.6 meters as shallow and 1 meter as a deep wetland section. While they fail to go into in this volume, the information I have seen suggests that having a deeper pool can allow anoxic processes to take place. I have some other sources, but I don't have them quite as well earmarked.

Thanks again,

Roy

-----Original Message-----
From: scanner1stfloor@adenus.com [mailto:scanner1stfloor@adenus.com]
Sent: Wednesday, May 7, 2014 2:41 PM
To: roy.denney@adenus.com
Subject: Scanned on Bizhub from NovaCopy

The attached document was scanned on a Konica Minolta Bizhub from Novacopy.

Water quality improvements can be expected through these components and can be estimated using the models presented in this chapter and with deep water zones analyzed with appropriate facultative pond models. The open water zones in such a system should not be larger than a 2- to 3-day detention times each to prevent the development of algae; these habitat components should be followed by a densely vegetated wetland unit with a short residence time for final polishing before final discharge.

4.4.1 *Process Design Criteria for Free-Water-Surface Wetlands*

The major design parameters are depth, detention time, loading rate, and aspect ratio. Typical design criteria are presented in Table 9.20.

4.4.1.1 *Depth*

The operating depth in FWS wetlands can range from 0.1 m (4 in.) to 0.6 m (2 ft). Design depths are typically 0.5 m (20 in.) to optimize detention time without exceeding the effective depth of emergent vegetation, which generally do not colonize at depths of 1 m or more.

4.4.1.2 *Detention Time*

The detention time in FWS wetlands depends on the limiting design parameter. For BOD and nitrate removal, the detention time can be relatively short, as shown in Table 9.20. If the removal of algae (pond TSS) is the limiting design

TABLE 9.20 Typical design criteria and expected effluent quality for FWS constructed wetlands (adapted from Crites and Tchobanoglous, 1998).

Item	Unit	Value
Design parameter		
Detention time	d	2–5 (BOD) 7–14 (N)
BOD loading rate	kg/ha·d	<110
Hydraulic loading rate	mm/d	25–125
Water depth	m	0.1–0.6
Open water zone percent	% of total area	20–30
Aspect ratio		2:1 to 4:1
Mosquito control		Required
Harvesting interval	yr	3–5
Expected effluent quality*		
BOD_5	mg/L	<15
TSS	mg/L	<15
TN	mg/L	<10
TP	mg/L	<5

* Expected effluent quality based on a BOD loading equal to or less than 110 kg/ha·d and typical settled municipal wastewater.

Roy Denney

From: Brad Harris <Brad.Harris@tn.gov>
Sent: Tuesday, June 10, 2014 9:23 AM
To: Roy Denney (Roy.Denney@adenus.com)
Cc: Britton Dotson; Allen Rather; Robert Odette
Subject: Maple Green Plans
Attachments: MapleGreenCAP_ReviewSKD_3_18_14.pdf

Roy,

We reviewed the plans you submitted for Maple Green. We found them acceptable for the most part. We do need some additional information and a few changes as described below.

1. The plans must include a flow meter (totalizer) capable of accurately measuring the wastewater flow to the system.
2. The plans must incorporate fencing around the wetland cells.
3. A description of plant placement and type. Such placement and type should be in line with the EPA recommendations. The plans mention, "If vegetation is problematic, mechanical aeration and a suspended growth media will be used to simulate plant stalks and plant roots." This is not acceptable. If such a redesign is proposed in the future it will require resubmission of plans.
4. A Startup and more detailed maintenance plan including tasks and frequencies.
5. One year of water use data for the commercial establishments connected to the system.
6. Soil information and drip field design supporting the system. We currently have one old map that shows approximately 3.5 acres supporting the system. I don't have any current plans for the drip system.

Give me a call if you would like to discuss or have any questions.

I have attached the letter from Director Dudley regarding the CAP. To my knowledge we haven't received a response from you to her letter.

I am also waiting on the operational manual and as-built for Logue Road.

Brad

Brad C Harris P.E.
Division of Water Resources
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243
(615) 532-5367

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF WATER RESOURCES
William R. Snodgrass - Tennessee Tower
312 Rosa L. Parks Avenue, 12th Floor
Nashville, Tennessee 37243-1102

March 18, 2014

Mr. Roy Denney, P.E.
Adenus Group, LLC
849 Aviation Parkway
Smyrna, TN 37167

Subject: State Operating Permit No. SOP-01028
TN Wastewater Systems – Maple Green Reclamation Facility
Coopertown, Robertson County, Tennessee

Mr. Denney:

The Division has reviewed the Preliminary Engineering Report for Remediation and Modification of Maple Green Reclamation Facility of 2/14/2014. We appreciate your timely submission. The Division acknowledges the construction of the emergency berm within the existing lagoon in order to hold and redirect flow to the portion of the lagoon that was not compromised during the events of 2/1/2014. In order for the Division to accept the remainder of the report, the following parts of the submittal must be updated and amended to address the following:

1. Stamped engineering plans and engineering report must be submitted to establish the design basis of the temporary treatment.
2. Sampling results must be submitted to the Division central office and field office weekly.
3. The sampling frequency must remain five days per week until the Division agrees that an acceptable treatment level is reliably being met.
4. In order to establish system design of 35,000 GPD, metering results and a detailed list of the system's current and future obligations must be submitted. While treatment system design and construction may not be required presently, to satisfy future commitments it is necessary for collection system and soils area plans review.
5. It is unclear how the current temporary drip area is to be used in the future. The report proposes to reclassify the area as a permanent drip area. There may be some potential for the future use of areas that are not impacted through the remediation effort; however, those areas would not be applicable for establishing system capacity.
6. The report mentions "surface irrigation" and "non-food subsurface agricultural drip" on portions of the lagoon site after remediation. There isn't sufficient information in the referenced report to consider temporary irrigation at this time.

Comments regarding the use of FWS wetlands were provided in a letter of 2/20/2014 from Sandra K. Dudley, Ph.D., P.E. If you have questions, feel free to contact Brad Harris at 615-532-5367.

Sincerely,

Sandra K. Dudley, Ph.D., P.E.
Director

cc: Permit File
Nashville Environmental Field Office
Mr. Charles R. Hyatt, CEO, Adenus Group, LLC Charles.Hyatt@adenus.com
Mr. Brian Carter, Maintenance Manager, Adenus Operations LLC, brian.carter@adenus.com
Ms. Michelle Ramsey, Utilities Division, Tennessee Regulatory Authority, michelle.ramsey@tn.gov

Roy Denney

From: Brad Harris <Brad.Harris@tn.gov>
Sent: Wednesday, June 25, 2014 10:34 AM
To: Roy Denney (Roy.Denney@adenus.com)
Cc: Britton Dotson; Allen Rather; Robert Odette
Subject: RE: Maple Green Plans

Roy,

We need a new copy of the plans incorporating items, 1,2,3.

We are missing section 6.2 you reference.

The water use numbers you submitted are not representative of one year of water use data. We would like the monthly flows for each establishment for the last year.

I would also like to see the plans used to install the drip system or updated plans if the system wasn't installed as per the original plan. I assume there isn't any additional area mapped other than the 3.5 mentioned.

Brad
Brad C Harris P.E.
Division of Water Resources
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243
(615) 532-5367

From: Brad Harris
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Give me a call if you would like to discuss or have any questions.

I have attached the letter from Director Dudley regarding the CAP. To my knowledge we haven't received a response from you to her letter.

I am also waiting on the operational manual and as-built for Logue Road.

Brad

Brad C Harris P.E.
Division of Water Resources
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243
(615) 532-5367

Roy Denney

From: Brad Harris <Brad.Harris@tn.gov>
Sent: Wednesday, July 2, 2014 6:54 AM
To: Roy Denney
Subject: RE: Maple Green Plans

Thanks Roy.

Brad

From: Roy Denney [mailto:roy.denney@adenus.com]
Sent: Tuesday, July 01, 2014 3:39 PM
To: Brad Harris
Subject: RE: Maple Green Plans

Brad,

I've sent everything over, except, I got a new person with the Springfield Water System who refused to provide further detail on water records, we've faxed in a written request. I sent you a copy of that as well.

I hope you have a good Fourth.

Roy

From: Brad Harris [mailto:Brad.Harris@tn.gov]
Sent: Wednesday, June 25, 2014 10:34 AM
To: Roy Denney (Roy.Denney@adenus.com)
Cc: Britton Dotson; Allen Rather; Robert Odette
Subject: RE: Maple Green Plans

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Brad C Harris P.E.
Division of Water Resources
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243
(615) 532-5367

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To: Roy Denney (Roy.Denney@adenus.com)
Cc: Britton Dotson; Allen Rather; Robert Odette
Subject: Maple Green Plans

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Brad

Brad C Harris P.E.
Division of Water Resources
William R. Snodgrass Tennessee Tower
312 Rosa L. Parks Avenue, 11th Floor
Nashville, Tennessee 37243
(615) 532-5367

Roy Denney

From: Allen Rather <Allen.Rather@tn.gov>
Sent: Friday, July 25, 2014 2:17 PM
To: roy.denney@adenus.com
Cc: Ann Morbitt
Subject: FW: Maple Green Treatment Facility
Attachments: 14-0471_Maple Green.pdf

Roy,
Attached is the approval letter for your project. The stamped plans and specs should be in Monday's mail. Please let me know if you have any questions.

Thanks,

Allen Rather, LPSS
Land Based Systems Unit
Division of Water Resources
615-532-5819

Roy Denney

From: Roy Denney <Roy.Denney@adenus.com>
Sent: Friday, February 7, 2014 11:38 AM
To: 'Britton Dotson'
Subject: maple green

Britton,

Is there a time we can talk by phone to discuss the plan, either this afternoon or maybe Monday? I want to make sure what I present next Friday sounds reasonable to you before I commit and lose a week. You can reach me on my cell phone at 691-2913.

Thank you,

Roy

Adenus
Roy Denney, P.E.
CTO

Adenus Group, LLC | 849 Aviation Pkwy, Smyrna, TN 37167
Direct: +1 615.220.7176 | Toll Free: +1 888.4.ADENUS Ext: 150 | Mobile: 615.691.2913 | Fax: 615.220.7207

Roy Denney

From: Roy Denney <Roy.Denney@adenus.com>
Sent: Monday, February 17, 2014 3:13 PM
To: 'Britton Dotson'
Subject: Maple Green Wetland Design
Attachments: preliminary design.pdf

Britton,

Here is the preliminary design calculations and details regarding the wetland designs at Maple Green.

I did not put fixed dimensions instead I listed area to support site loading and an aspect ratio target to maintain. This should give a little latitude for the final install while maintaining the correct flow patterns.

I remember the subject of the liner came up. I think for this site, compacted soil supporting a 30 mil liner will be best with woven geofabric underneath to protect from debris.

As mentioned in the narrative, the site will consist of two of the cells shown in the details capable of operating in parallel or series. Details on aeration are still in the works, however to replicate the 1mg/l DO typically provided by vegetation, a very modest blower similar to a farm pond air pump would be sufficient.

At the current loading we should be able to periodically take one side out of service or the other for maintenance and repairs.

If you have any questions, don't hesitate to call my cell phone,

Obviously the detail design will need to include more specifics regarding type of vegetation and hydraulic considerations, however the final design will follow the design criteria pretty closely.

I look forward to your response.

Thank you,

Roy Denney

Adenus
Roy Denney, P.E.
CTO

Adenus Group, LLC | 849 Aviation Pkwy, Smyrna, TN 37167
Direct: +1 615.220.7176 | Toll Free: +1 888.4.ADENUS Ext: 150 | Mobile: 615.691.2913 | Fax: 615.220.7207

Proposal Regarding Constructed Free Water Surface Wetland With Aeration for Treatment of Septic Tank Effluent In Rural Systems.

Abstract

Roy Denney, PE
Adenus Group

Wetland treatment for wastewater which has already received primary settling and minimal secondary treatment is well establish with systems in the US dating back more than fifty years(EPA, 2000).
The two prevailing approaches are Free Water Surface (FWS) and Subsurface Flow (SSF or VSF(vegetated)) wetlands. Conventional wisdom dictates that a VSF with some insulating cover will higher removal efficiencies and be better protected from extended cold periods, however the EPA findings reported in their 2000 manual indicate most constructed FWS wetlands raise their operating level in freezing weather and the increased detention time offsets the decrease in operational efficiency based on atmospheric conditions.

Maintenance of SSF systems is difficult as expected since the water surface is not visible and subsurface fouling can have a dramatic impact on treatment efficiency. FWS wetlands have the ability to be easily maintained and solids accumulation is mitigated by vegetative growth.

In recent years studies and patents regarding the supplemental addition of air to VSB and SSF wetlands shows potential for very high removal efficiencies even in the absence of active vegetation and during cold weather months with weather temperatures near freezing. (Redmond, 2012)

These findings coincide with the current understanding that these systems utilize a small area for BOD removal, approximately the first 25% to 30% of the detention time followed by the nitrification in the last 70% and denitrification in the last 20 to 25% of the wetland flow area.

There are various approaches to support this biological model. The approach we intend to take is to construct a conventional wetland based on existing models and calculations. Influent flow to the wetland will be installed in such a way as to introduce dissolved oxygen by sawtooth weir or a shallow pool overflow. The first 30% of a treatment cell will operate at a sufficiently high elevation to allow overflow by sawtooth weir into the second portion of treatment. Average water depths planned are 2.5 ft and 2 feet. Two treatment cells will be installed with piping to accommodate either parallel or series operation. Most traditional systems rely on anoxic, anaerobic or facultative digestion of solids vastly increasing required sizing of these systems. It is our intent to demonstrate a significantly increased uptake rate in a lightly aerated constructed wetland as opposed to conventional design with the hopes that future designs could be more efficient in space and layout.

Necessary flow diversion and mechanical aeration would be built into the design in the event of sustained freezing conditions or surge flow conditions.

The proposed system will be based on design standards from The EPA Manual Constructed Wetlands Treatment of Municipal Wastewaters 2000 and the WEF/ASCE Design of Wastewater Treatment Plants 2012.

1. EPA. "Constructed Wetlands Treatment of Municipal Wastewater" 2000
2. Redmond, Eric. "Nitrogen removal from wastewater by an Aerated subsurface flow constructed wetland." Master's thesis, University of Iowa, 2012.

Design Criteria

Site Specific Data
Permitted site flow. 35,000GPD based on present disposal Capacity.
Effluent BOD Limit: 45mg/L
Influent BOD: 90mg/L from historical information (averaged) Daily surges appear to have minimal impacts given the collected data from the EPA 2000, Table 4-1.

BOD Daily Loading:

35,000GPD*3.78L/Gal = 132300L/Day
132300L/day * 90mg/L = 12kg/day

From EPA 2000, Chapter 4

The open water FWS systems which permit reaeration and aerobic oxidation should be designed for an areal loading of no more than 60kg/ha-day.

Surface area:

EPA design calls for an average depth of .6 to .8 meters, 2 to 2.5 feet. This will be used for the depth for the system.

12 kg/day / 60kg/ha-day = 0.2ha
0.2ha = .5 acre = 21780ft^2

Volume and HRT

21780FT^2 * 2FT = 43560 FT^3 = 325828.8 gallons

HRT = 325828.8 gallons / 35000 Gallons/day = 9.3 day HRT

The EPA Design manual calls for a HRT of 7 to 9 Days for effective treatment confirming the intended loading rate. This also coincides with the results showing 50% BOD uptake occurring place in the first 30% of treatment and in the first 3 days of treatment.

Design Layout:

The treatment system will consist of two treatment cells capable to operating in series or in parallel. Each wetland will be constructed to maintain approximately a 3 to 1 aspect ratio with a full width influent and effluent system consisting of 8" perforated pipe protected by #4 stone wire wrapped to allow plug flow.

The wetlands will be excavated 5 feet. The ground is to be compacted, A woven geofabric will be applied to the site to protect the liner. A 30mil PVC or PE liner will be utilized. Soil will be replace above the liner in elevations varying from 6" to 28" above the liner.

The effluent header will be surrounded by #4 stone wrapped in poultry net and placed on geofabric above soil to protect the liners. and to prevent plugging of the effluent header. baffles will be located such as to capture settled solids at approximately 33% of the total length of each cell.
According to the EPA design manual, the primary functions of vegetation are to provide a fixed surface for bacterial growth and to provide dissolved oxygen.

The middle 35% to 40% provides oxygen production via fully submerged vegetation and disinfection by solar inactivation. This section therefore will have both passive and active aeration to augment oxygen when needed. This will be accomplished via air stones and overflow weirs.

The first third will be moderately vegetated at no more than 70% cover. The final third will be lightly vegetated with no more than 50% cover.

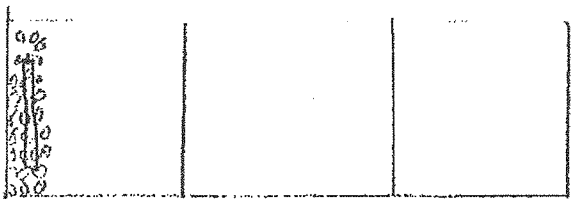
If vegetation is problematic, mechanical aeration and a suspended growth media will be used to simulate the plant stalks and root structures.

Under current site flows of 20,000GPD this design has a 16.3 day detention time.

