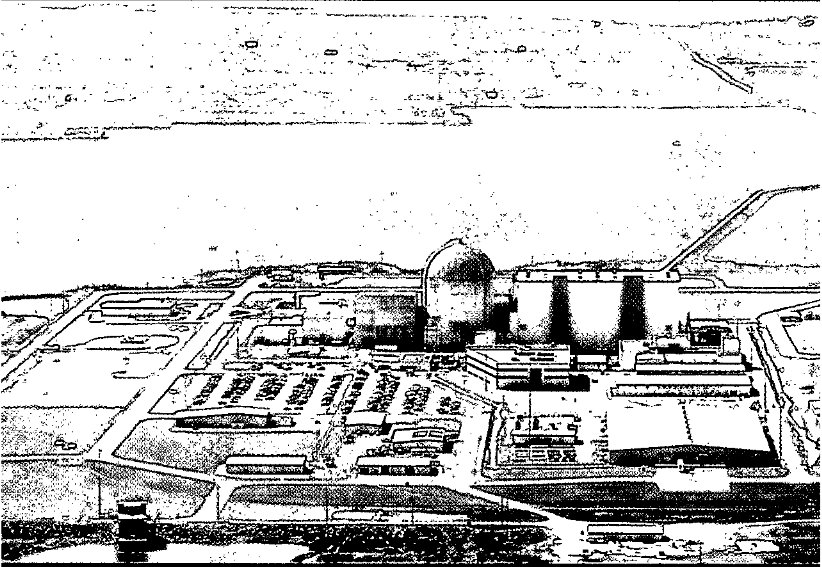
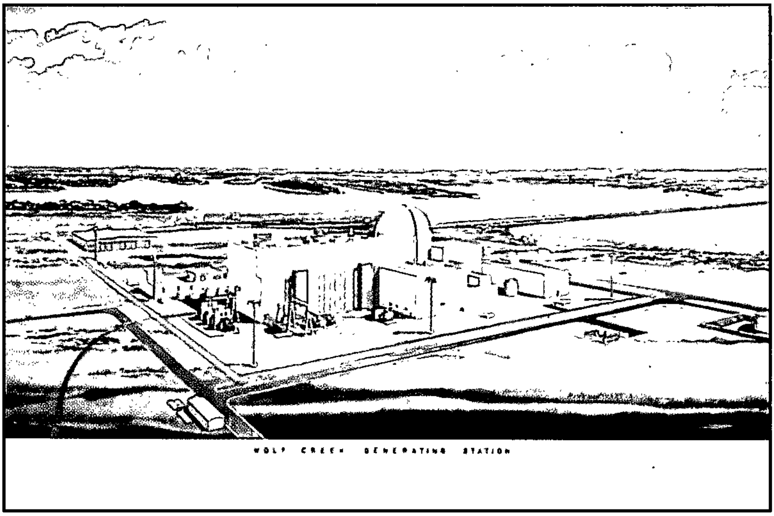
2. Photographs of the site dating to before and during site preparation and plant construction.

FROM PRAIRIE TO PROTONS



A Pictorial history of the construction of Wolf Creek Generating Station



Artists rendering of what Wolf Creek would look like when completed

WOLF CREEK

GENERATING STATION

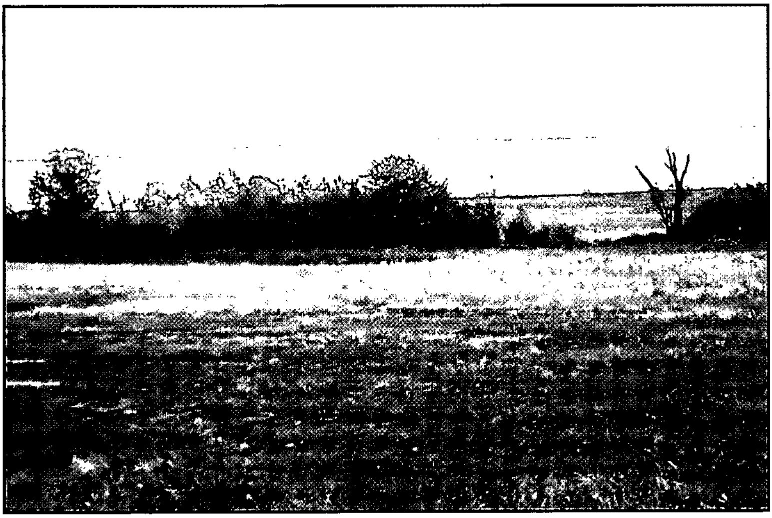
Early Wolf Creek logo

Created from a suggestion by Homer Adams and Kent Stukey.

Dedicated to all the people who helped construct and continue

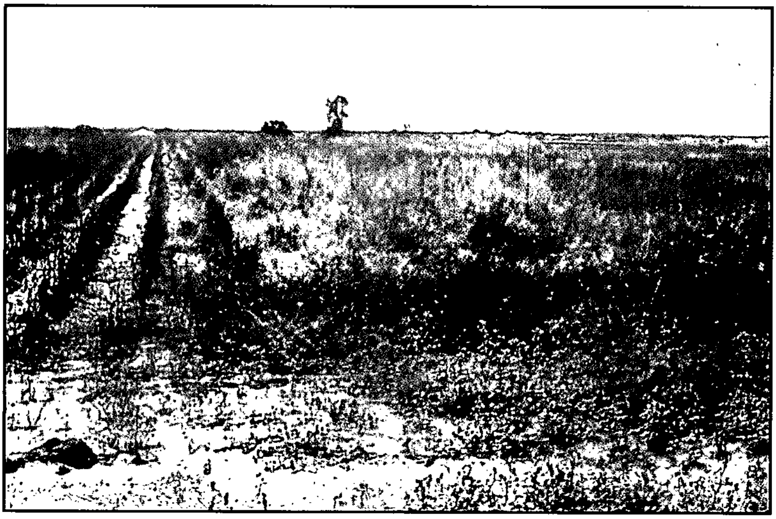
to safely operate Wolf Creek Generating Station.

Future site of plant, November 1973



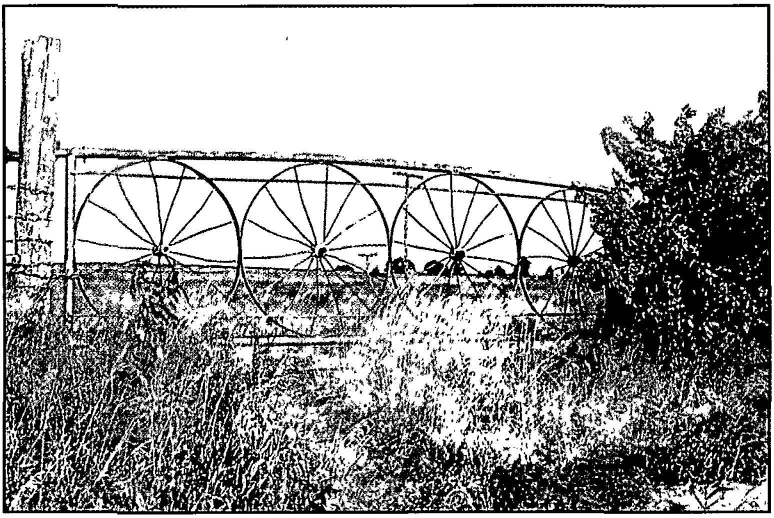
Future site of plant, November 1973

Taking piezometer (pressure) readings for site suitability, November 1973



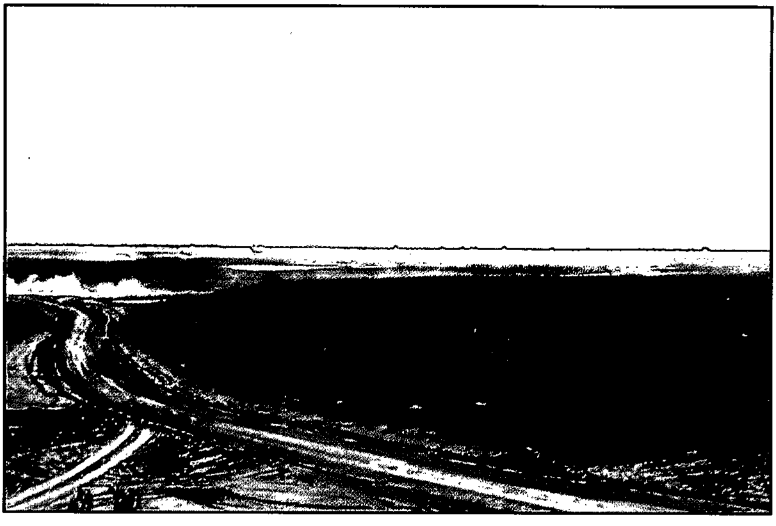
Future site of plant, November 1973

Bridgework over causeway on site access road, 1975

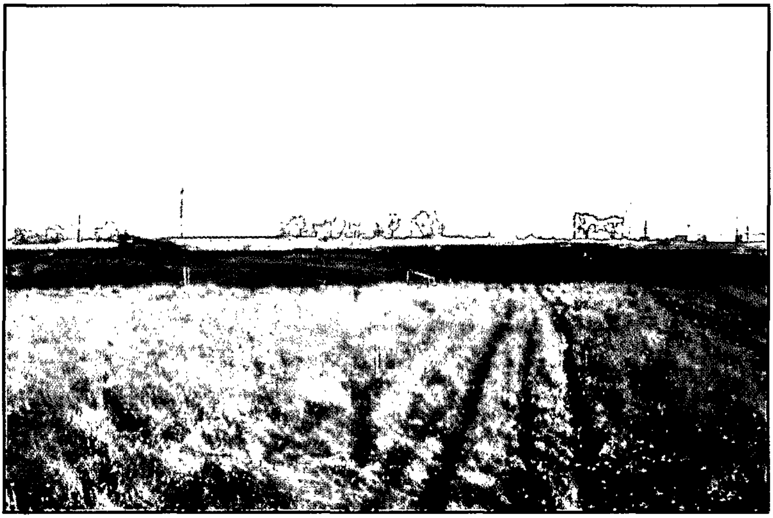


Wagon wheel gate on Wolf Creek property, 1975

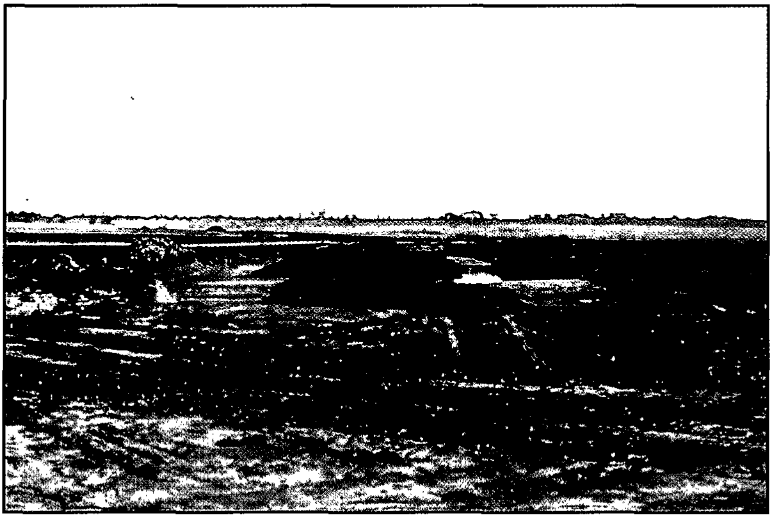
KG&E engineer visiting early site preparation



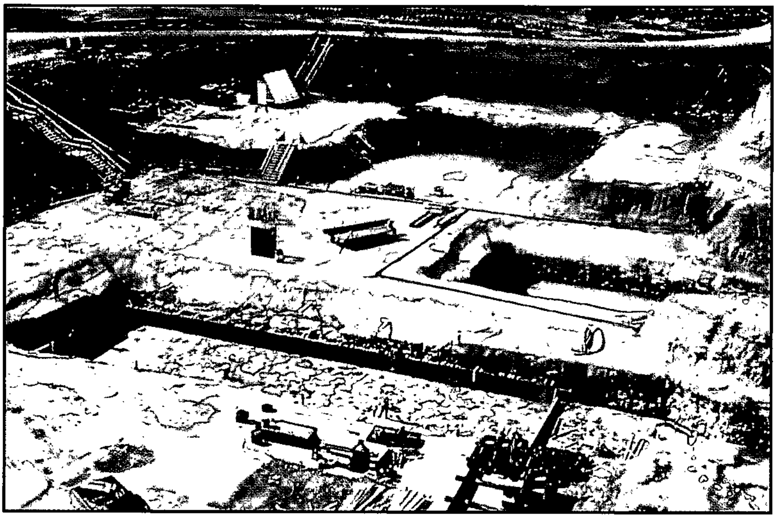
Early lake work, 1977



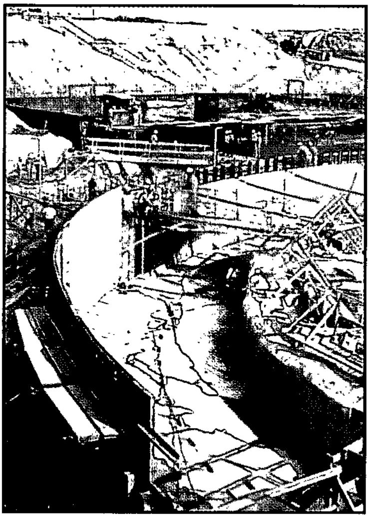
Area where powerblock will be built



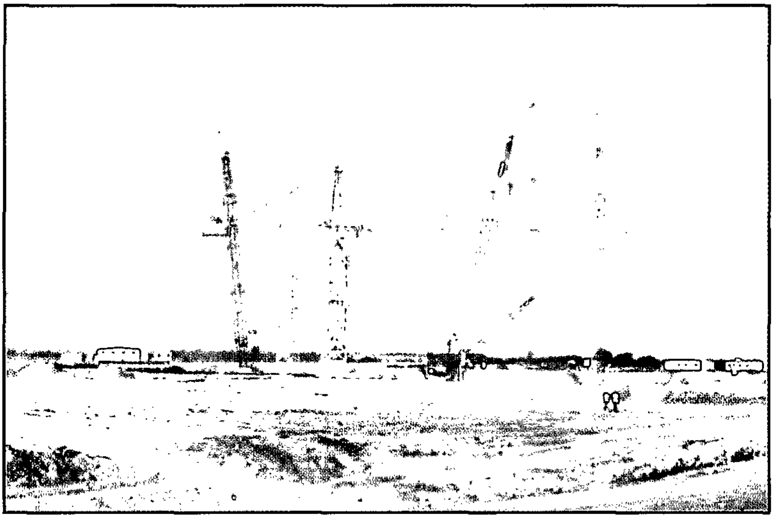
Early site preparation



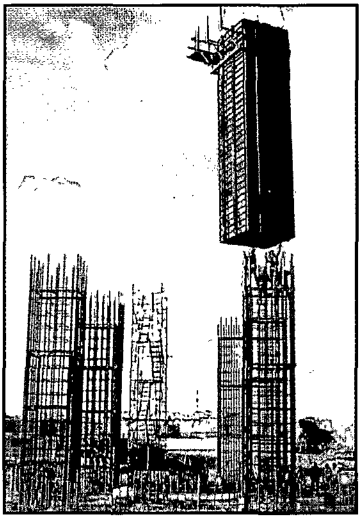
Early excavation, July 1977



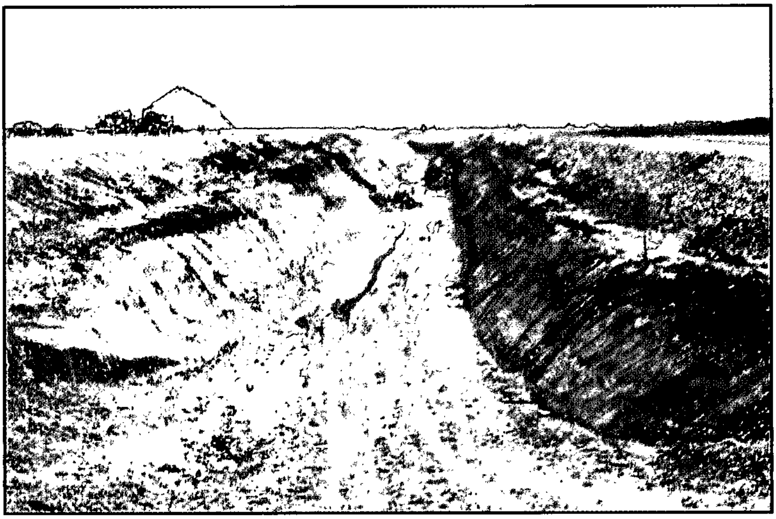
Containment tendon gallery work, August 1977



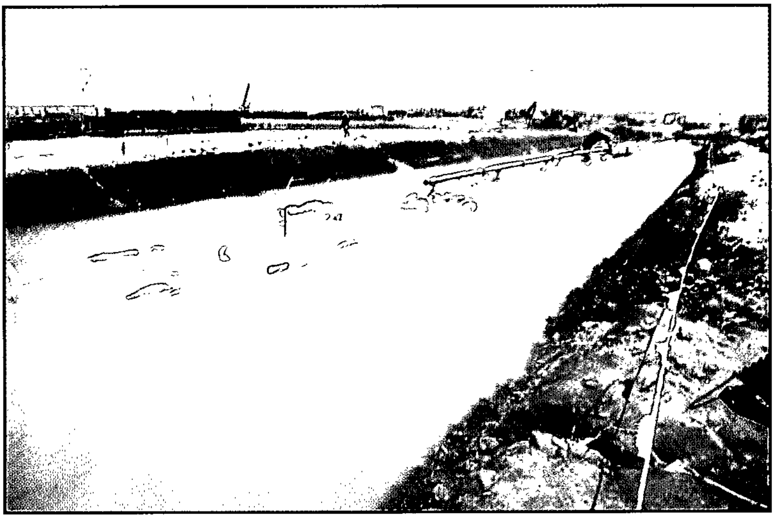
View looking west at early sitework, August 1977



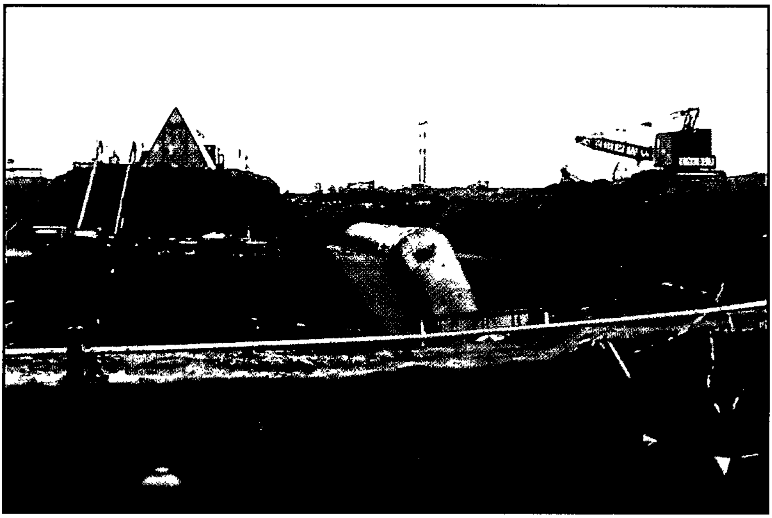
Turbine pedestal formwork, October 1977



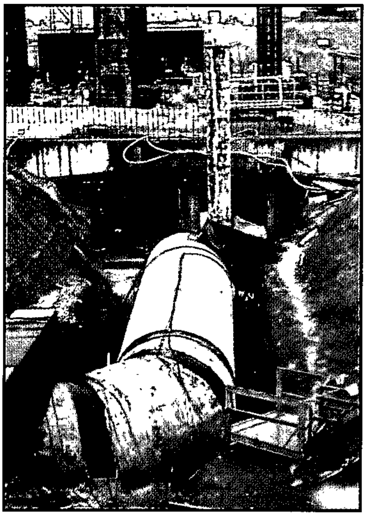
Ditch for circulating water piping, 1977



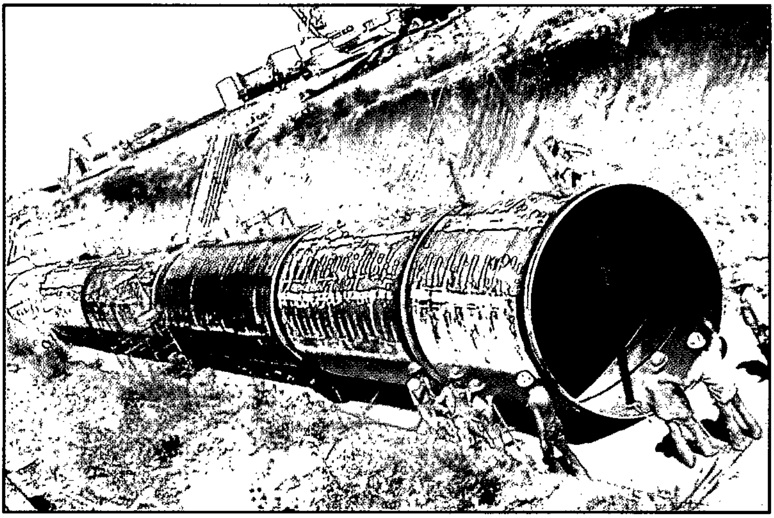
Circulating water piping ditch, flooded by rain



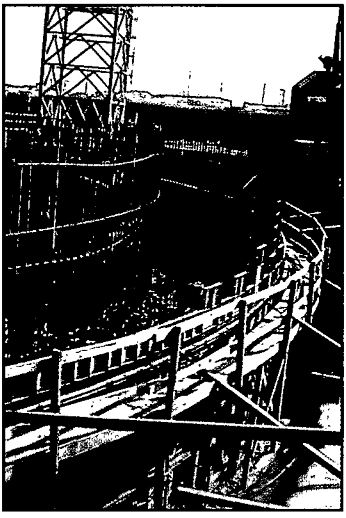
Circulating water pipe installation, 1977



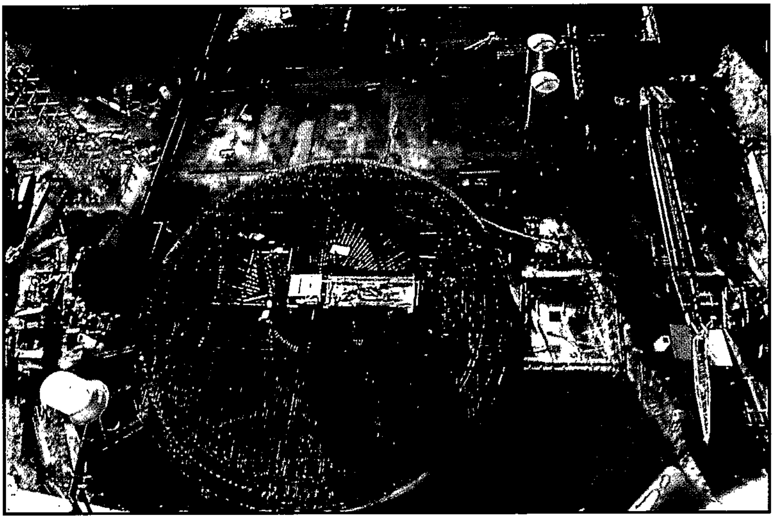
Circulating water pipe as it enters the turbine building, 1977

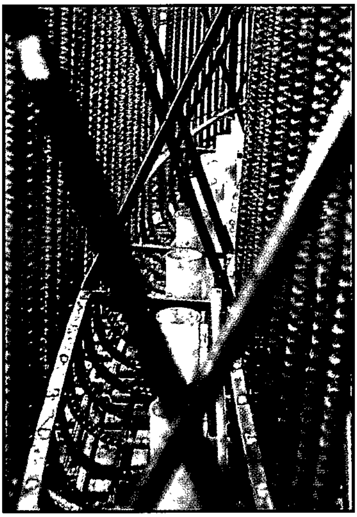


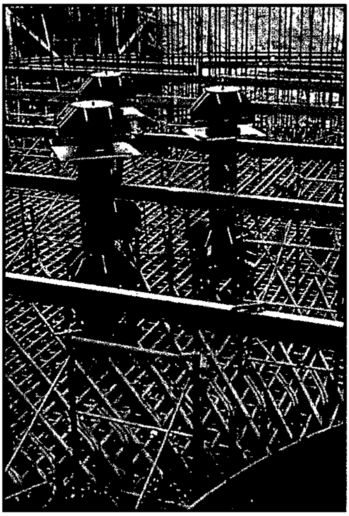
Laying 12 foot diameter circulating water piping, 1977



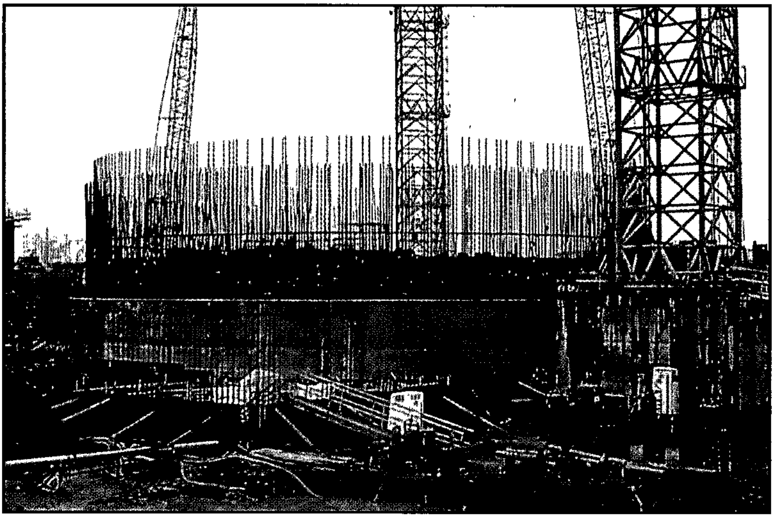
Tendon gallery construction, August 1977


Containment base mat, 1977

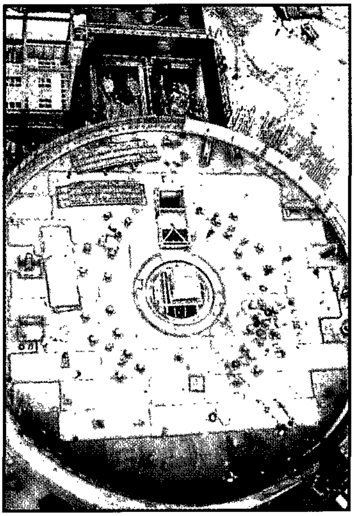

Tendon casings in containment walls, 1977



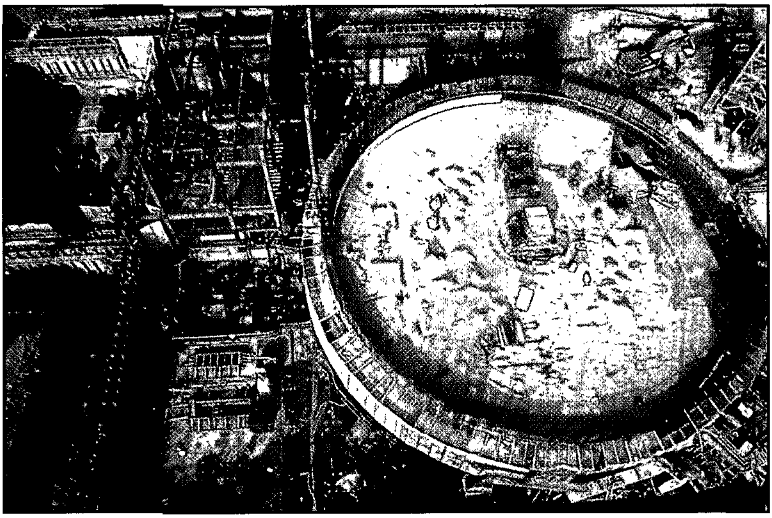
Reactor Coolant pump supports on containment rebar, 1977



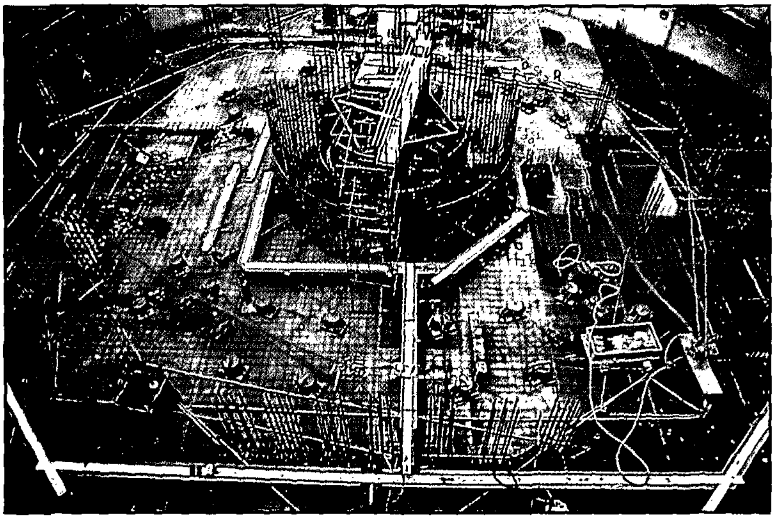
Containment, 1977



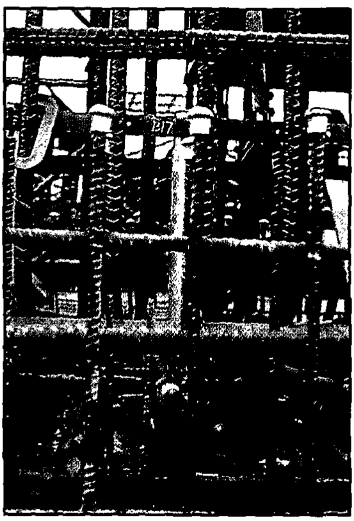
Containment base mat, 1977



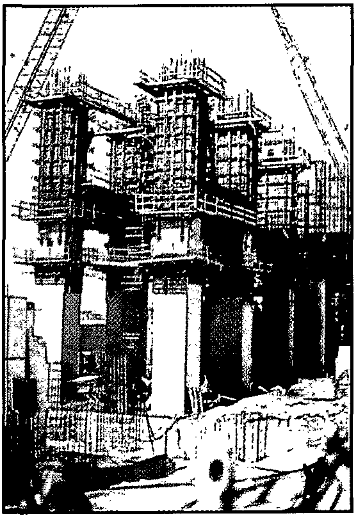
Containment base mat pour, 1977



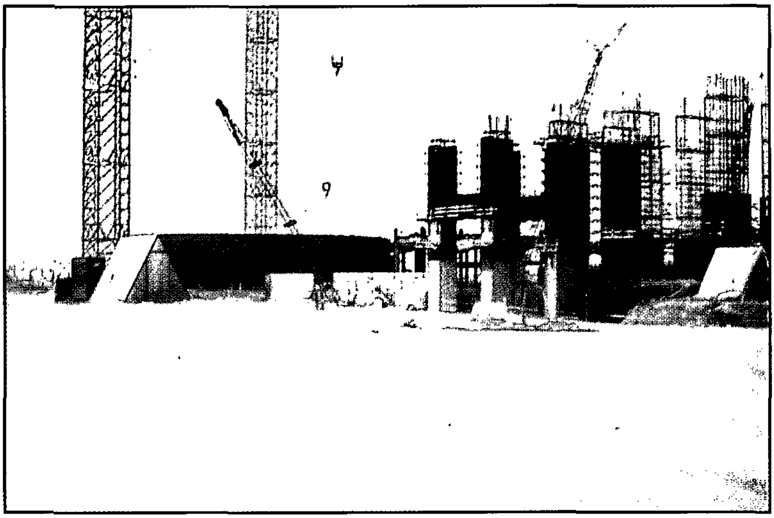
Containment base mat rebar work, 1977



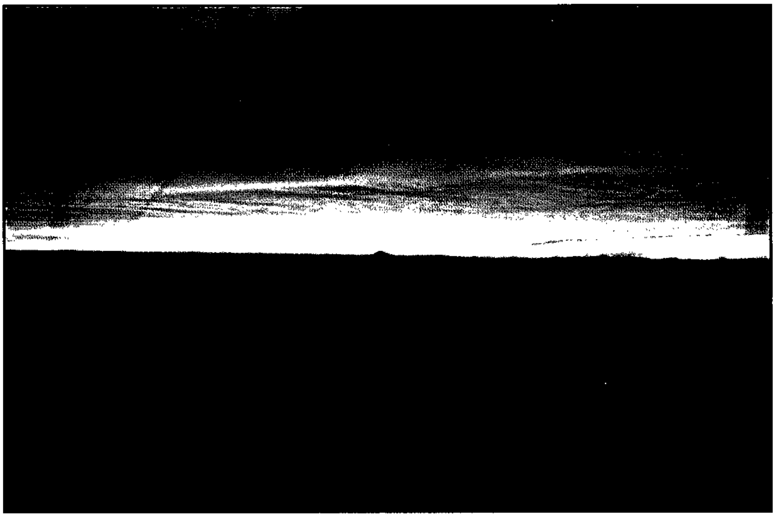
Closeup of rebar work, 1977



Turbine pedestals, 1977

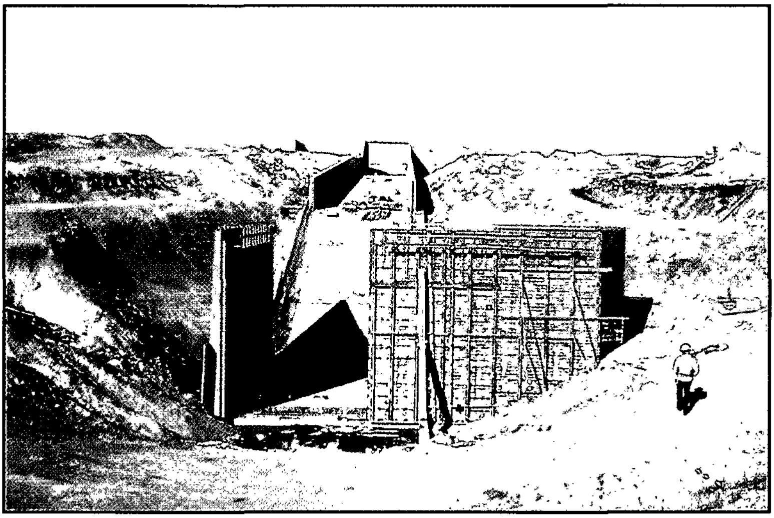


Containment and turbine pedestals, 1977

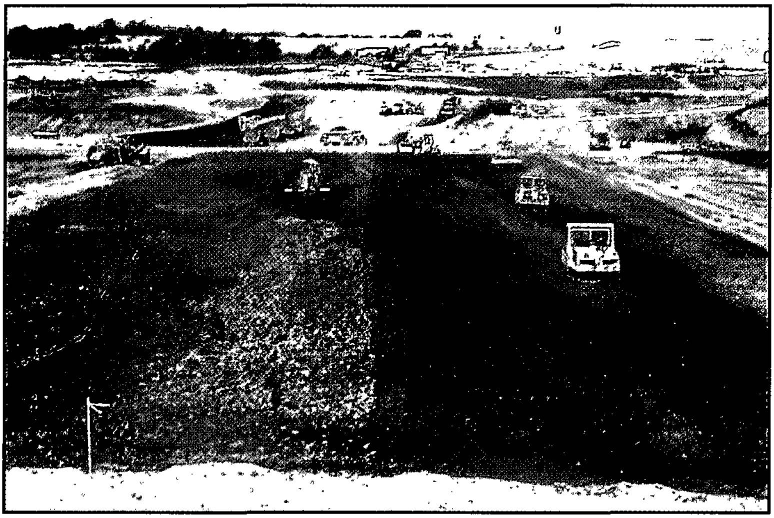


Sunset by meteorological tower

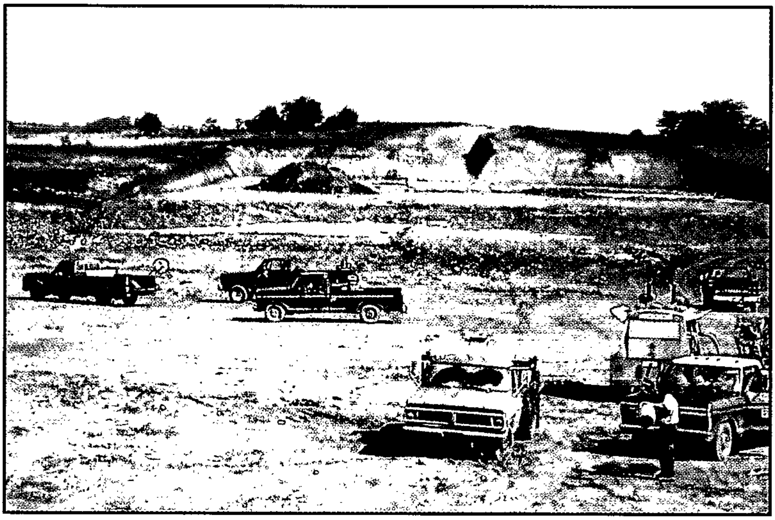
Accumulators and rebar in laydown yard, 1978



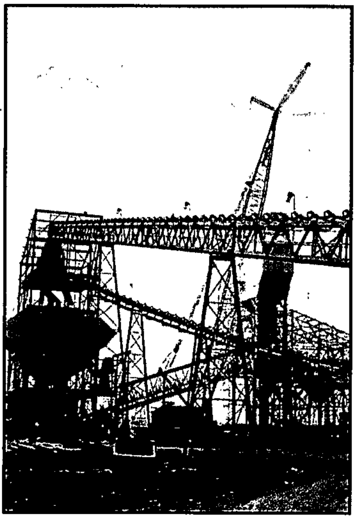
Basin at main dam, 1978



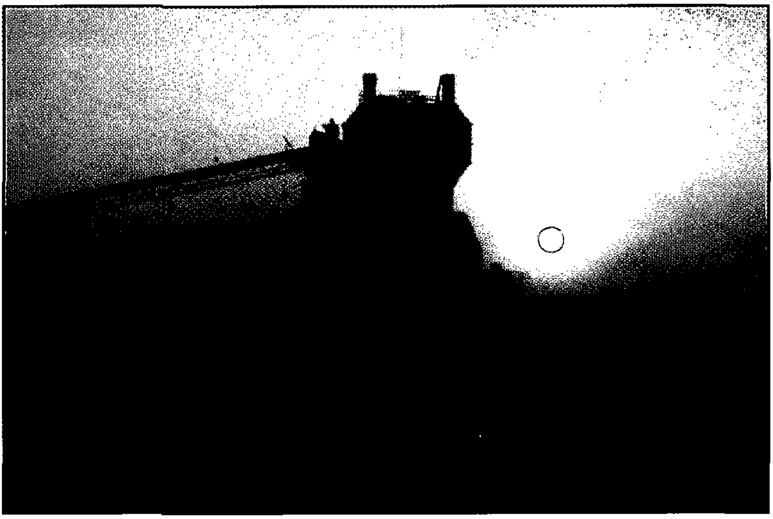
Lake construction, August 1978



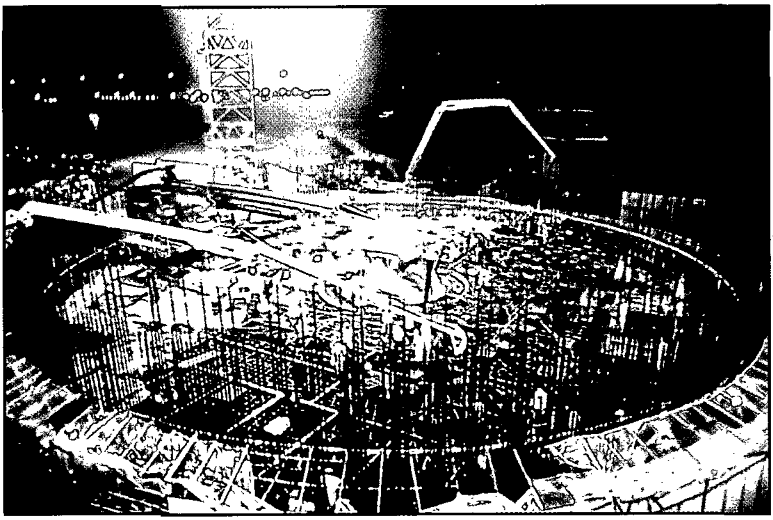
Lake construction at west end of main dam, 1978



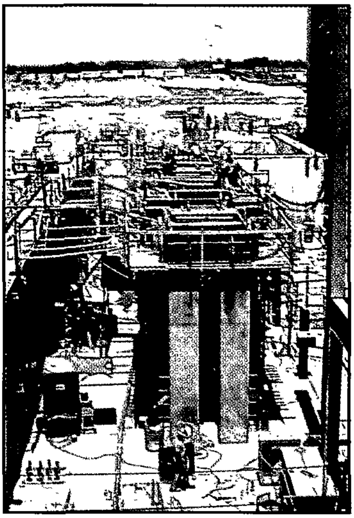
Batch (concrete) plant, 1978



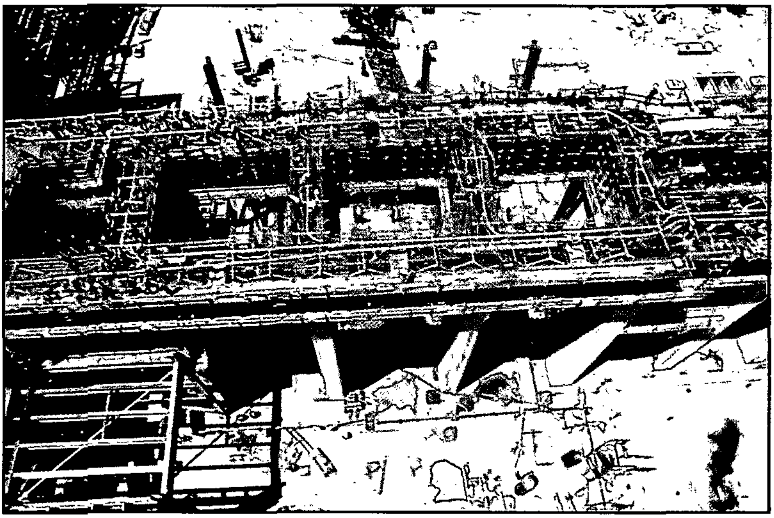
Sunrise over the batch plant, 1978



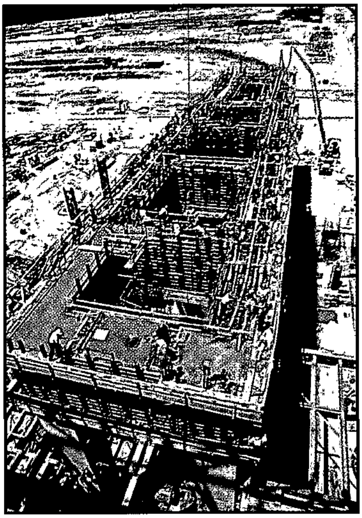
Containment base mat night pour, 1978



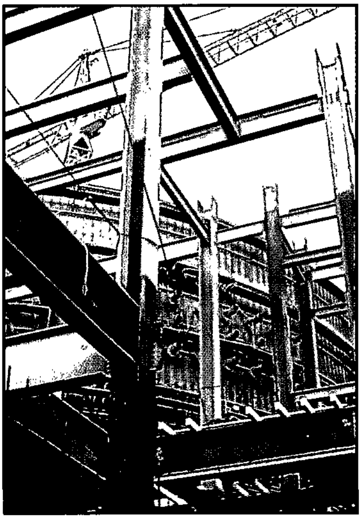
Main feedwater pump supports in turbine building, July 1978



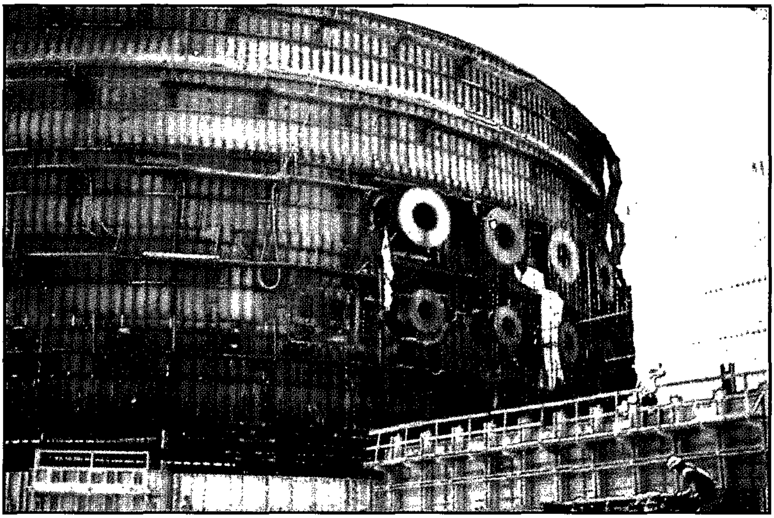
Turbine pedestals and building, August 1978



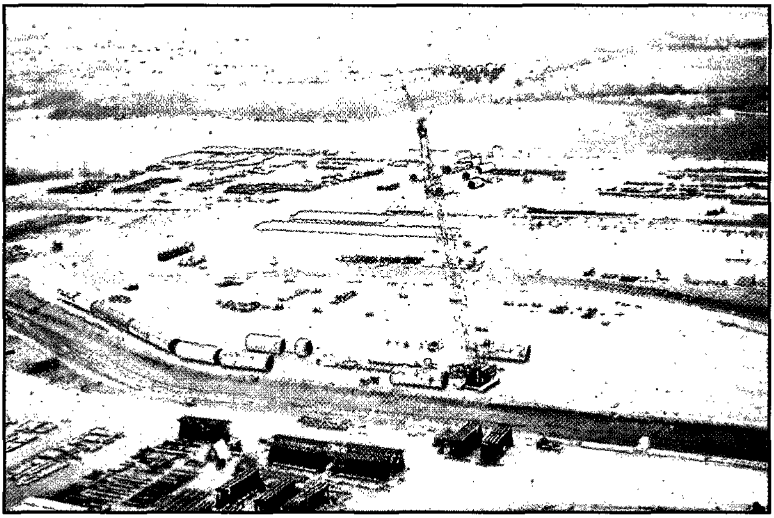
Turbine platform construction, August 1978



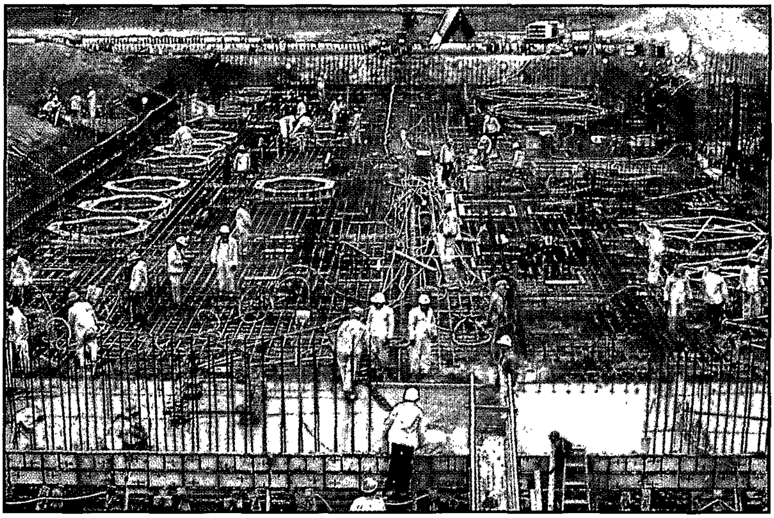
Containment showing penetrations, 1978



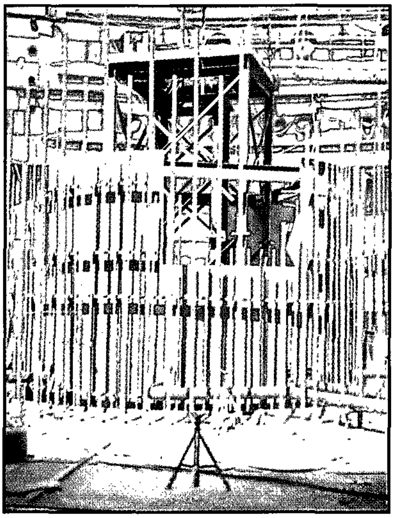
Containment with main steam and main feedwater
penetrations into Area 5, 1978



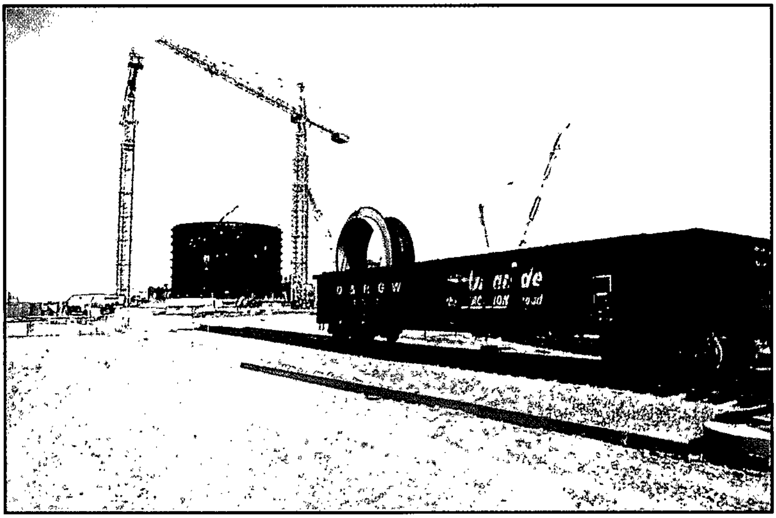
View looking NNW at laydown yard with circulating
water pipes being laid, 1978



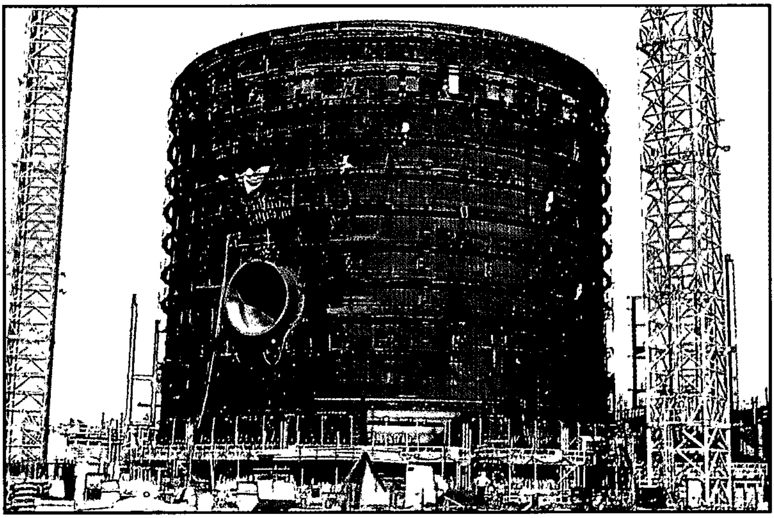
Radwaste building base mat work with essential service water pipe in background, 1978



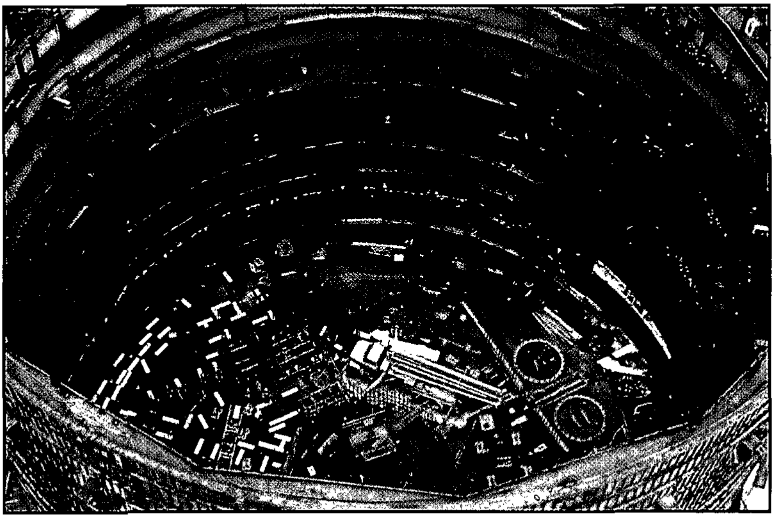
Reactor vessel supports, 1978



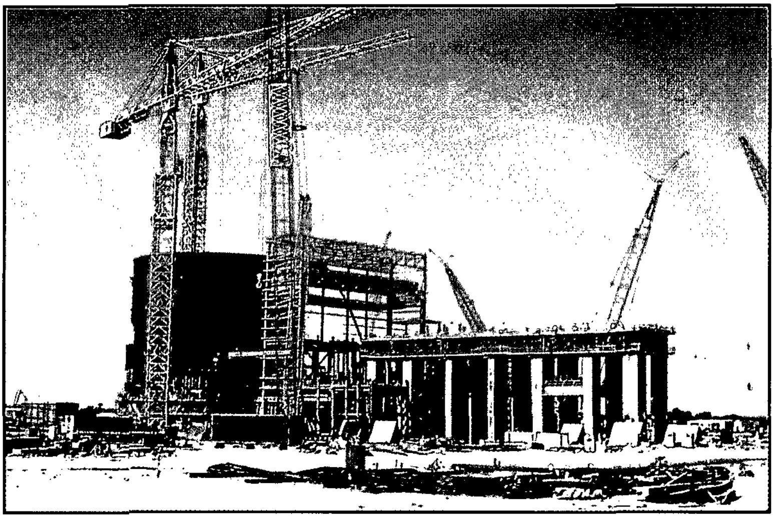
Delivery of circulating water transition ring, 1978



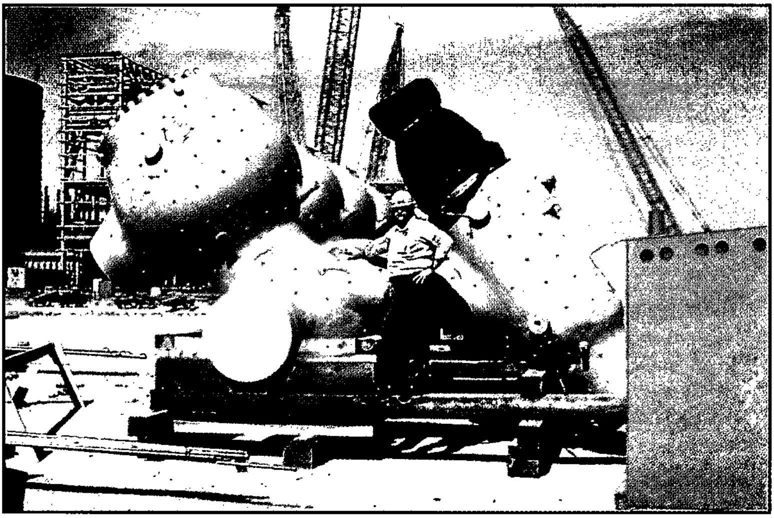
Steel plate of containment, 1978



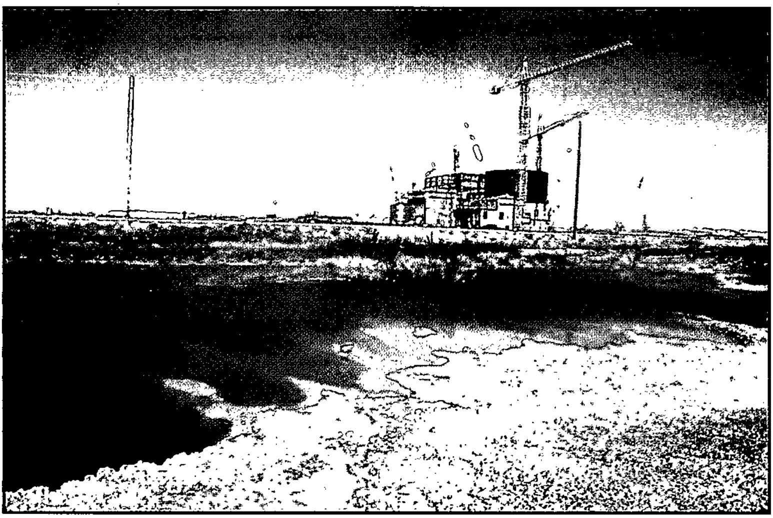
View inside steel plate of containment, 1978



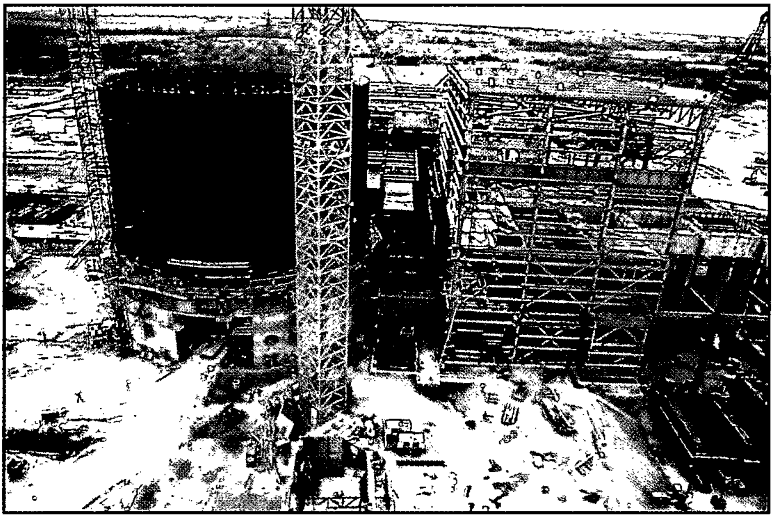
View looking SW at turbine building and containment, 1978



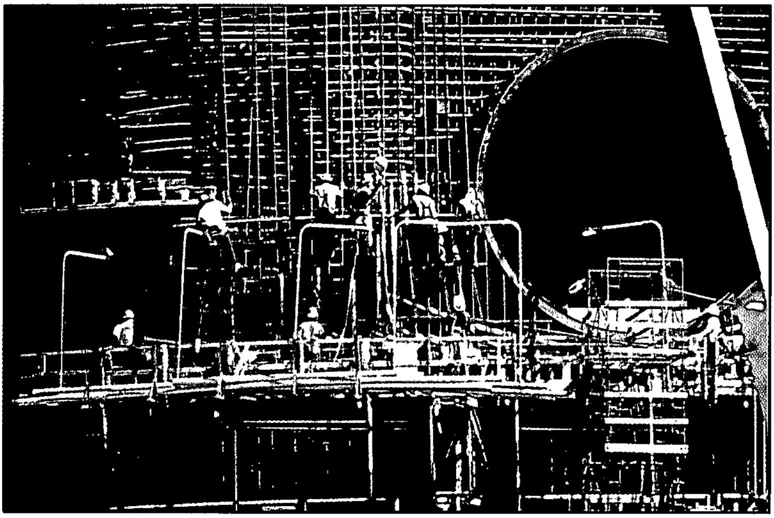
Main turbine stop/control valves in laydown yard, 1978



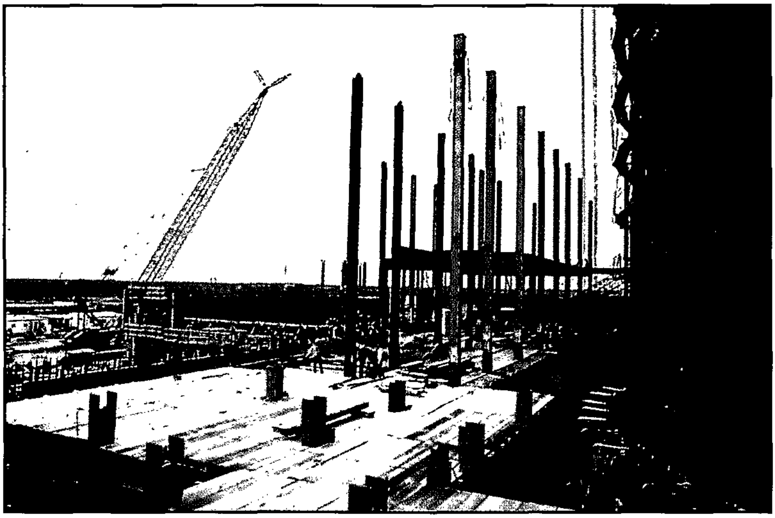
View looking NNE across filling lake, November 1978



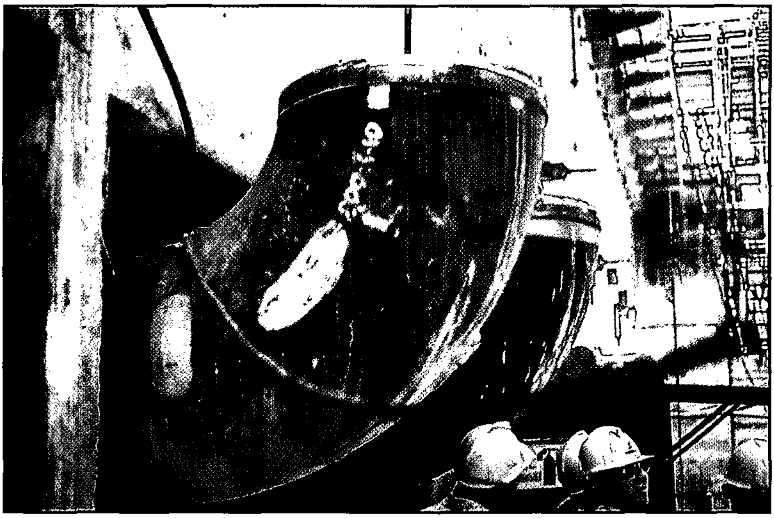
View looking west, late 1978



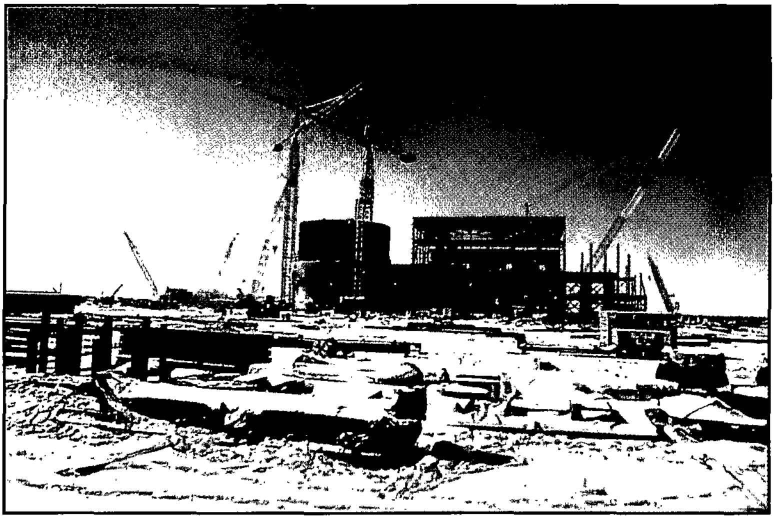
Containment rebar work on hatch opening, 1978



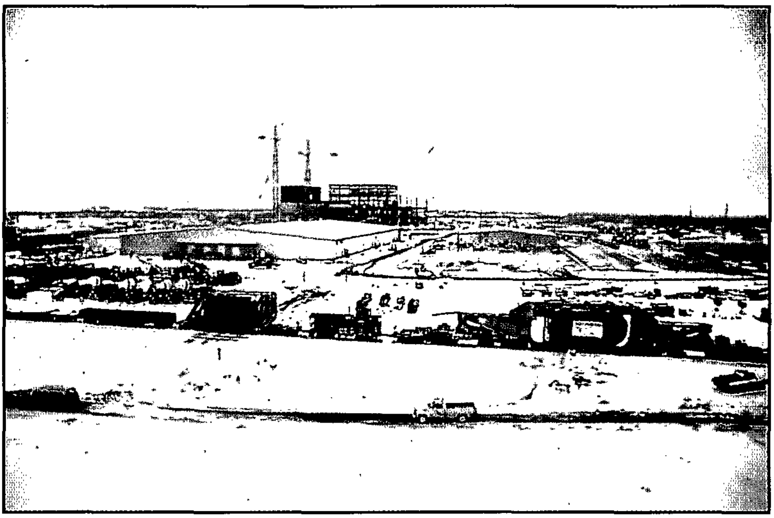
Auxiliary building work, 1978



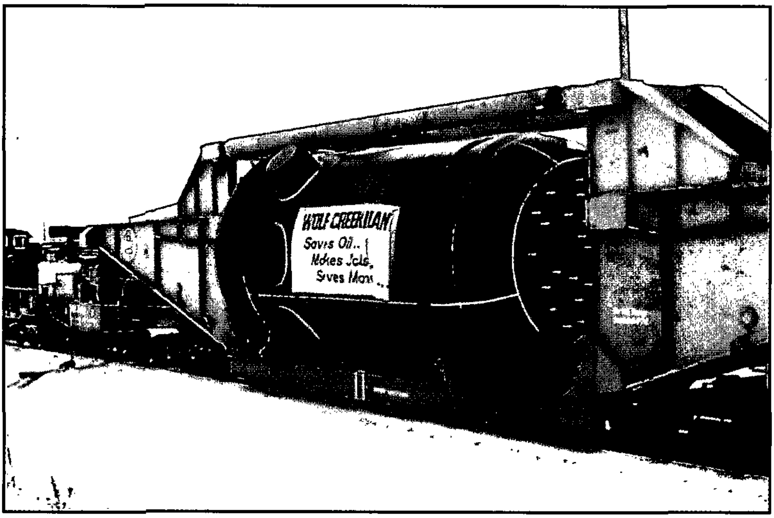
Essential service water piping entering Auxiliary building, 1978



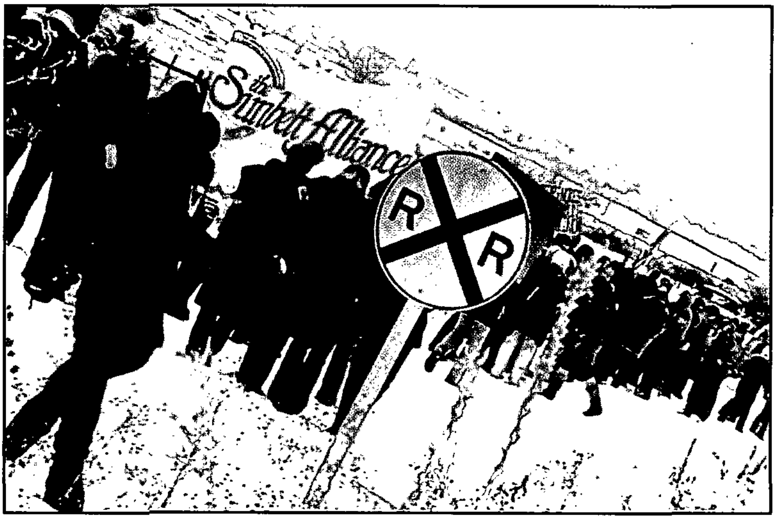
View looking west, 1979



Arrival of train delivering reactor vessel, January 1979



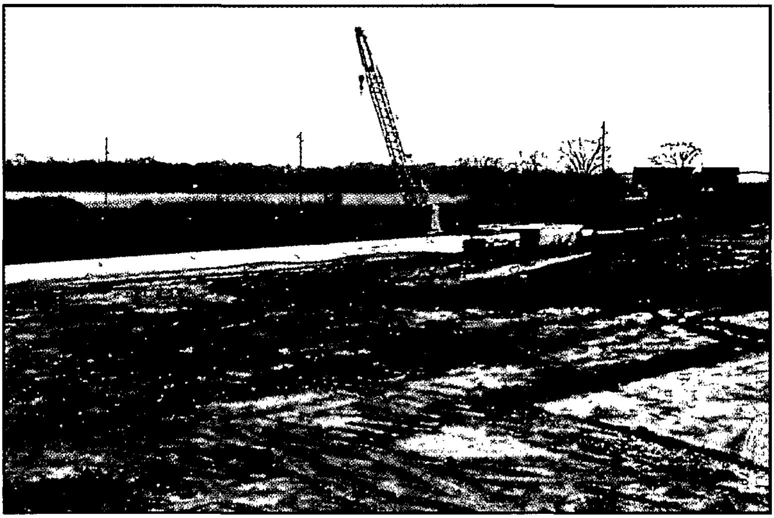
Reactor vessel arrives on site, January 1979



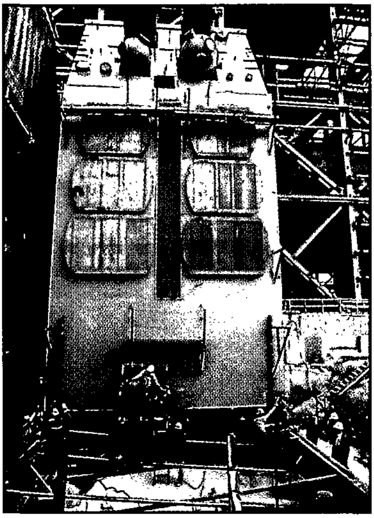
Protesters during reactor vessel delivery, January 1979

Protesters during reactor vessel delivery, January 1979

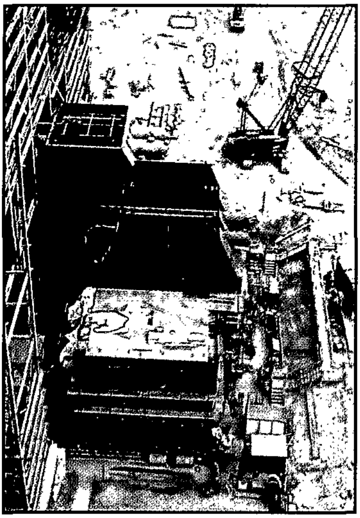
Cranes lifting reactor vessel off of rail car, January 1979



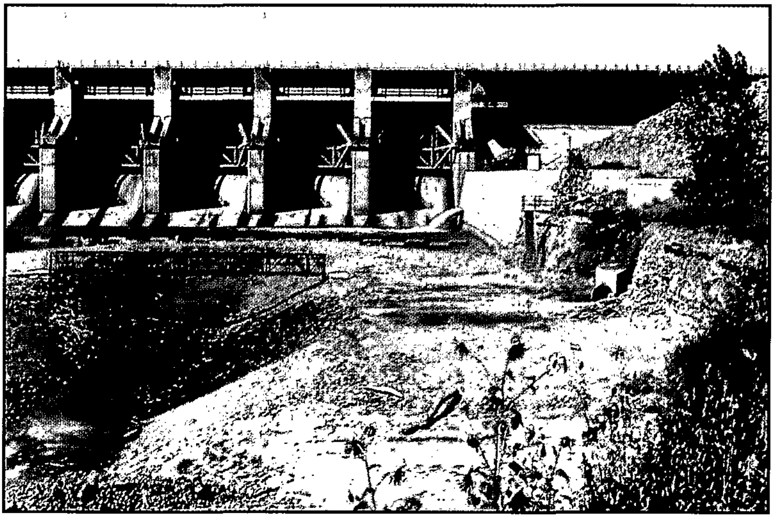
Lake work, 1979



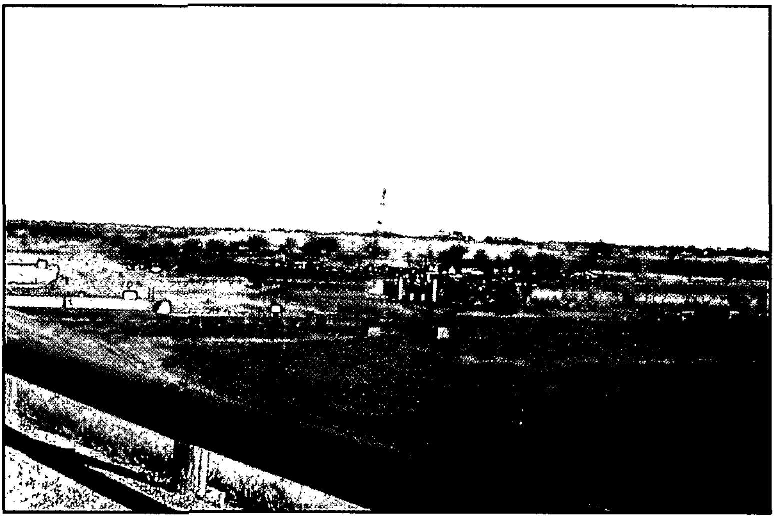
High pressure condenser being moved into turbine building, May 1979



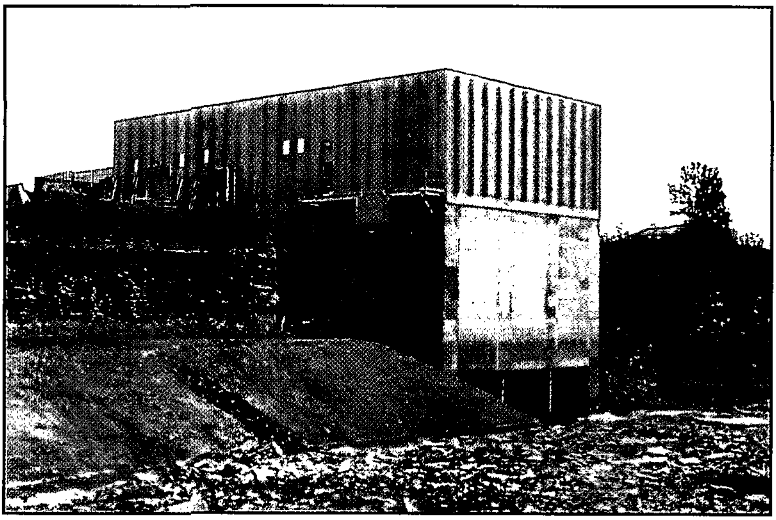
Condenser sections on east side of turbine building, May 1979



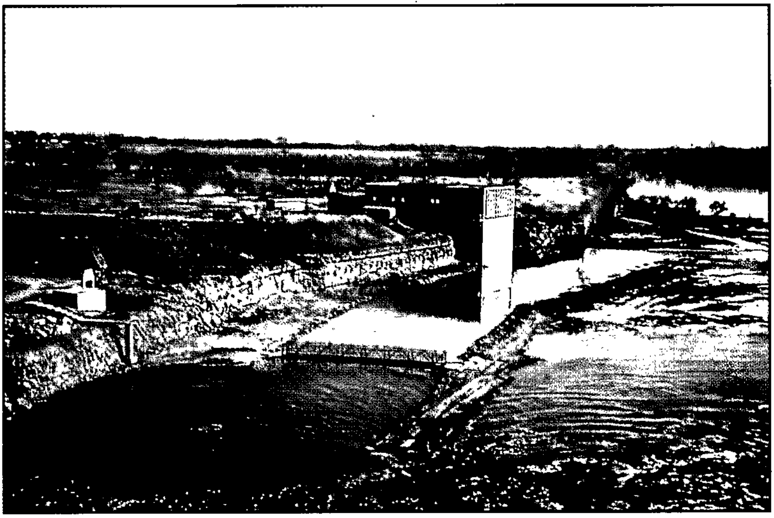
Makeup water screenhouse location below John Redmond dam, 1979



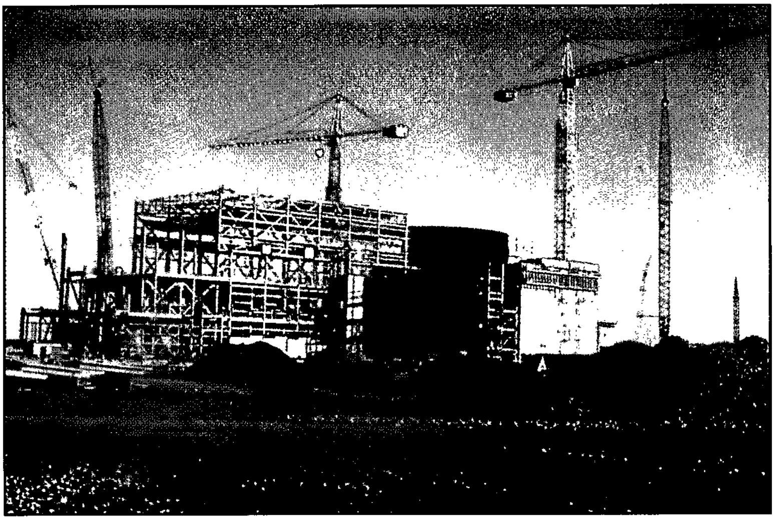
Construction of makeup water screenhouse, 1979



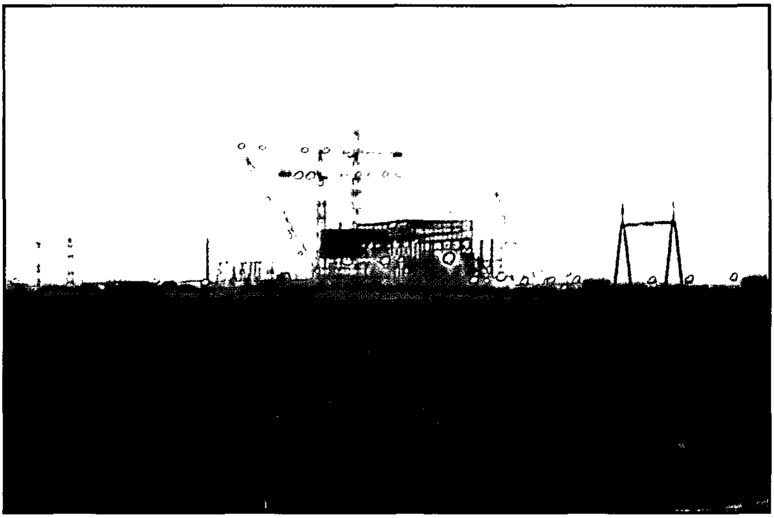
Makeup water screenhouse at John Redmond, 1979



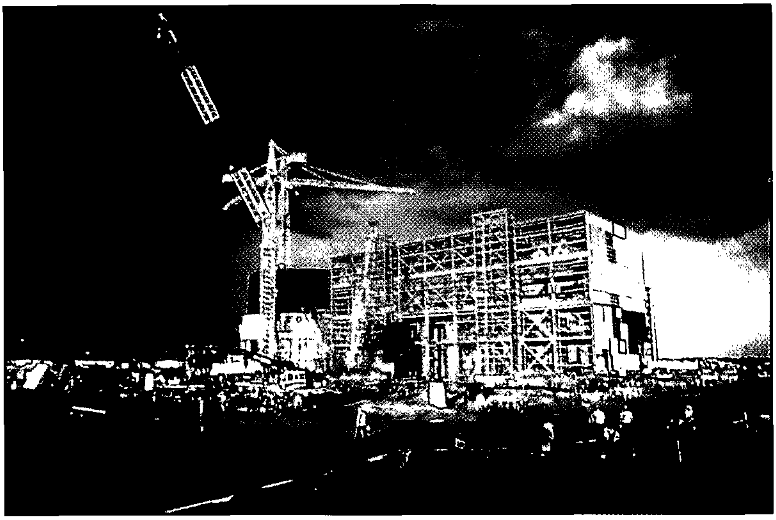
Makeup water screenhouse at John Redmond, 1979



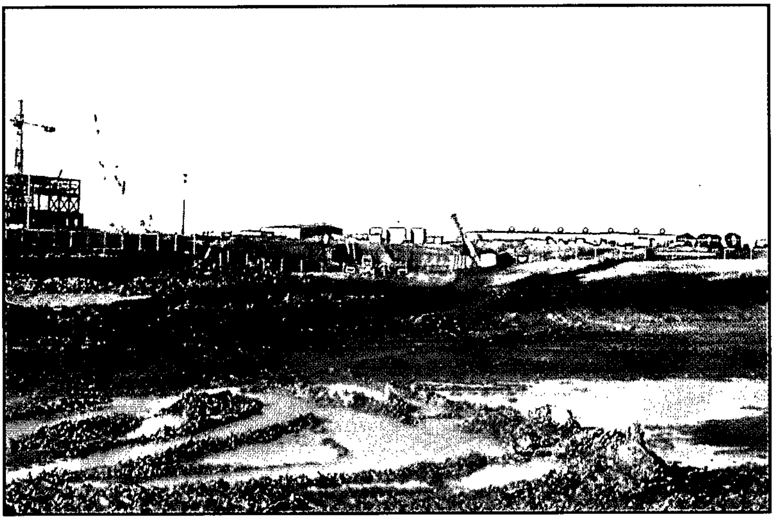
View of plant looking SE, 1979



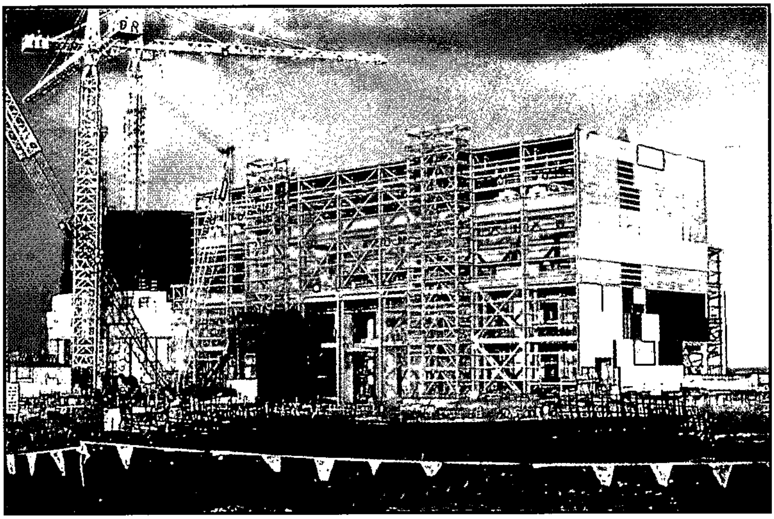
Sunset at site, looking SW, 1979



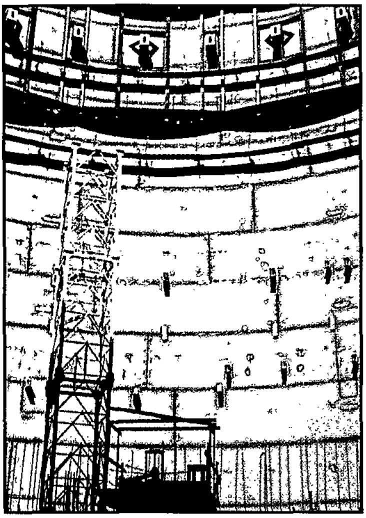
Installing condenser section, 1979



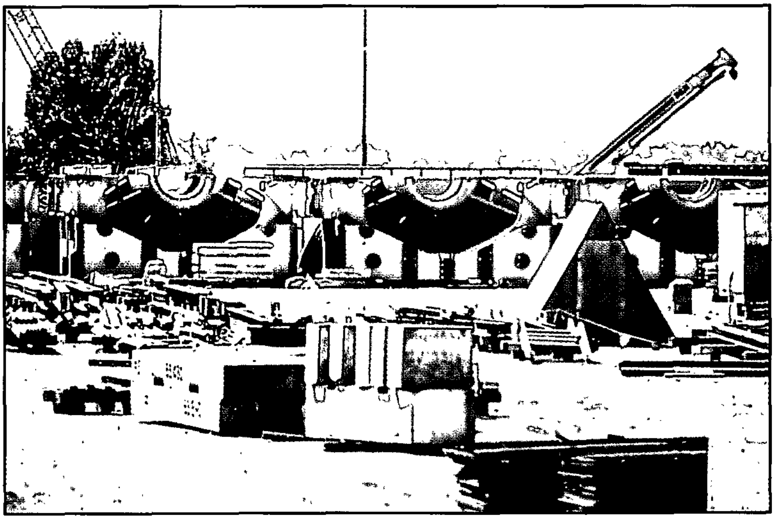
Circulating water screenhouse construction, 1979



