Appendix A: EXAMPLE OF A CT-STUDY-APPROVAL LETTER

March 23, 2010

Mr. I.M. Smart
Grenn and Barrett Consultants
1500 Downtown Boulevard
Big City, Texas 12345-6789

Subject: Public Drinking Water Supply
Approval of Revised CT Study for Schwartz Treatment Plant
Aguaville WSC—PWS ID No. 9876543
Rural County, Texas

Dear Mr. Smart:

We have completed the review of the CT study template and nine engineering drawings that were submitted with your letter of January 18, 2004. The materials describe proposed changes to the disinfection protocol at the Aguaville Water Supply Corporation's Schwartz Surface Water Treatment Plant. Revisions to the CT study were needed because the WSC recently installed baffle walls in each of its clearwells and has received permission to begin using chloramines. Based on our review, we are approving the updated CT study with a few minor revisions to incorporate the additional information we received from Allen Gammage, the Chief Operator, during our telephone call on March 5, 2004, and the changes you and I discussed during our telephone call on March 13, 2004. The information in this letter will replace, not supplement, the CT study approved in our letter of February 25, 1993.

The Schwartz Surface Water Treatment Plant is supplied by a raw-water pump station located near the Lake Schwartz Dam. The station consists of two 1000-gpm and one 1,500-gpm raw-water pumps which discharge to a 24-inch raw-water transmission line that supplies the SWTP. The 2,000-gpm SWTP is located about one-half mile from the lake and consists of an in-line rapid mix, a splitter box, a pair of 0.150 MG solids-contact, slurry-recirculation clarifiers, a filter splitter box and channel, six mixed-media gravity filters, a head control box, a filtered-water transfer pump station containing three 1,000-gpm transfer pumps, three 0.50-MG baffled clearwells that operate in parallel, and a high-service pump station.

The proposed disinfection protocol uses a standby chlorine application point located upstream of the in-line rapid mix, a primary chlorine injection point at the inlet to the filter splitter box, and a booster chlorination point at the high service pump station. There is a standby injection point for liquid ammonium sulfate (LAS) located just downstream of the rapid mix and a primary injection point at the header which supplies the three clearwells.

A disinfection zone is a segment of the treatment process that begins at a disinfectant application point and ends at the subsequent disinfectant application or residual sampling point. Each disinfectant application point, regardless of the frequency of use, represents the beginning of a separate disinfection zone. Based on the proposed disinfection protocol, three disinfection zones are defined for the plant. The first disinfection zone (D1) begins at the standby prechlorination point at the rapid mix. The second

disinfection zone (D2) begins at the filter influent and ends at the ammonia application point downstream of the filters. The last disinfection zone (D3) includes the clearwell.

CT calculations are used to evaluate the disinfection process. Based on the data provided in the CT study, T_{10} values were developed for individual components of the treatment process. These values are summarized in Table A-1.

Table A-1. Approved T_{10} table for Aguaville WSC's Schwartz Surface Water Treatment Plant.

Disinfection Zone	Treatment Unit	Volume (gallons)	Flow Rate (1)	Baffling Factor	T_{10}, Unit (min)	T_{10}, Zone (min)
D1	Raw-water line	2,800 (2)	2,000 gpm (2.880 MGD)	1.0 (3)	1.4	46.7
	Splitter box	1,800 (4)	2,000 gpm	0.1 (5)	0.1	
	Clarifiers (2)	150,700 (6)	1,000 gpm	0.3 (7)	45.2	
D2	Filters (6)	4,300 (8)	333 gpm	0.7 (9)	9.0	11.7
	Head Control Box	3,250 (10)	2,000 gpm	0.1 (5)	0.5	
	Piping	4,400 (11)	2,000 gpm	1.0 (3)	2.2	
D3	Clearwells (3)	211,500 (12)	667 gpm	0.7 (13)	222.1	222.1

Notes:

1. The flow rates used in this CT study are based on the cumulative capacity of the raw water pumps with the largest unit out of service and assume that flow is equally distributed to treatment units operating in parallel.
2. Based on 120 feet of 24-inch pipe from the rapid mix to the splitter box.
3. Assumes that "plug flow" hydraulic conditions exist in the pipeline.
4. Based on a basin with dimensions of 6.0 feet by 6.0 feet and a 6.0-foot side water depth.
5. In the absence of empirical data, assumes "unbaffled" hydraulic conditions exist in basins with mixers and in unbaffled basins that can have a high level of short-circuiting.
6. Based on the volume of a single solids contact clarifier with a 45.0-foot diameter, a 12.0-foot side water depth, and a center water depth of 14.0 feet.
7. Assumes that "poor" hydraulic conditions exist in a solids-contact, slurry-recirculation clarifier.
8. Based on the volume of a single filter which has a media bed with dimensions of 10.0 feet by 8.0 feet, a total depth of 3.67 feet, and an underdrain that is 1.0 feet deep. Assumes that the average porosity of the filter bed and gravel support system is 50%. Also assumes that a minimum water depth of 4.33 feet is maintained above the surface of the media by the head control box.
9. Assumes that "superior" hydraulic conditions exist in the filter and underdrain.
10. Based on a head control box with dimensions of 6.0 feet by 12.0 feet and a side water depth of 9.0 feet in front of the weir wall and a minimum 3.0-foot side water depth in the compartment that supplies the transfer pumps.
11. Based on 120 feet of 30-inch pipe from the head control box to the ammonia-injection point.
12. Based on the volume of a clearwell with a 60.0-foot diameter and a 24.0-foot side water depth. Assumes a minimum water level of 10.0 feet, or 42% of the nominal tank capacity.
13. Assumes superior hydraulic conditions in the clearwell due to the presence of a perforated internal riser with diffusion plates and four internal baffle walls.

As you review the T_{10} table, you will observe that no disinfection credit was allowed for the filter influent channel, which runs the length of the filter battery, because water is diverted from the channel at six different locations along its length. In addition, the volume of the head control box was based on the average water level maintained in the two-compartment structure rather than on the volume maintained in the first compartment. Finally, the worst-case—instead of the maximum—operating level was used to estimate the volume of variable-level contact basins, such as clearwells.

Note that multiple flow rates were used to determine the T_{10} values for individual units in two of the three disinfection zones. Although this approach is clearly the most versatile, it is not well suited for evaluating the performance of the plant on a daily basis and complying with the reporting requirements. As a result, we have prepared another table to help the operators complete their SWMORs. In Table A-2, we have characterized the T_{10} available in each of the three disinfection zones based on the flow rate through the units that contribute most to the disinfection process within that zone. We have also provided the operators with the disinfection requirements that they must meet on an ongoing basis.

Table A-2. Disinfection parameters for Aguaville WSC's Schwartz SWTP.

APPROVED CT-STUDY PARAMETERS						PERFORMANCE STDs	
Parameters	Disinfection Zones					Log Inactivation	
	D1	D2	D3	D4	D5	*Giardia*	Viruses
Flow rate (MGD)	1.440	0.480	0.960	NA	NA	0.5	2.0
T_{10} time (minutes)	46.7	11.7	222.1	NA	NA		

As you review Table A-2, you will note that we have based the T_{10} time for zone D1 on the volume of, and flow rate through, an individual clarifier. Similarly, T_{10} times for zones D2 and D3 are based on a single filter and a clearwell, respectively. We have taken this approach because it allows the plant to continue to operate when one of the respective units is out of service for backwashing, inspection, or repair.

Please ensure that the operators understand that they need to base their CT calculations for zone D1 on the maximum flow rate through an individual clarifier and the calculations for zones D2 and D3 on the filter and clearwell that are experiencing the highest flow rate, respectively. If the flow rate through individual treatment units is not being measured, the operators should assume an equal distribution of water in parallel treatment units.