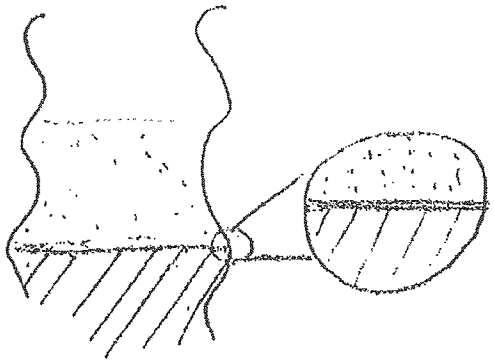
Solids removal will be through uptake by vegetation and manual removal as needed. Vegetation will be culled as needed to maintain the moderate to light vegetation.

Each pass will be designed to operate fully independently if needed for repairs or clean up.

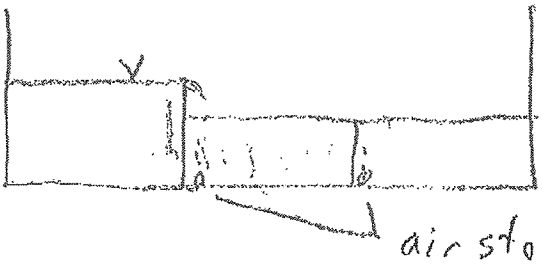
Each Cell



Liner detail

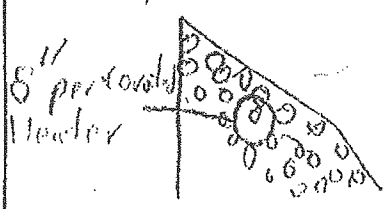


6" soil fill upto 28"
30 mil PVC liner
Geo fabric
Compacted soil



70% Cover floating plants	Open Surface Submerged vegetation or	50% Cover floating and rooted plants

Influent/Effluent Header
3/4 stone wrapped in poultry mat



Roy Denney

From: Roy Denney <Roy.Denney@adenus.com>
Sent: Monday, March 10, 2014 12:42 PM
To: 'Sandra.Dudley@tn.gov'
Cc: 'Charles. Hyatt'; 'Penny, William'; 'Britton Dotson'
Subject: Maple Green FWS Design OGC14-0013
Attachments: Cover Letter.pdf; Design Specifications.pdf; Maple Green 2014 Wetland - Cover (1).pdf; Maple Green 2014 Wetland - Site 200 (2).pdf; Maple Green 2014 Wetland - Wetland Site Layout (3).pdf; Maple Green 2014 Wetland - Wetland Xsection details (4).pdf

Dear Ms. Dudley,

Please see the attached cover letter and design pertaining to Maple Green Reclamation Facility.

Kindest Regards,

Roy Denney

Adenus
Roy Denney, P.E.
CTO

Adenus Group, LLC | 849 Aviation Pkwy, Smyrna, TN 37167
Direct: +1 615.220.7176 | Toll Free: +1 888.4.ADENUS Ext: 150 | Mobile: 615.691.2913 | Fax: 615.220.7207

Adenus

849 Aviation Parkway
Smyrna, TN 37167

March 10, 2014

Ms. Sandra K. Dudley, Ph. D., P.E.
Director
Division Of Water Resources
Department of Environment and Conservation
William R. Snodgrass - Tennessee Tower
312 Rosa L. Parks Avenue, 12th Floor
Nashville, Tennessee 37243-1102

Subject: **State Operating Permit No. SOP-01028**
TN Wastewater Systems - Maple Green Reclamation Facility
Coopertown, Robertson County, Tennessee
Maple Green Design Plans
OCG14-0019

Dear Ms. Dudley:

Please see attached for review one set each:

- Free Surface Wetlands Design Specifications
- Drawings

If there are any Questions Please contact me at this office.

Kindest Regards,

Roy Denney, PE
CTO

cc:
Mr. Charles Hyatt, CEO Adenus Group, LLC, charles.hyatt@adenus.com
Mr. William Penny, Member, Stites and Harbison, PLLC, william.penny@stites.com
Mr. Britton Dodson, Assistant Director, TDEC Division of Water Resources, Britton Dodson@tn.gov

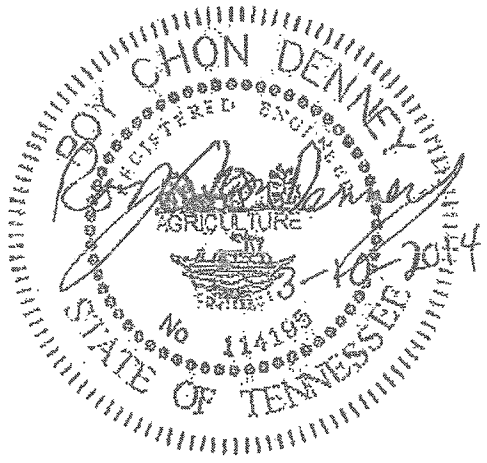
ADENUS SOLUTIONS GROUP

Free Surface Wetland Design Specifications

For The Maple Green Water Reclamation Facility

Roy Denney

3/10/2014



Design Specifications for the free water surface wastewater treatment wetland at Maple Green. Prepared for Tennessee Wastewater. Reference Case Number OGC14-0019

Maple Green Design Specifications

Table Of Contents

Section 1 Abstract

Proposal Regarding Constructed Free Water Surface Wetland With Aeration for Treatment of Septic Tank Effluent in Rural Systems.

Roy Denney, PE
Adenus Group

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1. EPA. "Constructed Wetlands Treatment of Municipal Wastewater" 2000
2. Redmond, Eric. "Nitrogen removal from wastewater by an Aerated subsurface flow constructed wetland." Master's thesis, University of Iowa, 2012.

Section 2 Wetland Construction

Site grade work and preparation will be performed in compliance with the geotechnical report and the liner manufacturer's recommendations for installation.

A geofabric will be installed above the clay liner to protect the synthetic liner.

The synthetic liner shall be installed above the geofabric. The synthetic liner shall be 30 mil PVC single sheet or approved equal.

Grading above the synthetic liner shall be irregular, but provide at least 6 inches of cover above the liner.

Liner installation to be approved by the manufacturer or their authorized representative.

Section 3 Mechanical Piping

3.1Pipe selection

	Type	Size	Connections
Process Water	PVC SDR 27 or approved	6 inch	Gasket bell ends or Glued couplings
Air	Schedule 40	1.5 inch	Glued connections

Connections

For water piping, gasketed bell end conn3ctions and glued coupling or as approved by the engineer.

For air piping, glued couplings or as approved by engineer.

3.2Tubing

For process equipment connections the use of flexible tubing will be permitted. Where exposure to Sunlight is likely UV resistance is required.

Connections shall be barb type connectors with stainless screw drive clamps.

Section 4 Equipment

3.1Aeration equipment:

3.11Blower requirements

Minimum of two blowers required.

Blowers shall be capable of 20CFM at 40 inches of water column.

Blowers shall employ an oil free design.

Blowers shall operate on single phase power.

3.12 Diffuser requirements

Because of the shallow nature of the treatment system, low flow rate diffusers will be used.

0.25 to 0.5 CFM air stones are currently planned.

Diffusers shall be located along the bottom of the wetlands in a manner to prevent scouring. or erosion of the bottom of the wetland.

Section 5 Maintenance and Operations

Bearing replacement on blowers after 26000 run hours as per manufacturers recommendations.

Stones are to be acid washed when needed to maintain good air flow.

Vegetation should be culled in the late fall to maintain the light to moderate vegetation. culling no more than once a year. The site is designed to operate hydraulically under dense vegetation.

Monthly visual inspections to ensure no damage or malfunctions.

Testing:

For the FWS system, a testing protocol measuring BOD removal should be employed. In operation a FWS system operates on the similar principals to a fixed film system. a similar consistency in the process is expected.

Section 6 Design Calculations

The site design considerations are as Follows,

Influent characteristics:

Flow	35000 GPD
BOD	150mg/L
Temperature	20C state design requirements
Temperature	4C cold weather capacity

Effluent Characteristics:

BOD	45mg/L

Aeration equipment

BOD peak loading	43.785 lbs per day
Capacity of Aerating equipment	57,600 CF per day
CF air per pound of BOD	1315.51

Sizing Calculations utilized the Design Of Wastewater Treatment Plants Fifth Edition Volume 2: Liquid Treatment Processes, Chapter 18 Section 6.1. Equation 18.17

$$A_{fw} = \frac{q(lnC_o - lnC_e)}{k_t * d * n * (10{,}000)}$$

Where,

A_{fw} = Surface Area of FWS Wetland

q = Wastewater flow, m^3/d

C_o = Influent BOD, mg/L

C_o = effluent BOD, mg/L

n = Porosity, fraction

d = wetted depth

k_t = first order rate coefficient

The sizing does not account for introduced aeration and is designed around vegetation supplying the required oxygen.

See Appendix For Treatment Models.

Section 7 Geotechnical Study

Prior to commencement of construction a subsurface investigation of the proposed site will be performed and the recommendations of the Geotechnical Consultant.

Investigation shall be Seismic Refraction Method as per ASTM D5777.

Section 8 Sources

1. EPA. "Constructed Wetlands Treatment of Municipal Wastewater" 2000
2. Redmond, Eric. "Nitrogen removal from wastewater by an Aerated subsurface flow constructed wetland." Master's thesis, University of Iowa, 2012.
3. wefpress. "Design Of Municipal Wastewater Treatment Plants; FIFTH EDITION" 2012.

Appendix 1 Treatment modelling

FWS Wetland Sizing

Variables				
			metric	
BOD influent	150	mg/L	150	mg/L
1 cell BOD eff.	68	mg/L	68	mg/L
BOD Limit	30	mg/L	30	mg/L
Flow	35000	GPD	132.08	M^3/Day
depth	2.5	ft	0.76	M
k20 factor	0.678	d^-1		
Theta	1.06			
Aspect Ratio X:1	3			
porosity	0.9	d		
Ground Loading	155.96	lb/sq foot		

light vegitation

design flow

peak loading

Single pass removal								
	Temperature C	[illegible]	6	10	15	[illegible]	25	30
Sizing		39.2	42.8	50	59	68	77	86
Area	Ha	0.116	0.103	0.082	0.061	0.046	0.034	0.026
Area	acre	0.287	0.255	0.202	0.151	0.113	0.084	0.063
Length	ft	64.53	60.88	54.18	46.84	40.49	35.00	30.25
Width	ft	193.59	182.63	162.54	140.51	121.46	104.99	90.76
Duel Pass 1								
	Temperature C	[illegible]	6	10	15	[illegible]	25	30
Sizing								
Area	Ha	0.057	0.051	0.040	0.030	0.022	0.017	0.013
Area	acre	0.141	0.125	0.099	0.074	0.055	0.041	0.031
Length	ft	45.24	42.68	37.99	32.84	28.39	24.54	21.21
Width	ft	135.73	128.04	113.96	98.51	85.16	73.61	63.63
Duel Pass 2								
	Temperature C	[illegible]	6	10	15	[illegible]	25	30
Sizing								
Area	Ha	0.059	0.053	0.042	0.031	0.023	0.017	0.013
Area	acre	0.146	0.130	0.103	0.077	0.057	0.043	0.032
Length	ft	46.01	43.41	38.63	33.40	28.87	24.96	21.57
Width	ft	138.04	130.23	115.90	100.19	86.61	74.87	64.72

HRT: 6.67437 3.515975

FWS Wetland Sizing

Variables				
			metric	
BOD influent	150	mg/L	150	mg/L
1 cell BOD eff.	68	mg/L	68	mg/L
BOD Limit	30	mg/L	30	mg/L
Flow	25000	GPD	94.34	M^3/Day
depth	2.5	ft	0.76	M
k20 factor	0.678	d^-1		
Theta	1.06			
Aspect Ratio X:1	3			
porosity	0.9	d		
Ground Loading	155.96	lb/sq foot		

light vegitation

design flow

peak loading

Single pass removal								
	Temperature C	[illegible]	6	10	15	[illegible]	25	30
Sizing		39.2	42.8	50	59	68	77	86
Area	Ha	0.083	0.074	0.058	0.044	0.033	0.024	0.018
Area	acre	0.205	0.182	0.144	0.108	0.081	0.060	0.045
Length	ft	54.54	51.45	45.79	39.58	34.22	29.58	25.57
Width	ft	163.61	154.35	137.37	118.75	102.65	88.74	76.71

Duel Pass 1								
	Temperature C	[illegible]	6	10	15	[illegible]	25	30
Sizing								
Area	Ha	0.041	0.036	0.029	0.021	0.016	0.012	0.009
Area	acre	0.101	0.090	0.071	0.053	0.040	0.030	0.022
Length	ft	38.24	36.07	32.10	27.75	23.99	20.74	17.93
Width	ft	114.71	108.22	96.31	83.26	71.97	62.21	53.78

Duel Pass 2								
	Temperature C	[illegible]	6	10	15	[illegible]	25	30
Sizing								
Area	Ha	0.042	0.038	0.030	0.022	0.017	0.012	0.009
Area	acre	0.104	0.093	0.073	0.055	0.041	0.031	0.023
Length	ft	38.89	36.69	32.65	28.22	24.40	21.09	18.23
Width	ft	116.66	110.06	97.95	84.67	73.20	63.27	54.70

HRT: 6.57437 3.515975

FWS Wetland Sizing

Variables				
			metric	
BOD influent	150	mg/L	150	mg/L
1 cell BOD eff.	82	mg/L	82	mg/L
BOD Limit	45	mg/L	45	mg/L
Flow	35000	GPD	132.08	M^3/Day
depth	2.5	ft	0.76	M
k20 factor	0.678	d^-1		
Theta	1.06			
Aspect Ratio X:1	3			
porosity	0.7	d		
Ground Loading	155.96	lb/sq foot		

dense vegitation

design flow

sustatined cold weather

peak loading

meeting limits

Single pass removal								
	Temperature C	[illegible]	6	10	15	[illegible]	25	30
Sizing		39.2	42.8	50	59	68	77	86
Area	Ha	0.112	0.099	0.079	0.059	0.044	0.033	0.025
Area	acre	0.276	0.245	0.194	0.145	0.109	0.081	0.061
Length	ft	63.29	59.70	53.14	45.93	39.71	34.32	29.67
Width	ft	189.86	179.11	159.41	137.80	119.12	102.97	89.01
Duel Pass 1								
	Temperature C	[illegible]	6	10	15	[illegible]	25	30
Sizing								
Area	Ha	0.056	0.050	0.039	0.030	0.022	0.016	0.012
Area	acre	0.138	0.123	0.098	0.073	0.054	0.041	0.030
Length	ft	44.82	42.28	37.63	32.53	28.12	24.31	21.01
Width	ft	134.46	126.85	112.90	97.59	84.36	72.93	63.04
Duel Pass 2								
	Temperature C	[illegible]	6	10	15	[illegible]	25	30
Sizing								
Area	Ha	0.056	0.050	0.039	0.029	0.022	0.016	0.012
Area	acre	0.137	0.122	0.097	0.072	0.054	0.040	0.030
Length	ft	44.68	42.15	37.51	32.43	28.03	24.23	20.95
Width	ft	134.03	126.45	112.54	97.28	84.09	72.69	62.84

HRT: 6.419441 3.381681

Appendix 2 Manufacturer's Data sheets for components.

Provided as examples.

Liner

The Liner Company

SOLUTIONS

ENVIRONMENTAL PROTECTION, INC.

1567 W. South Airport Rd.
Traverse City, Michigan
49686

Phone 1 800-OK-LINER
Fax 1 231-943-2270

www.geomembrane.com

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- Heap Leach Pads
- Industrial Waste Ponds
- Tailing Ponds

30 mil PVC Geomembrane Specifications

PVC liners fabricated by EPI are a single-ply construction with Polyvinyl Chloride as the principle polymer. Only first quality virgin resins are used and all materials meet or exceed the requirements of ASTM D7176 Standard Specification for PVC geomembranes used in buried applications.

EPI utilizes statistical process control (SPC) to ensure the integrity of each panel produced. Samples from actual factory seams are removed during the welding process for a rigorous, proven testing procedure that assures you of the highest quality factory-fabricated PVC geomembranes available.

PVC Liners are fabricated by EPI in panels, accordion-folded in both directions, and packaged for shipment to your site for quick, easy installation to save you time and money.

Thickness ± 5%	ASTM D-5199	.030"
Specific Gravity (min)	ASTM D-792	1.20
Tensile (lb/in-width, min)	ASTM D-882	73
Elongation at Break (% min)	ASTM D-882	380
Modulus (lb/in-width, min)	ASTM D-882	30
Tear Resistance (lb/in, min)	ASTM D-1004	8
Resistance to Soil Burial (% change, max)	ASTM G-160	
1. Breaking Factor		5
2. Elongation At Break		20
3. Modulus at 100% Elongation		20
Impact Cold Crack (°C)	ASTM D-1790	-29
Dimensional Stability (% change, max)	ASTM D-1204 (212°F/15 min.)	3
Water Extraction (%,max)	ASTM D-1239	0.15
Volatile Loss (%, max)	ASTM D-1203(A)	0.70
Hydrostatic Resistance (psi, min)	ASTM D-751(A)	100
Plasticizer Min Ave Molec Wt	ASTM 2124	400
Factory Fabricated Seams:		
Peel Strength (lbs/in, min)	ASTM D-882	15
Shear Strength (lbs/in, min)	ASTM D-882	58.4

These data are based on tests believed to be reliable. However, these are laboratory tests that may not simulate actual use conditions. They are provided for your informational purposes only. No warranty, express or implied, including any other further warranty of fitness for a particular purpose or merchantability, is made by this promotional literature.