View looking WSW, last condenser section still to be moved, 1979

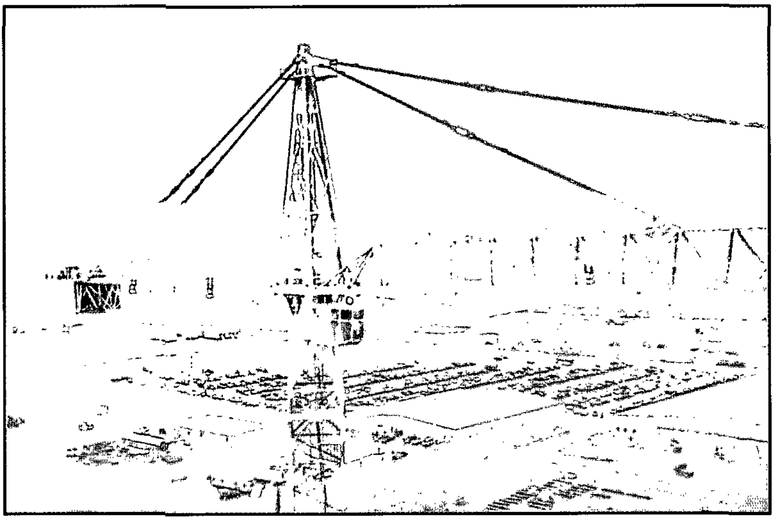


Building small crane inside containment, 1979

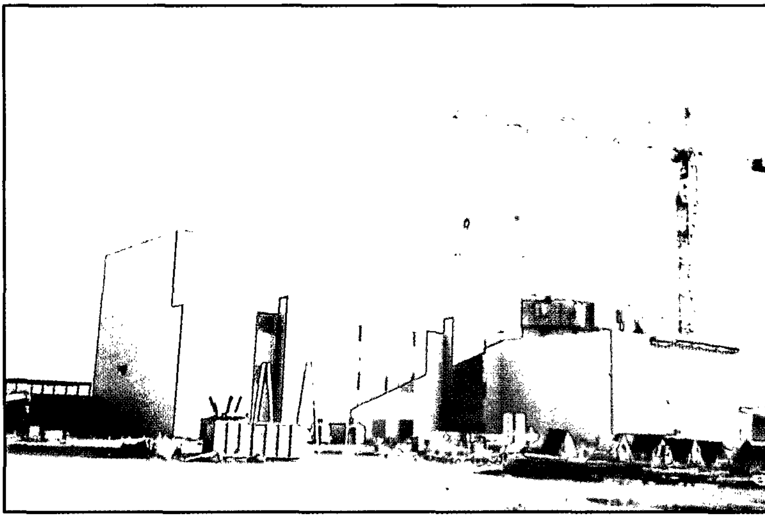


Laydown yard with turbine casings, 1979

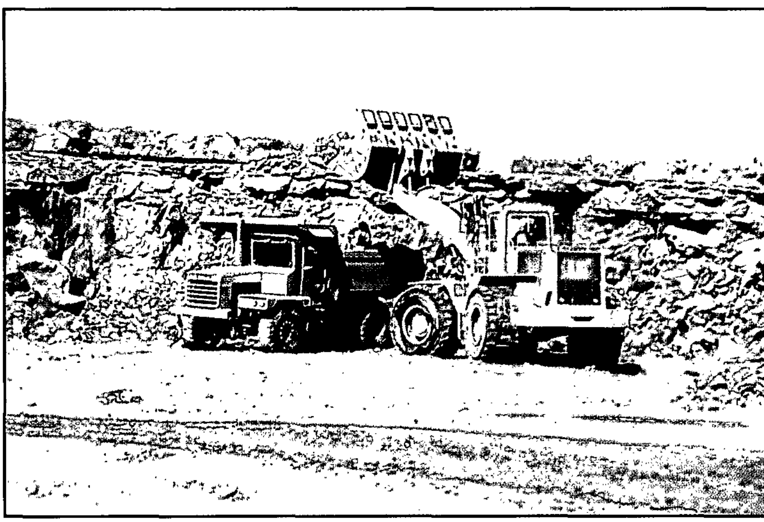
Refueling pool liner in laydown yard, 1979



View of crane from other crane, looking NE, 1979

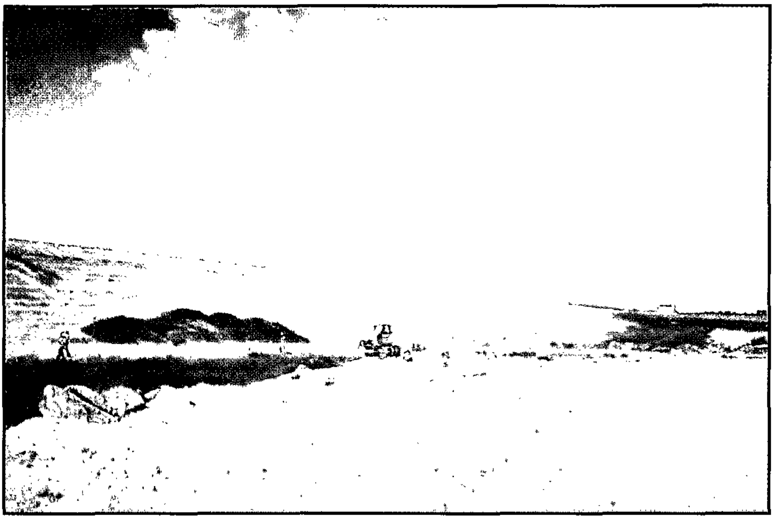


View of turbine building looking ESE, 1979

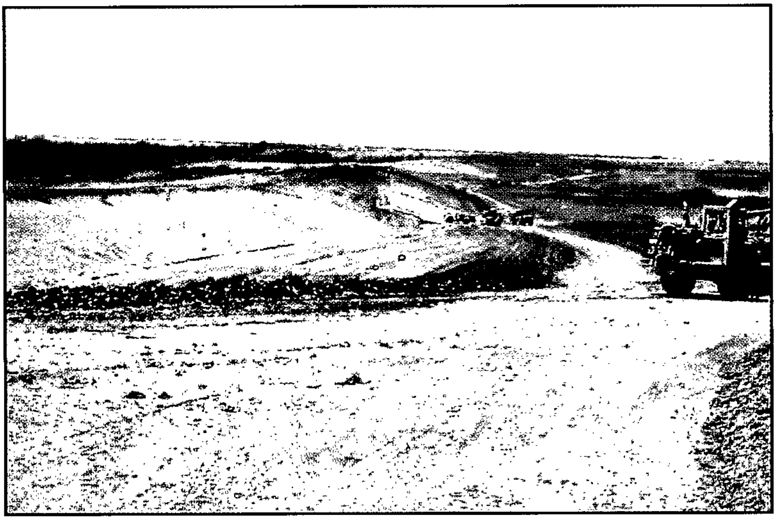


Quarrying rock in internal rock quarry, 1979

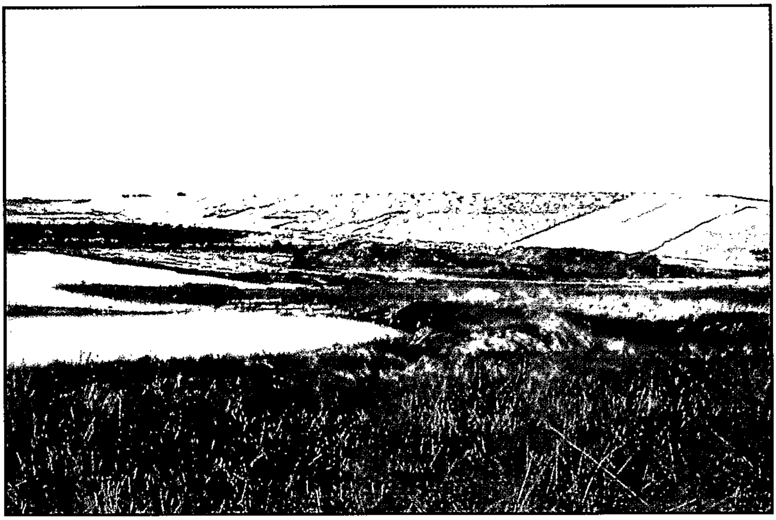
Saddle dam work, looking north, August 1979



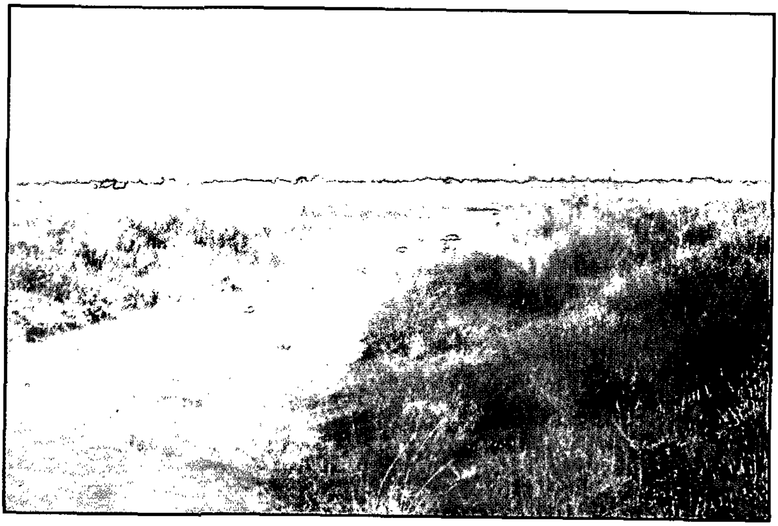
Baffle dike work, 1979



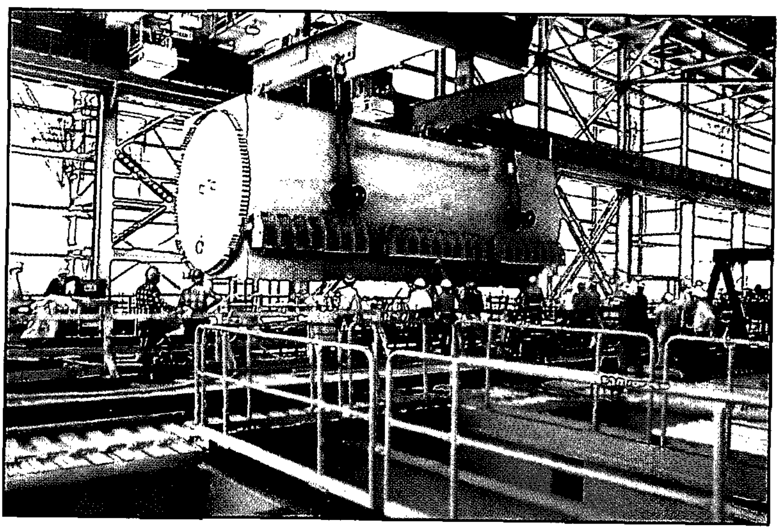
Main dam construction, August 1979



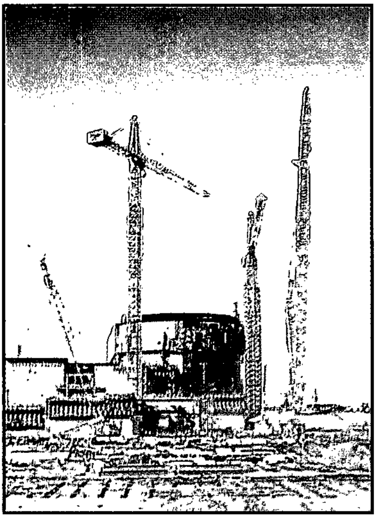
Main dam construction, 1979

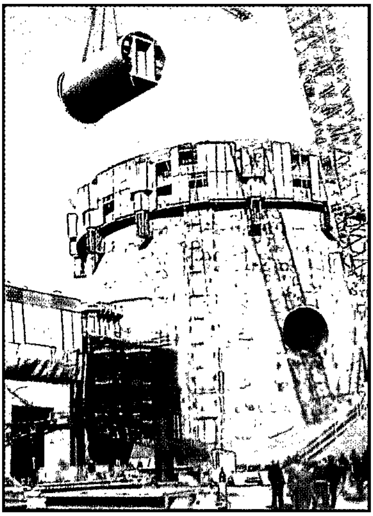


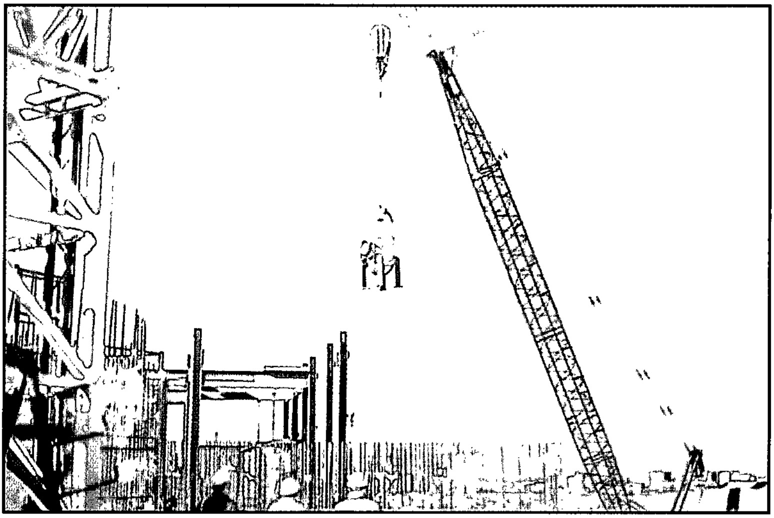
Flow from makeup water discharge filling lake, 1979



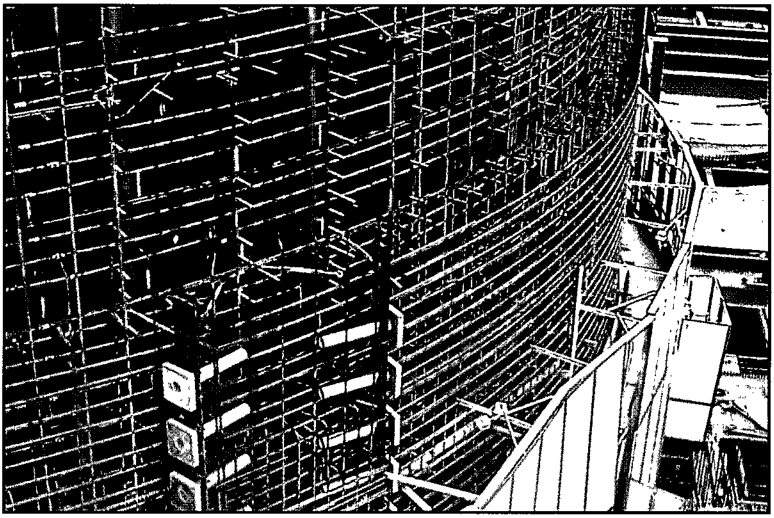
Main generator being moved into turbine building, 1979


View of containment looking north, October 1979

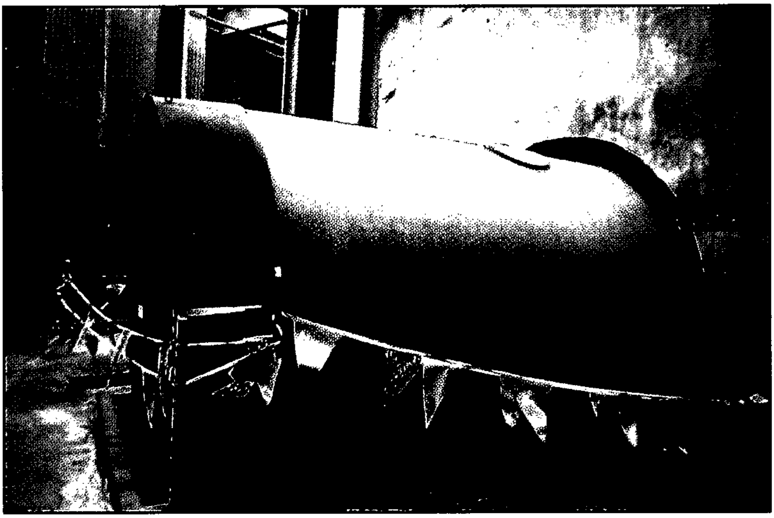

Personnel hatch being lifted into containment, December 1979



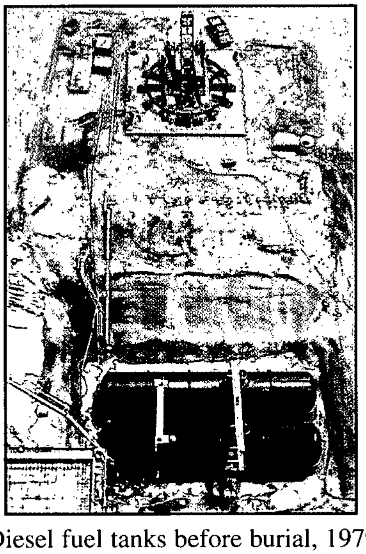
Movement of tank into Auxiliary building, 1979



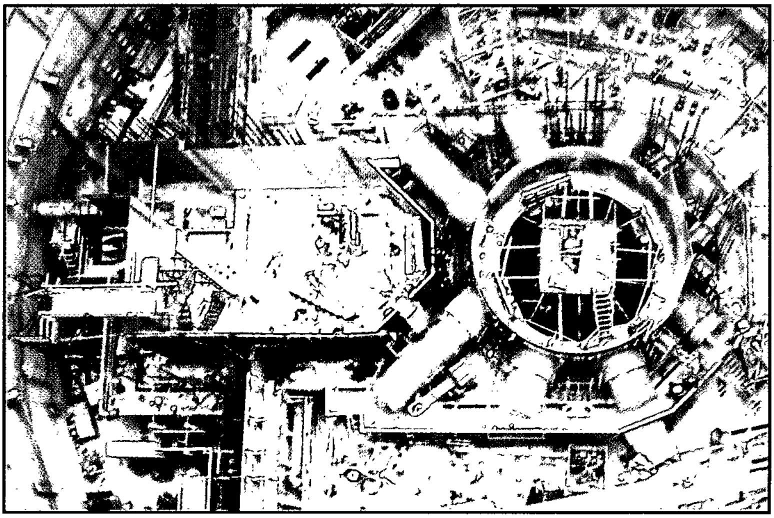
Rebar around containment showing tendon buttress, 1979



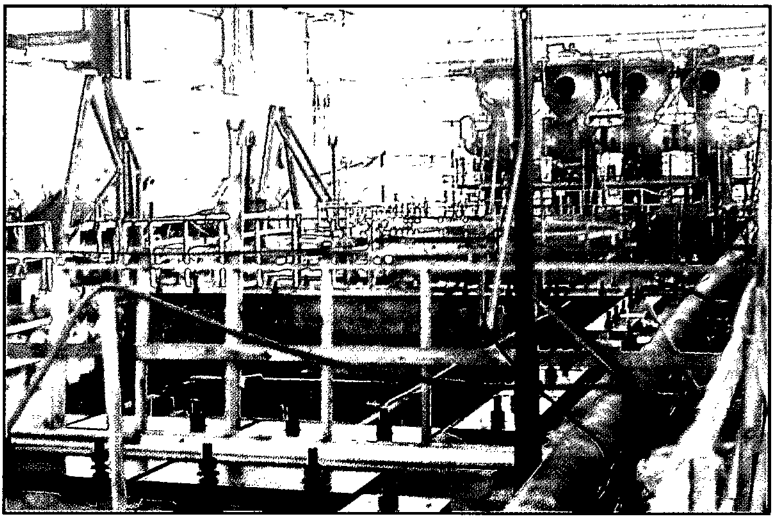
Personnel hatch coming out of containment, 1979



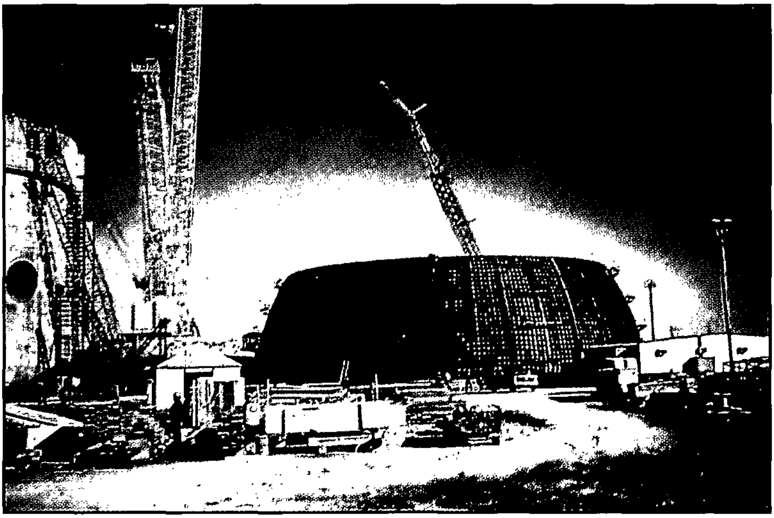
Diesel fuel tanks before burial, 1979



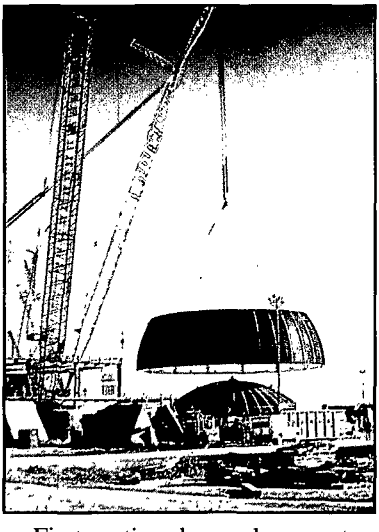
Containment work, 1979



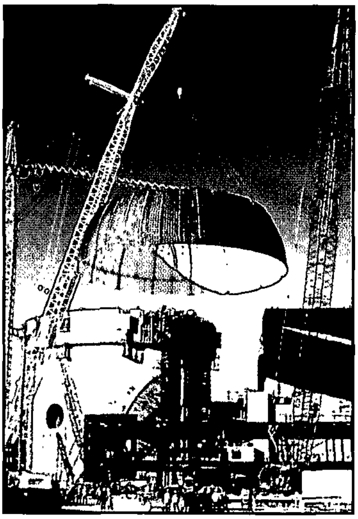
Looking south in turbine building with main turbine stop/control valves staged for installation, 1979



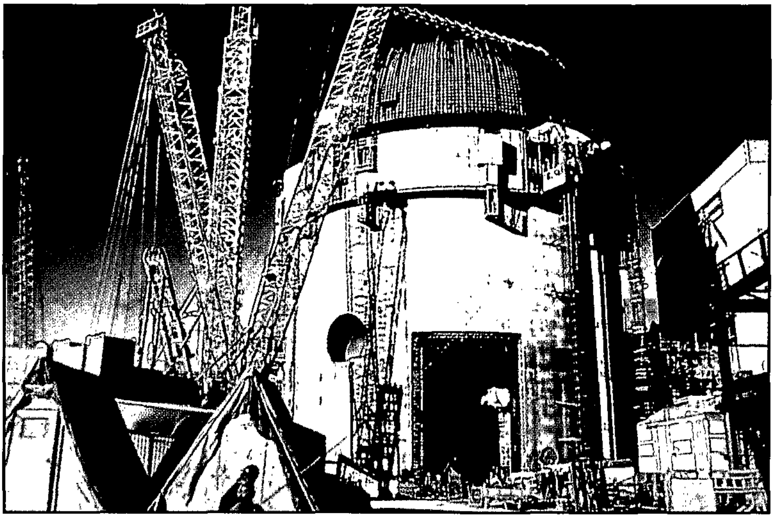
Placing first section of Containment dome, December 3, 1979



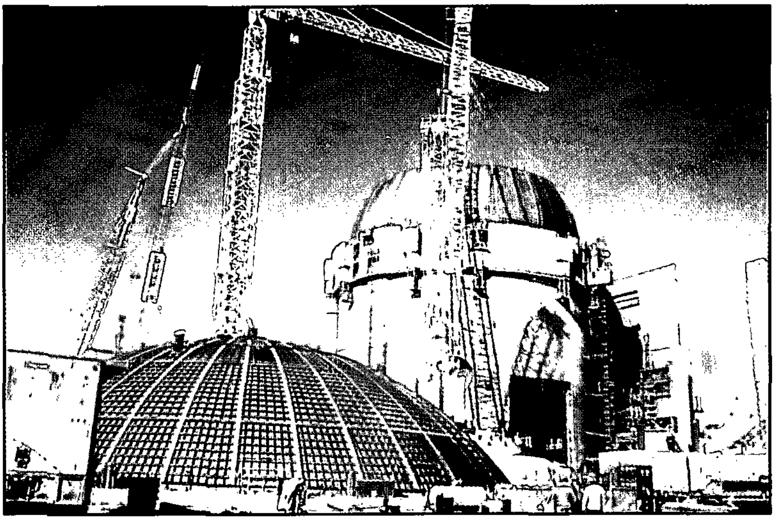
First section dome placement



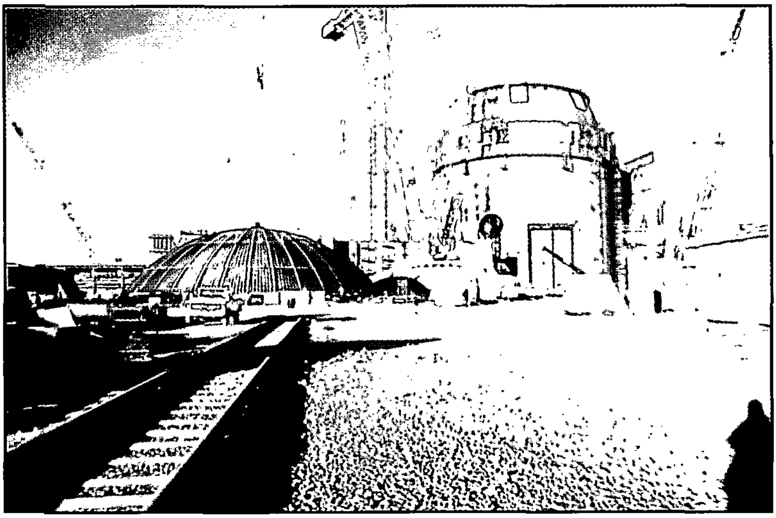
First section dome placement



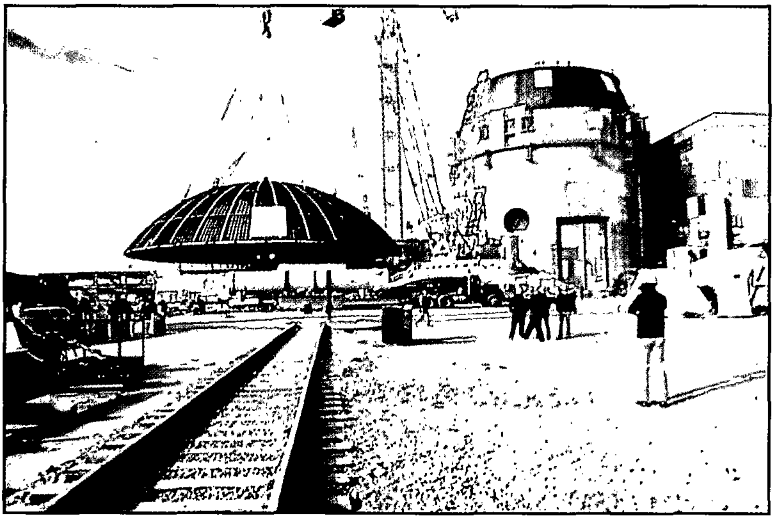
First section dome placement



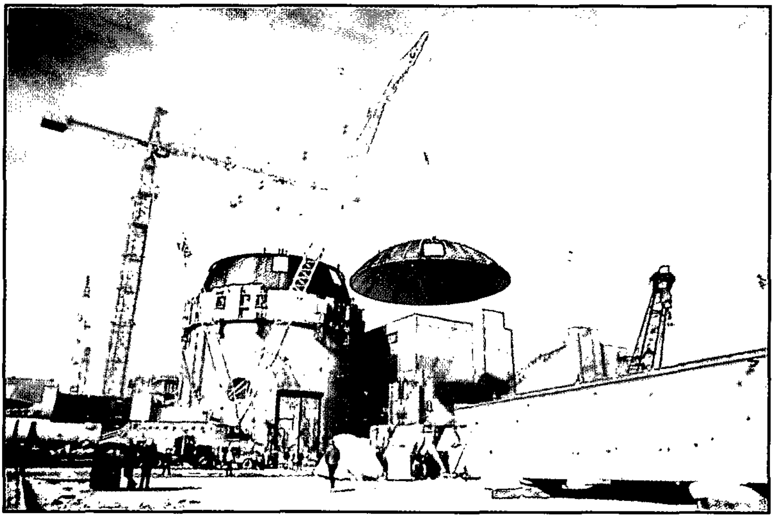
First section dome placement



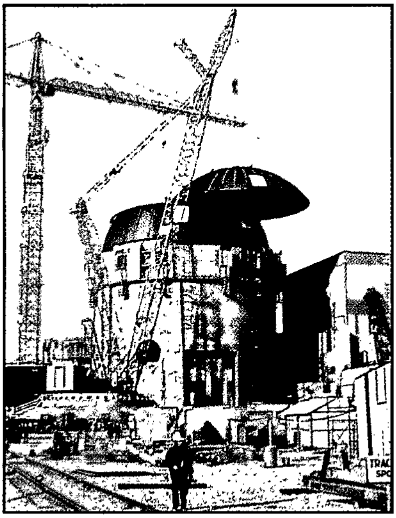
Placing final section of Containment dome, December 18, 1979



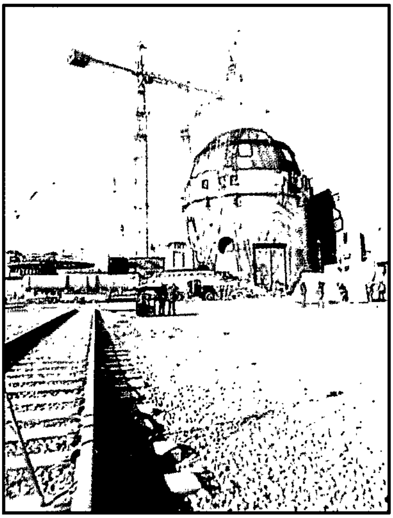
Final section dome placement



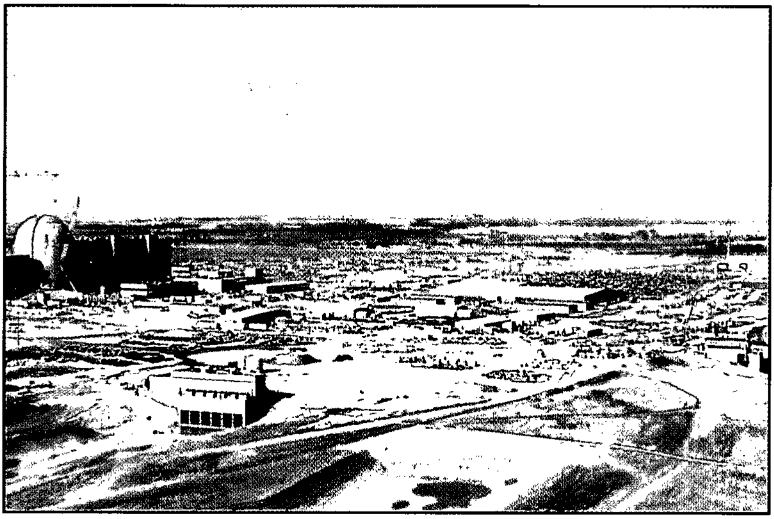
Final section dome placement



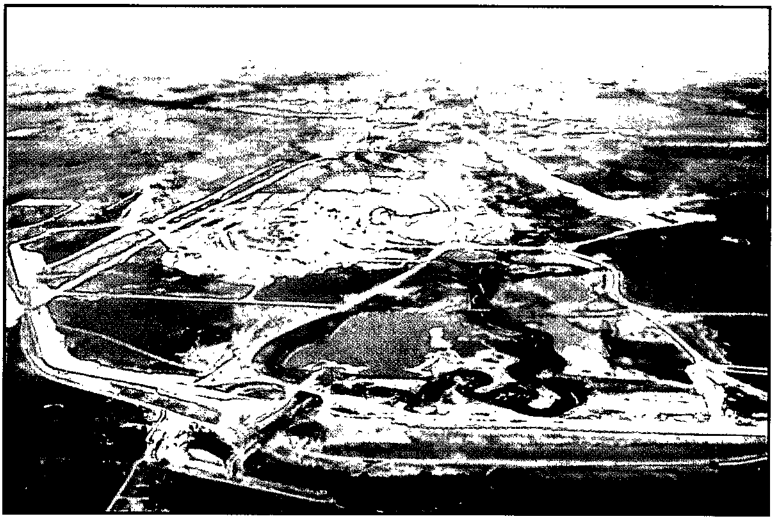
Final section dome placement



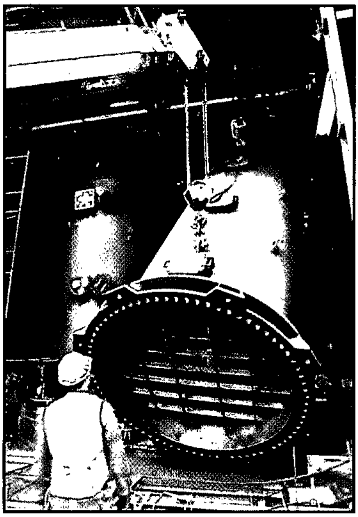
Final section dome placement



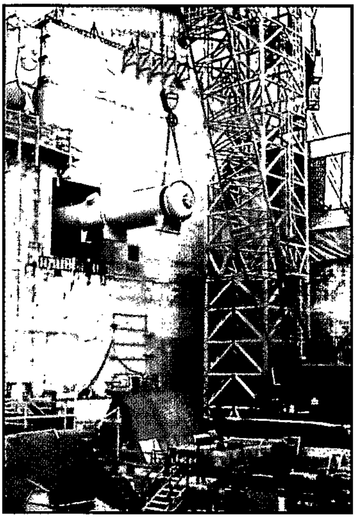
View looking NNW with Circulating Water Intake and channel for future Unit 2 Intake in foreground



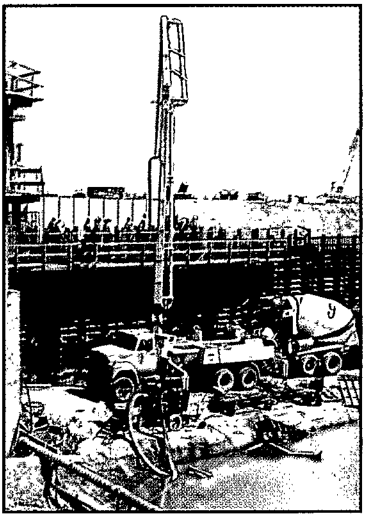
View looking north with lake work not yet completed, 1980

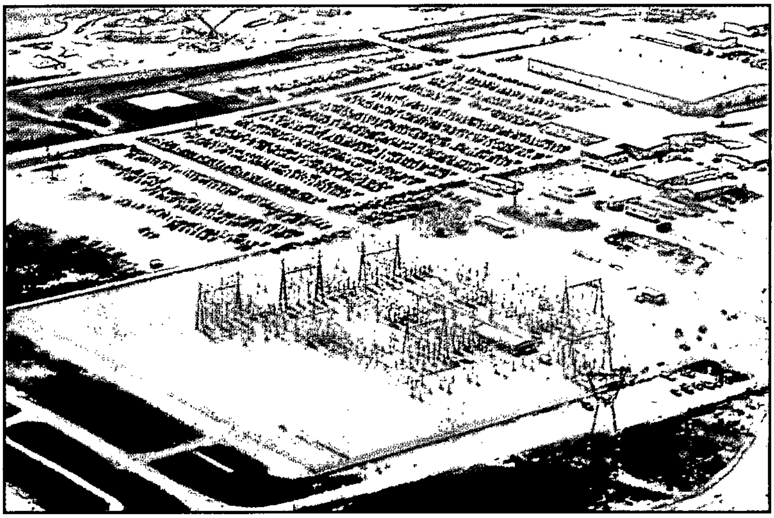


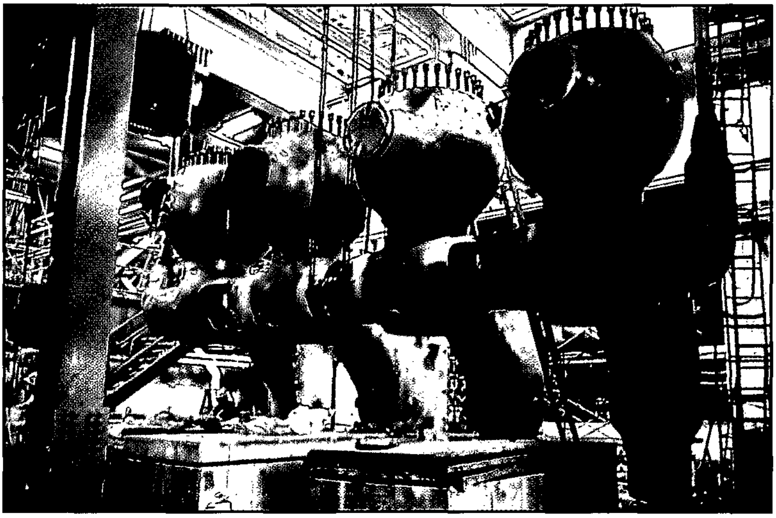
Circulating water stand pipes, 1980



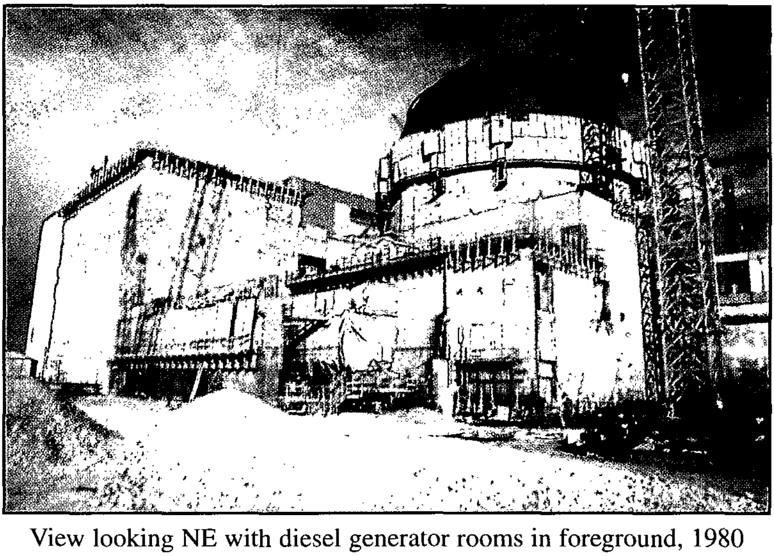
Component cooling water heat exchanger being placed in Auxiliary building, 1980


Concrete pour

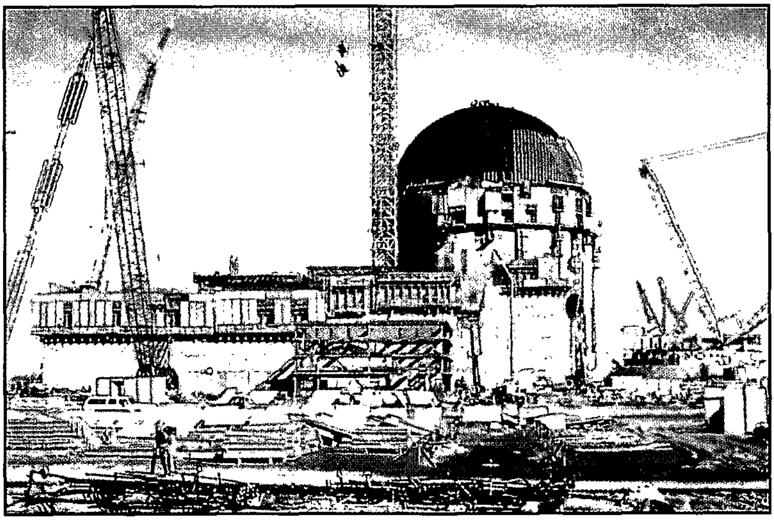

Switchyard, looking SE, 1980



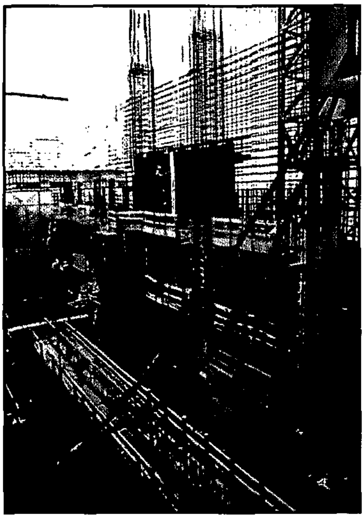
Main steam control and stop valves, 1980



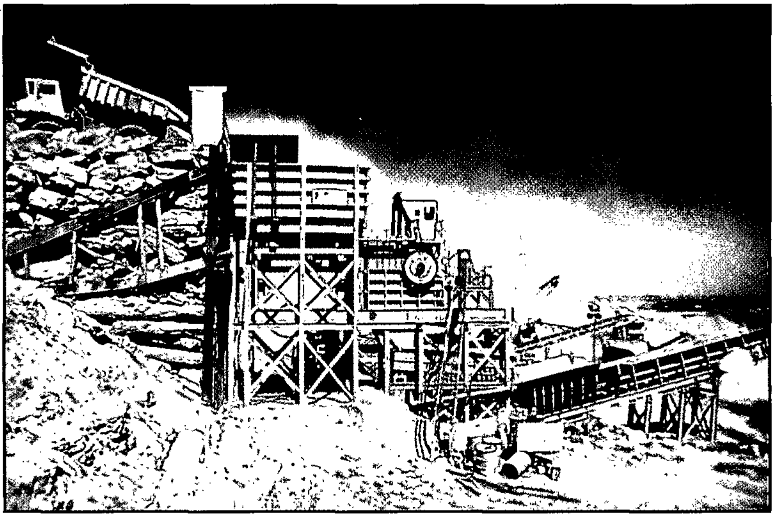
View looking NE with diesel generator rooms in foreground, 1980



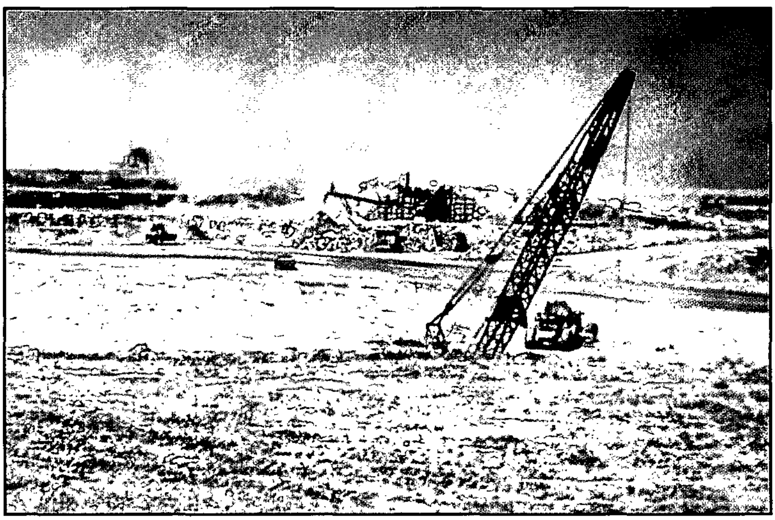
View looking north at fuel building and containment, 1980



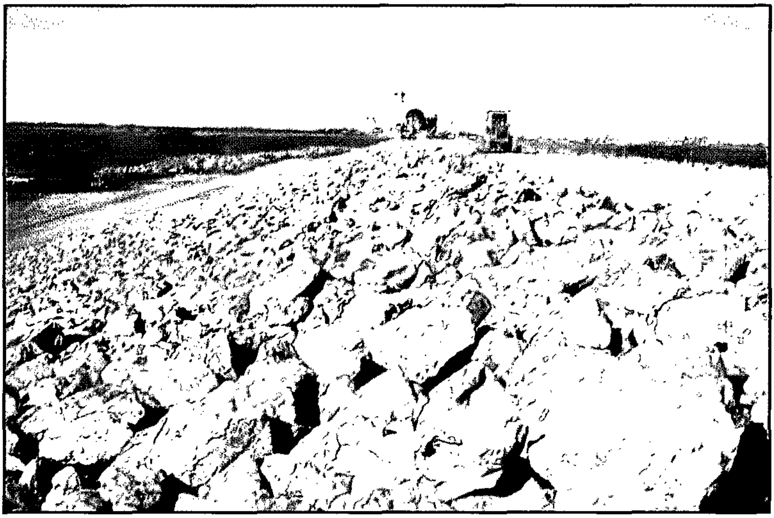
Fuel building work, 1980

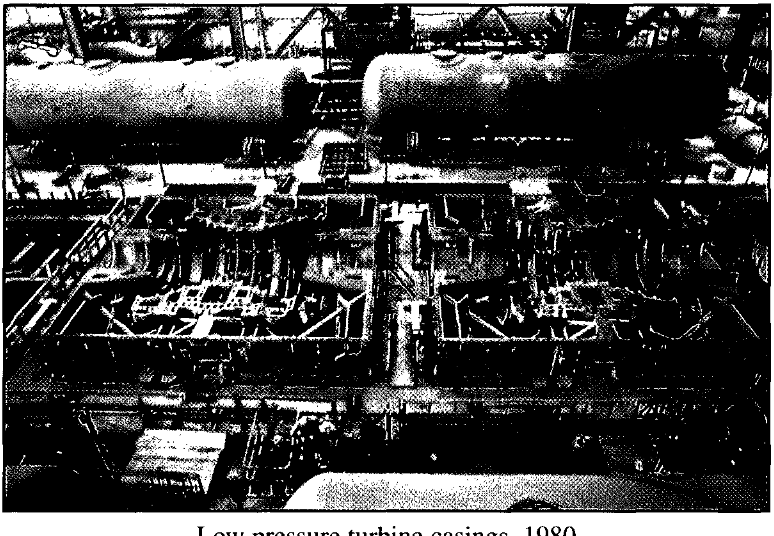


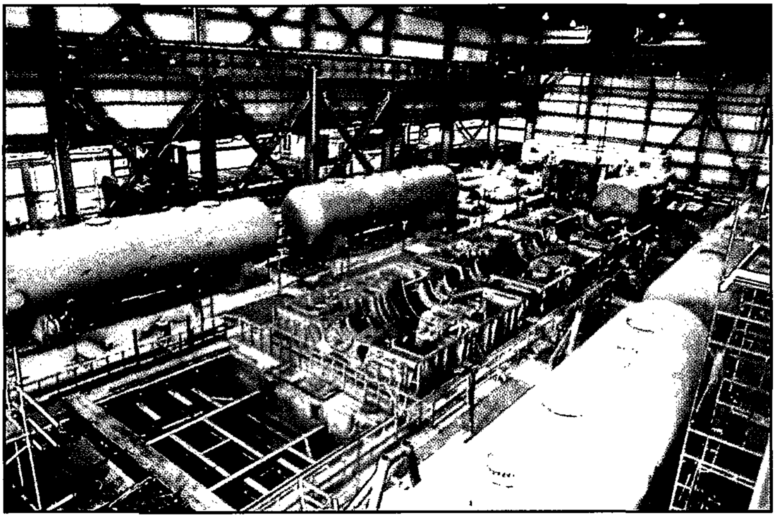
Crushing rock in internal rock quarry, 1980



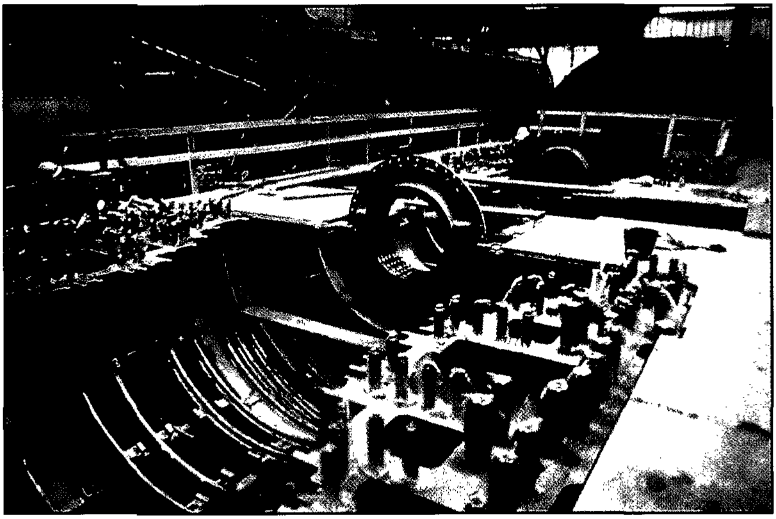
Quarry bed work on lake, 1980


Baffle dike work, 1980

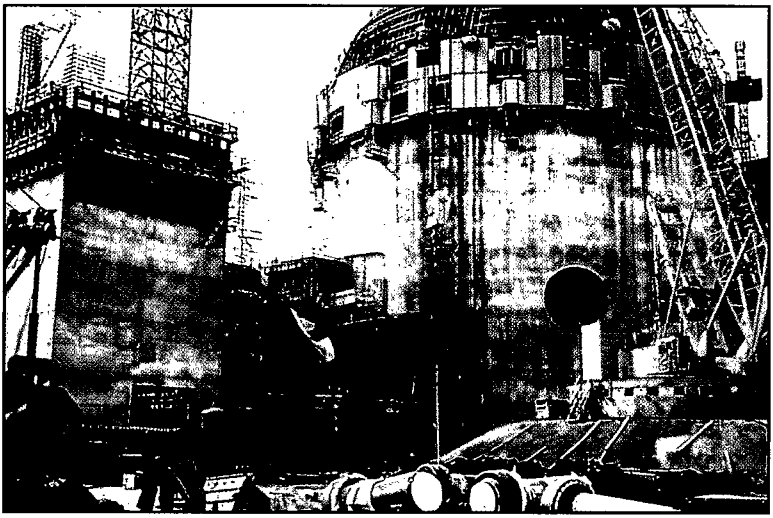

Low pressure turbine casings, 1980



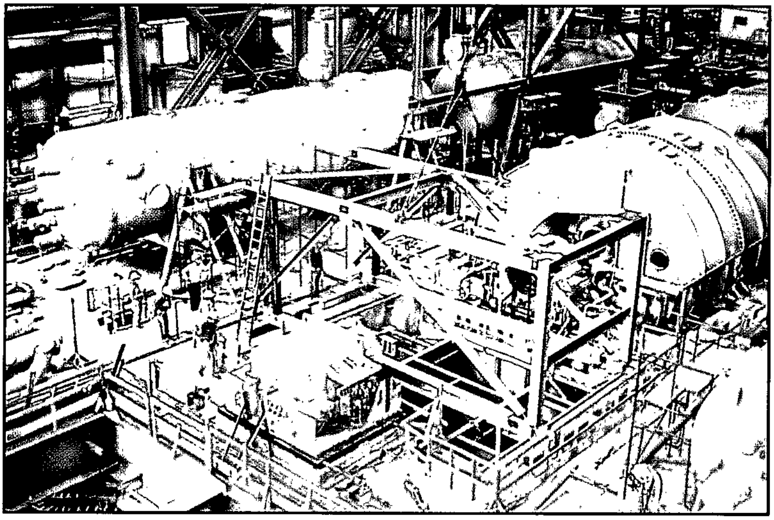
Turbine deck, 1980



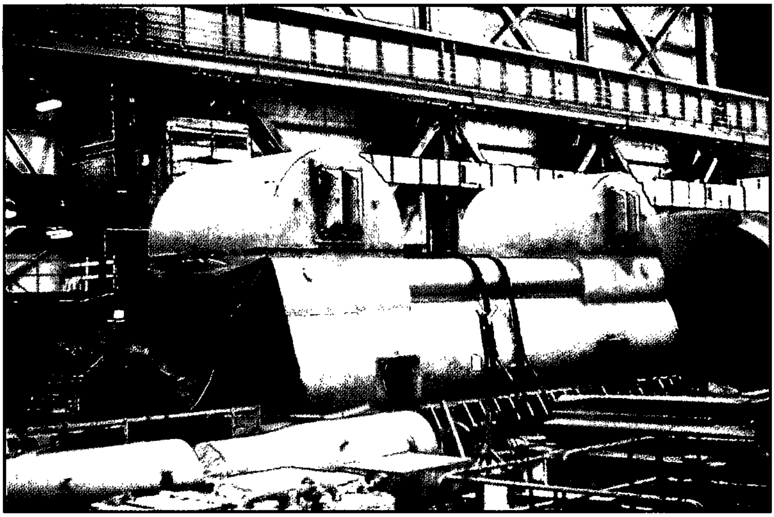
Closeup of turbine casings, 1980



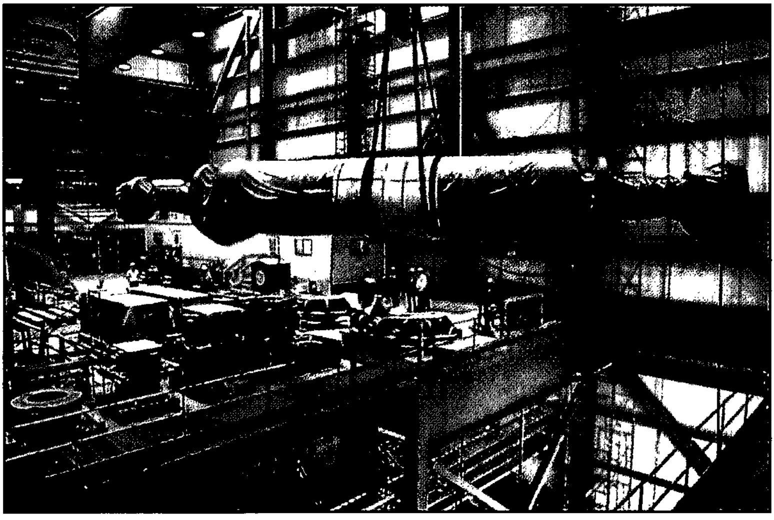
View of containment and fuel building, 1980



Turbine deck, 1980

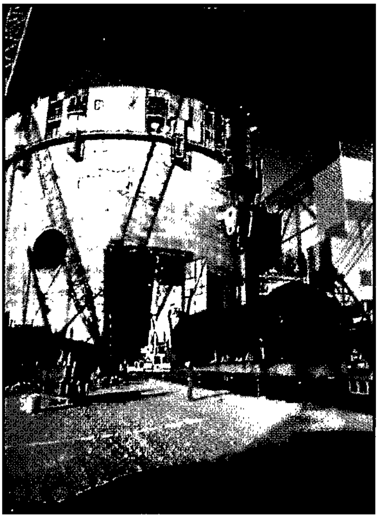


Main generator, 1980

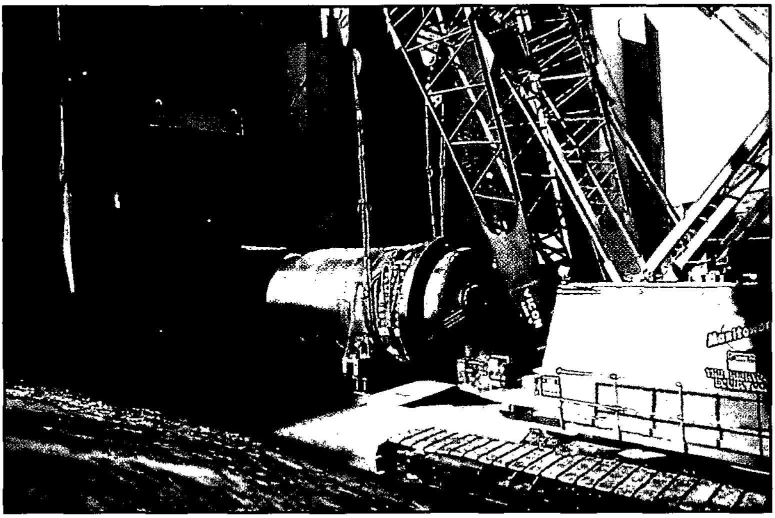


Rotor for main generator being moved in turbine building, 1980

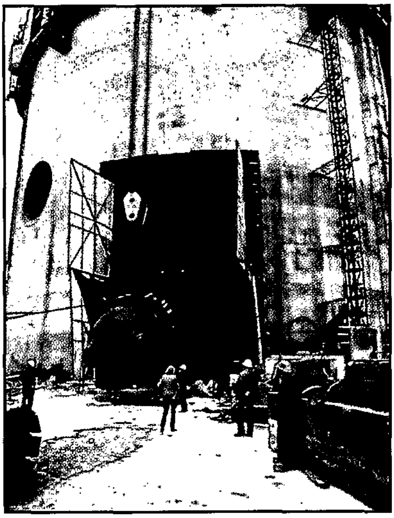
Steam generators in laydown yard, 1980



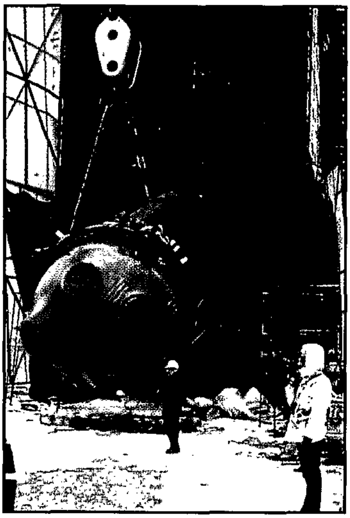
Steam generator ready to move into containment, 1980



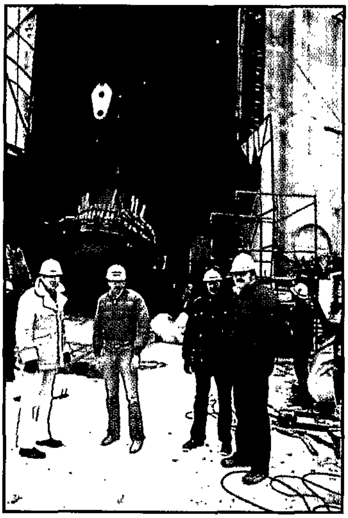
Steam generator being moved into containment, 1980



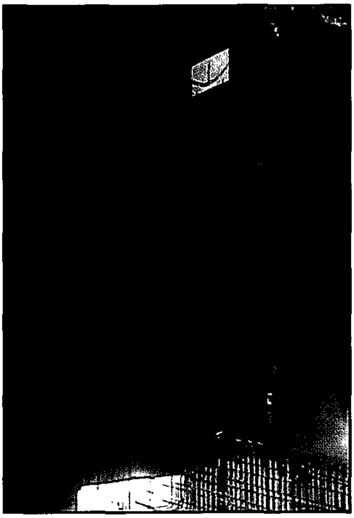
Steam generator being uprighted into containment, 1980



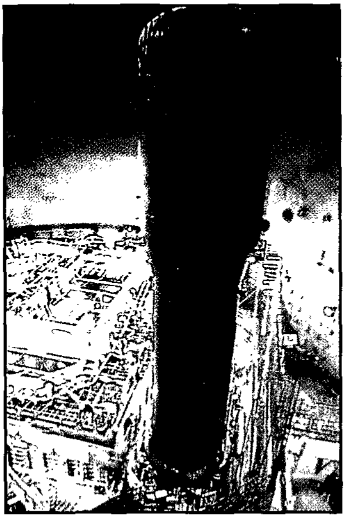
Steam generator being uprighted into containment, 1980



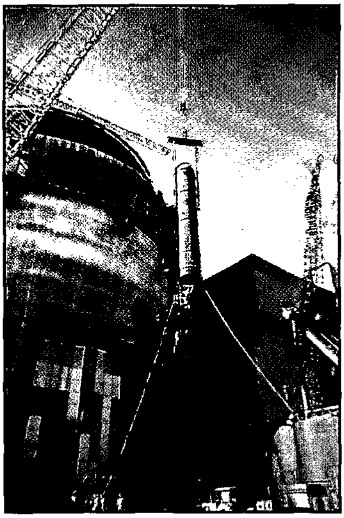
Steam generator being lifted into containment, 1980


Steam generator being lifted inside containment, 1980

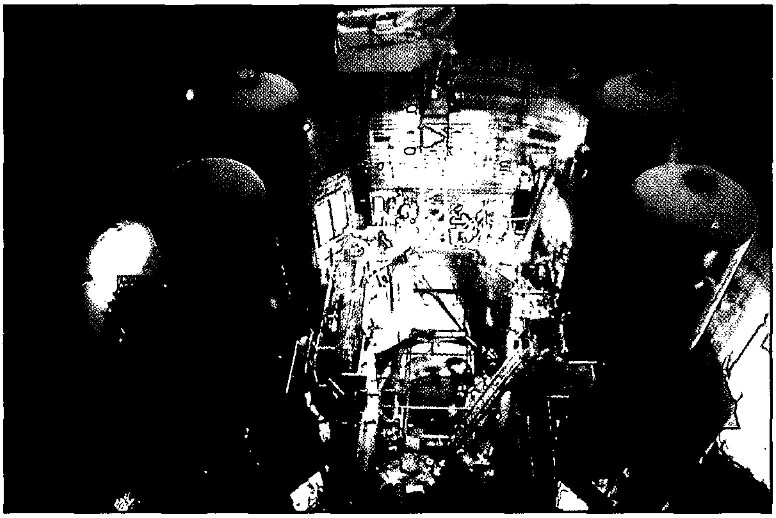

Moving steam generator inside containment, 1980



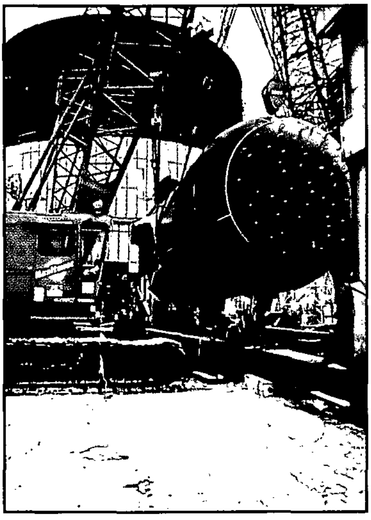
Placement of steam generator, 1980



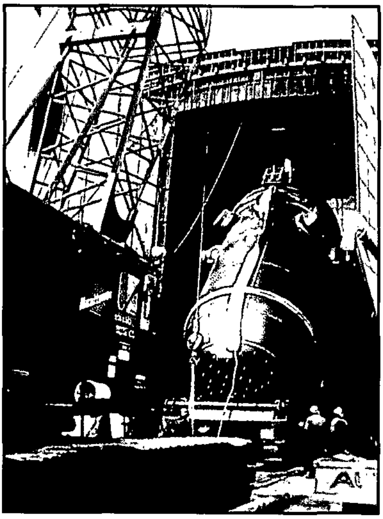
Pressurizer being lifted into containment, 1980



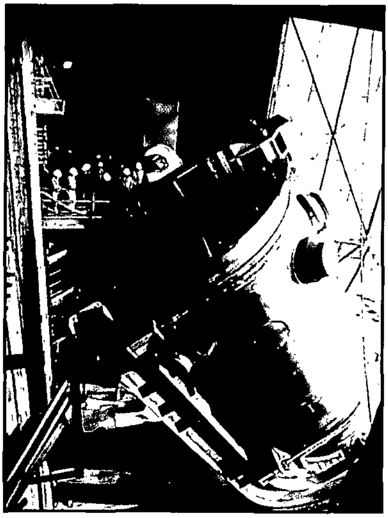
All four steam generators and pressurizer in place in containment, 1980



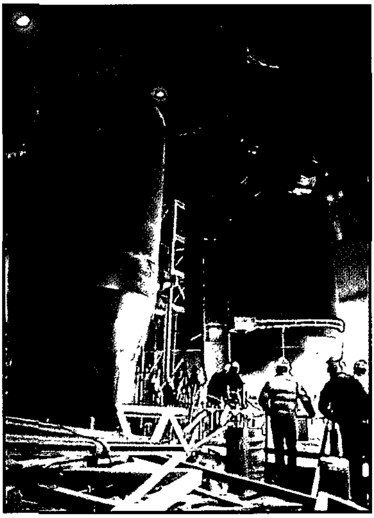
Lifting reactor vessel to place on moving skid, 1980



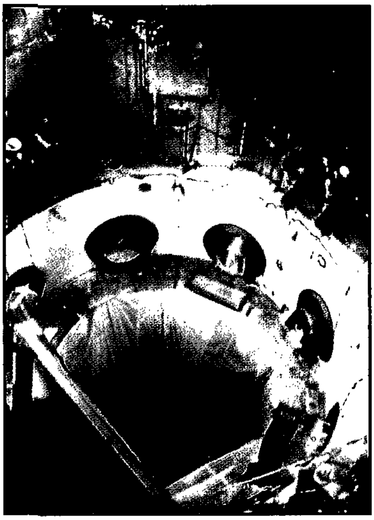
Moving reactor vessel into containment, 1980



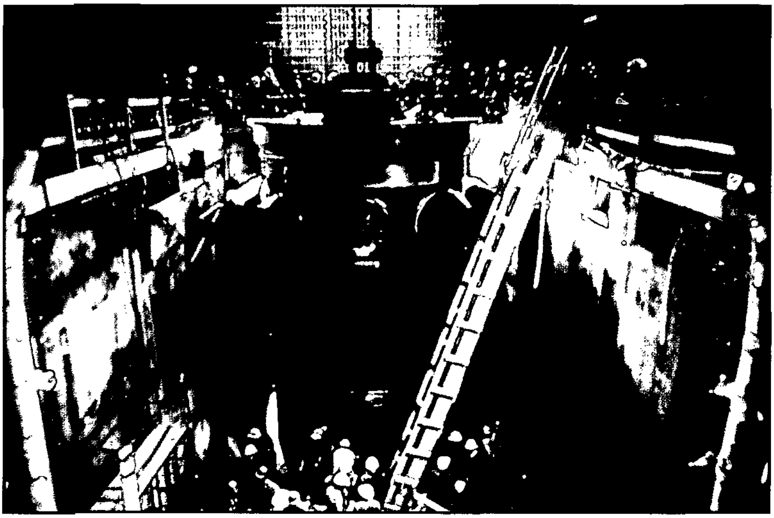
Uprighting reactor vessel as it moves into containment, 1980



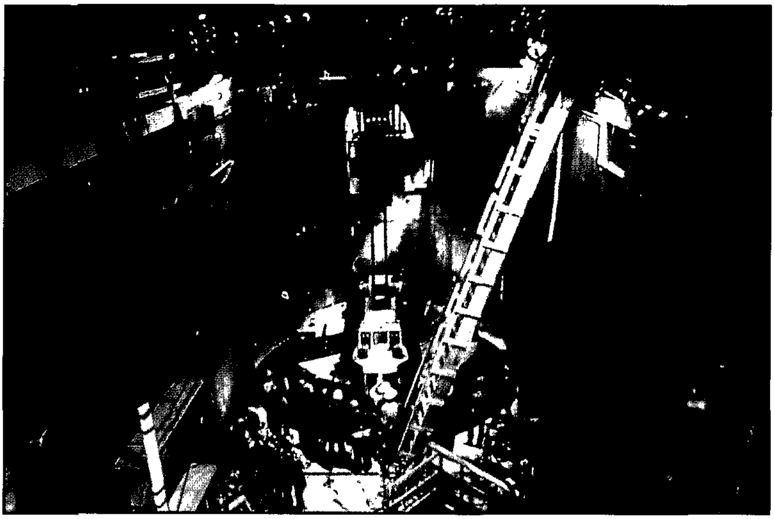
Lifting reactor vessel in containment, 1980



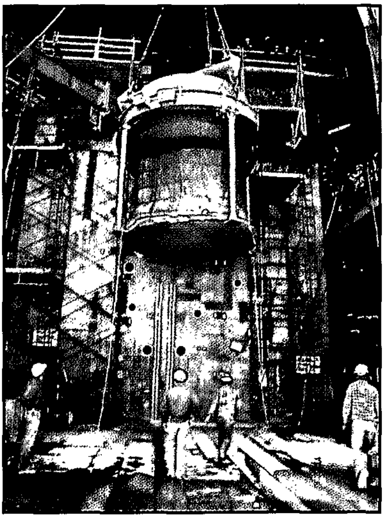
Cavity where reactor vessel will be placed, 1980



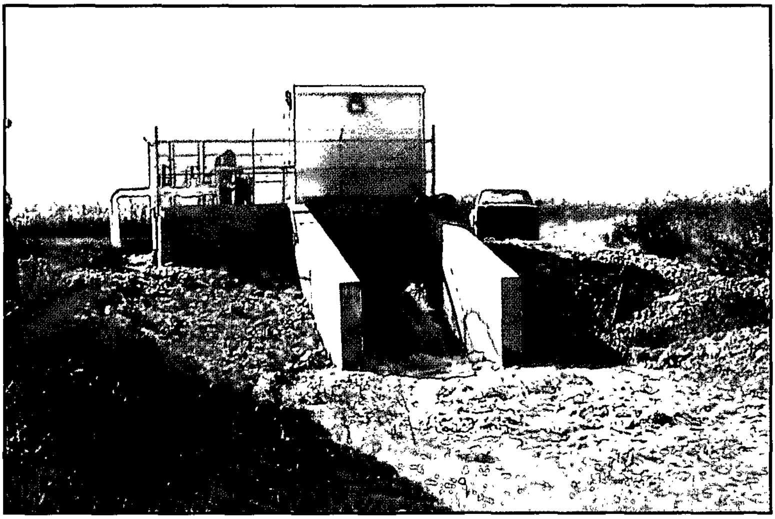
Lowering reactor vessel in containment, 1980



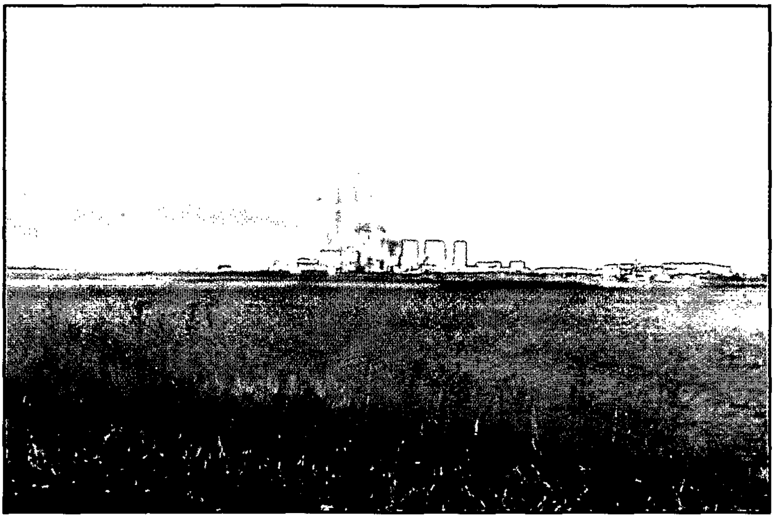
Placing reactor vessel in cavity in containment, 1980



Lifting reactor internals in containment, 1980

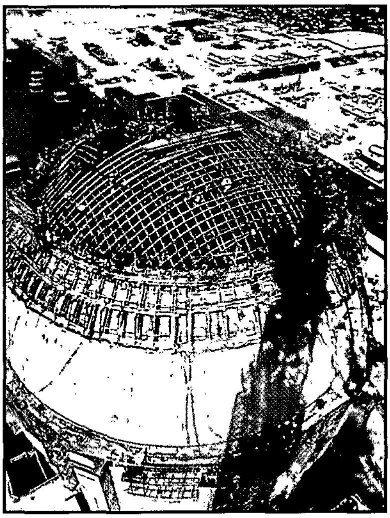


Makeup water discharge structure with water filling lake, 1980



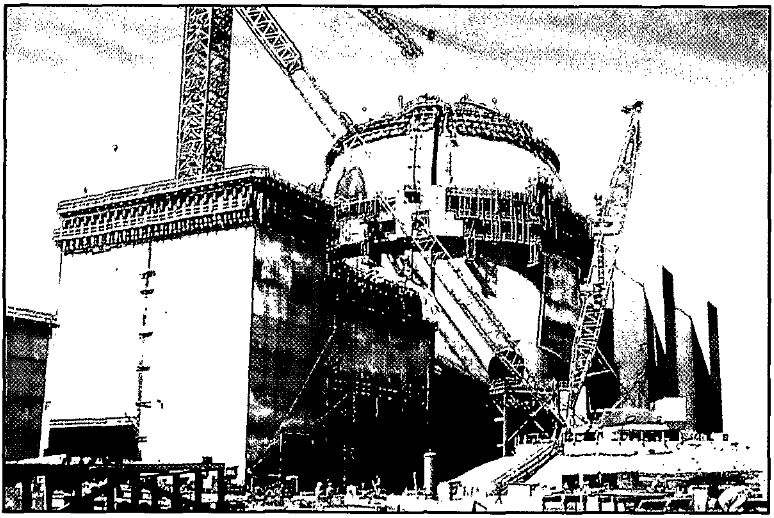
View looking west, 1980

View looking north from lake bottom, 1980

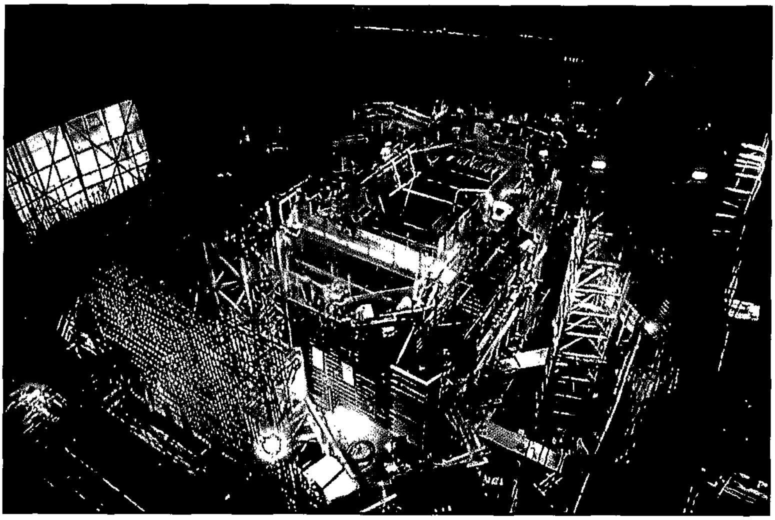


Installing tendon tubes on top of containment

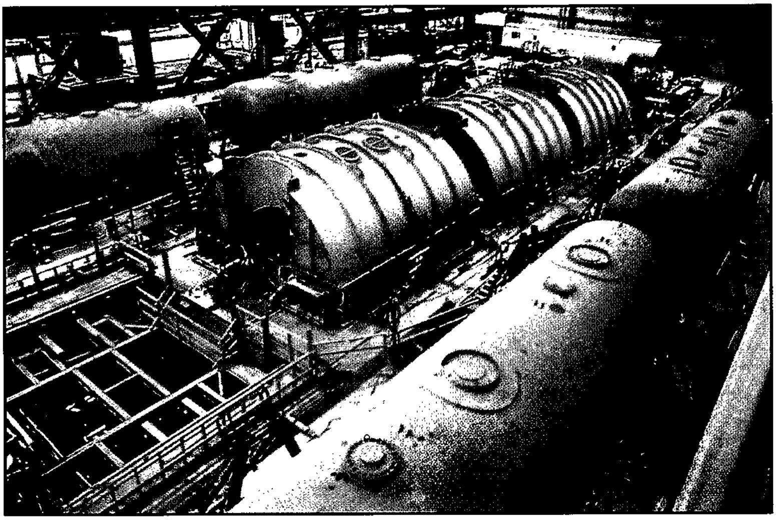
View looking west with Administrative and Maintenance buildings in foreground

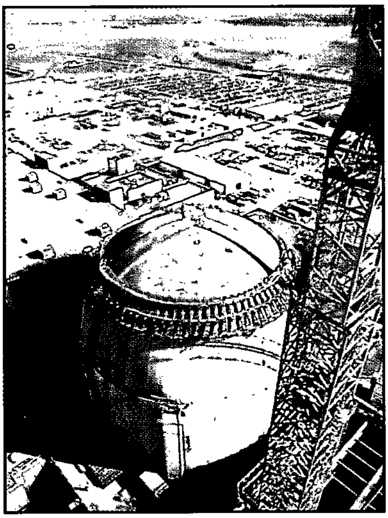


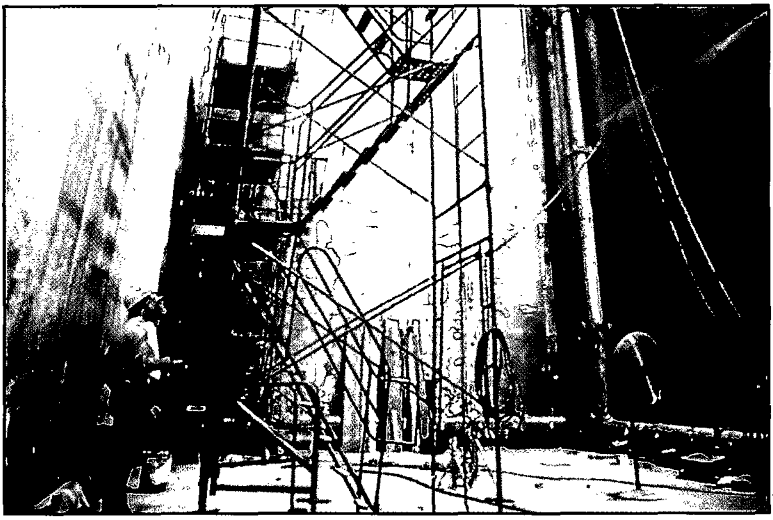
View looking NNW at containment and fuel building, 1981



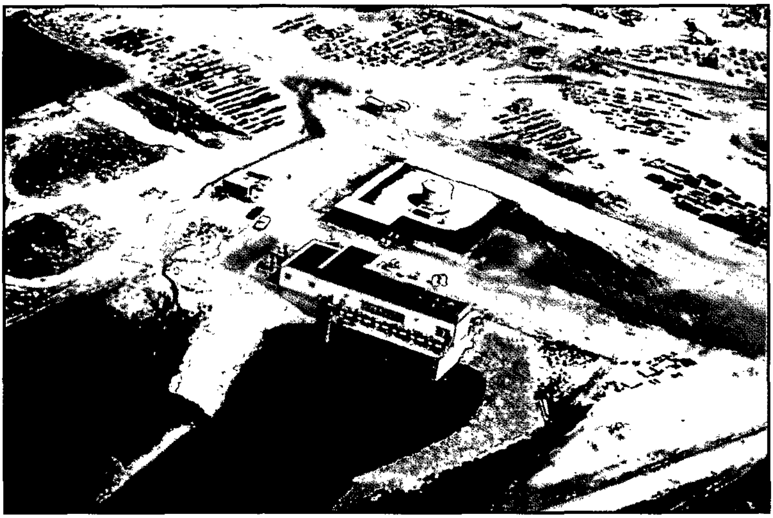
View inside containment, 1981


Turbine deck, 1981

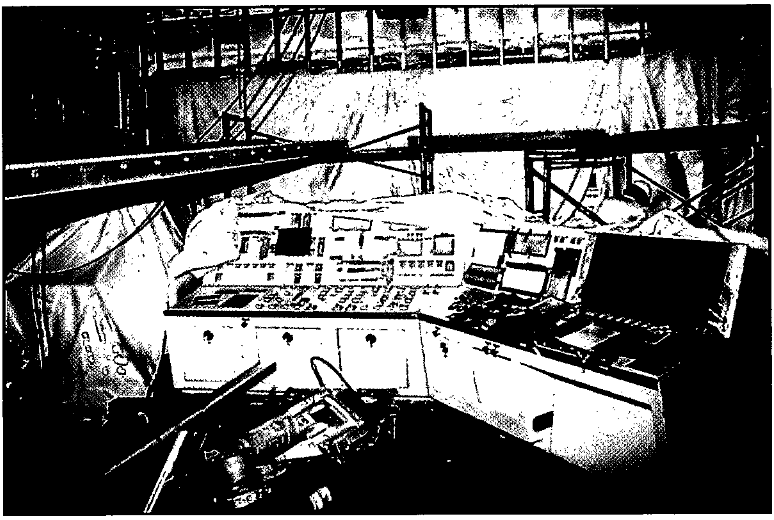

View of containment looking NE, 1981



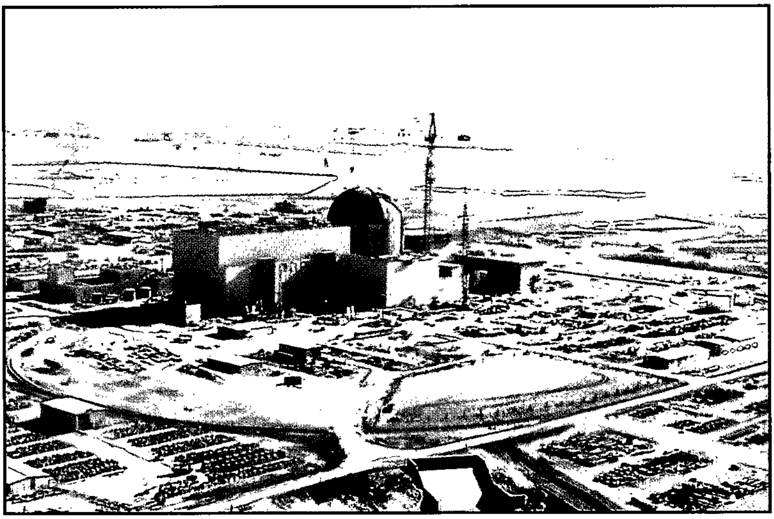
Inside spent fuel pool, 1981



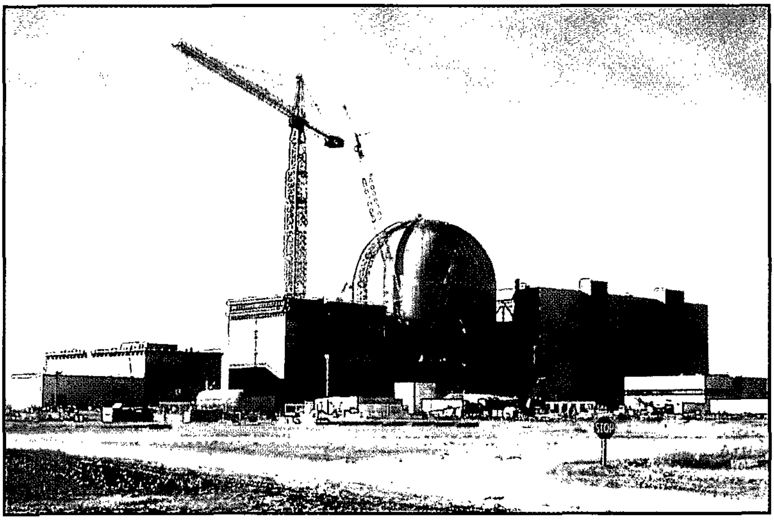
Circulating Water intake structure, 1981