If you have any questions concerning our evaluation or if we may be of other assistance, please contact us by e-mail at <CTstudy@tceq.texas.gov>, by phone at 512-239-4691 or at the TCEQ's address.

Sincerely,

Ima Competent, P.E.

Ima Competent, P.E.
Public Drinking Water Section, MC 155
Water Supply Division

Enclosure: Printout of the CT Study Template for the PDWS SWTP

Enclosure A

Printout from March 23, 2011 CT-Study Spreadsheet
for the Aguaville Water Supply Corporation's
Schulze Surface Water Treatment Plant

CT STUDY

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)

Description Worksheet

PUBLIC WATER SYSTEM NAME: Aguaville WSC **PWS ID No.:** 7654321

PLANT NAME OR NUMBER: Schulze Plant

Month: March
Day: 23
Year: 2011

Enter a detailed narrative description of the plant treatment processes and disinfection protocol.

The Aguaville WSC's Schulze Surface Water Treatment Plant (SWTP) is supplied by a raw water pump station located near the Lake Allen R. Gammage Dam. The raw water pump station consists of two 1000-gpm and one 1,500-gpm raw water pumps which discharge to a 24-inch raw water transmission line that supplies the SWTP which is located about 1/2 mile from the Lake.

The design capacity of the Schulze SWTP is 2,000 gpm. The SWTP consists of an in-line rapid mix, a splitter box, a pair of 0.150 MG solids-contact, slurry-recirculation clarifiers, a filter splitter box/channel, six mixed-media gravity filters, a head control box, three 1,000 gpm transfer pumps, and three 0.50-MG baffled clearwells that operate in parallel.

The proposed disinfection protocol utilizes a standby chlorine application point located upstream of the in-line rapid mix; a primary chlorine injection point at the inlet to the filter splitter box; and a booster chlorination point at the high service pump station. There is a standby injection point for liquid ammonium sulfate (LAS) located just downstream of the rapid mix and a primary injection point at the header which supplies the three clearwells.

The disinfection process utilizes the following three disinfection zones:
D1 - the clarifiers
D2 - the six filters, head control box, and piping
D3 - the three clearwells

The proposed disinfection protocol involves pre-chlorination followed by LAS addition to form chloramines so a total chlorine residual enters the distribution system.
In D1, the clarifiers, no disinfectant residual is normally maintained.
In D2, chlorine will be injected at the inlet to the filter splitter box, with a free chlorine residual maintained through the filters and head control box. The sample location for D2 is at the head control box.
LAS will be added about 120 feet downstream of the chlorine residual sampling point at the head control box. A chloramine residual will be maintained in D3, the clearwells.