Preserving water resources for future generations

Blower

Blower Specifications (at Sea Level, 68°F, 60 Hz)

Model Number	Cfm Free Air @ Inches Water 20"	30"	40"	50"	Max Duty	Hp	Phase	No. Filters	Running Watts Input @ Inches Water	Max Starting Watts	Voltage	Rated Full Load Amps	Height w/o Filter	Width	Outlet Hose Pipe Size	Weight (lbs)	Price (including Filter)
S11A ❶ ❷	13	3	—	—	34"	1/8	1	1	198/20"	900	115/230	2.0/115	10"	8"	1"	23	$ 528.40
S21 ❶ ❷	27	19	7	—	43"	1/3	1	1	377/30"	1,800	115/230	3.8/115	10"	9"	1"	28	589.19
S31 ❶ ❷	34	28	21	16	56"	1/2	1	1	471/30"	2,000	115/230	5.6/115	10"	10"	1 1/2"	38	625.81
S313 ❶	34	28	21	16	56"	1/2	3	1	410/30"	4,000	230/460	2.0/230	10"	10"	1 1/2"	36	645.90
S41 ❶ ❷	70	65	53	36	58"	1	1	1	971/40"	4,000	115/230	9.8/115	12"	12"	1 1/2"	50	762.06
S43 ❶	70	65	53	36	58"	1	3	1	860/40"	5,000	230/460	3.2/230	12"	12"	1 1/2"	50	764.37
S45 ❷	110	100	90	80	65"	1 1/2	1	2	1,430/40"	9,000	115/230	10.4/230	14"	15"	2"	77	1,021.86
S453 ❷	110	100	90	80	65"	1 1/2	3	2	1,500/40"	12,000	230/460	4.9/230	14"	15"	2"	85	1,042.30
S51 ❷	135	120	110	100	65"	2 1/2	1	2	1,760/40"	14,000	115/230	11.9/230	14"	15"	2"	87	1,106.46
S53 ❷	135	120	110	100	65"	2 1/2	3	2	1,750/40"	17,000	230/460	6.9/230	14"	15"	2"	100	1,063.63
S61 ❷	190	180	165	—	45"	2 1/2	1	2	2,600/40"	14,000	115/230	11.8/230	16"	17"	3"	100	1,492.83
S63 ❷	190	180	165	160	80"	3 1/2	3	2	3,260/60"	28,000	230/460	8.8/230	16"	17"	3"	115	1,394.48
S631 ❷ ❸	190	180	165	160	75"	3 1/2	1	2	3,400/60"	21,000	230	19.0/230	16"	17"	3"	115	1,516.29
S651 ❷	190	180	165	160	100"	5	1	2	3,710/80"	29,000	230	22.3/230	16"	17"	3"	150	1,554.26
S653 ❷	190	180	165	160	110"	5	3	2	3,520/80"	36,000	230/460	12.0/230	16"	17"	3"	150	1,562.03
S56 ❷	120	120	118	117	280"	6	3	2	4,000/150"	38,000	230/460	18.2/230	19"	22"	3"	215	2,917.40
S69 ❷	250	245	230	210	110"	5 1/2	3	2	4,190/60"	48,000	230/460	18.2/230	22"	22"	3"	250	2,185.43
S73 ❷	390	375	350	330	125"	10	3	4	7,640/80"	75,000	230/460	25.0/230	24"	22"	3"	245	2,647.51
2S41 ❷	78	74	70	61	110"	1+1	—	1	800/80"	—	—	19.6/115	—	—	—	—	—
S15	650	640	630	610	125"	15	3	1	11,000/80"	70,000	230/460	50/230	23"	21"	3"	452	5,677.21
S18P	720	710	690	650	105"	18	3	2	12,000/80"	90,000	230/460	52/230	20"	28"	4"	438	5,230.66
S18S	410	405	400	395	200"	18	3	1	12,000/80"	90,000	230/460	52/230	22"	28"	4"	431	5,230.66
S30P	1,275	1,230	1,200	1,190	125"	30	3	2	20,000/80"	140,000	230/460	98/230	23"	32"	5"	630	11,823.49
S30S	650	640	630	625	225"	30	3	1	20,000/80"	140,000	230/460	98/230	23"	33"	5"	606	11,823.49

❶ Standard with 115V or 230V 8' power cord (230V models are also rated for 208V). Add "230" to part number for 230V.
❷ S453 and smaller ship Ground. ❸ S51 and larger ship via motor freight only. ❹ Blowers in series double the pressure. ❺ No thermal overload protection.

Air diffuser

AS1.gif (750×512)

	Length *		Width *		Suggested			
	in	cm	in	cm	cfm	qes	Air Supply Connection	Actual Wt
AS1	1.5	4	.50	1.3	.05	1.5	3/16" O.D. (4 mm), ABS	.03 lb
AS2	1.5	4	.75	2	.10	3	3/16" O.D. (4 mm), ABS	.06 lb
AS3	2.0	5	1.0	2.5	.20	5	3/16" O.D. (4 mm), PE	.10 lb
ALS3	2.0	5	1.0	2.5	.20	5	1/4" NPT, PE	.10 lb
AS4	1.5	4	1.5	4	.25	7	3/16" O.D. (4 mm), PE	.21 lb
AS5S	3.0	8	1.0	2.5	.30	8	3/16" O.D. (4 mm), PE	.16 lb
AS5L	3.0	8	1.0	2.5	.30	8	1/4" O.D. (6 mm), PE	.16 lb
ALS5	3.0	8	1.0	2.5	.30	8	1/4" NPT, PE	.16 lb
AS8S	3.0	8	1.5	4	.35	10	3/16" O.D. (4 mm), PE	.39 lb
AS8L	3.0	8	1.5	4	.35	10	1/4" O.D. (6 mm), PE	.39 lb
ALS8	3.0	8	1.5	4	.35	10	1/4" NPT, PE	.39 lb
ALR8	3.0	8	1.5	4	.35	10	1/2" NPT, PE	.39 lb
AS15S	6.0	15	1.5	4	.50	14	1/4" O.D. (6 mm), PE	.75 lb
AS15L	6.0	15	1.5	4	.50	14	3/8" O.D. (9 mm), PE	.75 lb
ALR15	6.0	15	1.5	4	.50	14	1/2" NPT, PE	.75 lb
AS23S	9.0	23	1.5	4	.75	20	1/4" O.D. (6 mm), PE	1.35 lbs
AS23L	9.0	23	1.5	4	.75	20	3/8" O.D. (9 mm), PE	1.35 lbs
ALR23	9.0	23	1.5	4	.75	20	1/2" NPT, PE	1.35 lbs
AS30S	12.0	30	1.5	4	1.00	27	1/4" O.D. (6 mm), PE	1.50 lbs
AS30L	12.0	30	1.5	4	1.00	27	3/8" O.D. (9 mm), PE	1.50 lbs
ALR30	12.0	30	1.5	4	1.00	27	1/2" NPT, PE	1.50 lbs
ASW88S**	3.0	8	3.0	8	.70	19	1/4" O.D. (6 mm), PE	.70 lb
ASW88L**	3.0	8	3.0	8	.70	19	3/8" O.D. (6 mm), PE	.70 lb

*Dimensions of length and width are ±1/8" (3 mm). **Fitting is in center of 3" x 3" dimension. The suggested cfm shown above is typical for aquaculture; higher cfm amounts will create larger bubbles. Nonstandard fittings are available on request. PE is high density linear polyethylene. ABS is green plastic.

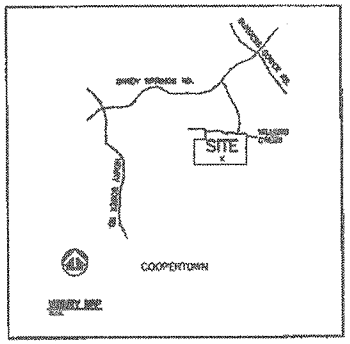
EMERGENCY ORDER REMEDIATION WETLAND

FOR

MAPLE GREEN RECLAMATION FACILITY
ROBERTSON COUNTY, TN

LOCATED OFF SANDY SPRINGS ROAD
COOPERTOWN, ROBERTSON COUNTY, TENNESSEE

CONTENTS:



FEBRUARY 27, 2014

ADENUS SOLUTIONS GROUP 849 AVIATION PARKWAY SMYRNA, TN 37167

Roy Denney

From: Roy Denney <Roy.Denney@adenus.com>
Sent: Monday, March 10, 2014 1:59 PM
To: 'Brad Harris'
Subject: FW: Maple Green FWS Design OGC14-0013
Attachments: Cover Letter.pdf; Design Specifications.pdf; Maple Green 2014 Wetland - Cover (1).pdf; Maple Green 2014 Wetland - Site 200 (2).pdf; Maple Green 2014 Wetland - Wetland Site Layout (3).pdf; Maple Green 2014 Wetland - Wetland Xsection details (4).pdf

FYI

Adenus
Roy Denney, P.E.
CTO

Adenus Group, LLC | 849 Aviation Pkwy, Smyrna, TN 37167
Direct: +1 615.220.7176 | Toll Free: +1 888.4.ADENUS Ext: 150 | Mobile: 615.691.2913 | Fax: 615.220.7207

From: Roy Denney [mailto:Roy.Denney@adenus.com]
Sent: Monday, March 10, 2014 12:42 PM
To: 'Sandra.Dudley@tn.gov'
Cc: 'Charles. Hyatt'; 'Penny, William'; 'Britton Dotson'
Subject: Maple Green FWS Design OGC14-0013

Dear Ms. Dudley,

Please see the attached cover letter and design pertaining to Maple Green Reclamation Facility.

Kindest Regards,

Roy Denney

Adenus
Roy Denney, P.E.
CTO

Adenus Group, LLC | 849 Aviation Pkwy, Smyrna, TN 37167
Direct: +1 615.220.7176 | Toll Free: +1 888.4.ADENUS Ext: 150 | Mobile: 615.691.2913 | Fax: 615.220.7207

Roy Denney

From: Roy Denney <Roy.Denney@adenus.com>
Sent: Thursday, March 13, 2014 2:11 PM
To: 'Brad Harris'
Subject: Maple Green BOD results
Attachments: 1402312_1 Email L1_Multiple_Sample_Per_Page 02 17 2014 1114.pdf; 1402429_1 Email L1_Multiple_Sample_Per_Page 02 18 2014 1352.pdf; 1402477_1 Email L1 _Multiple_Sample_Per_Page 02 19 2014 1201.pdf; 1402578_1 Email L1 _Multiple_Sample_Per_Page 02 21 2014 1101.pdf; 1402719_1 Email L1 _Multiple_Sample_Per_Page 02 27 2014 1853.pdf; 1402791_1 Email L1 _Multiple_Sample_Per_Page 02 27 2014 1853.pdf; 1402913_1 Email L1 _Multiple_Sample_Per_Page 02 27 2014 1852.pdf; 1403293_1 Email L1 _Multiple_Sample_Per_Page 03 04 2014 1655.pdf; 1403129_1 Email L1 _Multiple_Sample_Per_Page 03 06 2014 1630.pdf; 1403441_1 Email L1 _Multiple_Sample_Per_Page 03 06 2014 1752.pdf; 1403834_1 Email L1 _Multiple_Sample_Per_Page 03 12 2014 1719.pdf

Brad,
Attached is the lab data I have to date. We are still a little above the 45BOD target in the lagoon, although steadily moving that direction. My next step is to do a pond wide DO sampling I'm going to try to characterize portions of the pond and see if this is a stagnation/short circuiting issue or just a treatment time issue.

As we discussed on the phone, there are a couple really high data points which I believe to be improbable, likewise there is a 21mg/l I'd just toss as a sampling or procedural error.

Regards,

Roy

Adenus
Roy Denney, P.E.
CTO

Adenus Group, LLC | 849 Aviation Pkwy, Smyrna, TN 37167
Direct: +1 615.220.7176 | Toll Free: +1 888.4.ADENUS Ext: 150 | Mobile: 615.691.2913 | Fax: 615.220.7207

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Knoxville Division
505 E. Broadway Avenue Maryville, TN 37804 865.977.1200 Fax:865.984.8616
Tri-Cities, TN 423.926.6385 | Nashville, TN 615.242.1480
www.microbac.com
tennessee@microbac.com

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 2/17/2014
Date Received: 2/10/2014
Cust #: RA135
PO#:

Workorder: 1402312 **Project:** MAPLE GREEN - BOD

Analyte	Result	Units	Dil	Qualifier	Reporting Limit	Analyst	Analyzed	Method
MAPLE GREEN Sampled: 02/10/2014 09:00								
							1402312-01 (Water)	
Wet Chemistry							Analyzed By: Microbac Knoxville Division	
BOD-5	53.4	mg/L	1	K3	2.00	JPA	02/11/2014 20:50	SM5210 B-2001

USDA-EPA-NIOSH Testing Food Sanitation Consulting Chemical and Microbiological Analyses and Research

MEMBER ACIL

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Tri-Cities, TN 423.926.6385 | Nashville, TN 615.242.1480
www.microbac.com
tennessee@microbac.com

CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 2/17/2014
Date Received: 2/10/2014
Cust #: RA135
PO#:

Workorder: 1402312 **Project:** MAPLE GREEN - BOD

Certifications

Code	Description	Number	Expires
A2LAB-KNX	ISO 17025 KNX food	3131.01	05/31/2015
A2LAB-NSH	ISO 17025 NSH food	3131.02	06/30/2014
FI	State of Florida Nelac	E87966	06/30/2014
GA	Georgia Dept Natural Resources	980	04/13/2014
NCENV	NC Environmental	678	12/31/2013
TN_DW	State of Tennessee	TN02017	04/30/2014
USDA	US Department of Agriculture		11/30/2013

Notes and Definitions

K3	Glucose/glutamic acid recovery was above acceptance limits. The reported value is estimated.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Microbac Laboratories, Inc. - Knoxville

Danielle Abrams For Byron Evans, Project Manager

Thank you for your business. For any feedback, please contact Ashley Morris, at ashley.morris@microbac.com. You may also contact Sean Hyde, Chief Operating Officer at sean.hyde@microbac.com or James Nokes, President, at james.nokes@microbac.com.

As regulatory limits change frequently, Microbac advises the recipient of this report to confirm such limits with the appropriate Federal, state, or local authorities before acting in reliance on the regulatory limits provided.

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1402312-01 Sampled: 02/10/2014 09:00

Adenus Wastewater Professionals

Project Number / Title:	MAPLE GREEN
Contact/Address:	Brian Carter/Adenus
Desired Turnaround Time:	

SAMPLE DESCRIPTION Include all information to completely identify each sample. Also include a physical description. (Water, soil, ground water, etc.)	DATE	TIME	GRAB	COMP	ANALYSIS REQUIRED Comments, Instructions, etc.	Number / Type of Containers	Preservative
	2/10/14	9:00	X		BOD	1000 mL P	none
	2/10/14	9:00	X		Ammonia	250 mL P	H_2SO_4

Day 1 – pH/Temperature: Flow:

Day 2 – pH/Temperature: Flow:

SIGNATURE REQUIRED OF ALL PERSONS HANDLING SAMPLES	DATE	TIME	TEMPERATURE
Sample Collected By: Brian Carter	2-10-14	9:00	
Delivered to Lab By: Brian Carter	2-10-14	9:50	
Received By: [signature]	2/10/14	0951	3.7°C, 3.3°C
Batch Number (Office Use Only):			

Microbac

Microbac Laboratories, Inc.
Knoxville/Nashville Divisions

COOLER INSPECTION FORM # 10001.1

Client Name: ADENSUS

Date/Time Received: 02/10/14 0951

Work Order: _____

No. of Samples: 1

Received By: JL

Checklist Completed By: JL 02/10/14

Carrier: FedEx(_) UPS(_) Client(_) Field Services(_) Other(_): _____

After-Hours Receipt?	Yes ☐	No ☐	
Shipping container in good condition?	Yes ☐	No ☐	Not Present ☐
Custody seals intact on cooler?	Yes ☐	No ☐	Not Present ☐
Custody seals intact on samples?	Yes ☐	No ☐	Not Present ☐
Chain of custody present?	Yes ☐	No ☐	
Chain of custody includes proper client information?	Yes ☐	No ☐	
Chain of custody includes proper collection information and signatures?	Yes ☐	No ☐	
Chain of custody includes dates and times of sample collection?	Yes ☐	No ☐	
Chain of custody includes proper sample descriptions?	Yes ☐	No ☐	
Chain of custody agrees with sample labels?	Yes ☐	No ☐	
Chain of custody identifies proper sample matrix?	Yes ☐	No ☐	
Chain of custody identifies proper number of samples?	Yes ☐	No ☐	
Chain of custody includes required analysis?	Yes ☐	No ☐	
Chain of custody signed when relinquished and received?	Yes ☐	No ☐	
Samples are in proper containers/bottles?	Yes ☐	No ☐	
Sample containers are intact?	Yes ☐	No ☐	
Sufficient sample volume collected for requested analysis?	Yes ☐	No ☐	Not Present ☐
VOA vials for aqueous samples have zero headspace?	Yes ☐	No ☐	
Samples received within holding times?	Yes ☐	No ☐	
Samples received on ice?	Yes ☐	No ☐	
Sample properly preserved?			

