ANALYSIS

NORWEGIAN GULCH CREEK, A TRIBUTARY OF THE VERMILLION RIVER

TOWN OF WAKONDA

CLAY COUNTY, SOUTH DAKOTA

October 2004

South Dakota
Department of Environment and Natural Resources
Division of Environmental Services
Pierre, South Dakota

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Executive Summary

Name of Waterbody: Norwegian Gulch Creek, a tributary of the Vermillion River

Location: Clay County, South Dakota

Boundaries of Waterbody under Assessment: Norwegian Gulch Creek, from the Vermillion River confluence to its headwaters in Section 34, Township 95 North, Range 53 West.

Condition/Description of Creek Segment: DENR personnel assessed Norwegian Gulch Creek on two separate occasions, June 4 and 5, 2002, and on September 16 and 17, 2003. On both occasions, there was flow in the lower segment of Norwegian Gulch Creek (near site # 2 - see Attachment 16). However, flow is not constant in the upper segment of Norwegian Gulch Creek (associated with site # 1 – see attachment 16). Based upon field observations, it appears the lower segment of Norwegian Gulch Creek has base flow. This flow may be supplied by the Wakonda aquifer.

Creek Chub, blacknose dace, johnny darter, and unidentified shiners were collected from the lower segment of Norwegian Gulch Creek. Multiple age classes of creek chub and unidentified shiner were present.

Recommendation: It is recommended the assigned beneficial use for Norwegian Gulch Creek from the Vermillion River to Section 36, Township 95 North, Range 53 West, be changed to include the beneficial uses for (5) Warmwater semi-permanent fish life propagation waters and (8) Limited contact recreation waters. The headwaters of Norwegian Gulch Creek to Section 36, Township 95 North, Range 53 West, will remain a (9) Fish and wildlife propagation, recreation, and stock watering waters, and (10) Irrigation waters.

Introduction

The town of Wakonda is a small community in Clay County, South Dakota. According to the 2000 Census, the population of Wakonda is 374 and according to the statement of basis in the wastewater permit file, the facility serves a population of 420. The wastewater system has a three-cell system. The first two cells are conventional stabilization ponds while the third cell is a constructed wetland. The town of Wakonda is not currently allowed to discharge wastewater without permission from DENR. With permission, wastewater is piped about a mile before discharging to Norwegian Gulch Creek.

General Waterbody/Drainage Area Description

Surface Water

The waterbody under review is Norwegian Gulch Creek. The headwaters are southeast of Wakonda in Section 34, Township 95 North, Range 53 West. From the headwaters, Norwegian Gulch Creek flows in an easterly direction for about 4.5 miles before the confluence with the Vermillion River. For approximately the last 2.5 miles of its length, the creek flows through an eroded gorge referred to on a topographic map as "Norwegian Gulch."

Current Assigned Beneficial Uses

Currently, Norwegian Gulch Creek is assigned the beneficial uses for (9) Fish and wildlife propagation, recreation, and stock watering waters, and (10) Irrigation waters.

The segment of the Vermillion River, into which Norwegian Gulch Creek flows, is assigned the beneficial uses for (5) Warmwater semipermanent fish life propagation water, (8) Limited contact recreation waters, (9) Fish and wildlife propagation, recreation, and stock watering waters, and (10) Irrigation waters.

Wetlands

Wetlands in the segment of Norwegian Gulch Creek just downstream of the Wakonda wastewater discharge point and near sample site # 1 are palustrine wetlands of either the seasonally flooded emergent class, seasonally flooded forested class, or semipermanently flooded aquatic bed class (stockdam). Downstream in the segment of Norwegian Gulch Creek that is near sample site # 2, the same types of palustrine wetlands are found. However, semipermanently flooded, intermittent streambed class, riverine systems begin to appear.

Palustrine systems include wetlands dominated by trees, shrubs, persistent emergents, emergent mosses, or lichens. Riverine systems are wetlands and deepwater habitats contained within a channel.