Construction of main control boards in Control Room, 1981

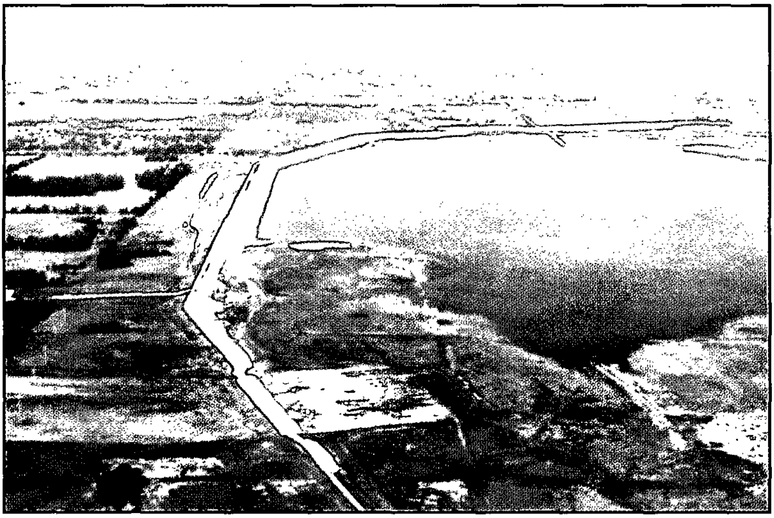


View looking SE with Circulating Water Discharge
in foreground, 1981

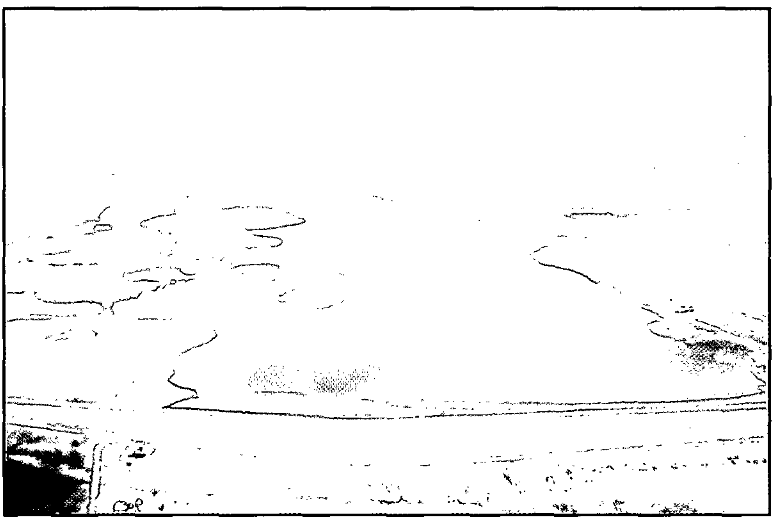


View looking NW, 1981

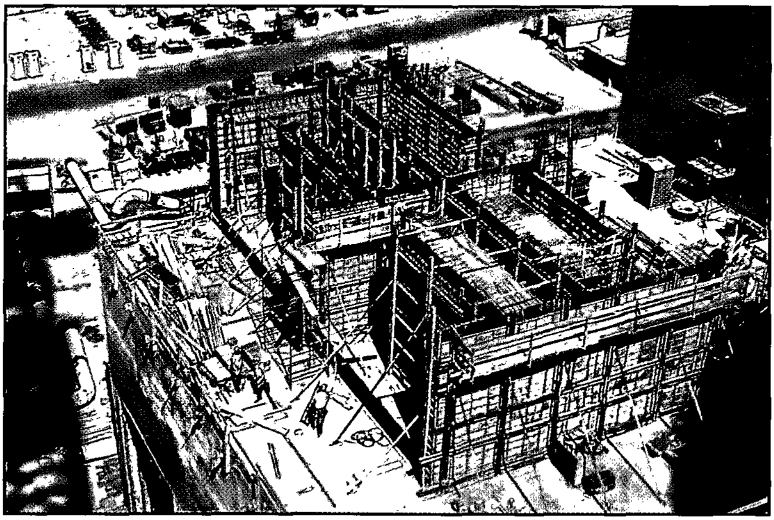
View looking east with Makeup Water Discharge Structure filling lake in foreground



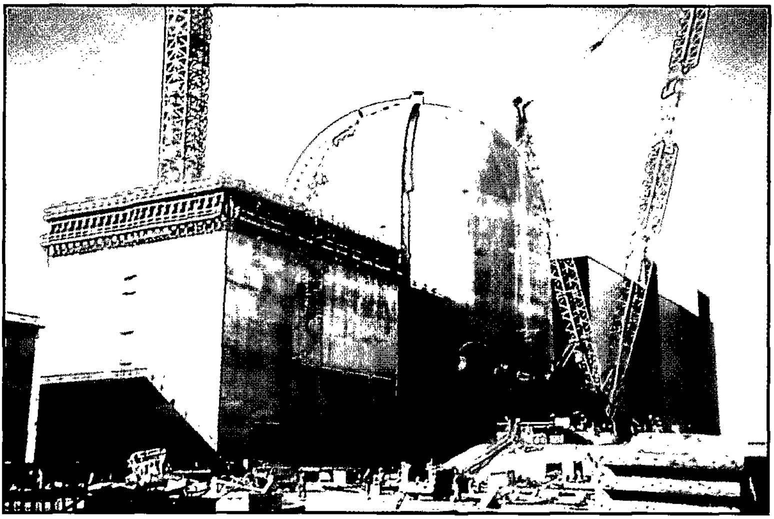
Main dam, looking west



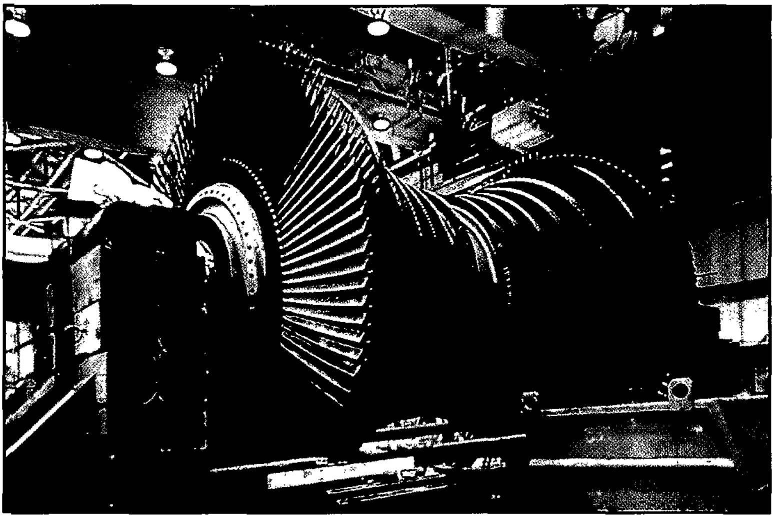
View looking north with lake filling, 1981



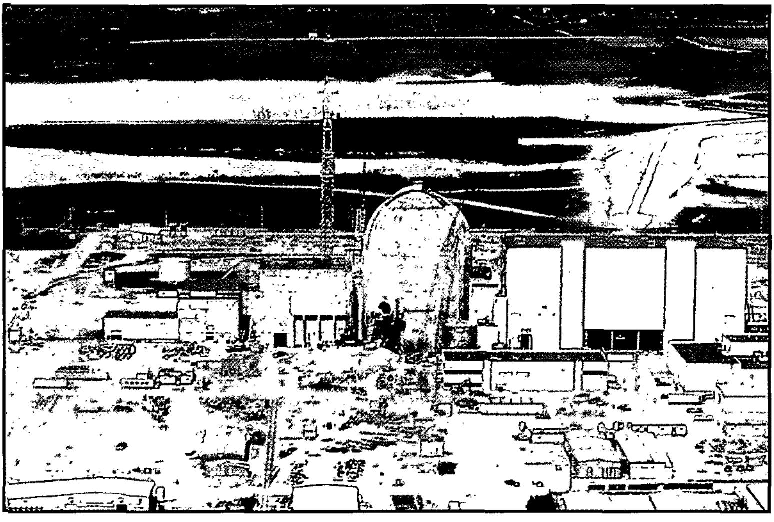
Diesel generator building roof, 1981



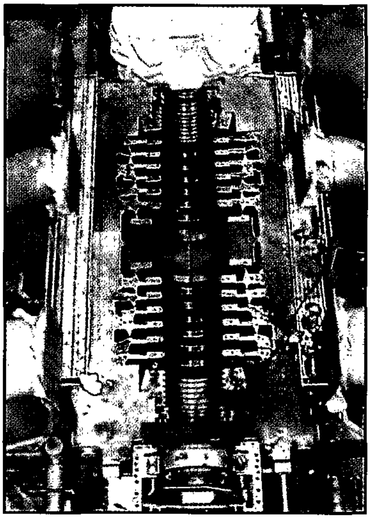
View looking NNW, 1981



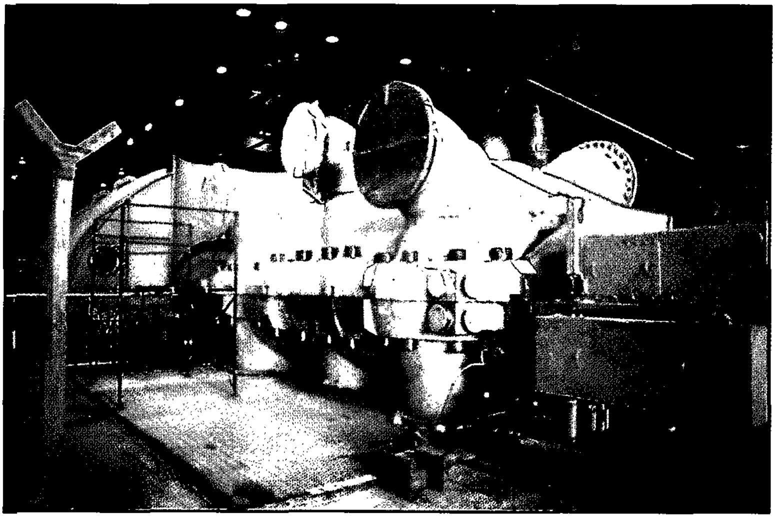
Low pressure turbine blades



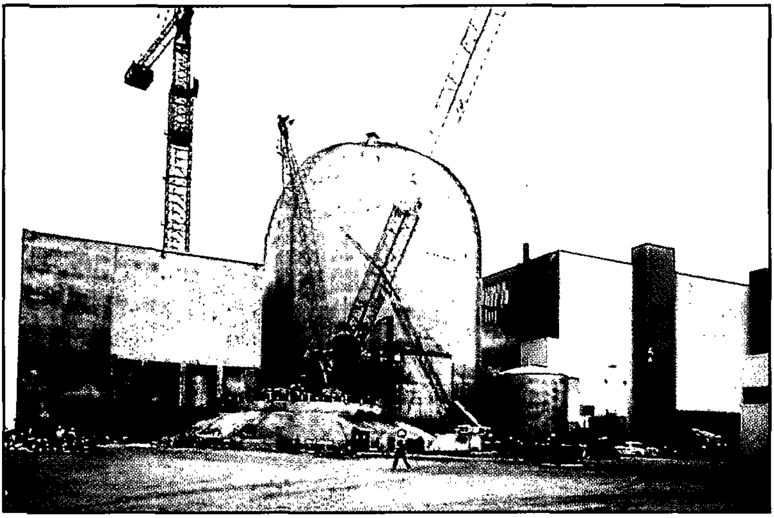
View looking west, 1981



High pressure turbine casing, 1981

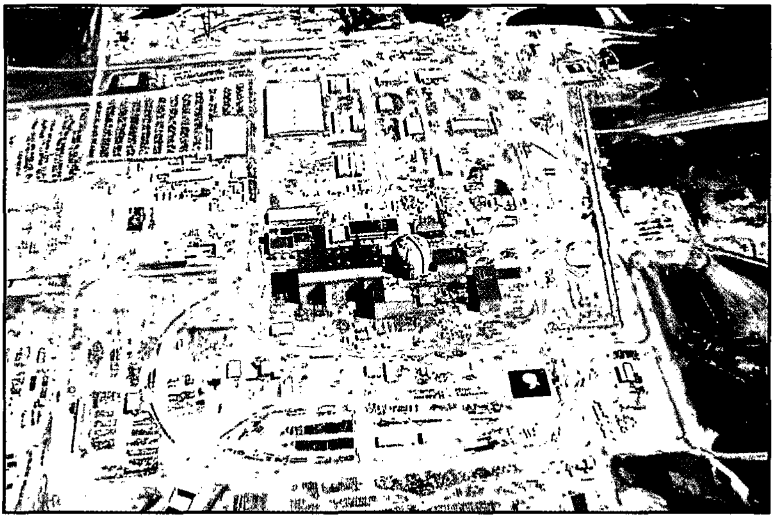


High pressure turbine, 1981

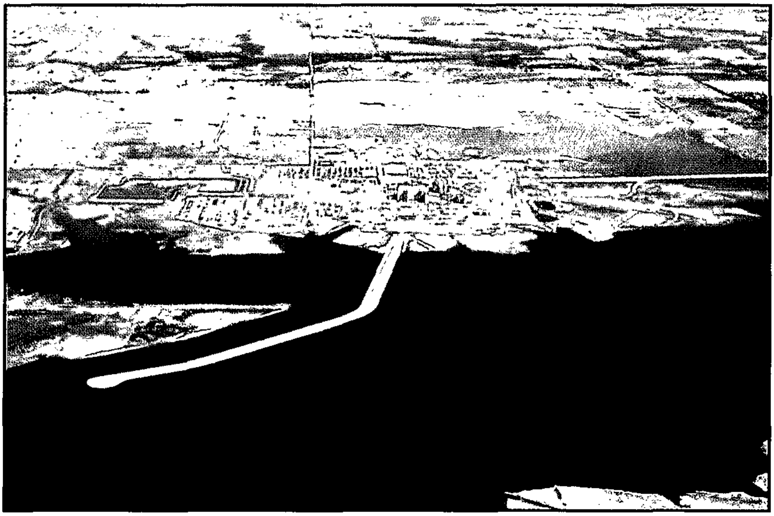


View looking NW at ringer crane, 1981

View looking NW — Circulating Water Screenhouse and channel for future screenhouse for Unit 2 in foreground

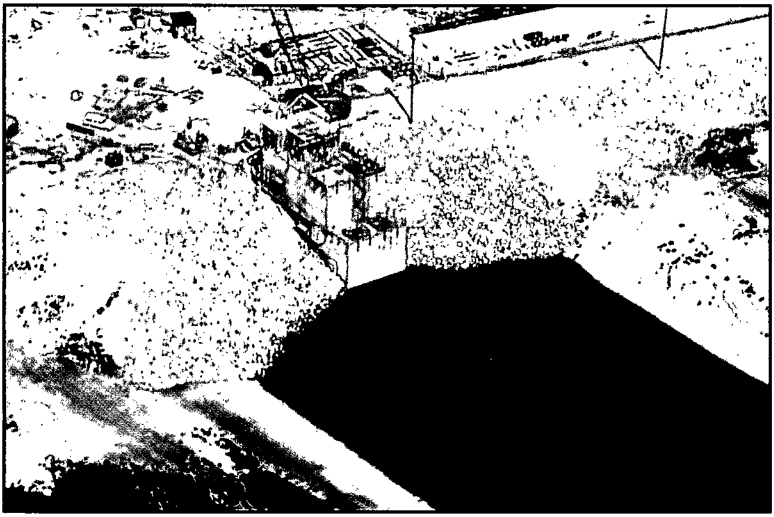


View looking east

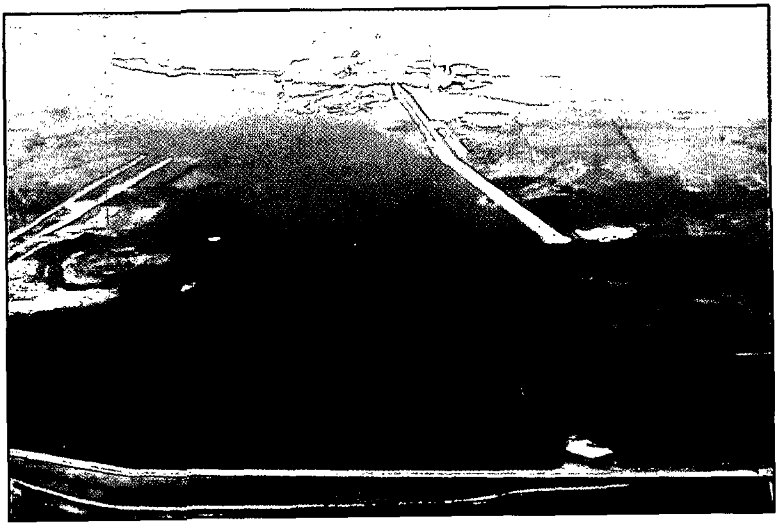


View looking east

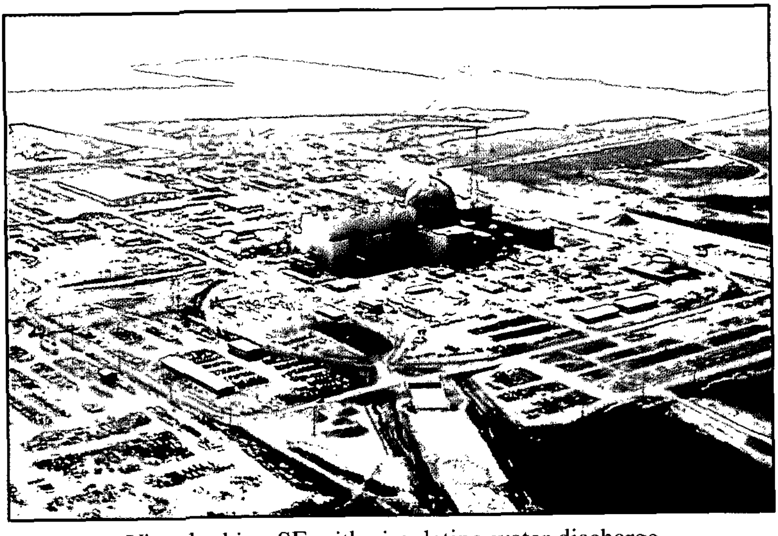
Essential Service Water intake structure, 1981



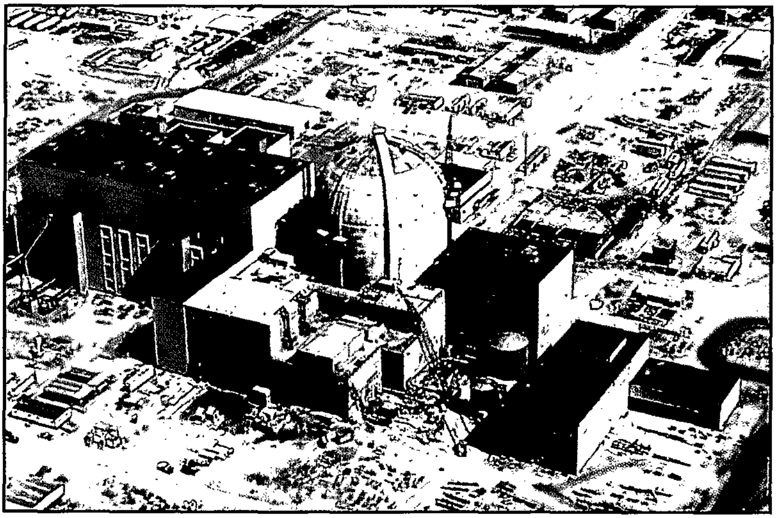
Essential Service Water intake structure, 1981



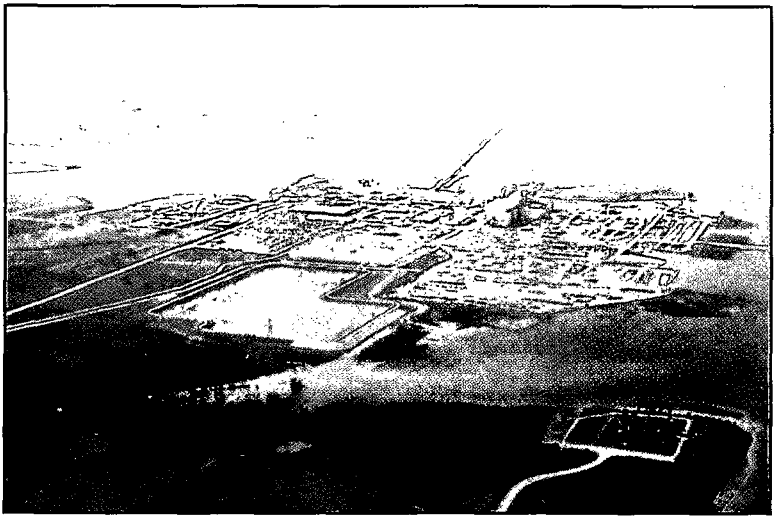
View of lake and plant looking north, 1981



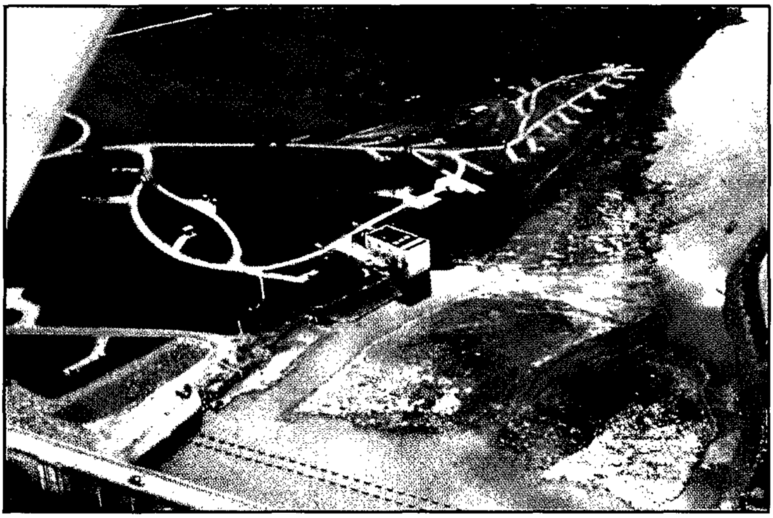
View looking SE with circulating water discharge structure in foreground, 1982



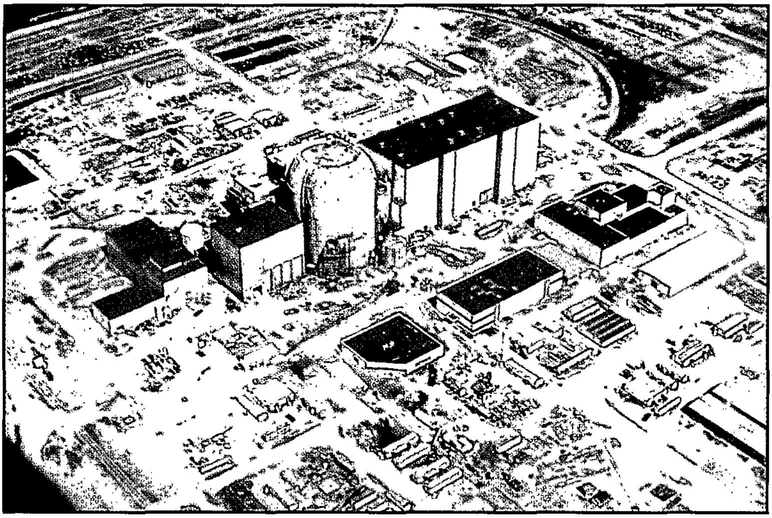
View looking NE, 1982



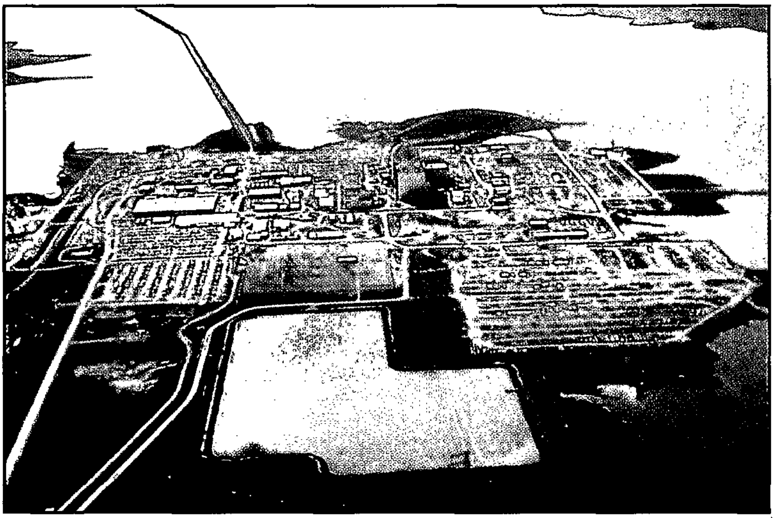
View looking SSE with cemetery in foreground, 1982



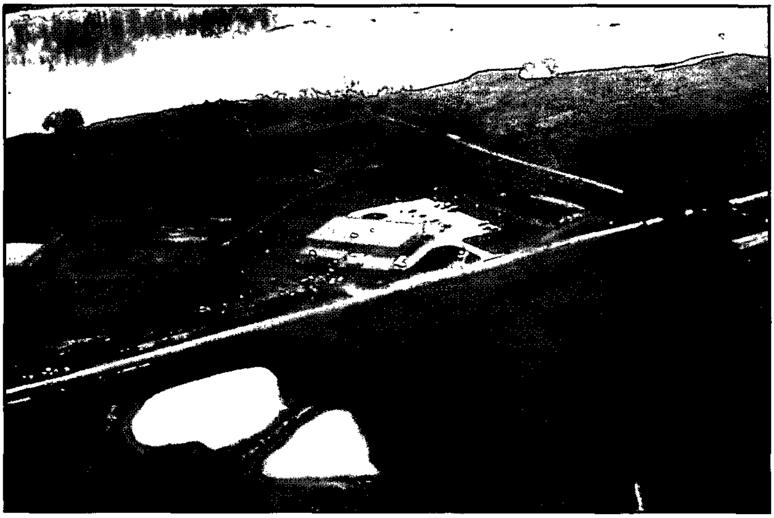
Makeup water screenhouse at John Redmond on Neosho River



View looking WNW

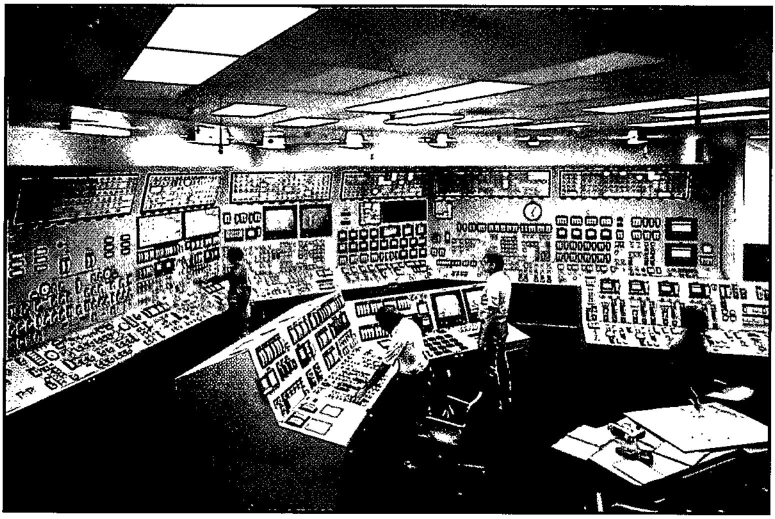


View looking south

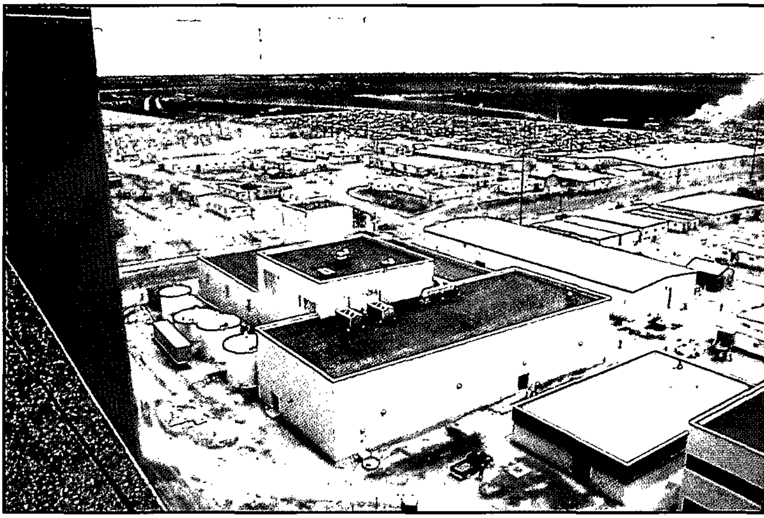


Learning Center looking ESE, 1983

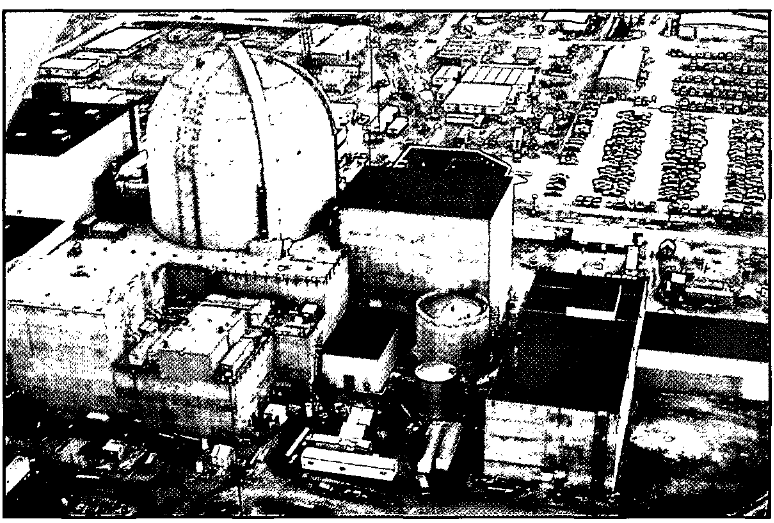
Learning Center looking SE towards the plant



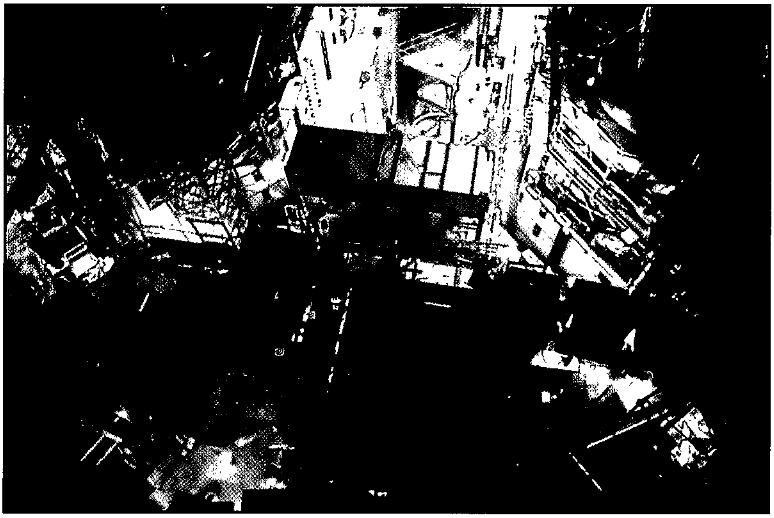
The Simulator in operation



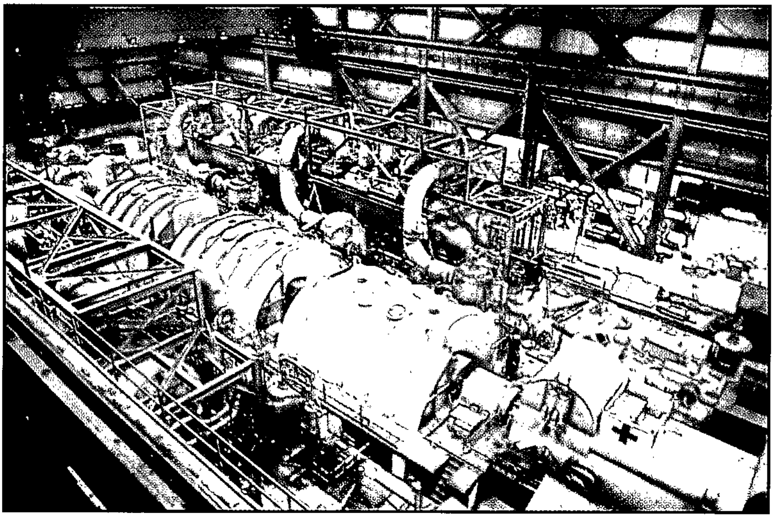
View looking NE at maintenance building and “trailer city”, 1983



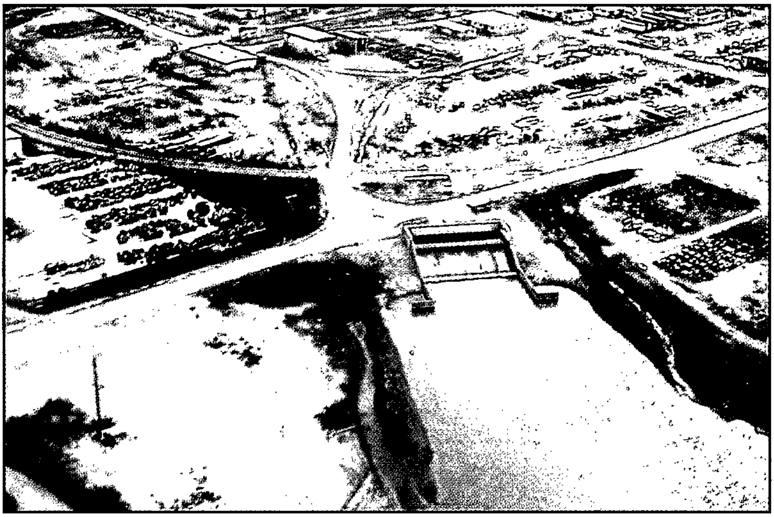
View looking ENE, 1983



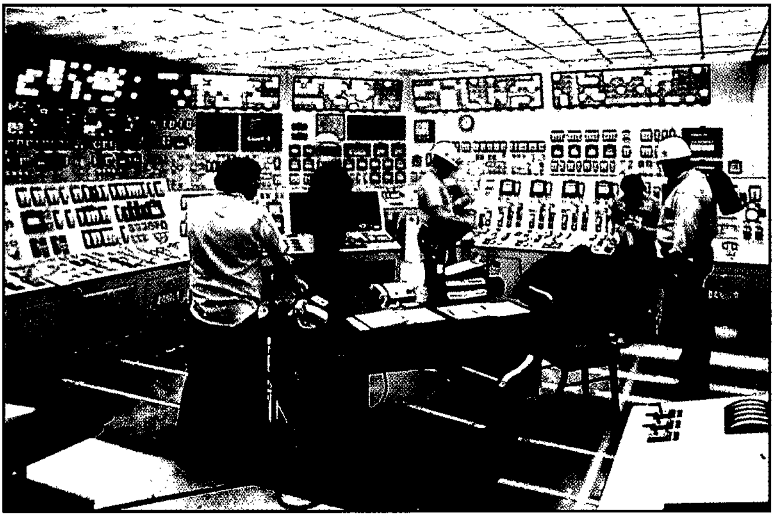
View inside containment, late 1983



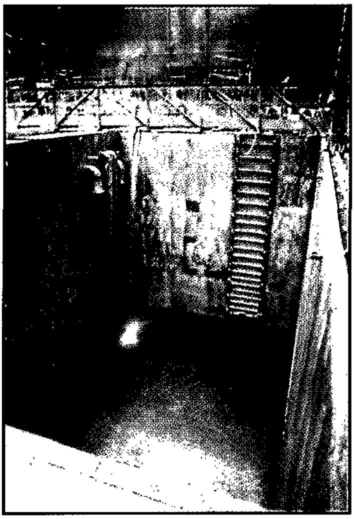
Turbine deck



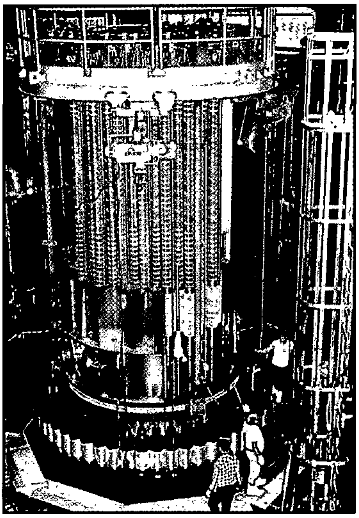
Circulating water discharge structure with water flowing, 1984



Main Control Room, 1984

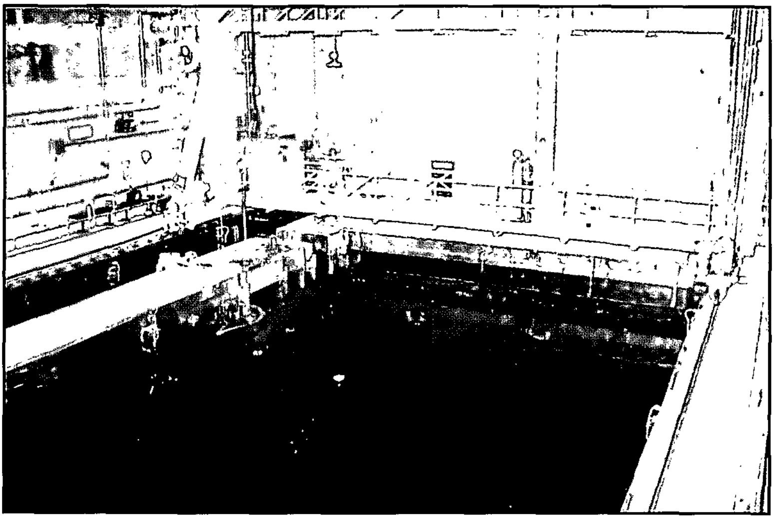


Spent fuel pool



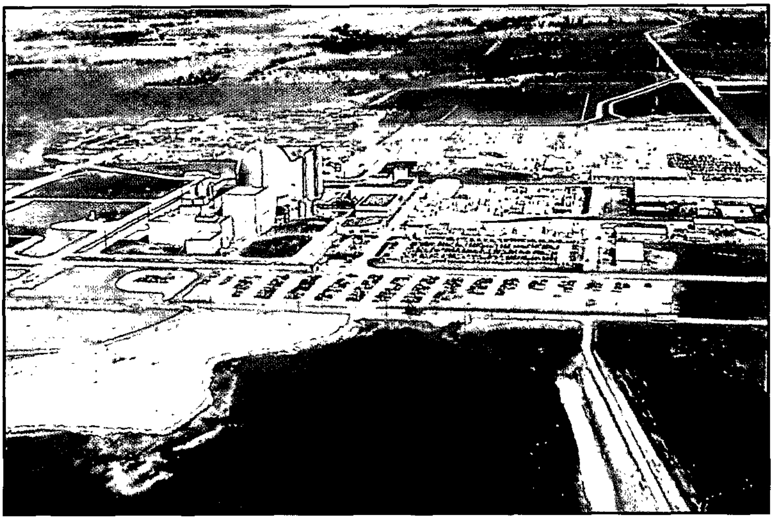
Control Rod Drive Mechanisms on top of
reactor vessel head, 1984

Fuel Pool transfer canal showing fuel assembly upender

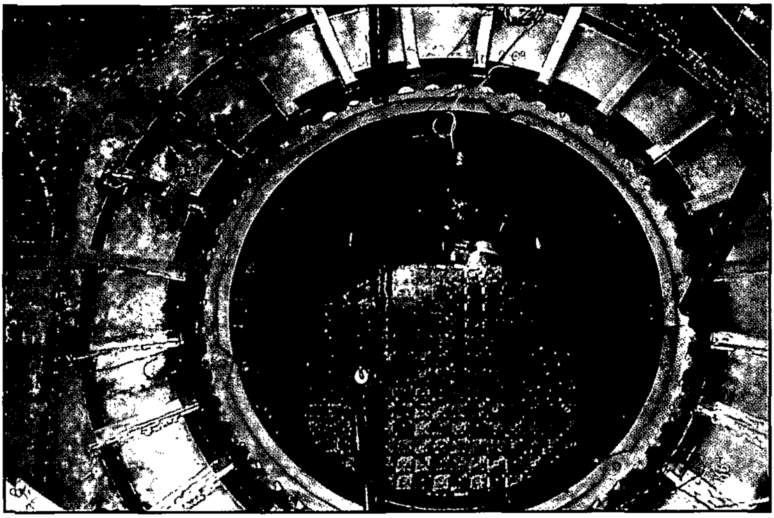


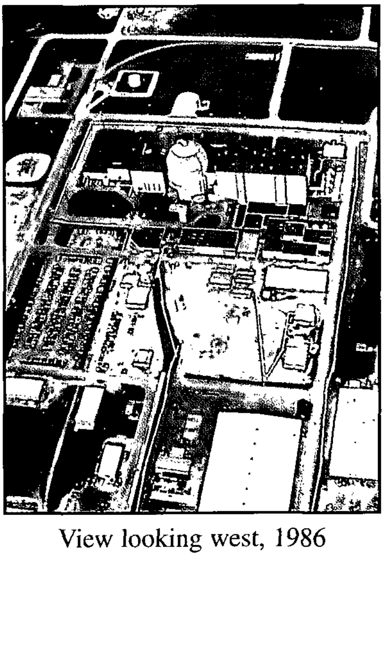
Fuel Pool with fuel racks installed

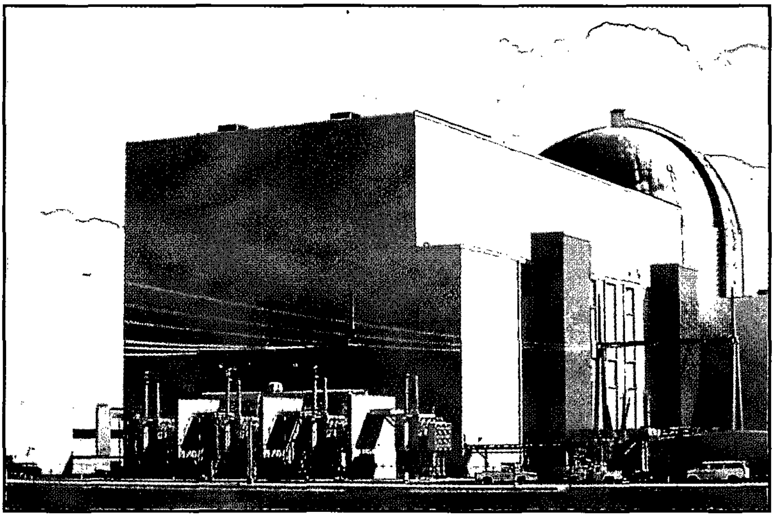
Initial fuel loading, 1985



View looking north, 1985

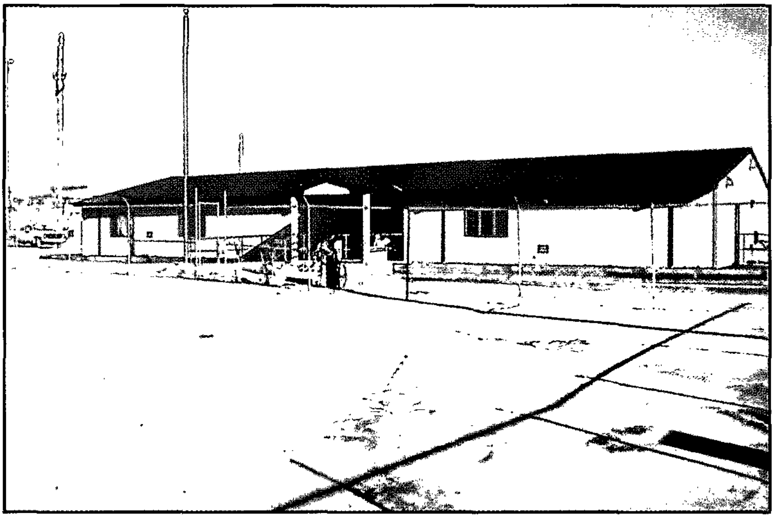

View inside reactor vessel with fuel loaded, 1985


View looking west, 1986

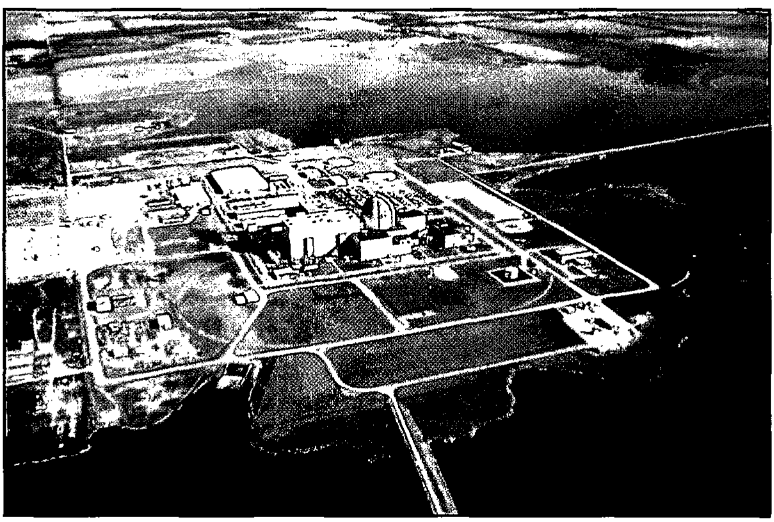


View looking south at main transformers, 1986

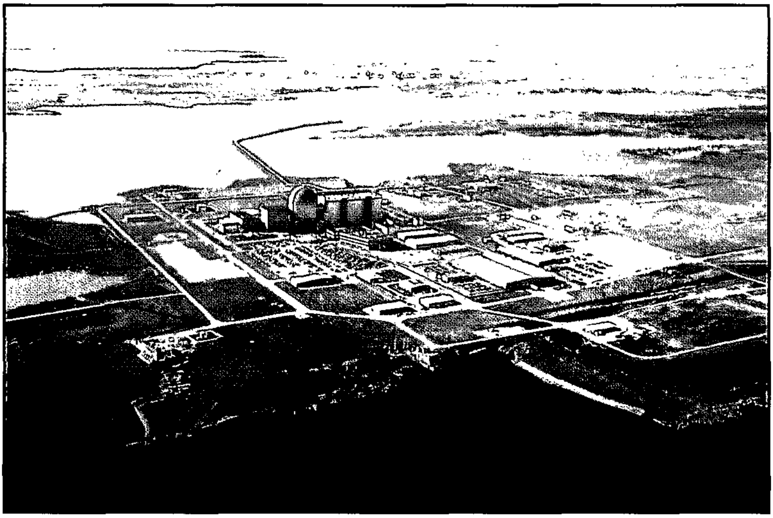
Construction of Evans Conference Center, 1986



Completed Evans Conference Center, 1986

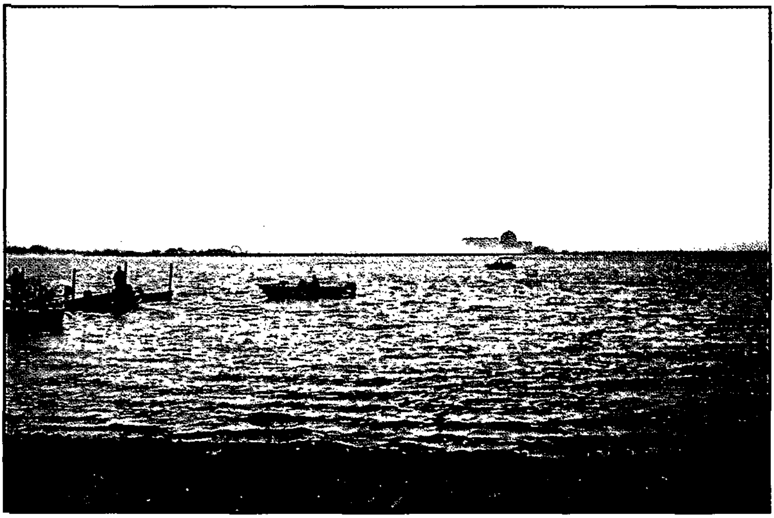


View looking east

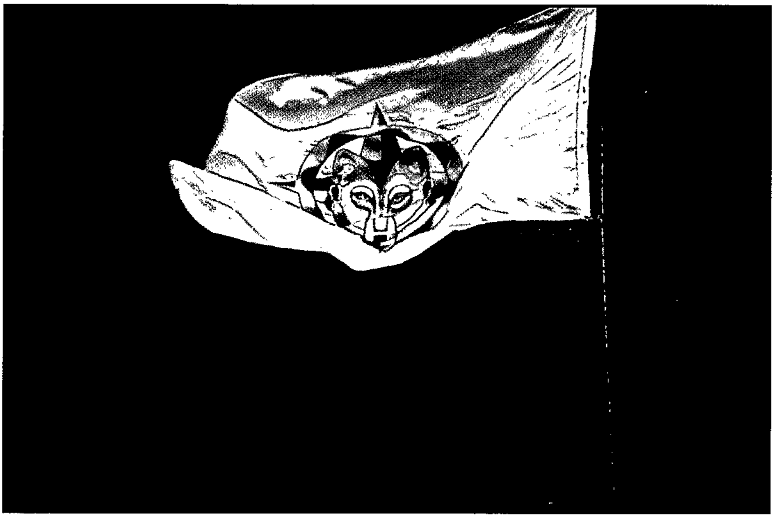

View looking west


Twilight at Wolf Creek

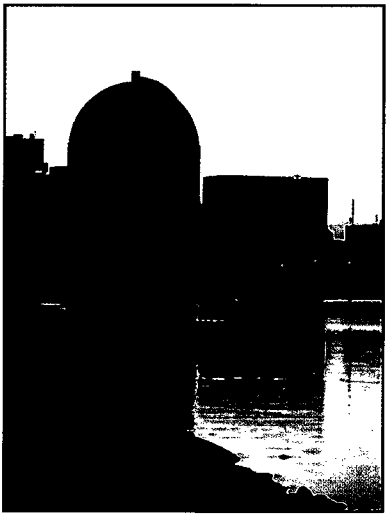
Sunrise over Wolf Creek



The lake opens to public fishing, October 1996



Wolf Creek flag in Kansas wind — long may it wave!



Wolf Creek — A great place to work!

THE SYMBOL

The likeness of a wolf — painted by one of the nation's most noted Indian artists — was adopted in 1980 as the logo for Wolf Creek Generating Station.

Blackbear Bosin, a Kiowa-Comanche born in Oklahoma, was the artist. Until his death, he pursued his art career in Kansas after his service in World War II as a member of the United States Marine Corps.

The wolf is a great hunter and a great provider, but also possesses an extraordinary knowledge of nature and lives in harmony with it. The wolf is accepted by the Indians as a teacher and tribes respect lessons taught by wolves.

In Bosin's painting, the stylized star behind the wolf is Sirius, the wolf star. In one Indian explanation, this star represents the pathway over which wolves travel to and from the world down the wolf road — Milky Way. The blue circle around the wolf's head represents nature's gift of water, which, in this case, is the cooling lake.

WOLF CREEK
GENERATING STATION

3. Available water or sediment quality data for John Redmond Reservoir (JRR), Coffey County Lake (CCL), and Neosho River.

~~NO TAB~~ DH
~~NO DATA~~ 4-17-07

Hooper Diane M

From: Logsdon Ralph L
Sent: Monday, March 19, 2007 10:40 AM
To: Hooper Diane M
Subject: FW: wq data

Dan Haines data.xls **Water Quality Data.xls**

The Neosho River and JRR data was from Dan Haines.XLS e-mail. The Wolf Creek data is also from this e-mail but I supplemented it with Environmental Associate data 1981 -1995 and CDM - NPDES data(1994 to 2006). Dan Haines.XLS was raw data from KDHE and Water Quality.XLS was added to and modified to address Question 102.

-----Original Message-----
From: Haines Daniel E
Sent: Thursday, January 25, 2007 11:37 AM
To: Logsdon Ralph L
Subject: FW: wq data

-----Original Message-----
From: TStiles@kdhe.state.ks.us [mailto:TStiles@kdhe.state.ks.us]
Sent: Thursday, January 25, 2007 11:10 AM
To: Haines Daniel E
Subject: wq data

Dan: here are the data for John REdmond, Wolf Creek Lake and the Neosho R above and below Redmond. Let me know if you need anything else.

tom

(See attached file: Dan Haines data.xls)

Thomas C. Stiles
Chief, Watershed Planning Section
Bureau of Water, Kansas Dept. of Health & Environment
1000 S. Jackson St., Suite 420
Topeka, Kansas 66612
T: (785) 296-6170
F: (785) 291-3266

SITE_LOCT	COL_DATE	COL_TIME	ALUMINUM	AMMONIA		ANTIMONY		ARSENIC		BARIUM	BERYLLIUM		BOD
John Redmond Reservoir	04/26/1977 0:00	2500		0.15									3.3
John Redmond Reservoir	04/26/1977 0:00	2500		0.10									3.3
John Redmond Reservoir	04/30/1980 0:00	2500		0.02				0.00		0.100			3.8
John Redmond Reservoir	04/30/1980 0:00	2500		0.15									3.3
John Redmond Reservoir	09/01/1987 0:00	1015		0.01	<			0.00		0.110			
John Redmond Reservoir	09/01/1987 0:00	1020		0.02				0.00		0.120			
John Redmond Reservoir	09/01/1987 0:00	1025		0.02									
John Redmond Reservoir	09/01/1987 0:00	1030		0.01	<								
John Redmond Reservoir	06/20/1990 0:00	1110	3.93	0.06		0.03	<	0.01		0.109	3	<	
John Redmond Reservoir	06/20/1990 0:00	1115	3.56	0.03		0.03	<	0.01		0.111	3	<	
John Redmond Reservoir	06/20/1990 0:00	1120	4.07	0.05	<	0.03	<	0.01		0.118	3	<	
John Redmond Reservoir	06/20/1990 0:00	1125	4.81	0.05	<	0.03	<	0.02		0.110	3	<	
John Redmond Reservoir	06/14/1993 0:00	0930	0.86	0.05	<	0.05	<	0.05	<	0.115	1	<	
John Redmond Reservoir	06/14/1993 0:00	0935	1.08	0.05	<	0.05	<	0.050	<	0.112	1	<	
John Redmond Reservoir	06/14/1993 0:00	0940	1.19	0.05	<	0.05	<	0.050	<	0.122	1	<	
John Redmond Reservoir	06/14/1993 0:00	0945	0.65	0.05	<	0.05	<	0.050	<	0.111	1	<	
John Redmond Reservoir	06/11/1996 0:00	0945	5.11	0.01		0.06		0.003		0.124	1	<	
John Redmond Reservoir	06/11/1996 0:00	0950	4.90	0.01	<	0.05		0.002		0.123	1	<	
John Redmond Reservoir	06/11/1996 0:00	0955	4.62	0.01	<	0.05	<	0.002		0.123	1	<	
John Redmond Reservoir	06/11/1996 0:00	1000	5.95	0.01	<	0.05	<	0.002		0.125	1	<	
John Redmond Reservoir	07/13/1999 0:00	1325	2.99	0.02	<	0.05	<	0.003		0.120	0.001	<	
John Redmond Reservoir	07/13/1999 0:00	1330	3.08	0.04		0.05	<	0.003		0.110	0.001	<	
John Redmond Reservoir	07/13/1999 0:00	1335	4.07	0.02	<	0.05	<	0.002		0.121	0.001	<	
John Redmond Reservoir	07/13/1999 0:00	1340	2.69	0.02		0.05	<	0.002		0.117	0.001	<	
John Redmond Reservoir	08/14/2002 0:00	1140	0.87	0.10	<	0.05	<	0.008		0.113	0.001	<	
John Redmond Reservoir	08/14/2002 0:00	1145	0.78	0.10	<	0.05	<	0.008		0.118	0.001	<	
John Redmond Reservoir	08/14/2002 0:00	1150	1.38	0.10	<	0.05	<	0.008		0.121	0.001	<	
John Redmond Reservoir	08/14/2002 0:00	1155	1.33	0.10	<	0.05	<	0.008		0.123	0.001	<	
John Redmond Reservoir	08/11/2005 0:00	0915	0.52	0.10	<	0.05	<	0.008		0.094	0.001	<	
John Redmond Reservoir	08/11/2005 0:00	0920	0.50	0.10	<	0.05	<	0.009		0.097	0.001	<	
John Redmond Reservoir	08/11/2005 0:00	0925	0.52	0.10	<	0.05	<	0.009		0.094	0.001	<	
John Redmond Reservoir	08/11/2005 0:00	0930	0.49	0.10	<	0.05	<	0.009		0.093	0.001	<	

SITE_LOCT	COL_DATE	COL_TIME	BORON		BROMIDE		CADMIUM		CALCIUM	CHLORIDE	CHROMIUM		COBALT	
John Redmond Reservoir	04/26/1977 0:00	2500	0.09							60.0				
John Redmond Reservoir	04/26/1977 0:00	2500	0.06							59.0				
John Redmond Reservoir	04/30/1980 0:00	2500	0.12						62.4	10.0				
John Redmond Reservoir	04/30/1980 0:00	2500	0.14						64.0	8.0				
John Redmond Reservoir	09/01/1987 0:00	1015	0.09				0.001	<	48.0	9.1	0.010	<		
John Redmond Reservoir	09/01/1987 0:00	1020	0.09				0.001	<	51.0	10.4	0.010	<		
John Redmond Reservoir	09/01/1987 0:00	1025	0.04						52.0	10.4				
John Redmond Reservoir	09/01/1987 0:00	1030	0.09						50.0	10.6				
John Redmond Reservoir	06/20/1990 0:00	1110	0.06				0.008		41.2	4.5	0.008		0.004	<
John Redmond Reservoir	06/20/1990 0:00	1115	0.06				0.003	<	42.5	4.6	0.009		0.004	
John Redmond Reservoir	06/20/1990 0:00	1120	0.07				0.003	<	43.6	4.8	0.009		0.004	
John Redmond Reservoir	06/20/1990 0:00	1125	0.06				0.003	<	40.8	4.8	0.005	<	0.004	<
John Redmond Reservoir	06/14/1993 0:00	0930	0.10				0.005	<	58.1	7.8	0.010	<	0.01	<
John Redmond Reservoir	06/14/1993 0:00	0935	0.12				0.005	<	56.0	7.7	0.010	<	0.01	<
John Redmond Reservoir	06/14/1993 0:00	0940	0.15				0.005	<	60.6	7.8	0.010	<	0.01	<
John Redmond Reservoir	06/14/1993 0:00	0945	0.11				0.005	<	56.2	7.5	0.010	<	0.01	<
John Redmond Reservoir	06/11/1996 0:00	0945	0.05		0.01	<	0.001	<	39.5	4.3	0.004		0.01	<
John Redmond Reservoir	06/11/1996 0:00	0950	0.04		0.01	<	0.001	<	38.8	4.2	0.004		0.01	<
John Redmond Reservoir	06/11/1996 0:00	0955	0.07		0.01	<	0.001	<	38.6	4.1	0.004		0.01	<
John Redmond Reservoir	06/11/1996 0:00	1000	0.05		0.03		0.001	<	38.0	4.1	0.004		0.01	<
John Redmond Reservoir	07/13/1999 0:00	1325	0.11		0.04		0.001	<	53.7	10.3	0.002		0.01	<
John Redmond Reservoir	07/13/1999 0:00	1330	0.08		0.02	<	0.001	<	54.0	11.2	0.002		0.01	<
John Redmond Reservoir	07/13/1999 0:00	1335	0.10		0.02	<	0.001	<	52.8	10.7	0.003		0.01	<
John Redmond Reservoir	07/13/1999 0:00	1340			0.04		0.001	<	54.5	10.1	0.004		0.01	<
John Redmond Reservoir	08/14/2002 0:00	1140	0.06		0.20	<	0.001	<	58.4	9.2	0.002		0.01	<
John Redmond Reservoir	08/14/2002 0:00	1145	0.06		0.20	<	0.001	<	62.8	9.2	0.001		0.01	<
John Redmond Reservoir	08/14/2002 0:00	1150	0.07		0.20	<	0.001	<	59.4	9.2	0.002		0.01	<
John Redmond Reservoir	08/14/2002 0:00	1155	0.07		0.20	<	0.001	<	62.0	9.2	0.002		0.01	<
John Redmond Reservoir	08/11/2005 0:00	0915	0.05	<	0.20	<	0.001	<	48.7	5.5	0.001		0.01	<
John Redmond Reservoir	08/11/2005 0:00	0920	0.053		0.20	<	0.001	<	51.6	6.2	0.001		0.01	<
John Redmond Reservoir	08/11/2005 0:00	0925	0.050	<	0.20	<	0.001	<	49.7	6.3	0.001		0.01	<
John Redmond Reservoir	08/11/2005 0:00	0930	0.050	<	0.2	<	0.001	<	50.0	6.3	0.001		0.01	<

SITE_LOCT	COL_DATE	COL_TIME	COPPER		DISOXY	FECCOLI		FECSTRP		FLUORIDE		IRON	LEAD	
John Redmond Reservoir	04/26/1977 0:00	2500			10.4	10		10				0.49		
John Redmond Reservoir	04/26/1977 0:00	2500			9.7							1.60		
John Redmond Reservoir	04/30/1980 0:00	2500	0.020		11.5	100		1100				0.64	0.010	
John Redmond Reservoir	04/30/1980 0:00	2500										3.10		
John Redmond Reservoir	09/01/1987 0:00	1015	0.010	<	7.3	8				0.30		2.02	0.001	
John Redmond Reservoir	09/01/1987 0:00	1020	0.010	<		6				0.28		2.20	0.012	
John Redmond Reservoir	09/01/1987 0:00	1025								0.27		2.42		
John Redmond Reservoir	09/01/1987 0:00	1030								0.27		2.17		
John Redmond Reservoir	06/20/1990 0:00	1110	0.023		7.2	10		23		0.18		3.25	0.010	
John Redmond Reservoir	06/20/1990 0:00	1115	0.024			8		24		0.18		3.01	0.012	
John Redmond Reservoir	06/20/1990 0:00	1120	0.022							0.18		3.43		
John Redmond Reservoir	06/20/1990 0:00	1125	0.007							0.18		3.23		
John Redmond Reservoir	06/14/1993 0:00	0930	0.010		6.5					0.18		0.61	0.050	<
John Redmond Reservoir	06/14/1993 0:00	0935	0.010	<						0.18		0.77	0.050	<
John Redmond Reservoir	06/14/1993 0:00	0940	0.010	<						0.18		0.87	0.050	<
John Redmond Reservoir	06/14/1993 0:00	0945	0.010	<						0.19		0.48	0.050	<
John Redmond Reservoir	06/11/1996 0:00	0945	0.011		6.9	30		90		0.16		3.72	0.002	
John Redmond Reservoir	06/11/1996 0:00	0950	0.009			80		80		0.16		3.51	0.002	
John Redmond Reservoir	06/11/1996 0:00	0955	0.010							0.16		3.54	0.002	
John Redmond Reservoir	06/11/1996 0:00	1000	0.006							0.16		4.02	0.001	<
John Redmond Reservoir	07/13/1999 0:00	1325	0.013		6.0	10	<	10	<	0.23		2.75	0.002	
John Redmond Reservoir	07/13/1999 0:00	1330	0.010			10	<	10	<	0.23		2.84	0.001	
John Redmond Reservoir	07/13/1999 0:00	1335	0.007							0.23		3.88	0.002	
John Redmond Reservoir	07/13/1999 0:00	1340	0.007							0.24		2.52	0.001	
John Redmond Reservoir	08/14/2002 0:00	1140	0.003		6.0	10	<			0.15		0.87	0.001	
John Redmond Reservoir	08/14/2002 0:00	1145	0.003			10	<			0.15	<	0.78	0.001	<
John Redmond Reservoir	08/14/2002 0:00	1150	0.003							0.15	<	1.35	0.001	
John Redmond Reservoir	08/14/2002 0:00	1155	0.003							0.15	<	1.29	0.002	
John Redmond Reservoir	08/11/2005 0:00	0915	0.002		8.0					0.17		0.511	0.001	
John Redmond Reservoir	08/11/2005 0:00	0920	0.0029							0.19		0.52	0.001	
John Redmond Reservoir	08/11/2005 0:00	0925	0.0020							0.20		0.54	0.001	
John Redmond Reservoir	08/11/2005 0:00	0930	0.0018							0.19		0.53	0.001	

SITE_LOCT	COL_DATE	COL_TIME	MAGNESIUM	MANGANESE	MERCURY		MOLYBDENM		NICKEL		NITRATE	
John Redmond Reservoir	04/26/1977 0:00	2500		0.03							0.10	
John Redmond Reservoir	04/26/1977 0:00	2500		0.07							0.10	
John Redmond Reservoir	04/30/1980 0:00	2500	20.5	0.11	0							
John Redmond Reservoir	04/30/1980 0:00	2500	17.6	0.36								
John Redmond Reservoir	09/01/1987 0:00	1015	11.1	0.11	0.0005	<						
John Redmond Reservoir	09/01/1987 0:00	1020	12.1	0.07	0.0005	<						
John Redmond Reservoir	09/01/1987 0:00	1025	12.3	0.08								
John Redmond Reservoir	09/01/1987 0:00	1030	12.0	0.07								
John Redmond Reservoir	06/20/1990 0:00	1110	7.9	0.11	0.0005	<	0.01	<	0.011			
John Redmond Reservoir	06/20/1990 0:00	1115	8.1	0.11	0.0005	<	0.01	<	0.010			
John Redmond Reservoir	06/20/1990 0:00	1120	8.4	0.14			0.01	<	0.014			
John Redmond Reservoir	06/20/1990 0:00	1125	8.0	0.12			0.01	<	0.006	<		
John Redmond Reservoir	06/14/1993 0:00	0930	12.25	0.112	0.0005	<	0.01	<	0.050	<		
John Redmond Reservoir	06/14/1993 0:00	0935	11.9	0.11	0.0005	<	0.01	<	0.050	<		
John Redmond Reservoir	06/14/1993 0:00	0940	12.9	0.12	0.0005	<	0.01	<	0.050	<		
John Redmond Reservoir	06/14/1993 0:00	0945	11.9	0.12	0.0005	<	0.01	<	0.050	<		
John Redmond Reservoir	06/11/1996 0:00	0945	6.4	0.08	0.0005	<	0.01	<	0.002		0.75	
John Redmond Reservoir	06/11/1996 0:00	0950	6.2	0.08	0.0005	<	0.01	<	0.001	<	0.76	
John Redmond Reservoir	06/11/1996 0:00	0955	6.3	0.08	0.0005	<	0.01	<	0.001	<	0.76	
John Redmond Reservoir	06/11/1996 0:00	1000	6.2	0.08	0.0005	<	0.01	<	0.001	<	0.76	
John Redmond Reservoir	07/13/1999 0:00	1325	11.4	0.15	0.0005	<	0.02	<	0.003		0.71	
John Redmond Reservoir	07/13/1999 0:00	1330	11.8	0.15	0.0005	<	0.02	<	0.004		0.69	
John Redmond Reservoir	07/13/1999 0:00	1335	11.6	0.15	0.0005	<	0.02	<	0.004		0.71	
John Redmond Reservoir	07/13/1999 0:00	1340	11.6	0.15	0.0005	<	0.02	<	0.003		0.72	
John Redmond Reservoir	08/14/2002 0:00	1140	14.5	0.16	0.0005	<	0.02	<	0.004		0.10	<
John Redmond Reservoir	08/14/2002 0:00	1145	15.7	0.15	0.0005	<	0.02	<	0.005		0.10	<
John Redmond Reservoir	08/14/2002 0:00	1150	15.0	0.18	0.0005	<	0.02	<	0.005		0.10	<
John Redmond Reservoir	08/14/2002 0:00	1155	15.3	0.18	0.0005	<	0.02	<	0.004		0.10	<
John Redmond Reservoir	08/11/2005 0:00	0915	10.8	0.19	0.0005	<	0.02	<	0.003		0.10	<
John Redmond Reservoir	08/11/2005 0:00	0920	11.6	0.20	0.0005	<	0.02	<	0.003		0.1	<
John Redmond Reservoir	08/11/2005 0:00	0925	11.1	0.20	0.0005	<	0.02	<	0.003		0.1	<
John Redmond Reservoir	08/11/2005 0:00	0930	11.2	0.20	0.0005	<	0.02	<	0.003		0.1	<

SITE_LOCT	COL_DATE	COL_TIME	NITRITE		NO2_NO3	ORTH_PHOS		PHLAB	PHFIELD	POTASSIUM	SELENIUM	
John Redmond Reservoir	04/26/1977 0:00	2500				0.02				4.7		
John Redmond Reservoir	04/26/1977 0:00	2500				0.02				4.7		
John Redmond Reservoir	04/30/1980 0:00	2500			0.60	0.01		8.4		3.8	0.001	
John Redmond Reservoir	04/30/1980 0:00	2500			0.60	0.03		8.2		3.6		
John Redmond Reservoir	09/01/1987 0:00	1015			0.65				8.0	3.4	0.001	<
John Redmond Reservoir	09/01/1987 0:00	1020			0.64				8.0	3.6	0.006	
John Redmond Reservoir	09/01/1987 0:00	1025			0.63				8.0	3.6		
John Redmond Reservoir	09/01/1987 0:00	1030			0.62				8.0	3.7		
John Redmond Reservoir	06/20/1990 0:00	1110			0.71			7.0	7.7	4.2	0.003	
John Redmond Reservoir	06/20/1990 0:00	1115			0.71					3.8	0.003	
John Redmond Reservoir	06/20/1990 0:00	1120			0.71				7.7	3.8		
John Redmond Reservoir	06/20/1990 0:00	1125			0.71					4.3		
John Redmond Reservoir	06/14/1993 0:00	0930			0.64			7.9	7.7	3.8	0.050	<
John Redmond Reservoir	06/14/1993 0:00	0935			0.65			7.9		3.6	0.050	<
John Redmond Reservoir	06/14/1993 0:00	0940			0.65			8.0	7.9	5.0	0.050	<
John Redmond Reservoir	06/14/1993 0:00	0945			0.64			8.1		3.9	0.050	<
John Redmond Reservoir	06/11/1996 0:00	0945	0.05	<		0.11		7.9	7.7	4.4	0.002	<
John Redmond Reservoir	06/11/1996 0:00	0950	0.05	<		0.11		7.8	7.6	4.8	0.002	<
John Redmond Reservoir	06/11/1996 0:00	0955	0.05	<		0.03		7.7	7.5	4.6	0.002	<
John Redmond Reservoir	06/11/1996 0:00	1000	0.05	<		0.01		7.6	7.5	4.6	0.002	<
John Redmond Reservoir	07/13/1999 0:00	1325	0.05			0.02	<	7.6	7.5	4.6	0.002	<
John Redmond Reservoir	07/13/1999 0:00	1330	0.05			0.02	<	7.9	7.5	4.8	0.002	<
John Redmond Reservoir	07/13/1999 0:00	1335	0.05			0.02	<	7.9	7.6	4.4	0.002	<
John Redmond Reservoir	07/13/1999 0:00	1340	0.05			0.02	<	8.0	7.6	4.6	0.002	<
John Redmond Reservoir	08/14/2002 0:00	1140	0.05	<		0.25	<	8.2	8.2	5.1	0.001	<
John Redmond Reservoir	08/14/2002 0:00	1145	0.05	<		0.25	<	8.3	8.2	5.3	0.001	<
John Redmond Reservoir	08/14/2002 0:00	1150	0.05	<		0.25	<	8.0	8.0	5.3	0.001	<
John Redmond Reservoir	08/14/2002 0:00	1155	0.05	<		0.25	<	8.0	8.0	5.4	0.001	<
John Redmond Reservoir	08/11/2005 0:00	0915	0.05	<		0.25	<		8.0	4.3	0.001	<
John Redmond Reservoir	08/11/2005 0:00	0920	0.05	<		0.25	<		8.0	4.5	0.001	<
John Redmond Reservoir	08/11/2005 0:00	0925	0.05	<		0.25	<		8.0	4.4	0.001	<
John Redmond Reservoir	08/11/2005 0:00	0930	0.05	<		0.25	<		8.0	4.4	0.001	<

SITE_LOCT	COL_DATE	COL_TIME	SILICA	SILVER		SODIUM	SPEC_COND	SULFATE	TEMP_CENT	THALLIUM	
John Redmond Reservoir	04/26/1977 0:00	2500	0.4			40.0		127.0	17.0		
John Redmond Reservoir	04/26/1977 0:00	2500	0.5			40.0		125.0	17.0		
John Redmond Reservoir	04/30/1980 0:00	2500	3.0			11.0	440	57.0	16.5		
John Redmond Reservoir	04/30/1980 0:00	2500	4.0			11.0	450	60.0			
John Redmond Reservoir	09/01/1987 0:00	1015	4.1	0.018		12.1	350	46.0	19.5		
John Redmond Reservoir	09/01/1987 0:00	1020	5.7	0.015		12.5	400	53.0			
John Redmond Reservoir	09/01/1987 0:00	1025	5.9			12.2	400	51.0			
John Redmond Reservoir	09/01/1987 0:00	1030	5.4			12.6	400	51.0			
John Redmond Reservoir	06/20/1990 0:00	1110	26.8	0.005	<	7.6		23.0	25.5	0.02	<
John Redmond Reservoir	06/20/1990 0:00	1115	25.5	0.005	<	7.7		23.0		0.02	<
John Redmond Reservoir	06/20/1990 0:00	1120	28.0	0.005	<	7.9		23.0		0.02	<
John Redmond Reservoir	06/20/1990 0:00	1125	32.3	0.005	<	6.5		23.0		0.02	<
John Redmond Reservoir	06/14/1993 0:00	0930	14.8	0.01	<	9.9	426	50.0	23.5	0.05	<
John Redmond Reservoir	06/14/1993 0:00	0935	15.6	0.010	<	9.5	430	50.0		0.05	<
John Redmond Reservoir	06/14/1993 0:00	0940	16.6	0.010	<	10.4	428	52.0		0.05	<
John Redmond Reservoir	06/14/1993 0:00	0945	13.6	0.010	<	9.6	427	50.0		0.05	<
John Redmond Reservoir	06/11/1996 0:00	0945	33.0	0.001	<	6.6	291	19.7			
John Redmond Reservoir	06/11/1996 0:00	0950	32.0	0.001	<	6.4	292	21.8			
John Redmond Reservoir	06/11/1996 0:00	0955	30.4	0.001	<	6.3	283	18.6			
John Redmond Reservoir	06/11/1996 0:00	1000	37.7	0.001	<	6.2	286	18.8			
John Redmond Reservoir	07/13/1999 0:00	1325	24.9	0.001	<	9.8	375	31.8	25.5	0.05	<
John Redmond Reservoir	07/13/1999 0:00	1330	25.1	0.001	<	10.2	376	31.7		0.05	<
John Redmond Reservoir	07/13/1999 0:00	1335	30.0	0.001	<	9.4	377	31.8		0.05	<
John Redmond Reservoir	07/13/1999 0:00	1340	24.8	0.001	<	9.7	372	31.8		0.05	<
John Redmond Reservoir	08/14/2002 0:00	1140	7.6	0.001	<	12.7	457	48.8	24.0	0.05	<
John Redmond Reservoir	08/14/2002 0:00	1145	7.4	0.001	<	13.5	461	49.1		0.05	<
John Redmond Reservoir	08/14/2002 0:00	1150	10.2	0.001	<	13.0	464	49.2		0.05	<
John Redmond Reservoir	08/14/2002 0:00	1155	10.0	0.001	<	13.2	463	48.9		0.05	<
John Redmond Reservoir	08/11/2005 0:00	0915	8.4	0.001	<	9.3	344	26.0	30.0	0.05	<
John Redmond Reservoir	08/11/2005 0:00	0920	8.7	0.001	<	9.8	346	29.4		0.05	<
John Redmond Reservoir	08/11/2005 0:00	0925	8.6	0.001	<	9.5	351	30.0		0.05	<
John Redmond Reservoir	08/11/2005 0:00	0930	8.4	0.001	<	9.5	354	30.1		0.05	<

SITE_LOCT	COL_DATE	COL_TIME	TDS	TOTHARD	PHOSPHU	TSS	TURBIDITY	VANADIUM		ZINC		TOC
John Redmond Reservoir	04/26/1977 0:00	2500		308		32						
John Redmond Reservoir	04/26/1977 0:00	2500		316		64						
John Redmond Reservoir	04/30/1980 0:00	2500		240	0.09	43	32.5			0.020		
John Redmond Reservoir	04/30/1980 0:00	2500		232	0.19	172	45.0					
John Redmond Reservoir	09/01/1987 0:00	1015	215	165	0.17	38	35.0			0.130		
John Redmond Reservoir	09/01/1987 0:00	1020	233	177	0.18	38	35.0			0.020		
John Redmond Reservoir	09/01/1987 0:00	1025	230	180	0.17	184	45.0					
John Redmond Reservoir	09/01/1987 0:00	1030	229	174	0.16	32	40.0					
John Redmond Reservoir	06/20/1990 0:00	1110	184	135	0.19	44	54.0	0.006		0.097		
John Redmond Reservoir	06/20/1990 0:00	1115	183	139	0.21	45	52.2	0.008		0.176		
John Redmond Reservoir	06/20/1990 0:00	1120	190	143	0.23	71	63.9	0.012		0.068		
John Redmond Reservoir	06/20/1990 0:00	1125	188	134	0.19	50	55.8	0.007		0.025		
John Redmond Reservoir	06/14/1993 0:00	0930	241	195	0.13	9	15.0	0.007		0.040		
John Redmond Reservoir	06/14/1993 0:00	0935	239	189	0.13	16	12.0	0.007		0.005	<	
John Redmond Reservoir	06/14/1993 0:00	0940	249	204	0.14	12	15.0	0.006		0.005	<	
John Redmond Reservoir	06/14/1993 0:00	0945	237	189	0.14	10	13.0	0.007				
John Redmond Reservoir	06/11/1996 0:00	0945	182	125	0.18	45	87.0	0.011				
John Redmond Reservoir	06/11/1996 0:00	0950	182	122	0.18	55	87.0	0.011		0.020		
John Redmond Reservoir	06/11/1996 0:00	0955	176	122	0.19	51	89.0	0.008		0.026		
John Redmond Reservoir	06/11/1996 0:00	1000	183	120	0.19	42	90.0	0.011		0.020		
John Redmond Reservoir	07/13/1999 0:00	1325	238	181	0.17	33	42.0	0.011		0.059		
John Redmond Reservoir	07/13/1999 0:00	1330	240	183	0.19	33	43.0	0.011		0.051		
John Redmond Reservoir	07/13/1999 0:00	1335	243	180	0.18	47	44.0	0.011		0.022		
John Redmond Reservoir	07/13/1999 0:00	1340	239	184	0.18	42	43.0	0.011		0.032		
John Redmond Reservoir	08/14/2002 0:00	1140	268	205	0.25	43	21.0	0.009		0.007		5.8
John Redmond Reservoir	08/14/2002 0:00	1145	276	221	0.22	43	20.0	0.010		0.007		5.7
John Redmond Reservoir	08/14/2002 0:00	1150	275	210	0.26	56	28.0	0.011		0.009		5.8
John Redmond Reservoir	08/14/2002 0:00	1155	277	218	0.25	47	25.0	0.010		0.008		5.8
John Redmond Reservoir	08/11/2005 0:00	0915	199	166	0.21	22	18.6	0.008		0.005	<	9.5
John Redmond Reservoir	08/11/2005 0:00	0920	209	177	0.20	25	19.5	0.008		0.005	<	9.0
John Redmond Reservoir	08/11/2005 0:00	0925	207	170	0.21	24	16.2	0.008		0.007		9.3
John Redmond Reservoir	08/11/2005 0:00	0930	207	171	0.21	23	19.5	0.008		0.006		8.6

SITE_LOCT	COL_DATE	COL_TIME	KJELDAHL	STRONTIUM	CHLOROPH	COD	CHARD
John Redmond Reservoir	04/26/1977 0:00	2500				4	204
John Redmond Reservoir	04/26/1977 0:00	2500				4	208
John Redmond Reservoir	04/30/1980 0:00	2500				12	156
John Redmond Reservoir	04/30/1980 0:00	2500				8	160
John Redmond Reservoir	09/01/1987 0:00	1015			7.5		128
John Redmond Reservoir	09/01/1987 0:00	1020			6.8		135
John Redmond Reservoir	09/01/1987 0:00	1025					132
John Redmond Reservoir	09/01/1987 0:00	1030					133
John Redmond Reservoir	06/20/1990 0:00	1110			5.9		
John Redmond Reservoir	06/20/1990 0:00	1115			6.7		
John Redmond Reservoir	06/20/1990 0:00	1120					
John Redmond Reservoir	06/20/1990 0:00	1125					
John Redmond Reservoir	06/14/1993 0:00	0930	1.1		7.5		
John Redmond Reservoir	06/14/1993 0:00	0935	1.6		7.7		
John Redmond Reservoir	06/14/1993 0:00	0940	1.0				
John Redmond Reservoir	06/14/1993 0:00	0945	1.3				
John Redmond Reservoir	06/11/1996 0:00	0945			3.7		
John Redmond Reservoir	06/11/1996 0:00	0950	0.5		4.0		
John Redmond Reservoir	06/11/1996 0:00	0955	0.5				
John Redmond Reservoir	06/11/1996 0:00	1000	0.6				
John Redmond Reservoir	07/13/1999 0:00	1325	0.7		8.9		
John Redmond Reservoir	07/13/1999 0:00	1330	0.6		7.8		
John Redmond Reservoir	07/13/1999 0:00	1335	0.6				
John Redmond Reservoir	07/13/1999 0:00	1340	0.7				
John Redmond Reservoir	08/14/2002 0:00	1140	1.1		43.5		
John Redmond Reservoir	08/14/2002 0:00	1145	1.0		41.5		
John Redmond Reservoir	08/14/2002 0:00	1150	1.0				
John Redmond Reservoir	08/14/2002 0:00	1155	1.0				
John Redmond Reservoir	08/11/2005 0:00	0915	0.8	0.533	51.3		
John Redmond Reservoir	08/11/2005 0:00	0920	0.8	0.534	48.9		
John Redmond Reservoir	08/11/2005 0:00	0925	0.9	0.519			
John Redmond Reservoir	08/11/2005 0:00	0930	1.1	0.521			

SITE_LOCT	COL_DATE	ALKALINTY	ALUMINUM	AMMONIA		ANTIMONY		ARSENIC		BARIUM	BERYLLIUM		BORON	BROMIDE
Wolf Creek Lake	11/23/1987	133												
Wolf Creek Lake	12/28/1987	123												
Wolf Creek Lake	02/22/1988	119												
Wolf Creek Lake	04/26/1988	119												
Wolf Creek Lake	06/21/1988	129												
Wolf Creek Lake	08/29/1988	122												
Wolf Creek Lake	10/24/1988	125												
Wolf Creek Lake	12/19/1988	127												
Wolf Creek Lake	02/20/1989	130												
Wolf Creek Lake	04/24/1989	138												
Wolf Creek Lake	06/19/1989	139												
Wolf Creek Lake	08/21/1989													
Wolf Creek Lake	10/23/1989													
Wolf Creek Lake	12/18/1989													
Wolf Creek Lake	02/19/1990	155												
Wolf Creek Lake	04/23/1990	141												
Wolf Creek Lake	06/18/1990	143												
Wolf Creek Lake	08/22/1990	143												
Wolf Creek Lake	10/22/1990	144												
Wolf Creek Lake	12/17/1990	149												
Wolf Creek Lake	02/18/1991	152												
Wolf Creek Lake	04/22/1991	185												
Wolf Creek Lake	06/18/1991	153												
Wolf Creek Lake	08/26/1991	123												
Wolf Creek Lake	10/21/1991	154												
Wolf Creek Lake	12/16/1991	151												
Wolf Creek Lake	02/17/1992	151												
Wolf Creek Lake	04/27/1992	155												
Wolf Creek Lake	06/22/1992	156												
Wolf Creek Lake	08/24/1992	143												
Wolf Creek Lake	10/19/1992	148												
Wolf Creek Lake	12/21/1992	145												
Wolf Creek Lake	02/22/1993	144												
Wolf Creek Lake	04/04/1993	140												
Wolf Creek Lake	06/22/1993	142												
Wolf Creek Lake	08/24/1993	135												