If No, adjusted by? _____ Date/Time: _____

Remarks: _____

ANY "NO" EVALUATION REQUIRES CLIENT NOTIFICATION (excluding After-Hours Receipt).

Comments: _____

Microbac Laboratories, Inc.
Knoxville Division
505 E. Broadway Avenue Maryville, TN 37804 865.977.1200 Fax:865.984.8616
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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 2/18/2014
Date Received: 2/11/2014
Cust #: RA135
PO#:

Workorder: 1402429 **Project:** Daily BOD

Analyte	Result	Units	Dil	Qualifier	Reporting Limit	Analyst	Analyzed	Method
MAPLE GREEN **Sampled: 02/11/2014 09:00**								
					1402429-01 (Water)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
BOD-5	90.1	mg/L	1		2.00	JPA	02/12/2014 16:40	SM5210 B-2001

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www.microbac.com
tennessee@microbac.com

CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 2/18/2014
Date Received: 2/11/2014
Cust #: RA135
PO#:

Workorder: 1402429 **Project:** Daily BOD

Certifications

Code	Description	Number	Expires
A2LAB-KNX	ISO 17025 KNX food	3131.01	05/31/2015
A2LAB-NSH	ISO 17025 NSH food	3131.02	06/30/2014
FI	State of Florida Nelac	E87966	06/30/2014
GA	Georgia Dept Natural Resources	980	04/13/2014
NCENV	NC Environmental	678	12/31/2013
TN_DW	State of Tennessee	TN02017	04/30/2014
USDA	US Department of Agriculture		11/30/2013

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Microbac Laboratories, Inc. - Knoxville

Danielle Abrams For Byron Evans, Project Manager

Thank you for your business. For any feedback, please contact Ashley Morris, at ashley.morris@microbac.com. You may also contact Sean Hyde, Chief Operating Officer at sean.hyde@microbac.com or James Nokes, President, at james.nokes@microbac.com.

As regulatory limits change frequently, Microbac advises the recipient of this report to confirm such limits with the appropriate Federal, state, or local authorities before acting in reliance on the regulatory limits provided.

MICROBAC®

SAMPLE C 1402429-01 Sampled: 02/11/2014 09:00

Adenus Wastewater Professionals

Project Number / Title:	Daily BOD MAPLE GREEN
Contact/Address:	Brian Carter/Adenus
Desired Turnaround Time:	

SAMPLE DESCRIPTION Include all information to completely identify each sample. Also include a physical description. (Water, soil, ground water, etc.)	DATE	TIME	GRAB	COMP	ANALYSIS REQUIRED Comments, Instructions, etc.	Number / Type of Containers	Preservative
	2/11/14	9:00	X		BOD	1000 mL P	none

Day 1 – pH/Temperature:	Flow:
Day 2 – pH/Temperature:	Flow:

SIGNATURE REQUIRED OF ALL PERSONS HANDLING SAMPLES	DATE	TIME	TEMPERATURE °C
Sample Collected By: Brian Carter	2/11/14	9:00	
Delivered to Lab By: Brian Carter	2/11/14		
Received By: Dwayne Lee	2/11/14	0944	2.9°
Batch Number (Office Use Only):			

Microbac

Microbac Laboratories, Inc.
Knoxville/Nashville Divisions

COOLER INSPECTION FORM # 10001.1

Client Name: ADENUS

Date/Time Received: 2/11/14 0944

Work Order: 1402479

No. of Samples: 1

Received By: LL

Checklist Completed By: LL / 02/11/14

Carrier: FedEx(_) UPS(_) Client(X) Field Services(_) Other(_): _____

After-Hours Receipt?	Yes ☐	No (X)	
Shipping container in good condition?	Yes ☐	No ☐	Not Present (X)
Custody seals intact on cooler?	Yes ☐	No ☐	Not Present (X)
Custody seals intact on samples?	Yes ☐	No ☐	Not Present (X)
Chain of custody present?	Yes (X)	No ☐	
Chain of custody includes proper client information?	Yes (X)	No ☐	
Chain of custody includes proper collection information and signatures?	Yes (X)	No ☐	
Chain of custody includes dates and times of sample collection?	Yes (X)	No ☐	
Chain of custody includes proper sample descriptions?	Yes (X)	No ☐	
Chain of custody agrees with sample labels?	Yes (X)	No ☐	
Chain of custody identifies proper sample matrix?	Yes (X)	No ☐	
Chain of custody identifies proper number of samples?	Yes (X)	No ☐	
Chain of custody includes required analysis?	Yes (X)	No ☐	
Chain of custody signed when relinquished and received?	Yes (X)	No ☐	
Samples are in proper containers/bottles?	Yes (X)	No ☐	
Sample containers are intact?	Yes (X)	No ☐	
Sufficient sample volume collected for requested analysis?	Yes ☐	No ☐	Not Present (X)
VOA vials for aqueous samples have zero headspace?	Yes (X)	No ☐	
Samples received within holding times?	Yes (X)	No ☐	
Samples received on ice?	Yes (X)	No ☐	
Sample properly preserved?	Yes (X)	No ☐	

If No, adjusted by? _____ Date/Time: _____

Remarks: _____

ANY "NO" EVALUATION REQUIRES CLIENT NOTIFICATION (excluding After-Hours Receipt).

Comments: _____

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 2/18/2014
Date Received: 2/11/2014
Cust #: RA135
PO#:

Workorder: 1402429 **Project:** Daily BOD

Analyte	Result	Units	Dil	Qualifier	Reporting Limit	Analyst	Analyzed	Method
MAPLE GREEN **Sampled: 02/11/2014 09:00**								
					1402429-01 (Water)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
BOD-5	90.1	mg/L	1		2.00	JPA	02/12/2014 16:40	SM5210 B-2001

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 2/18/2014
Date Received: 2/11/2014
Cust #: RA135
PO#:

Workorder: 1402429 **Project:** Daily BOD

Certifications

Code	Description	Number	Expires
A2LAB-KNX	ISO 17025 KNX food	3131.01	05/31/2015
A2LAB-NSH	ISO 17025 NSH food	3131.02	06/30/2014
FI	State of Florida Nelac	E87966	06/30/2014
GA	Georgia Dept Natural Resources	980	04/13/2014
NCENV	NC Environmental	678	12/31/2013
TN_DW	State of Tennessee	TN02017	04/30/2014
USDA	US Department of Agriculture		11/30/2013

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Microbac Laboratories, Inc. - Knoxville

Danielle Abrams For Byron Evans, Project Manager

Thank you for your business. For any feedback, please contact Ashley Morris, at ashley.morris@microbac.com. You may also contact Sean Hyde, Chief Operating Officer at sean.hyde@microbac.com or James Nokes, President, at james.nokes@microbac.com.

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SAMPLE (1402429-01 Sampled: 02/11/2014 09:00

Adenus Wastewater Professionals

Project Number / Title:	Daily BOD MAPLE GREEN
Contact/Address:	Brian Carter/Adenus
Desired Turnaround Time:	

SAMPLE DESCRIPTION Include all information to completely identify each sample. Also include a physical description. (Water, soil, ground water, etc.)	DATE	TIME	GRAB	COMP	ANALYSIS REQUIRED Comments, Instructions, etc.	Number / Type of Containers	Preservative
	2/11/14	9:00	X		BOD	1000 mL P	none
Day 1 – pH/Temperature:					Flow:		
Day 2 – pH/Temperature:					Flow:		

SIGNATURE REQUIRED OF ALL PERSONS HANDLING SAMPLES	DATE	TIME	TEMPERATURE
Sample Collected By: Brian Carter	2/11/14	9:00	
Delivered to Lab By: Brian Carter	2/11/14		
Received By: JOANNE LEE	2/14/14	0944	2.9°C
Batch Number (Office Use Only):			

Microbac

Microbac Laboratories, Inc.
Knoxville/Nashville Divisions

COOLER INSPECTION FORM # 10001.1

Client Name: ADENUS

Work Order: 1402439

Received By: LL

Date/Time Received: 2/11/14 0944

No. of Samples: 1

Checklist Completed By: LL / 02/11/14

Carrier: FedEx(_) UPS(_) Client(X) Field Services(_) Other(_):

After-Hours Receipt?	Yes ☐	No (X)
Shipping container in good condition?	Yes ☐	No ☐ Not Present (X)
Custody seals intact on cooler?	Yes ☐	No ☐ Not Present (X)
Custody seals intact on samples?	Yes ☐	No ☐ Not Present (X)
Chain of custody present?	Yes (X)	No ☐
Chain of custody includes proper client information?	Yes (X)	No ☐
Chain of custody includes proper collection information and signatures?	Yes (X)	No ☐
Chain of custody includes dates and times of sample collection?	Yes (X)	No ☐
Chain of custody includes proper sample descriptions?	Yes (X)	No ☐
Chain of custody agrees with sample labels?	Yes (X)	No ☐
Chain of custody identifies proper sample matrix?	Yes (X)	No ☐
Chain of custody identifies proper number of samples?	Yes (X)	No ☐
Chain of custody includes required analysis?	Yes (X)	No ☐
Chain of custody signed when relinquished and received?	Yes (X)	No ☐
Samples are in proper containers/bottles?	Yes (X)	No ☐
Sample containers are intact?	Yes (X)	No ☐
Sufficient sample volume collected for requested analysis?	Yes ☐	No ☐ Not Present (X)
VOA vials for aqueous samples have zero headspace?	Yes (X)	No ☐
Samples received within holding times?	Yes (X)	No ☐
Samples received on ice?	Yes (X)	No ☐
Sample properly preserved?	Yes (X)	No ☐

If No, adjusted by? _____ Date/Time: _____

Remarks: _____

ANY "NO" EVALUATION REQUIRES CLIENT NOTIFICATION (excluding After-Hours Receipt).

Comments: _____

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 2/19/2014
Date Received: 2/12/2014
Cust #: RA135
PO#:

Workorder: 1402477 **Project:** Daily BOD

Analyte	Result	Units	Dil	Qualifier	Reporting Limit	Analyst	Analyzed	Method
MAPLE GREEN Sampled: 02/12/2014 08:45								
					1402477-01 (Water)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
BOD-5	76.7	mg/L	1		2.00	JPA	02/13/2014 16:00	SM5210 B-2001

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 2/19/2014
Date Received: 2/12/2014
Cust #: RA135
PO#:

Workorder: 1402477 **Project:** Daily BOD

Certifications

Code	Description	Number	Expires
A2LAB-KNX	ISO 17025 KNX food	3131.01	05/31/2015
A2LAB-NSH	ISO 17025 NSH food	3131.02	06/30/2014
FL	State of Florida Nelac	E87966	06/30/2014
GA	Georgia Dept Natural Resources	980	04/13/2014
NCENV	NC Environmental	678	12/31/2013
TN_DW	State of Tennessee	TN02017	04/30/2014
USDA	US Department of Agriculture		11/30/2013

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Microbac Laboratories, Inc. - Knoxville

Danielle Abrams For Byron Evans, Project Manager

Thank you for your business. For any feedback, please contact Ashley Morris, at ashley.morris@microbac.com. You may also contact Sean Hyde, Chief Operating Officer at sean.hyde@microbac.com or James Nokes, President, at james.nokes@microbac.com.

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SAMPLE 1402477-01 Adenus Wastewater Professionals Sampled: 02/12/2014 08:45

Project Number / Title:	Daily BOD	MAPLE GREEN
Contact/Address:	Brian Carter/Adenus	
Desired Turnaround Time:		

SAMPLE DESCRIPTION Include all information to completely identify each sample. Also include a physical description. (Water, soil, ground water, etc.)	DATE	TIME	GRAB	COMP	ANALYSIS REQUIRED Comments, Instructions, etc.	Number / Type of Containers	Preservative
	2/12/14	8:45	X		BOD	1000 mL P	none
Day 1 – pH/Temperature:				Flow:			
Day 2 – pH/Temperature:				Flow:			

SIGNATURE REQUIRED OF ALL PERSONS HANDLING SAMPLES	DATE	TIME	TEMPERATURE
Sample Collected By: B Carter	2/12/14	8:45	
Delivered to Lab By: B Carter	2/12/14	9:57	
Received By: [illegible]	2/12/14	1000	4.1°C
Batch Number (Office Use Only):			

Microbac

Microbac Laboratories, Inc.
Knoxville/Nashville Divisions

COOLER INSPECTION FORM # 10001.1

Client Name: AQENUS

Date/Time Received: 02/12/14 1000

Work Order: 1402477

No. of Samples: 1

Received By: LL

Checklist Completed By: LL / 02/12/14

Carrier: FedEx(_) UPS(_) Client(X) Field Services(_) Other(_):

After-Hours Receipt?	Yes ☐	No ☒
Shipping container in good condition?	Yes ☐	No ☐ Not Present ☑
Custody seals intact on cooler?	Yes ☐	No ☐ Not Present ☑
Custody seals intact on samples?	Yes ☐	No ☐ Not Present ☑
Chain of custody present?	Yes ☑	No ☐
Chain of custody includes proper client information?	Yes ☑	No ☐
Chain of custody includes proper collection information and signatures?	Yes ☑	No ☐
Chain of custody includes dates and times of sample collection?	Yes ☑	No ☐
Chain of custody includes proper sample descriptions?	Yes ☑	No ☐
Chain of custody agrees with sample labels?	Yes ☑	No ☐
Chain of custody identifies proper sample matrix?	Yes ☑	No ☐
Chain of custody identifies proper number of samples?	Yes ☑	No ☐
Chain of custody includes required analysis?	Yes ☑	No ☐
Chain of custody signed when relinquished and received?	Yes ☑	No ☐
Samples are in proper containers/bottles?	Yes ☑	No ☐
Sample containers are intact?	Yes ☑	No ☐
Sufficient sample volume collected for requested analysis?	Yes ☑	No ☐
VOA vials for aqueous samples have zero headspace?	Yes ☐	No ☐ Not Present ☒
Samples received within holding times?	Yes ☑	No ☐
Samples received on ice?	Yes ☑	No ☐
Sample properly preserved?	Yes ☑	No ☐

If No, adjusted by? _____ Date/Time: _____

Remarks: _____

ANY "NO" EVALUATION REQUIRES CLIENT NOTIFICATION (excluding After-Hours Receipt).

Comments: _____

Roy Denney

From: Roy Denney <Roy.Denney@adenus.com>
Sent: Monday, March 24, 2014 11:56 AM
To: 'Brad Harris'; 'ann.morbit@tn.gov'
Subject: Maple Green Lab Results OCG14-0019
Attachments: 1404379_1 Email L1_Multiple_Sample_Per_Page 03 21 2014 0034.pdf; 1404281_1 Email L1_Multiple_Sample_Per_Page 03 20 2014 0126.pdf; 1404175_1 Email L1 _Multiple_Sample_Per_Page 03 18 2014 2354.pdf

Brad,

I've attached the lab data for last week. For the samples grabbed on the 12th, Sample A is from the pump building after the level rose enough to flow into the outlet riser. Sample B is from the same sample location previously used at the lagoon. Subsequent samples are from the Pump House.

The level In the lagoon is at the point where it will be necessary to go to drip irrigation to minimize storage in the lagoon and . We will begin utilizing the drip to maintain the 6ft level described in the PER.

Regards,

Roy

Adenus
Roy Denney, P.E.
CTO

Adenus Group, LLC | 849 Aviation Pkwy, Smyrna, TN 37167
Direct: +1 615.220.7176 | Toll Free: +1 888.4.ADENUS Ext: 150 | Mobile: 615.691.2913 | Fax: 615.220.7207

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/21/2014
Date Received: 3/13/2014
Cust #: RA135
PO#:

Workorder: 1404379 **Project:** Maple Green

Analyte	Result	Units	Dil	Qualifier	Reporting Limit	Analyst	Analyzed	Method
Maple Green Sampled: 03/13/2014 09:00								
					1404379-01 (Water)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
BOD-5	63.1	mg/L	1		2.00	JPA	03/14/2014 19:10	SM5210 B-2001

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/21/2014
Date Received: 3/13/2014
Cust #: RA135
PO#:

Workorder: 1404379 **Project:** Maple Green

Certifications

Code	Description	Number	Expires
A2LAB-KNX	ISO 17025 KNX food	3131.01	05/31/2015
A2LAB-NSH	ISO 17025 NSH food	3131.02	06/30/2014
FL	State of Florida NELAC	E87966	06/30/2014
GA	Georgia Dept Natural Resources	980	04/13/2014
NCENV	NC Environmental	678	12/31/2013
TN_DW	State of Tennessee	TN02017	04/30/2014
USDA	US Department of Agriculture		11/30/2013

Notes and Definitions

R1	Duplicate RPD is outside of acceptance limits.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Microbac Laboratories, Inc. - Knoxville

Brian Richard, Project Manager

Thank you for your business. For any feedback, please contact Ashley Morris, at ashley.morris@microbac.com. You may also contact Trevor Boyce, President, at trevor.boyce@microbac.com.