Intermittent subsystems are found in riverine systems and are wetlands in channels that contain flowing water for only part of the year, but may still hold water when flow is absent.

Aquatic bed class wetlands include habitats dominated by plants that grow principally on or below the surface of the water for most of the growing season during most years. Emergent class wetlands are characterized by erect, rooted plants and perennial vegetation that is present for most of the growing season during most years. Forested class wetlands are characterized by woody vegetation that is at least 6 meters in height. Streambed class wetlands are all wetlands found in intermittent riverine systems.

Seasonally flooded water regimes are areas where water is present for extended periods especially early in the growing season, but is usually absent by the end of the season. When surface water is absent, the water table is still at land surface. A semipermanently flooded water regime is found at sites where water persists throughout the growing season.

Soils/Ground Water

For most of its length, Norwegian Gulch Creek flows over the Wakonda aquifer, an "extensive aquifer complex in northwestern Clay County…Water in the aquifer is under artesian pressure except where the aquifer is unsaturated or at the land surface. In some stream valleys, water-table conditions prevail and water levels are at or near the land surface…Artesian springs issue from the Wakonda aquifer in…T. 95 N., Rs. 52 and 53 W. (SDGS & USGS – Bulletin 19, Part II)." Norwegian Gulch Creek lies within this township and range. For this reason, and because the lower segment of the tributary is in a deep gulch (see the photograph in attachment 5 and the map in attachment 16), it is likely the aquifer contributes some base flow. Nevertheless, a hydrological study of the aquifer as it relates to this particular waterbody has not been performed.

DENR Assessment Results

On June 4 and 5, 2002, and again on September 16 and 17, 2003, DENR personnel visited the Wakonda area and did a survey of Norwegian Gulch Creek.

Based upon the visual observations of department personnel, immersion recreation activities do not occur in Norwegian Gulch Creek. The property surrounding Norwegian Gulch Creek is dominated by cropland and is privately owned. There is no public access or facilities that would encourage immersion recreation use. In addition, the streambed is lined with large rocks and hydrophytes, and the stream banks are lined with overhanging trees, making Norwegian Gulch Creek an inhospitable place for (7) Immersion recreation.

Details pertaining to sampling, flow measurements, and fish collection are discussed below.

Site # 1 (Section 34, Township 95 North, Range 53 West):

Site # 1 is along 456th Avenue, approximately one mile east and one half mile south of town. The wastewater discharge point for the town of Wakonda is about 1/3 mile upstream of this site.

There was flow in this segment of Norwegian Gulch Creek (upper segment) in June 2002, but flow was not observed in September 2003. On both occasions, the creek bed was overgrown with hydrophytes. Attachments 1, 2, and 3 are photographs showing this sample site.

Fish collection was attempted at this site on June 4, 2002, using an Engineering Technical Services (ET) Model APB-3 electrofisher. No fish were observed or collected.

On June 5, 2002, water quality samples were taken. Data show that at this location, water quality meets standards for a waterbody assigned the 9 and 10 beneficial uses. Summaries of the field and lab data are provided in Attachments 11 and 12.

During the June 5, 2002, visit, flow measurements were taken. Flow was calculated to be 0.08 cubic feet per second (cfs). Attachment 13 is a copy of the velocity data.

Site # 2 (Section 36, Township 95 North, Range 53 West):

Site # 2 is along 458th Avenue, approximately one mile west and three quarters of a mile south of Colfax Corner. The site is at the western end of Norwegian Gulch.

There was flow in this segment of Norwegian Gulch Creek (lower segment) in June 2002 and again in September 2003. Water was visually very clear, and the creek bottom was composed of gravel. Attachments 4 and 5 are photographs of the sample site.