SITE_LOCT	COL_DATE	CADMIUM		CALCIUM	CHLORIDE	CHROMIUM		COBALT		COPPER		FLUORIDE	IRON	LEAD	
Wolf Creek Lake	11/23/1987			38.8	19.0										
Wolf Creek Lake	12/28/1987														
Wolf Creek Lake	02/22/1988			33.0	16.2										
Wolf Creek Lake	04/26/1988			39.0	15.0										
Wolf Creek Lake	06/21/1988			37.6	16.0										
Wolf Creek Lake	08/29/1988			31.1	17.2										
Wolf Creek Lake	10/24/1988			41.3	18.2										
Wolf Creek Lake	12/19/1988			38.5	17.8										
Wolf Creek Lake	02/20/1989			44.6	18.7										
Wolf Creek Lake	04/24/1989			44.7											
Wolf Creek Lake	06/19/1989			41.7	22.2										
Wolf Creek Lake	08/21/1989			38.6	21.2										
Wolf Creek Lake	10/23/1989			44.1	20.8										
Wolf Creek Lake	12/18/1989			30.6											
Wolf Creek Lake	02/19/1990			43.5	22.0										
Wolf Creek Lake	04/23/1990			46.0	19.4										
Wolf Creek Lake	06/18/1990			40.2	17.9										
Wolf Creek Lake	08/22/1990			42.2	19.2										
Wolf Creek Lake	10/22/1990			42.6	20.0										
Wolf Creek Lake	12/17/1990			47.8	21.1										
Wolf Creek Lake	02/18/1991			45.7											
Wolf Creek Lake	04/22/1991														
Wolf Creek Lake	06/18/1991			48.3	21.5										
Wolf Creek Lake	08/26/1991			37.9	20.3										
Wolf Creek Lake	10/21/1991			45.6	24.4										
Wolf Creek Lake	12/16/1991			48.7	19.8										
Wolf Creek Lake	02/17/1992			48.7											
Wolf Creek Lake	04/27/1992			43.4	15.7										
Wolf Creek Lake	06/22/1992			44.9	29.3										
Wolf Creek Lake	08/24/1992			45.0	32.5										
Wolf Creek Lake	10/19/1992			43.0	27.0										
Wolf Creek Lake	12/21/1992				20.5										
Wolf Creek Lake	02/22/1993			39.1	23.0										
Wolf Creek Lake	04/04/1993			40.1	24.7										
Wolf Creek Lake	06/22/1993			42.2	22.2										
Wolf Creek Lake	08/24/1993			37.7	19.5										

SITE_LOCT	COL_DATE	MAGNESIUM	MANGANESE	MERCURY		MOLYBDENM		NICKEL		NITRATE		NITRITE	
Wolf Creek Lake	11/23/1987	12.3											
Wolf Creek Lake	12/28/1987												
Wolf Creek Lake	02/22/1988	10.9											
Wolf Creek Lake	04/26/1988	11.8											
Wolf Creek Lake	06/21/1988	12.9											
Wolf Creek Lake	08/29/1988	10.9											
Wolf Creek Lake	10/24/1988												
Wolf Creek Lake	12/19/1988	15.1											
Wolf Creek Lake	02/20/1989	14.6											
Wolf Creek Lake	04/24/1989	13.9											
Wolf Creek Lake	06/19/1989	15.2											
Wolf Creek Lake	08/21/1989	15.6											
Wolf Creek Lake	10/23/1989	16.6											
Wolf Creek Lake	12/18/1989												
Wolf Creek Lake	02/19/1990	16.3											
Wolf Creek Lake	04/23/1990	17.0											
Wolf Creek Lake	06/18/1990	22.1											
Wolf Creek Lake	08/22/1990	15.4											
Wolf Creek Lake	10/22/1990	16.4											
Wolf Creek Lake	12/17/1990	18.3											
Wolf Creek Lake	02/18/1991	16.6											
Wolf Creek Lake	04/22/1991												
Wolf Creek Lake	06/18/1991	17.6											
Wolf Creek Lake	08/26/1991	15.1											
Wolf Creek Lake	10/21/1991	18.2											
Wolf Creek Lake	12/16/1991	19.5											
Wolf Creek Lake	02/17/1992												
Wolf Creek Lake	04/27/1992	16.6											
Wolf Creek Lake	06/22/1992	10.8											
Wolf Creek Lake	08/24/1992	12.0											
Wolf Creek Lake	10/19/1992	17.5											
Wolf Creek Lake	12/21/1992	16.0											
Wolf Creek Lake	02/22/1993	15.3											
Wolf Creek Lake	04/04/1993	15.6											
Wolf Creek Lake	06/22/1993	15.9											
Wolf Creek Lake	08/24/1993	14.6											

SITE_LOCT	COL_DATE	ORTH_PHOS		PH	POTASSIUM	SELENIUM		SILICA	SILVER		SODIUM	SPEC_COND	SULFATE
Wolf Creek Lake	11/23/1987			7.6								305	68.3
Wolf Creek Lake	12/28/1987			7.4								335	
Wolf Creek Lake	02/22/1988			7.7								425	58.0
Wolf Creek Lake	04/26/1988			7.8								382	55.8
Wolf Creek Lake	06/21/1988			8.1								465	58.7
Wolf Creek Lake	08/29/1988			7.9								440	60.8
Wolf Creek Lake	10/24/1988			7.3								400	
Wolf Creek Lake	12/19/1988			7.7								378	64.0
Wolf Creek Lake	02/20/1989			7.6								287	66.2
Wolf Creek Lake	04/24/1989			8.3								428	70.0
Wolf Creek Lake	06/19/1989			8.3								522	76.5
Wolf Creek Lake	08/21/1989												70.9
Wolf Creek Lake	10/23/1989												73.2
Wolf Creek Lake	12/18/1989												60.9
Wolf Creek Lake	02/19/1990			7.9								460	76.3
Wolf Creek Lake	04/23/1990			7.9								480	64.9
Wolf Creek Lake	06/18/1990			8.2								502	63.9
Wolf Creek Lake	08/22/1990			7.7								490	72.8
Wolf Creek Lake	10/22/1990			8.3								429	73.0
Wolf Creek Lake	12/17/1990			7.9								415	79.8
Wolf Creek Lake	02/18/1991			8.2							28.3	455	
Wolf Creek Lake	04/22/1991			8.1								533	
Wolf Creek Lake	06/18/1991			8.2				1.05			27.9	512	
Wolf Creek Lake	08/26/1991							1.08			27.2	503	74.6
Wolf Creek Lake	10/21/1991			8.1				1.63			35.2	522	
Wolf Creek Lake	12/16/1991			8.1				1.06			34.9	518	
Wolf Creek Lake	02/17/1992			8.0							35.5	517	
Wolf Creek Lake	04/27/1992			8.2							32.0	540	76.8
Wolf Creek Lake	06/22/1992			8.3								580	
Wolf Creek Lake	08/24/1992			8.1				1.28			35.0	527	88.6
Wolf Creek Lake	10/19/1992			8.0							34.6	527	76.8
Wolf Creek Lake	12/21/1992			7.9				1.08			30.5	467	91.8
Wolf Creek Lake	02/22/1993			8.1				1.32			30.4	482	84.0
Wolf Creek Lake	04/04/1993			7.8				1.05			30.7	515	88.5
Wolf Creek Lake	06/22/1993			8.0							31.7	527	79.2
Wolf Creek Lake	08/24/1993			8.2				1.28			28.7	447	70.2

SITE_LOCT	COL_DATE	TEMP_CENT	THALLIUM		TDS	TOTHARD	PHOSPHU		TSS		TURBIDITY	VANADIUM		ZINC
Wolf Creek Lake	11/23/1987				241						5.2			
Wolf Creek Lake	12/28/1987										4.8			
Wolf Creek Lake	02/22/1988				274						4.2			
Wolf Creek Lake	04/26/1988				244						4.2			
Wolf Creek Lake	06/21/1988				307						2.0			
Wolf Creek Lake	08/29/1988				293						2.5			
Wolf Creek Lake	10/24/1988				293						2.7			
Wolf Creek Lake	12/19/1988				287						2.0			
Wolf Creek Lake	02/20/1989				297						1.8			
Wolf Creek Lake	04/24/1989				297						1.5			
Wolf Creek Lake	06/19/1989				319						1.7			
Wolf Creek Lake	08/21/1989				348									
Wolf Creek Lake	10/23/1989				286									
Wolf Creek Lake	12/18/1989				215									
Wolf Creek Lake	02/19/1990				294						4.7			
Wolf Creek Lake	04/23/1990				307						1.8			
Wolf Creek Lake	06/18/1990				329						3.9			
Wolf Creek Lake	08/22/1990				313						3.5			
Wolf Creek Lake	10/22/1990				315						6.3			
Wolf Creek Lake	12/17/1990				326						3.9			
Wolf Creek Lake	02/18/1991				308						2.7			
Wolf Creek Lake	04/22/1991				357						5.6			
Wolf Creek Lake	06/18/1991				331						6.3			
Wolf Creek Lake	08/26/1991				215						2.4			
Wolf Creek Lake	10/21/1991				339						3.4			
Wolf Creek Lake	12/16/1991				334						3.8			
Wolf Creek Lake	02/17/1992				311						3.3			
Wolf Creek Lake	04/27/1992				323						3.8			
Wolf Creek Lake	06/22/1992				330						3.9			
Wolf Creek Lake	08/24/1992				341						4.8			
Wolf Creek Lake	10/19/1992				331						2.6			
Wolf Creek Lake	12/21/1992				324						6.0			
Wolf Creek Lake	02/22/1993				329						3.6			
Wolf Creek Lake	04/04/1993				317						5.7			
Wolf Creek Lake	06/22/1993				309						1.8			
Wolf Creek Lake	08/24/1993				323						4.0			

SITE_LOCT	COL_DATE		TOC	KJELDAHL	STRONTIUM	CHLOROPH	
Wolf Creek Lake	11/23/1987						
Wolf Creek Lake	12/28/1987						
Wolf Creek Lake	02/22/1988						
Wolf Creek Lake	04/26/1988						
Wolf Creek Lake	06/21/1988						
Wolf Creek Lake	08/29/1988						
Wolf Creek Lake	10/24/1988						
Wolf Creek Lake	12/19/1988						
Wolf Creek Lake	02/20/1989						
Wolf Creek Lake	04/24/1989						
Wolf Creek Lake	06/19/1989						
Wolf Creek Lake	08/21/1989						
Wolf Creek Lake	10/23/1989						
Wolf Creek Lake	12/18/1989						
Wolf Creek Lake	02/19/1990						
Wolf Creek Lake	04/23/1990						
Wolf Creek Lake	06/18/1990						
Wolf Creek Lake	08/22/1990						
Wolf Creek Lake	10/22/1990						
Wolf Creek Lake	12/17/1990						
Wolf Creek Lake	02/18/1991						
Wolf Creek Lake	04/22/1991						
Wolf Creek Lake	06/18/1991						
Wolf Creek Lake	08/26/1991						
Wolf Creek Lake	10/21/1991						
Wolf Creek Lake	12/16/1991						
Wolf Creek Lake	02/17/1992						
Wolf Creek Lake	04/27/1992						
Wolf Creek Lake	06/22/1992						
Wolf Creek Lake	08/24/1992						
Wolf Creek Lake	10/19/1992						
Wolf Creek Lake	12/21/1992						
Wolf Creek Lake	02/22/1993						
Wolf Creek Lake	04/04/1993						
Wolf Creek Lake	06/22/1993						
Wolf Creek Lake	08/24/1993						

SITE_LOCT	COL_DATE	ALKALINTY	ALUMINUM	AMMONIA		ANTIMONY		ARSENIC		BARIUM	BERYLLIUM		BORON	BROMIDE
Wolf Creek Lake	10/19/1993	137												
Wolf Creek Lake	12/15/1993	141												
Outfall 004-1994	yealy average													
Wolf Creek Lake	03/14/1995	151												
Wolf Creek Lake	04/28/1995	152												
Wolf Creek Lake	06/23/1995	143												
Wolf Creek Lake	08/25/1995	143												
Wolf Creek Lake	10/18/1995	153												
Wolf Creek Lake	12/13/1995	158												
Outfall 004-1996	yealy average													
Outfall 004-1997	yealy average													
Outfall 004-1998	yealy average													
Outfall 004-1999	yealy average													
Outfall 004	11/17/2000	160				0.010	<	0.002	<	0.15	0.005	<	0.22	
Outfall 004-2000	yealy average													
Outfall 004	04/23/2001	168		0.2		0.010	<	0.002	<	0.16	0.005	<	0.24	
Outfall 004-2001	yealy average													
Outfall 004	06/13/2002	150		0.2	<	0.010	<	0.005	<	0.17	0.001	<	0.27	
Outfall 004	05/20/2003	198				0.006	<	0.010	<	0.18	0.004	<	0.20	
Outfall 004	06/29/2004	190		0.1	<	0.006	<	0.010	<	0.16	0.004	<	0.30	
Outfall 004	07/11/2005	160		0.1	<	0.006	<	0.005	<		0.004	<		
Coffey County Lake	09/02/2005	154	0.22	0.1	<	0.050	<	0.003		0.16	0.001	<	0.32	1.46
Outfall 004-2005	yealy average													
Outfall 004	06/13/2006	198				0.006	<	0.005	<		0.004	<		
Coffey County Lake	09/13/2006	164	0.22	0.1	<	0.050	<	0.005		0.16	0.001	<	0.35	1.61
Outfall 004-2006	yealy average													

SITE_LOCT	COL_DATE	CADMIUM		CALCIUM	CHLORIDE	CHROMIUM		COBALT		COPPER		FLUORIDE	IRON	LEAD	
Wolf Creek Lake	10/19/1993			35.3	20.8										
Wolf Creek Lake	12/15/1993			38.7	20.2										
Outfall 004-1994	yealy average				21.4										
Wolf Creek Lake	03/14/1995			46.1	25.3										
Wolf Creek Lake	04/28/1995			48.3	20.8										
Wolf Creek Lake	06/23/1995			47.4	22.4										
Wolf Creek Lake	08/25/1995			46.6	25.3										
Wolf Creek Lake	10/18/1995			48.1	24.4										
Wolf Creek Lake	12/13/1995			59.3	23.4										
Outfall 004-1996	yealy average				25.3										
Outfall 004-1997	yealy average				26.6										
Outfall 004-1998	yealy average				25.0										
Outfall 004-1999	yealy average				25.4										
Outfall 004	11/17/2000	0.005	<			0.010	<			0.010	<			0.001	<
Outfall 004-2000	yealy average				25.1										
Outfall 004	04/23/2001	0.005	<			0.010	<			0.010	<			0.003	<
Outfall 004-2001	yealy average				30.0										
Outfall 004	06/13/2002	0.005	<		34.5	0.007	<			0.010	<			0.005	<
Outfall 004	05/20/2003	0.001	<		31.7	0.010	<			0.010	<			0.003	<
Outfall 004	06/29/2004	0.001	<		36.0	0.010	<			0.020	<			0.003	<
Outfall 004	07/11/2005	0.001	<		34.6	0.01	<			0.020	<			0.003	<
Coffey County Lake	09/02/2005	0.001	<	46.1	40.6	0.001	<	0.01	<	0.002		0.94	0.176	0.001	<
Outfall 004-2005	yealy average				31.9										
Outfall 004	06/13/2006	0.001	<		40.0	0.010	<			0.020	<			0.003	<
Coffey County Lake	09/13/2006	0.001	<	44.6	37.1	0.001	<	0.01	<	0.001		0.79	0.171	0.001	<
Outfall 004-2006	yealy average				36.3										

SITE_LOCT	COL_DATE	MAGNESIUM	MANGANESE	MERCURY		MOLYBDENM		NICKEL		NITRATE		NITRITE	
Wolf Creek Lake	10/19/1993	13.5											
Wolf Creek Lake	12/15/1993	14.8											
Outfall 004-1994	yealy average												
Wolf Creek Lake	03/14/1995	18.1											
Wolf Creek Lake	04/28/1995	18.8											
Wolf Creek Lake	06/23/1995	17.0											
Wolf Creek Lake	08/25/1995	17.9											
Wolf Creek Lake	10/18/1995	19.0											
Wolf Creek Lake	12/13/1995	21.8											
Outfall 004-1996	yealy average												
Outfall 004-1997	yealy average												
Outfall 004-1998	yealy average												
Outfall 004-1999	yealy average												
Outfall 004	11/17/2000			0.0002	<			0.010	<				
Outfall 004-2000	yealy average												
Outfall 004	04/23/2001			0.0002	<			0.010	<				
Outfall 004-2001	yealy average												
Outfall 004	06/13/2002			0.0002	<			0.030	<				
Outfall 004	05/20/2003			0.0002	<								
Outfall 004	06/29/2004			0.0002	<			0.040	<	0.1			
Outfall 004	07/11/2005			0.0002	<			0.040	<	0.1	<		
Coffey County Lake	09/02/2005	23.2	0.025	0.0005	<	0.02	<	0.002		0.1	<	0.05	<
Outfall 004-2005	yealy average												
Outfall 004	06/13/2006			0.0002	<			0.040	<				
Coffey County Lake	09/13/2006	26.5	0.026	0.0005	<	0.02	<	0.003		0.1	<	0.05	<
Outfall 004-2006	yealy average												

SITE_LOCT	COL_DATE	ORTH_PHOS		PH	POTASSIUM	SELENIUM		SILICA	SILVER		SODIUM	SPEC_COND	SULFATE
Wolf Creek Lake	10/19/1993			8.0							26.4	433	64.8
Wolf Creek Lake	12/15/1993			7.8				1.08			29.9	377	66.7
Outfall 004-1994	yealy average			8.4									69.3
Wolf Creek Lake	03/14/1995			8.4							38.1	500	83.7
Wolf Creek Lake	04/28/1995			8.4							37.0	500	89.1
Wolf Creek Lake	06/23/1995			8.6							36.1	550	81.7
Wolf Creek Lake	08/25/1995			8.5				1.40			38.1	550	74.6
Wolf Creek Lake	10/18/1995			8.5				1.97			38.9	600	90.4
Wolf Creek Lake	12/13/1995			8.3				1.87			43.6	475	88.0
Outfall 004-1996	yealy average			8.3									88.5
Outfall 004-1997	yealy average			8.4									102
Outfall 004-1998	yealy average			8.3									107
Outfall 004-1999	yealy average			8.3									99.6
Outfall 004	11/17/2000					0.002	<		0.010	<		575	
Outfall 004-2000	yealy average			8.4									107
Outfall 004	04/23/2001					0.002	<		0.010	<		550	
Outfall 004-2001	yealy average			8.0									122
Outfall 004	06/13/2002			8.6		0.005	<		0.007	<		708	
Outfall 004	05/20/2003			8.4		0.005	<		0.002	<		691	
Outfall 004	06/29/2004					0.005	<		0.002	<		724	
Outfall 004	07/11/2005			8.5		0.005	<		0.002	<		797	132
Coffey County Lake	09/02/2005	0.25	<	8.0	5.868	0.003		3.74	0.001	<	57.9	658	164
Outfall 004-2005	yealy average			8.4									116
Outfall 004	06/13/2006			8.6		0.005	<		0.002	<		580	147
Coffey County Lake	09/13/2006	0.25	<	8.2	6.502	0.011		3.60	0.001	<	66.5	725	135
Outfall 004-2006	yealy average			8.4									131

SITE_LOCT	COL_DATE	TEMP_CENT	THALLIUM		TDS	TOTHARD	PHOSPHU		TSS		TURBIDITY	VANADIUM		ZINC
Wolf Creek Lake	10/19/1993				232						3.3			
Wolf Creek Lake	12/15/1993				290						7.5			
Outfall 004-1994	yealy average													
Wolf Creek Lake	03/14/1995				324						3.5			
Wolf Creek Lake	04/28/1995				335						6.1			
Wolf Creek Lake	06/23/1995				307						2.7			
Wolf Creek Lake	08/25/1995				328						5.7			
Wolf Creek Lake	10/18/1995				300						5.0			
Wolf Creek Lake	12/13/1995				296						6.5			
Outfall 004-1996	yealy average													
Outfall 004-1997	yealy average													
Outfall 004-1998	yealy average													
Outfall 004-1999	yealy average													
Outfall 004	11/17/2000		0.010	<		212								0.012
Outfall 004-2000	yealy average													
Outfall 004	04/23/2001		0.010	<		230								0.010
Outfall 004-2001	yealy average													
Outfall 004	06/13/2002		0.011			245								
Outfall 004	05/20/2003		0.002	<		276								0.025
Outfall 004	06/29/2004		0.002	<		280								0.020
Outfall 004	07/11/2005	24	0.002	<		228								
Coffey County Lake	09/02/2005		0.050	<	434	210	0.020	<	10	<	5.9	0.005	<	0.01
Outfall 004-2005	yealy average													
Outfall 004	06/13/2006	27	0.002	<		235								0.012
Coffey County Lake	09/13/2006		0.050	<	418	220	0.021		10		4.3	0.005	<	0.005
Outfall 004-2006	yealy average													

SITE_LOCT	COL_DATE		TOC	KJELDAHL	STRONTIUM	CHLOROPH	DEPTH
Wolf Creek Lake	10/19/1993						
Wolf Creek Lake	12/15/1993						
Outfall 004-1994	yealy average						
Wolf Creek Lake	03/14/1995						
Wolf Creek Lake	04/28/1995						
Wolf Creek Lake	06/23/1995						
Wolf Creek Lake	08/25/1995						
Wolf Creek Lake	10/18/1995						
Wolf Creek Lake	12/13/1995						
Outfall 004-1996	yealy average						
Outfall 004-1997	yealy average						
Outfall 004-1998	yealy average						
Outfall 004-1999	yealy average						
Outfall 004	11/17/2000						
Outfall 004-2000	yealy average						
Outfall 004	04/23/2001	<					
Outfall 004-2001	yealy average						
Outfall 004	06/13/2002						
Outfall 004	05/20/2003						
Outfall 004	06/29/2004	<	7.4				
Outfall 004	07/11/2005						
Coffey County Lake	09/02/2005		9.4	0.519	0.698	8.7	
Outfall 004-2005	yealy average						
Outfall 004	06/13/2006						
Coffey County Lake	09/13/2006	<	7.6	0.728	0.779	6.0	
Outfall 004-2006	yealy average						

SITE_LOCT - D	COL_DATE	COL_TIME	ALKALINTY	ALUMINUM	AMMONIA		ANTIMONY		ARSENIC		BARIUM		BERYLLIUM		BOD		BORON	
HIGHWAY 57, 1	11/06/1985 0:00	1157	118		0.06										1.2		0.03	
HIGHWAY 57, 1	12/04/1985 0:00	1305	170		0.30										1.5		0.10	
HIGHWAY 57, 1	01/08/1986 0:00	1055	202		0.03										7.2		0.09	
HIGHWAY 57, 1	02/05/1986 0:00	1205	189												3.9		0.04	
HIGHWAY 57, 1	03/05/1986 0:00	1125	167												5.4		0.02	
HIGHWAY 57, 1	04/09/1986 0:00	1207	161		0.07				0.002		0.160				5.1		0.11	
HIGHWAY 57, 1	05/07/1986 0:00	1120	188		0.01	<									3.6		0.03	
HIGHWAY 57, 1	06/04/1986 0:00	1245	152		0.01	<									2.1		0.10	
HIGHWAY 57, 1	07/09/1986 0:00	1200	128		0.01	<									6.3		0.03	
HIGHWAY 57, 1	08/06/1986 0:00	1155	134		0.01	<									2.7		0.14	
HIGHWAY 57, 1	09/10/1986 0:00	1200	149		0.01	<									2.1		0.04	
HIGHWAY 57, 1	10/22/1986 0:00	1245	105		0.01	<									1.8		0.01	<
HIGHWAY 57, 1	11/05/1986 0:00	1145	170		0.05										3.3		0.03	
HIGHWAY 57, 1	12/10/1986 0:00	1140	209		0.01	<									3.9		0.02	
HIGHWAY 57, 1	01/14/1987 0:00	1145	189		0.02										3.9		0.06	
HIGHWAY 57, 1	02/03/1987 0:00	1140	220		0.02										3.3		0.06	
HIGHWAY 57, 1	03/11/1987 0:00	1142	108		0.03										3.0		0.13	
HIGHWAY 57, 1	04/15/1987 0:00	1450	85		0.01	<									5.4		0.11	
HIGHWAY 57, 1	05/13/1987 0:00	1215	201		0.01	<									3.0		0.10	
HIGHWAY 57, 1	06/10/1987 0:00	1145	145		0.01	<			0.002		0.130				3.9		0.10	
HIGHWAY 57, 1	07/15/1987 0:00	1125	110		0.01	<									5.7		0.06	
HIGHWAY 57, 1	08/12/1987 0:00	1142	145		0.01	<									3.3		0.09	
HIGHWAY 57, 1	09/09/1987 0:00	1215	126		0.01	<									3.3		0.09	
HIGHWAY 57, 1	10/14/1987 0:00	1140	159		0.01	<									2.2		0.12	
HIGHWAY 57, 1	11/04/1987 0:00	1205	158		0.02										4.8		0.14	
HIGHWAY 57, 1	12/09/1987 0:00	1155	163		0.01	<											0.06	
HIGHWAY 57, 1	01/13/1988 0:00	1245	164		0.03										1.5		0.10	
HIGHWAY 57, 1	02/10/1988 0:00	1205	187		0.01	<									4.8		0.01	<
HIGHWAY 57, 1	03/09/1988 0:00	1145	170		0.01	<									4.8		0.06	
HIGHWAY 57, 1	04/13/1988 0:00	1107	116		0.11										2.1		0.10	
HIGHWAY 57, 1	05/18/1988 0:00	1225	196		0.01	<			0.007		0.140				5.4		0.11	
HIGHWAY 57, 1	06/15/1988 0:00	1200	182		0.03										4.2		0.10	
HIGHWAY 57, 1	07/13/1988 0:00	1203	160		0.01	<									3.0		0.07	
HIGHWAY 57, 1	08/10/1988 0:00	1154	157		0.28										3.0		0.04	
HIGHWAY 57, 1	09/14/1988 0:00	1155	157		0.01	<									2.1		0.06	
HIGHWAY 57, 1	10/12/1988 0:00	1130	160		0.04										3.3		0.09	
HIGHWAY 57, 1	11/08/1988 0:00	1120	162		0.05										3.0		0.17	
HIGHWAY 57, 1	12/07/1988 0:00	1145	148		0.01	<									3.0		0.12	
HIGHWAY 57, 1	01/11/1989 0:00	1155	161		0.06										3.0		0.10	
HIGHWAY 57, 1	03/15/1989 0:00	1124	172		0.04										4.8		0.05	
HIGHWAY 57, 1	04/05/1989 0:00	1100	144		0.11				0.001	<	0.150				3.7		0.19	
HIGHWAY 57, 1	05/10/1989 0:00	1200	196		0.04										2.6		0.21	
HIGHWAY 57, 1	06/14/1989 0:00	1220	149		0.02										2.9		0.10	
HIGHWAY 57, 1	07/12/1989 0:00	1240	57		0.04										5.4		0.13	
HIGHWAY 57, 1	08/16/1989 0:00	1301	120		0.01	<									2.1		0.16	
HIGHWAY 57, 1	09/13/1989 0:00	1222	104		0.02										3.9		0.14	

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	BROMIDE		CADMIUM		CALCIUM	CHLORIDE	CHROMIUM		COBALT		COPPER		DISOXY		FLUORIDE	
HIGHWAY 57, 1	11/06/1985 0:00	1157					45.0	6.1							9.7			
HIGHWAY 57, 1	12/04/1985 0:00	1305					63.0	9.7							13.8			
HIGHWAY 57, 1	01/08/1986 0:00	1055					79.5	13.0							14.1			
HIGHWAY 57, 1	02/05/1986 0:00	1205					77.0	14.0							13.1			
HIGHWAY 57, 1	03/05/1986 0:00	1125					63.5	15.0							14.5			
HIGHWAY 57, 1	04/09/1986 0:00	1207			0.002		65.0	13.0	0.010				0.010	<	9.2			
HIGHWAY 57, 1	05/07/1986 0:00	1120					69.5	12.0							9.1			
HIGHWAY 57, 1	06/04/1986 0:00	1245					60.5	8.7							7.9			
HIGHWAY 57, 1	07/09/1986 0:00	1200					52.5	11.0							8.9			
HIGHWAY 57, 1	08/06/1986 0:00	1155					56.0	8.5							5.4			
HIGHWAY 57, 1	09/10/1986 0:00	1200					58.5	13.0							8.5			
HIGHWAY 57, 1	10/22/1986 0:00	1245					39.5	5.3							9.5			
HIGHWAY 57, 1	11/05/1986 0:00	1145					65.0	7.7							10.3			
HIGHWAY 57, 1	12/10/1986 0:00	1140					80.5	12.0							13.5			
HIGHWAY 57, 1	01/14/1987 0:00	1145					74.0	15.0							14.4			
HIGHWAY 57, 1	02/03/1987 0:00	1140					85.0	16.0							12.9			
HIGHWAY 57, 1	03/11/1987 0:00	1142					43.5	6.6							11.4			
HIGHWAY 57, 1	04/15/1987 0:00	1450					36.5	4.6							9.2			
HIGHWAY 57, 1	05/13/1987 0:00	1215					77.5	11.0							8.1			
HIGHWAY 57, 1	06/10/1987 0:00	1145			0.001		57.5	9.8	0.010	<			0.010	<	6.7			
HIGHWAY 57, 1	07/15/1987 0:00	1125					46.5	7.2							7.0			
HIGHWAY 57, 1	08/12/1987 0:00	1142					52.5	9.9							6.3			
HIGHWAY 57, 1	09/09/1987 0:00	1215					51.0	11.2										
HIGHWAY 57, 1	10/14/1987 0:00	1140					61.0	12.9							10.1			
HIGHWAY 57, 1	11/04/1987 0:00	1205					59.5	12.0							10.4			
HIGHWAY 57, 1	12/09/1987 0:00	1155					69.5	14.2							12.9			
HIGHWAY 57, 1	01/13/1988 0:00	1245					63.0	12.4							13.2			
HIGHWAY 57, 1	02/10/1988 0:00	1205					75.0	12.0							14.5			
HIGHWAY 57, 1	03/09/1988 0:00	1145					68.0	13.2							11.2			
HIGHWAY 57, 1	04/13/1988 0:00	1107					47.0	7.3							10.1			
HIGHWAY 57, 1	05/18/1988 0:00	1225			0.001	<	66.0	12.3	0.010	<			0.010	<	10.1			
HIGHWAY 57, 1	06/15/1988 0:00	1200					66.5	13.9							6.2			
HIGHWAY 57, 1	07/13/1988 0:00	1203					59.0	13.1							7.1			
HIGHWAY 57, 1	08/10/1988 0:00	1154					55.5	14.8							6.5			
HIGHWAY 57, 1	09/14/1988 0:00	1155					59.0	18.9							14.6			
HIGHWAY 57, 1	10/12/1988 0:00	1130					60.5	18.7							9.4			
HIGHWAY 57, 1	11/08/1988 0:00	1120					62.5	20.2							8.6			
HIGHWAY 57, 1	12/07/1988 0:00	1145					56.0	18.4							11.4			
HIGHWAY 57, 1	01/11/1989 0:00	1155					72.0	22.1							12.0			
HIGHWAY 57, 1	03/15/1989 0:00	1124					71.5	25.4							10.2			
HIGHWAY 57, 1	04/05/1989 0:00	1100			0.001	<	60.0	15.4	0.010	<			0.010	<	7.8			
HIGHWAY 57, 1	05/10/1989 0:00	1200					81.5	34.4							7.7			
HIGHWAY 57, 1	06/14/1989 0:00	1220					72.0	30.4							8.1			
HIGHWAY 57, 1	07/12/1989 0:00	1240					28.0	8.1							5.7			
HIGHWAY 57, 1	08/16/1989 0:00	1301					46.5	11.3							7.4			
HIGHWAY 57, 1	09/13/1989 0:00	1222					37.5	5.9							8.1			

SITE_LOCT - D	COL_DATE	COL_TIME	IRON		LEAD		MAGNESIUM	MANGANESE	MERCURY		MOLYBDENM		NICKEL		NITRATE		NITRITE	
HIGHWAY 57, 1	11/06/1985 0:00	1157					8.0											
HIGHWAY 57, 1	12/04/1985 0:00	1305					12.4											
HIGHWAY 57, 1	01/08/1986 0:00	1055					16.7											
HIGHWAY 57, 1	02/05/1986 0:00	1205					18.6											
HIGHWAY 57, 1	03/05/1986 0:00	1125					17.4											
HIGHWAY 57, 1	04/09/1986 0:00	1207	2.14		0.002		16.35	0.13	0.0005	<								
HIGHWAY 57, 1	05/07/1986 0:00	1120					16.9											
HIGHWAY 57, 1	06/04/1986 0:00	1245					12.5											
HIGHWAY 57, 1	07/09/1986 0:00	1200					12.8											
HIGHWAY 57, 1	08/06/1986 0:00	1155					12.1											
HIGHWAY 57, 1	09/10/1986 0:00	1200					12.8											
HIGHWAY 57, 1	10/22/1986 0:00	1245					7.3											
HIGHWAY 57, 1	11/05/1986 0:00	1145					11.7											
HIGHWAY 57, 1	12/10/1986 0:00	1140					16.4											
HIGHWAY 57, 1	01/14/1987 0:00	1145					20.2											
HIGHWAY 57, 1	02/03/1987 0:00	1140					22.4											
HIGHWAY 57, 1	03/11/1987 0:00	1142					8.4											
HIGHWAY 57, 1	04/15/1987 0:00	1450					7.1											
HIGHWAY 57, 1	05/13/1987 0:00	1215					16.9											
HIGHWAY 57, 1	06/10/1987 0:00	1145	2.54		0.001	<	13.5	0.15	0.0005	<								
HIGHWAY 57, 1	07/15/1987 0:00	1125					10.1											
HIGHWAY 57, 1	08/12/1987 0:00	1142					12.9											
HIGHWAY 57, 1	09/09/1987 0:00	1215					12.1											
HIGHWAY 57, 1	10/14/1987 0:00	1140					13.0											
HIGHWAY 57, 1	11/04/1987 0:00	1205					13.8											
HIGHWAY 57, 1	12/09/1987 0:00	1155					15.6											
HIGHWAY 57, 1	01/13/1988 0:00	1245					13.7											
HIGHWAY 57, 1	02/10/1988 0:00	1205					16.8											
HIGHWAY 57, 1	03/09/1988 0:00	1145					16.8											
HIGHWAY 57, 1	04/13/1988 0:00	1107					10.2											
HIGHWAY 57, 1	05/18/1988 0:00	1225	0.69		0.001	<	17.7	0.18	0.0005	<								
HIGHWAY 57, 1	06/15/1988 0:00	1200					19.4											
HIGHWAY 57, 1	07/13/1988 0:00	1203					17.4											
HIGHWAY 57, 1	08/10/1988 0:00	1154					17.9											
HIGHWAY 57, 1	09/14/1988 0:00	1155					18.9											
HIGHWAY 57, 1	10/12/1988 0:00	1130					18.1											
HIGHWAY 57, 1	11/08/1988 0:00	1120					18.1											
HIGHWAY 57, 1	12/07/1988 0:00	1145					15.2											
HIGHWAY 57, 1	01/11/1989 0:00	1155					19.4											
HIGHWAY 57, 1	03/15/1989 0:00	1124					19.8											
HIGHWAY 57, 1	04/05/1989 0:00	1100	1.25		0.001	<	13.0	0.23	0.0005	<								
HIGHWAY 57, 1	05/10/1989 0:00	1200					23.0											
HIGHWAY 57, 1	06/14/1989 0:00	1220					20.9											
HIGHWAY 57, 1	07/12/1989 0:00	1240					5.3											
HIGHWAY 57, 1	08/16/1989 0:00	1301					11.4											
HIGHWAY 57, 1	09/13/1989 0:00	1222					6.8											

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	NO2_NO3		ORTH_PHOS		PHFIELD	POTASSIUM	SELENIUM		SILICA		SILVER		SODIUM	SPEC_COND	SULFATE
HIGHWAY 57,	11/06/1985 0:00	1157	0.55					4.20			15.2				5.8	313	26.0
HIGHWAY 57,	12/04/1985 0:00	1305	0.88					3.70			13.1				10.2	417	42.0
HIGHWAY 57,	01/08/1986 0:00	1055	1.00					2.80			8.0				13.8	542	59.0
HIGHWAY 57,	02/05/1986 0:00	1205	0.49					2.50			3.3				16.0	533	72.0
HIGHWAY 57,	03/05/1986 0:00	1125	0.07					2.90			1.4				16.2	480	67.0
HIGHWAY 57,	04/09/1986 0:00	1207	0.44				8.0	2.90	0.001		3.3		0.009		16.0	475	62.0
HIGHWAY 57,	05/07/1986 0:00	1120	0.13				8.3	2.90			2.2				15.5	462	54.0
HIGHWAY 57,	06/04/1986 0:00	1245	1.10				8.0	3.90			10.8				11.5	371	35.0
HIGHWAY 57,	07/09/1986 0:00	1200	0.81					3.80			7.3				12.0	377	51.0
HIGHWAY 57,	08/06/1986 0:00	1155	0.74				8.1	4.70			15.8				10.6	364	45.0
HIGHWAY 57,	09/10/1986 0:00	1200	0.64					4.10			7.8				12.7	411	45.0
HIGHWAY 57,	10/22/1986 0:00	1245	0.43				7.6	5.50			24.9				5.7	258	23.0
HIGHWAY 57,	11/05/1986 0:00	1145	0.48				8.2	5.30			13.9				9.8	413	32.0
HIGHWAY 57,	12/10/1986 0:00	1140	0.45				8.8	3.80			6.6				13.6	536	52.0
HIGHWAY 57,	01/14/1987 0:00	1145	0.01	<			8.5	3.30			0.1	<			17.1	505	83.0
HIGHWAY 57,	02/03/1987 0:00	1140	0.17				8.5	2.70			1.3				18.0	550	75.0
HIGHWAY 57,	03/11/1987 0:00	1142	0.79				8.1	4.10			18.9				5.9	291	25.0
HIGHWAY 57,	04/15/1987 0:00	1450	0.80				7.8	3.00			20.4				8.8	251	38.0
HIGHWAY 57,	05/13/1987 0:00	1215	0.70				8.2	3.10			3.6				13.4	477	52.0
HIGHWAY 57,	06/10/1987 0:00	1145	1.10				8.2	3.70	0.001	<	4.8		0.001	<	12.1	425	32.0
HIGHWAY 57,	07/15/1987 0:00	1125	1.10				8.1	4.10			17.3				8.6	325	33.0
HIGHWAY 57,	08/12/1987 0:00	1142	0.80				8.2	4.10			8.8				12.2	415	59.0
HIGHWAY 57,	09/09/1987 0:00	1215	0.89				8.2	4.10			13.3				11.5	380	39.0
HIGHWAY 57,	10/14/1987 0:00	1140	0.93					4.30			7.2				13.2	440	53.0
HIGHWAY 57,	11/04/1987 0:00	1205	0.29				8.2	4.20			4.2				14.3	459	57.0
HIGHWAY 57,	12/09/1987 0:00	1155	0.16				8.9	4.20			0.1	<			15.3	486	68.0
HIGHWAY 57,	01/13/1988 0:00	1245	0.27				8.3	3.70			5.7				13.9	459	56.0
HIGHWAY 57,	02/10/1988 0:00	1205	0.32				8.6	2.80			0.6				14.8	525	65.0
HIGHWAY 57,	03/09/1988 0:00	1145	0.03				8.2	2.80			0.4				16.4	499	71.0
HIGHWAY 57,	04/13/1988 0:00	1107	0.62				8.0	3.50			16.9				9.5	345	39.0
HIGHWAY 57,	05/18/1988 0:00	1225	0.01	<			8.5	3.10	0.001	<	1.4		0.001		15.1	520	61.0
HIGHWAY 57,	06/15/1988 0:00	1200	0.01	<			8.2	3.30			0.1	<			16.8	529	71.0
HIGHWAY 57,	07/13/1988 0:00	1203	0.45				8.2	3.40			2.5				16.4	485	75.0
HIGHWAY 57,	08/10/1988 0:00	1154	0.01	<			8.2	3.40			0.1	<			18.0	496	72.0
HIGHWAY 57,	09/14/1988 0:00	1155	0.02				8.0	3.90			1.4				20.5	516	82.0
HIGHWAY 57,	10/12/1988 0:00	1130	0.01	<			8.3	3.80			2.6				21.0	531	80.0
HIGHWAY 57,	11/08/1988 0:00	1120	0.01	<			8.1	4.20			0.6				21.8	547	83.0
HIGHWAY 57,	12/07/1988 0:00	1145	0.20				8.2	3.70			0.6				20.9	518	79.0
HIGHWAY 57,	01/11/1989 0:00	1155	0.01	<			8.0	3.50			0.1	<			24.4	577	88.0
HIGHWAY 57,	03/15/1989 0:00	1124	0.05				8.2	3.50			0.5				28.9	621	113
HIGHWAY 57,	04/05/1989 0:00	1100	0.31				8.0	4.20	0.001	<	11.9		0.001	<	21.4	473	74.0
HIGHWAY 57,	05/10/1989 0:00	1200	0.01	<			7.9	4.20			3.2				33.5	698	120
HIGHWAY 57,	06/14/1989 0:00	1220	0.01	<			8.5	4.30			0.1	<			30.1	637	127
HIGHWAY 57,	07/12/1989 0:00	1240	0.38				7.7	4.20			31.5				8.0	210	25.0
HIGHWAY 57,	08/16/1989 0:00	1301	0.01	<			8.3	3.90			5.7				13.3	366	52.0
HIGHWAY 57,	09/13/1989 0:00	1222	0.42				7.8	4.80			16.4				7.3	282	24.0

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	THALLIUM		TDS	TOTHARD	PHOSPHU	TSS	TURBIDITY	VANADIUM		ZINC		TOC	KJELDAHL		STRONTIUM
HIGHWAY 57, 1	11/06/1985 0:00	1157			184	145	0.17	24	21.0								
HIGHWAY 57, 1	12/04/1985 0:00	1305			260	208	0.13	18	16.0								
HIGHWAY 57, 1	01/08/1986 0:00	1055			320	267	0.47	8	5.4								
HIGHWAY 57, 1	02/05/1986 0:00	1205			319	269	0.01		8.9								
HIGHWAY 57, 1	03/05/1986 0:00	1125			284	230	0.07		33.0								
HIGHWAY 57, 1	04/09/1986 0:00	1207			278	229	0.09		43.0			0.010	<				
HIGHWAY 57, 1	05/07/1986 0:00	1120			287	243	0.03		29.0								
HIGHWAY 57, 1	06/04/1986 0:00	1245			239	202	0.10		38.0								
HIGHWAY 57, 1	07/09/1986 0:00	1200			231	184	0.15	176	83.0								
HIGHWAY 57, 1	08/06/1986 0:00	1155			236	189	0.11	56	38.0								
HIGHWAY 57, 1	09/10/1986 0:00	1200			246	199	0.12	32	29.0								
HIGHWAY 57, 1	10/22/1986 0:00	1245			177	129	0.27	44	41.0								
HIGHWAY 57, 1	11/05/1986 0:00	1145			251	210	0.18	23	17.0								
HIGHWAY 57, 1	12/10/1986 0:00	1140			313	268	0.16	64	27.0								
HIGHWAY 57, 1	01/14/1987 0:00	1145			326	268	0.08	38	14.0								
HIGHWAY 57, 1	02/03/1987 0:00	1140			353	304	0.05	21	5.6								
HIGHWAY 57, 1	03/11/1987 0:00	1142			181	143	0.14	52	75.5								
HIGHWAY 57, 1	04/15/1987 0:00	1450			174	120	0.40	256	142								
HIGHWAY 57, 1	05/13/1987 0:00	1215			302	263	0.10	40	20.0								
HIGHWAY 57, 1	06/10/1987 0:00	1145			226	199	0.14	60	35.0			0.010	<				
HIGHWAY 57, 1	07/15/1987 0:00	1125			199	158	0.19	88	80.0								
HIGHWAY 57, 1	08/12/1987 0:00	1142			251	184	0.15	50	26.0								
HIGHWAY 57, 1	09/09/1987 0:00	1215			223	177	0.10	30	36.0								
HIGHWAY 57, 1	10/14/1987 0:00	1140			265	206	0.11	28	15.0								
HIGHWAY 57, 1	11/04/1987 0:00	1205			262	205	0.09	19	8.8								
HIGHWAY 57, 1	12/09/1987 0:00	1155			286	238	0.09	37	16.0								
HIGHWAY 57, 1	01/13/1988 0:00	1245			268	213	0.10	20	9.6								
HIGHWAY 57, 1	02/10/1988 0:00	1205			301	256	0.13	31	11.0								
HIGHWAY 57, 1	03/09/1988 0:00	1145			291	239	0.10	76	36.0								
HIGHWAY 57, 1	04/13/1988 0:00	1107			206	159	0.25	75	71.0								
HIGHWAY 57, 1	05/18/1988 0:00	1225			295	237	0.06	35	14.0			0.050					
HIGHWAY 57, 1	06/15/1988 0:00	1200			300	246	0.08	49	20.0								
HIGHWAY 57, 1	07/13/1988 0:00	1203			285	219	0.17	88	37.0								
HIGHWAY 57, 1	08/10/1988 0:00	1154			276	212	0.09	32	16.9								
HIGHWAY 57, 1	09/14/1988 0:00	1155			299	225	0.08	38	19.0								
HIGHWAY 57, 1	10/12/1988 0:00	1130			301	225	0.03	18	9.3								
HIGHWAY 57, 1	11/08/1988 0:00	1120			308	230	0.06	10	5.0								
HIGHWAY 57, 1	12/07/1988 0:00	1145			284	202	0.14	19	8.7								
HIGHWAY 57, 1	01/11/1989 0:00	1155			326	259	0.05	13	3.5								
HIGHWAY 57, 1	03/15/1989 0:00	1124			366	260	0.16	21	9.3								
HIGHWAY 57, 1	04/05/1989 0:00	1100			287	203	0.03	40	29.0			0.020					
HIGHWAY 57, 1	05/10/1989 0:00	1200			417	298	0.07	21	10.0								
HIGHWAY 57, 1	06/14/1989 0:00	1220			374	266	0.11	86	27.9								
HIGHWAY 57, 1	07/12/1989 0:00	1240			150	92	1.31	1500	700								
HIGHWAY 57, 1	08/16/1989 0:00	1301			216	163	0.14	40	24.0								
HIGHWAY 57, 1	09/13/1989 0:00	1222			168	122	0.26	52	70.0								

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	
HIGHWAY 57, 1	11/06/1985 0:00	1157	
HIGHWAY 57, 1	12/04/1985 0:00	1305	
HIGHWAY 57, 1	01/08/1986 0:00	1055	
HIGHWAY 57, 1	02/05/1986 0:00	1205	
HIGHWAY 57, 1	03/05/1986 0:00	1125	
HIGHWAY 57, 1	04/09/1986 0:00	1207	
HIGHWAY 57, 1	05/07/1986 0:00	1120	
HIGHWAY 57, 1	06/04/1986 0:00	1245	
HIGHWAY 57, 1	07/09/1986 0:00	1200	
HIGHWAY 57, 1	08/06/1986 0:00	1155	
HIGHWAY 57, 1	09/10/1986 0:00	1200	
HIGHWAY 57, 1	10/22/1986 0:00	1245	
HIGHWAY 57, 1	11/05/1986 0:00	1145	
HIGHWAY 57, 1	12/10/1986 0:00	1140	
HIGHWAY 57, 1	01/14/1987 0:00	1145	
HIGHWAY 57, 1	02/03/1987 0:00	1140	
HIGHWAY 57, 1	03/11/1987 0:00	1142	
HIGHWAY 57, 1	04/15/1987 0:00	1450	
HIGHWAY 57, 1	05/13/1987 0:00	1215	
HIGHWAY 57, 1	06/10/1987 0:00	1145	
HIGHWAY 57, 1	07/15/1987 0:00	1125	
HIGHWAY 57, 1	08/12/1987 0:00	1142	
HIGHWAY 57, 1	09/09/1987 0:00	1215	
HIGHWAY 57, 1	10/14/1987 0:00	1140	
HIGHWAY 57, 1	11/04/1987 0:00	1205	
HIGHWAY 57, 1	12/09/1987 0:00	1155	
HIGHWAY 57, 1	01/13/1988 0:00	1245	
HIGHWAY 57, 1	02/10/1988 0:00	1205	
HIGHWAY 57, 1	03/09/1988 0:00	1145	
HIGHWAY 57, 1	04/13/1988 0:00	1107	
HIGHWAY 57, 1	05/18/1988 0:00	1225	
HIGHWAY 57, 1	06/15/1988 0:00	1200	
HIGHWAY 57, 1	07/13/1988 0:00	1203	
HIGHWAY 57, 1	08/10/1988 0:00	1154	
HIGHWAY 57, 1	09/14/1988 0:00	1155	
HIGHWAY 57, 1	10/12/1988 0:00	1130	
HIGHWAY 57, 1	11/08/1988 0:00	1120	
HIGHWAY 57, 1	12/07/1988 0:00	1145	
HIGHWAY 57, 1	01/11/1989 0:00	1155	
HIGHWAY 57, 1	03/15/1989 0:00	1124	
HIGHWAY 57, 1	04/05/1989 0:00	1100	
HIGHWAY 57, 1	05/10/1989 0:00	1200	
HIGHWAY 57, 1	06/14/1989 0:00	1220	
HIGHWAY 57, 1	07/12/1989 0:00	1240	
HIGHWAY 57, 1	08/16/1989 0:00	1301	
HIGHWAY 57, 1	09/13/1989 0:00	1222	

SITE_LOCT - D	COL_DATE	COL_TIME	ALKALINTY	ALUMINUM	AMMONIA		ANTIMONY		ARSENIC		BARIUM		BERYLLIUM		BOD		BORON	
HIGHWAY 57,	10/11/1989 0:00	1214	146		0.02										1.8		0.19	
HIGHWAY 57,	11/01/1989 0:00	1224	76		0.01	<									4.4		0.16	
HIGHWAY 57,	12/13/1989 0:00	1153	163		0.01	<									2.1		0.04	
HIGHWAY 57,	04/11/1990 0:00	1100	178	1.97	0.01	<			0.001	<	0.130		0.01	<	2.8		0.06	
HIGHWAY 57,	06/13/1990 0:00	1134	116	5.59			0.03	<	0.034		0.138		0.003	<	5.2		0.05	
HIGHWAY 57,	08/15/1990 0:00	1052	147	3.45	0.03		0.03	<	0.010	<	0.135		0.003	<	3.2		0.09	
HIGHWAY 57,	10/10/1990 0:00	1206	188	0.46	0.09		0.03	<	0.010	<	0.134		0.003	<	1.2		0.14	
HIGHWAY 57,	12/05/1990 0:00	1215	205	0.24			0.03	<	0.010	<	0.135		0.003	<	2.4		0.11	
HIGHWAY 57,	03/13/1991 0:00	1155	188	0.33	0.01		0.01	<	0.021	<	0.118		0.001	<	3.4		0.11	
HIGHWAY 57,	05/15/1991 0:00	1227	132	2.06	0.04		0.01	<	0.021	<	0.130		0.001	<	3.6		0.16	
HIGHWAY 57,	07/31/1991 0:00	1205	134	0.99			0.01	<	0.021	<	0.103		0.001	<	3.0		0.06	
HIGHWAY 57,	09/11/1991 0:00	1140	129	0.92			0.01	<	0.021	<	0.106		0.001	<	2.6		0.08	
HIGHWAY 57,	11/06/1991 0:00	1235	129	0.26			0.01	<	0.021	<	0.101		0.001	<	3.2		0.10	
HIGHWAY 57,	02/12/1992 0:00	1219	139	0.51			0.01	<	0.021	<	0.089		0.001	<	4.8		0.12	
HIGHWAY 57,	04/15/1992 0:00	1240	122	6.09	0.05	<	0.01	<	0.021	<	0.134		0.001	<	6.7		0.13	
HIGHWAY 57,	06/10/1992 0:00	1053	76	9.78	0.05	<	0.01	<	0.021	<	0.162		0.001	<	4.0		0.10	
HIGHWAY 57,	08/05/1992 0:00	1258	75	2.88	0.05	<	0.01	<	0.021	<	0.090		0.001	<	1.7		0.06	
HIGHWAY 57,	10/07/1992 0:00	1213	181	0.58	0.05	<	0.03		0.021	<	0.122		0.001	<	3.1		0.14	
HIGHWAY 57,	12/09/1992 0:00	1205	110	2.27	0.05	<	0.01	<	0.021	<	0.094		0.001	<	1.7		0.05	
HIGHWAY 57,	03/10/1993 0:00	1216	114	3.47	0.05	<	0.05	<	0.050	<	0.096		0.001	<	2.8		0.09	
HIGHWAY 57,	05/05/1993 0:00	1143	184	3.04	0.05	<	0.05	<	0.050	<	0.137		0.001	<	2.7		0.12	
HIGHWAY 57,	07/14/1993 0:00	1126	78	5.61	0.05	<	0.01	<	0.001		0.110		0.001	<	3.7		0.10	
HIGHWAY 57,	09/15/1993 0:00	1212	150	3.05	0.05	<	0.05	<	0.003		0.128		0.001	<	3.6		0.02	
HIGHWAY 57,	11/10/1993 0:00	1156	166	1.75	0.05	<	0.05	<	0.002		0.118		0.001	<	2.9		0.10	
HIGHWAY 57,	02/09/1994 0:00	1135	206	0.15	0.05	<	0.05	<	0.003		0.107		0.001	<	5.2		0.06	
HIGHWAY 57,	04/13/1994 0:00	1255	87	6.18	0.13		0.05	<	0.002		0.104		0.001	<	4.7		0.06	
HIGHWAY 57,	06/15/1994 0:00	1207	166	3.31	0.05	<	0.05	<	0.004		0.139		0.001	<	4.0		0.15	
HIGHWAY 57,	08/10/1994 0:00	1058	143	0.97	0.01	<	0.05	<	0.003		0.106		0.001	<	5.6		0.12	
HIGHWAY 57,	10/12/1994 0:00	1316	139	0.49	0.02		0.05	<	0.002		0.109		0.001	<	2.8		0.08	
HIGHWAY 57,	12/07/1994 0:00	1237	131	1.08	0.13		0.05	<	0.002		0.089		0.001	<	5.3		0.06	
HIGHWAY 57,	01/19/1995 0:00	1256	152	0.35	0.01	<	0.05	<	0.003		0.088		0.001	<	6.9		0.06	
HIGHWAY 57,	03/22/1995 0:00	1220	120	4.76	0.09		0.05	<	0.003		0.136		0.001	<	3.3		0.05	
HIGHWAY 57,	05/17/1995 0:00	1233	150	2.28	0.13		0.05	<	0.003		0.113		0.001	<	2.4		0.03	
HIGHWAY 57,	07/19/1995 0:00	1146	151	1.10	0.01		0.05	<	0.005		0.105		0.001	<	2.5		0.03	
HIGHWAY 57,	09/20/1995 0:00	1219	157	2.26	0.28		0.05	<	0.003		0.125		0.001	<	4.6		0.02	
HIGHWAY 57,	11/15/1995 0:00	1143	202	0.20	0.03		0.05	<	0.004		0.120		0.001	<	4.5		0.07	
HIGHWAY 57,	02/21/1996 0:00	1211	198	0.20	0.02		0.05	<	0.001		0.120		0.001	<	5.2		0.07	
HIGHWAY 57,	04/17/1996 0:00	1245	209	0.42	0.41		0.055		0.003		0.156		0.001	<	4.7		0.09	
HIGHWAY 57,	06/19/1996 0:00	1216	138	5.33	0.15		0.059		0.003		0.144		0.001	<	3.6		0.06	
HIGHWAY 57,	08/14/1996 0:00	1240	183	0.92	0.01	<	0.07		0.003		0.131		0.001	<	3.2		0.08	
HIGHWAY 57,	10/09/1996 0:00	1210	157	3.39	0.15		0.053		0.003		0.133		0.001	<	6.9		0.06	
HIGHWAY 57,	12/04/1996 0:00	1240	143	2.12	0.03		0.05	<	0.001	<	0.106		0.001	<	3.2		0.01	<
HIGHWAY 57,	01/08/1997 0:00	1245	239	0.97	0.03		0.05	<	0.050	<	0.134		0.001	<	3.3		0.08	
HIGHWAY 57,	03/05/1997 0:00	1300	139	2.07	0.09		0.05	<	0.001	<	0.100		0.001	<	2.6		0.04	
HIGHWAY 57,	05/07/1997 0:00	1410	202	1.75	0.07		0.05	<	0.002		0.128		0.001	<	6.1		0.07	
HIGHWAY 57,	07/09/1997 0:00	1315	165	2.06	0.02	<	0.05		0.004		0.136		0.001	<	3.7		0.05	

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	BROMIDE		CADMIUM		CALCIUM	CHLORIDE	CHROMIUM		COBALT		COPPER		DISOXY		FLUORIDE	
HIGHWAY 57, 1	10/11/1989 0:00	1214					56.5	6.6							8.9			
HIGHWAY 57, 1	11/01/1989 0:00	1224					29.0	5.2							7.5			
HIGHWAY 57, 1	12/13/1989 0:00	1153					63.5	10.4							15.1			
HIGHWAY 57, 1	04/11/1990 0:00	1100			0.001	<	67.5	8.2	0.010	<			0.010		10.0			
HIGHWAY 57, 1	06/13/1990 0:00	1134			0.003	<	47.7	5.3	0.008		0.004	<	0.015		7.9			
HIGHWAY 57, 1	08/15/1990 0:00	1052			0.003	<	56.7	8.0	0.008		0.004	<	0.013		7.1			
HIGHWAY 57, 1	10/10/1990 0:00	1206			0.003	<	68.4	11.8	0.005	<	0.004	<	0.004		9.0			
HIGHWAY 57, 1	12/05/1990 0:00	1215			0.003	<	74.3	15.9	0.005		0.004	<	0.020		11.9			
HIGHWAY 57, 1	03/13/1991 0:00	1155			0.002	<	69.7	23.4	0.003	<	0.004	<	0.008		10.3			
HIGHWAY 57, 1	05/15/1991 0:00	1227			0.002	<	56.6	19.6	0.005		0.004	<	0.018		6.0			
HIGHWAY 57, 1	07/31/1991 0:00	1205			0.002	<	45.7	11.9	0.003	<	0.004	<	0.014		6.4			
HIGHWAY 57, 1	09/11/1991 0:00	1140			0.002	<	43.0	12.8	0.003	<	0.004	<	0.011		6.6			
HIGHWAY 57, 1	11/06/1991 0:00	1235			0.002	<	49.7	15.2	0.003		0.004	<	0.043		11.7			
HIGHWAY 57, 1	02/12/1992 0:00	1219			0.002	<	48.4	18.7	0.003	<	0.004	<	0.026		11.9			
HIGHWAY 57, 1	04/15/1992 0:00	1240			0.002	<	54.6	9.8	0.008		0.004	<	0.026		8.5			
HIGHWAY 57, 1	06/10/1992 0:00	1053			0.002	<	48.4	8.8	0.011		0.004	<	0.020		7.1			
HIGHWAY 57, 1	08/05/1992 0:00	1258			0.002	<	31.3	4.8	0.003	<	0.004	<	0.011		7.9			
HIGHWAY 57, 1	10/07/1992 0:00	1213			0.002	<	65.5	9.1	0.003	<	0.004	<	0.013		10.7			
HIGHWAY 57, 1	12/09/1992 0:00	1205			0.002	<	44.7	5.9	0.004		0.004	<	0.006		13.5			
HIGHWAY 57, 1	03/10/1993 0:00	1216			0.005	<	48.2	8.2	0.010	<	0.010	<	0.014		12.3			
HIGHWAY 57, 1	05/05/1993 0:00	1143			0.005	<	70.8	10.3	0.010	<	0.010	<	0.020		9.5			
HIGHWAY 57, 1	07/14/1993 0:00	1126			0.002	<	35.7	5.8	0.003	<	0.004	<	0.013		8.3			
HIGHWAY 57, 1	09/15/1993 0:00	1212			0.000	<	54.7	9.3	0.010	<	0.010	<	0.018		8.2			
HIGHWAY 57, 1	11/10/1993 0:00	1156			0.000	<	60.9	9.9	0.010	<	0.010	<	0.010	<	11.8		0.17	
HIGHWAY 57, 1	02/09/1994 0:00	1135			0.001		67.7	18.6	0.010	<	0.010	<	0.010	<	14.1		0.15	
HIGHWAY 57, 1	04/13/1994 0:00	1255			0.000	<	42.8	7.9	0.010	<	0.010	<	0.024		9.3		0.2	
HIGHWAY 57, 1	06/15/1994 0:00	1207			0.0001	<	63.1	10.9	0.010	<	0.010	<	0.010	<	7.3		0.23	
HIGHWAY 57, 1	08/10/1994 0:00	1058			0.001	<	48.9	11.9	0.010	<	0.010	<	0.010	<	7.3		0.27	
HIGHWAY 57, 1	10/12/1994 0:00	1316			0.001	<	49.1	13.9	0.010	<	0.010	<	0.010	<	8.8		0.23	
HIGHWAY 57, 1	12/07/1994 0:00	1237			0.001	<	44.6	16.4	0.002		0.010	<	0.014		10.9		0.22	
HIGHWAY 57, 1	01/19/1995 0:00	1256	0.140		0.001	<	50.2	18.1	0.004		0.010	<	0.011		15.9		0.22	
HIGHWAY 57, 1	03/22/1995 0:00	1220	0.040		0.001	<	42.7	7.7	0.008		0.010	<	0.012		9.0		0.17	
HIGHWAY 57, 1	05/17/1995 0:00	1233	0.040		0.001	<	51.4	6.6	0.003		0.010	<	0.005		8.7		0.18	
HIGHWAY 57, 1	07/19/1995 0:00	1146	0.060		0.001	<	48.5	5.7	0.001	<	0.010	<	0.006		7.1		0.10	
HIGHWAY 57, 1	09/20/1995 0:00	1219	0.060		0.001	<	54.6	6.5	0.004		0.010	<	0.014		8.0		0.19	
HIGHWAY 57, 1	11/15/1995 0:00	1143	0.090		0.001		69.5	13.0	0.003		0.010	<	0.005		13.1		0.20	
HIGHWAY 57, 1	02/21/1996 0:00	1211	0.150		0.001	<	71.7	20.9	0.001	<	0.010	<	0.005		13.5		0.19	
HIGHWAY 57, 1	04/17/1996 0:00	1245	0.160		0.001	<	83.5	23.8	0.001	<	0.010	<	0.005		10.0		0.12	
HIGHWAY 57, 1	06/19/1996 0:00	1216	0.040		0.001	<	51.2	5.5	0.005		0.010	<	0.012		7.2		0.17	
HIGHWAY 57, 1	08/14/1996 0:00	1240	0.130		0.001	<	60.2	12.6	0.001	<	0.010	<	0.006		8.4		0.19	
HIGHWAY 57, 1	10/09/1996 0:00	1210	0.040		0.001	<	54.2	7.2	0.005		0.010	<	0.012		9.6		0.13	
HIGHWAY 57, 1	12/04/1996 0:00	1240	0.040		0.001	<	49.8	7.1	0.003		0.010	<	0.011		13.9		0.23	
HIGHWAY 57, 1	01/08/1997 0:00	1245	0.050		0.005	<	96.5	10.4	0.010	<	0.010	<	0.010		13.5		0.20	
HIGHWAY 57, 1	03/05/1997 0:00	1300	0.030		0.001	<	52.7	8.9	0.001		0.010	<	0.010		12.6		0.11	
HIGHWAY 57, 1	05/07/1997 0:00	1410	0.060		0.001	<	72.0	8.8	0.004	<	0.010	<	0.005		8.6		0.17	
HIGHWAY 57, 1	07/09/1997 0:00	1315	0.050		0.001	<	62.6	8.5	0.002		0.010	<	0.004		7.3		0.22	

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	IRON		LEAD		MAGNESIUM	MANGANESE	MERCURY		MOLYBDENM		NICKEL		NITRATE		NITRITE	
HIGHWAY 57, 1	10/11/1989 0:00	1214					10.1											
HIGHWAY 57, 1	11/01/1989 0:00	1224					4.9											
HIGHWAY 57, 1	12/13/1989 0:00	1153					13.4											
HIGHWAY 57, 1	04/11/1990 0:00	1100	1.82		0.002		13.8	0.19	0.0005	<			0.010	<				
HIGHWAY 57, 1	06/13/1990 0:00	1134	4.14				9.4	0.16			0.005	<	0.013					
HIGHWAY 57, 1	08/15/1990 0:00	1052	3.03		0.005		11.8	0.18	0.0005	<	0.005	<	0.008					
HIGHWAY 57, 1	10/10/1990 0:00	1206	0.41				15.2	0.14			0.005	<	0.006	<				
HIGHWAY 57, 1	12/05/1990 0:00	1215	0.23		0.005		16.4	0.09	0.0005	<	0.005	<	0.006	<				
HIGHWAY 57, 1	03/13/1991 0:00	1155	0.29				18.3	0.17			0.001	<	0.007	<				
HIGHWAY 57, 1	05/15/1991 0:00	1227	1.73		0.005		15.2	0.20	0.0005	<	0.003		0.007	<				
HIGHWAY 57, 1	07/31/1991 0:00	1205	0.93				11.2	0.16			0.001	<	0.007	<				
HIGHWAY 57, 1	09/11/1991 0:00	1140	0.75		0.002		11.5	0.13	0.0005	<	0.001		0.007	<				
HIGHWAY 57, 1	11/06/1991 0:00	1235	0.30		0.001	<	12.7	0.07			0.001		0.007	<				
HIGHWAY 57, 1	02/12/1992 0:00	1219	0.42		0.001	<	11.5	0.11	0.0005	<	0.003		0.007	<				
HIGHWAY 57, 1	04/15/1992 0:00	1240	3.69				11.4	0.14			0.001	<	0.007	<				
HIGHWAY 57, 1	06/10/1992 0:00	1053	7.07		0.020	<	10.6	0.19	0.0005	<	0.001	<	0.009					
HIGHWAY 57, 1	08/05/1992 0:00	1258	2.41				5.5	0.11			0.001		0.007					
HIGHWAY 57, 1	10/07/1992 0:00	1213	0.54		0.020	<	13.1	0.09	0.0005	<	0.003		0.007	<				
HIGHWAY 57, 1	12/09/1992 0:00	1205	1.73				8.7	0.06			0.001	<	0.007	<				
HIGHWAY 57, 1	03/10/1993 0:00	1216	2.57		0.050	<	10.9	0.07	0.0005	<	0.010	<	0.050	<				
HIGHWAY 57, 1	05/05/1993 0:00	1143	2.27				16.3	0.13			0.010	<	0.050	<				
HIGHWAY 57, 1	07/14/1993 0:00	1126	3.60		0.004		7.7	0.10	0.0005	<	0.001	<	0.007	<				
HIGHWAY 57, 1	09/15/1993 0:00	1212	2.37		0.005		11.3	0.16			0.010	<	0.050	<				
HIGHWAY 57, 1	11/10/1993 0:00	1156	1.26		0.002		12.7	0.07	0.0005	<	0.010	<	0.050	<				
HIGHWAY 57, 1	02/09/1994 0:00	1135	0.15		0.005		18.9	0.09	0.0014		0.010	<	0.050	<				
HIGHWAY 57, 1	04/13/1994 0:00	1255	5.51		0.020		9.1	0.25			0.010	<	0.050	<				
HIGHWAY 57, 1	06/15/1994 0:00	1207	2.59		0.002		14.1	0.19	0.0005	<	0.010	<	0.050	<				
HIGHWAY 57, 1	08/10/1994 0:00	1058	0.67		0.001	<	13.1	0.13			0.010	<	0.005	<				
HIGHWAY 57, 1	10/12/1994 0:00	1316	0.47		0.003		13.7	0.12	0.001	<	0.010	<	0.005	<				
HIGHWAY 57, 1	12/07/1994 0:00	1237	0.94		0.001		10.3	0.11			0.010	<	0.003					
HIGHWAY 57, 1	01/19/1995 0:00	1256	0.28		0.005		12.0	0.06	0.0005	<	0.010	<	0.009		0.0		0.05	<
HIGHWAY 57, 1	03/22/1995 0:00	1220	4.23		0.015		8.9	0.16			0.010	<	0.019		0.6		0.05	
HIGHWAY 57, 1	05/17/1995 0:00	1233	2.21		0.001		9.5	0.12	0.0005	<	0.010	<	0.001	<	0.6		0.07	
HIGHWAY 57, 1	07/19/1995 0:00	1146	1.11		0.010		8.7	0.19			0.010	<	0.007		0.1		0.05	
HIGHWAY 57, 1	09/20/1995 0:00	1219	2.01		0.002		9.7	0.16	0.0005	<	0.010	<	0.001	<	0.7		0.05	<
HIGHWAY 57, 1	11/15/1995 0:00	1143	0.22		0.004		13.5	0.08			0.010	<	0.005		0.0		0.05	<
HIGHWAY 57, 1	02/21/1996 0:00	1211	0.19		0.004		18.8	0.13	0.0005	<	0.010	<	0.001	<	0.0		0.05	<
HIGHWAY 57, 1	04/17/1996 0:00	1245	0.46		0.001	<	21.4	0.26			0.010	<	0.005		0.0		0.05	<
HIGHWAY 57, 1	06/19/1996 0:00	1216	3.60		0.005		8.4	0.16	0.0005	<	0.010	<	0.005		0.7		0.05	<
HIGHWAY 57, 1	08/14/1996 0:00	1240	0.76		0.003		13.5	0.19			0.010	<	0.004		0.0	<	0.05	<
HIGHWAY 57, 1	10/09/1996 0:00	1210	2.32		0.004		10.2	0.18	0.0005	<	0.020	<	0.004		0.7		0.05	<
HIGHWAY 57, 1	12/04/1996 0:00	1240	1.62		0.003		9.5	0.11			0.020	<	0.002		0.7		0.05	<
HIGHWAY 57, 1	01/08/1997 0:00	1245	0.74		0.050	<	18.4	0.13			0.020	<	0.005	<	0.4		0.05	<
HIGHWAY 57, 1	03/05/1997 0:00	1300	1.73		0.006		11.8	0.10	0.0005	<	0.020	<	0.001	<	0.7		0.05	<
HIGHWAY 57, 1	05/07/1997 0:00	1410	1.31		0.001		14.9	0.11			0.020	<	0.002		0.5		0.05	<
HIGHWAY 57, 1	07/09/1997 0:00	1315	2.00		0.003		14.1	0.21	0.0005	<	0.020	<	0.002		0.6		0.05	<

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	NO2_NO3		ORTH_PHOS		PHFIELD	POTASSIUM	SELENIUM		SILICA		SILVER		SODIUM	SPEC_COND	SULFATE
HIGHWAY 57,	10/11/1989 0:00	1214	0.51				8.1	4.50			13.2				10.2	390	33.0
HIGHWAY 57,	11/01/1989 0:00	1224	0.28				7.4	5.50			20.8				7.4	214	21.0
HIGHWAY 57,	12/13/1989 0:00	1153	0.08				9.0	4.40			0.5				12.7	457	45.0
HIGHWAY 57,	04/11/1990 0:00	1100	0.35				8.4	3.30	0.001	<	15.1		0.001	<	14.3	464	48.0
HIGHWAY 57,	06/13/1990 0:00	1134	0.77				8.1	5.23			35.5		0.005	<	8.4	305	26.0
HIGHWAY 57,	08/15/1990 0:00	1052	0.27				8.2	5.41	0.001	<	21.8		0.005	<	10.8	392	35.0
HIGHWAY 57,	10/10/1990 0:00	1206	0.13				8.2	4.04			5.0		0.005	<	14.8	505	48.0
HIGHWAY 57,	12/05/1990 0:00	1215	0.01				9.7	4.71	0.001		4.9		0.005	<	22.0	535	53.0
HIGHWAY 57,	03/13/1991 0:00	1155	0.01				8.4	3.53			2.0		0.004	<	23.5	570	90.0
HIGHWAY 57,	05/15/1991 0:00	1227	0.17				8.1	4.30	0.001	<	11.0		0.004	<	19.7	500	85.0
HIGHWAY 57,	07/31/1991 0:00	1205	0.05				8.0	4.11			7.0		0.004	<	12.7	382	44.0
HIGHWAY 57,	09/11/1991 0:00	1140	0.12				8.3	4.31	0.001	<	7.2		0.004	<	13.9	394	42.0
HIGHWAY 57,	11/06/1991 0:00	1235	0.11				8.3	4.01	0.001	<	3.0		0.004	<	16.5	399	48.0
HIGHWAY 57,	02/12/1992 0:00	1219	0.06				8.4	3.40	0.001	<	3.5		0.004	<	16.8	463	62.0
HIGHWAY 57,	04/15/1992 0:00	1240	1.02				8.3	4.70			36.5		0.004	<	11.3	405	50.0
HIGHWAY 57,	06/10/1992 0:00	1053	0.79				6.7	4.49	0.030	<	47.6		0.004	<	9.9	362	79.0
HIGHWAY 57,	08/05/1992 0:00	1258	0.39				7.9	3.72			21.8		0.004	<	4.3	210	13.0
HIGHWAY 57,	10/07/1992 0:00	1213	0.02	<			8.6	3.65	0.030	<	9.9		0.004	<	12.4	375	37.0
HIGHWAY 57,	12/09/1992 0:00	1205	0.52					5.01			18.8		0.004	<	7.6	312	31.0
HIGHWAY 57,	03/10/1993 0:00	1216	0.88				8.1	3.18	0.050	<	23.0		0.010	<	10.1	385	45.0
HIGHWAY 57,	05/05/1993 0:00	1143	0.75				8.4	4.28			19.6		0.010	<	14.0	521	66.0
HIGHWAY 57,	07/14/1993 0:00	1126	1.24				8.1	5.00	0.030	<	30.2		0.004	<	6.6	280	30.0
HIGHWAY 57,	09/15/1993 0:00	1212	1.00				8.0	4.29	0.002	<	19.3		0.010	<	10.0	499	47.0
HIGHWAY 57,	11/10/1993 0:00	1156	1.07				7.9	5.04	0.002	<	16.3		0.010	<	12.7	479	46.0
HIGHWAY 57,	02/09/1994 0:00	1135	0.02				8.4	3.21	0.002	<	0.9		0.010	<	20.5	649	93.0
HIGHWAY 57,	04/13/1994 0:00	1255	1.51				7.8	3.78	0.002	<	32.6		0.010	<	13.2	323	44.0
HIGHWAY 57,	06/15/1994 0:00	1207	0.49				8.3	3.56	0.002	<	21.3		0.010	<	15.3	532	50.0
HIGHWAY 57,	08/10/1994 0:00	1058	0.01	<			8.4	4.00	0.002	<	4.9		0.010	<	16.4	449	52.0
HIGHWAY 57,	10/12/1994 0:00	1316	0.01	<			8.0	3.81	0.002	<	4.2		0.010	<	16.5	477	54.0
HIGHWAY 57,	12/07/1994 0:00	1237	0.58				8.0	4.08	0.002	<	9.4		0.001	<	16.1	470	51.3
HIGHWAY 57,	01/19/1995 0:00	1256			0.01	<	9.0	3.62	0.002	<	2.1		0.001	<	19.0	488	66.5
HIGHWAY 57,	03/22/1995 0:00	1220			0.01	<	8.0	5.33	0.002		28.3		0.001	<	10.8	388	38.2
HIGHWAY 57,	05/17/1995 0:00	1233			0.06		8.0	4.18	0.002	<	19.0		0.001	<	9.6	417	32.9
HIGHWAY 57,	07/19/1995 0:00	1146			0.06		8.1	4.71	0.003		12.4		0.001	<	8.9	414	29.4
HIGHWAY 57,	09/20/1995 0:00	1219			0.09		8.1	5.50	0.002	<	22.2		0.001	<	9.6	434	27.1
HIGHWAY 57,	11/15/1995 0:00	1143			0.01	<	8.4	4.84	0.002	<	5.6		0.001	<	16.4	373	52.6
HIGHWAY 57,	02/21/1996 0:00	1211			0.01	<	8.4	4.79	0.002		1.1		0.001	<	19.9	658	96.1
HIGHWAY 57,	04/17/1996 0:00	1245			0.01	<	8.4	4.21	0.002	<	3.3		0.001	<	25.3	727	116.2
HIGHWAY 57,	06/19/1996 0:00	1216			0.05	<	8.0	4.48	0.002	<	35.7		0.001	<	8.6	384	31.1
HIGHWAY 57,	08/14/1996 0:00	1240			0.01	<	8.4	3.98	0.002	<	6.5		0.001	<	13.7	510	52.8
HIGHWAY 57,	10/09/1996 0:00	1210			0.14		8.1	4.46	0.001		26.5		0.001	<	11.3	418	33.6
HIGHWAY 57,	12/04/1996 0:00	1240			0.12		8.1	4.90	0.001	<	18.4		0.001	<	8.5	401	32.0
HIGHWAY 57,	01/08/1997 0:00	1245			0.06		8.3	4.36	0.050	<	15.8		0.010	<	13.5	538	55.0
HIGHWAY 57,	03/05/1997 0:00	1300			0.06		8.0	4.05	0.001	<	16.2		0.001	<	10.6	404	42.0
HIGHWAY 57,	05/07/1997 0:00	1410			0.06		8.1	3.21	0.001	<	14.9		0.001	<	13.9	538	51.5
HIGHWAY 57,	07/09/1997 0:00	1315			0.02	<	8.2	4.08	0.001	<	16.3		0.001	<	9.4	437	46.7

SITE_LOCT - D	COL_DATE	COL_TIME	THALLIUM		TDS	TOTHARD	PHOSPHU	TSS	TURBIDITY	VANADIUM		ZINC		TOC	KJELDAHL		STRONTIUM
HIGHWAY 57, 1	10/11/1989 0:00	1214			225	182	0.14	44	33.0								
HIGHWAY 57, 1	11/01/1989 0:00	1224			142	92	0.39	90	84.0								
HIGHWAY 57, 1	12/13/1989 0:00	1153			248	214	0.07	17	10.4								
HIGHWAY 57, 1	04/11/1990 0:00	1100			279	225	0.11	106	48.0			0.220					
HIGHWAY 57, 1	06/13/1990 0:00	1134	0.020	<	212	158	0.22	122	78.0	0.011		0.033					
HIGHWAY 57, 1	08/15/1990 0:00	1052	0.020	<	240	190	0.18	137	51.2	0.010		0.049					
HIGHWAY 57, 1	10/10/1990 0:00	1206	0.020	<	281	233	0.04	14	11.0	0.003	<	0.029					
HIGHWAY 57, 1	12/05/1990 0:00	1215	0.020	<	314	253	0.06	16	4.5	0.004		0.020					
HIGHWAY 57, 1	03/13/1991 0:00	1155	0.015	<	343	249	0.06	17	8.1	0.003	<	0.016					
HIGHWAY 57, 1	05/15/1991 0:00	1227	0.015	<	292	204	0.16	72	42.0	0.006		0.050					
HIGHWAY 57, 1	07/31/1991 0:00	1205	0.015	<	218	160	0.11	29	18.0	0.004		0.031					
HIGHWAY 57, 1	09/11/1991 0:00	1140	0.015	<	213	154	0.12	30	17.8	0.005		0.001	<				
HIGHWAY 57, 1	11/06/1991 0:00	1235	0.015	<	228	176	0.08	10	5.5	0.003	<	0.057					
HIGHWAY 57, 1	02/12/1992 0:00	1219	0.015	<	248	168	0.06	16	9.3	0.003	<	0.022					
HIGHWAY 57, 1	04/15/1992 0:00	1240	0.015	<	257	183	0.19	84	61.6	0.010		0.049					
HIGHWAY 57, 1	06/10/1992 0:00	1053	0.015	<	259	164	0.26	329	148	0.016		0.049					
HIGHWAY 57, 1	08/05/1992 0:00	1258	0.015	<	132	101	0.22	67	48.0	0.006		0.017					
HIGHWAY 57, 1	10/07/1992 0:00	1213	0.015	<	259	217	0.09	22	11.4	0.006		0.020					
HIGHWAY 57, 1	12/09/1992 0:00	1205	0.015	<	191	147	0.17	47	37.0	0.006		0.118					
HIGHWAY 57, 1	03/10/1993 0:00	1216	0.050	<	221	165	0.15	66	38.0	0.006		0.018					
HIGHWAY 57, 1	05/05/1993 0:00	1143	0.050	<	315	244	0.15	88	34.0	0.009		0.022					
HIGHWAY 57, 1	07/14/1993 0:00	1126	0.015	<	174	121	0.20	70	58.0	0.010		0.030					
HIGHWAY 57, 1	09/15/1993 0:00	1212	0.050	<	251	183	0.24	78	55.0	0.010		0.097					
HIGHWAY 57, 1	11/10/1993 0:00	1156	0.050	<	269	204	0.13	29	20.0	0.006		0.025					
HIGHWAY 57, 1	02/09/1994 0:00	1135	0.050	<	347	247	0.05	14	4.8	0.005	<	0.106					
HIGHWAY 57, 1	04/13/1994 0:00	1255	0.050	<	213	144	0.28	160	101.0	0.007		0.043					
HIGHWAY 57, 1	06/15/1994 0:00	1207	0.050	<	281	216	0.16	66	38.0	0.010		0.021					
HIGHWAY 57, 1	08/10/1994 0:00	1058	0.050	<	238	176	0.09	29	9.0	0.006		0.019					
HIGHWAY 57, 1	10/12/1994 0:00	1316	0.050	<	239	179	0.03	13	6.0	0.005	<	0.035					
HIGHWAY 57, 1	12/07/1994 0:00	1237	0.050	<	234	154	0.13	28	16.0	0.006		0.020					
HIGHWAY 57, 1	01/19/1995 0:00	1256	0.050	<	263	175	0.07	11	4.0	0.005	<	0.020					
HIGHWAY 57, 1	03/22/1995 0:00	1220	0.050	<	217	143	0.26	136	103	0.009		0.034					
HIGHWAY 57, 1	05/17/1995 0:00	1233	0.050	<	226	167	0.22	86	26.0	0.005	<	0.028					
HIGHWAY 57, 1	07/19/1995 0:00	1146	0.050	<	210	157	0.12	51	9.0	0.005	<	0.005	<				
HIGHWAY 57, 1	09/20/1995 0:00	1219	0.050	<	233	176	0.20	53	32.0	0.010		0.043					
HIGHWAY 57, 1	11/15/1995 0:00	1143	0.050	<	297	229	0.07	14	2.0	0.005		0.009					
HIGHWAY 57, 1	02/21/1996 0:00	1211	0.050	<	353	257	0.08	17	5.2	0.005	<	0.011					
HIGHWAY 57, 1	04/17/1996 0:00	1245	0.050	<	404	296	0.12	25	7.0	0.005	<	0.018					
HIGHWAY 57, 1	06/19/1996 0:00	1216	0.050	<	231	162	0.20	72	58.0	0.009		0.057					
HIGHWAY 57, 1	08/14/1996 0:00	1240	0.050	<	274	206	0.14	29	10.0	0.008		0.031					
HIGHWAY 57, 1	10/09/1996 0:00	1210	0.050	<	245	177	0.20	61	44.0	0.010		0.053					
HIGHWAY 57, 1	12/04/1996 0:00	1240	0.050	<	220	163	0.17	38	29.0	0.007		0.243					
HIGHWAY 57, 1	01/08/1997 0:00	1245	0.050	<	360	317	0.13	29	15.4	0.005	<	0.048					
HIGHWAY 57, 1	03/05/1997 0:00	1300	0.050	<	233	180	0.17	54	44.0	0.011		0.022					
HIGHWAY 57, 1	05/07/1997 0:00	1410	0.050	<	303	241	0.13	51	36.0	0.007		0.040					
HIGHWAY 57, 1	07/09/1997 0:00	1315	0.050	<	264	214	0.21	92	56.0	0.011		0.033					