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1404379-01
Adenus Wastewater Professionals
Sampled: 03/13/2014 09:00

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SAMPLE CHAIN OF CUSTODY

Project Number / Title:	Daily BOD MAPLE GREEN
Contact/Address:	Brian Carter/Adenus
Desired Turnaround Time:	

SAMPLE DESCRIPTION Include all information to completely identify each sample. Also include a physical description. (Water, soil, ground water, etc.)	DATE	TIME	GRAB	COMP	ANALYSIS REQUIRED Comments, Instructions, etc.	Number / Type of Containers	Pr
	3/13/14	9:00	✓		BOD	1000 mL P	none

Day 1 – pH/Temperature: **Flow:**

Day 2 – pH/Temperature: **Flow:**

SIGNATURE REQUIRED ON ALL PERSONS HANDLING SAMPLES	DATE	TIME	TEMPERATURE
Sample Collected By:	3/13/14	9:00	
Delivered to Lab By:	3/13/14		
Received By:	3/13/14	1007	7.2°C
Batch Number (Office Use Only):			

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Microbac Laboratories, Inc.
Knoxville/Nashville Divisions

COOLER INSPECTION FORM # 10001.1

Client Name: ADERHOLT Date/Time Received: 3/13/14 1007

Work Order: 1404379 No. of Samples: 1

Received By: LL Checklist Completed By: LL 3/13/14

Carrier: FedEx(_) UPS(_) Client(✓) Field Services(_) Other(_): _____

After-Hours Receipt?	Yes ☐	No ☑	
Shipping container in good condition?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on samples?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody includes proper client information?	Yes ☑	No ☐	
Chain of custody includes proper collection information and signatures?	Yes ☑	No ☐	
Chain of custody includes dates and times of sample collection?	Yes ☑	No ☐	
Chain of custody includes proper sample descriptions?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Chain of custody identifies proper sample matrix?	Yes ☑	No ☐	
Chain of custody identifies proper number of samples?	Yes ☑	No ☐	
Chain of custody includes required analysis?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Samples are in proper containers/bottles?	Yes ☑	No ☐	
Sample containers are intact?	Yes ☑	No ☐	
Sufficient sample volume collected for requested analysis?	Yes ☑	No ☐	
VOA vials for aqueous samples have zero headspace?	Yes ☐	No ☐	Not Present ☑
Samples received within holding times?	Yes ☑	No ☐	
Samples received on ice?	Yes ☑	No ☐	
Sample properly preserved?	Yes ☑	No ☐	

If No, adjusted by? _____ Date/Time: _____

Remarks: _____

ANY "NO" EVALUATION REQUIRES CLIENT NOTIFICATION (excluding After-Hours Receipt).

Comments: _____

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www.microbac.com
tennessee@microbac.com

CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/20/2014
Date Received: 3/12/2014
Cust #: RA135
PO#:

Workorder: 1404281 **Project:** Maple Green

Analyte	Result	Units	Dil	Qualifier	Reporting Limit	Analyst	Analyzed	Method
Maple Green A **Sampled: 03/12/2014 09:00**								
					1404281-01 (Water)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
BOD-5	74.6	mg/L	1		2.00	JPA	03/13/2014 17:00	SM5210 B-2001
Maple Green B **Sampled: 03/12/2014 09:00**								
					1404281-02 (Water)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
BOD-5	38.7	mg/L	1		2.00	JPA	03/13/2014 17:00	SM5210 B-2001

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/20/2014
Date Received: 3/12/2014
Cust #: RA135
PO#:

Workorder: 1404281 **Project:** Maple Green

Certifications

Code	Description	Number	Expires
A2LAB-KNX	ISO 17025 KNX food	3131.01	05/31/2015
A2LAB-NSH	ISO 17025 NSH food	3131.02	06/30/2014
FL	State of Florida NELAC	E87966	06/30/2014
GA	Georgia Dept Natural Resources	980	04/13/2014
NCENV	NC Environmental	678	12/31/2013
TN_DW	State of Tennessee	TN02017	04/30/2014
USDA	US Department of Agriculture		11/30/2013

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Microbac Laboratories, Inc. - Knoxville

Brian Richard, Project Manager

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1404281-01
Adenus Wastewater Professionals
Sampled: 03/12/2014 09:00

MICROBAC®

SAMPLE CHAIN OF CUSTODY

Project Number / Title: Daily BOD MAPLE GREEN
Contact/Address: Brian Carter/Adenus
Desired Turnaround Time:

SAMPLE DESCRIPTION Include all information to completely identify each sample. Also include a physical description. (Water, soil, ground water, etc.)	DATE	TIME	GRAB	COMP	ANALYSIS REQUIRED Comments, Instructions, etc.	Number / Type of Containers	Pr
	3/12/14	9:00	✓		BOD – A	1000 mL P	none
	3/12/14	9:00	✓		BOD – B	1000 mL P	None

Day 1 – pH/Temperature: **Flow:**
Day 2 – pH/Temperature: **Flow:**

SIGNATURE REQUIRED OF ALL PERSONS HANDLING SAMPLES	DATE	TIME	TEMPERATURE
Sample Collected By: Brian Carter	3/12/14	9:00	
Delivered to Lab By: Brian Carter	3/12/14		
Received By: [signature]	3/13/14	1049	3.4°C
Batch Number (Office Use Only):			

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Microbac Laboratories, Inc.
Knoxville/Nashville Divisions

COOLER INSPECTION FORM # 10001.1

Client Name: AQUUS

Date/Time Received: 3/12/14 1049

Work Order: 1404281

No. of Samples: 2

Received By: LL

Checklist Completed By: LL, 3/12/14

Carrier: FedEx(_) UPS(_) Client(X) Field Services(_) Other(_):

After-Hours Receipt?	Yes ☐	No ☒	
Shipping container in good condition?	Yes ☐	No ☐	Not Present ☒
Custody seals intact on cooler?	Yes ☐	No ☐	Not Present ☒
Custody seals intact on samples?	Yes ☐	No ☐	Not Present ☒
Chain of custody present?	Yes ☒	No ☐	
Chain of custody includes proper client information?	Yes ☒	No ☐	
Chain of custody includes proper collection information and signatures?	Yes ☒	No ☐	
Chain of custody includes dates and times of sample collection?	Yes ☒	No ☐	
Chain of custody includes proper sample descriptions?	Yes ☒	No ☐	
Chain of custody agrees with sample labels?	Yes ☒	No ☐	
Chain of custody identifies proper sample matrix?	Yes ☒	No ☐	
Chain of custody identifies proper number of samples?	Yes ☒	No ☐	
Chain of custody includes required analysis?	Yes ☒	No ☐	
Chain of custody signed when relinquished and received?	Yes ☒	No ☐	
Samples are in proper containers/bottles?	Yes ☒	No ☐	
Sample containers are intact?	Yes ☒	No ☐	
Sufficient sample volume collected for requested analysis?	Yes ☒	No ☐	
VOA vials for aqueous samples have zero headspace?	Yes ☐	No ☐	Not Present ☒
Samples received within holding times?	Yes ☒	No ☐	
Samples received on ice?	Yes ☒	No ☐	
Sample properly preserved?	Yes ☒	No ☐	

If No, adjusted by? _____ Date/Time: _____

Remarks: _____

ANY "NO" EVALUATION REQUIRES CLIENT NOTIFICATION (excluding After-Hours Receipt).

Comments: _____

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/18/2014
Date Received: 3/11/2014
Cust #: RA135
PO#:

Workorder: 1404175 **Project:** Maple Green

Analyte	Result	Units	Dil	Qualifier	Reporting Limit	Analyst	Analyzed	Method
Maple Green Sampled: 03/11/2014 08:42								
					1404175-01 (Water)			
Wet Chemistry						Analyzed By: Microbac Knoxville Division		
BOD-5	43.0	mg/L	1		2.00	JPA	03/12/2014 18:15	SM5210 B-2001

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/18/2014
Date Received: 3/11/2014
Cust #: RA135
PO#:

Workorder: 1404175 **Project:** Maple Green

Certifications

Code	Description	Number	Expires
A2LAB-KNX	ISO 17025 KNX food	3131.01	05/31/2015
A2LAB-NSH	ISO 17025 NSH food	3131.02	06/30/2014
FL	State of Florida NELAC	E87966	06/30/2014
GA	Georgia Dept Natural Resources	980	04/13/2014
NCENV	NC Environmental	678	12/31/2013
TN_DW	State of Tennessee	TN02017	04/30/2014
USDA	US Department of Agriculture		11/30/2013

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Differenc

Microbac Laboratories, Inc. - Knoxville

Brian Richard, Project Manager

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1404175-01
Adenus Wastewater Professionals
Sampled: 03/11/2014 08:42

MICROBAC®

SAMPLE CHAIN OF CUSTODY

Project Number / Title: Daily BOD
Contact/Address: Brian Carter/Adenus
Desired Turnaround Time:

SAMPLE DESCRIPTION Include all information to completely identify each sample. Also include a physical description. (Water, soil, ground water, etc.)	DATE	TIME	GRAB	COMP	ANALYSIS REQUIRED Comments, Instructions, etc.	Number / Type of Containers	P
Mill - Green	3/11/14	8:42	X				
					BOD	1000 mL P	none

Day 1 – pH/Temperature: Flow:
Day 2 – pH/Temperature: Flow:

SIGNATURE REQUIRED OF ALL PERSONS HANDLING SAMPLES	DATE	TIME	TEMPERATURE:
Sample Collected By: Tracy Nichols	3/11/14	8:42	
Delivered to Lab By: Tracy Nichols	3/11/14	9:55	
Received By: [signature]	3/11/14	0960	13.8°C Temp. taken ~30 min after receipt
Batch Number (Office Use Only):			ANM 3.11.14

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Microbac

Microbac Laboratories, Inc.
Knoxville/Nashville Divisions

COOLER INSPECTION FORM # 10001.1

Client Name: AORUS

Date/Time Received: 3/11/14 0956

Work Order: 1404175

No. of Samples: 1

Received By: LL

Checklist Completed By: LL, 3/11/14

Carrier: FedEx(_) UPS(_) Client(✓) Field Services(_) Other(_):

After-Hours Receipt?	Yes ☐	No ☒	
Shipping container in good condition?	Yes ☐	No ☐	Not Present ☒
Custody seals intact on cooler?	Yes ☐	No ☐	Not Present ☒
Custody seals intact on samples?	Yes ☐	No ☐	Not Present ☒
Chain of custody present?	Yes ☒	No ☐	
Chain of custody includes proper client information?	Yes ☒	No ☐	
Chain of custody includes proper collection information and signatures?	Yes ☒	No ☐	
Chain of custody includes dates and times of sample collection?	Yes ☒	No ☐	
Chain of custody includes proper sample descriptions?	Yes ☒	No ☐	
Chain of custody agrees with sample labels?	Yes ☒	No ☐	
Chain of custody identifies proper sample matrix?	Yes ☒	No ☐	
Chain of custody identifies proper number of samples?	Yes ☒	No ☐	
Chain of custody includes required analysis?	Yes ☒	No ☐	
Chain of custody signed when relinquished and received?	Yes ☒	No ☐	
Samples are in proper containers/bottles?	Yes ☒	No ☐	
Sample containers are intact?	Yes ☒	No ☐	
Sufficient sample volume collected for requested analysis?	Yes ☒	No ☐	
VOA vials for aqueous samples have zero headspace?	Yes ☐	No ☐	Not Present ☒
Samples received within holding times?	Yes ☒	No ☐	
Samples received on ice?	Yes ☒	No ☐	
Sample properly preserved?	Yes ☒	No ☐	

If No, adjusted by? _____ Date/Time: _____

Remarks: _____

ANY "NO" EVALUATION REQUIRES CLIENT NOTIFICATION (excluding After-Hours Receipt).

Comments: _____

Roy Denney

From: Roy Denney <Roy.Denney@adenus.com>
Sent: Monday, March 24, 2014 12:21 PM
To: 'ann.morbitt@tn.gov'
Subject: FW: Maple Green Lab Results OCG14-0019
Attachments: 1404379_1 Email L1_Multiple_Sample_Per_Page 03 21 2014 0034.pdf; 1404281_1 Email L1_Multiple_Sample_Per_Page 03 20 2014 0126.pdf; 1404175_1 Email L1 _Multiple_Sample_Per_Page 03 18 2014 2354.pdf

Ann,
Sorry, failed to copy.

Roy

Adenus
Roy Denney, P.E.
CTO

Adenus Group, LLC | 849 Aviation Pkwy, Smyrna, TN 37167
Direct: +1 615.220.7176 | Toll Free: +1 888.4.ADENUS Ext: 150 | Mobile: 615.691.2913 | Fax: 615.220.7207

From: Roy Denney [mailto:Roy.Denney@adenus.com]
Sent: Monday, March 24, 2014 11:56 AM
To: 'Brad Harris'; 'ann.morbit@tn.gov'
Subject: Maple Green Lab Results OCG14-0019

Brad,

I've attached the lab data for last week. For the samples grabbed on the 12th, Sample A is from the pump building after the level rose enough to flow into the outlet riser. Sample B is from the same sample location previously used at the lagoon. Subsequent samples are from the Pump House.

The level in the lagoon is at the point where it will be necessary to go to drip irrigation to minimize storage in the lagoon and . We will begin utilizing the drip to maintain the 6ft level described in the PER.

Regards,

Roy

Adenus
Roy Denney, P.E.
CTO

Adenus Group, LLC | 849 Aviation Pkwy, Smyrna, TN 37167
Direct: +1 615.220.7176 | Toll Free: +1 888.4.ADENUS Ext: 150 | Mobile: 615.691.2913 | Fax: 615.220.7207

Roy Denney

From: Roy Denney <Roy.Denney@adenus.com>
Sent: Wednesday, March 26, 2014 11:53 AM
To: 'Brad Harris'
Subject: FWS Wetlands
Attachments: 20140326101004848.pdf

Brad,

I have reviewed the case studies and pilots you mentioned yesterday. From a first look it appears that several key factors are substantially different. The SUD system is a much shallower system with the majority of the surface area limited to 6 inches of depth. The "pools" are only 3 ft deep. While the areal loading rate is significantly lower, the hydraulic detention time is about the same and the shallow design could potentially lead to limitations. The depth used in their design isn't wrong, rather one of many alternatives that are out there.

Although the difference between 30mg/L BOD to 9 mg/L and 150mg/L to 45mg/L may seem large the natural log reduction is the same in both cases, 1.204.

It is important to remember the biological reaction is a first order reaction rate so different ranges of treatment will see different treatment requirements. Ultimately the equation is fairly conservative. I've attached the worksheet with the criteria used in planning the SUD wetland. You'll see it actually calls for a higher surface area, using the model we've worked with to get area for the Sewanee project, it calls for a 36 acre treatment area.

The areal loading rates are highly subjective and large shallow marshes would increase the volume required by increasing the vegetation density.

The system we've proposed should be sufficient to treat summer flows with only one cell in operation. At current site flows into Maple Green a single treatment cell should be sufficient to about 5 degrees Celsius.

As I mentioned the I did not intend for the aeration to be a primary mechanism in the treatment capacity of this system. It is sized with rather traditional design considerations. The aeration concept is intended as a method of improving upon the standard design, however such conditions would be closely monitors for the purposes of establishing a superior level of treatment and the eventual increase in capacity, not as a basis of the proposed design capacity.

With regard to utilizing the system in series. Most designs we've seen for wetlands allow for series or parallel use. Since they are commonly used for tertiary treatment there is no anticipated issue with a similar use after a wetland system.

Finally our design should allow for easy routine maintenance allowing for the easy removal of detritus and vegetation.

If there are further questions please don't hesitate to ask.

Thanks,

Roy

Adenus
Roy Denney, P.E.
CTO

Adenus Group, LLC | 849 Aviation Pkwy, Smyrna, TN 37167
Direct: +1 615.220.7176 | Toll Free: +1 888.4.ADENUS Ext: 150 | Mobile: 615.691.2913 | Fax: 615.220.7207

FWS Wetland Sizing

Variables				
			metric	
BOD influent	30	mg/L	30	mg/L
1 cell BOD eff.	15	mg/L	15	mg/L
BOD Limit	9	mg/L	9	mg/L
Flow	1000000	GPD	3773.58	M^3/Day
depth	0.5	ft	0.15	M
k20 factor	0.678	d^-1		
Theta	1.06			
Aspect Ratio X:1	3			
porosity	0.9	d		
Ground Loading	31.19	lb/sq foot		

1 MGD Site

Light Vegitation

6 inch depth

30mg/L BOD Influent
9mg/L Effluent

Single pass removal								
Sizing	Temperature C	1	6	10	15	20	25	30
Farhenheit		33.8	42.8	50	59	68	77	86
Area	Ha	14.778	11.043	8.747	6.536	4.884	3.650	2.727
Area	acre	36.502	27.276	21.605	16.145	12.064	9.015	6.737
Length	ft	728.01	629.32	560.10	484.17	418.54	361.80	312.75
Width	ft	2184.04	1887.97	1680.29	1452.51	1255.61	1085.40	938.26
Duel Pass 1								
	Temperature C	1	6	10	15	20	25	30
Sizing								
Area	Ha	8.508	6.358	5.036	3.763	2.812	2.101	1.570
Area	acre	21.015	15.703	12.438	9.295	6.946	5.190	3.878
Length	ft	552.39	477.51	424.98	367.37	317.57	274.52	237.31
Width	ft	1657.16	1432.52	1274.93	1102.11	952.71	823.56	711.92
Duel Pass 2								
	Temperature C	1	6	10	15	20	25	30
Sizing								
Area	Ha	6.270	4.685	3.711	2.773	2.072	1.549	1.157
Area	acre	15.487	11.573	9.167	6.850	5.119	3.825	2.858
Length	ft	474.21	409.92	364.83	315.37	272.62	235.67	203.72
Width	ft	1422.62	1229.77	1094.49	946.12	817.87	707.00	611.16

HRT: 5.946622 2.630196

Roy Denney

From: Roy Denney <Roy.Denney@adenus.com>
Sent: Monday, March 31, 2014 1:14 PM
To: 'Brad Harris'; 'ann.morbitt@tn.gov'
Subject: Maple Green BOD5
Attachments: 1404580_1 Email L1_Multiple_Sample_Per_Page 03 24 2014 2215.pdf; 1404672_1 Email L1_Multiple_Sample_Per_Page 03 25 2014 1839.pdf; 1404870_1 Email L1 _Multiple_Sample_Per_Page 03 28 2014 1147.pdf; 1404800_1 Email L1 _Multiple_Sample_Per_Page 03 28 2014 1148.pdf

Brad, Ann,

Please see attached results for the treatment at Maple Green.