Fish collection was attempted at this site on June 4, 2002. Fish were collected from a 200 foot segment of creek using an Engineering Technical Services (ET) Model APB-3 electrofisher. Species found included blacknose dace, creek chub, and unidentified shiner. DENR personnel returned and collected additional fish, on September 16, 2003. Fish were collected from a 150 foot segment of creek using a Engineering Technical Services (ET) Model APB-3 electrofisher. Species found included blacknose dace, creek chub, johnny darter, and unidentified shiners. On both occasions, there were multiple age classes of creek chub and unidentified shiners. The Department of Game, Fish, and Parks was contacted regarding the potential for topeka shiners to inhabit this stream. Sampling for topeka shiners has never been performed in this waterbody. However, topeka shiners have been found in the Vermillion River a short distance downstream of the confluence. Attachments 9 and 10 are summaries of the fish collection data for this site. Attachments 6, 7, and 8 are photographs of fish collected at this site.

DENR personnel took water samples on June 5, 2002, and again on September 17, 2003. Results indicate water quality in Norwegian Gulch Creek meets the standards established for the proposed 5 and 8 beneficial uses. Summaries of the field and lab data are provided in Attachments 11 and 12.

Flow measurements were taken in 2002 and again in 2003. Flow of 0.72 cfs was calculated in June 2002 and 0.94 cfs in September 2003. Attachment 14 and 15 are copies of the velocity data.

Recreation Use

The segment of Norwegian Gulch Creek under review exhibits seasonal variations in water level. The depth in June 2002 averaged about 0.2 feet; while the depth in September 2003 averaged approximately 1.0 foot. The shallow nature of Norwegian Gulch Creek makes (7) Immersion recreation unlikely. The property surrounding Norwegian Gulch Creek is dominated by cropland and is privately owned. There is no public access or facilities that would encourage visits by the public and immersion recreation use. In addition, the streambed is lined with large rocks and the stream banks are lined with overhanging trees, making Norwegian Gulch Creek an inhospitable

place for (7) Immersion recreation. These limiting factors are congruent with 40 CFR 131.10 (g)(2). DENR recommends (8) Limited contact recreation use for this segment of Norwegian Gulch Creek.

Summary

Norwegian Gulch Creek is a small stream that flows east from the Wakonda area to the Vermillion River. The upper segment of Norwegian Gulch Creek has little flow. However, the lower segment of the creek appears to have base flow as it holds water through the spring, summer, and into the early fall.

Water in Norwegian Gulch Creek is shallow and provides a generally inhospitable habitat for swimming. For this reason, the creek is not utilized for immersion recreation activities. Nevertheless, because water is present in the creek, there is a potential for limited contact use related to fishing or minnow collection activities.

Sample data indicate water quality in the segment of the creek associated with sample site # 2 meets standards established for the currently assigned 9 and 10 beneficial uses and for the proposed 5 and 8 beneficial uses.

A variety of warmwater fish species are found in Norwegian Gulch Creek. These include johnny darter, blacknose dace, creek chub, and a species of unidentified shiner. Of these species, multiple age classes of creek chub and unidentified shiner were present.

DENR does not recommend (7) Immersion recreation waters beneficial use for Norwegian Gulch Creek. Due to low and intermittent flow conditions and seasonally low water levels, Norwegian Gulch Creek is not capable of attaining an (7) Immersion recreation use.

It is recommended the assigned beneficial use for Norwegian Gulch Creek from Section 36, Township 95 North, Range 53 West, to the confluence with the Vermillion River, be changed to (5) Warmwater semi-permanent fish life propagation waters, (8) Limited contact recreation waters, (9) Fish and wildlife propagation, recreation, and stock watering waters, and (10) irrigation waters.

REFERENCES

United States Environmental Protection Agency. 1983. Methods for Chemical Analysis of Water and Wastes. EPA 600/4-79-020. Cincinnati, Ohio.

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National Oceanic and Atmospheric Administration. Monthly Station Normals of Temperature, Precipitation, and Heating and Cooling Degree Days 1971-2000.

ATTACHMENT 1

Site # 1

This photograph was taken on June 5, 2002. The photographer is standing on 256th Avenue, looking west. Norwegian Gulch Creek had flow at this location.