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	
HIGHWAY 57, 1	10/11/1989 0:00	1214	
HIGHWAY 57, 1	11/01/1989 0:00	1224	
HIGHWAY 57, 1	12/13/1989 0:00	1153	
HIGHWAY 57, 1	04/11/1990 0:00	1100	
HIGHWAY 57, 1	06/13/1990 0:00	1134	
HIGHWAY 57, 1	08/15/1990 0:00	1052	
HIGHWAY 57, 1	10/10/1990 0:00	1206	
HIGHWAY 57, 1	12/05/1990 0:00	1215	
HIGHWAY 57, 1	03/13/1991 0:00	1155	
HIGHWAY 57, 1	05/15/1991 0:00	1227	
HIGHWAY 57, 1	07/31/1991 0:00	1205	
HIGHWAY 57, 1	09/11/1991 0:00	1140	
HIGHWAY 57, 1	11/06/1991 0:00	1235	
HIGHWAY 57, 1	02/12/1992 0:00	1219	
HIGHWAY 57, 1	04/15/1992 0:00	1240	
HIGHWAY 57, 1	06/10/1992 0:00	1053	
HIGHWAY 57, 1	08/05/1992 0:00	1258	
HIGHWAY 57, 1	10/07/1992 0:00	1213	
HIGHWAY 57, 1	12/09/1992 0:00	1205	
HIGHWAY 57, 1	03/10/1993 0:00	1216	
HIGHWAY 57, 1	05/05/1993 0:00	1143	
HIGHWAY 57, 1	07/14/1993 0:00	1126	
HIGHWAY 57, 1	09/15/1993 0:00	1212	
HIGHWAY 57, 1	11/10/1993 0:00	1156	
HIGHWAY 57, 1	02/09/1994 0:00	1135	
HIGHWAY 57, 1	04/13/1994 0:00	1255	
HIGHWAY 57, 1	06/15/1994 0:00	1207	
HIGHWAY 57, 1	08/10/1994 0:00	1058	
HIGHWAY 57, 1	10/12/1994 0:00	1316	
HIGHWAY 57, 1	12/07/1994 0:00	1237	
HIGHWAY 57, 1	01/19/1995 0:00	1256	
HIGHWAY 57, 1	03/22/1995 0:00	1220	
HIGHWAY 57, 1	05/17/1995 0:00	1233	
HIGHWAY 57, 1	07/19/1995 0:00	1146	
HIGHWAY 57, 1	09/20/1995 0:00	1219	
HIGHWAY 57, 1	11/15/1995 0:00	1143	
HIGHWAY 57, 1	02/21/1996 0:00	1211	
HIGHWAY 57, 1	04/17/1996 0:00	1245	
HIGHWAY 57, 1	06/19/1996 0:00	1216	
HIGHWAY 57, 1	08/14/1996 0:00	1240	
HIGHWAY 57, 1	10/09/1996 0:00	1210	
HIGHWAY 57, 1	12/04/1996 0:00	1240	
HIGHWAY 57, 1	01/08/1997 0:00	1245	
HIGHWAY 57, 1	03/05/1997 0:00	1300	
HIGHWAY 57, 1	05/07/1997 0:00	1410	
HIGHWAY 57, 1	07/09/1997 0:00	1315	

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	ALKALINTY	ALUMINUM	AMMONIA		ANTIMONY		ARSENIC		BARIUM		BERYLLIUM		BOD		BORON	
HIGHWAY 57, 1	09/10/1997 0:00	1155	162	0.87	0.02	<	0.05	<	0.003		0.118		0.001	<	1.7		0.12	
HIGHWAY 57, 1	11/05/1997 0:00	1310	167	2.31	0.02	<	0.05	<	0.004		0.135		0.001	<	2.2		0.06	
HIGHWAY 57, 1	02/04/1998 0:00	1228	217	1.29	0.02	<	0.05	<	0.001		0.12		0.001	<	2.7		0.06	
HIGHWAY 57, 1	04/08/1998 0:00	1210	155	2.63	0.13		0.05	<	0.002		0.124		0.001	<	2.6		0.04	
HIGHWAY 57, 1	06/03/1998 0:00	1228	212	1.89	0.02	<	0.05	<	0.004		0.148		0.001	<	1.5		0.07	
HIGHWAY 57, 1	08/05/1998 0:00	1245	123	2.29	0.02	<	0.05	<	0.003		0.111		0.001	<	3.0		0.08	
HIGHWAY 57, 1	10/07/1998 0:00	1315	105	2.51	0.02	<	0.05	<	0.003		0.104		0.001	<	1.3		0.12	
HIGHWAY 57, 1	12/09/1998 0:00	1315	153	1.85	0.04		0.05	<	0.003		0.113		0.001	<	3.5		0.06	
HIGHWAY 57, 1	03/01/1999 0:00	0915	209	2.14	0.11		0.05	<	0.002		0.123		0.001	<	2.3		0.08	
HIGHWAY 57, 1	05/03/1999 0:00	0925	120	1.97	0.12		0.05	<	0.002		0.085		0.001	<	1.0	<	0.06	
HIGHWAY 57, 1	06/28/1999 0:00	1010	196	3.57	0.02	<	0.05	<	0.001		0.147		0.001	<	3.2		0.21	
HIGHWAY 57, 1	08/30/1999 0:00	0935	192	0.49	0.02	<	0.05	<	0.004		0.228		0.001	<	1.0	<	0.18	
HIGHWAY 57, 1	11/01/1999 0:00	0920	175	0.37	0.02	<	0.05	<	0.002		0.137		0.001	<	3.9		0.07	
HIGHWAY 57, 1	01/31/2000 0:00	0925	183	0.70	0.03		0.05	<	0.005		0.095		0.001	<	5.4		0.04	
HIGHWAY 57, 1	04/03/2000 0:00	0900	182	3.03	0.02		0.05	<	0.002		0.152		0.001	<	4.3		0.08	
HIGHWAY 57, 1	06/05/2000 0:00	1000	207	2.35	0.02	<	0.05	<	0.003		0.142		0.001	<	4.2		0.06	
HIGHWAY 57, 1	08/07/2000 0:00	0900	153	0.76	0.02	<	0.05	<	0.003		0.121		0.001	<	2.8		0.06	
HIGHWAY 57, 1	10/02/2000 0:00	0910	173	0.48	0.02	<	0.05	<	0.002		0.122		0.001	<	2.9		0.07	
HIGHWAY 57, 1	11/27/2000 0:00	0920	166	0.17	0.02		0.05	<	0.003		0.108		0.001	<	2.3		0.08	
HIGHWAY 57, 1	01/02/2001 0:00	0945	200	0.10	0.04		0.05	<	0.002		0.12		0.001	<	2.0		0.08	
HIGHWAY 57, 1	03/05/2001 0:00	0930	109	4.45	0.17		0.05	<	0.001	<	0.108		0.001	<	2.8		0.04	
HIGHWAY 57, 1	03/05/2001 0:00	0935	104	4.09	0.16		0.05	<	0.001		0.107		0.001	<	3.5		0.04	
HIGHWAY 57, 1	04/30/2001 0:00	0910	150	1.40	0.02	<	0.05	<	0.002		0.105		0.001	<	6.4		0.05	
HIGHWAY 57, 1	07/09/2001 0:00	0930	134	2.62	0.02	<	0.05	<	0.003		0.115		0.001	<	1.0		0.05	
HIGHWAY 57, 1	09/04/2001 0:00	1000	150	1.40	0.11		0.05	<	0.005		0.112		0.001	<	1.7		0.06	
HIGHWAY 57, 1	10/29/2001 0:00	0950	152	0.56	0.02	<	0.05	<	0.002		0.110		0.001	<	3.0		0.07	
HIGHWAY 57, 1	02/04/2002 0:00	0918	144	0.18	0.02	<	0.05	<	0.002		0.094		0.001	<			0.03	
HIGHWAY 57, 1	04/01/2002 0:00	0930	172	0.74	0.10	<	0.05	<	0.002		0.126		0.001	<			0.05	
HIGHWAY 57, 1	06/03/2002 0:00	0920	136	0.96	0.10	<	0.05	<	0.003		0.095		0.001	<			0.04	
HIGHWAY 57, 1	08/05/2002 0:00	0948	173	0.65	0.10	<	0.05	<	0.005		0.124		0.001	<			0.07	
HIGHWAY 57, 1	10/07/2002 0:00	0949	171	0.32	0.10	<	0.05	<	0.003		0.116		0.001	<			0.08	
HIGHWAY 57, 1	12/02/2002 0:00	1013	153	0.08	0.10	<	0.05	<	0.002		0.098		0.001	<			0.07	
HIGHWAY 57, 1	01/06/2003 0:00	0939	145	0.12	0.10	<	0.05	<	0.002		0.092		0.001	<			0.07	
HIGHWAY 57, 1	03/03/2003 0:00	0956	167	0.41	0.10	<	0.05	<	0.002		0.096		0.001	<			0.06	
HIGHWAY 57, 1	05/05/2003 0:00	0958	112	5.18	0.12		0.05	<	0.003		0.126		0.001	<			0.04	
HIGHWAY 57, 1	07/07/2003 0:00	1015	149	1.41	0.10	<	0.05	<	0.004		0.117		0.001	<			0.06	
HIGHWAY 57, 1	09/08/2003 0:00	1019	104	2.48	0.15		0.05	<	0.004		0.105		0.001	<			0.04	
HIGHWAY 57, 1	11/03/2003 0:00	1100	138	1.75	0.10	<	0.05	<	0.003		0.102		0.001	<			0.05	<
HIGHWAY 57, 1	04/05/2004 0:00	0942	161	2.26	0.10	<	0.05	<	0.002		0.123		0.001	<			0.05	<
HIGHWAY 57, 1	06/07/2004 0:00	1002	182	0.75	0.10	<	0.05	<	0.003		0.125		0.001	<			0.06	
HIGHWAY 57, 1	08/02/2004 0:00	1028	101	1.69	0.10	<	0.05	<	0.003		0.099		0.001	<			0.05	<
HIGHWAY 57, 1	10/04/2004 0:00	0916	192	0.51	0.10	<	0.05	<	0.002		0.146		0.001	<			0.07	
HIGHWAY 57, 1	12/06/2004 0:00	0912	104	5.10	0.10	<	0.05	<	0.002		0.132		0.001	<			0.05	<
HIGHWAY 57, 1	01/03/2005 0:00	0908	188	0.32	0.10	<	0.05	<	0.002		0.106		0.001	<			0.05	
HIGHWAY 57, 1	03/07/2005 0:00	0934	171	1.21	0.10	<	0.05	<	0.002		0.102		0.001	<			0.05	<
HIGHWAY 57, 1	05/02/2005 0:00	0850	229	0.97	0.10	<	0.05	<	0.003		0.128		0.001	<			0.05	<

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	BROMIDE		CADMIUM		CALCIUM	CHLORIDE	CHROMIUM		COBALT		COPPER		DISOXY		FLUORIDE	
HIGHWAY 57,	09/10/1997 0:00	1155	0.090		0.001	<	62.2	9.7	0.003		0.010	<	0.007		9.8		0.20	
HIGHWAY 57,	11/05/1997 0:00	1310	0.110		0.001	<	63.8	13.2	0.001		0.010	<	0.011		11.0		0.20	
HIGHWAY 57,	02/04/1998 0:00	1228	0.050		0.001	<	82.3	12.7	0.001	<	0.010	<	0.009		12.9		0.17	
HIGHWAY 57,	04/08/1998 0:00	1210	0.020	<	0.001	<	59.6	8.8	0.003		0.010	<	0.008		10.4		0.23	
HIGHWAY 57,	06/03/1998 0:00	1228	0.070		0.001	<	77.3	9.5	0.003		0.010	<	0.009		13.9		0.20	
HIGHWAY 57,	08/05/1998 0:00	1245	0.060		0.001	<	44.5	7.6	0.002		0.010	<	0.005		7.8		0.23	
HIGHWAY 57,	10/07/1998 0:00	1315	0.170		0.001	<	35.1	8.4	0.004		0.010	<	0.008		8.1		0.22	
HIGHWAY 57,	12/09/1998 0:00	1315	0.050		0.001	<	52.6	6.6	0.002		0.010	<	0.004		10.0		0.17	
HIGHWAY 57,	03/01/1999 0:00	0915	0.080		0.001	<	75.5	10.1	0.002		0.010	<	0.005		10.8		0.21	
HIGHWAY 57,	05/03/1999 0:00	0925	0.020	<	0.001	<	41.5	5.2	0.001	<	0.010	<	0.009		10.0		0.14	
HIGHWAY 57,	06/28/1999 0:00	1010	0.080		0.001	<	70.0	7.9	0.003		0.010	<	0.009		7.2		0.24	
HIGHWAY 57,	08/30/1999 0:00	0935	0.100		0.001	<	134.3	13.9	0.001	<	0.010	<	0.019		6.1		0.22	
HIGHWAY 57,	11/01/1999 0:00	0920	0.020	<	0.001	<	67.2	19.0	0.006		0.010	<	0.009		7.5		0.27	
HIGHWAY 57,	01/31/2000 0:00	0925	0.020	<	0.001	<	69.1	14.1	0.002		0.010	<	0.006		15.9		0.23	
HIGHWAY 57,	04/03/2000 0:00	0900	0.050		0.001	<	76.2	9.2	0.003		0.010	<	0.018		9.8		0.18	
HIGHWAY 57,	06/05/2000 0:00	1000	0.110		0.001	<	78.3	15.4	0.003		0.010	<	0.009		8.5		0.31	
HIGHWAY 57,	08/07/2000 0:00	0900	0.070		0.001	<	53.7	13.6	0.001	<	0.010	<	0.001	<	5.8		0.30	
HIGHWAY 57,	10/02/2000 0:00	0910	0.170		0.001	<	55.5	19.4	0.002		0.010	<	0.003		8.0		0.24	
HIGHWAY 57,	11/27/2000 0:00	0920	0.150		0.001	<	59.9	22.5	0.001	<	0.010	<	0.003		13.1		0.31	
HIGHWAY 57,	01/02/2001 0:00	0945	0.160		0.001	<	74.2	28.5	0.001	<	0.010	<	0.003		15.7		0.24	
HIGHWAY 57,	03/05/2001 0:00	0930	0.020	<	0.001	<	43.9	11.9	0.004		0.010	<	0.005		13.0		0.26	
HIGHWAY 57,	03/05/2001 0:00	0935	0.020	<	0.001	<	44.5	11.8	0.005		0.010	<	0.004		13.0		0.25	
HIGHWAY 57,	04/30/2001 0:00	0910	0.020	<	0.001	<	52.9	9.8	0.002		0.010	<	0.018		9.7		0.20	
HIGHWAY 57,	07/09/2001 0:00	0930	0.020	<	0.001	<	48.0	4.2	0.004		0.010	<	0.035		6.8		0.18	
HIGHWAY 57,	09/04/2001 0:00	1000	0.120		0.001	<	51.8	8.8	0.001		0.010	<	0.004		6.7		0.21	
HIGHWAY 57,	10/29/2001 0:00	0950	0.170		0.001	<	55.7	10.2	0.001	<	0.010	<	0.004		10.0		0.13	
HIGHWAY 57,	02/04/2002 0:00	0918	0.140		0.001	<	53.1	19.2	0.001		0.010	<	0.003		13.0		0.27	
HIGHWAY 57,	04/01/2002 0:00	0930	0.200	<	0.001	<	68.3	20.8	0.001		0.010	<	0.002		9.1		0.15	<
HIGHWAY 57,	06/03/2002 0:00	0920	0.200	<	0.001	<	44.3	7.9	0.002		0.010	<	0.003		6.8		0.17	
HIGHWAY 57,	08/05/2002 0:00	0948	0.200	<	0.001	<	55.7	8.8	0.001	<	0.010	<	0.002		6.1		0.23	
HIGHWAY 57,	10/07/2002 0:00	0949	0.200	<	0.001	<	53.2	13.8	0.001	<	0.010	<	0.002		8.0		0.23	
HIGHWAY 57,	12/02/2002 0:00	1013	0.200	<	0.001	<	57.2	41.1	0.001	<	0.010	<	0.003		11.9		0.23	
HIGHWAY 57,	01/06/2003 0:00	0939	0.200	<	0.001	<	55.7	15.5	0.001	<	0.010	<	0.003		11.3		0.25	
HIGHWAY 57,	03/03/2003 0:00	0956	0.200	<	0.001	<	60.7	18.9	0.001		0.010	<	0.003		13.8		0.25	
HIGHWAY 57,	05/05/2003 0:00	0958	0.200	<	0.001	<	40.9	4.4	0.006		0.010	<	0.006		8.5		0.49	
HIGHWAY 57,	07/07/2003 0:00	1015	0.200	<	0.001	<	52.9	9.9	0.002		0.010	<	0.003		6.8		0.32	
HIGHWAY 57,	09/08/2003 0:00	1019	0.200	<	0.001	<	37.7	5.7	0.004		0.010	<	0.005		7.9		0.20	
HIGHWAY 57,	11/03/2003 0:00	1100	0.200	<	0.001	<	48.9	5.3	0.002		0.010	<	0.004		8.9		0.24	
HIGHWAY 57,	04/05/2004 0:00	0942	0.200	<	0.001	<	59.7	6.5	0.003		0.010	<	0.005		9.1		0.19	
HIGHWAY 57,	06/07/2004 0:00	1002	0.200	<	0.001	<	66.2	9.8	0.002		0.010	<	0.004		8.0		0.30	
HIGHWAY 57,	08/02/2004 0:00	1028	0.200	<	0.001	<	33.5	2.6	0.002		0.010	<	0.005		7.7		0.20	
HIGHWAY 57,	10/04/2004 0:00	0916	0.200	<	0.001	<	70.4	11.8	0.001	<	0.010	<	0.004		8.1		0.31	
HIGHWAY 57,	12/06/2004 0:00	0912	0.200	<	0.001	<	37.9	6.8	0.006		0.010	<	0.006		10.3		0.22	
HIGHWAY 57,	01/03/2005 0:00	0908	0.200	<	0.001	<	68.6	21.5	0.001		0.010	<	0.003		11.4		0.30	
HIGHWAY 57,	03/07/2005 0:00	0934	0.200	<	0.001	<	61.8	7.3	0.001		0.010	<	0.003		10.7		0.21	
HIGHWAY 57,	05/02/2005 0:00	0850	0.200	<	0.001	<	81.9	9.1	0.001	<	0.010	<	0.003		9.2		0.25	

SITE_LOCT - D	COL_DATE	COL_TIME	IRON		LEAD		MAGNESIUM	MANGANESE	MERCURY		MOLYBDENM		NICKEL		NITRATE		NITRITE	
HIGHWAY 57, 1	09/10/1997 0:00	1155	0.82		0.002		13.7	0.11			0.020	<	0.001		0.3		0.05	<
HIGHWAY 57, 1	11/05/1997 0:00	1310	2.08		0.006		14.7	0.11	0.0005	<	0.020	<	0.004		1.1		0.05	<
HIGHWAY 57, 1	02/04/1998 0:00	1228	0.84		0.006		17.6	0.09			0.020	<	0.002		0.6		0.05	<
HIGHWAY 57, 1	04/08/1998 0:00	1210	2.44		0.002		13.7	0.14	0.0005	<	0.020	<	0.008		1.0		0.05	<
HIGHWAY 57, 1	06/03/1998 0:00	1228	1.89		0.003		17.6	0.16			0.020	<	0.006		0.9		0.08	
HIGHWAY 57, 1	08/05/1998 0:00	1245	2.59		0.003		11.2	0.20	0.0005	<	0.020	<	0.004		0.7		0.05	<
HIGHWAY 57, 1	10/07/1998 0:00	1315	2.62		0.004		9.5	0.15			0.020	<	0.005		0.4		0.05	<
HIGHWAY 57, 1	12/09/1998 0:00	1315	1.67		0.004		10.7	0.11	0.0005	<	0.020	<	0.004		0.6		0.05	<
HIGHWAY 57, 1	03/01/1999 0:00	0915	2.02		0.002		16.9	0.09			0.020	<	0.001	<	1.3		0.05	<
HIGHWAY 57, 1	05/03/1999 0:00	0925	1.57		0.002		8.2	0.06	0.0005	<	0.020	<	0.002		0.9		0.07	
HIGHWAY 57, 1	06/28/1999 0:00	1010	2.92		0.005		14.6	0.27	0.0005	<	0.020	<	0.004		0.7		0.05	<
HIGHWAY 57, 1	08/30/1999 0:00	0935	0.41		0.002		18.9	0.16	0.0005	<	0.020	<	0.003		0.1		0.07	
HIGHWAY 57, 1	11/01/1999 0:00	0920	0.33		0.001		15.4	0.11	0.0005	<	0.020	<	0.001	<	0.0		0.05	<
HIGHWAY 57, 1	01/31/2000 0:00	0925	0.72		0.002		18.3	0.05	0.0005	<	0.020	<	0.002		0.3		0.05	<
HIGHWAY 57, 1	04/03/2000 0:00	0900	3.10		0.001	<	18.4	0.18	0.0005	<	0.020	<	0.002		0.7		0.05	<
HIGHWAY 57, 1	06/05/2000 0:00	1000	2.21		0.002		21.4	0.16	0.0005	<	0.020	<	0.005		0.5		0.05	<
HIGHWAY 57, 1	08/07/2000 0:00	0900	0.74		0.003		18.2	0.13	0.0005	<	0.020	<	0.002		0.1		0.05	<
HIGHWAY 57, 1	10/02/2000 0:00	0910	0.45		0.002		18.8	0.09	0.0005	<	0.020	<	0.002		0.0		0.05	<
HIGHWAY 57, 1	11/27/2000 0:00	0920	0.17		0.002		17.6	0.06	0.0005	<	0.020	<	0.003		0.3		0.05	<
HIGHWAY 57, 1	01/02/2001 0:00	0945	0.15		0.001		22.3	0.05	0.0005	<	0.020	<	0.002		0.9		0.05	<
HIGHWAY 57, 1	03/05/2001 0:00	0930	3.48		0.003		10.7	0.07	0.0005	<	0.020	<	0.005		1.7		0.05	<
HIGHWAY 57, 1	03/05/2001 0:00	0935	3.30		0.003		11.0	0.07	0.0005	<	0.020	<	0.004		1.6		0.05	<
HIGHWAY 57, 1	04/30/2001 0:00	0910	1.48		0.008		14.7	0.10	0.0005	<	0.020	<	0.003		0.2		0.05	<
HIGHWAY 57, 1	07/09/2001 0:00	0930	3.32		0.016		9.6	0.09	0.0005	<	0.020	<	0.005		0.7		0.05	<
HIGHWAY 57, 1	09/04/2001 0:00	1000	1.23		0.002		13.5	0.11	0.0005	<	0.020	<	0.002		0.2		0.05	<
HIGHWAY 57, 1	10/29/2001 0:00	0950	0.59		0.002		13.8	0.08	0.0005	<	0.020	<	0.002		0.1		0.05	<
HIGHWAY 57, 1	02/04/2002 0:00	0918	0.19		0.001	<	14.1	0.08	0.0005	<	0.020	<	0.004		0.1		0.05	<
HIGHWAY 57, 1	04/01/2002 0:00	0930	0.75		0.001	<	18.1	0.16	0.0005	<	0.020	<	0.005		0.1	<	0.05	<
HIGHWAY 57, 1	06/03/2002 0:00	0920	0.99		0.001		8.8	0.11	0.0005	<	0.020	<	0.004		0.3		0.05	<
HIGHWAY 57, 1	08/05/2002 0:00	0948	0.67		0.003		13.3	0.10	0.0005	<	0.020	<	0.004		0.1	<	0.05	<
HIGHWAY 57, 1	10/07/2002 0:00	0949	0.34		0.001	<	15.1	0.06	0.0005	<	0.020	<	0.003		0.1	<	0.05	<
HIGHWAY 57, 1	12/02/2002 0:00	1013	0.12		0.106		17.3	0.05	0.0005	<	0.020	<	0.003		0.1	<	0.05	<
HIGHWAY 57, 1	01/06/2003 0:00	0939	0.14		0.001	<	17.0	0.07	0.0005	<	0.020	<	0.003		0.1		0.05	<
HIGHWAY 57, 1	03/03/2003 0:00	0956	0.42		0.001	<	18.5	0.11	0.0005	<	0.020	<	0.004		0.1	<	0.05	<
HIGHWAY 57, 1	05/05/2003 0:00	0958	4.46		0.004		8.7	0.14	0.0005	<	0.020	<	0.007		0.7		0.09	
HIGHWAY 57, 1	07/07/2003 0:00	1015	1.34		0.002		15.7	0.15	0.0005	<	0.020	<	0.005		0.1	<	0.05	<
HIGHWAY 57, 1	09/08/2003 0:00	1019	2.40		0.003		9.4	0.15	0.0005	<	0.020	<	0.008		0.4		0.05	
HIGHWAY 57, 1	11/03/2003 0:00	1100	1.59		0.001		10.0	0.06	0.0005	<	0.020	<	0.005		1.1		0.05	<
HIGHWAY 57, 1	04/05/2004 0:00	0942	2.09		0.002		11.9	0.11	0.0005	<	0.020	<	0.005		0.6		0.05	<
HIGHWAY 57, 1	06/07/2004 0:00	1002	0.72		0.001	<	17.1	0.08	0.0005	<	0.020	<	0.005		0.1	<	0.05	<
HIGHWAY 57, 1	08/02/2004 0:00	1028	1.49		0.002		6.0	0.07	0.0005	<	0.020	<	0.005		0.4		0.05	<
HIGHWAY 57, 1	10/04/2004 0:00	0916	0.50		0.001	<	18.9	0.07	0.0005	<	0.020	<	0.004		0.1	<	0.05	<
HIGHWAY 57, 1	12/06/2004 0:00	0912	5.50		0.005		8.1	0.22	0.0005	<	0.020	<	0.008		0.2		0.05	<
HIGHWAY 57, 1	01/03/2005 0:00	0908	0.37		0.001	<	18.5	0.10	0.0005	<	0.020	<	0.004		0.1	<	0.05	<
HIGHWAY 57, 1	03/07/2005 0:00	0934	1.18		0.001		12.5	0.13	0.0005	<	0.020	<	0.005		0.3		0.05	<
HIGHWAY 57, 1	05/02/2005 0:00	0850	0.94		0.001	<	17.7	0.09	0.0005	<	0.020	<	0.004		0.5		0.05	<

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	NO2_NO3		ORTH_PHOS		PHFIELD	POTASSIUM	SELENIUM		SILICA		SILVER		SODIUM	SPEC_COND	SULFATE
HIGHWAY 57,	09/10/1997 0:00	1155			0.02	<	8.3	4.69	0.002		10.9		0.001	<	12.9	434	45.1
HIGHWAY 57,	11/05/1997 0:00	1310					8.1	5.59	0.002	<	17.6		0.001	<	14.4	493	57.2
HIGHWAY 57,	02/04/1998 0:00	1228					8.4	3.56	0.002	<	15.1		0.001	<	13.8	489	71.2
HIGHWAY 57,	04/08/1998 0:00	1210					8.2	4.67	0.002	<	20.4		0.001	<	12.1	384	47.7
HIGHWAY 57,	06/03/1998 0:00	1228					8.2	4.27	0.002	<	21.6		0.001	<	14.0	528	53.1
HIGHWAY 57,	08/05/1998 0:00	1245					8.0	4.34	0.002	<	24.2		0.001	<	11.1	337	33.9
HIGHWAY 57,	10/07/1998 0:00	1315					7.6	4.97	0.002	<	20.6		0.001	<	14.2	316	32.8
HIGHWAY 57,	12/09/1998 0:00	1315					8.1	3.90	0.002	<	21.0		0.001	<	8.7	399	30.1
HIGHWAY 57,	03/01/1999 0:00	0915					7.8	3.18	0.002	<	19.9		0.001	<	14.5	557	58.2
HIGHWAY 57,	05/03/1999 0:00	0925					7.9	3.28	0.002	<	20.1		0.001	<	7.5	308	23.8
HIGHWAY 57,	06/28/1999 0:00	1010					8.5	3.90	0.002	<	23.2		0.001	<	11.5	474	39.7
HIGHWAY 57,	08/30/1999 0:00	0935					7.6	4.36	0.002	<	5.5		0.001	<	16.8	542	63.8
HIGHWAY 57,	11/01/1999 0:00	0920					8.1	3.60	0.002	<	3.6		0.001	<	15.9	512	63.0
HIGHWAY 57,	01/31/2000 0:00	0925			0.02	<	8.5	3.74	0.002	<	3.4		0.001	<	16.2	484	75.6
HIGHWAY 57,	04/03/2000 0:00	0900			0.02	<	8.3	3.97	0.002	<	23.8		0.001	<	13.0	506	63.3
HIGHWAY 57,	06/05/2000 0:00	1000			0.07		8.6	4.09	0.002	<	13.6		0.001	<	18.0	528	91.8
HIGHWAY 57,	08/07/2000 0:00	0900			0.02	<	7.7	4.57	0.002	<	7.0		0.001	<	16.9	456	63.6
HIGHWAY 57,	10/02/2000 0:00	0910			0.02	<	8.1	4.49	0.002	<	3.4		0.001	<	20.6	540	91.4
HIGHWAY 57,	11/27/2000 0:00	0920			0.02	<	8.3	4.85	0.002	<	4.7		0.001	<	23.4	567	90.7
HIGHWAY 57,	01/02/2001 0:00	0945			0.02	<	7.8	5.46	0.002	<	1.7		0.001	<	25.6	697	118.7
HIGHWAY 57,	03/05/2001 0:00	0930			0.02	<	7.7	4.44	0.002	<	27.7		0.001	<	10.6	344	48.7
HIGHWAY 57,	03/05/2001 0:00	0935			0.02	<	7.7	4.40	0.002	<	25.7		0.001	<	10.8	359	48.3
HIGHWAY 57,	04/30/2001 0:00	0910			0.02	<	8.1	3.63	0.002	<	6.5		0.001	<	13.0	427	61.8
HIGHWAY 57,	07/09/2001 0:00	0930			0.02	<	7.7	4.66	0.002	<	23.3		0.001	<	8.9	325	23.6
HIGHWAY 57,	09/04/2001 0:00	1000			0.04		7.8	4.63	0.002	<	9.9		0.001	<	12.2	398	44.7
HIGHWAY 57,	10/29/2001 0:00	0950			0.02		8.0	4.65	0.002	<	5.8		0.001	<	14.4	409	50.3
HIGHWAY 57,	02/04/2002 0:00	0918			0.02	<	8.1	4.02	0.001	<	1.2		0.001	<	19.5	451	67.6
HIGHWAY 57,	04/01/2002 0:00	0930			0.25	<	8.2	4.27	0.001		4.1		0.001	<	22.7	567	101.5
HIGHWAY 57,	06/03/2002 0:00	0920			0.25	<	7.7	4.00	0.001	<	13.8		0.001	<	10.6	340	29.7
HIGHWAY 57,	08/05/2002 0:00	0948			0.25	<	7.8	4.86	0.001	<	13.0		0.001	<	11.5	422	42.2
HIGHWAY 57,	10/07/2002 0:00	0949			0.25	<	7.7	4.93	0.001	<	5.4		0.001	<	15.2	440	61.6
HIGHWAY 57,	12/02/2002 0:00	1013			0.25	<	8.1	4.91	0.001	<	0.5		0.001	<	19.4	463	76.0
HIGHWAY 57,	01/06/2003 0:00	0939			0.25	<	7.8	4.61	0.001	<	1.3		0.001	<	19.0	468	75.0
HIGHWAY 57,	03/03/2003 0:00	0956			0.25	<	8.4	4.25	0.001	<	1.9		0.001	<	20.7	539	91.0
HIGHWAY 57,	05/05/2003 0:00	0958			0.25	<	7.7	5.14	0.001	<	35.8		0.001	<	7.1	274	18.9
HIGHWAY 57,	07/07/2003 0:00	1015			0.25	<	8.0	4.46	0.001		9.1		0.001	<	14.3	399	64.3
HIGHWAY 57,	09/08/2003 0:00	1019			0.25	<	7.8	5.01	0.001	<	19.7		0.001	<	8.6	269	28.9
HIGHWAY 57,	11/03/2003 0:00	1100			0.25	<	8.2	5.14	0.001	<	19.1		0.001	<	7.1	324	27.9
HIGHWAY 57,	04/05/2004 0:00	0942			0.25	<	7.8	3.98	0.001	<	19.2		0.001	<	9.8	362	36.0
HIGHWAY 57,	06/07/2004 0:00	1002			0.25	<	8.3	3.80	0.001	<	3.7		0.001	<	15.2	447	54.8
HIGHWAY 57,	08/02/2004 0:00	1028			0.25	<	7.7	5.03	0.001	<	20.7		0.001	<	3.9	220	13.2
HIGHWAY 57,	10/04/2004 0:00	0916			0.25	<	8.1	4.51	0.001	<	3.3		0.001	<	16.7	503	69.7
HIGHWAY 57,	12/06/2004 0:00	0912			0.25	<	7.3	3.91	0.001	<	29.7		0.001	<	9.3	278	35.9
HIGHWAY 57,	01/03/2005 0:00	0908			0.25	<	7.9	3.73	0.001	<	1.6		0.001	<	24.4	548	71.2
HIGHWAY 57,	03/07/2005 0:00	0934			0.25	<	7.8	3.47	0.001	<	14.9		0.001	<	11.3	414	33.4
HIGHWAY 57,	05/02/2005 0:00	0850			0.25	<	7.9	3.52	0.001	<	12.4		0.001	<	14.7	555	47.0

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	THALLIUM		TDS	TOTHARD	PHOSPHU	TSS	TURBIDITY	VANADIUM		ZINC		TOC	KJELDAHL		STRONTIUM
HIGHWAY 57,	09/10/1997 0:00	1155	0.050	<	259	212	0.13	27	16.0	0.009		0.020					
HIGHWAY 57,	11/05/1997 0:00	1310	0.050	<	293	220	0.22	96	63.0	0.007		0.021					
HIGHWAY 57,	02/04/1998 0:00	1228	0.050	<	350	278	0	37	18.0	0.005	<	0.090					
HIGHWAY 57,	04/08/1998 0:00	1210	0.050	<	265	205	0	76	51.0	0.007		0.032					
HIGHWAY 57,	06/03/1998 0:00	1228	0.050	<	329	265	0	56	28.0	0.010		0.023					
HIGHWAY 57,	08/05/1998 0:00	1245	0.050	<	214	157	0	62	53.0	0.009		0.087					
HIGHWAY 57,	10/07/1998 0:00	1315	0.050	<	191	127	0	84	53.0	0.007		0.016					
HIGHWAY 57,	12/09/1998 0:00	1315	0.050	<	229	175	0	59	39.0	0.006		0.047					
HIGHWAY 57,	03/01/1999 0:00	0915	0.050	<	330	258	0	60	35.0	0.006		0.020					
HIGHWAY 57,	05/03/1999 0:00	0925	0.050	<	187	137	0	34	31.0	0.007		0.015					
HIGHWAY 57,	06/28/1999 0:00	1010	0.050	<	292	235	0	78	58.0	0.011		0.028					
HIGHWAY 57,	08/30/1999 0:00	0935	0.050	<	374	413	0	23	10.8	0.005	<	0.023					
HIGHWAY 57,	11/01/1999 0:00	0920	0.050	<	293	231	0	15	7.8	0.005	<	0.021					
HIGHWAY 57,	01/31/2000 0:00	0925	0.050	<	312	248	0	35	11.0	0.005	<	0.026			1.3		
HIGHWAY 57,	04/03/2000 0:00	0900	0.050	<	321	266	0	82	42.0	0.009		0.039			1.1		
HIGHWAY 57,	06/05/2000 0:00	1000	0.050	<	370	284	0	77	12.4	0.011		0.022			0.6		
HIGHWAY 57,	08/07/2000 0:00	0900	0.050	<	271	209	0.11	32	13.0	0.007		0.131			0.7		
HIGHWAY 57,	10/02/2000 0:00	0910	0.050	<	317	216	0.09	20	9.9	0.005	<	0.015			1.1		
HIGHWAY 57,	11/27/2000 0:00	0920	0.050	<	325	222	0.10	11	2.6	0.005	<	0.015		7.5	1.0		
HIGHWAY 57,	01/02/2001 0:00	0945	0.050	<	401	277	0.09	2	2.3	0.005	<	0.011		7.2	0.5		
HIGHWAY 57,	03/05/2001 0:00	0930	0.050	<	231	153	0.27	54	64.0	0.009		0.025		8.4	1.4		
HIGHWAY 57,	03/05/2001 0:00	0935	0.050	<	226	156	0.26	53	72.0	0.008		0.022		7.7	1.4		
HIGHWAY 57,	04/30/2001 0:00	0910	0.050	<	253	192	0.16	72	28.0	0.008		0.079		11.1	0.9		
HIGHWAY 57,	07/09/2001 0:00	0930	0.050	<	205	159	0.23	51	11.0	0.012		0.059		9.0	0.1	<	
HIGHWAY 57,	09/04/2001 0:00	1000	0.050	<	236	185	0.16	39	10.0	0.007		0.049		6.8	0.8		
HIGHWAY 57,	10/29/2001 0:00	0950	0.050	<	247	196	0.13	19	11.0	0.005	<	0.028		6.4	0.7		
HIGHWAY 57,	02/04/2002 0:00	0918	0.050	<	266	191	0.07	13	6.3	0.005	<	0.006		6.8	0.9		
HIGHWAY 57,	04/01/2002 0:00	0930	0.050	<	343	245	0.10	23	13.0	0.005	<	0.009		6.8	0.9		
HIGHWAY 57,	06/03/2002 0:00	0920	0.050	<	202	147	0.19	32	27.0	0.006		0.009		7.2	0.7		
HIGHWAY 57,	08/05/2002 0:00	0948	0.050	<	254	194	0.15	31	14.0	0.008		0.007		5.3	0.5		0.659
HIGHWAY 57,	10/07/2002 0:00	0949	0.050	<	272	195	0.11	19	7.4	0.005	<	0.006		5.3	0.3		0.703
HIGHWAY 57,	12/02/2002 0:00	1013	0.050	<	309	214	0.07	10	2.3	0.005	<	0.005		6.7	1.0		0.774
HIGHWAY 57,	01/06/2003 0:00	0939	0.050	<	275	209	0.08	10	3.5	0.005	<	0.012		6.5	0.6		0.749
HIGHWAY 57,	03/03/2003 0:00	0956	0.050	<	317	228	0.16	15	10.3	0.005	<	0.007		9.3	1.2		0.883
HIGHWAY 57,	05/05/2003 0:00	0958	0.050	<	191	138	0.31	114	89.0	0.012		0.018		7.0	1.5		0.394
HIGHWAY 57,	07/07/2003 0:00	1015	0.050	<	260	197	0.17	53	34.7	0.008		0.007		4.1	0.6		0.771
HIGHWAY 57,	09/08/2003 0:00	1019	0.050	<	179	133	0.28	64	49.1	0.010		0.017		4.8	0.7		0.425
HIGHWAY 57,	11/03/2003 0:00	1100	0.050	<	211	163	0.22	41	56.7	0.008		0.009		4.8	0.4		0.506
HIGHWAY 57,	04/05/2004 0:00	0942	0.050	<	246	198	0.24	70	75.9	0.008		0.013		7.8	1.1		0.572
HIGHWAY 57,	06/07/2004 0:00	1002	0.050	<	280	236	0.10	29	28.3	0.006		0.008		4.6	0.3		0.818
HIGHWAY 57,	08/02/2004 0:00	1028	0.050	<	147	108	0.29	54	57.9	0.009		0.008		9.3	0.8		0.284
HIGHWAY 57,	10/04/2004 0:00	0916	0.050	<	311	253	0.09	19	18.4	0.005		0.006		4.3	0.5		0.875
HIGHWAY 57,	12/06/2004 0:00	0912	0.050	<	195	128	0.42	260	248	0.010		0.024		11.8	1.4		0.303
HIGHWAY 57,	01/03/2005 0:00	0908	0.050	<	323	247	0.08	22	4.4	0.005	<	0.005	<	5.2	0.9		0.886
HIGHWAY 57,	03/07/2005 0:00	0934	0.050	<	248	205	0.16	45	44.5	0.005		0.008		6.0	0.8		0.572
HIGHWAY 57,	05/02/2005 0:00	0850	0.050	<	326	277	0.16	35	30.2	0.007		0.009		8.7	0.3		0.886

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	
HIGHWAY 57, 1	09/10/1997 0:00	1155	
HIGHWAY 57, 1	11/05/1997 0:00	1310	
HIGHWAY 57, 1	02/04/1998 0:00	1228	
HIGHWAY 57, 1	04/08/1998 0:00	1210	
HIGHWAY 57, 1	06/03/1998 0:00	1228	
HIGHWAY 57, 1	08/05/1998 0:00	1245	
HIGHWAY 57, 1	10/07/1998 0:00	1315	
HIGHWAY 57, 1	12/09/1998 0:00	1315	
HIGHWAY 57, 1	03/01/1999 0:00	0915	
HIGHWAY 57, 1	05/03/1999 0:00	0925	
HIGHWAY 57, 1	06/28/1999 0:00	1010	
HIGHWAY 57, 1	08/30/1999 0:00	0935	
HIGHWAY 57, 1	11/01/1999 0:00	0920	
HIGHWAY 57, 1	01/31/2000 0:00	0925	
HIGHWAY 57, 1	04/03/2000 0:00	0900	
HIGHWAY 57, 1	06/05/2000 0:00	1000	
HIGHWAY 57, 1	08/07/2000 0:00	0900	
HIGHWAY 57, 1	10/02/2000 0:00	0910	
HIGHWAY 57, 1	11/27/2000 0:00	0920	
HIGHWAY 57, 1	01/02/2001 0:00	0945	
HIGHWAY 57, 1	03/05/2001 0:00	0930	
HIGHWAY 57, 1	03/05/2001 0:00	0935	
HIGHWAY 57, 1	04/30/2001 0:00	0910	
HIGHWAY 57, 1	07/09/2001 0:00	0930	
HIGHWAY 57, 1	09/04/2001 0:00	1000	
HIGHWAY 57, 1	10/29/2001 0:00	0950	
HIGHWAY 57, 1	02/04/2002 0:00	0918	
HIGHWAY 57, 1	04/01/2002 0:00	0930	
HIGHWAY 57, 1	06/03/2002 0:00	0920	
HIGHWAY 57, 1	08/05/2002 0:00	0948	
HIGHWAY 57, 1	10/07/2002 0:00	0949	
HIGHWAY 57, 1	12/02/2002 0:00	1013	
HIGHWAY 57, 1	01/06/2003 0:00	0939	
HIGHWAY 57, 1	03/03/2003 0:00	0956	
HIGHWAY 57, 1	05/05/2003 0:00	0958	
HIGHWAY 57, 1	07/07/2003 0:00	1015	
HIGHWAY 57, 1	09/08/2003 0:00	1019	
HIGHWAY 57, 1	11/03/2003 0:00	1100	
HIGHWAY 57, 1	04/05/2004 0:00	0942	
HIGHWAY 57, 1	06/07/2004 0:00	1002	
HIGHWAY 57, 1	08/02/2004 0:00	1028	
HIGHWAY 57, 1	10/04/2004 0:00	0916	
HIGHWAY 57, 1	12/06/2004 0:00	0912	
HIGHWAY 57, 1	01/03/2005 0:00	0908	
HIGHWAY 57, 1	03/07/2005 0:00	0934	
HIGHWAY 57, 1	05/02/2005 0:00	0850	

SITE_LOCT - D	COL_DATE	COL_TIME	ALKALINTY	ALUMINUM	AMMONIA		ANTIMONY		ARSENIC		BARIUM		BERYLLIUM		BOD		BORON	
HIGHWAY 57, 1	07/11/2005 0:00	0857	139	0.55	0.10	<	0.05	<	0.006		0.097		0.001	<			0.05	<
HIGHWAY 57, 1	09/12/2005 0:00	0847	133	3.21	0.10	<	0.05	<	0.005		0.129		0.001	<			0.05	<
HIGHWAY 57, 1	11/07/2005 0:00	0910	203	0.41	0.10	<	0.05	<	0.003		0.122		0.001	<			0.05	<
HIGHWAY 57, 1	01/30/2006 0:00	0848	197	0.22	0.10	<	0.05	<	0.001		0.112		0.001	<			0.05	<
HIGHWAY 57, 1	04/03/2006 0:00	0911	194	2.08	0.10	<	0.05	<	0.003		0.147		0.001	<			0.06	
HIGHWAY 57, 1	06/05/2006 0:00	0934	178	0.73	0.10		0.05	<	0.007		0.122		0.001	<			0.05	
HIGHWAY 57, 1	08/07/2006 0:00	0939	183	0.65	0.10	<	0.05	<	0.007		0.119		0.001	<			0.07	
HIGHWAY 57, 1	10/02/2006 0:00	0854	196	0.58	0.10	<	0.05	<	0.004		0.111		0.001	<			0.06	
HIGHWAY 57, 1	10/02/2006 0:00	0859	182	0.54	0.10	<	0.05	<	0.004		0.109		0.001	<			0.05	
HIGHWAY 57, 1	11/27/2006 0:00	0919	187	0.29	0.10	<	0.05	<	0.002		0.110		0.001	<			0.06	
HIGHWAY 57, 1	01/08/2007 0:00	0915																

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	BROMIDE		CADMIUM		CALCIUM	CHLORIDE	CHROMIUM		COBALT		COPPER		DISOXY		FLUORIDE	
HIGHWAY 57, 1	07/11/2005 0:00	0857	0.200	<	0.001	<	49.7	4.4	0.001		0.010	<	0.003		7.3		0.17	
HIGHWAY 57, 1	09/12/2005 0:00	0847	0.200	<	0.001	<	47.8	3.5	0.004		0.010	<	0.004		7.9		0.17	
HIGHWAY 57, 1	11/07/2005 0:00	0910	0.200	<	0.001	<	70.8	6.0	0.001	<	0.010	<	0.004		9.6		0.15	<
HIGHWAY 57, 1	01/30/2006 0:00	0848	0.200	<	0.001	<	71.3	13.3	0.001	<	0.010	<	0.002		11.9		0.23	
HIGHWAY 57, 1	04/03/2006 0:00	0911	0.200	<	0.001	<	73.8	16.2	0.002		0.010	<	0.004		8.8		0.24	
HIGHWAY 57, 1	06/05/2006 0:00	0934	0.200	<	0.001	<	61.5	6.6	0.001	<	0.010	<	0.004		7.0		0.20	
HIGHWAY 57, 1	08/07/2006 0:00	0939	0.200	<	0.001	<	57.5	8.2	0.001	<	0.010	<	0.003		6.3		0.26	
HIGHWAY 57, 1	10/02/2006 0:00	0854	0.200	<	0.001	<	56.9	10.6	0.001	<	0.010	<	0.002		8.4		0.29	
HIGHWAY 57, 1	10/02/2006 0:00	0859	0.200	<	0.001	<	56.5	10.1	0.001	<	0.010	<	0.002		7.9		0.27	
HIGHWAY 57, 1	11/27/2006 0:00	0919	0.200	<	0.001	<	61.8	12.8	0.001	<	0.010	<	0.002		9.4		0.27	
HIGHWAY 57, 1	01/08/2007 0:00	0915																

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	IRON		LEAD		MAGNESIUM	MANGANESE	MERCURY		MOLYBDENM		NICKEL		NITRATE		NITRITE	
HIGHWAY 57, 1	07/11/2005 0:00	0857	0.66		0.001	<	9.2	0.27	0.0005	<	0.020	<	0.003		0.1		0.05	<
HIGHWAY 57, 1	09/12/2005 0:00	0847	3.49		0.003		8.6	0.24	0.0005	<	0.020	<	0.005		0.3		0.05	<
HIGHWAY 57, 1	11/07/2005 0:00	0910	0.44		0.001	<	14.4	0.09	0.0005	<	0.020	<	0.003		0.2		0.05	<
HIGHWAY 57, 1	01/30/2006 0:00	0848	0.22		0.001	<	19.1	0.07	0.0005	<	0.020	<	0.003		0.1	<	0.05	<
HIGHWAY 57, 1	04/03/2006 0:00	0911	1.96		0.002		20.3	0.24	0.0005	<	0.020	<	0.010		0.3		0.05	<
HIGHWAY 57, 1	06/05/2006 0:00	0934	0.95		0.002		12.8	0.25	0.0005	<	0.020	<	0.005		0.2		0.05	
HIGHWAY 57, 1	08/07/2006 0:00	0939	0.63		0.001	<	13.5	0.10	0.0005	<	0.020	<	0.005		0.1	<	0.05	<
HIGHWAY 57, 1	10/02/2006 0:00	0854	0.62		0.001	<	14.6	0.12	0.0005	<	0.020	<	0.005		0.1	<	0.05	<
HIGHWAY 57, 1	10/02/2006 0:00	0859	0.58		0.001	<	14.2	0.11	0.0005	<	0.020	<	0.005		0.1	<	0.05	<
HIGHWAY 57, 1	11/27/2006 0:00	0919	0.36		0.001	<	15.7	0.08	0.0005	<	0.020	<	0.004		0.1	<	0.05	<
HIGHWAY 57, 1	01/08/2007 0:00	0915																

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	NO2_NO3		ORTH_PHOS		PHFIELD	POTASSIUM	SELENIUM		SILICA		SILVER		SODIUM	SPEC_COND	SULFATE
HIGHWAY 57, 1	07/11/2005 0:00	0857			0.25	<	7.4	4.83	0.001	<	14.1		0.001	<	6.9	331	24.0
HIGHWAY 57, 1	09/12/2005 0:00	0847			0.25	<	7.5	5.09	0.001	<	29.6		0.001	<	5.9	280	14.4
HIGHWAY 57, 1	11/07/2005 0:00	0910			0.25	<	7.5	4.25	0.001	<	6.7		0.001	<	12.4	485	18.0
HIGHWAY 57, 1	01/30/2006 0:00	0848			0.25	<	8.0	3.78	0.001	<	1.1		0.001	<	16.6	522	72.6
HIGHWAY 57, 1	04/03/2006 0:00	0911			0.25	<	8.0	4.22	0.001		9.9		0.001	<	19.7	569	88.9
HIGHWAY 57, 1	06/05/2006 0:00	0934			0.25	<	7.8	4.31	0.001	<	13.0		0.001	<	11.3	382	28.6
HIGHWAY 57, 1	08/07/2006 0:00	0939			0.25	<	7.7	4.54	0.001		4.8		0.001	<	12.8	422	29.5
HIGHWAY 57, 1	10/02/2006 0:00	0854			0.25	<	7.8	4.56	0.001		4.5		0.001	<	14.9	442	33.5
HIGHWAY 57, 1	10/02/2006 0:00	0859			0.25	<	7.8	4.55	0.001		4.3		0.001	<	14.9	430	31.6
HIGHWAY 57, 1	11/27/2006 0:00	0919			0.25	<	7.5	4.83	0.001	<	2.3		0.001	<	18.2	468	39.8
HIGHWAY 57, 1	01/08/2007 0:00	0915															

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	THALLIUM		TDS	TOTHARD	PHOSPHU	TSS	TURBIDITY	VANADIUM		ZINC		TOC	KJELDAHL		STRONTIUM
HIGHWAY 57, 1	07/11/2005 0:00	0857	0.050	<	197	162	0.22	22	18.2	0.005		0.005	<	11.0	0.7		0.433
HIGHWAY 57, 1	09/12/2005 0:00	0847	0.050	<	196	155	0.35	116	113	0.012		0.012		5.7	0.7		0.371
HIGHWAY 57, 1	11/07/2005 0:00	0910	0.050	<	255	236	0.09	20	10.5	0.005		0.005	<	5.0	0.2		0.686
HIGHWAY 57, 1	01/30/2006 0:00	0848	0.050	<	316	257	0.05	15	9.9	0.005	<	0.005	<	4.0	0.7		0.913
HIGHWAY 57, 1	04/03/2006 0:00	0911	0.050	<	350	268	0.22	92	59.0	0.007		0.010		5.5	1.6		0.957
HIGHWAY 57, 1	06/05/2006 0:00	0934	0.050	<	246	206	0.31	88	79.6	0.010		0.007		6.7	0.8		0.634
HIGHWAY 57, 1	08/07/2006 0:00	0939	0.050	<	241	199	0.16	22	16.9	0.008		0.005	<	5.6	0.7		0.650
HIGHWAY 57, 1	10/02/2006 0:00	0854	0.050	<	258	202	0.09	21	15.1	0.005		0.005	<	6.1	0.9		0.684
HIGHWAY 57, 1	10/02/2006 0:00	0859	0.050	<	246	200	0.12	16	14.6	0.006		0.005	<	6.2	0.7		0.677
HIGHWAY 57, 1	11/27/2006 0:00	0919	0.050	<	268	219	0.09	11	10.9	0.005	<	0.005	<	6.8	0.8		0.712
HIGHWAY 57, 1	01/08/2007 0:00	0915															

Neosho River Station - DOWN STREAM of WOLF CREEK - Highway 57, 1.0 Mi W Of LeRoy

SITE_LOCT - D	COL_DATE	COL_TIME	
HIGHWAY 57, 1	07/11/2005 0:00	0857	
HIGHWAY 57, 1	09/12/2005 0:00	0847	
HIGHWAY 57, 1	11/07/2005 0:00	0910	
HIGHWAY 57, 1	01/30/2006 0:00	0848	
HIGHWAY 57, 1	04/03/2006 0:00	0911	
HIGHWAY 57, 1	06/05/2006 0:00	0934	
HIGHWAY 57, 1	08/07/2006 0:00	0939	
HIGHWAY 57, 1	10/02/2006 0:00	0854	
HIGHWAY 57, 1	10/02/2006 0:00	0859	
HIGHWAY 57, 1	11/27/2006 0:00	0919	
HIGHWAY 57, 1	01/08/2007 0:00	0915	

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	ALKALINTY	ALUMINUM	AMMONIA		ANTIMONY		ARSENIC		BARIUM		BERYLLIUM		BOD	
0.75 W OF HIGHWAY 130 A	10/30/1985 0:00	1255	217		0.03										2.4	
0.75 W OF HIGHWAY 130 A	11/20/1985 0:00	1240	212		0.04										1.5	
0.75 W OF HIGHWAY 130 A	12/17/1985 0:00	1315	288		0.09										1.8	
0.75 W OF HIGHWAY 130 A	01/29/1986 0:00	1305	197		0.04										3.6	
0.75 W OF HIGHWAY 130 A	02/26/1986 0:00	1254	269		0.00	<									5.4	
0.75 W OF HIGHWAY 130 A	03/19/1986 0:00	1347	213		0.00	<									3.9	
0.75 W OF HIGHWAY 130 A	05/28/1986 0:00	1250	211		0.09				0.018		0.22				5.1	
0.75 W OF HIGHWAY 130 A	06/25/1986 0:00	1240	243		0.01	<									4.8	
0.75 W OF HIGHWAY 130 A	07/30/1986 0:00	1330	195		0.02										1.2	
0.75 W OF HIGHWAY 130 A	08/26/1986 0:00	1335	215		0.02										2.7	
0.75 W OF HIGHWAY 130 A	10/01/1986 0:00	1330	85		0.02										3.3	
0.75 W OF HIGHWAY 130 A	10/29/1986 0:00	1219	252		0.05										2.4	
0.75 W OF HIGHWAY 130 A	11/19/1986 0:00	1306	272		0.06										1.8	
0.75 W OF HIGHWAY 130 A	12/30/1986 0:00	1325	190		0.08										4.5	
0.75 W OF HIGHWAY 130 A	01/28/1987 0:00	1415	282		0.10										2.7	
0.75 W OF HIGHWAY 130 A	02/25/1987 0:00	1350	230		0.08										2.1	
0.75 W OF HIGHWAY 130 A	03/25/1987 0:00	1345	157		0.04										4.2	
0.75 W OF HIGHWAY 130 A	04/29/1987 0:00	1415	251		0.01	<									3.9	
0.75 W OF HIGHWAY 130 A	05/20/1987 0:00	1304	239		0.01	<									4.2	
0.75 W OF HIGHWAY 130 A	06/24/1987 0:00	1322	85		0.01	<			0.009		0.54				6.9	
0.75 W OF HIGHWAY 130 A	07/29/1987 0:00	1335	227		0.01	<									4.8	
0.75 W OF HIGHWAY 130 A	08/26/1987 0:00	1355	123		0.08										4.2	
0.75 W OF HIGHWAY 130 A	09/23/1987 0:00	1344	208		0.01	<									3.9	
0.75 W OF HIGHWAY 130 A	10/28/1987 0:00	1255	148		0.01	<									6.0	
0.75 W OF HIGHWAY 130 A	11/24/1987 0:00	1330	234		0.01	<									3.9	
0.75 W OF HIGHWAY 130 A	12/30/1987 0:00	1340	199		0.01	<										
0.75 W OF HIGHWAY 130 A	02/24/1988 0:00	1300	238		0.11										2.4	
0.75 W OF HIGHWAY 130 A	03/30/1988 0:00	1246	248		0.01	<									3.9	
0.75 W OF HIGHWAY 130 A	04/27/1988 0:00	1242	245		0.04				0.004		0.17				3.0	
0.75 W OF HIGHWAY 130 A	05/25/1988 0:00	1345	269		0.07										6.6	
0.75 W OF HIGHWAY 130 A	06/29/1988 0:00	1315	253		0.01	<									5.1	
0.75 W OF HIGHWAY 130 A	07/27/1988 0:00	1338	208		0.02										4.8	
0.75 W OF HIGHWAY 130 A	08/24/1988 0:00	1300	215		0.04										6.6	
0.75 W OF HIGHWAY 130 A	09/28/1988 0:00	1304	233		0.03										5.7	
0.75 W OF HIGHWAY 130 A	10/26/1988 0:00	1326	236		0.14										7.4	
0.75 W OF HIGHWAY 130 A	11/30/1988 0:00	1432	254		0.11										3.2	
0.75 W OF HIGHWAY 130 A	12/21/1988 0:00	1226	267		0.02										4.5	
0.75 W OF HIGHWAY 130 A	01/25/1989 0:00	1307	270		0.16										3.6	
0.75 W OF HIGHWAY 130 A	02/22/1989 0:00	1305	258		0.32										6.0	
0.75 W OF HIGHWAY 130 A	03/29/1989 0:00	1218	234		0.11										6.0	
0.75 W OF HIGHWAY 130 A	04/26/1989 0:00	1240	203		0.06										3.9	
0.75 W OF HIGHWAY 130 A	05/24/1989 0:00	1225	103		0.18										7.8	
0.75 W OF HIGHWAY 130 A	06/28/1989 0:00	1235	205		0.01	<			0.003		0.2				5.2	
0.75 W OF HIGHWAY 130 A	07/26/1989 0:00	1435	198		0.02										6.6	
0.75 W OF HIGHWAY 130 A	08/23/1989 0:00	1345	84		0.11										4.4	
0.75 W OF HIGHWAY 130 A	09/27/1989 0:00	1340	253		0.01	<									1.5	

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	BORON		BROMIDE		CADMIUM		CALCIUM	CHLORIDE	CHROMIUM		COBALT		COPPER	
0.75 W OF HIGHWAY 130 A	10/30/1985 0:00	1255	0.09						84.0	12.0						
0.75 W OF HIGHWAY 130 A	11/20/1985 0:00	1240	0.12						79.0	10.0						
0.75 W OF HIGHWAY 130 A	12/17/1985 0:00	1315	0.14						111	19.0						
0.75 W OF HIGHWAY 130 A	01/29/1986 0:00	1305	0.05						86.0	16.0						
0.75 W OF HIGHWAY 130 A	02/26/1986 0:00	1254	0.01	<					111	17.0						
0.75 W OF HIGHWAY 130 A	03/19/1986 0:00	1347	0.03						87.0	18.0						
0.75 W OF HIGHWAY 130 A	05/28/1986 0:00	1250	0.15				0.001	<	80.5	14.0	0.01	<			0.010	<
0.75 W OF HIGHWAY 130 A	06/25/1986 0:00	1240	0.09						96.0	18.0						
0.75 W OF HIGHWAY 130 A	07/30/1986 0:00	1330	0.12						75.0	17.3						
0.75 W OF HIGHWAY 130 A	08/26/1986 0:00	1335	0.11						86.0	20.0						
0.75 W OF HIGHWAY 130 A	10/01/1986 0:00	1330	0.04						35.0	4.8						
0.75 W OF HIGHWAY 130 A	10/29/1986 0:00	1219	0.10						88.5	14.0						
0.75 W OF HIGHWAY 130 A	11/19/1986 0:00	1306	0.01	<					110	15.0						
0.75 W OF HIGHWAY 130 A	12/30/1986 0:00	1325	0.13						86.0	16.0						
0.75 W OF HIGHWAY 130 A	01/28/1987 0:00	1415	0.11						106	17.0						
0.75 W OF HIGHWAY 130 A	02/25/1987 0:00	1350	0.08						89.0	11.0						
0.75 W OF HIGHWAY 130 A	03/25/1987 0:00	1345	0.08						61.5	7.4						
0.75 W OF HIGHWAY 130 A	04/29/1987 0:00	1415	0.08						94.5	14.0						
0.75 W OF HIGHWAY 130 A	05/20/1987 0:00	1304	0.07						92.0	8.3						
0.75 W OF HIGHWAY 130 A	06/24/1987 0:00	1322	0.07				0.001		45.5	8.2	0.05				0.070	
0.75 W OF HIGHWAY 130 A	07/29/1987 0:00	1335	0.09						89.5	28.0						
0.75 W OF HIGHWAY 130 A	08/26/1987 0:00	1355	0.16						52.0	10.6						
0.75 W OF HIGHWAY 130 A	09/23/1987 0:00	1344	0.13						85.5	14.2						
0.75 W OF HIGHWAY 130 A	10/28/1987 0:00	1255	0.11						65.0	15.8						
0.75 W OF HIGHWAY 130 A	11/24/1987 0:00	1330	0.16						88.0	18.6						
0.75 W OF HIGHWAY 130 A	12/30/1987 0:00	1340	0.18						77.5	11.7						
0.75 W OF HIGHWAY 130 A	02/24/1988 0:00	1300	0.12						93.0	17.0						
0.75 W OF HIGHWAY 130 A	03/30/1988 0:00	1246	0.05						91.5	18.9						
0.75 W OF HIGHWAY 130 A	04/27/1988 0:00	1242	0.16				0.001	<	92.0	10.9	0.01	<			0.020	
0.75 W OF HIGHWAY 130 A	05/25/1988 0:00	1345	0.19						111	22.0						
0.75 W OF HIGHWAY 130 A	06/29/1988 0:00	1315	0.15						100	26.7						
0.75 W OF HIGHWAY 130 A	07/27/1988 0:00	1338	0.13						82.5	19.8						
0.75 W OF HIGHWAY 130 A	08/24/1988 0:00	1300	0.27						97.5	38.1						
0.75 W OF HIGHWAY 130 A	09/28/1988 0:00	1304	0.26						118	42.0						
0.75 W OF HIGHWAY 130 A	10/26/1988 0:00	1326	0.25						117	41.6						
0.75 W OF HIGHWAY 130 A	11/30/1988 0:00	1432	0.18						122	54.3						
0.75 W OF HIGHWAY 130 A	12/21/1988 0:00	1226	0.16						149	58.2						
0.75 W OF HIGHWAY 130 A	01/25/1989 0:00	1307	0.22						136	60.0						
0.75 W OF HIGHWAY 130 A	02/22/1989 0:00	1305	0.16						138	56.8						
0.75 W OF HIGHWAY 130 A	03/29/1989 0:00	1218	0.21						123	41.1						
0.75 W OF HIGHWAY 130 A	04/26/1989 0:00	1240	0.23						93.5	40.2						
0.75 W OF HIGHWAY 130 A	05/24/1989 0:00	1225	0.15						48.5	11.3						
0.75 W OF HIGHWAY 130 A	06/28/1989 0:00	1235	0.19				0.001	<	86.0	13.4	0.010	<			0.020	
0.75 W OF HIGHWAY 130 A	07/26/1989 0:00	1435	0.16						78.0	13.4						
0.75 W OF HIGHWAY 130 A	08/23/1989 0:00	1345	0.09						32.5	5.5						
0.75 W OF HIGHWAY 130 A	09/27/1989 0:00	1340	0.18						90.0	11.0						

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	DISOXY		FLUORIDE		IRON		LEAD		MAGNESIUM	MANGANESE	MERCURY		MOLYBDENM	
0.75 W OF HIGHWAY 130 A	10/30/1985 0:00	1255	9.4								17.4					
0.75 W OF HIGHWAY 130 A	11/20/1985 0:00	1240	10.3								15.7					
0.75 W OF HIGHWAY 130 A	12/17/1985 0:00	1315	13.6								24.8					
0.75 W OF HIGHWAY 130 A	01/29/1986 0:00	1305	11.2								22.8					
0.75 W OF HIGHWAY 130 A	02/26/1986 0:00	1254	13.3								24.2					
0.75 W OF HIGHWAY 130 A	03/19/1986 0:00	1347	12.3								22.6					
0.75 W OF HIGHWAY 130 A	05/28/1986 0:00	1250	7.5				8.41		0.010		16.9	0.38	0.0005	<		
0.75 W OF HIGHWAY 130 A	06/25/1986 0:00	1240	10.5								21.2					
0.75 W OF HIGHWAY 130 A	07/30/1986 0:00	1330	9.3								19.7					
0.75 W OF HIGHWAY 130 A	08/26/1986 0:00	1335	8.2								19.7					
0.75 W OF HIGHWAY 130 A	10/01/1986 0:00	1330	6.5								5.8					
0.75 W OF HIGHWAY 130 A	10/29/1986 0:00	1219	9.2								17.8					
0.75 W OF HIGHWAY 130 A	11/19/1986 0:00	1306	12.1								24.6					
0.75 W OF HIGHWAY 130 A	12/30/1986 0:00	1325	12.6								22.7					
0.75 W OF HIGHWAY 130 A	01/28/1987 0:00	1415	14.3								22.7					
0.75 W OF HIGHWAY 130 A	02/25/1987 0:00	1350	11.5								18.7					
0.75 W OF HIGHWAY 130 A	03/25/1987 0:00	1345	9.4								12.1					
0.75 W OF HIGHWAY 130 A	04/29/1987 0:00	1415	9.8								23.8					
0.75 W OF HIGHWAY 130 A	05/20/1987 0:00	1304	6.8								19.6					
0.75 W OF HIGHWAY 130 A	06/24/1987 0:00	1322	5.6				47.65		0.050		8.5	1.19	0.0005	<		
0.75 W OF HIGHWAY 130 A	07/29/1987 0:00	1335	7.9								24.5					
0.75 W OF HIGHWAY 130 A	08/26/1987 0:00	1355	6.6								11.6					
0.75 W OF HIGHWAY 130 A	09/23/1987 0:00	1344	8.4								19.6					
0.75 W OF HIGHWAY 130 A	10/28/1987 0:00	1255	7.7								14.7					
0.75 W OF HIGHWAY 130 A	11/24/1987 0:00	1330	10.4								19.0					
0.75 W OF HIGHWAY 130 A	12/30/1987 0:00	1340	12.6								15.4					
0.75 W OF HIGHWAY 130 A	02/24/1988 0:00	1300	13.6								21.1					
0.75 W OF HIGHWAY 130 A	03/30/1988 0:00	1246	11.3								21.5					
0.75 W OF HIGHWAY 130 A	04/27/1988 0:00	1242	8.6				2.03		0.001	<	19.6	0.18	0.0005	<		
0.75 W OF HIGHWAY 130 A	05/25/1988 0:00	1345	6.8								27.2					
0.75 W OF HIGHWAY 130 A	06/29/1988 0:00	1315	8.7								27.5					
0.75 W OF HIGHWAY 130 A	07/27/1988 0:00	1338	9.3								22.3					
0.75 W OF HIGHWAY 130 A	08/24/1988 0:00	1300	8.8								28.5					
0.75 W OF HIGHWAY 130 A	09/28/1988 0:00	1304	9.2								33.3					
0.75 W OF HIGHWAY 130 A	10/26/1988 0:00	1326	13.3								32.9					
0.75 W OF HIGHWAY 130 A	11/30/1988 0:00	1432	12.4								33.0					
0.75 W OF HIGHWAY 130 A	12/21/1988 0:00	1226	16.5								42.2					
0.75 W OF HIGHWAY 130 A	01/25/1989 0:00	1307	13.4								37.0					
0.75 W OF HIGHWAY 130 A	02/22/1989 0:00	1305	15.9								36.9					
0.75 W OF HIGHWAY 130 A	03/29/1989 0:00	1218	10.7								32.7					
0.75 W OF HIGHWAY 130 A	04/26/1989 0:00	1240	12.9								29.5					
0.75 W OF HIGHWAY 130 A	05/24/1989 0:00	1225									11.2					
0.75 W OF HIGHWAY 130 A	06/28/1989 0:00	1235	8.2				1.11		0.001	<	17.5	0.20	0.0005	<		
0.75 W OF HIGHWAY 130 A	07/26/1989 0:00	1435	11.9								16.8					
0.75 W OF HIGHWAY 130 A	08/23/1989 0:00	1345	5.9								5.6					
0.75 W OF HIGHWAY 130 A	09/27/1989 0:00	1340	9.6								16.0					

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	NICKEL		NITRATE		NITRITE		NO2_NO3		ORTH_PHOS		PHFIELD	POTASSIUM	SELENIUM	
0.75 W OF HIGHWAY 130 A	10/30/1985 0:00	1255							1.2					3.5		
0.75 W OF HIGHWAY 130 A	11/20/1985 0:00	1240							1.3					3.6		
0.75 W OF HIGHWAY 130 A	12/17/1985 0:00	1315							1.6					2.4		
0.75 W OF HIGHWAY 130 A	01/29/1986 0:00	1305							0.98					3.2		
0.75 W OF HIGHWAY 130 A	02/26/1986 0:00	1254							1.2					2.1		
0.75 W OF HIGHWAY 130 A	03/19/1986 0:00	1347							0.25				8.4	2.3		
0.75 W OF HIGHWAY 130 A	05/28/1986 0:00	1250							1.2				8.2	5.2	0.001	<
0.75 W OF HIGHWAY 130 A	06/25/1986 0:00	1240							0.36				8.5	3		
0.75 W OF HIGHWAY 130 A	07/30/1986 0:00	1330							0.32					3.7		
0.75 W OF HIGHWAY 130 A	08/26/1986 0:00	1335							0.7					4		
0.75 W OF HIGHWAY 130 A	10/01/1986 0:00	1330							0.21				7.7	5.2		
0.75 W OF HIGHWAY 130 A	10/29/1986 0:00	1219							1				8.1	3.7		
0.75 W OF HIGHWAY 130 A	11/19/1986 0:00	1306							1				8.2	2.7		
0.75 W OF HIGHWAY 130 A	12/30/1986 0:00	1325							0.43				8.4	4		
0.75 W OF HIGHWAY 130 A	01/28/1987 0:00	1415							0.92				8.4	2.2		
0.75 W OF HIGHWAY 130 A	02/25/1987 0:00	1350							0.53				8.3	2.5		
0.75 W OF HIGHWAY 130 A	03/25/1987 0:00	1345							0.52				8.2	2.9		
0.75 W OF HIGHWAY 130 A	04/29/1987 0:00	1415							0.5				8.2	2.2		
0.75 W OF HIGHWAY 130 A	05/20/1987 0:00	1304							1.5				8.2	3		
0.75 W OF HIGHWAY 130 A	06/24/1987 0:00	1322							1.3				8	4.3	0.001	<
0.75 W OF HIGHWAY 130 A	07/29/1987 0:00	1335							0.2				8.2	3.9		
0.75 W OF HIGHWAY 130 A	08/26/1987 0:00	1355							0.93				7.6	4.1		
0.75 W OF HIGHWAY 130 A	09/23/1987 0:00	1344							0.68				8.2	3.8		
0.75 W OF HIGHWAY 130 A	10/28/1987 0:00	1255							0.29				8.1	6		
0.75 W OF HIGHWAY 130 A	11/24/1987 0:00	1330							0.44				8.2	3.8		
0.75 W OF HIGHWAY 130 A	12/30/1987 0:00	1340							0.52				8.3	2.8		
0.75 W OF HIGHWAY 130 A	02/24/1988 0:00	1300							0.4				8.3	2.2		
0.75 W OF HIGHWAY 130 A	03/30/1988 0:00	1246							0.3				8.3	2.1		
0.75 W OF HIGHWAY 130 A	04/27/1988 0:00	1242							0.46				8.1	2.5	0.002	
0.75 W OF HIGHWAY 130 A	05/25/1988 0:00	1345							0.52				8.3	2.5		
0.75 W OF HIGHWAY 130 A	06/29/1988 0:00	1315							0.01	<			8.5	4		
0.75 W OF HIGHWAY 130 A	07/27/1988 0:00	1338							0.01	<			8.5	3.5		
0.75 W OF HIGHWAY 130 A	08/24/1988 0:00	1300							0.01	<			8.5	4.5		
0.75 W OF HIGHWAY 130 A	09/28/1988 0:00	1304							0.47					4.2		
0.75 W OF HIGHWAY 130 A	10/26/1988 0:00	1326							0.42				8.5	4.6		
0.75 W OF HIGHWAY 130 A	11/30/1988 0:00	1432							0.83					5.8		
0.75 W OF HIGHWAY 130 A	12/21/1988 0:00	1226							0.77				8.6	6		
0.75 W OF HIGHWAY 130 A	01/25/1989 0:00	1307							0.66				8.5	5.5		
0.75 W OF HIGHWAY 130 A	02/22/1989 0:00	1305							0.71				8.6	4.2		
0.75 W OF HIGHWAY 130 A	03/29/1989 0:00	1218							0.62				8.4	4		
0.75 W OF HIGHWAY 130 A	04/26/1989 0:00	1240							0.01	<			8.9	4.9		
0.75 W OF HIGHWAY 130 A	05/24/1989 0:00	1225							0.4				7.6	4.2		
0.75 W OF HIGHWAY 130 A	06/28/1989 0:00	1235							0.26				8.6	4.6	0.001	<
0.75 W OF HIGHWAY 130 A	07/26/1989 0:00	1435							0.01	<			8.7	4.9		
0.75 W OF HIGHWAY 130 A	08/23/1989 0:00	1345							0.35				7.8	3.8		
0.75 W OF HIGHWAY 130 A	09/27/1989 0:00	1340							0.57				8.3	3		

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	SILICA		SILVER		SODIUM	SPEC_COND	SULFATE	THALLIUM		TDS	TOTHARD	PHOSPHU	TSS
0.75 W OF HIGHWAY 130 A	10/30/1985 0:00	1255	13.9				12.8	571	58			338	281	0.15	122
0.75 W OF HIGHWAY 130 A	11/20/1985 0:00	1240	11.6				11.3	503	41			306	262	0.15	128
0.75 W OF HIGHWAY 130 A	12/17/1985 0:00	1315	10.8				18.5	717	88			454	378	0.09	12
0.75 W OF HIGHWAY 130 A	01/29/1986 0:00	1305	4.1				16.7	620	104			376	308	0.07	19
0.75 W OF HIGHWAY 130 A	02/26/1986 0:00	1254	7.3				17.5	717	84			430	376	0.07	
0.75 W OF HIGHWAY 130 A	03/19/1986 0:00	1347	0.5				19.8	614	88			367	310	0.03	
0.75 W OF HIGHWAY 130 A	05/28/1986 0:00	1250	9.9		0.001	<	14.6	516	57			332	270	0.43	460
0.75 W OF HIGHWAY 130 A	06/25/1986 0:00	1240	8.8				18.3	608	84			397	327	0.22	52
0.75 W OF HIGHWAY 130 A	07/30/1986 0:00	1330	11.8				18.7	513	62			327	268	0.15	88
0.75 W OF HIGHWAY 130 A	08/26/1986 0:00	1335	13.1				19.7	557	76			371	296	0.26	100
0.75 W OF HIGHWAY 130 A	10/01/1986 0:00	1330	36.6				4.9	227	22			168	111	0.49	450
0.75 W OF HIGHWAY 130 A	10/29/1986 0:00	1219	13.2				16.1	637	59			368	294	0.21	92
0.75 W OF HIGHWAY 130 A	11/19/1986 0:00	1306	9.5				18.5	728	88			436	374	0.13	12
0.75 W OF HIGHWAY 130 A	12/30/1986 0:00	1325	4.1				16.9	593	112			378	308	0.07	56
0.75 W OF HIGHWAY 130 A	01/28/1987 0:00	1415	6.6				18.5	668	74			421	358	0.15	11
0.75 W OF HIGHWAY 130 A	02/25/1987 0:00	1350	6.5				14.7	564	55			338	299	0.11	60
0.75 W OF HIGHWAY 130 A	03/25/1987 0:00	1345	11.7				8.8	361	31			234	203	0.62	760
0.75 W OF HIGHWAY 130 A	04/29/1987 0:00	1415	4.3				16.5	611	77			386	334	0.2	70
0.75 W OF HIGHWAY 130 A	05/20/1987 0:00	1304	8.9				14.3	546	61			358	310	0.2	92
0.75 W OF HIGHWAY 130 A	06/24/1987 0:00	1322	39.5		0.003		8.4	305	44			219	148	1.23	1560
0.75 W OF HIGHWAY 130 A	07/29/1987 0:00	1335	9.4				27	695	100			420	324	0.2	62
0.75 W OF HIGHWAY 130 A	08/26/1987 0:00	1355	14.1				10.8	375	38			221	177	0.48	330
0.75 W OF HIGHWAY 130 A	09/23/1987 0:00	1344	10.5				16.2	553	82			361	294	0.33	64
0.75 W OF HIGHWAY 130 A	10/28/1987 0:00	1255	12				15.6	463	64			284	223	0.34	84
0.75 W OF HIGHWAY 130 A	11/24/1987 0:00	1330	10.3				19.4	628	71			373	298	0.25	42
0.75 W OF HIGHWAY 130 A	12/30/1987 0:00	1340	10.4				13.9	503	56			310	257	0.09	32
0.75 W OF HIGHWAY 130 A	02/24/1988 0:00	1300	1.2				18.5	658	84			382	319	0.16	9
0.75 W OF HIGHWAY 130 A	03/30/1988 0:00	1246	2.4				19.6	657	83			389	317	0.14	50
0.75 W OF HIGHWAY 130 A	04/27/1988 0:00	1242	8.9		0.001	<	14.1	621	67			364	310	0.14	94
0.75 W OF HIGHWAY 130 A	05/25/1988 0:00	1345	12.8				18.8	768	114			474	389	0.63	600
0.75 W OF HIGHWAY 130 A	06/29/1988 0:00	1315	9.4				25	779	133			478	363	0.34	62
0.75 W OF HIGHWAY 130 A	07/27/1988 0:00	1338	9.9				19.6	660	104			388	297	0.34	60
0.75 W OF HIGHWAY 130 A	08/24/1988 0:00	1300	9.6				31.2	799	150			490	360	0.4	50
0.75 W OF HIGHWAY 130 A	09/28/1988 0:00	1304	11.7				33.8	980	241			627	430	0.36	40
0.75 W OF HIGHWAY 130 A	10/26/1988 0:00	1326	4.6				36	926	189			571	427	0.42	40
0.75 W OF HIGHWAY 130 A	11/30/1988 0:00	1432	7.2				44.5	1010	235			660	440	0.53	15
0.75 W OF HIGHWAY 130 A	12/21/1988 0:00	1226	1.7				48.1	1095	223			694	545	0.58	17
0.75 W OF HIGHWAY 130 A	01/25/1989 0:00	1307	0.5				48.5	1071	247			702	490	0.68	27
0.75 W OF HIGHWAY 130 A	02/22/1989 0:00	1305	0.9				42.4	1086	258			697	496	0.48	4
0.75 W OF HIGHWAY 130 A	03/29/1989 0:00	1218	1				38.6	963	229			614	441	0.42	42
0.75 W OF HIGHWAY 130 A	04/26/1989 0:00	1240	4.8				38.9	871	185			520	355	0.31	39
0.75 W OF HIGHWAY 130 A	05/24/1989 0:00	1225	16.7				11.4	389	58			227	167	0.97	1120
0.75 W OF HIGHWAY 130 A	06/28/1989 0:00	1235	11.9		0.001	<	15.1	621	79			353	286	0.31	58
0.75 W OF HIGHWAY 130 A	07/26/1989 0:00	1435	12.1				16.4	592	83			344	264	0.3	44
0.75 W OF HIGHWAY 130 A	08/23/1989 0:00	1345	20.8				5.4	211	15			142	104	0.69	550
0.75 W OF HIGHWAY 130 A	09/27/1989 0:00	1340	11.2				13.4	594	48			347	290	0.17	33