With the exception of Sample 1404870, all results have been below the permit limits.

If this week's results show we are achieving the treatment limits, we intend to reduce sampling of the lagoon to monthly.

Kind Regards,

Roy Denney

Adenus
Roy Denney, P.E.
CTO

Adenus Group, LLC | 849 Aviation Pkwy, Smyrna, TN 37167
Direct: +1 615.220.7176 | Toll Free: +1 888.4.ADENUS Ext: 150 | Mobile: 615.691.2913 | Fax: 615.220.7207

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www.microbac.com
tennessee@microbac.com

CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/24/2014
Date Received: 3/17/2014
Cust #: RA135
PO#:

Workorder: 1404580 **Project:** Maple Green

Analyte	Result	Units	Dil	Qualifier	Reporting Limit	Analyst	Analyzed	Method
Maple Green Sampled: 03/17/2014 10:00								
					1404580-01 (Water)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
BOD-5	43.4	mg/L	1		2.00	JPA	03/18/2014 19:30	SM5210 B-2001

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Knoxville Division
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www.microbac.com
tennessee@microbac.com

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/24/2014
Date Received: 3/17/2014
Cust #: RA135
PO#:

Workorder: 1404580 **Project:** Maple Green

Certifications

Code	Description	Number	Expires
A2LAB-KNX	ISO 17025 KNX food	3131.01	05/31/2015
A2LAB-NSH	ISO 17025 NSH food	3131.02	06/30/2014
FL	State of Florida NELAC	E87966	06/30/2014
GA	Georgia Dept Natural Resources	980	04/13/2014
NCENV	NC Environmental	678	12/31/2013
TN_DW	State of Tennessee	TN02017	04/30/2014
USDA	US Department of Agriculture		11/30/2013

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Microbac Laboratories, Inc. - Knoxville

Brian Richard, Project Manager

Thank you for your business. For any feedback, please contact Ashley Morris, at ashley.morris@microbac.com. You may also contact Trevor Boyce, President, at trevor.boyce@microbac.com.

As regulatory limits change frequently, Microbac advises the recipient of this report to confirm such limits with the appropriate Federal, state, or local authorities before acting in reliance on the regulatory limits provided.

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SAMPLE CHAIN OF CUSTODY

Project Number / Title:	Daily BOD MAPLE GREEN
Contact/Address:	Brian Carter/Adenus
Desired Turnaround Time:	

SAMPLE DESCRIPTION Include all information to completely identify each sample. Also include a physical description. (Water, soil, ground water, etc.)	DATE	TIME	GRAB	COMP	ANALYSIS REQUIRED Comments, Instructions, etc.	Number / Type of Containers	Preservative
	3/17/14	10:00	√		BOD	1000 mL P	none

Day 1 – pH/Temperature: Flow:

Day 2 – pH/Temperature: Flow:

SIGNATURE REQUIRED OF ALL PERSONS HANDLING SAMPLES	DATE	TIME	TEMPERATURE
Sample Collected By: Ben Carter	3/17/14	10:00	
Delivered to Lab By: Ben Carter	3/17/14		
Received By: 20 June 202	3/17/14	1107	0.2°C

Batch Number (Office Use Only):

1404580-01
Adenus Wastewater Professionals
Sampled: 03/17/2014 10:00

Microbac

Microbac Laboratories, Inc.
Knoxville/Nashville Divisions

COOLER INSPECTION FORM # 10001.1

Client Name: ADENUS

Date/Time Received: 3/17/14 1107

Work Order: 1404580

No. of Samples: 1

Received By: LL

Checklist Completed By: LL / 3/17/14

Carrier: FedEx(_) UPS(_) Client(✓) Field Services(_) Other(_): _____

After-Hours Receipt?	Yes ☐	No ☒	
Shipping container in good condition?	Yes ☐	No ☐	Not Present ☒
Custody seals intact on cooler?	Yes ☐	No ☐	Not Present ☒
Custody seals intact on samples?	Yes ☐	No ☐	Not Present ☒
Chain of custody present?	Yes ☑	No ☐	
Chain of custody includes proper client information?	Yes ☑	No ☐	
Chain of custody includes proper collection information and signatures?	Yes ☑	No ☐	
Chain of custody includes dates and times of sample collection?	Yes ☑	No ☐	
Chain of custody includes proper sample descriptions?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Chain of custody identifies proper sample matrix?	Yes ☑	No ☐	
Chain of custody identifies proper number of samples?	Yes ☑	No ☐	
Chain of custody includes required analysis?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Samples are in proper containers/bottles?	Yes ☑	No ☐	
Sample containers are intact?	Yes ☑	No ☐	
Sufficient sample volume collected for requested analysis?	Yes ☑	No ☐	
VOA vials for aqueous samples have zero headspace?	Yes ☐	No ☐	Not Present ☒
Samples received within holding times?	Yes ☑	No ☐	
Samples received on ice?	Yes ☑	No ☐	
Sample properly preserved?	Yes ☑	No ☐	

If No, adjusted by? _____ Date/Time: _____

Remarks: _____

ANY "NO" EVALUATION REQUIRES CLIENT NOTIFICATION (excluding After-Hours Receipt).

Comments: _____

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Knoxville Division
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www.microbac.com
tennessee@microbac.com

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/25/2014
Date Received: 3/18/2014
Cust #: RA135
PO#:

Workorder: 1404672 **Project:** Maple Green

Analyte	Result	Units	Dil	Qualifier	Reporting Limit	Analyst	Analyzed	Method
Maple Green Sampled: 03/18/2014 09:00								
					1404672-01 (Water)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
BOD-5	40.2	mg/L	1		2.00	JPA	03/19/2014 18:20	SM5210 B-2001

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www.microbac.com
tennessee@microbac.com

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/25/2014
Date Received: 3/18/2014
Cust #: RA135
PO#:

Workorder: 1404672 **Project:** Maple Green

Certifications

Code	Description	Number	Expires
A2LAB-KNX	ISO 17025 KNX food	3131.01	05/31/2015
A2LAB-NSH	ISO 17025 NSH food	3131.02	06/30/2014
FL	State of Florida NELAC	E87966	06/30/2014
GA	Georgia Dept Natural Resources	980	04/13/2014
NCENV	NC Environmental	678	12/31/2013
TN_DW	State of Tennessee	TN02017	04/30/2014
USDA	US Department of Agriculture		11/30/2013

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Microbac Laboratories, Inc. - Knoxville

Brian Richard, Project Manager

Thank you for your business. For any feedback, please contact Ashley Morris, at ashley.morris@microbac.com. You may also contact Trevor Boyce, President, at trevor.boyce@microbac.com.

As regulatory limits change frequently, Microbac advises the recipient of this report to confirm such limits with the appropriate Federal, state, or local authorities before acting in reliance on the regulatory limits provided.

MICROBAC®

SAMPLE CHAIN OF CUSTODY

1404672-01 Sampled: 03/18/2014 09:00

Adenus Wastewater Professionals

Project Number / Title:	Daily BOD
Contact/Address:	Brian Carter/Adenus
Desired Turnaround Time:	

SAMPLE DESCRIPTION Include all information to completely identify each sample. Also include a physical description. (Water, soil, ground water, etc)	DATE	TIME	GRAB	COMP	ANALYSIS REQUIRED Comments, Instructions, etc	Number / Type of Containers	Preservative
Maple grove	3-18-14	9:00	X				
					BOD	1000 mL P	none
Day 1 – pH/Temperature:					Flow:		
Day 2 – pH/Temperature:					Flow:		

SIGNATURE REQUIRED OF ALL PERSONS HANDLING SAMPLES	DATE	TIME	TEMPERATURE
Sample Collected By:	3-18-14	9:00	
Delivered to Lab By: Trudy Nichols	3-18-14		
Received By:	3/18/14	1044	8.9°C
Batch Number(Office Use Only):			

Microbac

Microbac Laboratories, Inc.
Knoxville/Nashville Divisions

COOLER INSPECTION FORM # 10001.1

Client Name: ADENUS

Date/Time Received: 3/18/14 1044

Work Order: 1404672

No. of Samples: 1

Received By: LL

Checklist Completed By: LL 3/18/14

Carrier: FedEx(_) UPS(_) Client(X) Field Services(_) Other(_): _____

After-Hours Receipt?	Yes ☐	No ☒	
Shipping container in good condition?	Yes ☐	No ☐	Not Present ☒
Custody seals intact on cooler?	Yes ☐	No ☐	Not Present ☒
Custody seals intact on samples?	Yes ☐	No ☐	Not Present ☒
Chain of custody present?	Yes ☒	No ☐	
Chain of custody includes proper client information?	Yes ☒	No ☐	
Chain of custody includes proper collection information and signatures?	Yes ☒	No ☐	
Chain of custody includes dates and times of sample collection?	Yes ☒	No ☐	
Chain of custody includes proper sample descriptions?	Yes ☒	No ☐	
Chain of custody agrees with sample labels?	Yes ☒	No ☐	
Chain of custody identifies proper sample matrix?	Yes ☒	No ☐	
Chain of custody identifies proper number of samples?	Yes ☒	No ☐	
Chain of custody includes required analysis?	Yes ☒	No ☐	
Chain of custody signed when relinquished and received?	Yes ☒	No ☐	
Samples are in proper containers/bottles?	Yes ☒	No ☐	
Sample containers are intact?	Yes ☒	No ☐	
Sufficient sample volume collected for requested analysis?	Yes ☒	No ☐	
VOA vials for aqueous samples have zero headspace?	Yes ☐	No ☐	Not Present ☒
Samples received within holding times?	Yes ☒	No ☐	
Samples received on ice?	Yes ☒	No ☐	
Sample properly preserved?	Yes ☒	No ☐	

If No, adjusted by? _____ Date/Time: _____

Remarks: _____

ANY "NO" EVALUATION REQUIRES CLIENT NOTIFICATION (excluding After-Hours Receipt).

Comments: _____

Roy Denney

From: Roy Denney <Roy.Denney@adenus.com>
Sent: Monday, March 31, 2014 1:14 PM
To: 'Brad Harris'; 'ann.morbitt@tn.gov'
Subject: Maple Green BOD5
Attachments: 1404580_1 Email L1_Multiple_Sample_Per_Page 03 24 2014 2215.pdf; 1404672_1 Email L1_Multiple_Sample_Per_Page 03 25 2014 1839.pdf; 1404870_1 Email L1 _Multiple_Sample_Per_Page 03 28 2014 1147.pdf; 1404800_1 Email L1 _Multiple_Sample_Per_Page 03 28 2014 1148.pdf

Brad, Ann,

Please see attached results for the treatment at Maple Green.

With the exception of Sample 1404870, all results have been below the permit limits.

If this week's results show we are achieving the treatment limits, we intend to reduce sampling of the lagoon to monthly.

Kind Regards,

Roy Denney

Adenus
Roy Denney, P.E.
CTO

Adenus Group, LLC | 849 Aviation Pkwy, Smyrna, TN 37167
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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/28/2014
Date Received: 3/20/2014
Cust #: RA135
PO#:

Workorder: 1404870 **Project:** Maple Green

Analyte	Result	Units	Dil	Qualifier	Reporting Limit	Analyst	Analyzed	Method
Maple Green Sampled: 03/20/2014 08:10								
					1404870-01 (Water)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
BOD-5	47.9	mg/L	1		2.00	JPA	03/21/2014 16:50	SM5210 B-2001

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Knoxville Division
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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/28/2014
Date Received: 3/20/2014
Cust #: RA135
PO#:

Workorder: 1404870 **Project:** Maple Green

Certifications

Code	Description	Number	Expires
A2LAB-KNX	ISO 17025 KNX food	3131.01	05/31/2015
A2LAB-NSH	ISO 17025 NSH food	3131.02	06/30/2014
FL	State of Florida NELAC	E87966	06/30/2014
GA	Georgia Dept Natural Resources	980	04/13/2014
NCENV	NC Environmental	678	12/31/2013
TN_DW	State of Tennessee	TN02017	04/30/2014
USDA	US Department of Agriculture		11/30/2013

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Microbac Laboratories, Inc. - Knoxville

Brian Richard, Project Manager

Thank you for your business. For any feedback, please contact Ashley Morris, at ashley.morris@microbac.com. You may also contact Trevor Boyce, President, at trevor.boyce@microbac.com.

As regulatory limits change frequently, Microbac advises the recipient of this report to confirm such limits with the appropriate Federal, state, or local authorities before acting in reliance on the regulatory limits provided.

MICROBAC®

1404870-01 Sampled: 03/20/2014 08:10

Adenus Wastewater Professionals

Project Number / Title:	Daily BOD MAPLE GREEN
Contact/Address:	Brian Carter/Adenus
Desired Turnaround Time:	

SAMPLE DESCRIPTION Include all information to completely identify each sample. Also include a physical description. (Water, soil, ground water, etc.)	DATE	TIME	GRAB	COMP	ANALYSIS REQUIRED Comments, Instructions, etc.	Number / Type of Containers	Preservative
	3/20/14	8:10	✓		BOD	1000 mL P	none

Day 1 – pH/Temperature:	Flow:
Day 2 – pH/Temperature:	Flow:

SIGNATURE REQUIRED OF ALL PERSONS HANDLING SAMPLES:	DATE:	TIME:	TEMPERATURE
Sample Collected By: Brian Carter	3/20/14	8:10	
Delivered to Lab By: Brian Carter	3/20/14		
Received By: [illegible]	3/20/14	1030	12.4°C
Batch Number (Office Use Only):			

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Knoxville/Nashville Divisions

COOLER INSPECTION FORM # 10001.1

Client Name: ADENUS

Date/Time Received: 3/20/14 1030

Work Order: K049890

No. of Samples: 1

Received By: LL

Checklist Completed By: LL / 3/20/14

Carrier: FedEx(_) UPS(_) Client(✓) Field Services(_) Other(_):

After-Hours Receipt?	Yes ☐	No ☒	
Shipping container in good condition?	Yes ☐	No ☐	Not Present ☒
Custody seals intact on cooler?	Yes ☐	No ☐	Not Present ☒
Custody seals intact on samples?	Yes ☐	No ☐	Not Present ☒
Chain of custody present?	Yes ☑	No ☐	
Chain of custody includes proper client information?	Yes ☑	No ☐	
Chain of custody includes proper collection information and signatures?	Yes ☑	No ☐	
Chain of custody includes dates and times of sample collection?	Yes ☑	No ☐	
Chain of custody includes proper sample descriptions?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Chain of custody identifies proper sample matrix?	Yes ☑	No ☐	
Chain of custody identifies proper number of samples?	Yes ☑	No ☐	
Chain of custody includes required analysis?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Samples are in proper containers/bottles?	Yes ☑	No ☐	
Sample containers are intact?	Yes ☑	No ☐	
Sufficient sample volume collected for requested analysis?	Yes ☑	No ☐	
VOA vials for aqueous samples have zero headspace?	Yes ☐	No ☐	Not Present ☒
Samples received within holding times?	Yes ☑	No ☐	
Samples received on ice?	Yes ☑	No ☐	
Sample properly preserved?	Yes ☑	No ☐	

If No, adjusted by? _____ Date/Time: _____

Remarks: _____

ANY "NO" EVALUATION REQUIRES CLIENT NOTIFICATION (excluding After-Hours Receipt).

Comments: _____

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Tri-Cities, TN 423.926.6385 | Nashville, TN 615.242.1480
www.microbac.com
tennessee@microbac.com

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/28/2014
Date Received: 3/19/2014
Cust #: RA135
PO#:

Workorder: 1404800 **Project:** Maple Green

Analyte	Result	Units	Dil	Qualifier	Reporting Limit	Analyst	Analyzed	Method
Maple Green Sampled: 03/19/2014 07:30								
					1404800-01 (Water)			
Wet Chemistry								
						Analyzed By: Microbac Knoxville Division		
BOD-5	41.6	mg/L	1		2.00	JPA	03/20/2014 18:00	SM5210 B-2001

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849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/28/2014
Date Received: 3/19/2014
Cust #: RA135
PO#:

Workorder: 1404800 **Project:** Maple Green

Certifications

Code	Description	Number	Expires
A2LAB-KNX	ISO 17025 KNX food	3131.01	05/31/2015
A2LAB-NSH	ISO 17025 NSH food	3131.02	06/30/2014
FL	State of Florida NELAC	E87966	06/30/2014
GA	Georgia Dept Natural Resources	980	04/13/2014
NCENV	NC Environmental	678	12/31/2013
TN_DW	State of Tennessee	TN02017	04/30/2014
USDA	US Department of Agriculture		11/30/2013

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Microbac Laboratories, Inc. - Knoxville

Brian Richard, Project Manager

Thank you for your business. For any feedback, please contact Ashley Morris, at ashley.morris@microbac.com. You may also contact Trevor Boyce, President, at trevor.boyce@microbac.com.