ATTACHMENT 2

Site # 1

This photograph was taken on September 16, 2003. The photographer is standing on 256th Avenue, looking west. Norwegian Gulch Creek has limited ponded water but no flow.

ATTACHMENT 3

Site # 1

This photograph was taken on September 16, 2003. The photographer is standing on 256th Avenue, looking east. Norwegian Gulch Creek has limited ponded water but no flow.

ATTACHMENT 4

Site # 2

This photograph was taken on September 16, 2003. The site is next to the road along 458th Avenue. The photographer is standing next to the creek, looking east. Fish found at this site included unidentified shiners, creek chub, blacknose dace, and Johnny darter. There were multiple age classes of creek chub and unidentified shiner.

ATTACHMENT 5

Site # 2

This photograph was taken on September 16, 2003. The site is next to the road along 458th Avenue. The photographer is standing on 258th Avenue, looking down at the creek and facing west. Norwegian Gulch Creek has flow. Fish found at this site included unidentified shiners, creek chub, blacknose dace, and johnny darter. There were multiple age classes of creek chub and unidentified shiner.

ATTACHMENT 6

Site # 2
This photograph was taken on September 16, 2003. The fish is a johnny darter.

ATTACHMENT 7

Site # 2
This photograph was taken on September 16, 2003. The fish is a creek chub.

ATTACHMENT 8

Site # 2
This photograph was taken on September 16, 2003. The fish is a johnny darter.

ATTACHMENT 9

SITE # 2
FISH SPECIES

Length in Millimeters
June 4, 2002

Electroshocked 200 feet

	Blacknose Dace	Unidentified Shiner	Creek Chub			
	95	48	146	64	47	82
		52	132	58	152	63
		63	68	42	69	59
		48	92	47	152	40
		78	68	52	119	111
		61	64	68	94	92
		68	58	44	62	59
		53	52	53	52	48
		53	164	52	64	69
		68	54	35	144	58
		78	63	63	60	59
		56	54	58	70	64
		58	71	44	53	74
		53	54	44	88	69
		58	52	43	84	78
		63	53	54	58	44
		71	48	52	64	58
		54	35	48	80	59
		53	63			
Number of fish:	1	19	73			
Maximum Length:	95	78	164			
Minimum Length:	95	48	35			
Average Length:	95	60	69			
Median Length:	95	58	59			

ATTACHMENT 10

SITE # 2
FISH SPECIES

Length in Millimeters
September 16, 2003

Electrochocked 150 feet

	Johnny Darter	Blacknose Dace	Creek Chub*			Unidentified Shiner**	
	67	90	52	82	71	72	62
	61		70	81	57	55	75
	65		62	51	65	44	65
			42	75	150	60	52
			42	77	70	60	55
			77	71	44	62	71
			41	48	130	52	44
			42	160	44	72	60
			70	48	72	87	68
			82	65	42	54	
			61	25	48		
			48	145	175		
			138	145	144		
Number of fish:	3	1	39 + 15			19 + 10	
Maximum Length:	67	90	175			87	
Minimum Length:	61	90	25			44	
Average Length:	64	90	77			62	
Median Length:	65	90	70			60	

Comments: Many fish were observed swimming away from the electrofisher.
* 15 additional creek chub were collected but not measured. Sizes were similar to those already measured.
** 10 additional unidentified shiners were collected but not measured. Sizes were similar to those already measured.