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	TURBIDITY	VANADIUM		ZINC		TOC	KJELDAHL		STRONTIUM	
0.75 W OF HIGHWAY 130 A	10/30/1985 0:00	1255	63									
0.75 W OF HIGHWAY 130 A	11/20/1985 0:00	1240	60									
0.75 W OF HIGHWAY 130 A	12/17/1985 0:00	1315	7.2									
0.75 W OF HIGHWAY 130 A	01/29/1986 0:00	1305	9									
0.75 W OF HIGHWAY 130 A	02/26/1986 0:00	1254	9.2									
0.75 W OF HIGHWAY 130 A	03/19/1986 0:00	1347	20									
0.75 W OF HIGHWAY 130 A	05/28/1986 0:00	1250	185			0.05						
0.75 W OF HIGHWAY 130 A	06/25/1986 0:00	1240	28									
0.75 W OF HIGHWAY 130 A	07/30/1986 0:00	1330	39									
0.75 W OF HIGHWAY 130 A	08/26/1986 0:00	1335	34									
0.75 W OF HIGHWAY 130 A	10/01/1986 0:00	1330	199									
0.75 W OF HIGHWAY 130 A	10/29/1986 0:00	1219	31									
0.75 W OF HIGHWAY 130 A	11/19/1986 0:00	1306	5.3									
0.75 W OF HIGHWAY 130 A	12/30/1986 0:00	1325	21									
0.75 W OF HIGHWAY 130 A	01/28/1987 0:00	1415	6.3									
0.75 W OF HIGHWAY 130 A	02/25/1987 0:00	1350	18									
0.75 W OF HIGHWAY 130 A	03/25/1987 0:00	1345	211									
0.75 W OF HIGHWAY 130 A	04/29/1987 0:00	1415	18									
0.75 W OF HIGHWAY 130 A	05/20/1987 0:00	1304	41									
0.75 W OF HIGHWAY 130 A	06/24/1987 0:00	1322	668			0.17						
0.75 W OF HIGHWAY 130 A	07/29/1987 0:00	1335	26									
0.75 W OF HIGHWAY 130 A	08/26/1987 0:00	1355	146									
0.75 W OF HIGHWAY 130 A	09/23/1987 0:00	1344	29									
0.75 W OF HIGHWAY 130 A	10/28/1987 0:00	1255	51									
0.75 W OF HIGHWAY 130 A	11/24/1987 0:00	1330	20									
0.75 W OF HIGHWAY 130 A	12/30/1987 0:00	1340	21									
0.75 W OF HIGHWAY 130 A	02/24/1988 0:00	1300	5.9									
0.75 W OF HIGHWAY 130 A	03/30/1988 0:00	1246	16.9									
0.75 W OF HIGHWAY 130 A	04/27/1988 0:00	1242	31			0.04						
0.75 W OF HIGHWAY 130 A	05/25/1988 0:00	1345	165									
0.75 W OF HIGHWAY 130 A	06/29/1988 0:00	1315	23.2									
0.75 W OF HIGHWAY 130 A	07/27/1988 0:00	1338	25									
0.75 W OF HIGHWAY 130 A	08/24/1988 0:00	1300	22.1									
0.75 W OF HIGHWAY 130 A	09/28/1988 0:00	1304	14.7									
0.75 W OF HIGHWAY 130 A	10/26/1988 0:00	1326	16.4									
0.75 W OF HIGHWAY 130 A	11/30/1988 0:00	1432	7.6									
0.75 W OF HIGHWAY 130 A	12/21/1988 0:00	1226	7.4									
0.75 W OF HIGHWAY 130 A	01/25/1989 0:00	1307	10.6									
0.75 W OF HIGHWAY 130 A	02/22/1989 0:00	1305	5									
0.75 W OF HIGHWAY 130 A	03/29/1989 0:00	1218	16.7									
0.75 W OF HIGHWAY 130 A	04/26/1989 0:00	1240	15.9									
0.75 W OF HIGHWAY 130 A	05/24/1989 0:00	1225	446									
0.75 W OF HIGHWAY 130 A	06/28/1989 0:00	1235	22.3			0.04						
0.75 W OF HIGHWAY 130 A	07/26/1989 0:00	1435	21.5									
0.75 W OF HIGHWAY 130 A	08/23/1989 0:00	1345	315									
0.75 W OF HIGHWAY 130 A	09/27/1989 0:00	1340	16									

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	ALKALINTY	ALUMINUM	AMMONIA		ANTIMONY		ARSENIC		BARIUM		BERYLLIUM		BOD	
0.75 W OF HIGHWAY 130 A	10/25/1989 0:00	1343	242		0.05										3.6	
0.75 W OF HIGHWAY 130 A	11/29/1989 0:00	1302	277		0.02										3.6	
0.75 W OF HIGHWAY 130 A	04/18/1990 0:00	0830	196	2.4	0.06				0.001	<	0.15		0.01	<	2.9	
0.75 W OF HIGHWAY 130 A	06/20/1990 0:00	0930	164	15.7	0.03										6.7	
0.75 W OF HIGHWAY 130 A	08/22/1990 0:00	0904	195	1.2	0.00	<	0.030	<	0.01	<	0.193		0.003	<	5.3	
0.75 W OF HIGHWAY 130 A	10/17/1990 0:00	0940	221	1.0	0.04		0.030	<	0.01	<	0.175		0.003	<	5.0	
0.75 W OF HIGHWAY 130 A	01/16/1991 0:00	0841	289		0.85										6.4	
0.75 W OF HIGHWAY 130 A	03/06/1991 0:00	0852	219	0.5	0.82		0.010	<	0.021	<	0.13		0.001	<	4.6	
0.75 W OF HIGHWAY 130 A	05/08/1991 0:00	0825	137	2.6	0.14		0.010	<	0.021	<	0.137		0.001	<	5.1	
0.75 W OF HIGHWAY 130 A	07/10/1991 0:00	0917	210	1.8	0.21		0.010	<	0.021	<	0.158		0.001	<	4.9	
0.75 W OF HIGHWAY 130 A	09/04/1991 0:00	0830	183	1.8	0.21		0.010	<	0.021	<	0.158		0.001	<	7.2	
0.75 W OF HIGHWAY 130 A	11/13/1991 0:00	0947	180	0.3	0.32		0.010	<	0.021	<	0.139		0.001	<	5.4	
0.75 W OF HIGHWAY 130 A	02/05/1992 0:00	0850	214	0.7	0.00	<	0.010	<	0.021	<	0.131		0.001	<	4.7	
0.75 W OF HIGHWAY 130 A	04/08/1992 0:00	0820	179	2.9	0.05	<	0.010	<	0.021	<	0.136		0.001	<	2.6	
0.75 W OF HIGHWAY 130 A	06/03/1992 0:00	0817	158	3.9	0.05	<	0.010	<	0.021	<	0.147		0.001	<	6.0	
0.75 W OF HIGHWAY 130 A	08/12/1992 0:00	0818	139	7.5	0.05	<	0.010	<	0.021	<	0.184		0.001	<	3.5	
0.75 W OF HIGHWAY 130 A	10/14/1992 0:00	0811	262	0.7	0.05	<	0.010	<	0.021	<	0.178		0.001	<	3.6	
0.75 W OF HIGHWAY 130 A	12/02/1992 0:00	0920	226	2.2	0.05	<	0.020		0.021	<	0.133		0.001	<	1.4	
0.75 W OF HIGHWAY 130 A	01/06/1993 0:00	0855	220	1.6	0.09		0.010	<	0.021	<	0.114		0.001	<	5.0	
0.75 W OF HIGHWAY 130 A	03/03/1993 0:00	0850	118	12.9	0.07		0.050	<	0.05	<	0.295		0.001		4.0	
0.75 W OF HIGHWAY 130 A	05/19/1993 0:00	0852	148	7.0	0.05	<	0.050	<	0.05	<	0.204		0.001	<	5.2	
0.75 W OF HIGHWAY 130 A	07/07/1993 0:00	0916	71	16.9	0.05	<	0.010	<	0.002		0.318		0.001		8.0	
0.75 W OF HIGHWAY 130 A	09/08/1993 0:00	0829	176	2.2	0.05	<	0.050	<	0.003		0.159		0.001	<	2.4	
0.75 W OF HIGHWAY 130 A	11/03/1993 0:00	0825	291	0.1	0.05	<	0.050	<	0.003		0.092		0.001	<	3.8	
0.75 W OF HIGHWAY 130 A	02/02/1994 0:00	0829	261	0.1	0.05	<	0.050	<	0.0009	<	0.114		0.001	<	4.8	
0.75 W OF HIGHWAY 130 A	04/06/1994 0:00	0900	256	0.5	0.05	<	0.050	<	0.004		0.143		0.001	<	7.1	
0.75 W OF HIGHWAY 130 A	06/08/1994 0:00	0848	142	3.2	0.05	<	0.050	<	0.003		0.14		0.001	<	8.5	
0.75 W OF HIGHWAY 130 A	08/03/1994 0:00	0857	193	2.4	0.02		0.050	<	0.004		0.173		0.001	<	6.2	
0.75 W OF HIGHWAY 130 A	10/05/1994 0:00	0845	192	1.2	0.03		0.050	<	0.008		0.13		0.001	<	4.9	
0.75 W OF HIGHWAY 130 A	12/27/1994 0:00	0848	221	0.3	0.03		0.050	<	0.0015		0.105		0.001	<	3.8	
0.75 W OF HIGHWAY 130 A	01/11/1995 0:00	0835	245	0.1	0.18		0.050	<	0.0012		0.106		0.001	<	4.3	
0.75 W OF HIGHWAY 130 A	03/15/1995 0:00	0821	92	24.8	0.14		0.050	<	0.0083		0.399		0.002		6.9	
0.75 W OF HIGHWAY 130 A	05/10/1995 0:00	0812	159	14.6	0.06		0.050	<	0.0048		0.289		0.001		10.1	
0.75 W OF HIGHWAY 130 A	07/12/1995 0:00	0758	284	1.1	0.01	<	0.050	<	0.0031		0.182		0.001	<	3.7	
0.75 W OF HIGHWAY 130 A	09/13/1995 0:00	0810	263	0.9	0.05		0.050	<	0.0028		0.18		0.001	<	1.0	<
0.75 W OF HIGHWAY 130 A	11/08/1995 0:00	0815	328	0.9	0.06		0.050	<	0.0022		0.214		0.001	<	5.3	
0.75 W OF HIGHWAY 130 A	02/14/1996 0:00	0820	286	0.2	0.01	<	0.050	<	0.0013		0.117		0.001	<	4.7	
0.75 W OF HIGHWAY 130 A	04/10/1996 0:00	0820	261	1.2	0.11		0.051		0.0022		0.162		0.001	<	8.9	
0.75 W OF HIGHWAY 130 A	06/12/1996 0:00	0942	140	9.9	0.02		0.098		0.0037		0.223		0.001	<	4.6	
0.75 W OF HIGHWAY 130 A	06/12/1996 0:00	0953	140	10.5	0.01	<	0.107		0.0049		0.215		0.001	<	4.4	
0.75 W OF HIGHWAY 130 A	08/21/1996 0:00	0825	77	19.4	0.19		0.141		0.0062		0.345		0.002		6.1	
0.75 W OF HIGHWAY 130 A	10/16/1996 0:00	1004	251	1.3	0.14		0.050	<	0.001	<	0.15		0.001	<	6.7	
0.75 W OF HIGHWAY 130 A	12/11/1996 0:00	0902	281	0.4	0.02	<	0.050	<	0.001	<	0.132		0.001	<	2.2	
0.75 W OF HIGHWAY 130 A	01/15/1997 0:00	0945	289	0.1	0.17		0.050	<	0.05	<	0.137		0.001	<	1.1	
0.75 W OF HIGHWAY 130 A	03/12/1997 0:00	0850	271	1.3	0.02	<	0.050	<	0.001	<	0.137		0.001	<	4.6	
0.75 W OF HIGHWAY 130 A	05/14/1997 0:00	0920	186	6.7	0.07		0.077		0.0045		0.217		0.001	<	8.6	

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	BORON		BROMIDE		CADMIUM		CALCIUM	CHLORIDE	CHROMIUM		COBALT		COPPER	
0.75 W OF HIGHWAY 130 A	10/25/1989 0:00	1343	0.22						98.0	28.9						
0.75 W OF HIGHWAY 130 A	11/29/1989 0:00	1302	0.14						98.5	20.9						
0.75 W OF HIGHWAY 130 A	04/18/1990 0:00	0830	0.07				0.001	<	78.5	8.2	0.010	<			0.010	
0.75 W OF HIGHWAY 130 A	06/20/1990 0:00	0930	0.38						78.4	6.0	0.017		0.008		0.036	
0.75 W OF HIGHWAY 130 A	08/22/1990 0:00	0904	0.15				0.003	<	93.8	24.4	0.005		0.004	<	0.013	
0.75 W OF HIGHWAY 130 A	10/17/1990 0:00	0940	0.08				0.003	<	88.9	27.4	0.005	<	0.004	<	0.018	
0.75 W OF HIGHWAY 130 A	01/16/1991 0:00	0841								63.6						
0.75 W OF HIGHWAY 130 A	03/06/1991 0:00	0852	0.11				0.002	<	96.2	30.4	0.003	<	0.004	<	0.008	
0.75 W OF HIGHWAY 130 A	05/08/1991 0:00	0825	0.09				0.002	<	57.7	10.4	0.006		0.004	<	0.011	
0.75 W OF HIGHWAY 130 A	07/10/1991 0:00	0917	0.10				0.002	<	69.4	26.8	0.004		0.004	<	0.018	
0.75 W OF HIGHWAY 130 A	09/04/1991 0:00	0830	0.09				0.002	<	58.5	23.9	0.004		0.004	<	0.017	
0.75 W OF HIGHWAY 130 A	11/13/1991 0:00	0947	0.12				0.002		74.5	33.6	0.004		0.004	<	0.028	
0.75 W OF HIGHWAY 130 A	02/05/1992 0:00	0850	0.16				0.002	<	102	40.2	0.006		0.004	<	0.019	
0.75 W OF HIGHWAY 130 A	04/08/1992 0:00	0820	0.08				0.002	<	71.5	10.3	0.004		0.004	<	0.024	
0.75 W OF HIGHWAY 130 A	06/03/1992 0:00	0817	0.09				0.002	<	72.4	14.2	0.003	<	0.004	<	0.011	
0.75 W OF HIGHWAY 130 A	08/12/1992 0:00	0818	0.06				0.002	<	59.3	6.0	0.010		0.006		0.014	
0.75 W OF HIGHWAY 130 A	10/14/1992 0:00	0811	0.15				0.002	<	101	26.6	0.003		0.004	<	0.007	
0.75 W OF HIGHWAY 130 A	12/02/1992 0:00	0920	0.16				0.002	<	82.2	9.3	0.005		0.004	<	0.017	
0.75 W OF HIGHWAY 130 A	01/06/1993 0:00	0855	0.07				0.002	<	74.5	10.6	0.004		0.004	<	0.014	
0.75 W OF HIGHWAY 130 A	03/03/1993 0:00	0850	0.14				0.005	<	63.4	6.9	0.012		0.010	<	0.034	
0.75 W OF HIGHWAY 130 A	05/19/1993 0:00	0852	0.09				0.005	<	67.5	8.5	0.010	<	0.010	<	0.019	
0.75 W OF HIGHWAY 130 A	07/07/1993 0:00	0916	0.03				0.001		49.6	4.2	0.017		0.012		0.027	
0.75 W OF HIGHWAY 130 A	09/08/1993 0:00	0829	0.06				0.000	<	70.5	10.6	0.010	<	0.010	<	0.019	
0.75 W OF HIGHWAY 130 A	11/03/1993 0:00	0825	0.23				0.000	<	326	24.1	0.010	<	0.010	<	0.013	
0.75 W OF HIGHWAY 130 A	02/02/1994 0:00	0829	0.10				0.000	<	102	22.0	0.010	<	0.010	<	0.016	
0.75 W OF HIGHWAY 130 A	04/06/1994 0:00	0900	0.10				0.000	<	95.5	25.1	0.010	<	0.010	<	0.017	
0.75 W OF HIGHWAY 130 A	06/08/1994 0:00	0848	0.10				0.000	<	60.1	10.7	0.010	<	0.010	<	0.013	
0.75 W OF HIGHWAY 130 A	08/03/1994 0:00	0857	0.09				0.001	<	76.2	21.1	0.010	<	0.010	<	0.010	<
0.75 W OF HIGHWAY 130 A	10/05/1994 0:00	0845	0.10				0.001	<	65.2	47.1	0.010	<	0.010	<	0.010	<
0.75 W OF HIGHWAY 130 A	12/27/1994 0:00	0848	0.08				0.001	<	96.4	42.3	0.004		0.010	<	0.011	
0.75 W OF HIGHWAY 130 A	01/11/1995 0:00	0835	0.07				0.001	<	93.3	43.4	0.002		0.010	<	0.004	
0.75 W OF HIGHWAY 130 A	03/15/1995 0:00	0821	0.04		0.010	<	0.001	<	51.0	4.1	0.030		0.017		0.028	
0.75 W OF HIGHWAY 130 A	05/10/1995 0:00	0812	0.06		0.010	<	0.001	<	76.0	6.5	0.018		0.012		0.033	
0.75 W OF HIGHWAY 130 A	07/12/1995 0:00	0758	0.07		0.090		0.001	<	100	14.3	0.002		0.010	<	0.011	
0.75 W OF HIGHWAY 130 A	09/13/1995 0:00	0810	0.07		0.150		0.001	<	92.6	23.9	0.004		0.010	<	0.003	
0.75 W OF HIGHWAY 130 A	11/08/1995 0:00	0815	0.10		0.170		0.001	<	132	31.2	0.004		0.010	<	0.011	
0.75 W OF HIGHWAY 130 A	02/14/1996 0:00	0820	0.07		0.180		0.001	<	123	31.9	0.001	<	0.010	<	0.011	
0.75 W OF HIGHWAY 130 A	04/10/1996 0:00	0820	0.10		0.220		0.001	<	117	35.7	0.002		0.010	<	0.003	
0.75 W OF HIGHWAY 130 A	06/12/1996 0:00	0942	0.07		0.040		0.001	<	58.1	5.7	0.001	<	0.010	<	0.013	
0.75 W OF HIGHWAY 130 A	06/12/1996 0:00	0953	0.08		0.010	<	0.001	<	54.4	5.7	0.010		0.010	<	0.013	
0.75 W OF HIGHWAY 130 A	08/21/1996 0:00	0825	0.06		0.010	<	0.001	<	45.8	3.6	0.019		0.014		0.028	
0.75 W OF HIGHWAY 130 A	10/16/1996 0:00	1004	0.07		0.050		0.001	<	86.9	12.4	0.003		0.010	<	0.011	
0.75 W OF HIGHWAY 130 A	12/11/1996 0:00	0902	0.06		0.080		0.001	<	100	11.5	0.002		0.010	<	0.015	
0.75 W OF HIGHWAY 130 A	01/15/1997 0:00	0945	0.06		0.070		0.005	<	110	17.7	0.010	<	0.010	<	0.010	<
0.75 W OF HIGHWAY 130 A	03/12/1997 0:00	0850	0.02		0.020	<	0.001	<	99.5	11.0	0.001	<	0.010	<	0.009	
0.75 W OF HIGHWAY 130 A	05/14/1997 0:00	0920	0.05		0.050		0.001	<	78.6	11.7	0.002		0.010	<	0.012	

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	DISOXY		FLUORIDE		IRON		LEAD		MAGNESIUM	MANGANESE	MERCURY		MOLYBDENM	
0.75 W OF HIGHWAY 130 A	10/25/1989 0:00	1343	11.5								21.4					
0.75 W OF HIGHWAY 130 A	11/29/1989 0:00	1302	16.3								22.3					
0.75 W OF HIGHWAY 130 A	04/18/1990 0:00	0830	9.1				2.07				16.0	0.17				
0.75 W OF HIGHWAY 130 A	06/20/1990 0:00	0930	5.9				13.25		0.039		16.3	0.80				
0.75 W OF HIGHWAY 130 A	08/22/1990 0:00	0904	7.3				1.11				24.3	0.24			0.005	<
0.75 W OF HIGHWAY 130 A	10/17/1990 0:00	0940	9.1				0.91		0.013		23.0	0.16	0.0005	<	0.005	<
0.75 W OF HIGHWAY 130 A	01/16/1991 0:00	0841	14.5													
0.75 W OF HIGHWAY 130 A	03/06/1991 0:00	0852	11.5				0.57				25.4	0.36			0.001	<
0.75 W OF HIGHWAY 130 A	05/08/1991 0:00	0825	6.1				2.38		0.003		11.6	0.16	0.0005	<	0.001	<
0.75 W OF HIGHWAY 130 A	07/10/1991 0:00	0917	3.9				1.65				14.1	0.21			0.003	
0.75 W OF HIGHWAY 130 A	09/04/1991 0:00	0830	4.9				1.58		0.005		12.0	0.20	0.0005	<	0.002	
0.75 W OF HIGHWAY 130 A	11/13/1991 0:00	0947	11.5				0.27		0.001	<	17.1	0.13			0.002	
0.75 W OF HIGHWAY 130 A	02/05/1992 0:00	0850	12.4				0.59		0.001	<	24.9	0.11			0.001	<
0.75 W OF HIGHWAY 130 A	04/08/1992 0:00	0820	8.9				1.99		0.020	<	14.0	0.15	0.0005	<	0.001	
0.75 W OF HIGHWAY 130 A	06/03/1992 0:00	0817	7.8				3.10				16.2	0.16			0.001	<
0.75 W OF HIGHWAY 130 A	08/12/1992 0:00	0818	6.3				6.00		0.020	<	11.8	0.25	0.0005	<	0.001	<
0.75 W OF HIGHWAY 130 A	10/14/1992 0:00	0811	9.3				0.65				25.5	0.10			0.001	<
0.75 W OF HIGHWAY 130 A	12/02/1992 0:00	0920	12.1				1.83		0.020	<	15.6	0.14	0.0005	<	0.001	<
0.75 W OF HIGHWAY 130 A	01/06/1993 0:00	0855	13.6				1.33				14.8	0.13			0.001	<
0.75 W OF HIGHWAY 130 A	03/03/1993 0:00	0850	12.0				10.45		0.050	<	13.1	0.58	0.0005	<	0.010	<
0.75 W OF HIGHWAY 130 A	05/19/1993 0:00	0852	8.2				6.27				14.8	0.29			0.010	<
0.75 W OF HIGHWAY 130 A	07/07/1993 0:00	0916	6.0				14.57		0.015		10.2	0.72	0.0005	<	0.001	<
0.75 W OF HIGHWAY 130 A	09/08/1993 0:00	0829	7.3				1.82		0.001		14.9	0.15			0.010	<
0.75 W OF HIGHWAY 130 A	11/03/1993 0:00	0825	11.7		0.30		0.13		0.001	<	74.1	0.15	0.0005	<	0.010	<
0.75 W OF HIGHWAY 130 A	02/02/1994 0:00	0829	15.7		0.20		0.18		0.004		25.5	0.13			0.010	<
0.75 W OF HIGHWAY 130 A	04/06/1994 0:00	0900	10.5		0.27		0.54		0.008		25.4	0.31	0.0005	<	0.010	<
0.75 W OF HIGHWAY 130 A	06/08/1994 0:00	0848	6.5		0.23		2.70		0.001		14.6	0.42			0.010	<
0.75 W OF HIGHWAY 130 A	08/03/1994 0:00	0857	8.5		0.31		1.99		0.002		18.7	0.22			0.010	<
0.75 W OF HIGHWAY 130 A	10/05/1994 0:00	0845	7.4		0.32		1.14		0.001	<	14.5	0.17			0.010	<
0.75 W OF HIGHWAY 130 A	12/27/1994 0:00	0848	14.7		0.24		0.28		0.003		21.3	0.11	0.0005	<	0.010	<
0.75 W OF HIGHWAY 130 A	01/11/1995 0:00	0835	16.1		0.22		0.16		0.001	<	21.4	0.11	0.001	<	0.010	<
0.75 W OF HIGHWAY 130 A	03/15/1995 0:00	0821	7.5		0.15		20.90		0.025		10.9	1.14			0.010	<
0.75 W OF HIGHWAY 130 A	05/10/1995 0:00	0812	7.3		0.19		13.69		0.016		16.4	0.82	0.0012		0.010	<
0.75 W OF HIGHWAY 130 A	07/12/1995 0:00	0758	7.2		0.18		1.03		0.006		18.4	0.15			0.010	<
0.75 W OF HIGHWAY 130 A	09/13/1995 0:00	0810	8.9		0.20		0.78		0.002		22.0	0.16	0.0005	<	0.010	<
0.75 W OF HIGHWAY 130 A	11/08/1995 0:00	0815	10.9		0.24		0.94		0.004		30.9	0.22			0.010	<
0.75 W OF HIGHWAY 130 A	02/14/1996 0:00	0820	15.7		0.20		0.21		0.004		32.0	0.14	0.0005	<	0.010	<
0.75 W OF HIGHWAY 130 A	04/10/1996 0:00	0820	14.0		0.19		0.96		0.004		30.1	0.37			0.010	<
0.75 W OF HIGHWAY 130 A	06/12/1996 0:00	0942	7.8		0.13		8.14		0.009		10.2	0.40	0.0005	<	0.010	<
0.75 W OF HIGHWAY 130 A	06/12/1996 0:00	0953	7.7		0.13		8.04		0.007		9.6	0.38	0.0005	<	0.010	<
0.75 W OF HIGHWAY 130 A	08/21/1996 0:00	0825	6.0		0.15		14.08		0.021		8.9	0.88			0.010	<
0.75 W OF HIGHWAY 130 A	10/16/1996 0:00	1004	7.9		0.21		1.01		0.001	<	16.3	0.22	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	12/11/1996 0:00	0902	12.0		0.23		0.41		0.007		18.2	0.12			0.020	<
0.75 W OF HIGHWAY 130 A	01/15/1997 0:00	0945	14.8		0.23		0.19		0.050	<	25.4	0.18	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	03/12/1997 0:00	0850	10.4		0.24		1.10		0.004		20.5	0.23	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	05/14/1997 0:00	0920	7.4		0.21		5.36		0.007		19.6	0.36			0.020	<

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	NICKEL		NITRATE		NITRITE		NO2_NO3		ORTH_PHOS		PHFIELD	POTASSIUM	SELENIUM	
0.75 W OF HIGHWAY 130 A	10/25/1989 0:00	1343							0.27				8.3	4.9		
0.75 W OF HIGHWAY 130 A	11/29/1989 0:00	1302							0.01	<			8.7	3.4		
0.75 W OF HIGHWAY 130 A	04/18/1990 0:00	0830	0.010	<					0.42				7.9	3.3		
0.75 W OF HIGHWAY 130 A	06/20/1990 0:00	0930	0.037						0.9				7.9	7.74	0.001	
0.75 W OF HIGHWAY 130 A	08/22/1990 0:00	0904	0.006	<					0	<			8.3	3.8		
0.75 W OF HIGHWAY 130 A	10/17/1990 0:00	0940	0.006	<					0.44				8.4	4.09	0.002	
0.75 W OF HIGHWAY 130 A	01/16/1991 0:00	0841							0.8				8			
0.75 W OF HIGHWAY 130 A	03/06/1991 0:00	0852	0.007	<					0.3				8.3	3.37		
0.75 W OF HIGHWAY 130 A	05/08/1991 0:00	0825	0.007	<					0.85				7.7		0.003	
0.75 W OF HIGHWAY 130 A	07/10/1991 0:00	0917	0.007	<					0.26				8.3	5.69		
0.75 W OF HIGHWAY 130 A	09/04/1991 0:00	0830	0.007	<					0.47				8	5.78	0.001	<
0.75 W OF HIGHWAY 130 A	11/13/1991 0:00	0947	0.007	<					1.13				8.1	8.03	0.001	<
0.75 W OF HIGHWAY 130 A	02/05/1992 0:00	0850	0.007	<					0.47				8.5	5.9	0.001	<
0.75 W OF HIGHWAY 130 A	04/08/1992 0:00	0820	0.013						0.7				8.2	2.52	0.03	<
0.75 W OF HIGHWAY 130 A	06/03/1992 0:00	0817	0.008						0.94				7.8	3.72		
0.75 W OF HIGHWAY 130 A	08/12/1992 0:00	0818	0.011						0.58				7.9	7.59	0.03	<
0.75 W OF HIGHWAY 130 A	10/14/1992 0:00	0811	0.007	<					0.25				8.3	3.42		
0.75 W OF HIGHWAY 130 A	12/02/1992 0:00	0920	0.007	<					0.9				7.8	4.71	0.03	<
0.75 W OF HIGHWAY 130 A	01/06/1993 0:00	0855	0.007	<					0.98				7.8	2.1		
0.75 W OF HIGHWAY 130 A	03/03/1993 0:00	0850	0.050	<					0.74				7.9	4.22	0.05	<
0.75 W OF HIGHWAY 130 A	05/19/1993 0:00	0852	0.050	<					0.86				7.8	5.28		
0.75 W OF HIGHWAY 130 A	07/07/1993 0:00	0916	0.007	<					0.92				7.8	6.24	0.03	<
0.75 W OF HIGHWAY 130 A	09/08/1993 0:00	0829	0.050	<					1.29				7.7	4.95	0.0022	<
0.75 W OF HIGHWAY 130 A	11/03/1993 0:00	0825	0.050	<					1				8	4.48	0.004	
0.75 W OF HIGHWAY 130 A	02/02/1994 0:00	0829	0.050	<					0.75				8.5	3	0.0022	<
0.75 W OF HIGHWAY 130 A	04/06/1994 0:00	0900	0.050	<					0.34				8.3	3.29	0.0022	<
0.75 W OF HIGHWAY 130 A	06/08/1994 0:00	0848	0.050	<					0.76				7.9	5.41	0.0022	<
0.75 W OF HIGHWAY 130 A	08/03/1994 0:00	0857	0.007						0.01	<			8.3	4.812	0.002	
0.75 W OF HIGHWAY 130 A	10/05/1994 0:00	0845	0.005	<					0.01	<			8	6.732	0.002	<
0.75 W OF HIGHWAY 130 A	12/27/1994 0:00	0848	0.001						1.33				8.4	5.144	0.0033	
0.75 W OF HIGHWAY 130 A	01/11/1995 0:00	0835	0.006		1.3								8.4	5.235	0.002	<
0.75 W OF HIGHWAY 130 A	03/15/1995 0:00	0821	0.039		0.4		0.05				0.08		7.3	7.592	0.002	<
0.75 W OF HIGHWAY 130 A	05/10/1995 0:00	0812	0.022		0.4		0.06				0.01	<	7.7	6.388	0.002	<
0.75 W OF HIGHWAY 130 A	07/12/1995 0:00	0758	0.001	<	1.0		0.06				0.13		8.1	3.822	0.002	<
0.75 W OF HIGHWAY 130 A	09/13/1995 0:00	0810	0.003		0.2		0.05				0.05		8.3	5.298	0.002	<
0.75 W OF HIGHWAY 130 A	11/08/1995 0:00	0815	0.004		0.2		0.05	<			0.21		8.2	4.836	0.002	<
0.75 W OF HIGHWAY 130 A	02/14/1996 0:00	0820	0.001	<	0.4		0.05	<			0.01	<	7.9	2.8	0.002	<
0.75 W OF HIGHWAY 130 A	04/10/1996 0:00	0820	0.002		0.7		0.06				0.11		8.1	3.382	0.002	<
0.75 W OF HIGHWAY 130 A	06/12/1996 0:00	0942	0.009		0.6		0.05	<			0.7		7.8	6.234	0.002	<
0.75 W OF HIGHWAY 130 A	06/12/1996 0:00	0953	0.011		0.6		0.05	<			0.01	<	7.3	6.753	0.0029	
0.75 W OF HIGHWAY 130 A	08/21/1996 0:00	0825	0.029		0.4		0.05	<			0.01	<	7.2	5.505	0.002	<
0.75 W OF HIGHWAY 130 A	10/16/1996 0:00	1004	0.005		0.6		0.05	<			0.17		8.2	4.054	0.001	<
0.75 W OF HIGHWAY 130 A	12/11/1996 0:00	0902	0.001	<	0.8		0.05	<			0.1		8.1	13.521	0.001	<
0.75 W OF HIGHWAY 130 A	01/15/1997 0:00	0945	0.005	<	0.5		0.05	<			0.18		8	2.761	0.05	<
0.75 W OF HIGHWAY 130 A	03/12/1997 0:00	0850	0.002		0.8		0.05	<			0.02	<	8	2.416	0.001	<
0.75 W OF HIGHWAY 130 A	05/14/1997 0:00	0920	0.010		1.4		0.05	<			0.12		7.8	5.185	0.001	<

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	SILICA		SILVER		SODIUM	SPEC_COND	SULFATE	THALLIUM		TDS	TOTHARD	PHOSPHU	TSS
0.75 W OF HIGHWAY 130 A	10/25/1989 0:00	1343	8.3				29.9	756	96			435	332	0.33	36
0.75 W OF HIGHWAY 130 A	11/29/1989 0:00	1302	6.9				25.3	888	119			463	337	0.19	11
0.75 W OF HIGHWAY 130 A	04/18/1990 0:00	0830	20.7		0.001	<	12.5	507	46			305	262	0.2	116
0.75 W OF HIGHWAY 130 A	06/20/1990 0:00	0930	81.01				9.535	391	28			332	263	0.86	720
0.75 W OF HIGHWAY 130 A	08/22/1990 0:00	0904	13.59		0.005	<	22.73	711	127	0.02		430	334	0.23	52
0.75 W OF HIGHWAY 130 A	10/17/1990 0:00	0940	12.68		0.005	<	24.07	691	114	0.02		430	316	0.28	39
0.75 W OF HIGHWAY 130 A	01/16/1991 0:00	0841						1080	208					0.82	8
0.75 W OF HIGHWAY 130 A	03/06/1991 0:00	0852	3.408		0.004	<	25.75	806	156	0.015		475	344	0.38	29
0.75 W OF HIGHWAY 130 A	05/08/1991 0:00	0825	19.68		0.004	<	12.67	413	48	0.015		247	192	0.21	90
0.75 W OF HIGHWAY 130 A	07/10/1991 0:00	0917	17.91		0.004	<	23.49	496	62	0.015		349	231	0.51	71
0.75 W OF HIGHWAY 130 A	09/04/1991 0:00	0830	19.22		0.004	<	24.29	520	40	0.015		297	195	0.43	59
0.75 W OF HIGHWAY 130 A	11/13/1991 0:00	0947	9.668		0.004	<	32.56	696	103	0.015		393	256	0.56	15
0.75 W OF HIGHWAY 130 A	02/05/1992 0:00	0850	5.767		0.004	<	34.15	866	162	0.015		507	357	0.35	27
0.75 W OF HIGHWAY 130 A	04/08/1992 0:00	0820	22.72		0.004	<	11.16	501	47	0.015		290	236	0.18	103
0.75 W OF HIGHWAY 130 A	06/03/1992 0:00	0817	25.56		0.004	<	15.97	558	78	0.015		326	248	0.31	121
0.75 W OF HIGHWAY 130 A	08/12/1992 0:00	0818	45.05		0.004	<	6.935	375	27	0.015		251	197	0.41	332
0.75 W OF HIGHWAY 130 A	10/14/1992 0:00	0811	13.36		0.004	<	22.78	805	110	0.015		461	356	0.22	44
0.75 W OF HIGHWAY 130 A	12/02/1992 0:00	0920	22.46		0.004	<	12.07	450	45	0.015		332	269	0.18	62
0.75 W OF HIGHWAY 130 A	01/06/1993 0:00	0855	16.74		0.004	<	13	574	57	0.015		326	247	0.17	52
0.75 W OF HIGHWAY 130 A	03/03/1993 0:00	0850	62.08		0.01	<	8.737	349	34	0.05		268	212	0.63	888
0.75 W OF HIGHWAY 130 A	05/19/1993 0:00	0852	40.31		0.01	<	9.793	442	54	0.05		294	229	0.37	320
0.75 W OF HIGHWAY 130 A	07/07/1993 0:00	0916	63.92		0.004	<	4.647	213	16	0.015		204	166	1.01	1240
0.75 W OF HIGHWAY 130 A	09/08/1993 0:00	0829	19.85		0.01	<	13.21	536	51	0.05		297	237	0.28	72
0.75 W OF HIGHWAY 130 A	11/03/1993 0:00	0825	13.58		0.01	<	40.75	812	113	0.05		776	1116	0.24	13
0.75 W OF HIGHWAY 130 A	02/02/1994 0:00	0829	2.558		0.01	<	22.96	795	133	0.05		468	359	0.07	4
0.75 W OF HIGHWAY 130 A	04/06/1994 0:00	0900	6.282		0.01	<	24.69	853	129	0.05		466	343	0.15	36
0.75 W OF HIGHWAY 130 A	06/08/1994 0:00	0848	22.96		0.01	<	20.58	487	56	0.05		282	210	0.77	800
0.75 W OF HIGHWAY 130 A	08/03/1994 0:00	0857	20.188		0.01	<	20.353	752	100	0.05		378.5	267.128	0.31	104
0.75 W OF HIGHWAY 130 A	10/05/1994 0:00	0845	17.219		0.01	<	38.729	694	52	0.05		358.2	222.426	0.49	40
0.75 W OF HIGHWAY 130 A	12/27/1994 0:00	0848	9.194		0.001	<	32.498	825	136	0.05		483.9	328.384	0.66	9
0.75 W OF HIGHWAY 130 A	01/11/1995 0:00	0835	6.067		0.001	<	32.182	883	145.83	0.05		502.5	320.978	0.63	4
0.75 W OF HIGHWAY 130 A	03/15/1995 0:00	0821	115.79		0.001	<	4.85	245	17.77	0.05		272.5	172.191	1.13	1340
0.75 W OF HIGHWAY 130 A	05/10/1995 0:00	0812	78.932		0.001	<	7.867	431	37.83	0.05		329.9	256.871	0.91	1210
0.75 W OF HIGHWAY 130 A	07/12/1995 0:00	0758	19.331		0.001	<	17.707	724	70.8	0.05		420.7	326.552	0.27	60
0.75 W OF HIGHWAY 130 A	09/13/1995 0:00	0810	12.884		0.001	<	25.13	769	85.99	0.05		427.2	321.555	0.302	34
0.75 W OF HIGHWAY 130 A	11/08/1995 0:00	0815	17.568		0.001	<	32.428	962	141.07	0.05		589.1	456.523	0.397	32
0.75 W OF HIGHWAY 130 A	02/14/1996 0:00	0820	1.107		0.001	<	28.197	1030	197.15	0.05		589.7	437.883	0.135	7
0.75 W OF HIGHWAY 130 A	04/10/1996 0:00	0820	7.652		0.001	<	35.292	1000	188.33	0.05		578.6	416.462	0.424	62
0.75 W OF HIGHWAY 130 A	06/12/1996 0:00	0942	54.203		0.001	<	9.663	393	33.56	0.05		265.8	186.791	0.398	300
0.75 W OF HIGHWAY 130 A	06/12/1996 0:00	0953	58.54		0.001	<	9.262	393	33.4	0.05		265.5	175.343	0.394	272
0.75 W OF HIGHWAY 130 A	08/21/1996 0:00	0825	86.169		0.001	<	2.777	180	9.59	0.05		213.8	150.808	1.094	1330
0.75 W OF HIGHWAY 130 A	10/16/1996 0:00	1004	19.445		0.001	<	17.246	604	44.28	0.05		354.8	283.923	0.263	34
0.75 W OF HIGHWAY 130 A	12/11/1996 0:00	0902	14.626		0.001	<	13.256	732	68.5	0.05		412.9	325.359	0.128	21
0.75 W OF HIGHWAY 130 A	01/15/1997 0:00	0945	7.426		0.01	<	21.702	794	100.05	0.05		460.6	378.418	0.134	4
0.75 W OF HIGHWAY 130 A	03/12/1997 0:00	0850	15.575		0.001	<	16.105	639	67.18	0.05		399.1	332.756	0.131	63
0.75 W OF HIGHWAY 130 A	05/14/1997 0:00	0920	39.562		0.001	<	15.715	562	77.06	0.05		367	277.019	0.403	288

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	TURBIDITY	VANADIUM		ZINC		TOC	KJELDAHL		STRONTIUM	
0.75 W OF HIGHWAY 130 A	10/25/1989 0:00	1343	14.8									
0.75 W OF HIGHWAY 130 A	11/29/1989 0:00	1302	4.6									
0.75 W OF HIGHWAY 130 A	04/18/1990 0:00	0830	43			0.02						
0.75 W OF HIGHWAY 130 A	06/20/1990 0:00	0930	210	0.026		0.243						
0.75 W OF HIGHWAY 130 A	08/22/1990 0:00	0904	26	0.011		0.396						
0.75 W OF HIGHWAY 130 A	10/17/1990 0:00	0940	21.1	0.003	<	0.02						
0.75 W OF HIGHWAY 130 A	01/16/1991 0:00	0841	3.9									
0.75 W OF HIGHWAY 130 A	03/06/1991 0:00	0852	6.2	0.003	<	0.057						
0.75 W OF HIGHWAY 130 A	05/08/1991 0:00	0825	50.6	0.008		0.024						
0.75 W OF HIGHWAY 130 A	07/10/1991 0:00	0917	36	0.014		0.02						
0.75 W OF HIGHWAY 130 A	09/04/1991 0:00	0830	35	0.011		0.009						
0.75 W OF HIGHWAY 130 A	11/13/1991 0:00	0947	6.4	0.004		0.036						
0.75 W OF HIGHWAY 130 A	02/05/1992 0:00	0850	12.5	0.005		0.036						
0.75 W OF HIGHWAY 130 A	04/08/1992 0:00	0820	42	0.007		0.078						
0.75 W OF HIGHWAY 130 A	06/03/1992 0:00	0817	55	0.011		0.026						
0.75 W OF HIGHWAY 130 A	08/12/1992 0:00	0818	140	0.015		0.035						
0.75 W OF HIGHWAY 130 A	10/14/1992 0:00	0811	15.2	0.009		0.011						
0.75 W OF HIGHWAY 130 A	12/02/1992 0:00	0920	27	0.005		0.174						
0.75 W OF HIGHWAY 130 A	01/06/1993 0:00	0855	20	0.004		0.053						
0.75 W OF HIGHWAY 130 A	03/03/1993 0:00	0850	350	0.019		0.063						
0.75 W OF HIGHWAY 130 A	05/19/1993 0:00	0852	126	0.015		0.052						
0.75 W OF HIGHWAY 130 A	07/07/1993 0:00	0916	410	0.025		0.076						
0.75 W OF HIGHWAY 130 A	09/08/1993 0:00	0829	32	0.008		0.039						
0.75 W OF HIGHWAY 130 A	11/03/1993 0:00	0825	5.1	0.005	<	0.087						
0.75 W OF HIGHWAY 130 A	02/02/1994 0:00	0829	2.9	0.005	<	0.013						
0.75 W OF HIGHWAY 130 A	04/06/1994 0:00	0900	18.2	0.005	<	0.015						
0.75 W OF HIGHWAY 130 A	06/08/1994 0:00	0848	255	0.006		0.063						
0.75 W OF HIGHWAY 130 A	08/03/1994 0:00	0857	33	0.012		0.04						
0.75 W OF HIGHWAY 130 A	10/05/1994 0:00	0845	15	0.011		0.03						
0.75 W OF HIGHWAY 130 A	12/27/1994 0:00	0848	2	0.005	<	0.03						
0.75 W OF HIGHWAY 130 A	01/11/1995 0:00	0835	34	0.005	<	0.019						
0.75 W OF HIGHWAY 130 A	03/15/1995 0:00	0821	400	0.035		0.111						
0.75 W OF HIGHWAY 130 A	05/10/1995 0:00	0812	194	0.024		0.074						
0.75 W OF HIGHWAY 130 A	07/12/1995 0:00	0758	7	0.009		0.005	<					
0.75 W OF HIGHWAY 130 A	09/13/1995 0:00	0810	19	0.006		0.08						
0.75 W OF HIGHWAY 130 A	11/08/1995 0:00	0815	10.6	0.006		0.034						
0.75 W OF HIGHWAY 130 A	02/14/1996 0:00	0820	3.8	0.005	<	0.031						
0.75 W OF HIGHWAY 130 A	04/10/1996 0:00	0820	16	0.005	<	0.014						
0.75 W OF HIGHWAY 130 A	06/12/1996 0:00	0942	148	0.018		0.137						
0.75 W OF HIGHWAY 130 A	06/12/1996 0:00	0953	150	0.02		0.033						
0.75 W OF HIGHWAY 130 A	08/21/1996 0:00	0825	525	0.026		0.094						
0.75 W OF HIGHWAY 130 A	10/16/1996 0:00	1004	4	0.009		0.031						
0.75 W OF HIGHWAY 130 A	12/11/1996 0:00	0902	8	0.005	<	0.078						
0.75 W OF HIGHWAY 130 A	01/15/1997 0:00	0945	2.2	0.005	<	0.016						
0.75 W OF HIGHWAY 130 A	03/12/1997 0:00	0850	20	0.005	<	0.009						
0.75 W OF HIGHWAY 130 A	05/14/1997 0:00	0920	116	0.015		0.032						

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	ALKALINTY	ALUMINUM	AMMONIA		ANTIMONY		ARSENIC		BARIUM		BERYLLIUM		BOD	
0.75 W OF HIGHWAY 130 A	07/16/1997 0:00	0840	190	2.0	0.02	<	0.071		0.0023		0.199		0.001	<	2.5	
0.75 W OF HIGHWAY 130 A	09/03/1997 0:00	0930	211	0.3	0.02	<	0.050	<	0.0021		0.136		0.001	<	1.4	
0.75 W OF HIGHWAY 130 A	11/12/1997 0:00	0843	237	0.4	0.02	<	0.050	<	0.0017		0.14		0.001	<	2.7	
0.75 W OF HIGHWAY 130 A	02/11/1998 0:00	0925	230	0.7	0.08		0.050	<	0.001	<	0.12		0.001	<	2.2	
0.75 W OF HIGHWAY 130 A	04/15/1998 0:00	0945	262	2.0	0.02	<	0.050	<	0.001	<	0.163		0.001	<	3.0	
0.75 W OF HIGHWAY 130 A	06/10/1998 0:00	1020	285	0.8	0.02	<	0.050	<	0.0021		0.183		0.001	<	1.0	<
0.75 W OF HIGHWAY 130 A	08/12/1998 0:00	0950	204	1.0	0.02		0.050	<	0.0032		0.142		0.001	<	3.8	
0.75 W OF HIGHWAY 130 A	10/14/1998 0:00	0950	182	2.0	0.02	<	0.050	<	0.0024		0.167		0.001	<	2.7	
0.75 W OF HIGHWAY 130 A	12/29/1998 0:00	0933	315	0.2	0.02	<	0.050	<	0.0017		0.155		0.001	<	1.0	<
0.75 W OF HIGHWAY 130 A	01/13/1999 0:00	1000	327	0.2	0.02		0.050	<	0.001	<	0.163		0.001	<	1.0	<
0.75 W OF HIGHWAY 130 A	03/10/1999 0:00	1000	250	0.4	0.02	<	0.050	<	0.001	<	0.121		0.001	<	4.2	
0.75 W OF HIGHWAY 130 A	05/12/1999 0:00	1025	239	5.0	0.05		0.050	<	0.0019		0.187		0.001	<	2.0	
0.75 W OF HIGHWAY 130 A	07/07/1999 0:00	1010	162	5.6	0.02	<	0.050	<	0.0025		0.273		0.001	<	3.1	
0.75 W OF HIGHWAY 130 A	09/08/1999 0:00	1030	221	2.4	0.02		0.050	<	0.0059		0.183		0.001	<	1.0	<
0.75 W OF HIGHWAY 130 A	11/09/1999 0:00	1046	308	2.0	0.02	<	0.050	<	0.0034		0.182		0.001	<	3.8	
0.75 W OF HIGHWAY 130 A	02/09/2000 0:00	0850	254	0.2	0.03		0.050	<	0.001	<	0.098		0.001	<	3.4	
0.75 W OF HIGHWAY 130 A	04/12/2000 0:00	0900	263	2.5	0.02	<	0.050	<	0.0012		0.15		0.001	<	2.6	
0.75 W OF HIGHWAY 130 A	06/14/2000 0:00	0910	236	3.4	0.02	<	0.050	<	0.003		0.163		0.001	<	3.4	
0.75 W OF HIGHWAY 130 A	08/16/2000 0:00	0840	206	2.0	0.10		0.050	<	0.0044		0.186		0.001	<	5.4	
0.75 W OF HIGHWAY 130 A	10/11/2000 0:00	0915	242	0.8	0.02	<	0.050	<	0.004		0.178		0.001	<	7.8	
0.75 W OF HIGHWAY 130 A	12/06/2000 0:00	0855	274	0.2	0.02	<	0.050	<	0.0016		0.133		0.001	<	5.4	
0.75 W OF HIGHWAY 130 A	01/11/2001 0:00	0915	281	0.2	0.07		0.050	<	0.001	<	0.145		0.001	<	5.3	
0.75 W OF HIGHWAY 130 A	03/15/2001 0:00	0930	232	2.0	0.02	<	0.050	<	0.001	<	0.134		0.001	<	1.7	
0.75 W OF HIGHWAY 130 A	05/10/2001 0:00	0930	192	4.5	0.04		0.050	<	0.0038		0.176		0.001	<	3.5	
0.75 W OF HIGHWAY 130 A	07/19/2001 0:00	0950	186	1.3	0.02	<	0.050	<	0.0038		0.152		0.001	<	2.5	
0.75 W OF HIGHWAY 130 A	09/13/2001 0:00	1125	144	3.6	0.02	<	0.050	<	0.0045		0.145		0.001	<	2.5	
0.75 W OF HIGHWAY 130 A	11/06/2001 0:00	1030	241	1.3	0.03		0.050	<	0.0029		0.174		0.001	<	2.6	
0.75 W OF HIGHWAY 130 A	02/13/2002 0:00	0920	230	0.4	0.02	<	0.050	<	0.0019		0.111		0.001	<		
0.75 W OF HIGHWAY 130 A	04/10/2002 0:00	1000	231	1.7	0.10	<	0.050	<	0.0037		0.158		0.001	<		
0.75 W OF HIGHWAY 130 A	06/13/2002 0:00	0910	182	6.2	0.10	<	0.050	<	0.0042		0.178		0.001	<		
0.75 W OF HIGHWAY 130 A	08/14/2002 0:00	1005	244	2.2	0.10		0.050	<	0.0076		0.214		0.001	<		
0.75 W OF HIGHWAY 130 A	10/16/2002 0:00	0942	208	0.7	0.10	<	0.050	<	0.0039		0.171		0.001	<		
0.75 W OF HIGHWAY 130 A	12/23/2002 0:00	0936	280	0.3	0.10	<	0.050	<	0.0026		0.151		0.001	<		
0.75 W OF HIGHWAY 130 A	01/22/2003 0:00	0932	276	0.1	0.10	<	0.050	<	0.0019		0.135		0.001	<		
0.75 W OF HIGHWAY 130 A	03/12/2003 0:00	0901	243	0.2	0.10	<	0.050	<	0.0017		0.111		0.001	<		
0.75 W OF HIGHWAY 130 A	05/28/2003 0:00	0936	201	2.1	0.10	<	0.050	<	0.003		0.158		0.001	<		
0.75 W OF HIGHWAY 130 A	07/16/2003 0:00	0854	195	0.9	0.10	<	0.050	<	0.006		0.158		0.001	<		
0.75 W OF HIGHWAY 130 A	09/17/2003 0:00	1004	123	3.7	0.10	<	0.050	<	0.0031		0.115		0.001	<		
0.75 W OF HIGHWAY 130 A	11/12/2003 0:00	0946	289	0.3	0.10	<	0.050	<	0.0027		0.166		0.001	<		
0.75 W OF HIGHWAY 130 A	02/11/2004 0:00	1007	268	0.1	0.10	<	0.050	<	0.0012		0.117		0.001	<		
0.75 W OF HIGHWAY 130 A	04/14/2004 0:00	0925	267	0.8	0.10	<	0.050	<	0.002		0.148		0.001	<		
0.75 W OF HIGHWAY 130 A	06/16/2004 0:00	0849	78	25.9	0.10	<	0.050	<	0.0042		0.361		0.002			
0.75 W OF HIGHWAY 130 A	08/11/2004 0:00	0919	283	0.7	0.10	<	0.050	<	0.0037		0.189		0.001	<		
0.75 W OF HIGHWAY 130 A	10/13/2004 0:00	0912	270	0.8	0.10	<	0.050	<	0.0034		0.183		0.001	<		
0.75 W OF HIGHWAY 130 A	12/01/2004 0:00	0922	235	0.5	0.10	<	0.050	<	0.0022		0.119		0.001	<		
0.75 W OF HIGHWAY 130 A	01/19/2005 0:00	1015	225	0.9	0.10	<	0.050	<	0.0012		0.107		0.001	<		

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	BORON		BROMIDE		CADMIUM		CALCIUM	CHLORIDE	CHROMIUM		COBALT		COPPER
0.75 W OF HIGHWAY 130 A	07/16/1997 0:00	0840	0.11		0.110		0.001	<	95.5	18.0	0.001	<	0.010	<	0.007
0.75 W OF HIGHWAY 130 A	09/03/1997 0:00	0930	0.06		0.080		0.001	<	67.8	10.9	0.001	<	0.010	<	0.007
0.75 W OF HIGHWAY 130 A	11/12/1997 0:00	0843	0.07		0.100		0.001	<	87.9	19.1	0.001	<	0.010	<	0.004
0.75 W OF HIGHWAY 130 A	02/11/1998 0:00	0925	0.06		0.080		0.001	<	84.8	11.8	0.001	<	0.010	<	0.003
0.75 W OF HIGHWAY 130 A	04/15/1998 0:00	0945	0.08		0.070		0.001	<	95.6	12.9	0.002		0.010	<	0.009
0.75 W OF HIGHWAY 130 A	06/10/1998 0:00	1020	0.08		0.100		0.001	<	105	20.5	0.001	<	0.010	<	0.019
0.75 W OF HIGHWAY 130 A	08/12/1998 0:00	0950	0.08		0.070		0.001	<	72.6	11.5	0.002		0.010	<	0.008
0.75 W OF HIGHWAY 130 A	10/14/1998 0:00	0950	0.12		0.070		0.001	<	70.8	8.5	0.001		0.010	<	0.008
0.75 W OF HIGHWAY 130 A	12/29/1998 0:00	0933	0.08		0.070		0.001	<	117	13.7	0.001	<	0.010	<	0.003
0.75 W OF HIGHWAY 130 A	01/13/1999 0:00	1000	0.10		0.080		0.001	<	124	17.2	0.002		0.010	<	0.006
0.75 W OF HIGHWAY 130 A	03/10/1999 0:00	1000	0.09		0.100		0.001	<	89.4	17.8	0.001	<	0.010	<	0.009
0.75 W OF HIGHWAY 130 A	05/12/1999 0:00	1025	0.18		0.020	<	0.001	<	82.7	9.1	0.004		0.010	<	0.016
0.75 W OF HIGHWAY 130 A	07/07/1999 0:00	1010	0.08		0.020	<	0.001	<	58.8	10.9	0.005		0.010	<	0.009
0.75 W OF HIGHWAY 130 A	09/08/1999 0:00	1030	0.30		0.120		0.001	<	88.1	31.5	0.001		0.010	<	0.005
0.75 W OF HIGHWAY 130 A	11/09/1999 0:00	1046	0.09		0.170		0.001	<	121	36.2	0.002		0.010	<	0.006
0.75 W OF HIGHWAY 130 A	02/09/2000 0:00	0850	0.08		0.020	<	0.001	<	97.3	28.6	0.001	<	0.010	<	0.010
0.75 W OF HIGHWAY 130 A	04/12/2000 0:00	0900	0.13		0.070		0.001	<	96.0	13.0	0.003		0.010	<	0.013
0.75 W OF HIGHWAY 130 A	06/14/2000 0:00	0910	0.05		0.090		0.001	<	84.3	17.5	0.003		0.010	<	0.005
0.75 W OF HIGHWAY 130 A	08/16/2000 0:00	0840	0.09		0.170		0.001	<	90.4	26.8	0.005		0.010	<	0.005
0.75 W OF HIGHWAY 130 A	10/11/2000 0:00	0915	0.12		0.310		0.001	<	104	50.6	0.002		0.010	<	0.006
0.75 W OF HIGHWAY 130 A	12/06/2000 0:00	0855	0.06		0.200		0.001	<	105	27.5	0.002		0.010	<	0.004
0.75 W OF HIGHWAY 130 A	01/11/2001 0:00	0915	0.09		0.140		0.001	<	135	44.9	0.001	<	0.010	<	0.002
0.75 W OF HIGHWAY 130 A	03/15/2001 0:00	0930	0.04		0.040		0.001	<	87.2	5.0	0.002		0.010	<	0.007
0.75 W OF HIGHWAY 130 A	05/10/2001 0:00	0930	0.01	<	0.020	<	0.001	<	75.0	8.1	0.006		0.010	<	0.031
0.75 W OF HIGHWAY 130 A	07/19/2001 0:00	0950	0.08		0.020	<	0.001	<	73.3	15.4	0.002		0.010	<	0.009
0.75 W OF HIGHWAY 130 A	09/13/2001 0:00	1125	0.06		0.140		0.001	<	59.5	10.1	0.003		0.010	<	0.011
0.75 W OF HIGHWAY 130 A	11/06/2001 0:00	1030	0.09		0.280		0.001	<	93.6	26.6	0.001		0.010	<	0.006
0.75 W OF HIGHWAY 130 A	02/13/2002 0:00	0920	0.07		0.260		0.001	<	101	51.6	0.001	<	0.010	<	0.006
0.75 W OF HIGHWAY 130 A	04/10/2002 0:00	1000	0.09		0.300		0.001	<	116	39.0	0.002		0.010	<	0.003
0.75 W OF HIGHWAY 130 A	06/13/2002 0:00	0910	0.06		0.200	<	0.001	<	62.1	11.5	0.007		0.010	<	0.010
0.75 W OF HIGHWAY 130 A	08/14/2002 0:00	1005	0.11		0.200	<	0.001	<	97.3	26.2	0.004		0.010	<	0.004
0.75 W OF HIGHWAY 130 A	10/16/2002 0:00	0942	0.11		0.290		0.001	<	99.4	32.9	0.001	<	0.010	<	0.003
0.75 W OF HIGHWAY 130 A	12/23/2002 0:00	0936	0.08		0.250		0.001	<	119	26.9	0.001	<	0.010	<	0.003
0.75 W OF HIGHWAY 130 A	01/22/2003 0:00	0932	0.11		0.310		0.001	<	126	33.5	0.001	<	0.010	<	0.006
0.75 W OF HIGHWAY 130 A	03/12/2003 0:00	0901	0.09		0.200	<	0.001	<	113	32.2	0.001		0.010	<	0.002
0.75 W OF HIGHWAY 130 A	05/28/2003 0:00	0936	0.07		0.200	<	0.001	<	82.4	11.8	0.003		0.010	<	0.004
0.75 W OF HIGHWAY 130 A	07/16/2003 0:00	0854	0.08		0.200	<	0.001	<	78.9	11.4	0.002		0.010	<	0.005
0.75 W OF HIGHWAY 130 A	09/17/2003 0:00	1004	0.04		0.200	<	0.001	<	42.4	3.6	0.004		0.010	<	0.006
0.75 W OF HIGHWAY 130 A	11/12/2003 0:00	0946	0.09		0.200	<	0.001	<	118	17.8	0.001	<	0.010	<	0.002
0.75 W OF HIGHWAY 130 A	02/11/2004 0:00	1007	0.06		0.200	<	0.001	<	111	20.7	0.001	<	0.010	<	0.002
0.75 W OF HIGHWAY 130 A	04/14/2004 0:00	0925	0.05	<	0.200	<	0.001	<	95.5	11.1	0.001		0.010	<	0.003
0.75 W OF HIGHWAY 130 A	06/16/2004 0:00	0849	0.05	<	0.200	<	0.001	<	45.1	1.9	0.024		0.014		0.019
0.75 W OF HIGHWAY 130 A	08/11/2004 0:00	0919	0.06		0.200	<	0.001	<	103	11.5	0.001	<	0.010	<	0.001
0.75 W OF HIGHWAY 130 A	10/13/2004 0:00	0912	0.09		0.200	<	0.001	<	104	17.3	0.001	<	0.010	<	0.002
0.75 W OF HIGHWAY 130 A	12/01/2004 0:00	0922	0.06		0.200	<	0.001	<	87.6	16.4	0.001	<	0.010	<	0.002
0.75 W OF HIGHWAY 130 A	01/19/2005 0:00	1015	0.05	<	0.200	<	0.001	<	79.2	17.2	0.004		0.010	<	0.002

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	DISOXY		FLUORIDE		IRON		LEAD		MAGNESIUM	MANGANESE	MERCURY		MOLYBDENM	
0.75 W OF HIGHWAY 130 A	07/16/1997 0:00	0840	6.8		0.25		1.74		0.006		22.9	0.21	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	09/03/1997 0:00	0930	7.8		0.21		0.28		0.003		15.2	0.09			0.020	<
0.75 W OF HIGHWAY 130 A	11/12/1997 0:00	0843	11.0		0.16		0.38		0.003		20.2	0.08	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	02/11/1998 0:00	0925	12.0		0.29		0.57		0.002		18.5	0.08			0.020	<
0.75 W OF HIGHWAY 130 A	04/15/1998 0:00	0945	9.9		0.32		1.98		0.007		22.7	0.17	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	06/10/1998 0:00	1020	9.5		0.27		0.81		0.008		27.0	0.11			0.020	<
0.75 W OF HIGHWAY 130 A	08/12/1998 0:00	0950	8.6		0.26		1.01		0.005		15.0	0.17	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	10/14/1998 0:00	0950	8.9		0.22		2.07		0.006		14.7	0.27			0.020	<
0.75 W OF HIGHWAY 130 A	12/29/1998 0:00	0933	13.1		0.25		0.26		0.002		25.2	0.14	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	01/13/1999 0:00	1000	13.2		0.24		0.25		0.002		29.4	0.14	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	03/10/1999 0:00	1000	12.6		0.20		0.51		0.004		24.2	0.10			0.020	<
0.75 W OF HIGHWAY 130 A	05/12/1999 0:00	1025	8.2		0.22		4.76		0.014		17.1	0.35	0.0015		0.020	<
0.75 W OF HIGHWAY 130 A	07/07/1999 0:00	1010	6.8		0.19		5.08		0.004		11.7	0.24	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	09/08/1999 0:00	1030	7.3		0.38		2.12		0.004		24.1	0.22	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	11/09/1999 0:00	1046	10.3		0.31		2.00		0.007		32.0	0.22	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	02/09/2000 0:00	0850	15.3		0.28		0.25		0.009		29.4	0.10	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	04/12/2000 0:00	0900	10.0		0.23		2.10		0.006		24.0	0.14	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	06/14/2000 0:00	0910	6.6		0.33		3.16		0.003		20.4	0.18	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	08/16/2000 0:00	0840	5.9		0.34		1.89		0.005		22.2	0.19	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	10/11/2000 0:00	0915	12.7		0.28		0.73		0.002		29.6	0.10	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	12/06/2000 0:00	0855	13.0		0.19		0.19		0.001	<	22.5	0.07	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	01/11/2001 0:00	0915	18.3		0.30		0.25		0.005		35.8	0.08	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	03/15/2001 0:00	0930	10.5		0.22		1.69		0.005		17.0	0.13	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	05/10/2001 0:00	0930	6.7		0.17		4.39		0.010		16.6	0.30	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	07/19/2001 0:00	0950	8.5		0.28		1.19		0.004		17.2	0.09	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	09/13/2001 0:00	1125	8.5		0.28		3.11		0.005		12.0	0.15	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	11/06/2001 0:00	1030	9.6		0.31		1.14		0.002		21.6	0.10	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	02/13/2002 0:00	0920	16.6		0.28		0.44		0.001	<	30.1	0.13	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	04/10/2002 0:00	1000	13.1		0.23		1.45		0.002		30.8	0.23	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	06/13/2002 0:00	0910	6.5		0.32		5.72		0.008		12.9	0.29	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	08/14/2002 0:00	1005	6.7		0.15		1.95		0.002		24.1	0.21	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	10/16/2002 0:00	0942	9.9		0.22		0.67		0.003		31.2	0.06	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	12/23/2002 0:00	0936	15.3		0.15	<	0.36		0.017		28.4	0.06	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	01/22/2003 0:00	0932	15.9		0.26		0.17		0.002		31.7	0.12	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	03/12/2003 0:00	0901	15.8		0.34		0.20		0.001	<	29.0	0.06	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	05/28/2003 0:00	0936	8.1		0.31		1.88		0.002		20.8	0.13	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	07/16/2003 0:00	0854	6.8		0.26		0.84		0.002		16.3	0.07	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	09/17/2003 0:00	1004	7.5		0.18		3.27		0.004		7.8	0.14	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	11/12/2003 0:00	0946	11.6		0.24		0.35		0.001	<	25.5	0.08	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	02/11/2004 0:00	1007	14.3		0.23		0.14		0.001	<	25.1	0.07	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	04/14/2004 0:00	0925	11.2		0.26		0.78		0.002		20.3	0.12	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	06/16/2004 0:00	0849	5.3		0.18		22.14		0.024		10.8	0.89	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	08/11/2004 0:00	0919	6.8		0.24		0.71		0.001	<	21.5	0.12	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	10/13/2004 0:00	0912	8.9		0.30		0.73		0.001	<	26.0	0.08	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	12/01/2004 0:00	0922	11.2		0.36		0.49		0.001	<	18.6	0.06	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	01/19/2005 0:00	1015	13.4		0.24		0.83		0.001	<	14.9	0.06	0.0005	<	0.020	<

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	NICKEL		NITRATE		NITRITE		NO2_NO3		ORTH_PHOS		PHFIELD	POTASSIUM	SELENIUM	
0.75 W OF HIGHWAY 130 A	07/16/1997 0:00	0840	0.004		0.7		0.05	<			0.1		7.8	6.265	0.001	<
0.75 W OF HIGHWAY 130 A	09/03/1997 0:00	0930	0.002		0.7		0.05	<			0.14		7.9	4.229	0.0017	
0.75 W OF HIGHWAY 130 A	11/12/1997 0:00	0843	0.001	<	0.9		0.05	<					8	4.503	0.002	<
0.75 W OF HIGHWAY 130 A	02/11/1998 0:00	0925	0.001	<	0.9		0.09						8.1	4.224	0.002	<
0.75 W OF HIGHWAY 130 A	04/15/1998 0:00	0945	0.005		0.5		0.05	<					8.1	3.819	0.002	<
0.75 W OF HIGHWAY 130 A	06/10/1998 0:00	1020	0.001	<	1.3		0.05						8.2	3.754	0.002	<
0.75 W OF HIGHWAY 130 A	08/12/1998 0:00	0950	0.005		1.2		0.05	<					8.2	4.293	0.002	<
0.75 W OF HIGHWAY 130 A	10/14/1998 0:00	0950	0.004		0.9		0.05	<					7.9	4.709	0.002	<
0.75 W OF HIGHWAY 130 A	12/29/1998 0:00	0933	0.002		1.7		0.05	<					8	3.578	0.002	<
0.75 W OF HIGHWAY 130 A	01/13/1999 0:00	1000	0.001		2.2		0.05	<					7.8	3.298	0.002	<
0.75 W OF HIGHWAY 130 A	03/10/1999 0:00	1000	0.001		0.8		0.05	<					8.2	2.731	0.002	<
0.75 W OF HIGHWAY 130 A	05/12/1999 0:00	1025	0.006		1.2		0.05	<					7.7	3.578	0.002	<
0.75 W OF HIGHWAY 130 A	07/07/1999 0:00	1010	0.006		0.9		0.05	<					7.7	4.774	0.002	<
0.75 W OF HIGHWAY 130 A	09/08/1999 0:00	1030	0.006		2.4		0.09						8.1	4.366	0.002	
0.75 W OF HIGHWAY 130 A	11/09/1999 0:00	1046	0.006		2.4		0.09						8.3	5.556	0.002	<
0.75 W OF HIGHWAY 130 A	02/09/2000 0:00	0850	0.001	<	0.4		0.05	<			0.02	<	8.4	2.697	0.002	<
0.75 W OF HIGHWAY 130 A	04/12/2000 0:00	0900	0.001	<	0.8		0.05	<			0.02	<	8.6	3	0.002	<
0.75 W OF HIGHWAY 130 A	06/14/2000 0:00	0910	0.005		1.3		0.05	<			0.14		8.2	3.785	0.002	<
0.75 W OF HIGHWAY 130 A	08/16/2000 0:00	0840	0.006		3.2		0.07				0.08		8.1	5.266	0.002	<
0.75 W OF HIGHWAY 130 A	10/11/2000 0:00	0915	0.002		5.4		0.10				0.25		8.2	6.007	0.002	<
0.75 W OF HIGHWAY 130 A	12/06/2000 0:00	0855	0.002		4.0		0.05	<			0.09		8.2	4.416	0.002	<
0.75 W OF HIGHWAY 130 A	01/11/2001 0:00	0915	0.002		2.8		0.07				0.02	<	8.2	4.752	0.002	<
0.75 W OF HIGHWAY 130 A	03/15/2001 0:00	0930	0.002		2.1		0.05	<			0.02	<	8.1	3.003	0.002	<
0.75 W OF HIGHWAY 130 A	05/10/2001 0:00	0930	0.006		0.8		0.05	<			0.02	<	8.1	4.17	0.002	<
0.75 W OF HIGHWAY 130 A	07/19/2001 0:00	0950	0.004		1.9		0.05	<			0.1		8.3	4.346	0.002	<
0.75 W OF HIGHWAY 130 A	09/13/2001 0:00	1125	0.005		3.9		0.05	<			0.34		8.2	5.906	0.002	<
0.75 W OF HIGHWAY 130 A	11/06/2001 0:00	1030	0.003		5.3		0.05	<			0.61		8.1	6.211	0.002	<
0.75 W OF HIGHWAY 130 A	02/13/2002 0:00	0920	0.004		0.0		0.05	<			0.07		8.6	4.243	0.0015	
0.75 W OF HIGHWAY 130 A	04/10/2002 0:00	1000	0.008		5.2		0.07				0.45		8.8	5.162	0.0022	
0.75 W OF HIGHWAY 130 A	06/13/2002 0:00	0910	0.011		1.7		0.05	<			0.25	<	7.7	5.832	0.001	<
0.75 W OF HIGHWAY 130 A	08/14/2002 0:00	1005	0.009		3.8		0.05	<			0.25	<	8	5.719	0.0017	
0.75 W OF HIGHWAY 130 A	10/16/2002 0:00	0942	0.005		2.2		0.05	<			0.25	<	8.2	4.779	0.0014	
0.75 W OF HIGHWAY 130 A	12/23/2002 0:00	0936	0.004		3.5		0.05	<			0.45		8.4	5.543	0.0012	
0.75 W OF HIGHWAY 130 A	01/22/2003 0:00	0932	0.006		4.5		0.19				0.45		8.3	4.867	0.001	<
0.75 W OF HIGHWAY 130 A	03/12/2003 0:00	0901	0.003		3.5		0.05	<			0.39		8.4	4.324	0.001	<
0.75 W OF HIGHWAY 130 A	05/28/2003 0:00	0936	0.007		1.0		0.05	<			0.25	<	8.1	4.597	0.001	<
0.75 W OF HIGHWAY 130 A	07/16/2003 0:00	0854	0.005		4.5		0.05	<			0.52		8.3	6.591	0.0015	
0.75 W OF HIGHWAY 130 A	09/17/2003 0:00	1004	0.007		0.9		0.05	<			0.25	<	7.8	5.059	0.0012	
0.75 W OF HIGHWAY 130 A	11/12/2003 0:00	0946	0.005		2.3		0.05	<			0.25		8.2	4.081	0.0013	
0.75 W OF HIGHWAY 130 A	02/11/2004 0:00	1007	0.004		2.4		0.05	<			0.29		8	2.586	0.001	
0.75 W OF HIGHWAY 130 A	04/14/2004 0:00	0925	0.005		0.2		0.05	<			0.25	<	7.9	2.78	0.0011	
0.75 W OF HIGHWAY 130 A	06/16/2004 0:00	0849	0.029		0.4		0.05	<			0.25	<	7.9	7.851	0.0012	
0.75 W OF HIGHWAY 130 A	08/11/2004 0:00	0919	0.004		0.8		0.19				0.25	<	7.8	3.916	0.0016	
0.75 W OF HIGHWAY 130 A	10/13/2004 0:00	0912	0.005		0.3		0.15				0.25	<	8.2	3.341	0.0019	
0.75 W OF HIGHWAY 130 A	12/01/2004 0:00	0922	0.004		0.9		0.05	<			0.25	<	7.9	3.565	0.001	<
0.75 W OF HIGHWAY 130 A	01/19/2005 0:00	1015	0.004		0.7		0.05				0.25	<	7.9	2.665	0.001	<

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	SILICA		SILVER		SODIUM	SPEC_COND	SULFATE	THALLIUM		TDS	TOTHARD	PHOSPHU	TSS
0.75 W OF HIGHWAY 130 A	07/16/1997 0:00	0840	17.814		0.001	<	22.889	650	122.8	0.05		424.6	332.832	0.264	138
0.75 W OF HIGHWAY 130 A	09/03/1997 0:00	0930	14.382		0.001	<	12.375	522	50.34	0.05		305.8	231.84	0.201	37
0.75 W OF HIGHWAY 130 A	11/12/1997 0:00	0843	13.488		0.001	<	20.695	654	72.12	0.05		385.6	302.528	0.316	15
0.75 W OF HIGHWAY 130 A	02/11/1998 0:00	0925	11.488		0.001	<	14.001	582	66.1	0.05		353.7	287.806	0.143	26
0.75 W OF HIGHWAY 130 A	04/15/1998 0:00	0945	18.512		0.001	<	16.5	681	74.35	0.05		404.9	331.958	0.16	72
0.75 W OF HIGHWAY 130 A	06/10/1998 0:00	1020	16.415		0.001	<	24.916	798	97.11	0.05		472.7	373.883	0.2	55
0.75 W OF HIGHWAY 130 A	08/12/1998 0:00	0950	17.498		0.001	<	16.284	506	42.77	0.05		308.3	242.792	0.21	45
0.75 W OF HIGHWAY 130 A	10/14/1998 0:00	0950	22.262		0.001	<	11.736	506	50.79	0.05		298	237.114	0.299	188
0.75 W OF HIGHWAY 130 A	12/29/1998 0:00	0933	16.123		0.001	<	19.717	810	75.37	0.05		468.6	395.992	0.177	13
0.75 W OF HIGHWAY 130 A	01/13/1999 0:00	1000	15.285		0.001	<	21.401	865	97.79	0.05		514.8	430.01	0.193	14
0.75 W OF HIGHWAY 130 A	03/10/1999 0:00	1000	6.231		0.001	<	20.299	696	101.68	0.05		416.6	322.618	0.159	23
0.75 W OF HIGHWAY 130 A	05/12/1999 0:00	1025	36.673		0.001	<	13.761	589	43.88	0.05		356.3	276.814	0.33	208
0.75 W OF HIGHWAY 130 A	07/07/1999 0:00	1010	41.007		0.001	<	10.093	412	29.37	0.05		269.7	194.71	0.41	158
0.75 W OF HIGHWAY 130 A	09/08/1999 0:00	1030	21.437		0.001	<	24.72	718	104.97	0.05		444.3	318.854	0.494	74
0.75 W OF HIGHWAY 130 A	11/09/1999 0:00	1046	19.887		0.001	<	30.859	955	153.95	0.05		596.9	433.383	0.633	51
0.75 W OF HIGHWAY 130 A	02/09/2000 0:00	0850	3.073		0.001	<	27.706	687	150.72	0.05		494.7	363.941	0.17	11
0.75 W OF HIGHWAY 130 A	04/12/2000 0:00	0900	19		0.001	<	18	710	91	0.05		430	340	0.22	70
0.75 W OF HIGHWAY 130 A	06/14/2000 0:00	0910	31.674		0.001	<	17.093	676	74.52	0.05		398.3	294.327	0.32	138
0.75 W OF HIGHWAY 130 A	08/16/2000 0:00	0840	22.174		0.001	<	26.284	707	116.94	0.05		447.8	316.991	0.49	61
0.75 W OF HIGHWAY 130 A	10/11/2000 0:00	0915	12.072		0.001	<	40.282	901	170.28	0.05		582.2	382.232	0.89	35
0.75 W OF HIGHWAY 130 A	12/06/2000 0:00	0855	12.327		0.001	<	24.189	804	118.7	0.05		497.1	355.149	0.596	5
0.75 W OF HIGHWAY 130 A	01/11/2001 0:00	0915	3.007		0.001	<	36.95	1050	231.19	0.05		673.1	484.968	0.62	17
0.75 W OF HIGHWAY 130 A	03/15/2001 0:00	0930	19.402		0.001	<	14.727	624	69.3	0.05		364.3	287.499	0.29	77
0.75 W OF HIGHWAY 130 A	05/10/2001 0:00	0930	31.018		0.001	<	14.139	513.5	56.95	0.05		328.6	255.421	0.344	211
0.75 W OF HIGHWAY 130 A	07/19/2001 0:00	0950	16.872		0.001	<	18.665	549.6	68.78	0.05		334.2	253.866	0.4	46
0.75 W OF HIGHWAY 130 A	09/13/2001 0:00	1125	31.005		0.001	<	13.429	399.1	32.33	0.05		268.4	197.864	0.591	72
0.75 W OF HIGHWAY 130 A	11/06/2001 0:00	1030	14.63		0.001	<	26.953	701.7	104.52	0.05		462.3	322.602	0.995	39
0.75 W OF HIGHWAY 130 A	02/13/2002 0:00	0920	2.242		0.001	<	40.572	876.7	198.52	0.05		566.4	376.228	0.285	29
0.75 W OF HIGHWAY 130 A	04/10/2002 0:00	1000	9.297		0.001	<	38.322	899.7	197.68	0.05		598	416.945	0.947	62
0.75 W OF HIGHWAY 130 A	06/13/2002 0:00	0910	41.434		0.001	<	13.021	440.3	28.29	0.05		292	208.266	0.577	294
0.75 W OF HIGHWAY 130 A	08/14/2002 0:00	1005	23.375		0.001	<	28.054	731.7	121.38	0.05		489.9	342.231	0.914	85
0.75 W OF HIGHWAY 130 A	10/16/2002 0:00	0942	12.819		0.001	<	31.781	817.6	192.33	0.05		539.5	376.455	0.588	32
0.75 W OF HIGHWAY 130 A	12/23/2002 0:00	0936	4.085		0.001	<	28.036	799.6	136.4	0.05		531.4	412.724	0.91	18
0.75 W OF HIGHWAY 130 A	01/22/2003 0:00	0932	4.252		0.001	<	33.216	922	186.18	0.05		605.2	443.982	0.839	11
0.75 W OF HIGHWAY 130 A	03/12/2003 0:00	0901	1.46		0.001	<	30.611	809.1	156.12	0.05		527.9	400.613	0.759	11
0.75 W OF HIGHWAY 130 A	05/28/2003 0:00	0936	17.05		0.001	<	16.562	569.8	93.88	0.05		372.3	291.129	0.277	91
0.75 W OF HIGHWAY 130 A	07/16/2003 0:00	0854	19.388		0.001	<	17.065	539.7	51.15	0.05		337.8	263.918	0.728	36
0.75 W OF HIGHWAY 130 A	09/17/2003 0:00	1004	29.85		0.001	<	5.602	275.7	14.5	0.05		186.2	137.979	0.35	131
0.75 W OF HIGHWAY 130 A	11/12/2003 0:00	0946	13.264		0.001	<	21.268	742.1	108.53	0.05		491.8	398.475	0.468	15
0.75 W OF HIGHWAY 130 A	02/11/2004 0:00	1007	7.571		0.001	<	23.142	729.7	117.47	0.05		479.1	380.592	0.385	10
0.75 W OF HIGHWAY 130 A	04/14/2004 0:00	0925	9.712		0.001	<	14.648	589.3	63.01	0.05		377.8	322.027	0.135	35
0.75 W OF HIGHWAY 130 A	06/16/2004 0:00	0849	108.86		0.001	<	3.195	162.7	8.23	0.05		234.4	157.189	0.945	1285
0.75 W OF HIGHWAY 130 A	08/11/2004 0:00	0919	18.534		0.001	<	15.777	625	62.29	0.05		410.1	346.494	0.237	39
0.75 W OF HIGHWAY 130 A	10/13/2004 0:00	0912	15.574		0.001	<	23.184	734.1	99.94	0.05		452.5	367.122	0.31	33
0.75 W OF HIGHWAY 130 A	12/01/2004 0:00	0922	14.014		0.001	<	17.947	628.2	86.35	0.05		389.5	295.092	0.222	19
0.75 W OF HIGHWAY 130 A	01/19/2005 0:00	1015	15.042		0.001	<	13.866	507	45.13	0.05		325.8	258.982	0.18	30

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	TURBIDITY	VANADIUM		ZINC		TOC	KJELDAHL		STRONTIUM	
0.75 W OF HIGHWAY 130 A	07/16/1997 0:00	0840	66	0.01		0.062						
0.75 W OF HIGHWAY 130 A	09/03/1997 0:00	0930	17	0.009		0.016						
0.75 W OF HIGHWAY 130 A	11/12/1997 0:00	0843	8.2	0.005	<	0.034						
0.75 W OF HIGHWAY 130 A	02/11/1998 0:00	0925	14	0.006		0.036						
0.75 W OF HIGHWAY 130 A	04/15/1998 0:00	0945	24	0.007		0.086						
0.75 W OF HIGHWAY 130 A	06/10/1998 0:00	1020	18	0.009		0.018						
0.75 W OF HIGHWAY 130 A	08/12/1998 0:00	0950	20	0.009		0.542						
0.75 W OF HIGHWAY 130 A	10/14/1998 0:00	0950	75	0.01		0.044						
0.75 W OF HIGHWAY 130 A	12/29/1998 0:00	0933	4.8	0.005	<	0.005	<					
0.75 W OF HIGHWAY 130 A	01/13/1999 0:00	1000	2.5	0.005	<	0.011						
0.75 W OF HIGHWAY 130 A	03/10/1999 0:00	1000	6.3	0.005	<	0.073						
0.75 W OF HIGHWAY 130 A	05/12/1999 0:00	1025	74	0.01		0.04						
0.75 W OF HIGHWAY 130 A	07/07/1999 0:00	1010	80	0.014		0.119						
0.75 W OF HIGHWAY 130 A	09/08/1999 0:00	1030	30	0.012		0.032						
0.75 W OF HIGHWAY 130 A	11/09/1999 0:00	1046	21	0.007		0.223						
0.75 W OF HIGHWAY 130 A	02/09/2000 0:00	0850	3	0.005	<	0.013			0.1	<		
0.75 W OF HIGHWAY 130 A	04/12/2000 0:00	0900	24	0.0081		0.025			0.54			
0.75 W OF HIGHWAY 130 A	06/14/2000 0:00	0910	33	0.014		0.024			0.73			
0.75 W OF HIGHWAY 130 A	08/16/2000 0:00	0840	37	0.017		0.153			0.98			
0.75 W OF HIGHWAY 130 A	10/11/2000 0:00	0915	14	0.01		0.017			1.52			
0.75 W OF HIGHWAY 130 A	12/06/2000 0:00	0855	3.1	0.005	<	0.027		6.596	0.34			
0.75 W OF HIGHWAY 130 A	01/11/2001 0:00	0915	3.9	0.005	<	0.076		8.416	1.208			
0.75 W OF HIGHWAY 130 A	03/15/2001 0:00	0930	32	0.006		0.032		5.746	0.91			
0.75 W OF HIGHWAY 130 A	05/10/2001 0:00	0930	87	0.013		0.053		6.109	1.034			
0.75 W OF HIGHWAY 130 A	07/19/2001 0:00	0950	20	0.014		0.116		6.42	0.736			
0.75 W OF HIGHWAY 130 A	09/13/2001 0:00	1125	50	0.014		0.027		6.453	1.38			
0.75 W OF HIGHWAY 130 A	11/06/2001 0:00	1030	22	0.008		0.036		5.423	1.579			
0.75 W OF HIGHWAY 130 A	02/13/2002 0:00	0920	10.3	0.005	<	0.013		7.828	1.095			
0.75 W OF HIGHWAY 130 A	04/10/2002 0:00	1000	18	0.008		0.015		7.203	1.414			
0.75 W OF HIGHWAY 130 A	06/13/2002 0:00	0910	102	0.017		0.034		6.724	0.397			
0.75 W OF HIGHWAY 130 A	08/14/2002 0:00	1005	36	0.018		0.015		3.756	1.041		1.212	
0.75 W OF HIGHWAY 130 A	10/16/2002 0:00	0942	12	0.008		0.009		3.809	0.665		1.645	
0.75 W OF HIGHWAY 130 A	12/23/2002 0:00	0936	7.9	0.005	<	0.011		5.332	1.035		1.597	
0.75 W OF HIGHWAY 130 A	01/22/2003 0:00	0932	4.1	0.005	<	0.015		4.442	0.784		1.869	
0.75 W OF HIGHWAY 130 A	03/12/2003 0:00	0901	4.2	0.005	<	0.009		4.033	0.649		1.799	
0.75 W OF HIGHWAY 130 A	05/28/2003 0:00	0936	28	0.009		0.012		4.047	0.658		1.081	
0.75 W OF HIGHWAY 130 A	07/16/2003 0:00	0854	29	0.014		0.008		3.812	0.722		0.949	
0.75 W OF HIGHWAY 130 A	09/17/2003 0:00	1004	110	0.011		0.016		6.424	0.803		0.4	
0.75 W OF HIGHWAY 130 A	11/12/2003 0:00	0946	10.1	0.005	<	0.009		3.061	0.241		1.477	
0.75 W OF HIGHWAY 130 A	02/11/2004 0:00	1007	3.34	0.005	<	0.012		2.621	0.239		1.424	
0.75 W OF HIGHWAY 130 A	04/14/2004 0:00	0925	17.3	0.005		0.009		3.783	0.985		1.078	
0.75 W OF HIGHWAY 130 A	06/16/2004 0:00	0849	269	0.041		0.092		7.937	3.279		0.322	
0.75 W OF HIGHWAY 130 A	08/11/2004 0:00	0919	26.2	0.009		0.008		4.104	0.663		1.199	
0.75 W OF HIGHWAY 130 A	10/13/2004 0:00	0912	18.2	0.008		0.013		3.708	0.727		1.467	
0.75 W OF HIGHWAY 130 A	12/01/2004 0:00	0922	16.9	0.005	<	0.007		4.55	0.555		1.112	
0.75 W OF HIGHWAY 130 A	01/19/2005 0:00	1015	23	0.005	<	0.009		4.144	0.5		0.816	