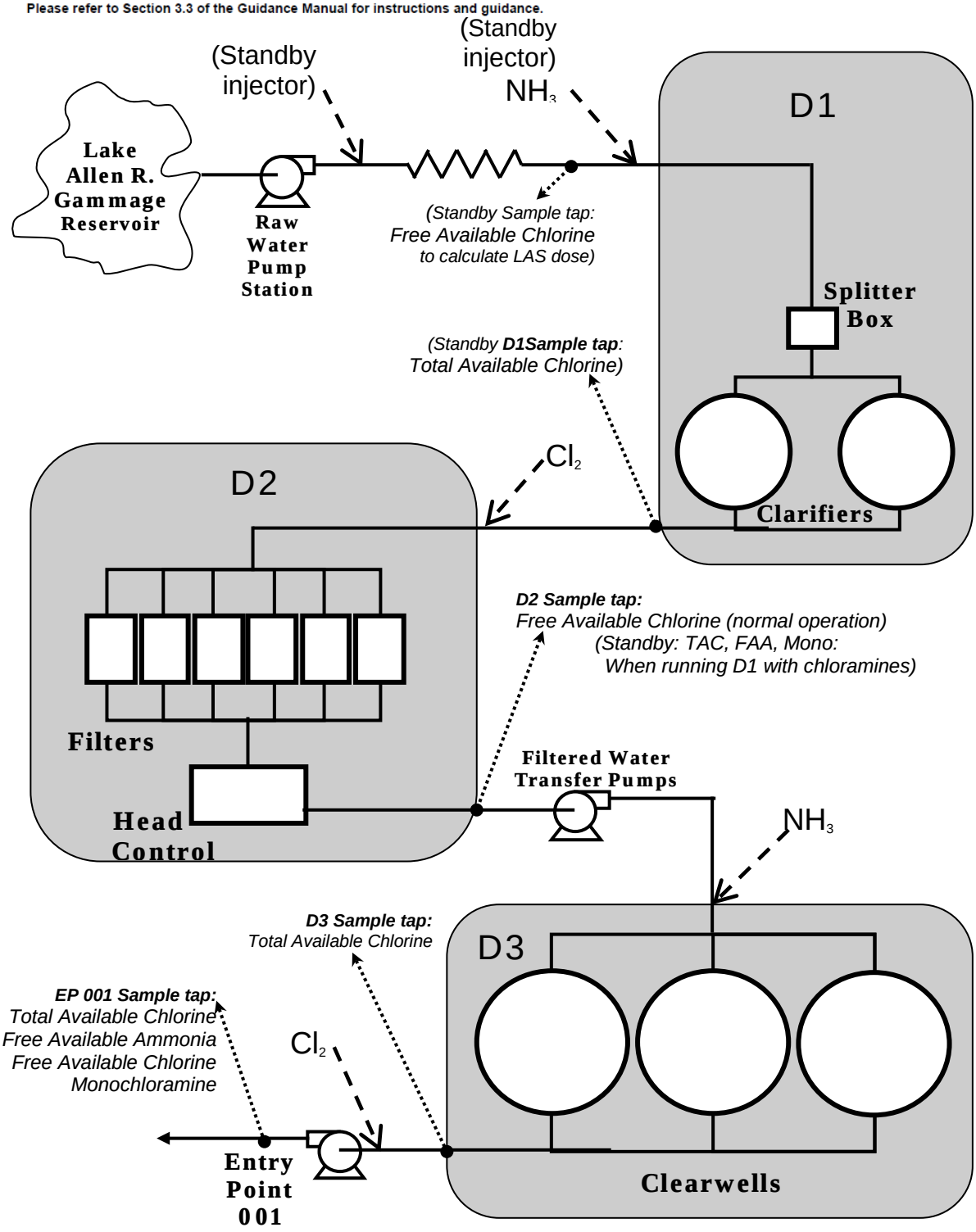
CT STUDY

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)

Schematic Worksheet

PUBLIC WATER SYSTEM NAME:	Aguaville WSC	**PLANT NAME OR NUMBER:**	Schulze Plant
PWS ID No.:	7654321	**Date:**	March 23, 2011

Use this worksheet to create your plant schematic with the Microsoft Drawing Tools.
If you are not familiar with the drawing tools, you may create your schematic using any other suitable medium.
Please refer to Section 3.3 of the Guidance Manual for instructions and guidance.



CT STUDY

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)

T10 Details Worksheet

PUBLIC WATER SYSTEM NAME: Aguaville WSC **PWS ID No.:** 7654321

PLANT NAME OR NUMBER: Schulze Plant **Date:** March 23, 2011

Treatment Plant Capacity 2.880 mgd / 2,000 gpm

Disinfection Zone: D1 **Disinfectant:** Free Chlorine

Unit - 1 Type: Piping Shape: Pipe

Further Description: Water to splitter box after rapid mix

Characteristic			Comments
Number of Units	1		Dimensions reported by Grenn & Barrett Consultants in 2/3/11 submission
Diameter	24	in	Dimensions reported by Grenn & Barrett Consultants in 2/3/11 submission
Length	120	ft	Dimensions reported by Grenn & Barrett Consultants in 2/3/11 submission
Volume (each)	2,820	gal	
Flow Rate (each)	2,000	gpm	
Detention Time	1.4	min	
Baffling Factor	1.0		Piping
			Baffling Characteristics: Perfect
			Approved Baffling Factor:
T_{10}	**1.4**	**min**	