ATTACHMENT 11

FIELD ANALYSIS PARAMETERS, INSTRUMENTS, AND RESULTS				
PARAMETER	INSTRUMENT / REFERENCE METHOD	RESULTS		
		Site # 1 June 5, 2002	Site # 2 June 5, 2002	Site # 2 September 17, 2003
Temperature Air (^{0}C)	Thermometer / EPA (170.1)	19.4	17.8	33.3
Water (^{0}C)	Hanna 9025 portable pH meter / EPA (170.1)	14.4	16	25.5
Dissolved oxygen (mg/L)	Azide Modification of Winkler / EPA (360.2)	10.54	9.71	8.9
pH (su)	Hanna 9025 portable pH meter / EPA (360.2)	8	7.95	8.13

mg/L = *Milligrams per liter;*
su = *Standard Unit; and*
EPA = *Environmental Protection Agency.*

ATTACHMENT 12

LABORATORY ANALYSIS PARAMETERS, METHODS, AND RESULTS				
PARAMETER	METHOD / REFERENCE	RESULTS		
		Site # 1 June 5, 2002	Site # 2 June 5, 2002	Site # 2 September 17, 2003
Fecal Coliform Bacteria (organisms/100 ml)	SM 9222 B EC	10	230	280
Ammonia (mg/L)	SM 4500 NH3 H	<0.02	<0.02	<0.02
Nitrate (mg/L)	SM 4500 NO3 F	8.0	4.1	4.2
Biochemical Oxygen Demand (mg/L)	5 day incubation, 20°C / EPA Method (405.1)	<2	<2	--
Total Suspended Solids (mg/L)	SM 2540 D	5	7	9
Total Dissolved Solids (mg/L)	SM 2540 C	2912*	2771*	2460
Total Solids (mg/L)	SM 2540 B	2917	2778	2469*
Alkalinity – M (mg/L)	SM 2320 B	--	--	270
Conductivity (umhos/cm)	EPA 120.1	--	--	2520

umhos/cm = *Micro mhos per centimeter;*
< = *Not detected, followed by a number documenting the detection limit;*
ml = *Milliliter;*
* = *Calculated from other fractions that were determined by laboratory analysis;*
SM = *Standard Method;*
EPA = *Environmental Protection Agency;*
-- = *Not measured; and*
mg/L = *Milligrams per liter.*

ATTACHMENT 13

SITE # 1
VELOCITY MEASUREMENTS AND CALCULATED FLOW RATE*

Field Data			CALCULATED FLOW RATE (CUBIC FEET/SECOND)
LOCATION	WATER DEPTH (FEET)	VELOCITY (FEET/SECOND)	
1	0.6	0.06	0.05
2	0.6	0.02	0.01
3	0.5	0.03	0.02
		June 5, 2002, Flow Rate:	0.08

*As Determined Using A Marsh McBirney Model-201E Flow Meter.

ATTACHMENT 14

SITE # 2
VELOCITY MEASUREMENTS AND CALCULATED FLOW RATE*

Field Data			CALCULATED FLOW RATE (CUBIC FEET/SECOND)
LOCATION	WATER DEPTH (FEET)	VELOCITY (FEET/SECOND)	
1	0.1	0.12	0.02
2	0.2	0.25	0.05
3	0.2	0.53	0.11
4	0.2	0.67	0.13
5	0.3	0.75	0.23
6	0.3	0.41	0.18
		June 5, 2002, Flow Rate:	0.72

*As Determined Using A Marsh McBirney Model-201E Flow Meter.