As regulatory limits change frequently, Microbac advises the recipient of this report to confirm such limits with the appropriate Federal, state, or local authorities before acting in reliance on the regulatory limits provided.

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1404800-01 Sampled: 03/19/2014 07:30

SAMPLE C Adenus Wastewater Professionals

Project Number / Title:	Daily BOD
Contact/Address:	Brian Carter/Adenus
Desired Turnaround Time:	

SAMPLE DESCRIPTION Include all information to completely identify each sample. Also include a physical description. (Water, soil, ground water, etc.)	DATE	TIME	GRAB	COMP	ANALYSIS REQUIRED Comments, Instructions, etc.	Number / Type of Containers	Preservative
Wpl. grun	3-19-14	7:30	X				
					BOD	1000 mL P	none

Day 1 – pH/Temperature: Flow:

Day 2 – pH/Temperature: Flow:

SIGNATURE REQUIRED OF ALL PERSONS HANDLING SAMPLES:	DATE	TIME	TEMPERATURE:
Sample Collected By: Travis Nichols	3-19-14	7:30	
Delivered to Lab By: Travis Nichols	3-19-14	[illegible]	1250 3/19/14
Received By: [signature]	3/19/14	1250	13.6°C
Batch Number (Office Use Only):			

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Knoxville/Nashville Divisions

COOLER INSPECTION FORM # 10001.1

Client Name: Adenuri

Date/Time Received: 3.19.14/1250

Work Order: 1404800

No. of Samples: 1

Received By: LeAnne Lee

Checklist Completed By: ANW / 3.19.14

Carrier: FedEx(_) UPS(_) Client(✓) Field Services(_) Other(_): _____

After-Hours Receipt?	Yes ☐	No ☑	
Shipping container in good condition?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on samples?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody includes proper client information?	Yes ☑	No ☐	
Chain of custody includes proper collection information and signatures?	Yes ☑	No ☐	
Chain of custody includes dates and times of sample collection?	Yes ☑	No ☐	
Chain of custody includes proper sample descriptions?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Chain of custody identifies proper sample matrix?	Yes ☑	No ☐	
Chain of custody identifies proper number of samples?	Yes ☑	No ☐	
Chain of custody includes required analysis?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Samples are in proper containers/bottles?	Yes ☑	No ☐	
Sample containers are intact?	Yes ☑	No ☐	
Sufficient sample volume collected for requested analysis?	Yes ☑	No ☐	
VOA vials for aqueous samples have zero headspace?	Yes ☐	No ☐	Not Present ☑
Samples received within holding times?	Yes ☑	No ☐	
Samples received on ice?	Yes ☑	No ☐	
Sample properly preserved?	Yes ☑	No ☐	

If No, adjusted by? _____ Date/Time: _____

Remarks: _____

ANY "NO" EVALUATION REQUIRES CLIENT NOTIFICATION (excluding After-Hours Receipt).

Comments: _____

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CERTIFICATE OF ANALYSIS

Brian Carter
Adenus Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/28/2014
Date Received: 3/19/2014
Cust #: RA135
PO#:

Workorder: 1404800 **Project:** Maple Green

Analyte	Result	Units	Dil	Qualifier	Reporting Limit	Analyst	Analyzed	Method
Maple Green Sampled: 03/19/2014 07:30								
1404800-01 (Water)								
Wet Chemistry								
Analyzed By: Microbac Knoxville Division								
BOD-5	41.5	mg/L	1		2.00	JPA	03/20/2014 18:00	SM5210 B-2001

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CERTIFICATE OF ANALYSIS

Brian Carter
Adonis Wastewater Professionals
849 Aviation Parkway
Smyrna, TN 37167

Date Reported: 3/28/2014
Date Received: 3/19/2014
Cust #: RA135
PO#:

Workorder: 1404800 **Project:** Maple Green

Certifications

Code	Description	Number	Expires
A2LAB-KNX	ISO 17025 KNX food	3131.01	05/31/2015
A2LAB-NSH	ISO 17025 NSH food	3131.02	06/30/2014
FL	State of Florida NELAC	E87966	06/30/2014
GA	Georgia Dept Natural Resources	980	04/13/2014
NCENV	NC Environmental	678	12/31/2013
TN_DW	State of Tennessee	TN02017	04/30/2014
USDA	US Department of Agriculture		11/30/2013

Notes and Definitions

DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the reporting limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference

Microbac Laboratories, Inc. - Knoxville

Brian Richard, Project Manager

Thank you for your business. For any feedback, please contact Ashley Morris, at ashley.morris@microbac.com. You may also contact Trevor Boyce, President, at trevor.boyce@microbac.com.

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1404800-01 Sampled: 03/19/2014 07:30

SAMPLE (Adenus Wastewater Professionals

Project Number / Title:	Daily BOD
Contact/Address:	Brian Carter/Adenus
Desired Turnaround Time:	

SAMPLE DESCRIPTION Include all information to completely identify each sample. Also include a physical description. (Water, soil, ground water, etc)	DATE	TIME	GRAB	COMP	ANALYSIS REQUIRED Comments, Instructions, etc	Number / Type of Containers	Preservative
Mapl. grove	3/19/14	7:30	X				
					BOD	1000 mL P	none
Day 1 – pH/Temperature:					Flow:		
Day 2 – pH/Temperature:					Flow:		

SIGNATURE REQUIRED OF ALL PERSONS HANDLING SAMPLES:	DATE	TIME	TEMPERATURE:
Sample Collected By: Travis Hicks	3-19-14	7:30	
Delivered to Lab By: Travis Hicks	3-19-14	[illegible]	1250 3/19/14
Received By: [signature]	3/19/14	1250	15.6°C
Batch Number (Office Use Only):			

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COOLER INSPECTION FORM # 10001.1

Client Name: Adenus

Date/Time Received: 3.19.14/1250

Work Order: 1404800

No. of Samples: 1

Received By: LeAnne Lee

Checklist Completed By: AMM / 3.19.14

Carrier: FedEx(_) UPS(_) Client(✓) Field Services(_) Other(_): _____

After-Hours Receipt?	Yes ☐	No ☑	
Shipping container in good condition?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on cooler?	Yes ☐	No ☐	Not Present ☑
Custody seals intact on samples?	Yes ☐	No ☐	Not Present ☑
Chain of custody present?	Yes ☑	No ☐	
Chain of custody includes proper client information?	Yes ☑	No ☐	
Chain of custody includes proper collection information and signatures?	Yes ☑	No ☐	
Chain of custody includes dates and times of sample collection?	Yes ☑	No ☐	
Chain of custody includes proper sample descriptions?	Yes ☑	No ☐	
Chain of custody agrees with sample labels?	Yes ☑	No ☐	
Chain of custody identifies proper sample matrix?	Yes ☑	No ☐	
Chain of custody identifies proper number of samples?	Yes ☑	No ☐	
Chain of custody includes required analysis?	Yes ☑	No ☐	
Chain of custody signed when relinquished and received?	Yes ☑	No ☐	
Samples are in proper containers/bottles?	Yes ☑	No ☐	
Sample containers are intact?	Yes ☑	No ☐	
Sufficient sample volume collected for requested analysis?	Yes ☑	No ☐	
VOA vials for aqueous samples have zero headspace?	Yes ☐	No ☐	Not Present ☑
Samples received within holding times?	Yes ☑	No ☐	
Samples received on ice?	Yes ☑	No ☐	
Sample properly preserved?	Yes ☑	No ☐	

If No, adjusted by? _____ Date/Time: _____

Remarks: _____

ANY "NO" EVALUATION REQUIRES CLIENT NOTIFICATION (excluding After-Hours Receipt).

Comments: _____

Roy Denney

From: Roy Denney <roy.denney@adenus.com>
Sent: Monday, April 28, 2014 2:36 PM
To: 'brad.harris@tn.gov'
Cc: charles.hyatt@adenus.com; bob.pickney@adenus.com; william.penny@stites.com
Subject: Maple Green Response
Attachments: Maple Green Free Water Surface Wetland Surface Calculation.pdf; error regarding engineering units.pdf; EPA Chapter 4 HRT sizing.pdf; epa excerpt regarding using multiple cells in series in a free water surface wetland.pdf; Response to Brad Harris regarding Maple Green.pdf

Brad,

Please see attached letter and supporting documentation.

Kind Regards,

Roy Denney

Maple Green Free Water Surface Wetland Surface Calculation

Description of sizing calculation for the treatment area for the free water surface wetland proposed at Maple Green Reclamation Facility.

Equation provided by TDEC In comments dated 3/24/14. This equation is the same equation as the one used in the original design submittal.

$$A_S = \frac{Q \times ln\left(\frac{C_O}{C_E}\right)}{K_T \times y \times n}$$

A_S = Surface Area (ft^2; m^2) (note - ft^2 used in first submittal and this submittal)

Q = Average Flow (ft^3/day ; m^3/day) (note- ft^3 used in first submittal and this submittal)

C_O = Influent BOD concentration = 150 mg/L

C_e = effluent BOD Design with safety factor = 30 mg/L (Note: Permit limit is 45 mg/l, however this is a technology limit for the previous treatment system and not a limit intended for soil loading.)

K_T = Temperature Dependent First Order Rate Reaction constant for BOD_5

y = Depth of Free Surface Wetland

n = Porosity (as defined in Design of Municipal Wastewater Treatment Plants Fifth Edition; Volume 2; Liquid treatment Processes; Chapter 18; section 6.6; ISBN 978-0-07-16358-8)

θ = 1.06 (as suggested by Design of Municipal Wastewater Treatment Plants Fifth Edition; Volume 2; Liquid treatment Processes; Chapter 18; section 6.6; ISBN 978-0-07-16358-8)

K_{20} = 20° C First Order Rate Reaction constant for BOD_5 = 0.678 $Days^{-1}$ (Design of Municipal Wastewater Treatment Plants Fifth Edition; Volume 2; Liquid treatment Processes; Chapter 18; section 6.6; ISBN 978-0-07-16358-8)

1.

$$Q = Current\ approved\ site\ disposal\ capacity$$

$$Q = 35000 \frac{Gallons}{Day}$$

$$Q = 35000 \frac{Gallons}{Day} \times \frac{1}{7.48} \frac{ft^3}{Gallon}$$

$$Q = 35000 \frac{Gallons}{Day} \times 0.1337 \frac{ft^3}{Gallon}$$

2

$$Q = 4680\ \frac{ft^3}{Day}$$

2.

$$\ln\left(\frac{C_o}{C_e}\right) = \ln\left(\frac{150}{30}\right)$$

$$\ln\left(\frac{C_o}{C_e}\right) = \ln(5)$$

$$\ln\left(\frac{C_o}{C_e}\right) = 1.61$$

3.

$K_T = K_{20} \times (\theta)^{(T-20)}$ (Rate reaction temperature correction as presented in Design of Municipal Wastewater Treatment Plants Fifth Edition; Volume 2; Liquid treatment Processes; Chapter 18; section 6.6; ISBN 978-0-07-16358-8)

T is assumed to be 1°C. (1°C is selected to be a conservative low estimate of the temperature of the wastewater in the system. Surface icing and continual flow would prevent the wetland from entirely freezing. The aeration is also an effective means of deicing shallow bodies of water through the mechanical introduction of energy into the system; in fact the model indicated in the design is actually sold for that express purpose.)

$$K_T = 0.678 \times (1.06)^{(1-20)}$$

$$K_T = 0.678 \times (1.06)^{(-19)}$$

$$K_T = (0.678) \times (0.331)$$

$$K_T = 0.2244\ Day^{-1}$$

4.

Porosity (n) is accepted as 0.7 which is actually representative of a densely vegetated system however it shows a more conservative number. A range of 0.7 to 0.9 porosity is used to indicate the flow restriction of vegetation where 0.7 indicates a densely vegetated wetland with restricted flow and reduced volume and 1.0 represents open water with no vegetation. (Design of Municipal Wastewater Treatment Plants Fifth Edition; Volume 2; Liquid treatment Processes; Chapter 18; section 6.6; ISBN 978-0-07-16358-8)

$$A_S = \frac{Q \times ln\left(\frac{C_O}{C_E}\right)}{K_T \times y \times n}$$

$$A_S = \frac{4680\ \frac{ft^3}{Day} \times 1.61}{0.2244\ Day^{-1} \times 2.5\ ft \times 0.7}$$

$$A_S = \frac{7534\ \frac{ft^3}{Day}}{0.6171 \frac{ft}{Day}}$$

$$A_S = 12{,}208.72 \frac{ft^3 * Day}{ft * Day} = 12{,}208.72\ ft^2$$

5.

Currently, each proposed wetland cell has a wetted surface area of 60 ft in width by 150 ft in length. This provides in the two cell arrangement the following.

$$A_{Individual\ cell} = 60\ ft \times 150\ ft$$

$$A_{Individual\ cell} = 9000\ ft^2$$

$$A_{Total\ Area} = A_{Individual\ cell} \times Number\ Of\ Cells$$

$$A_{Treatment\ Area} = 9000\ ft^2 \times 2$$

$$A_{Treatment\ Area} = 18000\ ft^2$$

public access is restricted and habitat values are minimized. Tertiary treatment with nutrient removal may be necessary prior to discharge to natural wetlands where preservation of the existing habitat and ecosystem is desired. Common preliminary features in stormwater wetlands are a trash rack and a forebay to allow the settling and removal of large objects carried with the stormwater runoff. Wetlands designed for mine drainage treatment may require a preliminary unit for pH or alkalinity adjustment (Brodie et al, 1993).

6.5.3 General Design Procedures

All constructed wetland systems can be considered to be attached-growth biological reactors, and their performance can be estimated with first-order plug-flow kinetics for BOD and nitrogen removal. Design models are presented in this chapter for removal of BOD, TSS, ammonia nitrogen, nitrate, total nitrogen, and phosphorus, for both FWS and SSF wetlands. In some cases, an alternative model from other sources is also presented for comparison purposes because a universal consensus does not exist on the "best" design approach. The basic relationship for plug-flow reactors is given by Equation 6.8:

$$C_e / C_o = \exp[-K_T t] \tag{6.8}$$

where

C_e = Effluent constituent concentration (mg/L).
C_o = Influent constituent concentration (mg/L).
K_T = Temperature-dependent, first-order reaction rate constant (d^{-1}).
t = Hydraulic residence time (d).

The hydraulic residence time in the wetland can be calculated with Equation 6.9:

$$t = LWdn / Q \tag{6.9}$$

where

L = Length of the wetland cell (ft; m).

W = Width of the wetland cell (ft; m).

y = Depth of water in the wetland cell (ft; m).

n = Porosity, or the space available for water to flow through the wetland. Vegetation and litter occupy some space in the FWS wetland, and the media, roots, and other solids do the same in the SSF case. Porosity is a percent (expressed as a decimal).

Q = The average flow through the wetland (ft^3/d; m^3/d)

$$Q = (Q_{in} + Q_{out})/2 \tag{6.10}$$

It is necessary to determine the average flow with Equation 6.10 to compensate for water losses or gains via seepage or precipitation as the wastewater flows through the wetland. A conservative design might assume no seepage and adopt reasonable estimates for evapotranspiration losses and rainfall gains from local records for each month of concern. This requires a preliminary assumption regarding the surface area of the wetland so the volume of water lost or added can be calculated. It is usually reasonable for a preliminary design estimate to assume that Q_{out} equals Q_{in}.

It is then possible to determine the surface area of the wetland by combining Equation 6.8 and Equation 6.9:

$$A_s = (LW) = \frac{Q\ln(C_o/C_e)}{K_T y n} \tag{6.11}$$

where A_s is the surface area of wetland (ft^2; m^2). The value used for K_T in Equation 6.1 or Equation 6.4 depends on the pollutant that must be removed and on the temperature; these aspects are presented in later sections of this chapter.

Because the biological reactions involved in treatment are temperature dependent it is necessary, for a proper design, to estimate the water temperature in the wetland. The performance and basic feasibility of FWS wetlands in very cold climates are also influenced by ice formation on the system. In the extreme case, a relatively shallow wetland might freeze to the bottom and effective treatment would cease. This chapter contains calculation procedures for estimating water temperatures in the wetland and for estimating the thickness

stir up settled solids contributing to an increase in turbidity, TSS, and BOD. Table 4-4 shows the typical background levels for the constituents of interest recommended for users of this document. Designs requiring effluent quality close to the values in Table 4-4 must be aware of the natural fluctuations about the mean values, as shown in Figure 4-12. For more details on the numerical values in the table, the reader is urged to refer to Reed, et al, (1995), Kadlec and Knight, 1996, and Gearheart, 1992.