Unit - 2 Type: Other Shape: Rectangular

Further Description: Coagulated water splitter box

Characteristic			Comments
Number of Units	1		Dimensions reported by Grenn & Barrett Consultants in 2/3/11 submission
Length	6	ft	Dimensions reported by Grenn & Barrett Consultants in 2/3/11 submission
Width	6	ft	Dimensions reported by Grenn & Barrett Consultants in 2/3/11 submission
Side Water Depth	6	ft	Dimensions reported by Grenn & Barrett Consultants in 2/3/11 submission
Volume (each)	1,616	gal	
Flow Rate (each)	2,000	gpm	
Detention Time	0.8	min	

CT STUDY

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)

T10 Details Worksheet

Baffling Factor	0.1		Baffling Characteristics: Unbaffled
			Approved Baffling Factor:
T_{10}	**0.1**	**min**	

Unit - 3 Type: **Clarifier** Shape: **Circular**

Further Description: Solids contact clarifiers

Characteristic			Comments
Number of Units	2		Dimensions reported by Grenn & Barrett Consultants in 2/3/11 submission
Diameter	45	ft	Top of mixing chamber has a 15 foot diameter per G&B sheet 3 of 9
Side Water Depth	12	ft	Dimensions reported by Grenn & Barrett Consultants, 2/3/11, page 4 of 9
Center Water Depth	14	ft	Dimensions reported by Grenn & Barrett Consultants, 2/3/11, page 4 of 9
Volume (each)	150,718	gal	
Flow Rate (each)	1,000	gpm	HDT = 150.7 minutes and SOR(sed) = 0.71 gpm per square foot
Detention Time	150.7	min	
Baffling Factor	0.3		Slurry recirculation with skirt
			Baffling Characteristics: Poor
			Approved Baffling Factor:
T_{10}	**45.2**	**min**	
D1 FLOW RATE	**1.440**	**mgd**	
T10 SUM FOR D1	**46.7**	**min**	

Disinfection Zone: **D2** **Disinfectant:** **Free Chlorine**

Unit - 1 Type: **Filter** Shape: **Rectangular**

Further Description: Six multimedia filters: sand/anthracite

Characteristic			Comments
Number of Units	6		1/29/98 G&B engineering drawings, p. 2 of 9
Length	10	ft	G&B engineering drawings, 4 of 9
Width	8	ft	"
Media Depth	3.67	ft	G&B engineering drawings, 45 of 9
Underdrain Depth	1	ft	"
Minimum Water Depth Over Media	4.33	ft	"
Average Porosity	50	%	Assumed
Volume (each)	4,288	gal	

CT STUDY

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)

T10 Details Worksheet

Assumes equal flow to each filter operating in parallel with all filters in service. Filter Loading Rate = 4.2 gpm/ft2

Flow Rate (each)	333	gpm
Detention Time	12.9	min
Baffling Factor	0.7	
T_{10}	**9.0**	**min**

Filter

Baffling Characteristics: Superior

Approved Baffling Factor:

D2 FLOW RATE	**0.480**	**mgd**
T10 SUM FOR D2	**9.0**	**min**

Disinfection Zone: D3 **Disinfectant:** Chloramines

Unit - 1 Type: Clearwell Shape: Circular

Further Description:

Characteristic			Comments
Number of Units	3		
Diameter	60	ft	
Side Water Depth	24	ft	
Center Water Depth	24	ft	
Maximum Volume (each)	507,683	gal	
Minimum Operating Level	10	ft	
Worst Case Volume (each)	211,534	gal	
Percent of Maximum Volume	42	%	