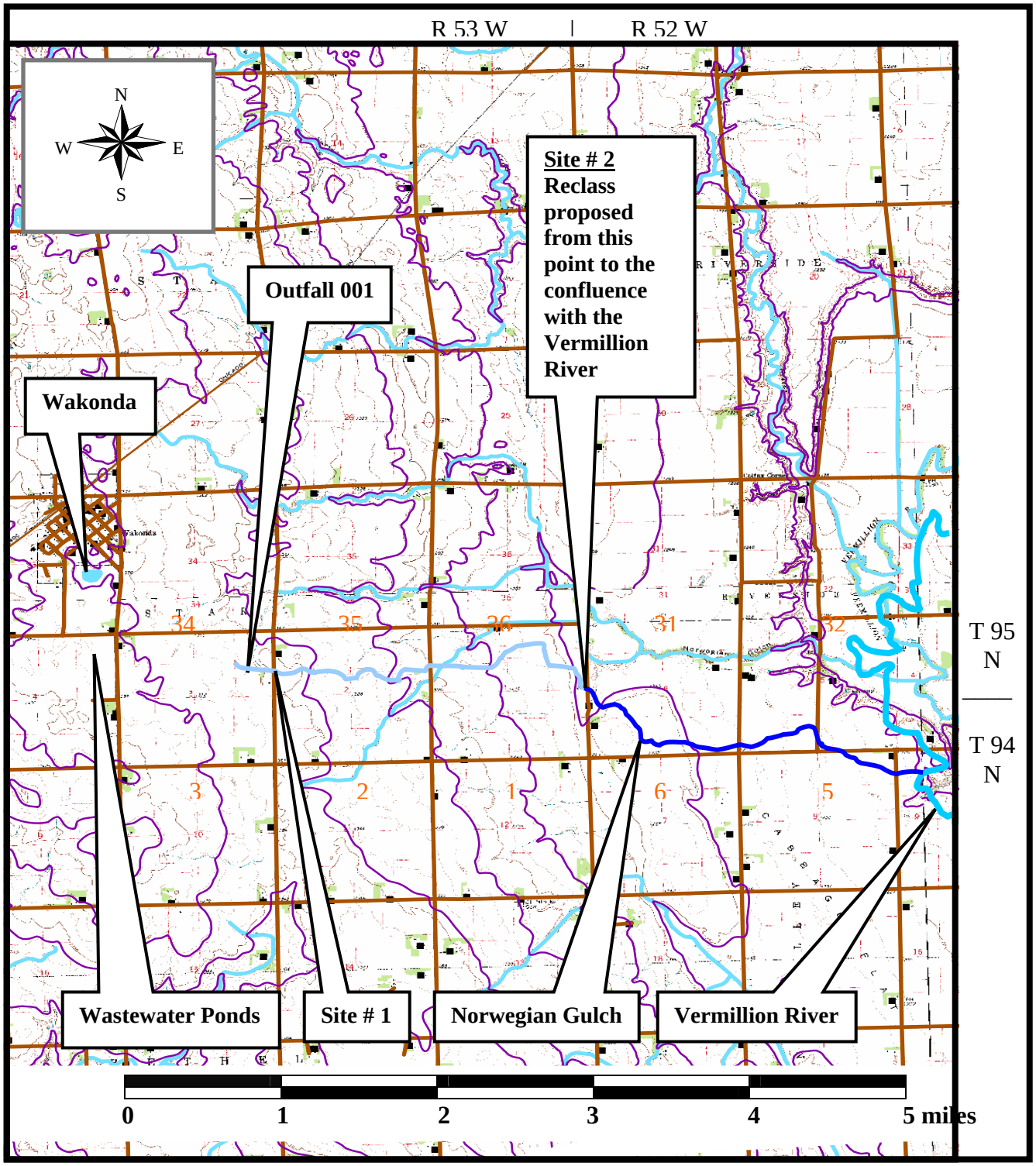
ATTACHMENT 15

SITE # 2
VELOCITY MEASUREMENTS AND CALCULATED FLOW RATE*

Field Data			CALCULATED FLOW RATE (CUBIC FEET/SECOND)
LOCATION	WATER DEPTH (FEET)	VELOCITY (FEET/SECOND)	
1	0.3	0.00	0.00
2	1.1	0.05	0.06
3	1.5	0.07	0.11
4	1.1	0.12	0.13
5	1.1	0.18	0.20
6	1.2	0.11	0.13
7	1.3	0.12	0.16
8	0.9	0.11	0.15
		September 16, 2003, Flow Rate:	0.94

*As Determined Using A Marsh McBirney Model-201E Flow Meter.

ATTACHMENT 16



The segment with the proposed beneficial use change is illustrated in bold blue. The upper segment beneficial use classification, illustrated in light blue, will remain unchanged.