A similar approach to the one suggested here for designing FWS wetlands, referred to as the "sequential model", has been developed by Gearheart and Finney (1999). The overall approach of the model is to consider the dominant physical and biological processes responsible for determining effluent quality from each distinctive area or zone of the constructed wetland and allow the designer to specify areal requirements and wetland depth for each of these specific functions. This methodology recognizes that while some of the constituent transformations and removal mechanisms are to some degree occurring simultaneously throughout the wetland, the majority of the removal occurs in a sequential fashion, with one process or mechanism providing the products for the next process or mechanism. The total area required for treatment is then a sum of each of the zones required to reach a specific effluent objective. This approach allows the designer to sequentially determine the range of effluent characteristics which are attainable in a given definable zone before entering a subsequent reactor (zone) which has known treatment capabilities.

Table 4-4. Background Concentrations of Water Quality Constituents of Concern in FWS Constructed Wetlands

Parameter	Range (mg/L)	Typical (mg/L)	Factors governing
TSS	2 - 5	3	Plant types, plant coverage, climate, wildlife activity
BOD[1]	2 - 8	5	Plant types, plant coverage, plant density, climate, wildlife activity
BOD[2]	5 - 12	10	Plant types, plant coverage, plant density, climate
TN	1 - 3	2	Plant types, plant coverage, climate, oxic/anoxic conditions
NH_4-N	0.2 - 1.5	1	Plant types, plant coverage, climate, oxic/anoxic conditions
TP soil	0.1 - 0.5	0.3	Plant types, plant coverage, climate, type
FC[3]	50 - 5000	200	Plant types, plant coverage, climate, wildlife activity

[1]FWS with open water and submergent and floating aquatic macrophytes.
[2]Fully vegetated with emergent macrophytes and with a minimum of open water.
[3]Measured in cfu/100 ml

The sequential model approach recognizes that all the treatment objectives beyond secondary require a minimum of three general wetland "compartments" (see Figure 4-13): (1) an initial compartment where the bulk of the flocculation and sedimentation will occur, (2) an aerobic compartment where soluble BOD reduction and nitrification can occur, and (3) a vegetated polishing compartment where further reductions in TSS and associated constituents and nitrogen (via denitrification) can occur. Permanent phosphorus removal in wetlands is generally small and is largely the result of phosphorus adsorption to solids and plant detritus. Sedimentation and pathogen reduction are related to detention time in zone 1, to retention time and temperature in zone 2, and to retention time in zone 3. As noted earlier, the notion of "compartments" is artificial as the treatment processes overlap in time and space, and no specific physical compartment is necessarily implied. However, separation of an FWS into a series of single-function zones (cells) with individual outlet controls is not an unattractive concept.

A rational overview of the FWS system is depicted in Figure 4-14. It illustrates that the primary mechanisms in zone 1, which is fully vegetated and anaerobic throughout its depth during the growing season, are sedimentation and flocculation, as determined by transect measurements of dissolved oxygen and pollutant concentrations. Any extension of the HRT in zone 1 beyond approximately 2 days at Qmax would be essentially wasteful since the anaerobic conditions will not result in any significant further removal of soluble constituents and flocculation sedimentation has been effectively completed. The TSS and associated constituents (particulate BOD, organic nitrogen and phosphorous, metals and certain semivolatile organic compounds) have also reached this same status. Volatile organics are likely to be removed from the wastewater during the collection or oxidation pond treatment processes (Hannah, et al, 1986), while most semivolatiles are removed with the solids in the oxidation pond or in zone 1 of the FWS system.

For many years it has been recognized that effluent flocculation is primarily a function of energy input from either external sources or internal hydrodynamic forces, and that reduced Reynolds' Numbers (Re) induce optimal sedimentation of particles. Over the past several decades this phenomena has been applied in the development of hydrodynamic devices which accomplish excellent flocculation and/or sedimentation without moving parts, such as pipe mixers and flocculators, tube and plate settlers, and pebble bed and wedgewire outlet devices for clarifiers. Flow through the emerging vegetation is extremely tortuous and is accompanied by a very small hydraulic radius. The Reynolds Number (Re) is a direct function of the hydraulic radius (diameter, if the path were round (as in a pipe). If the Re falls in a range which corresponds to laminar flow, sedimentation is maximized. Re is several thousand in large basins, and even larger in non-vegetated ponds. No direct measurements of Re or laminar flow have been made at the time of this writing, but analogous results from studies

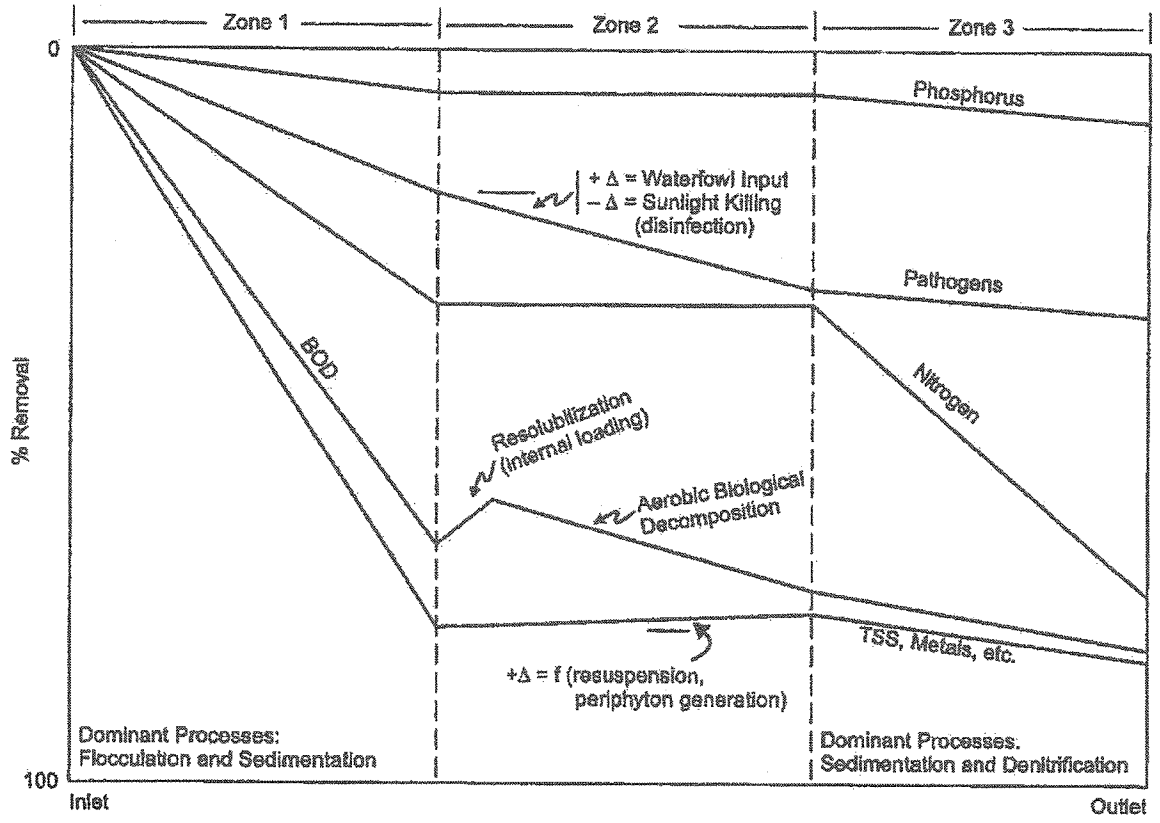

Figure 4-14. Generic removal of pollutants in 3-zone FWS system

of tube settlers and particle-size removals support this theory, given the large amount of wetted surface available. (Sparham, 1970). This concept also supports the use of fully vegetated areas immediately preceding outlet weirs.

In zone 2, which is primarily open-water, the natural reaeration processes are supplemented by submerged macrophytes during daylight periods to elevate dissolved oxygen in order to oxidize carbonaceous compounds (BOD) to sufficiently low levels to facilitate nitrification of the NH_4-N to NO_3-N. These processes require large amounts of oxygen and time in a passive system (no mechanical assistance). The maximum HRT in zone 2 is generally limited to about 2 to 3 days before unwanted algal blooms occur. Therefore, more than one open zone may be required to complete these reactions. If so, the result would be a five (or more) zone design since each open zone would be followed by a fully vegetated zone. The reactions in zone 2 are essentially the same as in a facultative lagoon. Therefore, the equations which apply to those systems might offer reasonable approximations to the rate of transformations occurring in this open-water zone. Therefore, the first-order Marais and Shaw (1961) equation for fecal coliform dieoff could be applied as an approximation, along with its temperature dependancy:

$$\frac{Ce}{Co} = \frac{1}{(1 + tK_p)^N} \qquad (4\text{-}7)$$

where: Co = influent FC concentration, cfu/100 ml
Ce = effluent FC concentration, cfu/100 ml
N = number of open-water zones in the FWS
t = HRT (T)
K_p = fecal coliform removal rate constant (T^{-1})

$$= 2.6\,(1.19)^{T-20} \qquad (4\text{-}8)$$

where: T = temperature, °C

BOD removal in the open-water zone should also follow existing equations such as (Crites and Tchobanoglous, 1998):

$$\frac{Ce}{Co} = \frac{1}{(1 + tK_p)^N} \qquad (4\text{-}9)$$

where:

C = BOD, mg/L

Kb = specific BODs removal rate constant (T^{-1})

$$Kb = 0.15\ (1.04)^{T-20} \qquad (4\text{-}10)$$

Therefore, in analyzing Figure 4-14 the downward slope in FC and BOD in zone 2 can be approximated through the above equations, without considering offsets from wildlife. As noted previously, the nitrifying bacteria can proliferate and convert ammonia-nitrogen to nitrate(NO_3-N) and will be the primary nitrogen transformation role of zone 2. However, the carbonaceous BOD must be low enough to allow these reactions to occur. In rotating biological contactors this concentration of BOD is about 15 mg/l (USEPA, 1993). As noted by Gearheart (1992) increasing the size of the open-water zone generally increases dissolved oxygen, pH, and NO_3-N, while decreasing soluble BOD and ammonium.

U.K.'s Department of Environment has studied lagoon systems treating similar quality influent to that of zone 2. They have noted that algal growth generally starts to occur between days 2 and 3 (UK, 1973). Algal growth can raise pH, interfere with FC kill and the growth of submerged plants, increase NH_3-N volatilization, and induce phosphorus precipitation. Also, the additional biomass and precipitates that must be removed in zone 3 will add to the internal loading on the FWS system. The primary goal of the open-water zone is to provide dissolved oxygen to remove BOD and convert NH_4-N to NO_3-N. Therefore, the optimum sizing of this zone would be an HRT of 2 to 3 days. Assuming a Q_{max}/Q_{ave} of 2, the designer might choose an HRT of 2 days at Q_{max} or an HRT of 3 days at Q_{ave}. Climate would likely be the final criterion, with the larger size favored in northern areas and the smaller in southern ones.

The third zone is fully vegetated like zone 1 and has a similar function. Zone 3, like zone 1 is also capable of denitrification if the influent flow contains NO_3-N. Where oxidation pond pretreatment of municipal wastewaters is employed, zone 1 of the FWS system is not generally required to denitrify, but zone 3 will if zone 2 induces nitrification. The primary energy source for successful denitrification is the release of organic substrates from the detritus from decaying plants. However, partially digested, previously removed organics may also be available. Denitrifying bacteria perform only under anaerobic conditions and best when attached to large surface areas, e.g., plants. Denitrification, like nitrification, is temperature-sensitive. Nitrification and denitrification are greatly impaired when water temperatures are reduced below 10°C. Gearheart (1992) showed total inorganic nitrogen in the Arcata Marsh to be reduced from 25 to 5 mg/L. In 1995 he demonstrated pilot-scale removal of NO_3-N from 130 mg/L to 6 mg/L using no supplemental carbon sources in 80 hours at 15°C. The primary limitation in a three-zone FWS system designed to remove nitrogen is the rate of nitrification in the open-water zone. If the open-water zone succeeds in nitrifying the NH_4-N, the system should be able to denitrify it. Reed, et al, (1995) indicate that denitrification should require less than one day hydraulic retention time (HRT) for denitrification from municipal wastewater concentrations to an effluent requirement of ≤ 10 mg/L. Kadlec and Knight (1996) found that 1 to 2 days should suffice to reach 90% NO_3-N removal. Therefore the previously- stated requirement for zone 3 (HRT of 2 days) should meet this retention requirement and ensure significant denitrification. WEF Manual of Practice FD-16 (1990) indicates that the denitrification rate can be as high as 10 kg/ha-d. Loadings must be within the limits of available labile carbon to proceed at the maximum rate.

As with zone 1 there is additional, temporary nutrient (N and P) removal by plant uptake in zone 3, which may be significant at certain times during the year, while release of most of these nutrients occurs at other times. These plant effects can mask the effects of other processes which could be impacting the system performance at the same times. Unfortunately, there are insufficient data to fully quantify the nutrient cycle for each zone of the FWS system.

4.5.2 *Total Suspended Solids Removal Design Considerations*

Since prior discussion indicates that TSS removal (rather than BOD removal) drives the sizing process, there is a need to provide further discussion of the mechanisms involved and their implications on design. Treatment mechanisms which dominate in the vegetated inlet zone of a FWS constructed wetland volume are flocculation, sedimentation and anaerobic decomposition. Discrete and flocculent settling occurs as the wastewater flows through the initial fully vegetated zone. Since the FWS was likely preceded by an oxidation pond where most discrete settling has occurred already, the enhanced settling in zone1 is mostly due to flocculation of large supracolloidal solids in passage through the emergent vegetation. The processes are generally not temperature dependent and occur at relatively high hydraulic loading rates. TSS removal rates of 40 to 60% are common with a q of 0.06 m/day to 0.27 m/day, but relative removals are more accurately determined by influent characteristics and the hydrodynamics of the initial vegetated zone.

The majority of incoming solids are removed in this initial settling volume. Hyacinth and duckweed systems are similar to (but not as good as) zone 1 of an FWS in the hydrodynamics which promote excellent flocculation and sedimentation. The mechanisms of the fully vegetated zone 1 can be estimated from the use of particle size distribution analysis. Generally, wastewaters have been analyzed in form size ranges:

Settleable (>100 μm)
Supracolloidal (1 to 100 μm)
Colloidal (0.001 to 1 μm)
Dissolved (< 0.001 μm)

Roy Denney

From: Roy Denney <roy.denney@adenus.com>
Sent: Tuesday, May 6, 2014 9:40 AM
To: brad.harris@tn.gov
Subject: Maple Green

Brad,
Have you had the opportunity to look over the letter and documentation I sent you on the 28th?

Regards,

Roy

Roy Denney

From: Roy Denney <roy.denney@adenus.com>
Sent: Tuesday, May 6, 2014 10:40 AM
To: 'Brad Harris'
Cc: 'Robert Odette'
Subject: RE: Maple Green

615-691-2913 will be the best number to reach me. I have a meeting at 2:00PM today.

Currently the site serves,
Providence Baptist Church, Robertson County EMS #5, Coopertown Middle School,148 connections at Oak Pointe Subdivision, P&C Corner Market, Pizza Hut, Sudden Service BP, and a Mapco Express.

Roy

From: Brad Harris [mailto:Brad.Harris@tn.gov]
Sent: Tuesday, May 6, 2014 10:01 AM
To: Roy Denney
Cc: Robert Odette
Subject: RE: Maple Green

Yes we have. Bob and I will try to call you later in the day. I am covered up right now. Send me a number that would work. We'll shoot for 1:30pm.

Check your math in the example calc. We would also like you to verify the current obligations for the system?

Brad

From: Roy Denney [mailto:roy.denney@adenus.com]
Sent: Tuesday, May 06, 2014 9:40 AM
To: Brad Harris
Subject: Maple Green

Brad,
Have you had the opportunity to look over the letter and documentation I sent you on the 28th?

Regards,

Roy

Roy Denney

From: Roy Denney <roy.denney@adenus.com>
Sent: Tuesday, May 6, 2014 12:38 PM
To: 'Brad Harris'
Cc: 'Robert Odette'
Subject: RE: Maple Green

Yes,
I look forward to the call

From: Brad Harris [mailto:Brad.Harris@tn.gov]
Sent: Tuesday, May 6, 2014 12:21 PM
To: Roy Denney
Cc: Robert Odette
Subject: RE: Maple Green

Roy,

Can we try 9:00am in the morning instead of this afternoon?

Thanks,
Brad

From: Roy Denney [mailto:roy.denney@adenus.com]
Sent: Tuesday, May 06, 2014 12:01 PM
To: Brad Harris
Subject: Re: Maple Green

144 customers currently. 168 plated lots but the developer defaulted so there appears to be no urgency to developing. Found the error on the math. We can make the cells 10 feet longer.

Sent from my iPhone

On May 6, 2014, at 10:51 AM, Brad Harris <Brad.Harris@tn.gov> wrote:

> How many connections (existing and future) are involved with Oak Pointe?
>
> Brad
>
> **From:** Roy Denney [mailto:roy.denney@adenus.com]
> **Sent:** Tuesday, May 06, 2014 10:40 AM
> **To:** Brad Harris
> **Cc:** Robert Odette
> **Subject:** RE: Maple Green
>
> 615-691-2913 will be the best number to reach me. I have a meeting at 2:00PM today.
>
> Currently the site serves,
>
> Providence Baptist Church, Robertson County EMS #5, Coopertown Middle School,148 connections at Oak Pointe Subdivision, P&C Corner Market, Pizza Hut, Sudden Service BP,

and a Mapco Express.

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Regards,

Roy