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	ALKALINTY	ALUMINUM	AMMONIA		ANTIMONY		ARSENIC		BARIUM		BERYLLIUM		BOD	
0.75 W OF HIGHWAY 130 A	03/16/2005 0:00	0916	256	0.5	0.10	<	0.050	<	0.0016		0.126		0.001	<		
0.75 W OF HIGHWAY 130 A	05/11/2005 0:00	0857	259	0.6	0.10	<	0.050	<	0.0024		0.148		0.001	<		
0.75 W OF HIGHWAY 130 A	07/06/2005 0:00	0851	179	5.5	0.10	<	0.050	<	0.0036		0.165		0.001	<		
0.75 W OF HIGHWAY 130 A	09/07/2005 0:00	0908	130	4.5	0.10	<	0.050	<	0.0043		0.138		0.001	<		
0.75 W OF HIGHWAY 130 A	11/02/2005 0:00	0840	291	0.3	0.10	<	0.050	<	0.0032		0.163		0.001	<		
0.75 W OF HIGHWAY 130 A	02/08/2006 0:00	0910	194	0.3	0.10	<	0.050	<	0.0029		0.099		0.001	<		
0.75 W OF HIGHWAY 130 A	04/12/2006 0:00	0904	185	2.1	0.10	<	0.050	<	0.0038		0.133		0.001	<		
0.75 W OF HIGHWAY 130 A	06/14/2006 0:00	1016	196	1.5	0.10	<	0.050	<	0.0048		0.161		0.001	<		
0.75 W OF HIGHWAY 130 A	08/16/2006 0:00	0937	206	2.2	0.13		0.050	<	0.0085		0.181		0.001	<		
0.75 W OF HIGHWAY 130 A	10/11/2006 0:00	0934	214	1.3	0.10	<	0.050	<	0.007		0.176		0.001	<		
0.75 W OF HIGHWAY 130 A	12/06/2006 0:00	0903	205	0.2	0.10	<	0.050	<	0.0034		0.145		0.001	<		
0.75 W OF HIGHWAY 130 A	12/06/2006 0:00	0908	206	0.2	0.10	<	0.050	<	0.0033		0.138		0.001	<		

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	BORON		BROMIDE		CADMIUM		CALCIUM	CHLORIDE	CHROMIUM		COBALT		COPPER	
0.75 W OF HIGHWAY 130 A	03/16/2005 0:00	0916	0.05		0.200	<	0.001	<	89.6	12.4	0.001	<	0.010	<	0.002	
0.75 W OF HIGHWAY 130 A	05/11/2005 0:00	0857	0.06		0.200	<	0.001	<	93.7	19.2	0.001	<	0.010	<	0.002	
0.75 W OF HIGHWAY 130 A	07/06/2005 0:00	0851	0.05	<	0.200	<	0.001	<	68.4	7.9	0.006		0.010	<	0.007	
0.75 W OF HIGHWAY 130 A	09/07/2005 0:00	0908	0.05	<	0.200	<	0.001	<	44.5	3.7	0.005		0.010	<	0.005	
0.75 W OF HIGHWAY 130 A	11/02/2005 0:00	0840	0.06		0.200	<	0.001	<	110	12.4	0.001		0.010	<	0.002	
0.75 W OF HIGHWAY 130 A	02/08/2006 0:00	0910	0.05		0.200	<	0.001	<	72.9	10.7	0.001	<	0.010	<	0.002	
0.75 W OF HIGHWAY 130 A	04/12/2006 0:00	0904	0.05	<	0.200	<	0.001	<	67.6	9.5	0.002		0.010	<	0.004	
0.75 W OF HIGHWAY 130 A	06/14/2006 0:00	1016	0.05	<	0.200	<	0.001	<	76.8	9.3	0.002		0.010	<	0.004	
0.75 W OF HIGHWAY 130 A	08/16/2006 0:00	0937	0.08		0.200	<	0.001	<	79.3	20.0	0.002		0.010	<	0.004	
0.75 W OF HIGHWAY 130 A	10/11/2006 0:00	0934	0.10		0.200	<	0.001	<	95.7	31.1	0.001		0.010	<	0.004	
0.75 W OF HIGHWAY 130 A	12/06/2006 0:00	0903	0.09		0.200	<	0.001	<	97.7	29.3	0.001	<	0.010	<	0.002	
0.75 W OF HIGHWAY 130 A	12/06/2006 0:00	0908	0.08		0.200	<	0.001	<	94.4	29.4	0.001	<	0.010	<	0.003	

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	DISOXY		FLUORIDE		IRON		LEAD		MAGNESIUM	MANGANESE	MERCURY		MOLYBDENM	
0.75 W OF HIGHWAY 130 A	03/16/2005 0:00	0916	11.7		0.27		0.48		0.001	<	21.6	0.10	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	05/11/2005 0:00	0857	8.7		0.35		0.53		0.001		23.5	0.09	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	07/06/2005 0:00	0851	6.8		0.29		4.91		0.005		14.1	0.24	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	09/07/2005 0:00	0908	7.4		0.19		4.23		0.004		8.0	0.22	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	11/02/2005 0:00	0840	10.0		0.15		0.33		0.001	<	24.7	0.07	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	02/08/2006 0:00	0910	13.2		0.21		0.32		0.001	<	16.1	0.09	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	04/12/2006 0:00	0904	9.1		0.22		2.12		0.003		14.6	0.20	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	06/14/2006 0:00	1016	7.0		0.23		1.46		0.002		15.6	0.12	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	08/16/2006 0:00	0937	5.7		0.29		2.12		0.003		18.5	0.20	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	10/11/2006 0:00	0934	8.1		0.36		1.14		0.002		24.6	0.13	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	12/06/2006 0:00	0903	13.2		0.30		0.22		0.001	<	24.1	0.06	0.0005	<	0.020	<
0.75 W OF HIGHWAY 130 A	12/06/2006 0:00	0908	13.0		0.30		0.22		0.001	<	23.5	0.06	0.0005	<	0.020	<

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	NICKEL		NITRATE		NITRITE		NO2_NO3		ORTH_PHOS		PHFIELD	POTASSIUM	SELENIUM	
0.75 W OF HIGHWAY 130 A	03/16/2005 0:00	0916	0.005		0.6		0.05	<			0.25	<	7.9	2.229	0.0013	
0.75 W OF HIGHWAY 130 A	05/11/2005 0:00	0857	0.004		1.1		0.05	<			0.25	<	8	2.734	0.0011	
0.75 W OF HIGHWAY 130 A	07/06/2005 0:00	0851	0.009		1.1		0.05	<			0.25	<	7.4	5.307	0.001	<
0.75 W OF HIGHWAY 130 A	09/07/2005 0:00	0908	0.007		0.4		0.05	<			0.25	<	7.4	4.961	0.001	<
0.75 W OF HIGHWAY 130 A	11/02/2005 0:00	0840	0.001	<	2.1		0.05	<			0.25	<	7.8	3.958	0.0025	
0.75 W OF HIGHWAY 130 A	02/08/2006 0:00	0910	0.003		1.4		0.05	<			0.25	<	7.6	3.827	0.0011	
0.75 W OF HIGHWAY 130 A	04/12/2006 0:00	0904	0.006		0.7		0.05	<			0.25	<	7.9	4.42	0.0017	
0.75 W OF HIGHWAY 130 A	06/14/2006 0:00	1016	0.006		2.5		0.05	<			0.33		7.7	5.365	0.001	<
0.75 W OF HIGHWAY 130 A	08/16/2006 0:00	0937	0.008		3.7		0.09				0.46		7.8	6.483	0.002	
0.75 W OF HIGHWAY 130 A	10/11/2006 0:00	0934	0.007		6.0		0.06				0.82		8	7.871	0.0019	
0.75 W OF HIGHWAY 130 A	12/06/2006 0:00	0903	0.006		9.2		0.05	<			1.56		7.7	7.867	0.0017	
0.75 W OF HIGHWAY 130 A	12/06/2006 0:00	0908	0.006		9.2		0.05	<			1.52		7.7	7.666	0.0018	

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	SILICA		SILVER		SODIUM	SPEC_COND	SULFATE	THALLIUM		TDS	TOTHARD	PHOSPHU	TSS
0.75 W OF HIGHWAY 130 A	03/16/2005 0:00	0916	5.372		0.001	<	16.326	607.9	65.03	0.05		368.8	312.653	0.182	25
0.75 W OF HIGHWAY 130 A	05/11/2005 0:00	0857	7.035		0.001	<	18.531	659.9	102.4	0.05		427.1	330.614	0.153	40
0.75 W OF HIGHWAY 130 A	07/06/2005 0:00	0851	36.678		0.001	<	10.169	419.6	43.03	0.05		297.5	228.662	0.355	220
0.75 W OF HIGHWAY 130 A	09/07/2005 0:00	0908	33.687		0.001	<	5.997	285.6	15.31	0.05		195.9	143.961	0.329	132
0.75 W OF HIGHWAY 130 A	11/02/2005 0:00	0840	13.447		0.001	<	22.403	716.7	87.41	0.05		458.7	376.578	0.382	14
0.75 W OF HIGHWAY 130 A	02/08/2006 0:00	0910	7.467		0.001	<	15.636	507.3	62.64	0.05		311.9	248.191	0.242	15
0.75 W OF HIGHWAY 130 A	04/12/2006 0:00	0904	16.288		0.001	<	13.094	475.9	58.32	0.05		297.9	228.737	0.296	103
0.75 W OF HIGHWAY 130 A	06/14/2006 0:00	1016	23.409		0.001	<	13.813	518.1	58	0.05		330.7	255.906	0.528	72
0.75 W OF HIGHWAY 130 A	08/16/2006 0:00	0937	28.015		0.001	<	25.666	591	59.62	0.05		377.5	274.009	0.826	56
0.75 W OF HIGHWAY 130 A	10/11/2006 0:00	0934	18.441		0.001	<	36.572	758.7	106.92	0.05		476.2	340.007	1.532	41
0.75 W OF HIGHWAY 130 A	12/06/2006 0:00	0903	8.72		0.001	<	34.687	720.5	107.6	0.05		474.3	343.16	1.855	20
0.75 W OF HIGHWAY 130 A	12/06/2006 0:00	0908	8.818		0.001	<	33.763	789.6	108.44	0.05		470.6	332.259	1.83	10

Neosho River Station - UP STREAM OF JRR - 0.75 W Of Highway 130 at Neosho Rapids

SITE_LOCT - UP STREAM	COL_DATE	COL_TIME	TURBIDITY	VANADIUM		ZINC		TOC	KJELDAHL		STRONTIUM	
0.75 W OF HIGHWAY 130 A	03/16/2005 0:00	0916	15.7	0.005	<	0.006		5.416	0.597		1.141	
0.75 W OF HIGHWAY 130 A	05/11/2005 0:00	0857	26.2	0.005		0.005		6.991	0.1	<	1.25	
0.75 W OF HIGHWAY 130 A	07/06/2005 0:00	0851	149	0.014		0.017		9.653	0.911		0.699	
0.75 W OF HIGHWAY 130 A	09/07/2005 0:00	0908	98.4	0.013		0.018		5.936	0.982		0.337	
0.75 W OF HIGHWAY 130 A	11/02/2005 0:00	0840	6.97	0.006		0.005	<	4.734	0.167		1.324	
0.75 W OF HIGHWAY 130 A	02/08/2006 0:00	0910	10.9	0.005	<	0.007		3.668	0.628		0.843	
0.75 W OF HIGHWAY 130 A	04/12/2006 0:00	0904	72.9	0.009		0.01		5.353	0.959		0.716	
0.75 W OF HIGHWAY 130 A	06/14/2006 0:00	1016	50.8	0.012		0.011		4.509	0.902		0.866	
0.75 W OF HIGHWAY 130 A	08/16/2006 0:00	0937	26.2	0.018		0.01		4.325	1.472		0.947	
0.75 W OF HIGHWAY 130 A	10/11/2006 0:00	0934	30	0.014		0.01		5.462	1.293		1.307	
0.75 W OF HIGHWAY 130 A	12/06/2006 0:00	0903	4.87	0.005	<	0.007		6.072	0.706		1.27	
0.75 W OF HIGHWAY 130 A	12/06/2006 0:00	0908	6.17	0.005	<	0.005		6.184	0.883		1.268	

4. Available information regarding local, state, or federal management measures for the JRR, CCL, and the Neosho River. This may include fisheries management, watershed management, flow regulation, etc.

• Available water or sediment quality data for John Redmond Reservoir (JRR), Coffey County Lake (CCL), and Neosho River.

4 • Available information regarding local, state, or federal management measures for the JRR, CCL, and the Neosho River. This may include fisheries management, watershed management, flow regulation, etc. HC

• Any available documentation regarding minimum flows in the Neosho River.

• Available records regarding the operation of the intake screens at either the Neosho River or CCL screen houses as well as information on the ongoing and periodic maintenance that occurs on the screens.

• Available information on invasive or nuisance species observed in the facility's intake, JRR, CCL, or the Neosho River and available information on Wolf Creek Nuclear Operating Corporation (WCNOC) efforts to address this issue.

• Documentation regarding the WCNOC or Coffey County Sheriff's office management of the CCL access program.

• Examples of the fishery regulations developed by the Kansas Department of Wildlife & Parks for CCL.

• If available, information on any occurrences of the Topeka Shiner in the JRR, CCL, Neosho River, or any water bodies crossed by the facility's transmission lines.

• Section 2.5 of the ER (Wolf Creek Generating Station (WCGS), 1980) states that U.S. Fish and Wildlife Service (USFWS) and U.S. Geological Survey (USGS) recommended that additional data be obtained on the habitat requirements of the Neosho River madtoms. Please provide any new information related to these habitat requirements.

• Section 2.5 of the ER (WCGS, 1980) states that USFWS and USGS recommended that flows below the John Redmond Dam be increased during critical periods for the Neosho River madtoms. Please provide any new information related to this issue.

• If available, information on any occurrences of the Neosho river madtom in the JRR, CCL or Neosho river.

• If available, information on any occurrences of the Neosho mucket mussel in the JRR, CCL or Neosho river.

• Section 3.1.2 of the ER (WCGS, 1980) states that water is released to Wolf Creek infrequently. Please provide available records documenting these releases and/or information regarding the frequency of these releases.

• Details on the anti-scalants, dispersants, biocides, and corrosion inhibitors which are released into the circulating water system. Specifically, names of additives used, concentrations used, and frequency of application.

• System operating procedures for the circulating water system traveling screens.

PROGRESS AND MANAGEMENT REPORT
2005

WATER: John Redmond Reservoir

BIOLOGIST: Leonard Jirak

HISTORY: This reservoir has the lowest storage ratio/drainage index and shoreline development index of any reservoir in the state. Because of the high flow through rates, high turbidity and lack of shoreline development, this lake has a a poor sport fishery, although it has some sporatic good fishing.

The reservoir has some redeeming qualities, in that it is very fertile and has the potential for water level management to keep the aquatic ecosystem dynamic. The lake is shallow and the bottom is very flat. The shallow, flat bottom allows for 1,000 acres of bottom exposure for every foot of draw down. When the fertile soils are exposed in the summer there is a rapid vegetative response. This revegetation can be used for waterfowl and sportfish enhancement. For this to occur it will require cooperation of state and federal agencies.

After years of meetings, negotiations, and compromise a drawdown and raise was approved by the Kansas water office and supported by the Kansas water authority. The plan calls for a drawdown to 1037 in late June and a raise to 1041 in the fall for waterfowl. Several stipulations were included to forgo the plan such as, if a dry condition would jeopardize the Wolf Creek water supply contract.

The drawdown was accomplished in 2002, 03,04,05. The past summer was wet, and vegetation growth was limited due to flooding.. With the drawdown in the past 3 years good amounts of willows have become establised in shallow areas and may contribute to an increase in crappie production in the future.

Due to the inability to manage water levels for fish management purposes the lake will not be sampled in the future unless there is a special project. The rearing pond will be utilized to rear fish for the lake and commercial fish harvest will continue. Wipers began showing up in good numbers off the dam in the fall of 2002. The most recent paddlefish stockings are just beginning to show up in some of the commercial nettings. A new State record white bass was caught at John Redmond Reservoir in the spring of 2002.

The log jam in the lower part of the river above the lake grew past the Jacobs Creek boat ramp in the spring of 2004. There was very little access to the river because of the log jam early in the year. By late summer the jam had totally closed off access to the river except from the Hartford ramp which is about 20 river miles above the lake. A small low water ramp was constructed with the County, Hartford Fish and Wildlife Service and Kansas Wildlife and parks on eagle creek to provide some fishing access in the upper reaches of the lake, this did not allow access to the Neosho river since there is another log jam at the mouth of Eagle creek.

Federal, State, County government and Politicians became involved in a task force to try and find a way to remove the log jam. The results of a study by the Corps of Engineers deemed it too expensive to remove the jam. The log jam will result in the loss of about 1,000 fishing trips in the Neosho river above John Redmond lake annually.

PHYSICAL AND HYDROLOGICAL DATA

Surface Acres	9,700
Mean Depth	6 feet
Contributing Watershed (Acres)	1,929,600
Volume at Conservation Pool	56,000 A.F.
Elevation at Conservation Pool	1039
Shoreline Development Index (SDI)	4.3
Storage Ratio/Drainage Index (SR/DI)	0.06

SPECIAL REGULATIONS

No Special Regulations.

MANAGEMENT OBJECTIVES

1. Implement water level management to benefit the sport fishery and waterfowl.

2. Produce 50,000 Wiper fingerlings in Corps rearing pond for reservoir stocking.

3. Establish a paddlefish population.

4. Establish a bluecat fishery.

FISH STOCKING RECORDS

DATE	SPECIES	NUMBER	NO/ACRE	SIZE	SOURC
7/14/2005	Paddlefish	5,970	.18	5/ lb	FWS/ Tishamingo
8/15/2005	Wipers	500,000	2	25/lb	MILH

FISH SAMPLING SUMMARY:
None in 2005

CREEL SURVEY HISTORY

No Reservoir Creel Census.

There was a creel census during the paddlefish snagging season at the Burington city dam, in 1996-1998. A total of 4 fish from 8-45 pounds was caught. Good flows during most of the season should have helped the movement of paddlefish up to the dam. The 1998 season was considered a disappointment with very low numbers of paddlefish. More fish need to be stocked to rebuild the population. During the years when there was a good population of paddlefish the season was not open. The population was produced in 1981-1983 with 2,500 shorts from a private hatchery, only a handful have been stocked since then. The paddle fish season was not opened in 1999 and 2000 due to low numbers of paddlefish in the river. The population needs to be enhanced by stocking 5,000 shorts every other year once a good population is established. There was a stocking of 5,553 paddlefish shorts stocked in 2000.

PADDLEFISH HARVEST:

Year	No. Harvested
1996	14
1997	5
1998	4

FISH POPULATIONS

TABLE I.

Channel Catfish - Fall Gill Net Sample Data from John Redmond Reservoir.

YEAR	1994	1995	1996	1997	2002
TOTAL CATCH	40	23	14	14	18
STOCK CATCH	34	21	10	14	18
UE NCN	10	8	6	6	1
STOCK CPUE	3.4	2.6	1.6	2.3	18
SUB-STOCK CPUE	0.6	0.2	0.6	0	0
RSD S-Q	12	57	20	14	78
RSD Q-P	78	38	40	79	22
RSD P-M	9	5	40	7	0
RSD M-T					0
RSD T+					0
PSD	88	43	80	86	22
Mean Wr S-Q	82	82	71	78	102
Wr Q-P	76	91	92	97	99
Wr P-M	84	96	92	86	
Wr M+					
Power Rating	3	2	1	2	4

Table I indicates the quality and density of the channel catfish in the lake. The channel cat fishery is about average for this type of reservoir. There are few fish above 10 pounds with fair numbers in the 2-4 pound range as indicated by the PSD of 86. Wr values are below the desirable range for management purposes, but acceptable to most anglers. Large numbers of channel catfish are harvested from the spillway every year. Anglers reported and increase in the size of channel cat harvested from the lake in 2002. This may be due to the removal of large numbers of rough fish during the past 8 years.

TABLE II.

White Bass - Fall Gill Net Sample Data from John Redmond Reservoir.

YEAR	1994	1995	1996	1997	2002	2004
TOTAL CATCH	384	418	72	337	25	3
STOCK CATCH	383	417	72	337	25	3
UE NCN	10	8	6	6	1	1
STOCK CPUE	38	52	12	56	25	3
SUB-STOCK CPUE	0	0	0	0	0	0
RSD S-Q	51	39	7	65	36	0
RSD Q-P	31	54	82	25	20	0
RSD P-M	13	6	11	7	28	0
RSD M-T	5	1		3	16	3
RSD T+	1				0	0
PSD	49	61	93	35	64	100
Mean Wr S-Q	116	112	100	110	124	0
Wr Q-P	98	107	100	112	112	0
Wr P-M	100	107	103	117	110	0
Wr M-T	105	111		119	112	113
Wr T	85					

Table II Angler harvest is dependant on weather conditions. An early wet Spring hampers harvest during the spawning run. There was a good harvest in the area below the log jam in the river in the spring and off the dam in the fall. A new state record white bass was caught at the log jam in the spring of 2002. It appears that the white bass can not make it past the log jam during low water. A short net sampling with a 2.5 inch gill net shows several white bass in M-T range with a Wr value of 113.

TABLE II.

Wiper - Fall Gill Net Sample Data from John Redmond Reservoir.

YEAR	2004
TOTAL CATCH	3
STOCK CATCH	3
UE NCN	1
STOCK CPUE	3
SUB-STOCK CPUE	0
RSD S-Q	0
RSD Q-P	0
RSD P-M	2
RSD M-T	1
RSD T+	0
PSD	100
Mean Wr S-Q	
Wr Q-P	
Wr P-M	100
Wr M+	99

Narrative:

A sampling with a 2.5 inch gill net near the flood gates indicates some large wipers in the lake. Anglers have reported some good catches of wipers in the spillway in the past year.

TABLE III.

Saugeye - Fall Gill Net Sample Data from John Redmond Reservoir.

YEAR	1994	1995	1996	1997	2002
TOTAL CATCH	107	44	4	12	0
STOCK CATCH	107	42	4	11	
UE NCN	10	8	6	6	
STOCK CPUE	10	5	0.6	1.8	
SUB-STOCK CPUE	11	0.2	0	0.2	
RSD S-Q	98	78	50	64	
RSD Q-P	2	19	50	9	
RSD P-M		2		27	
RSD M-T					
RSD T+					
PSD	2	21	50	36	
Mean Wr S-Q	110	109	102	108	
Wr Q-P	99	107	93	110	
Wr P-M		109		118	
Wr M+					

Table III shows that in 1997 the saugeye were below the management objective of 10 fish per NCN, with all of them reaching stock size. Many are caught in the tail waters and up in the river during dry Springs. The 1997 saugeye population shows a sharp catch rate decline from 1994 and 1995, which is probably the result of loss through the spillway. There were few fish stocked from the rearing pond facility due to losses at time of harvest. There were reports of saugeye from the spillway and Burlington city dam in the spring of 2001. No saugeye were caught in the fall 2004 sample.

TABLE IV.

White Crappie - Fall Trap Net Sample Data from John Redmond Reservoir.

YEAR	1993	1995	1996	1997
TOTAL CATCH	14	5	19	3
STOCK CATCH	4	5	19	3
UE TNN	8	12	6	8
STOCK CPUE	0.5	0.4	3	0.4
SUB-STOCK CPUE	1.2	0	0	0
RSD S-Q			32	
RSD Q-P	25	40	68	33
RSD P-M	75	40		67
RSD M-T		20		
RSD T+				
PSD	100	100	68	100
Mean Wr S-Q			110	
Wr Q-P	111	98	108	103
Wr P-M	112	129		115
Wr M+		107		

John Redmond Reservoir has a very poor crappie fishery. Table IV shows the poor catch rate of 0.4 stock size crappie per TNN when the management objective is 20. A fair number of crappie are caught in the flooded creek areas in the Spring and some of these are very large. The water level management of the late 1970s and early 80's produced a crappie fishery like a new lake. Since the water level program was eliminated in the late 1980's, the reservoir has had a declining crappie fishery. The current water level program will probably not be effective since the amount of drawdown was reduced to 2 feet and the lake was up to 30 feet high in the fall of 1998. Trap netting of crappie in the fall will not be done until water level management improves.

OTHER FISH:

GENERAL:

The sportfish population is typical of a turbid, high flow through impoundment. There was a significant decrease in all sportfish and forage fish species which reinforces the flushing concerns during the last several feet of the summer drawdown.

Rough fish such as carp and buffalo dominate the total biomass in the lake. Channel catfish, white bass, flatheads, and crappie are the predominant sportfish that anglers harvest. The majority of the harvest takes place in the stilling basin area and in the river above the lake.

Angler success is very dependant on weather conditions at this reservoir. High water increases catfish harvest. Low water in the Spring encourages white bass and crappie harvest.

FLATHEADS:

The lake has a good population of flatheads of all sizes. Good numbers are caught in the spillway by pole and line fishermen. There is also a good harvest by set line fishermen above the lake in the flooded river channel.

PADDLEFISH:

There were 14 paddlefish harvested in 1996, 5 in 1997, and 4 in 1998. The largest fish was about 40 pounds. Water conditions were good during 1998. The paddlefish season was not opened in 1999 or 2000. It will reopen in 2007.

FORAGE FISH:

Table V shows the third annual shoreline seining sample at JRDR. The catch rate of 21.5 gizzard shad per haul is well below the objective of 100 per seine haul. Removal of rough fish and water level management are tools being used to increase the number of YOY gizzard shad.

FISH STOCKING REQUESTS

YEAR	SPECIES	NUMBER	NO./ACRE	SIZE	MONTH	JUST.
2003	Wipers	500,000	50,000	fry	May	Rearing Pond

YEAR	SPECIES	NUMBER	NO./ACRE	SIZE	MONTH	JUST.
2003	Paddlefish	10,000	1	12"	Sept.	T,IFC
2003	Blue Catfish	18,000	2	Interm.	Oct.	M, T

SPECIAL PROJECTS:

COMMERCIAL FISHING: See Melvern Reservoir progress report and Management plan for methods and procedures.

Table 1. JOHN REDMOND COMMERCIAL FISH HARVEST
(All amounts are in pounds)

Year	Bigmouth Buffalo	Smallmouth Buffalo	Carp	River Carpsucker	Drum	Gar	TOTAL
1994-1995*	32,525	15,867	4,115	558	992	79	54136
1995-1996*	32,143	20,395	6,932	530	3,382	130	63512
1996-1997**	51,231	41,977	3,752	120	2,608	116	99804
1997-1998**	29,985	57,480	896	30	2,319	192	90902
1998-1999**	42,801	53,247	1,486	0	1,624	135	99297
1999-2000**	34,104	95,173	7,222	910	4,073	358	150,422
2000-2001***	28794	82077	4547	910	3284	358	122,045
2001-2002***	5004	42,505	3,213	0	1,714	10	52,446
2002-2003	17,682	15,744	1,604	530	1,933	25	37,518
2004							0
2005							0
Totals	**274,269**	**424,465**	**33,767**	**3,588**	**21,929**	**1,403**	**770,107**

*Contract period from October thru May.
**Contract period from October to October.
***Calender year

RESULTS:

The commercial harvest was above the objective of 50,000 for JRDR at 122,045 pounds in 2000. A dramatic impact to the overall fishery is not expected from commercial fishing at John Redmond Reservoir due to all the other problems the lake has concerning sportfish production. There was no harvest of rough fish in 2004. The commercial fishermen has moved his operation to central Kansas.

RECOMMENDATIONS:

1. Continue rearing wipers at Corps pond.

2. Maintain commercial fish harvest.

3. Continue to pursue water level management.

4. Close paddlefish snagging season until population is increased through stocking.

5. Stock 10,000 paddlefish shorts in 2001.

ACCOMPLISHMENTS

1. Reared 12,000 wipers to large fingerling (60 per lb.).

2. Had a 3 ft drawdown, but fall recharge occurred to early.

4. Five thousand nine hundred paddlefish were stocked.

5. Any available documentation regarding minimum flows in the Neosho River.

• Available water or sediment quality data for John Redmond Reservoir (JRR), Coffey County Lake (CCL), and Neosho River.

• Available information regarding local, state, or federal management measures for the JRR, CCL, and the Neosho River. This may include fisheries management, watershed management, flow regulation, etc.

6 • Any available documentation regarding minimum flows in the Neosho River.

• Available records regarding the operation of the intake screens at either the Neosho River or CCL screen houses as well as information on the ongoing and periodic maintenance that occurs on the screens.

• Available information on invasive or nuisance species observed in the facility's intake, JRR, CCL, or the Neosho River and available information on Wolf Creek Nuclear Operating Corporation (WCNOC) efforts to address this issue.

• Documentation regarding the WCNOC or Coffey County Sheriff's office management of the CCL access program.

• Examples of the fishery regulations developed by the Kansas Department of Wildlife & Parks for CCL.

• If available, information on any occurrences of the Topeka Shiner in the JRR, CCL, Neosho River, or any water bodies crossed by the facility's transmission lines.

• Section 2.5 of the ER (Wolf Creek Generating Station (WCGS), 1980) states that U.S. Fish and Wildlife Service (USFWS) and U.S. Geological Survey (USGS) recommended that additional data be obtained on the habitat requirements of the Neosho River madtoms. Please provide any new information related to these habitat requirements.

• Section 2.5 of the ER (WCGS, 1980) states that USFWS and USGS recommended that flows below the John Redmond Dam be increased during critical periods for the Neosho River madtoms. Please provide any new information related to this issue.

• If available, information on any occurrences of the Neosho river madtom in the JRR, CCL or Neosho river.

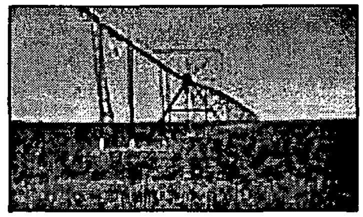
• If available, information on any occurrences of the Neosho mucket mussel in the JRR, CCL or Neosho river.

• Section 3.1.2 of the ER (WCGS, 1980) states that water is released to Wolf Creek infrequently. Please provide available records documenting these releases and/or information regarding the frequency of these releases.

• Details on the anti-scalants, dispersants, biocides, and corrosion inhibitors which are released into the circulating water system. Specifically, names of additives used, concentrations used, and frequency of application.

• System operating procedures for the circulating water system traveling screens.

Kansas Department of Agriculture
Division of Water Resources



KDA > DWR > Operations and Technical Services Program > MDS

Minimum Desirable Streamflows

In 1984, the Kansas legislature amended the Kansas Water Appropriation Act to establish minimum desirable streamflows (MDS) on four Kansas streams: the Marais des Cygnes, Neosho, Cottonwood and Little Arkansas Rivers. It also provided for the establishment of MDS on additional streams which were to be designated before July 1, 1990. Between 1984 and 1990, MDS were established on a number of additional streams. See the linked Act for a full listing of streams and the monthly schedule of MDS values at the specified gaging stations on those streams.

The statute further requires that the Chief Engineer to withhold from appropriation that amount of water deemed necessary to establish and maintain for the identified watercourse the desired minimum streamflow. All water appropriations with priority dates junior to April 12, 1984, are subject to MDS, and may be regulated by the Chief Engineer, if deemed necessary, to maintain MDS.

The statutory provisions concerning MDS are incorporated into the Kansas Water Appropriation Act in K.S.A. 82a-703a through K.S.A. 82a-703c.

Last updated 11/14/2003

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KANSAS WATER APPROPRIATION ACT

STATUTES K.S.A. 82A-701 THROUGH 82A-737, AND K.S.A. 42-313, 42-314
AS AMENDED 2004

INDEX TO KANSAS WATER APPROPRIATION ACT 2004

KANSAS WATER APPROPRIATION ACT
K.S.A. 82a-701 through 82a-737, and K.S.A. 42-303, 42-313, and 42-314
2004

K.S.A. 82a-701. Definitions. When used in this act, unless the context indicates otherwise, the following words shall have the following meanings:

(a) "Person" shall mean and include a natural person, a partnership, an organization, a corporation, a municipality and any agency of the state or federal government.

(b) "Chief engineer" means the chief engineer of the division of water resources of the Kansas department of agriculture.

(c) "Domestic uses" means the use of water by any person or by a family unit or household for household purposes, or for the watering of livestock, poultry, farm and domestic animals used in operating a farm, and for the irrigation of lands not exceeding a total of two acres in area for the growing of gardens, orchards and lawns.

(d) "Vested right" means the right of a person under a common law or statutory claim to continue the use of water having actually been applied to any beneficial use, including domestic use, on or before June 28, 1945, to the extent of the maximum quantity and rate of diversion for the beneficial use made thereof, and shall include the right to take and use water for beneficial purposes where a person is engaged in the construction of works for the actual application of water to a beneficial use on June 28, 1945, provided such works shall be completed and water is actually applied for such use within a reasonable time thereafter by such person, such person's heirs, successors or assigns. Such a right does not include, however, those common law claims under which a person has not applied water to any beneficial use within the periods of time set out in this subsection.

(e) "Appropriator" means and includes a person who has an appropriation right that has been perfected in conformity with article 7 of chapter 82a of the Kansas Statutes Annotated and amendments thereto.

(f) "Appropriation right" is a right, acquired under the provisions of article 7 of chapter 82a of the Kansas Statutes Annotated and amendments thereto, to divert from a definite water supply a specific quantity of water at a specific rate of diversion, provided such water is available in excess of the requirements of all vested rights that relate to such supply and all appropriation rights of earlier date that relate to such supply, and to apply such water to a specific beneficial use or uses in preference to all appropriations right of later date.

(g) "Water right" means any vested right or appropriation right under which a person may lawfully divert and use water. It is a real property right appurtenant to and severable from the land on or in connection with which the water is used and such water right passes as an appurtenance with a conveyance of the land by deed, lease, mortgage, will, or other voluntary disposal, or by inheritance. (**History:** L. 1945, ch. 390, § 1; L. 1957, ch. 539, § 1; L. 1977, ch. 356, § 3; L. 2004, ch. 101, § 141; July 1.)

K.S.A. 82a-702. Dedication of use of water. All water within the state of Kansas is hereby dedicated to the use of the people of the state, subject to the control and regulation of the state in the manner herein prescribed. (**History:** L. 1945, ch. 395, § 2; June 28.)

K.S.A. 82a-703. Water may be appropriated subject to vested rights. Except as provided in K.S.A. 82a-703a and subject to vested rights, all waters within the state may be appropriated for beneficial use as herein provided. Nothing contained in this act shall impair the vested right of any person except for nonuse. (**History:** L. 1945, ch. 390, § 3; L. 1980, ch. 332, § 1; July 1.)

K.S.A. 82a-703a. Minimum streamflows; duties of chief engineer. Whenever the legislature enacts legislation establishing a minimum desirable streamflow for any watercourse in this state, the chief engineer shall withhold from appropriation that amount of water deemed necessary to establish and maintain for the identified watercourse the desired minimum streamflow. (**History:** L. 1980, ch. 332, § 2; L. 1984, ch. 379, § 21; L. 1985, ch. 338, § 1; July 1.)

K.S.A. 82a-703b. Minimum streamflows; condition of appropriation right. (a) In addition to any other limitation or condition prescribed by law or rule and regulation of the chief engineer, it shall be an express condition of each and every appropriation right, except for use of water for domestic purposes, applied for after April 12, 1984, that such right shall be subject to any minimum desirable streamflow requirements identified and established pursuant to law on or before July 1, 1990, for the source of water supply to which such right applies.

(b) All vested rights, water appropriation rights and applications for permits to appropriate water having a priority date on or before April 12, 1984, shall not be subject to any minimum desirable streamflow requirements established pursuant to law. (**History:** L. 1984, ch. 377, § 1; L. 1987, ch. 402, § 2; July 1.)

K.S.A. 82a-703c. Minimum streamflows established. In accordance with the provisions of K.S.A. 82a-703a, and amendments thereto, the legislature hereby establishes the following minimum desirable streamflows:

Table--Minimum Desirable Streamflows (cfs)

Watercourse	Month											
	J	F	M	A(a)	M(a)	J(a)	J	A	S	O	N	D
Marais des Cygnes												
Ottawa	15	15	15	15(40)	20(50)	25(50)	2525	20	15	15	15	
LaCygne	20	20	20	20(50)	20(150)	25(150)	2525	20	20	20	20	
Neosho												
Americus	5	5	5	5(20)	5(30)	5(30)	5	5	5	5	5	5
Iola	40	40	40	40(60)	40(200)	40(200)	4040	40	40	40	40	
Parsons	50	50	50	50(100)	50(300)	50(300)	5050	50	50	50	50	
Cottonwood												
Florence	10	10	10	10(30)	10(60)	10(60)	1010	10	10	10	10	
Plymouth	20	20	20	20(60)	20(150)	20(150)	2020	20	20	20	20	
Little Arkansas												
Alta Mills	8	8	8	8	8	8	8	8	8	8	8	8
Valley Center	20	20	20	20	20	20	2020	20	20	20	20	
Arkansas River												
Kinsley(b)	2	2	3	3	5	5	3	1	1	1	2	2
Great Bend(b)	3	3	3	3	10	10	5	3	2	2	2	3
Hutchinson	80	80	100	100	100	100	8080	60	60	60	80	
Rattlesnake Creek												
Macksville(b)	5	5	10	10	10	10	5	1	1	1	5	5
Zenith	15	15	15	15	15	15	5	3	3	3	10	15
North Fork Ninnescah Above												
Cheney	40	50	50	50	40	30	105	5	10	40	40	
South Fork Ninnescah												
Pratt	10	10	10	8	8	8	5	5	5	5	10	10
Murdock	80	90	90	90	90	50	3030	30	50	80	80	
Ninnescah												
Peck	100	100	100	100	100	70	3030	30	50	100	100	
Saline												
Russell	5	5	15	15	15	12	2	2	2	5	5	5
Smoky Hill												
Ellsworth(c)	20	20	25	30	35	45	3515	15	15	20	20	
Medicine Lodge												
Kiowa	50	55	60	60	40	30	6	1	1	4	40	50
Chikaskia												
Corbin	30	45	50	45	40	30	165	5	8	30	30	
Big Blue												
Marysville	100	100	125	150	150(d)	150(d)	8090	65	80	80	80	
Little Blue												
Barnes	100	100	125	150	150(d)	150(d)	7580	60	80	80	80	
Republican												
Concordia(e)	100	125	150	150	150	150	150	150	80	65	80	100
Clay Center	125	150	200	250	250	250	200	200	100	90	100	125
Mill Creek												
Paxico	8	8	8	25	30	35	105	5	2	5	8	
Delaware												
Muscotah	10	10	20	20	20	20	5	3	3	2	10	10
Walnut River												
Winfield	30	35	40	65	100	100	3025	20	20	20	30	
Whitewater River												
Towanda	10	15	15	20	25	25	105	5	5	6	10	
Spring River												
Baxter Springs(f)	175	200	250	300	450	350	200	160	120	120	150	175
Chapman Creek												
Chapman	10	15	15	15	15	15	1010	10	10	10	10	
Solomon River												
Niles	40	50	60	60	90	90	5050	40	40	40	40	

(a) Spawning flows to be managed if reservoirs in flood pool; otherwise use lower flows.

(b) Subject to subsequent assessment of lagged effects of extensive groundwater appropriations in regional aquifer.

(c) Subject to subsequent assessment of lagged effects of upstream depletions.

(d) Subject to the stateline flows contained in the Blue River Compact.

(e) Subject to subsequent assessment of Harlan County reservoir operations, development of compact stateline flows and lagged effects of upstream depletions.

(f) Flows measured at Quapah, Oklahoma; may need review if a new station is established. (**History:** L. 1985, ch. 338, § 2; L. 1987, ch. 402, § 1; L. 1989, ch. 309, § 1; April 13.)

K.S.A. 82a-704. (**History:** L. 1945, ch. 390, § 4; L. 1957, ch. 539, § 6; Repealed, L. 1978, ch. 434, § 4; July 1.)

K.S.A. 82a-704a. Determination of vested rights; procedure; duties of chief engineer. (a) All persons claiming a vested right for the beneficial use of water, other than for domestic use, which has not been determined pursuant to K.S.A. 82a-704, shall file by July 1, 1980, with the chief engineer a verified claim for such vested right. The chief engineer shall not accept any such claim after said date. Such verified claim shall be upon forms provided therefor by the chief engineer and shall set forth:

(1) The name and post-office address of the claimant;
(2) the source to which the claim relates;
(3) the amount of water claimed;
(4) the location of the works for the diversion and use of the claimed water;
(5) the dates of the beneficial use made; and
(6) any additional information the chief engineer may require.

(b) Upon receipt of a verified claim for a vested right for the beneficial use of water, the chief engineer shall investigate the same and shall conduct a hearing thereon. Such hearing shall be noticed by restricted mail to the claimant and to other known interested persons within a five (5) mile radius of the point of diversion of such claimed vested right at least thirty (30) days prior to the date set for the hearing. Notice shall also be given by publication in a newspaper of general circulation in the county wherein the vested right is claimed to exist at least once each week for three (3) consecutive weeks prior to the hearing. Such published notice shall contain the date and place of hearing and a general description of the area affected by the claimed vested right and shall be directed to all persons interested and concerned. At the hearing, the chief engineer shall take evidence of all persons interested and concerned and the same shall be considered in the determination of the existence of a vested right for beneficial use of water. As soon as possible thereafter the chief engineer shall make an order determining the existence or nonexistence of the claimed vested right and shall notify the claimant and contestants thereof as to the contents of such order. Service of such notice shall be deemed complete upon depositing such notice in the post office as restricted mail addressed to the vested right claimant and any contestant thereto whose address is known to the chief engineer, and upon the publication of an abstract of such order once each week for three (3) consecutive weeks in a newspaper of general circulation in the county wherein the vested right is claimed to exist.

(c) Any claimant of a vested right or person contesting the same who considers himself or herself aggrieved by the order of determination of a vested right may appeal to the district court in the manner prescribed by K.S.A. 82a-724.

(d) The order of determination of a vested right of the chief engineer shall be in full force and effect from the date of its entry in the records of his or her office unless and until its operation shall be stayed by an appeal therefrom by the claimant thereof or a contestant thereto in accordance with the provisions of K.S.A. 82a-724 except that no such determination shall be deemed an adjudication of the relation between any vested right holders with respect to the operation or exercise of their vested rights.

(e) The chief engineer shall file a copy of any order of determination of the existence of a vested right with the register of deeds of the county wherein the land is located to which such vested right is appurtenant. The register of deeds shall record the same as other instruments affecting real estate.

(f) No vested right for the beneficial use of water, other than for domestic use, shall be deemed to exist from and after July 1, 1980, unless the same has been determined to exist pursuant to the provisions of this act or pursuant to the provisions of K.S.A. 82a-704. (**History:** L. 1978, ch. 434, § 1; July 1.)

K.S.A. 82a-704b. Same; notice. The chief engineer shall provide notice throughout the state of the provisions of this act by means assuring the widest dissemination thereof as practicable. (**History:** L. 1978, ch. 434, § 2; July 1.)

K.S.A. 82a-704c. Same; supplemental to Kansas water appropriation act. The provisions of K.S.A. 82a-704a shall be a part of and supplemental to the Kansas water appropriation act. (**History:** L. 1978, ch. 434, § 3; July 1.)

K.S.A. 82a-705. Acquisition of appropriation right to use water other than domestic; approval. No person shall have the power or authority to acquire an appropriation right to the use of water for other than domestic use without first obtaining the approval of the chief engineer, and no water rights of any kind may be acquired hereafter solely by adverse use, adverse possession, or by estoppel. (**History:** L. 1945, ch. 390, § 5; L. 1957, ch. 539, § 7; June 29.)

K.S.A. 82a-705a. Domestic use after June 28, 1945; information to chief engineer. The use of water for domestic purposes instituted subsequently to June 28, 1945, to the extent that it is beneficial, shall constitute an appropriation right. The chief engineer, however, may require any person using water for any purpose to furnish information with regard to such use thereof. (**History:** L. 1957, ch. 539, § 2; June 29.)

K.S.A. 82a-706. Duties of chief engineer as to beneficial use and rights of priority of appropriation. The chief engineer shall enforce and administer the laws of this state pertaining to the beneficial use of water and shall control, conserve, regulate, allot and aid in the distribution of the water resources of the state for the benefits and beneficial uses of all of its inhabitants in accordance with the rights of priority of appropriation. (**History:** L. 1945, ch. 390, § 6; L. 1957, ch. 539, § 8; June 29.)

K.S.A. 82a-706a. Rules, regulations and standards. The chief engineer shall adopt, amend, promulgate, and enforce such reasonable rules, regulations, and standards necessary for the discharge of his or her duties and for the achievement of the purposes of this act pertaining to the control, conservation, regulation, allotment, and distribution of the water resources of the state. (**History:** L. 1957, ch. 539, § 9; L. 1977, ch. 356, § 4; January 1, 1978.)

K.S.A. 82a-706b. Diversion of water prohibited, when; unlawful acts; enforcement by chief engineer. It shall be unlawful for any person to prevent, by diversion or otherwise, any waters of this state from moving to a person having a prior right to use the same, or for any person without an agreement with the state of Kansas to divert or take any water that has been released from storage under authority of the state of Kansas or that has been released from storage pursuant to an agreement between the state and federal government. Upon making a determination of an unlawful diversion the chief engineer or his or her authorized agents, shall direct that the headgates, valves, or other controlling works of any ditch, canal, conduit, pipe, well, or structure be opened, closed, adjusted, or regulated as may be necessary to secure water to the person having the prior right to its use, or to secure water for the purpose for which it was released from storage under authority of the state of Kansas or pursuant to an agreement between the state and federal government. The chief engineer, or his or her authorized agents, shall deliver a copy of such a directive to the persons involved either personally or by mail or by attaching a copy thereof to such headgates, valves, or other controlling works to which it applies and such directive shall be legal notice to all persons involved in the diversion and distribution of the water of the ditch, canal, conduit, pipe, well, or structure. For the purpose of making investigations of diversions and delivering directives as provided herein and determining compliance therewith, the chief engineer or his or her authorized agents shall have the right of access and entry upon private property. (**History:** L. 1957, ch. 539, § 10; L. 1965, ch. 557, § 1; June 30.)

K.S.A. 82a-706c. Meters, gages and other measuring devices; waste and quality checks. The chief engineer shall have full authority to require any water user to install meters, gages, or other measuring devices, which devices he or she or his or her agents may read at any time, and to require any water user to report the reading of such meters, gages, or other measuring devices at reasonable intervals. He or she shall have full authority to make, and to require any water user to make, periodic water waste and water quality checks and to require the user making such checks to report the findings thereof. (**History:** L. 1957, ch. 539, § 11: June 29.)

K.S.A. 82a-706d. Duties of attorney general. Upon request of the chief engineer the attorney general shall bring suit in the name of the state of Kansas, in courts of competent jurisdiction to enjoin the unlawful appropriation, diversion, use of the waters of the state, and waste or loss thereof. (**History:** L. 1957, ch. 539, § 12; June 29.)

K.S.A. 82a-706e. State field offices and commissioners. The chief engineer, subject to the approval of the secretary of agriculture, may establish field offices within this state to secure the best protection to all claimants of water therein and the most economical supervision thereof. Subject to the approval of the secretary of agriculture, the chief engineer may appoint a water commissioner for each field office so established, in accordance with the Kansas civil service laws, who shall be the agent of the chief engineer in supervising the distribution of waters within the area served by such field office, according to the rights and priorities of all parties concerned, and who shall perform such other duties as the chief engineer may direct. (**History:** L. 1957, ch. 539, § 13; L. 2004, ch. 101, § 142; July 1.)

K.S.A. 82a-707. Principles governing appropriations; priorities. (a) Surface or ground waters of the state may be appropriated as herein provided. Such appropriation shall not constitute ownership of such water, and appropriation rights shall remain subject to the principle of beneficial use.

(b) Where uses of water for different purposes conflict such uses shall conform to the following order of preference: Domestic, municipal, irrigation, industrial, recreational and water power uses. However, the date of priority of an appropriation right, and not the purpose of use, determines the right to divert and use water at any time when the supply is not sufficient to satisfy all water rights that attach to it. The holder of a water right for an inferior beneficial use of water shall not be deprived of the use of the water either temporarily or permanently as long as such holder is making proper use of it under the terms and conditions of such holder's water right and the laws of this state, other than through condemnation.

(c) As between persons with appropriation rights, the first in time is the first in right. The priority of the appropriation right to use water for any beneficial purpose except domestic purposes shall date from the time of the filing of the application therefor in the office of the chief engineer. The priority of the appropriation right to use water for domestic purposes shall date from the time of the filing of the application therefor in the office of the chief engineer or from the time the user makes actual use of water for domestic purposes, whichever is earlier.

(d) Any water right returned to the state under the provisions of K.S.A. 2-1915, and amendments thereto, shall be placed in the custodial care of the state. While in the custodial care of the state, the priority of the water right shall remain in effect and water available under the terms and conditions of the water right shall not be considered available for further appropriation. Any surface water right held in the custodial care of the state shall neither directly benefit nor impair any other surface water right within the stream reach designated for recovery. Any water right donated to the state shall be placed in the custodial care of the state or retired at the discretion of the chief engineer.

(e) Appropriation rights in excess of the reasonable needs of the appropriators shall not be allowed. **(History:** L. 1917, ch. 172, § 6; R.S. 1923, 24-903; L. 1945, ch. 390, § 7; L. 1957, ch. 539, § 14; L. 1988, ch. 396, § 3; July 1.)

K.S.A. 82a-708. **(History:** L. 1945, ch. 390, § 8; Repealed, L. 1957, ch. 539, § 26; June 29.)

K.S.A. 82a-708a. Applications for permits to appropriate water; fee. (a) Any person may apply for a permit to appropriate water to a beneficial use, notwithstanding that the application pertains to the use of water by another, or upon or in connection with the lands of another. Any rights to the beneficial use of water perfected under such application shall attach to the lands on or in connection with which the water is used and shall remain subject to the control of the owners of the lands as in other cases provided by law.

(b) Except as otherwise provided in subsections (d), (e) and (f), each application for a permit to appropriate water, except applications for permits for domestic use, shall be accompanied by an application fee fixed by this section for the appropriate category of acre feet in accordance with the following:

Acre Feet	Fee
0 to 100	$100
101 to 320	$150
More than	$150 + $10 for each additional 100 acre feet or any part thereof

Commencing July 1, 2002, and ending June 30, 2010, the application fee shall be fixed by this section for the appropriate category of acre feet in accordance with the following:

Acre Feet	Fee
0 to 100	$200
101 to 320	$300
More than 320	$300 + $20 for each additional 100 acre feet or any part thereof

The chief engineer shall render a decision on such permit applications within 150 days of receiving a complete application except when the application cannot be processed due to the standards established in K.A.R. 5-3-4c. Upon failure to render a decision within 150 days of receipt of a complete application, the application fee is subject to refund upon request.

(c) Except as otherwise provided in subsections (d), (e) and (f), each application for a permit to appropriate water for storage, except applications for permits for domestic use, shall be accompanied by an application fee fixed by this section for the appropriate category of storage-acre feet in accordance with the following:

Storage-Acre Fee	Fee
0 to 250	$100
More than 250	$100 + $10 for each additional 250 storage-acre feet or any part thereof

Commencing July 1, 2002 and ending June 30, 2010, the application fee shall be fixed by this section for the appropriate category of storage-acre feet in accordance with the following:

Storage-Acre Feet	Fee
0 to 250	$200
More than 250	$200 + $20 for each additional 250 storage-acre feet or any part thereof

The chief engineer shall render a decision on such permit applications within 150 days of receiving a complete application except when the application cannot be processed due to the standards established in K.A.R. 5-3-4c. Upon failure to render a decision within 150 days of receipt of a complete application, the application fee is subject to refund upon request.

(d) Each application for a term permit pursuant to K.S.A. 2004 Supp. 82a-736, and amendments thereto, shall be accompanied by an application fee established by rules and regulations of the chief engineer in an amount not to exceed $400 for the five-year period covered by the permit.

(e) For any application for a permit to appropriate water, except applications for permits for domestic use, which proposes to appropriate by both direct flow and storage, the fee charged shall be the fee under subsection (b) or subsection (c), whichever is larger, but not both fees.

(f) Each application for a permit to appropriate water for water power or dewatering purposes shall be accompanied by an application fee of $100 plus $200 for each 100 cubic feet per second, or part thereof, of the diversion rate requested in the application for the proposed project.

(g) All fees collected by the chief engineer pursuant to this section shall be remitted to the state treasurer as provided in K.S.A. 82a-731 and amendments thereto. (**History:** L. 1957, ch. 539, § 3; L. 1973, ch. 414, § 1; L. 1982, ch. 4, § 17; L. 1985, ch. 339, § 1; L. 1989, ch. 310, § 1; L. 2001, ch. 160, § 17; L. 2002, ch. 181, § 21; L. 2004, ch.85, § 16; July 1.)

K.S.A. 82a-708b. Application for change in place of use, point of diversion or use; fee; review of action on application. (a) Any owner of a water right may change the place of use, the point of diversion or the use made of the water, without losing priority of right, provided such owner shall: (1) Apply in writing to the chief engineer for approval of any proposed change; (2) demonstrate to the chief engineer that any proposed change is reasonable and will not impair existing rights; (3) demonstrate to the chief engineer that any proposed change relates to the same local source of supply as that to which the water right relates; and (4) receive the approval of the chief engineer with respect to any proposed change. The chief engineer shall approve or reject the application for change in accordance with the provisions and procedures prescribed for processing original applications for permission to appropriate water. If the chief engineer disapproves the application for change, the rights, priorities and duties of the applicant shall remain unchanged. Any person aggrieved by an order or decision by the chief engineer relating to an application for change may petition for review thereof in accordance with the provisions of K.S.A. 2004 Supp. 82a-1901 and amendments thereto.

(b) Each application to change the place of use, the point of diversion or the use made of the water under this section shall be accompanied by the application fee set forth in the schedule below:

(1)	Application to change a point of diversion 300 feet or less............	$ 50
(2)	Application to change a point of diversion more than 300 feet........	100
(3)	Application to change the place of use..	100
(4)	Application to change the use made of the water............................	150

Commencing July 2, 2002, and ending June 30, 2010, the application fee shall be set forth in the schedule below:

(1)	Application to change a point of diversion 300 feet or less............	$100
(2)	Application to change a point of diversion more than 300 feet........	200
(3)	Application to change the place of use..	200
(4)	Application to change the use made of the water............................	300

The chief engineer shall render a decision on such permit applications within 150 days of receiving a complete application except when the application cannot be processed due to the standards established in K.A.R. 5-3-4c. Upon failure to render a decision within 150 days of receipt of a complete application, the application fee is subject to refund upon request. Any application submitted which requests two of the types of changes set forth above shall be accompanied by a fee of $150, or commencing July 1, 2002, and ending June 30, 2010, a fee of not to exceed $300. Any application which requests three types of changes shall be accompanied by a fee of $250, or commencing July 1, 2002, and ending June 30, 2010, a fee of not to exceed $500.

(c) All fees collected by the chief engineer pursuant to this section shall be remitted to the state treasurer as provided in K.S.A. 82a-731 and amendments thereto. (**History:** L. 1957, ch. 539, § 4; L. 1982, ch. 4, § 18; L. 1985, ch. 339, § 2; L. 1990, ch. 361, § 1; L. 1999, ch. 130, § 4; L. 2002, ch. 181, § 22; L. 2004, ch.85, § 17; July 1.)

K.S.A. 82a-709. Same; contents; time of filing. No person may acquire an appropriation right to the use of waters of the state for other than domestic purposes without making an application to the chief engineer for a permit to make such appropriation. However, any person using water for domestic purposes subsequent to June 28, 1945, and any person intending to use water hereafter for domestic purposes may make application to the chief engineer for a permit the same as any other person. The application shall set forth (a) the name and post-office address of the applicant;

(b) the source from which said appropriation shall be made;

(c) the maximum rate at which water is to be diverted or used and the total annual quantity of water sought;

(d) the location of the works or proposed works for the diversion and use of the water;

(e) the estimated time for the completion of any proposed works;

(f) the time of the first actual application of the water to the beneficial use involved, if there was such, and the estimated time for the first actual application of the water for the beneficial use proposed;

(g) if for irrigation use, a description of the land to be irrigated by designating the number of irrigable acres in each forty (40) acre tract or fractional portion thereof;

(h) if for municipal water supply, it shall give the present population to be served and estimated future requirements of the city;

(i) any additional factors which may be required by the chief engineer.

Such application shall be filed and approved before the commencement of any work in connection with the construction, enlargement or extension of any works for the diversion, storage, and use of water. (**History:** L. 1945, ch. 390, § 9; L. 1957, ch. 539, § 15; L. 1977, ch. 356, § 5; January 1, 1978.)

K.S.A. 82a-710. Same; return for correction or completion; maps, plats, plans and drawings; default in refiling. Upon receipt of the application it shall be the duty of the chief engineer to endorse thereon the date of its receipt and assign a number to the same. If upon examination the application is found to be defective, inadequate or insufficient to enable such official to determine the nature and amount of the proposed appropriation, it shall be returned for correction or completion or for other required information. No application shall lose its priority of filing on account of such defects, provided acceptable data, proofs, maps, plats, plans and drawings are filed in the office of the chief engineer within thirty days following the date of the posting of the return of such application or such further time not exceeding one year as may be given by the chief engineer.

All maps, plats, plans and drawings shall conform to prescribed uniform standard as to materials, size, coloring and scale, and shall show: (a) The source from which the proposed appropriation is to be taken, (b) all proposed dams, dikes, reservoirs, canals, pipe lines, power houses and other structures for the purpose of storing, conveying or using water for the purpose approved and their positions or courses in connection with the boundary lines and corners of the lands which they occupy. Land listed for irrigation shall be shown in government subdivisions or fractions thereof. Default in the refiling of any application within the time limit specified shall constitute a forfeiture of priority date and the dismissal of the application. (**History:** L. 1945, ch. 390, § 10; June 28.)

K.S.A. 82a-711. Permits to appropriate water; standards for approval of use; review of action on application. (a) If a proposed use neither impairs a use under an existing water right nor prejudicially and unreasonably affects the public interest, the chief engineer shall approve all applications for such use made in good faith in proper form which contemplate the utilization of water for beneficial purpose, within reasonable limitations except that the chief engineer shall not approve any application submitted for the proposed use of fresh water in any case where other waters are available for such proposed use and the use thereof is technologically and economically feasible. Otherwise, the chief engineer shall make an order rejecting such application or requiring its modification to conform to the public interest to the end that the highest public benefit and maximum economical development may result from the use of such water.

(b) In ascertaining whether a proposed use will prejudicially and unreasonably affect the public interest, the chief engineer shall take into consideration:

(1) Established minimum desirable streamflow requirements;

(2) the area, safe yield and recharge rate of the appropriate water supply;

(3) the priority of existing claims of all persons to use the water of the appropriate water supply;

(4) the amount of each claim to use water from the appropriate water supply; and

(5) all other matters pertaining to such question.

(c) With regard to whether a proposed use will impair a use under an existing water right, impairment shall include the unreasonable raising or lowering of the static water level or the unreasonable increase or decrease of the streamflow or the unreasonable deterioration of the water quality at the water user's point of diversion beyond a reasonable economic limit. Any person aggrieved by any order or decision by the chief engineer relating to that person's application for a permit to appropriate water may petition for review thereof in accordance with the provisions of K.S.A. 2001 Supp. 82a-1901 and amendments thereto. (**History:** L. 1945, ch. 390, § 11; L. 1957, ch. 539, § 16; L. 1977, ch. 356, § 6; L. 1980, ch. 332, § 3; L. 1986, ch. 392, § 3; L. 1991, ch. 292, § 3; L. 1999, ch. 130, § 5; July 1.)

K.S.A. 82a-711a. Same; express conditions of appropriations. It shall be an express condition of each appropriation of surface or ground water that the right of the appropriator shall relate to a specific quantity of water and that such right must allow for a reasonable raising or lowering of the static water level and for the reasonable increase or decrease of the streamflow at the appropriator's point of diversion: PROVIDED, That in determining such reasonable raising or lowering of the static water level in a particular area, the chief engineer shall consider the economics of diverting or pumping water for the water uses involved; and nothing herein shall be construed to prevent the granting of permits to applicants later in time on the ground that the diversions under such proposed later appropriations may cause the water level to be raised or lowered at the point of diversion of a prior appropriator, so long as the rights of holders of existing water rights can be satisfied under such express conditions. **(History:** L. 1957, ch. 539, § 17; June 29.)

K.S.A. 82a-712. Same; notice of approval or disapproval of application; approval constitutes permit. The chief engineer shall notify the applicant of the approval or disapproval of the application. Upon approving the application the chief engineer shall authorize the applicant to proceed with the construction of the proposed diversion works and to proceed with all steps necessary for the application of the water to the approved and proposed beneficial use and otherwise perfect his or her proposed appropriation. The chief engineer may approve an application for a smaller amount of water than requested and he or she may approve an application upon such terms, conditions, and limitations as he or she shall deem necessary for the protection of the public interest. The approval of the application by the chief engineer, subject to the terms and conditions thereof, upon issuance, constitutes a permit to proceed with construction of diversion or other authorized works and with the diversion and use of water in accordance with the terms and conditions of his or her permit and no common-law claimant without a vested right, or other person without a vested right, a prior appropriation right, or an earlier permit shall prevent, restrain, or enjoin an applicant from proceeding in accordance with the terms and conditions of his or her permit or from diminishing the water supply. **(History:** L. 1945, ch. 390, § 12; L. 1957, ch. 539, § 18; June 29.)

K.S.A. 82a-713. Same; limiting time for perfection of appropriation; extension. The chief engineer shall limit the time for the perfecting of an appropriation to a reasonable period within which the proposed works can be completed by expeditious procedure, and he or she shall for good cause shown by the applicant allow an extension of time. **(History:** L. 1945, ch. 390, § 13; June 28.)

K.S.A. 82a-714. Same; completion of works; extension of time; certificate of appropriation; fees. [See Revisor's Note] (a) Upon the completion of the construction of the works and the actual application of water to the proposed beneficial use within the time allowed, the applicant shall notify the chief engineer to that effect. The chief engineer or the chief engineer's duly authorized representative shall then examine and inspect the appropriation diversion works and, if it is determined that the appropriation diversion works have been completed and the appropriation right perfected in conformity with the approved application and plans, the chief engineer shall issue a certificate of appropriation in duplicate. The original of such certificate shall be sent to the owner and shall be recorded with the register of deeds in the county or counties wherin the point of diversion is located, as are other instruments affecting real estate, and the duplicate shall be made a matter of record in the office of the chief engineer.

(b) Not later than 60 days before the expiration of the time allowed in the permit to complete the construction of the appropriation diversion works or the time allowed in the permit to actually apply water to the proposed beneficial use, the chief engineer shall notify the permit holder by certified mail that any request for extension of such time must be filed wth the chief engineer before the expiration of the time allowed in the permit.

(c) Unless the applicant requests an extension or the certificate has not been issued due to the applicant's failure to comply with reasonable requests for information or to allow the opportunity to examine and inspect the appropriation diversion works, as necessary for certification, the chief engineer shall certify an appropriation:

(1) Before July 1, 2004, if the time allowed in the permit to perfect the water right expired before July 1, 1999, except in those cases in which abandonment proceedings pursuant to K.S.A. 82a-718, and amendments thereto, are pending on July 1, 2004;

(2) before July 1, 2006, in such cases in which an abandonment proceeding was pending pursuant to K.S.A. 82a-718, and amendments thereto, on July 1, 2004; or

(3) not later than five years after the date the applicant notifies the chief engineer of the completion of construction of the works and the actual application of water to the proposed beneficial use within the time allowed, in all other cases.

If the chief engineer fails to issue a certificate within the time provided by this subsection, the applicant may request review, pursuant to K.S.A. 2004 Supp. 82a-1901, and amendments thereto, of the chief engineer's failure to act.

(d) Except for works constructed to appropriate water for domestic use, each notification to the chief engineer under subsection (a) shall be accompanied by a field inspection fee of $200, or commencing July 1, 2002, and ending June 30, 2010, a fee of $400. Failure to pay the field inspection fee, after reasonable notice by the chief engineer of such failure, shall result in the permit to appropriate water being revoked, forfeiture of the priority date and revocation of any appropriation right that may exist.

(e) A request for an extension of time to: (1) Complete the diversion works; or (2) perfect the water right, shall be accompanied by a fee of $50, or commencing July 1, 2002, and ending June 30, 2010, a fee of $100.

(f) A request to reinstate a water right or a permit to appropriate water which has been dismissed shall be filed with the chief engineer within 60 days of the date dismissed and shall be accompanied by a fee of $100, or commencing July 1, 2002, and ending June 30, 2010, a fee of $200.

(g) All fees collected by the chief engineer pursuant to this section shall be remitted to the state treasurer as provided in K.S.A. 82a-731, and amendments thereto. (**History:** L. 1945, ch. 390, § 14; L. 1957, ch. 539, § 20; L. 1985, ch. 339, § 3; L. 1990, ch. 362, § 1; L. 1999, ch. 130, § 6; L. 2002, ch. 181, § 23; L. 2004, ch.165, § 2; May 27.)

Revisor's Note: Section was amended twice in 2004 session, see also 82a-714a.

K.S.A. 82a-714a. Same; completion of works; extension of time; certificate of appropriation; fees. [See Revisor's Note] (a) Upon the completion of the construction of the works and the actual application of water to the proposed beneficial use within the time allowed, the applicant shall notify the chief engineer to that effect. The chief engineer or the chief engineer's duly authorized representative shall then examine and inspect the appropriation diversion works and, if it is determined that the appropriation diversion works have been completed and the appropriation right perfected in conformity with the approved application and plans, the chief engineer shall issue a certificate of appropriation in duplicate. The original of such certificate shall be sent to the owner and shall be recorded with the register of deeds in the county or counties wherein the point of diversion is located, as are other instruments affecting real estate, and the duplicate shall be made a matter of record in the office of the chief engineer.

(b) Not later than 60 days before the expiration of the time allowed in the permit to complete the construction of the appropriation diversion works or the time allowed in the permit to actually apply water to the proposed beneficial use, the chief engineer shall notify the permit holder by certified mail that any request for extension of such time must be filed with the chief engineer before the expiration of the time allowed in the permit.

(c) Unless the applicant requests an extension or the certificate has not been issued due to the applicant's failure to comply with reasonable requests for information or to allow the opportunity to examine and inspect the appropriation diversion works, as necessary for certification, the chief engineer shall certify an appropriation:

(1) Before July 1, 2004, if the time allowed in the permit to perfect the water right expired before July 1, 1999; or

(2) not later than five years after the date the applicant notifies the chief engineer of the completion of construction of the works and the actual application of water to the proposed beneficial use within the time allowed, in all other cases.

If the chief engineer fails to issue a certificate within the time provided by this subsection, the applicant may request review, pursuant to K.S.A. 2004 Supp. 82a-1901 and amendments thereto, of the chief engineer's failure to act.

(d) Except for works constructed to appropriate water for domestic use, each notification to the chief engineer under subsection (a) shall be accompanied by a field inspection fee of $200, or commencing July 1, 2002, and ending June 30, 2010, a fee of $400. Failure to pay the field inspection fee, after reasonable notice by the chief engineer of such failure, shall result in the permit to appropriate water being revoked, forfeiture of the priority date and revocation of any appropriation right that may exist.

(e) A request for an extension of time to: (1) Complete the diversion works; or (2) perfect the water right, shall be accompanied by a fee of $50, or commencing July 1, 2002, and ending June 30, 2010, a fee of $100.

(f) A request to reinstate a water right or a permit to appropriate water which has been dismissed shall be filed with the chief engineer within 60 days of the date dismissed and shall be accompanied by a fee of $100, or commencing July 1, 2002, and ending June 30, 2010, a fee of $200.

(g) All fees collected by the chief engineer pursuant to this section shall be remitted to the state treasurer as provided in K.S.A. 82a-731, and amendments thereto. (**History:** L.

1945, ch. 390, § 14; L. 1957, ch. 539, § 20; L. 1985, ch. 339, § 3; L. 1990, ch. 362, § 1; L. 1999, ch. 130, § 6; L. 2002, ch. 181, § 23; L. 2004, ch.85, § 18; July 1.)

Revisor's Note: Section was amended twice in 2004 session, see also 82a-714.

K.S.A. 82a-715. Same; validation of certain applications. All applications for the appropriation of water to beneficial use as filed with the chief engineer, subsequent to May 5, 1941, and all processing, proceedings and certificates pertaining thereto are validated to same extent as if filed after the effective date of this act, but with priorities as of the dates of filing of applications. All subsequent processing of such applications as are still pending and undetermined shall be further considered and processed as provided in this act. (**History:** L. 1945, ch. 390, § 15; June 28.)

K.S.A. 82a-716. Common-law claimants; action for compensation; injunctions. If any appropriation, or the construction and operation of authorized diversion works results in an injury to any common-law claimant, such person shall be entitled to due compensation in a suitable action at law against the appropriator for damages proved for any property taken. Any person with a valid water right or permit to divert and use water may restrain or enjoin in any court of competent jurisdiction a subsequent diversion by a common-law claimant without vested rights without first condemning those common-law rights. An appropriator shall have the right to injunctive relief to protect his or her prior right of beneficial use as against use by an appropriator with a later priority of right. (**History:** L. 1945, ch. 390, § 16; L. 1957, ch. 539, § 21; June 29.)

K.S.A. 82a-717. (**History:** L. 1945, ch. 390, § 17; Repealed, L. 1957, ch. 539, § 26; June 29.).

K.S.A. 82a-717a. Diversions by common-law claimants and others; injunctions. No common-law claimant without a vested right, or other person without a vested right, a prior appropriation right, or an earlier permit shall divert or threaten to divert water if such diversion or threatened diversion impairs or would impair any vested right, appropriation right, or right under a permit to appropriate water. But any common-law claimant with a vested right, or other person with a vested right, a prior appropriation right, or an earlier permit may divert water in accordance with any such right or permit although such diversion or use thereunder conflicts with the diversion, use, proposed diversion, or proposed use made or proposed by a common-law claimant who does not have a vested right, or other person who does not have a vested right, a prior appropriation right or an earlier permit. Moreover, any common-law claimant with a vested right, or other person with a vested right, a prior appropriation right, or an earlier permit may restrain or enjoin in any court of competent jurisdiction any diversion or proposed diversion that impairs or would impair such right in the event that any such diversion or proposed diversion is made or is threatened to be made by any common-law claimant, or other person who does not have a vested right, a prior appropriation right, or an earlier permit. (**History:** L. 1957, ch. 539, § 19; June 29.)

K.S.A. 82a-718. Abandonment of water rights; notices; hearing; review of action; exceptions. (a) All appropriations of water must be for some beneficial purpose. Every water right of every kind shall be deemed abandoned and shall terminate when without due and sufficient cause no lawful, beneficial use is henceforth made of water under such right for five successive years. Before any water right shall be declared abandoned and terminated the chief engineer shall conduct a hearing thereon. Notice shall be served on the user at least 30 days before the date of the hearing. The determination of the chief engineer pursuant to this section shall be subject to review in accordance with the provisions of K.S.A. 2001 Supp. 82a-1901, and amendments thereto.

The verified report of the chief engineer or such engineer's authorized representative shall be prima facie evidence of the abandonment and termination of any water right.

(b) When no lawful, beneficial use of water under a water right has been reported for three successive years, the chief engineer shall notify the user, by certified mail, return receipt requested, that: (1) No lawful, beneficial use of the water has been reported for three successive years; (2) if no lawful, beneficial use is made of the water for five successive years, the right may be terminated; and (3) the right will not be terminated if the user shows that for one or more of the five consecutive years the beneficial use of the water was prevented or made unnecessary by circumstances that are due and sufficient cause for nonuse, which circumstances shall be included in the notice.

(c) The provisions of subsection (a) shall not apply to a water right that has not been declared abandoned and terminated before the effective date of this act if the five years of successive nonuse occurred exclusively and entirely before January 1, 1990. However, the provisions of subsection (a) shall apply if the period of five successive years of nonuse began before January 1, 1990, and continued after that date. (**History:** L. 1945, ch. 390, § 19; L. 1957, ch. 539, § 23; L. 1988, ch. 356, § 350; L. 1999, ch. 122, § 1; L. 1999, ch. 149, § 13; July 1.)

K.S.A. 82a-719. Distribution of water according to decree of court. Whenever the rights for the use of waters of the state shall have been adjudicated by any court, the division of water resources with the aid of its chief engineer and other officers and employees, shall aid in the distribution of such water according to such decree and shall distribute the water among the several ditches or water users pursuant to the decree; and shall have the power to open, close or adjust the headgates and regulate the controlling works of any ditch or structure, or cause the same to be opened, closed, adjusted and regulated so as to make a distribution of the water in conformity with the decree. (**History:** L. 1933, ch. 206, § 2; L. 1945, ch. 390, § 20; June 28.)

K.S.A. 82a-720. Same; certified copies of decrees. The clerk of any court of this state in which a decree shall be made fixing the rights pertaining to ditches or water users to water, shall within ten days after such decree shall have been entered, forward to the chief engineer of the division of water resources, by registered mail, a certified copy of such decree. (**History:** L. 1933, ch. 206, § 4; L. 1945, ch. 390, § 21; June 28.)

K.S.A. 82a-721. Construction of act. This act shall be construed liberally to effectuate the purposes hereof, and the enumeration of specific powers in this act shall not operate to restrict the meaning of any general grant of power contained in this act or to exclude other powers comprehended in such general grant. (**History:** L. 1945, ch. 390, § 23; June 28.)

K.S.A. 82a-721a. Same; damages to land. Nothing in this act shall be construed as limiting any right of an owner of an estate or interest in or concerning land to recover damage for any injury done to his or her land or to any water rights appurtenant thereto. (**History:** L. 1957, ch. 539, § 22; June 29.)

K.S.A. 82a-722. Invalidity of part. If any clause, sentence, paragraph, section or part of this act shall be adjudged by any court of competent jurisdiction to be invalid, such judgment shall not affect, impair or invalidate the remainder thereof, but shall be confined in its operation to the clause, sentence, paragraph, section or part thereof directly involved in the controversy in which such judgment shall have been rendered, and it shall be presumed that the legislature would have enacted this law with the section, subsection or clause held to be invalid, omitted. (**History:** L. 1945, ch. 390, § 24; June 29.)

K.S.A. 82a-723. (**History:** L. 1955, ch. 449, § 1; Repealed, L. 1957, ch. 539, § 26; June 29.)

K.S.A. 82a-724. Review of administrative actions. Any order pursuant to K.S.A. 2001 Supp. 82a-1901 and amendments thereto upon review of any action of the chief engineer pursuant to K.S.A. 82a-704a, 82a-708b, 82a-711 or 82a-718, and amendments thereto, is subject to review in accordance with the act for judicial review and civil enforcement of agency actions. (**History:** L. 1957, ch. 539, § 24; L. 1978, ch. 435, § 1; L. 1986, ch. 318, § 143; L. 1999, ch. 130, § 8; July 1.)

K.S.A. 82a-725. Same; reference to state division or its chief engineer; procedures; cases in federal courts. In any suit to which the state is not a proper party brought in any court of competent jurisdiction in this state for determination of rights to water, the court may order a reference to the division of water resources or its chief engineer, as referee, for investigation of and report upon any or all of the physical facts involved and the division or its chief engineer shall thereupon make such an investigation and report as ordered by the court. The report shall set forth such findings of fact as may be required by the court's order of reference and may contain such opinions upon the facts as it deems proper in view of the issues submitted. Before filing its report, the division or its chief engineer shall mail notice of its report, together with a copy of it, to the parties or their attorneys of record.

Within thirty (30) days from the date of the mailing of the copy of the report, any party may file objections to it with the division of water resources or its chief engineer. After the division, or its chief engineer, has considered the objections, it shall file its report, as referee, with the clerk of the court and give notice by registered or certified mail of the filing of its report to the parties or their attorneys. The court shall review the report upon exceptions thereto filed with the clerk of the court within thirty (30) days after date of mailing registered notice of filing of the report. Except in its discretion or for good cause shown, the court shall not consider any exception to the report unless it appears that the excepting party presented the matter of the exception to the division or its chief engineer in the form of an objection. The report shall be evidence of the physical facts found therein, but the court shall hear such evidence as may be offered by any party to rebut the report or the evidence. If suit is brought in a federal court for determination of rights to water within, or partially within, the state, the division or its chief engineer may accept a reference of such suit as master or referee for the court. (**History:** L. 1957, ch. 539, § 25; June 29.)

K.S.A. 82a-726. Diversion and transportation of water for use in another state; approval by chief engineer; conditions. (a) Any person intending to divert and transport water produced from a point or points of diversion located in this state for use in another state, shall make application to the chief engineer for a permit to appropriate water for beneficial use or file an application for change in point of diversion, place of use, type of use or any combination thereof. Subject to the provisions of subsection (b), the chief engineer shall approve such application upon such terms, conditions and limitations that the chief engineer shall deem necessary for the protection of public interest, including an express condition that if any such water is necessary to protect the public health and safety of the citizens of this state, such approved application may be suspended, modified or revoked by the chief engineer for such necessity.

(b) The chief engineer shall approve an application pursuant to this section only if the chief engineer finds that:

(1) The diversion and transportation of such water complies with the Kansas water appropriation act, the water transfer act and any other state law pertaining to such diversion, transportation and use of water;

(2) the statutes and common law of the state where such water will be used do not prohibit the use of water at the proposed place of use or for the proposed type of use, or both, if the water were to be diverted in that state; and

(3) the proposed diversion and transportation of water will not allow water apportioned to the state of Kansas by an interstate water compact to be used in another state.

(c) In order to make the finding required by subsection (b)(2), the chief engineer shall rely on a determination by the attorney general of the other state of whether the proposed use would be prohibited in that state. (**History:** L. 1976, ch. 435, § 1; L. 1984, ch. 380, § 1; L. 2000, ch. 98, § 1; July 1.)

K.S.A. 82a-727. Temporary permits to appropriate water; extension; fee; rules and regulations. (a) Subject to existing water rights and the principle of beneficial use, the chief engineer may grant upon application made therefor temporary permits and extensions thereof to appropriate water in any case where the public interest in such water will not be unreasonably or prejudicially affected, except that the chief engineer shall not grant any such permit to appropriate fresh water in any case where other waters are available for the proposed use and the use thereof is technologically and economically feasible. No such temporary permit or any extension thereof shall be granted for a period of time in excess of six months. Each application submitted for a temporary permit or extension thereof shall be accompanied by an application fee of $100, or commencing July 1, 2002, and ending June 30, 2010, a fee of $200.

(b) The chief engineer shall adopt rules and regulations to effectuate and administer the provisions of this section.

(c) Nothing in this section shall be deemed to vest in the holder of any permit granted pursuant to provisions of this section any permanent right to appropriate water except as is provided by such permit.

(d) All fees collected by the chief engineer pursuant to this section shall be remitted to the state treasurer as provided in K.S.A. 82a-731 and amendments thereto. (**History:** L. 1977, ch. 356, § 1; L. 1982, ch. 4, § 19; L. 1985, ch. 339, § 4; L. 2002, ch. 181, § 24; L. 2004, ch.85, § 19; July 1.)

K.S.A. 82a-728. Unlawful acts; penalties. (a) Except for the appropriation of water for the purpose of domestic use, the production and return of salt water in connection with the operation of oil and gas wells in accordance with the written approval granted therefor by the Kansas corporation commission pursuant to K.S.A. 55-901, and amendments thereto, the withdrawal and use of water in accordance with provisions of K.S.A. 82a-1313, and amendments thereto, and the annual diversion and beneficial use of not more than 15 acre feet of surface water impounded in any reservoir having a total water volume of less than 15 acre feet, it shall be unlawful for any person to appropriate or threaten to appropriate water from any source without first applying for and obtaining a permit to appropriate water in accordance with the provisions of chapter 7 of article 82a of the Kansas Statutes Annotated and acts amendatory thereof or supplemental thereto or, for any person to violate any condition of a vested right, appropriation right or an approved application for a permit to appropriate water for beneficial use. As used in this subsection salt water shall mean water containing more than 5,000 milligrams per liter chlorides.

(b) (1) The violation of any provision of this section by any person is a class C misdemeanor. (2) Each day that any such violation occurs after notice of the original violation is given by the chief engineer to any such violator by restricted mail shall constitute a separate offense. (**History:** L. 1977, ch. 356, § 2; L. 1981, ch. 397, § 2; July 1.)

K.S.A. 82a-729. Act supplemental to article 7 of chapter 82a of the Kansas Statutes Annotated. The provisions of K.S.A. 82a-727 and 82a-728 shall be a part of and supplemental to the provisions of article 7 of chapter 82a of the Kansas Statutes Annotated and acts amendatory thereof or supplemental thereto. (**History:** L. 1977, ch. 356, § 7; January 1, 1978.)

K.S.A. 82a-730. Citation of act. K.S.A. 82a-701 to 82a-726, inclusive, and acts amendatory thereof and supplemental thereto shall be called and may be cited as the Kansas water appropriation act. (**History:** L. 1977, ch. 356, § 8; L. 1984, ch. 380, § 2; July 1.)

K.S.A. 82a-731. Water appropriation certification fund created; expenditures therefrom. There is hereby created in the state treasury the water appropriation certification fund. The chief engineer of the division of water resources of the Kansas department of agriculture shall remit all moneys received under K.S.A. 82a-708a, 82a-708b and 82a-727, and amendments thereto, to the state treasurer in accordance with the provisions of K.S.A. 75-4215, and amendments thereto. Upon receipt of each such remittance, the state treasurer shall deposit the entire amount in the state treasury to the credit of the water appropriation certification fund. All expenditures from the water appropriation certification fund shall be made in accordance with appropriation acts upon warrants of the director of accounts and reports issued pursuant to vouchers approved by the secretary of agriculture or by a person designated by the secretary. (**History:** L. 1982, ch. 4, § 21; L. 2001, ch. 5, § 471; L. 2004, ch. 101 § 143; July 1.)