Worst Case Volume (each)	211,534	gal
Flow Rate (each)	667	gpm
Detention Time	317.1	min
Baffling Factor	0.7	
T_{10}	**222.0**	**min**

Baffling Characteristics: Superior

Approved Baffling Factor:

D3 FLOW RATE	**0.960**	**mgd**
T10 SUM FOR D3	**222.0**	**min**

Disinfection Zone: D4 **Disinfectant:**

Disinfection Zone: D5 **Disinfectant:**

CT STUDY

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER (cont.)

Summary Worksheet

PUBLIC WATER SYSTEM NAME: Aguaville WSC **PWS ID No.:** 7654321

PLANT NAME OR NUMBER: Schulze Plant **Date:** March 23, 2011

Disinfection Zone	Treatment Unit	Volume* (each) (gal)	Flow Rate* (each) (MGD)	Baffling Factor*	T_{10}* (min) Unit	T_{10}* (min) Zone
D1	Water to splitter box after rapid mix (1)	2,820	2.880	1	1.410	46.71
	Coagulated water splitter box (1)	1,616	2.880	0.1	0.081	
	Solids contact clarifiers (2)	150,718	1.440	0.3	45.215	
D2	Six multimedia filters: sand/anthracite (6)	4,288	0.480	0.7	9.015	9.01
D3	Clearwell (3)	211,534	0.960	0.7	222.000	222.00

* These values are calculated on the T10 Details Sheet

TCEQ - (09-01-11) CT STUDY

Appendix H:
EXAMPLE OF A COMPLETED CPE-REQUEST FORM

COMPREHENSIVE PERFORMANCE EVALUATION REQUEST FORM

FOR PUBLIC WATER SYSTEMS THAT ARE USING SURFACE WATER SOURCES OR GROUND WATER SOURCES UNDER THE INFLUENCE OF SURFACE WATER THAT ARE REQUIRED TO CONDUCT A COMPREHENSIVE PERFORMANCE EVALUATION

PUBLIC WATER SYSTEM NAME: Aguaville WSC **PWS ID No.:** 9876543

PLANT NAME OR NUMBER: Schulze Surface Water Treatment Plant

EVENTS THAT TRIGGERED THE CPE REQUEST

EVENT NUMBER 1		EVENT NUMBER 2	
Filter Number:	5	Filter Number:	3
Date of Event:	April 5, 2011	Date of Event:	May 13, 2011
FAR Prepared?		FAR Prepared?	
CAP Prepared?		CAP Prepared?	

PUBLIC WATER SYSTEM PREFERENCES

PREFERRED DATES FOR CPE:

(1) Week of: June 10, 2011
(2) Week of: June 17, 2011
(3) Week of: July 15, 2011

ADMINISTRAVE CONTACT INFORMATION:		PLANT CONTACT INFORMATION:	
Name:	Haile Paide	Name:	Mas Papeleo
Title:	General Manager	Title:	Plant Superintendent
Phone:	(123) 456-7890	Phone:	(123) 456-8907
Fax:	(123) 456-7809	Fax:	(123) 456-7809
Address:	Aguaville WSC RR 4, Box Z Aguaville, TX 78900	Address:	Aguaville WSC RR 5, Box A Aguaville, TX 78900

I certify that I am familiar with the information contained in this report and that, to the best of my knowledge, the information is true, complete, and accurate.

Operator's Signature: _____ **Date:** May 12, 2011

Name (printed): Haile Paide

If applicable, Certificate No. and Class: NA

The request must be submitted with your Monthly Operational Report and a copy should be faxed to the Drinking Water Section at (512) 239-6050 as soon as it is signed.

TCEQ/WSD/Public

Reserved for TCEQ Use Only

TCEQ - 10278 (01-22-02) CPE Request Form