K.S.A. 82a-732. Annual water use report required; penalty for violations. (a) The owner of a water right or permit to appropriate water for beneficial use, except for domestic use, shall file an annual water use report on a form prescribed by the chief engineer of the division of water resources of the Kansas department of agriculture on or before March 1 following the end of the previous calendar year. The report shall completely and accurately set forth such water use information as requested by the chief engineer.

(b) Any person failing to file a water use report or other documents required under the provisions of subsection (a) shall be subject to a civil penalty in an amount not to exceed $250. The chief engineer upon a finding that the owner of a water right or permit to appropriate water for beneficial use has failed to file such a report may impose a civil penalty as provided in this section. Any person filing a document knowing it to contain any false information as to a material matter shall be guilty of a class C misdemeanor. All fines collected by the chief engineer pursuant to this subsection shall be remitted to the state treasurer as provided in K.S.A. 82a-731, and amendments thereto. (**History:** L. 1988, ch. 395, § 1; L. 1991, ch. 292, § 4; L. 2004, ch. 101 § 144; July 1.)

K.S.A. 82a-733. Conservation plans and practices. (a) The chief engineer may require an applicant for a permit to appropriate water for beneficial use or the owner of a water right or permit to appropriate water for beneficial use to adopt and implement conservation plans and practices. The chief engineer shall not mandate the adoption and implementation of conservation plans and practices except pursuant to a finding that such plans and practices will assure public benefit and promote public interest. In selecting the applications, water rights or permits for which conservation plans and practices are required to be adopted and implemented, the chief engineer shall give priority to: (1) Water users that share a common source of supply that could be insufficient during times of drought; (2) water users whose use is significantly higher than their peers from the same geographical area with comparable circumstances; and (3) water users who apply for any state administered grant, loan or cost-share moneys for water-related projects. Prior to requiring the adoption and implementation of conservation plans and practices, the chief engineer shall assess the availability of technical assistance and inform the owner of a water right or permit to appropriate water for beneficial use or the applicant for such a permit who is required to adopt and implement a conservation plan and practices of the available sources of technical assistance to prepare the conservation plan.

(b) The chief engineer shall allow the owner of a water right or permit to appropriate water for beneficial use or the applicant for such a permit a minimum of 60 days to prepare a required conservation plan. The time allowed to prepare the required conservation plan may be extended by the chief engineer for good cause shown by the applicant. The chief engineer shall provide the owner of the water right or permit to appropriate water for beneficial use or the applicant for such a permit a reasonable time to implement the conservation plan and, for good cause shown, such as the need to apply extensive land treatment practices, the chief engineer may extend the time for implementation for a period of up to five years.

(c) Plans and practices required pursuant to this section shall be consistent with the guidelines for conservation plans and practices developed and maintained by the Kansas water office pursuant to subsection (c) of K.S.A. 74-2608 and amendments thereto. If requested by the owner of the water right or permit to appropriate water for beneficial use or the applicant for such a permit, the chief engineer, in consultation with the director of the Kansas water office, shall determine whether such plans and practices are consistent with the guidelines adopted by the Kansas water office. The Kansas water office shall provide, or arrange to provide, technical assistance for water users required to adopt and implement conservation plans and practices pursuant to this section.

(d) Before any state agency makes any loan or grant, or provides any cost-share funds, for any water-related projects to any person or entity, the state agency may require the person or entity to submit to, and have approved by, the chief engineer a water conservation plan consistent with the guidelines for conservation plans and practices developed and maintained by the Kansas water office pursuant to subsection (c) of K.S.A. 1990 Supp. 74-2608 and amendments thereto.

(e) As used in this section, "water-related projects" shall include, but not be limited to, the following: Interconnections between water supply systems; development of new water supply and delivery systems; improvements or repairs to an existing water supply system, sanitary sewer system or water treatment system, which would significantly increase the amount of water used; small lakes development, improvement or repair; and development of other small impoundments for public water supply or irrigation.

(f) The chief engineer may approve the conservation plans and practices required pursuant to the provisions of this section on such terms, conditions and limitations as deemed necessary to carry out the provisions of this section. The implementation of the conservation plan and practices as approved or any subsequent approved modification shall constitute a condition of the water right or permit to appropriate water for beneficial use.

(g) Any conservation plans and practices required pursuant to this section with regard to any groundwater right or permit to appropriate groundwater from within the boundaries of a groundwater management district shall be subject to approval by both the chief engineer and the board of directors of the groundwater management district unless such plans and practices are incorporated in the groundwater management district's management program which has been approved by the chief engineer pursuant to K.S.A. 82a-1029 and amendments thereto.

(h) The chief engineer may delegate authority to implement and enforce any of the provisions of this section to a groundwater management district on such terms as may be appropriate and necessary to carry out the provisions of this section within the boundaries of such district.

(i) The chief engineer may delegate to any city which has conservation plans meeting state guidelines the authority to require domestic water users within such city to adopt and implement conservation plans and practices so that such city can require compliance from private domestic well owners within the city limits.

(j) This section shall be part of and supplemental to the Kansas water appropriation act. (**History:** L. 1991, ch. 292, § 5; July 1.)

K.S.A. 82a-734. Sand and gravel pits; beneficial use of water, when; permit; perfection of appropriation; reports to chief engineer. (a) An operator will notify the chief engineer of the location and area extent of any existing or proposed sand and gravel pit to be excavated, expanded or operated by the operator.

(b) The net evaporation of water exposed as the result of the opening or operation of sand and gravel pits shall be construed to be a beneficial use or diversion of water for the purposes of the Kansas water appropriation act, K.S.A. 82a-701 et seq., and amendments thereto, if the sand and gravel pit is opened or operated in a township where the average annual potential net evaporation is greater than 18 inches per year, as determined by the chief engineer.

(c) If the chief engineer determines that an existing or proposed sand and gravel pit operation is a beneficial use of water, the operator shall apply to the chief engineer for a permit to appropriate water in accordance with the Kansas water appropriation act or otherwise acquire ownership or control of sufficient water rights, or by other methods pursuant to rules and regulations adopted by the chief engineer, or both, to offset net evaporation for the operation.

(d)(1) The period of time allowed to complete construction of diversion works pursuant to an approved application to appropriate water for the purpose of net evaporation from a sand and gravel pit operation shall be reasonable and consistent with the proposed use, but not less than five years. The chief engineer may allow extension of such period by not to exceed two five-year extensions if it can be shown that the operation requires the additional time for the operator to satisfy the operator's market demand in the area. The two five-year extensions may be granted at the same time, to run consecutively, if the applicant submits to the chief engineer a written development plan.

(2) The period of time allowed to perfect an approved application to appropriate water for the purpose of net evaporation from a sand and gravel pit operation shall be not less than 20 years and, for good cause shown, the chief engineer may allow one or more 10-year extensions of such period. The chief engineer shall consider the time needed until exhaustion of proven reserves, closure in accordance with the surface land reclamation and mining act, K.S.A. 49-601 et seq., and amendments thereto, and the availability of water for the proposed use, but in no case shall allow longer than 60 years for perfection.

(3) Nothing herein shall require an extension of time to construct diversion works or to perfect a water right if there is demonstrable impairment of a use under an existing water right

from the same source of supply, as determined pursuant to K.S.A. 82a-711, and amendments thereto.

(e) Evaporation from sand and gravel pits, as calculated by the chief engineer, will be reported as an industrial use to the director of taxation for the purpose of assessing the water protection fee pursuant to K.S.A. 82a-954, and amendments thereto.

(f) This section shall be part of and supplemental to the Kansas Water appropriations act. (**History:** L. 1995, ch. 72, § 1; L. 2004, ch. 100, § 1; July 1.)

K.S.A. 82a-735. Sunflower ammunition plant water rights. (a) The state of Kansas shall have the sole authority to enter into negotiations, agreements and contracts with the federal government regarding water rights, file number 37 and file number 38, appurtenant to federal property located in Johnson county. The Kansas water office, on behalf of the state, shall enter into such negotiations, agreements and contracts when the Kansas water office deems it necessary for the achievement of policies of the state relative to the water resources of the state. Such negotiations, agreements and contracts shall be for the purpose of:

(1) The return of such water rights to the state, in which case the rights shall be terminated and their priority forfeited; or

(2) the acquisition of such water rights by the state.

(b) Any agreement or contract entered into pursuant to this section shall be binding on the state only upon adoption by the legislature of a concurrent resolution approving such agreement or contract.

(c) If water rights are acquired by the state pursuant to this section:

(1) The Kansas water office, on behalf of the state, shall accept and hold such water rights in trust;

(2) the Kansas water office shall have no authority to assign, transfer or otherwise dispose of such water rights;

(3) all contractual agreements associated with such water rights shall remain in effect and the provisions of K.S.A. 82a-718 and amendments thereto shall not apply to such water rights while held by the Kansas water office; and

(4) the Kansas water office shall make all annual payments associated with such acquired water rights to any water assurance district under the provisions of the water assurance program act until such time as such water rights are transferred to another person or entity.

(d) Changes to any water rights acquired by the state pursuant to this section shall be in accordance with the Kansas water appropriation act, including the provisions of K.S.A. 82a-708b and amendments thereto. (**History:** L. 1999, ch. 122, § 2; July 1.)

K.S.A. 82a-736. Multi-year flex accounts. (a) As used in this section: (1) "Base average usage" means (A) The average amount of water actually used for a beneficial use under a groundwater water right during calendar years 1996 through 2000, excluding any amount used in any such year in excess of the amount authorized by such water right; or (B) if the holder of a groundwater water right shows to the satisfaction of the chief engineer that the holder has implemented significant water conservation measures during calendar years 1996 through 2000, the average amount of water actually used for a beneficial use under such right during the five calendar years immediately before the calendar year when such measures were implemented, excluding any amount used in any such year in excess of the amount authorized by such water right.

(2) "Chief engineer" means the chief engineer of the division of water resources of the department of agriculture.

(b) Any holder of a groundwater water right which has not been deposited or placed in a safe deposit account in a chartered water bank may establish a flex account where the holder may deposit, in advance, water from such water right for any five consecutive calendar years, subject to the following:

(1) The water right must be vested or shall have been issued a certificate of appropriation;

(2) the withdrawal of water pursuant to the water right shall be properly and adequately metered;

(3) the water right shall not have been abandoned and shall be in good standing, based on past water usage and compliance with the terms of the holder's permit and all applicable provisions of law and orders of the chief engineer; and

(4) the amount of water that shall be deposited in the account shall be 90% of the amount of the holder's base average usage times five.

(c) The chief engineer shall implement a program providing for the issuance of term permits to holders of groundwater water rights who have established flex accounts in accordance with this section. Such term permits shall authorize the use of water in a flex account at any time during the five consecutive calendar years for which the application for the term permit is made, without annual limits on such use. Application for any such term permit shall be filed not later than October 10, of the year preceding the first year for which the application is made.

(d) Term permits provided for by this section shall be subject to the following:

(1) A separate term permit shall be required for each point of diversion.

(2) The quantity of water authorized for diversion shall be limited to the amount deposited pursuant to subsection (b)(4).

(3) The authorized place of use for the term permit shall not be greater than that authorized by the existing groundwater right.

(4) The chief engineer may establish, by rules and regulations, criteria for such term permits when the water right authorizes multiple points of diversion or multiple water rights authorize a single point of diversion or overlapping places of use.

(5) Except as explicitly provided for by this section, such term permits shall be subject to all provisions of the Kansas water appropriation act, and rules and regulations adopted under such act, and nothing in this section shall authorize impairment of any vested right or prior appropriation right by the exercise of such term permit.

(e) All costs of administration of this section shall be paid from fees for term permits provided for by this section. Any appropriation or transfer from any fund other than the water appropriation certification fund for the purpose of paying such costs shall be repaid to the fund from which such appropriation or transfer is made. At the time of repayment, the secretary of agriculture shall certify to the director of accounts and reports the amount to be repaid and the fund to be repaid. Upon receipt of such certification, the director of accounts and reports shall promptly transfer the amount certified to the specified fund.

(f) The chief engineer shall submit a written report on the implementation of this section to the house standing committee on environment and the senate standing committee on natural resources on or before February 1 of each year.

(g) This section shall be part of and supplemental to the Kansas water appropriation act. (**History:** L. 2001, ch. 160, § 16; July 1.)

K.S.A. 82a-737. Civil enforcement of act. (a) As used in this section: (1) "Chief engineer" means the chief engineer of the division of water resources of the department of agriculture.

(2) "Secretary" means the secretary of agriculture.

(b) Any person who commits any of the following may incur a civil penalty as provided by this section:

(1) Any violation of the Kansas water appropriation act (K.S.A. 82a-701 *et seq.*, and amendments thereto) or any rule and regulation adopted thereunder;

(2) any violation of an order issued pursuant to K.S.A. 82a-1038, and amendments thereto, relating to an intensive groundwater use control area; or

(3) any violation of a term, condition or limitation imposed by the chief engineer as authorized by law, including, but not limited to: (A) Diversion of water from an unauthorized point of diversion; (B) failure to limit the use of water to the authorized place of use; (C) failure to submit or comply with the terms of conservation plans as required pursuant to K.S.A. 82a-733, and amendments thereto; (D) failure to comply with the maximum annual quantity or rate of diversion authorized; (E) failure to properly install, maintain or assure the accuracy of acceptable water measurement devices; (F) failure to comply with orders related to minimum desirable stream flow, unlawful diversion, impairment of senior water rights or waste of water; or (G) failure to limit the use of water to an authorized type of use.

(c) The amount of the civil penalty provided for by this section shall be not less than $100 nor more than $1,000 per violation. In the case of a continuing violation, each day such violation continues may be deemed a separate violation. Such civil penalty may be assessed in addition to any other penalty provided by law.

(d) The chief engineer or the chief engineer's duly authorized agent, upon a finding that a person has committed a violation specified in subsection (b), may order the modification or suspension of the person's water right or use of water, in addition to any other penalty provided by law.

(e) No civil penalty or suspension or modification of a water right or use of water shall be imposed pursuant to this section except on the written order of the chief engineer or duly authorized agent of the chief engineer. Such order shall state the nature of the violation, the factual basis for the finding, the penalty to be imposed and the appropriate procedure for appeal of the order to the chief engineer or the secretary, as established by K.S.A. 2001 Supp. 82a-1901, and amendments thereto. Upon review, the order shall be affirmed, reversed or modified and the reasons therefor shall be specified.

(f) Any person aggrieved by an order of the chief engineer, or the chief engineer's duly authorized agent, pursuant to this section may request review by the secretary as provided by K.S.A. 2001 Supp. 82a-1901, and amendments thereto, and, upon exhaustion of administrative remedies, may appeal to the district court in the manner provided by the act for judicial review and civil enforcement of agency actions.

(g) The provisions of this section shall be part of and supplemental to the Kansas water appropriation act. (**History:** L. 2001, ch. 160, § 14; July 1.)

K.S.A. 42-303. Right to conduct water along natural channels and withdraw same. Any person may conduct water into and along any of the natural streams or channels of the state, and may withdraw all such waters so by him turned into such channel at any point desired, without regard to prior appropriations of water from said stream, due allowance being made for evaporation and seepage. (**History:** L. 1891, ch. 133, art. 1, §3; May 20; R.S. 1923, 42-303.)

K.S.A. 42-313. Right to collect and store water. Any person entitled to use water for beneficial purposes may collect and store the same and all natural flows for use thereafter, so long as such collection, storage, use and times of use thereafter are consistent with reasonable storage and conservation practices; and the failure to apply or use such waters during the period of such collection and storage shall not be deemed or taken to impair his right in that behalf; *Provided*, Such collection and storage of all natural flows shall be subject to vested rights and prior appropriation rights. (**History:** L. 1891, ch. 133, art. 2, § 4; R.S. 1923, 42-313; L. 1957, ch. 539, § 5; June 29.)

K.S.A. 42-314. (**History:** L. 1891, ch. 133, art. 2, § 4; R.S. 1923, 42-313; Repealed, L. 1957, ch. 539, § 26; June 29.)

6. Available records regarding the operation of the intake screens at either the Neosho River or CCL screen houses as well as information on the ongoing and periodic maintenance that occurs on the screens.

• Available water or sediment quality data for John Redmond Reservoir (JRR), Coffey County Lake (CCL), and Neosho River.

• Available information regarding local, state, or federal management measures for the JRR, CCL, and the Neosho River. This may include fisheries management, watershed management, flow regulation, etc.

• Any available documentation regarding minimum flows in the Neosho River.

6 • Available records regarding the operation of the intake screens at either the Neosho River or CCL screen houses as well as information on the ongoing and periodic maintenance that occurs on the screens.

• Available information on invasive or nuisance species observed in the facility's intake, JRR, CCL, or the Neosho River and available information on Wolf Creek Nuclear Operating Corporation (WCNOC) efforts to address this issue.

• Documentation regarding the WCNOC or Coffey County Sheriff's office management of the CCL access program.

• Examples of the fishery regulations developed by the Kansas Department of Wildlife & Parks for CCL.

• If available, information on any occurrences of the Topeka Shiner in the JRR, CCL, Neosho River, or any water bodies crossed by the facility's transmission lines.

• Section 2.5 of the ER (Wolf Creek Generating Station (WCGS), 1980) states that U.S. Fish and Wildlife Service (USFWS) and U.S. Geological Survey (USGS) recommended that additional data be obtained on the habitat requirements of the Neosho River madtoms. Please provide any new information related to these habitat requirements.

• Section 2.5 of the ER (WCGS, 1980) states that USFWS and USGS recommended that flows below the John Redmond Dam be increased during critical periods for the Neosho River madtoms. Please provide any new information related to this issue.

• If available, information on any occurrences of the Neosho river madtom in the JRR, CCL or Neosho river.

• If available, information on any occurrences of the Neosho mucket mussel in the JRR, CCL or Neosho river.

• Section 3.1.2 of the ER (WCGS, 1980) states that water is released to Wolf Creek infrequently. Please provide available records documenting these releases and/or information regarding the frequency of these releases.

• Details on the anti-scalants, dispersants, biocides, and corrosion inhibitors which are released into the circulating water system. Specifically, names of additives used, concentrations used, and frequency of application.

• System operating procedures for the circulating water system traveling screens.

Medenciy Charlie M

From: Huynh Duc T
Sent: Friday, January 26, 2007 1:01 PM
To: Medenciy Charlie M
Cc: Womelsdorf Daniel J; Mosebey Dennis G
Subject: Question # 31 & 32 for NRC License Renewal Audit

Charlie,

31. Are records maintained for operation of the intake screens at either the Neosho? No.

- 24 minutes every 8 hours per screen at the CWSH (CCL).
- 24 minutes every 24 hours per screen at the MUSH (Neosho River) when the make-up pumps are running. This is about three months per year.

#32. Describe the ongoing and periodic maintenance that occurs on the screens.
<u>At the CWSH house:</u>
1. Overhaul/replace every 3276 days. PM File # 30383.
2. CWSH TRAVELING SCREEN GEARS REDUCERS OIL SAMPLES. MECHANICAL MAINTENANCE SUPERVISION AND OPERATIONS PERSONNEL HAVE DETERMINED THAT A CLEARANCE ORDER IS NOT REQUIRED FOR THIS WORK ACTIVITY. Every 364 days. PM File # 30382.
- The purpose of this time-directed task is to prevent traveling screen or motor failure due to inadequate lubrication and subsequent bearing seizure.
- Task scope and frequency is based on site operating experience and manufacturer instruction manual recommendations. Previous work history supports retaining this task at the current frequency assignment.

3. 1SW001FA CWSH TRAVELING SCREENS CLEANING, INSPECTION AND LUBRICATION. Every 28 days. PM File # 30384. A Local Control may be used on this equipment during the performance of this PM activity (ref. CCP 07050). The purpose of this time-directed task is to prevent traveling screen or motor failure due to inadequate lubrication and subsequent bearing seizure. Task scope and frequency is based on site operating experience and manufacturer instruction manual recommendations. Previous work history supports retaining this task at the current frequency assignment.

<u>At the MUSH (Neosho River):</u>
1. 0SW001FA, FB and FC -- TRAVELING SCREENS OIL SAMPLE, CLEANING, INSPECTION and LUBRICATION. Every 182 days. PM File # 30376.

The purpose of this time-directed task is to prevent traveling screen or motor failure due to inadequate lubrication and subsequent bearing seizure.

Task scope and frequency is based on site operating experience and manufacturer instruction manual recommendations. Previous work history supports retaining this task at the current frequency assignment. This represents a maintenance cost basis PM strategy for the components attached to this reference number.

Duc

6

WOLF CREEK NUCLEAR OPERATING CORPORATION

MPM SW-001

CWSH AND MUSH TRAVELING SCREENS PREVENTIVE MAINTENANCE ACTIVITY

Responsible Manager

MANAGER MAINTENANCE MA

Revision Number	6
Use Category	Reference
Administrative Controls Procedure	No
Management Oversight Evolution	No
Program Number	16B

DC38 2/01/2007

TABLE OF CONTENTS

1.0 PURPOSE

1.1 To provide direction for performing PM activities on the CWSH and MUSH Traveling Screens.

2.0 SCOPE

2.1 This procedure applies to 1SW001FA, FB, FC, FD, FE, FF, and 0SW001FA, FB, FC.

3.0 REFERENCES AND COMMITMENTS

3.1 References

3.1.1 T/M A-3818-05, Traveling Screens

3.1.2 AP 21E-001, Clearance Orders

3.1.3 AP 22C-002, Work Controls

3.1.4 MGM MOOC-04, Alignment of Rotating Equipment

3.2 Commitments

3.2.1 RCMS 90-166, Letter OP 90-0173, Control Of Work Activities

4.0 PRECAUTIONS/LIMITATIONS

4.1 A portion of this activity may be performed while the equipment is in service. [Commitment Step 3.2.1]

4.2 Ensure Low Voltage lighting is available when required to perform this PM Activity.

4.3 Attachment A, Procedure Sign-Off Sheets will be used for CWSH Traveling Screens, 1SW001FA, FB, FC, FD, FE, and FF. Attachment B, Procedure Sign-Off Sheets will be used for MUSH Traveling Screens, 0SW001FA, FB, and FC. If this procedure is used for partial performance, only the section(s) of the procedure that are going to be performed, along with the cover page and any applicable Attachments/Procedure Sign-Off Sheets are required to be attached to the procedure cover sheet.

5.0 SPECIAL EQUIPMENT, MATERIALS, AND PARTS

NOTE

Stock Item (SI) Numbers listed in this section are for reference only. The work order parts list will provide the current SI numbers and traceability of the parts or components per AP 24E-001.

5.1 Special Equipment

5.1.1 Carpenter level

5.1.2 Grease gun

5.1.3 Test Shear Pin

5.2 Materials

5.2.1 Mobilux EP-2, SR515500076

5.2.2 MobilGear 629, SR51500006

5.2.3 Mobilgrease XHP 222 Special, SR51500094 for Chain Rollers

5.3 Parts

5.3.1 None listed

6.0 PREREQUISITES

6.1 See work document

7.0 PROCEDURE

CAUTION

Traveling Screens will be in operation during a portion of the maintenance activities. The Traveling Screens may start automatically.

7.1 Remove the Splashproof Housings necessary to facilitate access to the carrying chain, baskets, and spray nozzles.

7.2 Visually inspect the following items for damage and excessive wear while the Traveling Water Screens are in operation:

7.2.1 Headshaft Bushing

7.2.2 Carrying Chain Rollers (side links should be greater than 1/4" in thickness)

7.2.3 Sprocket Tooth Inserts

7.2.4 Spray Nozzles

7.2.5 Screens

7.3 Inspect the Refuse Trough and Holding Basket for build-up of debris and clean as necessary.

NOTES

- **IF there is wear on the lip of the Screen Baskets THEN tighten the Carrying Chain.**
- **When carrying chain wear occurs, a gap will appear between the bottom of the Spring Retainer Plate and the top of the Spring Housing. Maximum allowable gap should be 1/4".**

7.4 Inspect the Carrying Chain and ensure gap between spring retainer plate and top of Spring Housing is less than 1/4".

7.5 If tightening is required, perform the following instructions:

7.5.1 Lubricate the Take-Up Device Thrust Bearing with Mobilux EP-2.

7.5.2 Compress spring until the Spring Retainer Plate touches the top of the Spring Housing.

7.5.3 Ensure headshaft is level after Carrying Chain is adjusted. A Carpenter Level may be used.

7.6 Inspect the top sprocket Headshaft Keys for tightness, or worn or damaged keys.

CAUTIONS

- **The Carrying Chain must be in adjustment prior to inspecting the Drive Chain.**
- **The Traveling Screen shall not be in operation while adjusting the Drive Chain.**
- **Drive chain tension should never be adjusted by using the capstans. The capstans are for adjustment of the carrying chains.**
- **If mechanical repairs are not necessary prior to initiating this PM Activity, operating the screens with the Test Pin will not be required.**

7.7 Remove the Drive Chain Guards to accommodate the Drive Chain Inspections.

7.7.1 Inspect the Drive chain.

7.7.2 IF enough slack is present to allow removal of one link, THEN remove one full link of chain.

7.7.3 Open the petcock at the bottom of Drive Chain Oil Reservoir, and drain water until oil is evident.

7.7.4 Check the Drive Chain Sump Oil, and add Mobilgear 629 if required.

7.7.5 Check the Gear Reducer Oil, and add Mobilgear 629 if required.

7.8 Lubricate the following:

7.8.1 Rollers with Mobilgrease XHP 222 Special

7.8.2 Drive Sprocket and Bore with Mobilux EP2

7.8.3 Head Shaft Bearings with Mobilux EP2

7.8.4 Take-Up Screw Thrust Bearings zerk fittings with Mobilux EP2.

7.9 Change Gear Reducer Oil when required by the Work Instructions using Mobilgear 629.

8.0 RESTORATION

8.1 If mechanical repairs were required, run the unit two revolutions with a Test Sheer Pin in to check for binding or misalignment.

8.2 IF maintenance activities were performed which affect equipment alignment, THEN check alignment of affected rotating components.

8.3 On completion of mechanical repairs (when performed), remove Test Shear Pin.

8.4 When Test Shear Pin is removed install normal Shear Pin.

8.5 Replace drive chain guard and splash proof housings removed during PM Activities.

8.6 Notify the Shift Manager/Designee the work activity is complete.

9.0 RECORDS

9.1 The following QA Record is generated by this procedure:

9.1.1 Attachment A - Procedure Sign-Off Sheets CWSH

9.1.2 Attachment B - Procedure Sign-Off Sheets MUSH

9.2 These documents will not have to be retained in the Decommissioning or Plant Life Extension Files.

- END -

ATTACHMENT A
(Page 1 of 6)
PROCEDURE SIGN-OFF SHEET CWSH

Component No. **1SW001FA**

K08-001 Work Order No. ____________

Procedure Step	**Operation**	**Verify/Accept Initials/Date**
7.2	Visual Inspections	___/___
7.3	Trough and holding basket	___/___
7.4	Carrying Chain gap	___/___
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	___/___
7.7.1	Inspect Drive Chain	___/___
7.7.2	Drive chain adjusted	___/___
7.7.4	Check Drive Chain Sump Oil	___/___
	____________ Amount Used	
7.8	Lubrication Complete	___/___
7.9	Gear Reducing Oil changed	___/___
8.4	Installed Normal Shear Pin	___/___
8.6	Notified SM of completion	___/___

Remarks: ____

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Maintenance Activity Complete: ______________________/________
Performer's Signature Date

Maintenance Activity Completed Satisfactorily: ______________________/________
Supervisor's Signature Date

ATTACHMENT A
(Page 2 of 6)
PROCEDURE SIGN-OFF SHEET CWSH

Component No. **1SW001FB**

K08-001 Work Order No. ____________

Procedure Step	**Operation**	**Verify/Accept Initials/Date**
7.2	Visual Inspections	____/____
7.3	Trough and holding basket	____/____
7.4	Carrying Chain gap	____/____
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	____/____
7.7.1	Inspect Drive Chain	____/____
7.7.2	Drive chain adjusted	____/____
7.7.4	Check Drive Chain Sump Oil ____________________ Amount Used	____/____
7.8	Lubrication Complete	____/____
7.9	Gear Reducing Oil changed	____/____
8.4	Installed Normal Shear Pin	____/____
8.6	Notified SM of completion	____/____

Remarks: ____

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Maintenance Activity Complete: ______________________ / __________
Performer's Signature Date

Maintenance Activity Completed Satisfactorily: ______________________ / __________
Supervisor's Signature Date

ATTACHMENT A
(Page 3 of 6)
PROCEDURE SIGN-OFF SHEET CWSH

Component No. **1SW001FC**

K08-001 Work Order No. ____________

Procedure Step	**Operation**	**Verify/Accept Initials/Date**
7.2	Visual Inspections	____/____
7.3	Trough and holding basket	____/____
7.4	Carrying Chain gap	____/____
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	____/____
7.7.1	Inspect Drive Chain	____/____
7.7.2	Drive chain adjusted	____/____
7.7.4	Check Drive Chain Sump Oil	____/____
	____________________ Amount Used	
7.8	Lubrication Complete	____/____
7.9	Gear Reducing Oil changed	____/____
8.4	Installed Normal Shear Pin	____/____
8.6	Notified SM of completion	____/____

Remarks: ____

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Maintenance Activity Complete: ______________________/________
Performer's Signature Date

Maintenance Activity Completed Satisfactorily: ______________________/________
Supervisor's Signature Date

ATTACHMENT A
(Page 4 of 6)
PROCEDURE SIGN-OFF SHEET CWSH

Component No. **1SW001FD**

K08-001 Work Order No. ____________

Procedure Step	**Operation**	**Verify/Accept Initials/Date**
7.2	Visual Inspections	____/____
7.3	Trough and holding basket	____/____
7.4	Carrying Chain gap	____/____
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	____/____
7.7.1	Inspect Drive Chain	____/____
7.7.2	Drive chain adjusted	____/____
7.7.4	Check Drive Chain Sump Oil	____/____
	____________________ Amount Used	
7.8	Lubrication Complete	____/____
7.9	Gear Reducing Oil changed	____/____
8.4	Installed Normal Shear Pin	____/____
8.6	Notified SM of completion	____/____

Remarks: ____

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Maintenance Activity Complete: ______________________/__________
Performer's Signature Date

Maintenance Activity Completed Satisfactorily: ______________________/__________
Supervisor's Signature Date

ATTACHMENT A
(Page 5 of 6)
PROCEDURE SIGN-OFF SHEET CWSH

Component No. **1SW001FE**

K08-001 Work Order No. ____________

Procedure Step	**Operation**	**Verify/Accept Initials/Date**
7.2	Visual Inspections	____/____
7.3	Trough and holding basket	____/____
7.4	Carrying Chain gap	____/____
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	____/____
7.7.1	Inspect Drive Chain	____/____
7.7.2	Drive chain adjusted	____/____
7.7.4	Check Drive Chain Sump Oil	____/____
	____________________ Amount Used	
7.8	Lubrication Complete	____/____
7.9	Gear Reducing Oil changed	____/____
8.4	Installed Normal Shear Pin	____/____
8.6	Notified SM of completion	____/____

Remarks: ____

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Maintenance Activity Complete: ____________________/________
Performer's Signature Date

Maintenance Activity Completed Satisfactorily: ____________________/________
Supervisor's Signature Date

ATTACHMENT A
(Page 6 of 6)
PROCEDURE SIGN-OFF SHEET CWSH

Component No. **1SW001FF**

K08-001 Work Order No. ____________

Procedure Step	**Operation**	**Verify/Accept Initials/Date**
7.2	Visual Inspections	____/____
7.3	Trough and holding basket	____/____
7.4	Carrying Chain gap	____/____
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	____/____
7.7.1	Inspect Drive Chain	____/____
7.7.2	Drive chain adjusted	____/____
7.7.4	Check Drive Chain Sump Oil ____________________ Amount Used	____/____
7.8	Lubrication Complete	____/____
7.9	Gear Reducing Oil changed	____/____
8.4	Installed Normal Shear Pin	____/____
8.6	Notified SM of completion	____/____

Remarks: ____

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Maintenance Activity Complete: ____________________ / ________
Performer's Signature Date

Maintenance Activity Completed Satisfactorily: ____________________ / ________
Supervisor's Signature Date

- END -

ATTACHMENT B
(Page 1 of 3)
PROCEDURE SIGN-OFF SHEET MUSH

Component No. **0SW001FA**

K08-001 Work Order No. ______________

Procedure Step	**Operation**	**Verify/Accept Initials/Date**
7.2	Visual Inspections	____/____
7.3	Trough and holding basket	____/____
7.4	Carrying Chain gap	____/____
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	____/____
7.7.1	Inspect Drive Chain	____/____
7.7.2	Drive chain adjusted	____/____
7.7.4	Check Drive Chain Sump Oil ______________________ Amount Used	____/____
7.8	Lubrication Complete	____/____
7.9	Gear Reducing Oil changed	____/____
8.4	Installed Normal Shear Pin	____/____
8.6	Notified SM of completion	____/____

Remarks: ____

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Maintenance Activity Complete: ______________________/__________
Performer's Signature Date

Maintenance Activity Completed Satisfactorily: ______________________/__________
Supervisor's Signature Date

ATTACHMENT B
(Page 2 of 3)
PROCEDURE SIGN-OFF SHEET MUSH

Component No. **0SW001FB**

K08-001 Work Order No. ____________

Procedure Step	**Operation**	**Verify/Accept Initials/Date**
7.2	Visual Inspections	____/____
7.3	Trough and holding basket	____/____
7.4	Carrying Chain gap	____/____
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	____/____
7.7.1	Inspect Drive Chain	____/____
7.7.2	Drive chain adjusted	____/____
7.7.4	Check Drive Chain Sump Oil	____/____
	____________ Amount Used	
7.8	Lubrication Complete	____/____
7.9	Gear Reducing Oil changed	____/____
8.4	Installed Normal Shear Pin	____/____
8.6	Notified SM of completion	____/____

Remarks: ____

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Maintenance Activity Complete: ______________________/________
Performer's Signature Date

Maintenance Activity Completed Satisfactorily: ______________________/________
Supervisor's Signature Date

ATTACHMENT B
(Page 3 of 3)
PROCEDURE SIGN-OFF SHEET MUSH

K08-001

Component No. **OSW001FC**
Work Order No. ______________

Procedure Step	**Operation**	**Verify/Accept Initials/Date**
7.2	Visual Inspections	___/___
7.3	Trough and holding basket	___/___
7.4	Carrying Chain gap	___/___
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	___/___
7.7.1	Inspect Drive Chain	___/___
7.7.2	Drive chain adjusted	___/___
7.7.4	Check Drive Chain Sump Oil	___/___
	______________________ Amount Used	
7.8	Lubrication Complete	___/___
7.9	Gear Reducing Oil changed	___/___
8.4	Installed Normal Shear Pin	___/___
8.6	Notified SM of completion	___/___

Remarks: ____

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Maintenance Activity Complete: ______________________/__________
Performer's Signature Date

Maintenance Activity Completed Satisfactorily: ______________________/__________
Supervisor's Signature Date

-END-

6

APF 16C-006-02 Rev 0

WOLF CREEK NUCLEAR OPERATING CORPORATION

WO # 06-290030-000

Date Reqrd	: 02/12/2007	**Late Date**	: 02/19/2007
Action Code	: PM PREVENTIVE MAINTENANCE	**Mode Restraint**	: 7 - NO MODE RESTR
PM File #	: 30384 **CCD:** A	**Date Generated**	: 01/19/2007
Requester/Ext	: HOLMAN, EDWARD C / 4695	**Priority**	: 4P30

Asset : 1SW001FA
Asset Desc : CWSH TRAVELING SCREEN
System : SW **Asset Safety Class** : NS
Asset Location : Z019B TRAVELING WATER SCREEN ENCLOSURE

Associated Assets
1SW001FB
1SW001FC
1SW001FD
1SW001FE
1SW001FF

EQ Harsh :

Governing Code: N/A **Code Class:** N/A **Program:** N/A **R/R Plan** : N/A

Work Description : **Work Safety Class** : NS

shelton 1SW001FA thru 1SW001FF - CWSH TRAVELING WATER SCREENS CLEANING, INSPECTION, and LUBRICATION. A Local Control may be used on this equipment during the performance of this PM activity (ref. CCP 07050).

Assigned Planner : SHELTON, STEVEN M

Equipment Operable Re-Evaluation
Equipment Operable(Y/N) NA

Ref:
Time Limit:

Permission To Start:
2/16/07
/

PROCEDURE - MPM SW-001 SHEET

Documents Verified latest revision and changes included: / 2-16-07

WOLF CREEK NUCLEAR OPERATING CORPORATION

WO # 06-290030-000

Step:	1	Craft:	MEC	Crew:	3012030B	Persons:	3	Est Hrs:	6.00

Permit Section

LOCAL CONTROL LCD16-D16-0083

Work Instructions

1SW001FA thru 1SW001FF - CWSH TRAVELING WATER SCREENS CLEANING, INSPECTION, and LUBRICATION.

Perform work in accordance with the attached instruction.

A Local Control may be used on this equipment during the performance of this PM activity (ref. CCP 07050).

Parts List

Description	Matcode	Lot#	Qty Reqd	Qty Used	Verify By
LUBRICANT, OIL, MOBILGEAR 629, 400 LB DRUM	SR51500006	NA	0.00	Ø	NA

Notes: Quantity is as required

SIR # NA

Description	Matcode	Lot#	Qty Reqd	Qty Used	Verify By
LUBRICANT, GREASE, MOBILUX EP2, 14 OZ CARTRIDGE, 40/CS	SR51500076	248853	0.00	AR	[illegible] 2-16-07

Notes: Quantity is as required

SIR # 06-2721

Description	Matcode	Lot#	Qty Reqd	Qty Used	Verify By
SEALANT, PIPE THREAD, LOW HALOGEN CONTENT, 1.69 OZ TUBE, NEOLUBE 100, USE SHALL NOT EXCEED 300 DEG F	NS51601000	NA	0.00	Ø	NA

Notes: Quantity is as required

SIR # NA

WOLF CREEK NUCLEAR OPERATING CORPORATION

WO # 06-290030-000

Parts List

Description	Matcode	Lot#	Qty Reqd	Qty Used	Verify By
LUBRICANT, GREASE, 14 OZ CARTRIDGE, MOBILGREASE XHP 222 SPECIAL, NGLI 2, PRODUCT NO 53055-0, 10 TUBES PER CASE	SR51500094	NA	0.00	Ø	NA

Notes: Quantity is as required - Stock Item SR51500094 and SR51500095 are the same lubricant (different container sizes)

SIR # NA

Description	Matcode	Lot#	Qty Reqd	Qty Used	Verify By
FITTING, GREASE, ZERK, MAIN CHAIN PIN, ITEM 13, FOR ENVIREX TRAVELING SCREEN	NS41720095	NA	0.00	Ø	NA

Notes: Quantity is if required

SIR # NA

Description	Matcode	Lot#	Qty Reqd	Qty Used	Verify By
LUBRICANT, GREASE, 120 LB PAIL, MOBILGREASE XHP 222 SPECIAL, NGLI 2, PRODUCT NO 53055-0	SR51500095	249848	0.00	AR	[initials] 2-16-07

Notes: Quantity is as required

SIR # 07-1036

WOLF CREEK NUCLEAR OPERATING CORPORATION

WO # 06-290030-000

M&TE No.	Cal Due Date	Range/Scale	M&TE No.	Cal Due Date	Range/Scale
	N/A			N/A	

As Found Condition: Found several nozzles frozen not allowing screen wash flow.

Cause of Failure Cold

Work Summary Opened screen wash valve to allow them to thaw. Sprayed "D" nozzles with water to thaw. Performed PM per procedure and work instructions.

WOLF CREEK NUCLEAR OPERATING CORPORATION

WO # 06-290030-000

Worker(s) Sig/Date: [signature] / 2-16-07
John Givens / 2-16-07
Scott Coffman / 2-16-07
Jolene Shaner / 2-16-07

Work Completion Date: 2-16-07 Field Work Hrs: 2 ME 6 hrs

Shift Supervisor Notified: per telecon

Work Group Supervisor : [signature] 2/19/07

Feedback

Repetitive Work Codes (pick 1): O PM-1 - Like New ✓ PM-2 - Satisfactory
O PM-3 - Degraded O PM-4 - Failed O N - Not Applicable

Work Order Planning (pick 1): ✓ 1 - No Issues
O 2 - Clarification Required
O 3 - Enhancements Suggested
O 4 - Changes Required to Complete the Work

Advance Tool Request (pick 1):
O 1 - Tool Request Missing
O 2 - Tool Request Incomplete or Incorrect
✓ 3 - Tool List Complete and Accurate

Tools Staged as Expected (pick 1): ✓ Yes
O No
O N/A

IMAGED 02/20/07

WOLF CREEK NUCLEAR OPERATING CORPORATION

WO # 06-290030-000

Notes

Subject: PM Basis Update **Entered By:** LEVAUGH **Date:** 11/14/2006

The purpose of this time-directed task is to prevent traveling screen or motor failure due to inadequate lubrication and subsequent bearing seizure.

Task scope and frequency is based on site operating experience and manufacturer instruction manual recommendations. Previous work history supports retaining this task at the current frequency assignment.

Subject: UPDATED BY COPY UTILITY/061114 **Entered By:** LEVAUGH **Date:** 11/14/2006

This WO was updated using the Copy Utility on 11/14/06.

The originating WO was 02-238413-000.

Subject: PRINTED CCD A **Entered By:** JEBENHA **Date:** 01/09/2007

Subject: Filed **Entered By:** JEBENHA **Date:** 01/10/2007

In week 107

WOLF CREEK NUCLEAR OPERATING CORPORATION

WO # 06-290030-000

Tool List

Tool Description	Request Number	Tool No	Qty	Tool Room	Row/Bin

NA

*** * * End of Report (170091) * * ***

Work Order:
PM File: 30384

Step(s): 001

Work Instructions

SCOPE

- **Description of work:** CWSH Traveling Screen Cleaning, Inspection, and Lubrication.
- **Equipment Name**: 1SW001FA, 1SW001FB, 1SW001FC, 1SW001FD, 1SW001FE, 1SW001FF
- **Equipment Description:** CWSH Screens
- **Equipment Location:** Circulating Water Screen House

GENERAL NOTES

- Steps in the work instructions may be performed out of sequence at the discretion of the Worker provided that the intent of the instructions is met.
- If work instructions provided for multiple work activities, which are contingent upon the condition of the equipment, N/A all instructions which are not required.
- Steps within the instructions may be re-performed (in lieu of re-performing the entire instructions). Maintain documentation by resigning next to the original work step and/or adding a note in the Historical Summary/Comments Section.
- The guideline of AP 12-003, FME shall be adhered to during this work activity.
- Procedure step 7.9 (Gear Reducer Oil Change) **will not** be performed at this maintenance interval **unless** the oil is obviously seriously contaminated.
- PMT Comments: No Post Maintenance Testing is required – The components are in operation during the performed work.
- References: A-3818-05

PREREQUISITES

- Workman to contact the building watch prior to starting work for all work activities.

AM 12-18-07
Init/Date

Work Order:
PM File: 30384

Step(s): 001

Work Instructions

MATERIALS

- Obtain replacement parts from Parts List as required per AP 24E-001.
- Maintain material control in accordance with AP 24E-001.

WORK INSTRUCTIONS

1 Any of the Main Chain grease zerk fittings that are damaged **during** the performance of this activity may be replaced with new.

A work request should be initiated if grease fittings **are found** broken during the performance, however, this work order may be revised to replace those fittings found broken (the WR number should be referenced on the Revision Sheet and the new WR should note that the zerk was replaced under the PM). Document the inspection results:

none found broken

2 **1SW001FA:**

2.1 Perform work in accordance with procedure MPM SW-001 **excluding** procedure step 7.9 (Gear Reducer Oil Change).

Init/Date: Qal 2-16-07

3 **1SW001FB:**

3.1 Perform work in accordance with procedure MPM SW-001 **excluding** procedure step 7.9 (Gear Reducer Oil Change).

Init/Date: Qal 2-16-07

4 **1SW001FC:**

4.1 Perform work in accordance with procedure MPM SW-001 **excluding** procedure step 7.9 (Gear Reducer Oil Change).

Init/Date: Qal 2-16-07

Work Order:
PM File: 30384

Step(s): 001

Work Instructions

5 **1SW001FD:**

5.1 Perform work in accordance with procedure MPM SW-001 **excluding** procedure step 7.9 (Gear Reducer Oil Change).

[illegible] / 2-16-07
Init/Date

6 **1SW001FE:**

6.1 Perform work in accordance with procedure MPM SW-001 **excluding** procedure step 7.9 (Gear Reducer Oil Change).

[illegible] / 2-16-07
Init/Date

7 **1SW001FF:**

7.1 Perform work in accordance with procedure MPM SW-001 **excluding** procedure step 7.9 (Gear Reducer Oil Change).

[illegible] / 2-16-07
Init/Date

ATTACHMENT A
(Page 1 of 6)
PROCEDURE SIGN-OFF SHEET CWSH

Component No. **1SW001FA**
K08-001 Work Order No. 06-290038-000

Procedure Step	**Operation**	**Verify/Accept Initials/Date**
7.2	Visual Inspections	DW 12-16-07
7.3	Trough and holding basket	DW 12-16-07
7.4	Carrying Chain gap	DW 12-16-07
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	DW 12-16-07
7.7.1	Inspect Drive Chain	DW 12-16-07
7.7.2	Drive chain adjusted	N/A
7.7.4	Check Drive Chain Sump Oil Level sat. Amount Used	DW 12-16-07
7.8	Lubrication Complete	DW 12-16-07
7.9	Gear Reducing Oil changed	N/A
8.4	Installed Normal Shear Pin	N/A
8.6	Notified SM of completion	DW 12-16-07

Remarks: none

Maintenance Activity Complete: [signature] / 2-16-07
Performer's Signature — Date

Maintenance Activity Completed Satisfactorily: [signature] / 2/19/07
Supervisor's Signature — Date

IMAGED 0320 ... 0 2 0 0 7

ATTACHMENT A
(Page 2 of 6)
PROCEDURE SIGN-OFF SHEET CWSH

Component No. 1SW001FB
K08-001 Work Order No. 06-280030-000

Procedure Step	Operation	Verify/Accept Initials/Date
7.2	Visual Inspections	QW/2-16-07
7.3	Trough and holding basket	QW/2-16-07
7.4	Carrying Chain gap	QW/2-16-07
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	QW 2-16-07
7.7.1	Inspect Drive Chain	QW/2-16-07
7.7.2	Drive chain adjusted	N/A
7.7.4	Check Drive Chain Sump Oil Level Sat. Amount Used	QW/2-16-07
7.8	Lubrication Complete	QW 2-16-07
7.9	Gear Reducing Oil changed	N/A
8.4	Installed Normal Shear Pin	N/A
8.6	Notified SM of completion	QW/2-16-07

Remarks: None

Maintenance Activity Complete: [signature] / 2-16-07
Performer's Signature Date

Maintenance Activity Completed Satisfactorily: [signature] / 2/19/07
Supervisor's Signature Date

ATTACHMENT A
(Page 3 of 6)
PROCEDURE SIGN-OFF SHEET CWSH

Component No. **1SW001FC**

K08-001 Work Order No. 06-29030-000

Procedure Step	**Operation**	**Verify/Accept Initials/Date**
7.2	Visual Inspections	DW 12-16-07
7.3	Trough and holding basket	DW 12-16-07
7.4	Carrying Chain gap	DW 12-16-07
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	DW 12-16-07
7.7.1	Inspect Drive Chain	DW 12-16-07
7.7.2	Drive chain adjusted	N/A
7.7.4	Check Drive Chain Sump Oil	DW 12-16-07
	Level Sat Amount Used	
7.8	Lubrication Complete	DW 12-16-07
7.9	Gear Reducing Oil changed	N/A
8.4	Installed Normal Shear Pin	N/A
8.6	Notified SM of completion	DW 12-16-07

Remarks: None

Maintenance Activity Complete: [signature] / 12-16-07
Performer's Signature Date

Maintenance Activity Completed Satisfactorily: [signature] / 12/19/07
Supervisor's Signature Date

ATTACHMENT A
(Page 4 of 6)
PROCEDURE SIGN-OFF SHEET CWSH

Component No. 1SW001FD

K08-001 Work Order No. 06-290030-000

Procedure Step	Operation	Verify/Accept Initials/Date
7.2	Visual Inspections	DM 12-16-07
7.3	Trough and holding basket	DM 12-16-07
7.4	Carrying Chain gap	DM 12-16-07
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	DM 12-16-07
7.7.1	Inspect Drive Chain	DM 12-16-07
7.7.2	Drive chain adjusted	N/A
7.7.4	Check Drive Chain Sump Oil	DM 12-16-07
	Level Set Amount Used	
7.8	Lubrication Complete	DM 12-16-07
7.9	Gear Reducing Oil changed	N/A
8.4	Installed Normal Shear Pin	N/A
8.6	Notified SM of completion	DM 12-16-07

Remarks: None

Maintenance Activity Complete: [signature] / 12-16-07
Performer's Signature Date

Maintenance Activity Completed Satisfactorily: [signature] / 12/19/07
Supervisor's Signature Date

ATTACHMENT A
(Page 5 of 6)
PROCEDURE SIGN-OFF SHEET CWSH

Component No. 1SW001FE
K08-001 Work Order No. 06-290830-00

Procedure Step	Operation	Verify/Accept Initials/Date
7.2	Visual Inspections	DM/2-16-07
7.3	Trough and holding basket	DM/2-16-07
7.4	Carrying Chain gap	DM/2-16-07
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	DM 2-16-07
7.7.1	Inspect Drive Chain	DM 2-16-07
7.7.2	Drive chain adjusted	NA
7.7.4	Check Drive Chain Sump Oil Level Sat Amount Used	DM 2-16-07
7.8	Lubrication Complete	DM 2-16-07
7.9	Gear Reducing Oil changed	N/A
8.4	Installed Normal Shear Pin	N/A
8.6	Notified SM of completion	DM 2-16-07

Remarks: None

Maintenance Activity Complete: [signature] 2-16-07
Performer's Signature Date

Maintenance Activity Completed Satisfactorily: [signature] 2/19/07
Supervisor's Signature Date

ATTACHMENT A
(Page 6 of 6)
PROCEDURE SIGN-OFF SHEET CWSH

Component No. 1SW001FF

K08-001 Work Order No. 06-290830-000

Procedure Step	Operation	Verify/Accept Initials/Date
7.2	Visual Inspections	QM 2-16-07
7.3	Trough and holding basket	QM 2-16-07
7.4	Carrying Chain gap	QM 2-16-07
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	QM 2-16-07
7.7.1	Inspect Drive Chain	QM 2-16-07
7.7.2	Drive chain adjusted	N/A
7.7.4	Check Drive Chain Sump Oil Level Sat Amount Used	QM 2-16-07
7.8	Lubrication Complete	QM 2-16-07
7.9	Gear Reducing Oil changed	~~QM~~ NA
8.4	Installed Normal Shear Pin	N/A
8.6	Notified SM of completion	QM 2-16-07

Remarks: None

Maintenance Activity Complete: [signature] / 2-16-07
Performer's Signature Date

Maintenance Activity Completed Satisfactorily: [signature] / 2/19/07
Supervisor's Signature Date

- END -

6

Work Order: Step(s): 001
PM File: 30384

Work Instructions

SCOPE

- **Description of work:** CWSH Traveling Screen Cleaning, Inspection, and Lubrication.
- **Equipment Name**: 1SW001FA, 1SW001FB, 1SW001FC, 1SW001FD, 1SW001FE, 1SW001FF
- **Equipment Description:** CWSH Screens
- **Equipment Location:** Circulating Water Screen House

GENERAL NOTES

- Steps in the work instructions may be performed out of sequence at the discretion of the Worker provided that the intent of the instructions is met.
- If work instructions provided for multiple work activities, which are contingent upon the condition of the equipment, N/A all instructions which are not required.
- Steps within the instructions may be re-performed (in lieu of re-performing the entire instructions). Maintain documentation by resigning next to the original work step and/or adding a note in the Historical Summary/Comments Section.
- The guideline of AP 12-003, FME shall be adhered to during this work activity.
- Procedure step 7.9 (Gear Reducer Oil Change) **will not** be performed at this maintenance interval **unless** the oil is obviously seriously contaminated.
- PMT Comments: No Post Maintenance Testing is required – The components are in operation during the performed work.
- References: A-3818-05

PREREQUISITES

- Workman to contact the building watch prior to starting work for all work activities.

____/____
Init/Date

MATERIALS

- Obtain replacement parts from Parts List as required per AP 24E-001.
- Maintain material control in accordance with AP 24E-001.

WORK INSTRUCTIONS

1 Any of the Main Chain grease zerk fittings that are damaged **during** the performance of this activity may be replaced with new.

A work request should be initiated if grease fittings **are found** broken during the performance, however, this work order may be revised to replace those fittings found broken (the WR number should be referenced on the Revision Sheet and the new WR should note that the zerk was replaced under the PM). Document the inspection results:

____

____

2 1SW001FA:

2.1 Perform work in accordance with procedure MPM SW-001 **excluding** procedure step 7.9 (Gear Reducer Oil Change). ____/____ Init/Date

3 1SW001FB:

3.1 Perform work in accordance with procedure MPM SW-001 **excluding** procedure step 7.9 (Gear Reducer Oil Change). ____/____ Init/Date

4 1SW001FC:

4.1 Perform work in accordance with procedure MPM SW-001 **excluding** procedure step 7.9 (Gear Reducer Oil Change). ____/____ Init/Date

5 1SW001FD:

5.1 Perform work in accordance with procedure MPM SW-001 **excluding** procedure step 7.9 (Gear Reducer Oil Change).

____/____
Init/Date

6 1SW001FE:

6.1 Perform work in accordance with procedure MPM SW-001 **excluding** procedure step 7.9 (Gear Reducer Oil Change).

____/____
Init/Date

7 1SW001FF:

7.1 Perform work in accordance with procedure MPM SW-001 **excluding** procedure step 7.9 (Gear Reducer Oil Change).

____/____
Init/Date

6

Work Order:
PM File: 30382

Step(s): 01

Work Instructions

1 SCOPE

1.1.1 Description of work: OIL SAMPLE OF GEAR REDUCERS

1.1.2 Equipment Name: 1SW001FA, 1SW001FB, 1SW001FC, 1SW001FD, 1SW001FE & 1SW001FF

1.1.3 Equipment Description: CWSH TRAVELING SCREEN GEAR REDUCERS

1.1.4 Equipment Location: CWSH

1.2 GENERAL NOTES

1.2.1 Steps within the instructions may be re-performed (in-lieu of re-performing the entire instructions) adequate documentation may be maintained by resigning next to the original work step and/or adding a note in the Historical Summary/Comments Section.

1.2.2 Gear reducer lubricant will be changed based on the lubricant sample

1.3 WORKING DOCUMENTS

1.3.1 MPM OS-001

1.4 PREREQUISITES

1.4.1 Workman to notify Site Watch prior to start of work.

____/____
Init/Date

1.4.2 Responsible Work Group Supervisor or designee shall conduct a pre-job briefing prior to beginning of work

1.5 MATERIALS

1.5.1 Obtain replacement parts from Parts Page/Bill of Material as required per AP 24E-001.

1.6 WORK INSTRUCTIONS

CAUTION
Gear box plugs must be reinstalled back to their proper location. (Vent plugs versus non vent plugs.)

1.6.1 Obtain an oil sample of the gear reducer in accordance with MPM OS-001 for each equipment listed and replenish oil as needed.

1.6.1.1 1SW001FA______ ____/____ Init/Date

1.6.1.2 1SW001FB______ ____/____ Init/Date

1.6.1.3 1SW001FC______ ____/____ Init/Date

1.6.1.4 1SW001FD______ ____/____ Init/Date

1.6.1.5 1SW001FE______ ____/____ Init/Date

1.6.1.6 1SW001FF______ ____/____ Init/Date

6

I M A G E D 10/25/2006

APF 16C-006-02 Rev 0

WOLF CREEK NUCLEAR OPERATING CORPORATION

WO # 06-285439-000

Date Reqrd	: 10/23/2006	**Late Date**	: 01/22/2007
Action Code	: PM PREVENTIVE MAINTENANCE	**Mode Restraint**	: 7 - NO MODE RESTR
PM File #	: 30382 **CCD:** B	**Date Generated**	: 10/23/2006
Requester/Ext	: HOLMAN, EDWARD C / 4695	**Priority**	: 4P30

Asset : 1SW001FA
Asset Desc : CWSH TRAVELING SCREEN
System : SW **Asset Safety Class** : NS
Asset Location : Z019B TRAVELING WATER SCREEN ENCLOSURE

Associated Assets
1SW001FB
1SW001FC
1SW001FD
1SW001FE
1SW001FF

EQ Harsh :

Governing Code: N/A **Code Class:** N/A **Program:** N/A **R/R Plan** : N/A

Work Description : **Work Safety Class** : NS

Wallace CWSH TRAVELING SCREEN GEARS REDUCERS OIL SAMPLES. MECHANICAL MAINTENANCE SUPERVISION AND OPERATIONS PERSONNEL HAVE DETERMINED THAT A CLEARANCE ORDER IS NOT REQUIRED FOR THIS WORK ACTIVITY. 1SW001FA 01000

Assigned Planner : WALLACE, ROGER E

Equipment Operable Re-Evaluation
Equipment Operable(Y/N) N/A
Ref: ____
Time Limit: ____

Permission To Start:
[signature] / 10-23-06
____ / ____

[initials]

I M A G E D 10/25/2006

WOLF CREEK NUCLEAR OPERATING CORPORATION

WO # 06-285439-000

Step : 1 **Craft :** MEC **Crew :** **Persons :** 2 **Est Hrs :** 4.00

Permit Section

LOCAL CONTROL LCD16-D16-0006

Work Instructions

CWSH TRAVELING SCREENS GEAR REDUCERS OIL SAMPLES.

Perform work in accordance with the attached instruction.

Parts List

Description	Matcode	Lot#	Qty Reqd	Qty Used	Verify By
LUBRICANT, OIL, MOBILGEAR 629, 400 LB DRUM	SR51500006	NA	0.00	0	JMS/10-24-06
SEALANT, PIPE THREAD, LOW HALOGEN CONTENT, 1.69 OZ TUBE, NEOLUBE 100, USE SHALL NOT EXCEED 300 DEG F	NS51601000	NA	0.00	0	JMS/10-24-06

Notes: 0000 ASREQ (first item)

SIR # NA

Notes: 0000 ASREQ (second item)

SIR # NA

I M A G E D 10/25/2006

WOLF CREEK NUCLEAR OPERATING CORPORATION

WO # 06-285439-000

M&TE No.	Cal Due Date	Range/Scale	M&TE No.	Cal Due Date	Range/Scale
N/A	N/A	N/A	N/A	N/A	N/A

As Found Condition:
Sat.

Cause of Failure
N/A

Work Summary
Collected oil samples from gear reducers on CW Traveling Screens. AH. 10-24-06

IMAGED 10/25/2006

WOLF CREEK NUCLEAR OPERATING CORPORATION

WO # 06-285439-000

Worker(s) Sig/Date: John M Shaner / 10-24-06

ARHaufman /

A. Lucas /

V. Arb. /

Work Completion Date: 10-24-06 **Field Work Hrs:** 4 Mech. 2hrs.

Shift Supervisor Notified: Oar 10-23-06

Work Group Supervisor : 10-24-06

Feedback

Repetitive Work Codes (pick 1): O **PM-1** - Like New ✓ **PM-2** - Satisfactory

O **PM-3** - Degraded O **PM-4** - Failed O **N** - Not Applicable

Work Order Planning (pick 1): ✓ 1 - No Issues

O 2 - Clarification Required

O 3 - Enhancements Suggested

O 4 - Changes Required to Complete the Work

Advance Tool Request (pick 1):

O 1 - Tool Request Missing NA

O 2 - Tool Request Incomplete or Incorrect

O 3 - Tool List Complete and Accurate

Tools Staged as Expected (pick 1): O Yes

O No

✓ N/A

WOLF CREEK NUCLEAR OPERATING CORPORATION

WO # 06-285439-000

Notes

Subject: PM Basis Update **Entered By:** LEVAUGH **Date:** 06/01/2006

The purpose of this time-directed task is to prevent traveling screen or motor failure due to inadequate lubrication and subsequent bearing seizure.

Task scope and frequency is based on site operating experience and manufacturer instruction manual recommendations. Previous work history supports retaining this task at the current frequency assignment.

Subject: UPDATED BY COPY UTILITY/060601 **Entered By:** LEVAUGH **Date:** 06/01/2006

This WO was updated using the Copy Utility on 06/01/06.

The originating WO was 02-238477-000.

Subject: PRINTED CCD A **Entered By:** TERICE **Date:** 09/30/2006

Filed in CPC Refuel 15 files.

Subject: To SE **Entered By:** JEBENHA **Date:** 10/22/2006

For pre-approval to work dayshift 10/23/06

Subject: Released (not approved) **Entered By:** TERICE **Date:** 10/23/2006

To Craft. Scheduled for 10-23-06 dayshift.

Subject: PRINTED CCD B **Entered By:** KALOUIA **Date:** 10/23/2006

IMAGED 10/25/2006

WOLF CREEK NUCLEAR OPERATING CORPORATION

WO # 06-285439-000

Tool List

Tool Description	Request Number	Tool No	Qty	Tool Room	Row/Bin
TOWELS, PAPER {P28}	2580	T07920	20	MAIN_TOOL_ROOM	M150B02
WRENCH, ADJUSTABLE, CRESCENT 12"	2580	T05397	1	MAIN_TOOL_ROOM	M050F10
BOTTLE, OIL SAMPLE, PLASTIC	2580	T02035	6	MAIN_TOOL_ROOM	M040A03
LADDER, STEP, 8 FT.	2580	T04393	1	MAIN_TOOL_ROOM	MIGRATED

*** * * End of Report (96150) * * ***

IMAGED 10/25/2006

Work Order:
PM File: 30382

Step(s): 01

Work Instructions

1 SCOPE

1.1.1 Description of work: OIL SAMPLE OF GEAR REDUCERS

1.1.2 Equipment Name: 1SW001FA, 1SW001FB, 1SW001FC, 1SW001FD, 1SW001FE & 1SW001FF

1.1.3 Equipment Description: CWSH TRAVELING SCREEN GEAR REDUCERS

1.1.4 Equipment Location: CWSH

1.2 GENERAL NOTES

1.2.1 Steps within the instructions may be re-performed (in-lieu of re-performing the entire instructions) adequate documentation may be maintained by resigning next to the original work step and/or adding a note in the Historical Summary/Comments Section.

1.2.2 Gear reducer lubricant will be changed based on the lubricant sample

1.3 WORKING DOCUMENTS

1.3.1 MPM OS-001

1.4 PREREQUISITES

1.4.1 Workman to notify Site Watch prior to start of work.

APL / 10-24-06
Init/Date

1.4.2 Responsible Work Group Supervisor or designee shall conduct a pre-job briefing prior to beginning of work

1.5 MATERIALS

1.5.1 Obtain replacement parts from Parts Page/Bill of Material as required per AP 24E-001.

Work Order:
PM File: 30382

Step(s): 01

Work Instructions

1.6 **WORK INSTRUCTIONS**

CAUTION
Gear box plugs must be reinstalled back to their proper location. (Vent plugs versus non vent plugs.)

1.6.1 Obtain an oil sample of the gear reducer in accordance with MPM OS-001 for each equipment listed and replenish oil as needed.

1.6.1.1 1SW001FA ✓ — ARN / 10-24-06 Init/Date

1.6.1.2 1SW001FB ✓ — ARN / 10-24-06 Init/Date

1.6.1.3 1SW001FC ✓ — ARN / 10-24-06 Init/Date

1.6.1.4 1SW001FD ✓ — ARN / 10-24-06 Init/Date

1.6.1.5 1SW001FE ✓ — ARN / 10-24-06 Init/Date

1.6.1.6 1SW001FF ✓ — ARN / 10-24-06 Init/Date

PROCEDURE SIGN-OFF SHEET FOR MPM OS-001

MPMF OS-001-01 REV. 1

Work Document No. 06-285437.000 Equipment No. 1SW001FA

PROCEDURE STEP	OPERATION	INITIAL/DATE
6.7	Lubricant Type Identified Location: ________ (where used on equipment) oil Type: Mobil Gear 629	ARN/10-24-06
6.9	Prerequisites satisfied	ARN./10-24-06
7.1.1-3.a.	If required, valve CLOSED (Drain Method)	NA
7.1.1-4.	Oil Plug re-installed (Drain Method)	NA
7.1.1-7.	Bottle(s) labeled	ARN/10-24-06
7.2.3	Oil Plug re-installed (If lubricant replaced)	NA
7.2.4	Verify lubricant (If lubricant added) Verified:	NA /
7.2.5	Oil fill equipment is clean	/
7.2.6-2/7.2.13	Quantity of Oil Added: NA	/
7.2.6-5/7.2.15	Oil Addition Complete	/
8.2.1	Sample Location Top Vent Verified:	ARN/10-24-06 JMS/10-24-06
8.2.2	Sample Valve Restored & Number NA Verified:	NA NA
8.2.3	Sample Connection(s) re-installed	ARN/10-24-06
8.5	Restoration complete	ARN./10-24-06

Remarks: ________________________________

Maintenance Activity Complete ARHalfman / 10-24-06

Performer's Signature Date

Activity Satisfactorily Completed [signature] / 10-24-06

Supervisor's Signature Date

PROCEDURE SIGN-OFF SHEET FOR MPM OS-001

MPMF OS-001-01 REV. 1 Page 1 of 1

Work Document No. 06-285439-000 Equipment No. 1SW001FB

PROCEDURE STEP	OPERATION	INITIAL/DATE
6.7	Lubricant Type Identified Location: Resv. (where used on equipment) oil Type: Mobil Gear 629	ARN/ 10-24-06
6.9	Prerequisites satisfied	ARN/ 10-24-06
7.1.1-3.a.	If required, valve CLOSED (Drain Method)	NA
7.1.1-4.	Oil Plug re-installed (Drain Method)	NA
7.1.1-7.	Bottle(s) labeled	ARN/ 10-24-06
7.2.3	Oil Plug re-installed (If lubricant replaced)	NA
7.2.4	Verify lubricant (If lubricant added) Verified:	NA /
7.2.5	Oil fill equipment is clean	/
7.2.6-2/7.2.13	Quantity of Oil Added: NA	/
7.2.6-5/7.2.15	Oil Addition Complete	/
8.2.1	Sample Location Top Vent Verified:	ARN/ 10-24-06 JMS/ 10-24-06
8.2.2	Sample Valve Restored & Number NA Verified:	NA NA
8.2.3	Sample Connection(s) re-installed	ARN/ 10-24-06
8.5	Restoration complete	ARN/ 10-24-06

Remarks: __________

Maintenance Activity Complete [signature] / 10-24-06

Performer's Signature Date

Activity Satisfactorily Completed [signature] / 10-24-06

Supervisor's Signature Date

IMAGED 10/25/2006

PROCEDURE SIGN-OFF SHEET FOR MPM OS-001

MPMF OS-001-01 REV. 1 Page 1 of 1
Work Document No. 06-285439-000 Equipment No. 15W001FC

PROCEDURE STEP	OPERATION	INITIAL/DATE
6.7	Lubricant Type Identified Location: Resv (where used on equipment) oil Type: Mobil Gear 629	ARN/ 10-24-06
6.9	Prerequisites satisfied	ARN/10-24-06
7.1.1-3.a.	If required, valve CLOSED (Drain Method)	NA
7.1.1-4.	Oil Plug re-installed (Drain Method)	NA
7.1.1-7.	Bottle(s) labeled	ARN/10-24-06
7.2.3	Oil Plug re-installed (If lubricant replaced)	NA
7.2.4	Verify lubricant (If lubricant added) Verified:	~~NA~~ N/A ARN. NA
7.2.5	Oil fill equipment is clean	/
7.2.6-2/7.2.13	Quantity of Oil Added: NA	/
7.2.6-5/7.2.15	Oil Addition Complete	/
8.2.1	Sample Location Top Vent Verified:	ARN/10-24-06 JMS/10-24-06
8.2.2	Sample Valve Restored & Number NA Verified:	NA NA
8.2.3	Sample Connection(s) re-installed	ARN/10-24-06
8.5	Restoration complete	ARN/10-24-06

Remarks: ______

Maintenance Activity Complete ARHalfmann / 10-24-06
Performer's Signature Date

Activity Satisfactorily Completed [signature] / 10-24-06
Supervisor's Signature Date

IMAGED 10/25/2006

PROCEDURE SIGN-OFF SHEET FOR MPM OS-001

MPMF OS-001-01 REV. 1 Page 1 of 1

Work Document No. 06-285439-000 Equipment No. 1SW001FD

PROCEDURE STEP	OPERATION	INITIAL/DATE
6.7	Lubricant Type Identified Location: Resv (where used on equipment) oil Type: Mobil Gear 629	ARH 10-24-06
6.9	Prerequisites satisfied	ARH / 10-24-06
7.1.1-3.a.	If required, valve CLOSED (Drain Method)	NA
7.1.1-4.	Oil Plug re-installed (Drain Method)	NA
7.1.1-7.	Bottle(s) labeled	ARH / 10-24-06
7.2.3	Oil Plug re-installed (If lubricant replaced)	NA
7.2.4	Verify lubricant (If lubricant added) Verified:	/ /
7.2.5	Oil fill equipment is clean	/
7.2.6-2/7.2.13	Quantity of Oil Added: NA	/
7.2.6-5/7.2.15	Oil Addition Complete	/
8.2.1	Sample Location Vent Plug Verified:	ARH / 10-24-06 JMS / 10-24-06
8.2.2	Sample Valve Restored & Number NA Verified:	NA NA
8.2.3	Sample Connection(s) re-installed	ARH / 10-24-06
8.5	Restoration complete	ARH / 10-24-06

Remarks: ______

Maintenance Activity Complete A R Hoffman / 10-24-06

Performer's Signature Date

Activity Satisfactorily Completed [signature] / 10-24-06

Supervisor's Signature Date

I M A G E D 10/25/2006

PROCEDURE SIGN-OFF SHEET FOR MPM OS-001

MPMF OS-001-01 REV. 1

Work Document No. 06-285439-000 Equipment No. $SW001FE

PROCEDURE STEP	OPERATION	INITIAL/DATE
6.7	Lubricant Type Identified Location: Resu (where used on equipment) oil Type: MobilGear 629	ARH/10-24-06
6.9	Prerequisites satisfied	ARH/10-24-06
7.1.1-3.a.	If required, valve CLOSED (Drain Method)	NA
7.1.1-4.	Oil Plug re-installed (Drain Method)	NA
7.1.1-7.	Bottle(s) labeled	ARH/10-24-06
7.2.3	Oil Plug re-installed (If lubricant replaced)	NA
7.2.4	Verify lubricant (If lubricant added) Verified:	/ /
7.2.5	Oil fill equipment is clean	/
7.2.6-2/7.2.13	Quantity of Oil Added: NA	/
7.2.6-5/7.2.15	Oil Addition Complete	/
8.2.1	Sample Location Vent plug Verified:	ARH/10-24-06 JMS / 10-24-06
8.2.2	Sample Valve Restored & Number NA Verified:	NA NA
8.2.3	Sample Connection(s) re-installed	ARH/10-24-06
8.5	Restoration complete	ARH/10-24-06

Remarks: ____________________

Maintenance Activity Complete A R Halfman 10-24-06

Performer's Signature Date

Activity Satisfactorily Completed [signature] 10-24-06

Supervisor's Signature Date

IMAGED 10/25/2006

PROCEDURE SIGN-OFF SHEET FOR MPM OS-001

MPMF OS-001-01 REV. 1 Page 1 of 1

Work Document No. 06-285439-000 Equipment No. 1SW001FF

PROCEDURE STEP	OPERATION	INITIAL/DATE
6.7	Lubricant Type Identified Location: Resu (where used on equipment) oil Type: Mobil Gear 629	ARH / 10-24-06
6.9	Prerequisites satisfied	ARH / 10-24-06
7.1.1-3.a.	If required, valve CLOSED (Drain Method)	NA
7.1.1-4.	Oil Plug re-installed (Drain Method)	/
7.1.1-7.	Bottle(s) labeled	ARH / 10-24-06
7.2.3	Oil Plug re-installed (If lubricant replaced)	NA
7.2.4	Verify lubricant (If lubricant added) Verified:	/ /
7.2.5	Oil fill equipment is clean	/
7.2.6-2/7.2.13	Quantity of Oil Added: NA	/
7.2.6-5/7.2.15	Oil Addition Complete	/
8.2.1	Sample Location Resu Vent hole Verified:	ARH / 10-24-06 JMS / 10-24-06
8.2.2	Sample Valve Restored & Number NA Verified:	NA NA
8.2.3	Sample Connection(s) re-installed	ARH / 10-24-06
8.5	Restoration complete	ARH / 10-24-06

Remarks: ______________________________

Maintenance Activity Complete ARHalfman / 10-24-06

Performer's Signature Date

Activity Satisfactorily Completed [signature] / 10-24-06

Supervisor's Signature Date

1 PURPOSE/SCOPE

1.1 KELLY CLAIR, ext. 4646, has primary responsibility for the planning of this Work Package Task.

1.2 SUPERINTENDENT MECHANICAL MAINTENANCE will have primary responsibility for implementing this Work Package Task.

1.3 This Work Package Task includes PREVENTIVE MAINTENANCE work on the following item:

Component: **1SW001FA**

CID Description: CWSH TRAVELING SCREEN

CID Safety Class: NS CID EQ Harsh:

CID BLA or Room: CID LLRT: N

1.4 Description of the work to be performed under this Work Package Task.

1SW001FA TRAVELING SCREEN REPLACEMENT

1.5 If the work is governed by the ASME Section XI Repair and Replacement Program or the R Program for Boiler Repairs/Alterations, list the following information:

Governing Code	n/a .
Code Class	n/a .
Program	n/a .
R/R Plan	n/a .

1.6 The Mode Restraint for this Work Package Task is 7.

1.7 The Safety Classification for this Work Package Task is NS.

1.8 This Work Package Task IS NOT associated with project .

1.9 This Work Package Task IS NOT associated with a Nonconformance Report.

2 REFERENCES

2.1 This provides a listing of Reference and Working documents used for development and/or performance of the work associated with this Work Package Task.

2.2 Working Documents

Document Number	Rev	Sheet	UD
MPM SW-001	~~3~~ 4	1	Y
MGM M00C-04	~~6~~ 7	1	Y
APF 24E-001-01	n/a	1	n/a
APF 12-003-01	n/a	1	n/a
MPM OS-001	n/a	1	n/a

2.3 Reference Documents

Document Number	Rev	Sheet	UD
A-3818-05	W01	n/a	N
SYS SW-121 ITSC 97-0699	~~8~~ 12	n/a	Y
MGM MOOP-08	n/a	n/a	N
AP 12-003	n/a	n/a	Y

3 SPECIAL EQUIPMENT, MATERIALS AND PARTS

3.1 Bill of Materials (BOM)

Refer To Attachment

4 PREREQUISITES

4.1 Work Permits/Requests

Type	Permit Number
CLEARANCE ORDER PERMIT REQUIRED	980245SW

4.2 Pre Work Reviews

4.2.1 Electronic Reviews

n/a

4.2.2 ANII/ANI/AI N/A
Sig/Date

4.3 Equipment Operable Re-Evaluation

4.3.1 Equipment Operable (Y/N) N/A

4.3.2 Ref. ______

4.3.3 Time Limit ______

4.4 Permission to Start (SS or CWA) / 3/16/98
[Start Date, if permission not req'd] Sig Date

5 WORK INSTRUCTIONS

5.1 SCOPE

5.1.1 **Description of work:** The following instructions are provided to perform the removal and installation of the circulating water traveling screen 1SW001FA,

5.1.2 **Equipment Name:** 1SW001FA

5.1.3 **Equipment Description:** CWSH Traveling Screen "A"

5.1.4 **Equipment Location:** CWSH, Far west screen

5.2 GENERAL NOTES

5.2.1 Steps in the work instructions may be performed out of sequence at the discretion of the Worker provided that the intent of the instructions are met and no QC hold points are by-passed.

5.2.2 If work instructions provided for multiple work activities, which are contingent upon the condition of the equipment, N/A all instructions which are not required to be performed.

5.2.3 Steps within the instructions may be reperformed (in-lieu of reperforming the entire instructions) adequate documentation may be maintained by resigning next to the original work step and/or adding a note in the Historical Summary/Comments Section.

5.2.4 Related tasks are as follows:

Task 2 is Electrical PMT
Task 3 is Mechanical PMT
Task 4 is Operations PMT
Task 5 is to install and remove stop logs
Task 6 is to determ and reterm miscellaneous electrical components
Task 7 is to remove and install the roof and roof beams
Task 8 is to re-assemble the traveling screen
Task 9 is for welding support

5.2.5 There is no known welding at this time. If none is performed, task 9 will be deleted or closed.

5.3 PREREQUISITES

5.3.1 Workman to contact the building watch prior to starting work for all power block work activities. RD 3/6/98 Init/Date

5.4 **MATERIALS**

5.4.1 Obtain replacement parts from Bill of Material as required per AP 24E-001. Some of the parts may be duplicate with task 8 and already pulled from stores.

5.5 **DISASSEMBLY**

5.5.1 Remove the roof panels per task 7. RD 3/20/98 Init/Date

5.5.2 Install stop logs per task 5. RD 3/20/98 Init/Date

5.5.3 Coordinate with electrical maintenance to determinate all electrical connections necessary for screen removal per task 6. RD 3/16/98 Init/Date

5.5.4 Remove the fiberglass housing as needed to gain access to screens. RD 3/20/98 Init/Date

5.5.5 Remove the motor guard and fan then install the temporary drive fixture to the motor shaft to rotate the screens. N/A* Init/Date

> **CAUTION**
>
> • Removing too many screens on one side could cause the basket chain to free wheel due to the weight difference.

5.5.6 Remove the screen baskets a few (2 or 4) at a time then rotating the screen so the removal is symmetric, until they are all removed from the chain. * N/A Init/Date

5.5.7 Drain the oil from the chain guard then remove the guard, chain, motor and gearbox. RD 3/18/98 Init/Date

5.5.8 Disconnect the spray piping system at the flange connection and remove all miscellaneous items obstructing the lift; ladders, braces, brackets, etc. RD 3/18/98 Init/Date

5.5.9 To assure the screen isn't wedged, use jacks to break the screen free using the pads on each side of the screen. RD 3/24/98 Init/Date

5.5.10 Remove screen from the screen bay. The screen, without baskets will weigh approximately 23,000 lbs. The baskets weigh approximately 100 lbs each (41 baskets/screen). Reference CNT MC-660 for rigging/lifting. RD 3/24/98 Init/Date

5.6 INSPECTIONS

5.6.1 At this point divers can perform an inspection of the guide channels and the bottom of the bay. Historically, debris gathers in the area that would be under the belly pan, preventing the screen from setting completely in the hole. The debris is usually grout material. RD 3/24/98 Init/Date

* Screen will be pulled with the ~~screens~~ BASKETS attached RD 3/19/98
BASKETS will be removed during screen disassembly.

5.7 **REASSEMBLY**

NOTE

- Task 8 will be used to perform pre-assembly of the new screen. Some of the work performed on this task may need to be performed in conjunction with this task.

5.7.1 Set the assembled screen in place. Diver support may be required. The screen, without baskets will weigh approximately 23,000 lbs. The baskets weigh approximately 100 lbs each (41 baskets/screen). Reference CNT MC-660 for rigging/lifting.

RD 3/24/98
Init/Date

5.7.2 Finish assembly of the new screen referencing Technical Manual A-3818-05. Torque all bolting referencing A-3818-05 if needed. Task 8 will assemble the Boot Section, two Intermediate Sections, Upper Intermediate Section, Head Section and basket chain. This should be all the assembly needed to install.

RD 3/24/98
Init/Date

Measurement and Test Equipment

WC NO		Cal Due Date		Date Used		Range Used	
WC NO		Cal Due Date		Date Used		Range Used	
WC NO		Cal Due Date		Date Used		Range Used	
WC NO		Cal Due Date		Date Used		Range Used	

5.7.3 Install the new screen in the screen bay. RD 3/24/98
Init/Date

5.7.4 Install the motor, gearbox and drive chain. RD 3/24/98
Init/Date

5.7.5 Install the chain guard and refill the with oil per MPM OS-001. RD 3/24/98
Init/Date

5.7.6 Align gearbox and motor per MGM-MOOC-04. *N/A
Init/Date

*Gearbox & Motor are one unit RD 3/24/98

5.7.7 Reinstall the screens baskets a few at a time using the special fixture to rotate the screen. N/A*

Init/Date

CAUTION

- Care shall be used when reinstalling baskets to maintain a balanced weight on each side of the basket chain.

5.7.8 Reconnect the spray wash piping using new gaskets and torque bolting referencing MGM-MOOP-08. RO 3/25/98

Init/Date

Measurement and Test Equipment

WC NO N/A ~~Cal Due Date~~ Date Used ____ Range Used ____

5.7.9 AFTER the baskets have been installed on the screen, the stop logs can be removed on task 5. RO 3/25/98

Init/Date

5.7.10 After all material that needs to go through the roof by use of the crane is in the screen house, install the roof beams and panel on task 7. RO 3/25/98

Init/Date

5.7.11 Coordinate with electrical maintenance to re-terminate all electrical connections on task 6. RO 3/18/98

Init/Date

5.7.12 Reinstall and assemble all misc. items remove during disassembly, ladders, brackets, splash guards, etc. RO 3/26/98

Init/Date

5.7.13 Perform procedure MPM SW-001 on the assembled screen to perform final inspection, lubricate and adjust the screen. Preventive Maintenance Work Package 126467 is open and scheduled. Work Package 126467 can be performed on the screen instead of performing this step. Record below the option taken.

Performed MPM SW-001 RO 3/26/98

Init/Date

* ~~Screens w~~ RO Baskets were 3/18/98 installed on task 8. RO 3/18/98

5.7.14 Remove the special adapter from the motor then reinstall the fan and guard. RCD 3/27/98
Init/Date

6 **RESTORATION**

6.1 Describe the cause of the problem

Screen Replacement.

6.2 Work Completion

6.2.1 Field Work Hours 5 ME - 40 hrs.

6.2.2 Worker(s) Donnelly, Shannon, Houston, Topper, SPARKS 3/27/98
Sig/Date

6.2.3 Date Work Complete 3/27/98

6.2.4 Tag Removed (Y/N) n/a

if not, explain why

6.2.5 SS Notified Ferguson per Telecom RCD 3/27/98
Init/Date

6.3 Drawings Update n/a
(Work Group Supervisor or Implementing Engineer Sig/Date)

6.4 Work Group Supervisor [signature] 3/27/98
Sig/Date

WP: 126386 Task: 1 **Work Package Task**
Rev: 0 CONTROLLED

6.5 Post Maintenance Testing

6.5.1 Associated PMT Work Package Tasks

WP: 126386 Task: 2

Description: ELEC PMT FOR 1SW001FA / CWSH TRAVELING SCREEN

WP: 126386 Task: 3

Description: MECH PMT FOR 1SW001FA / CWSH TRAVELING SCREEN

WP: 126386 Task: 4

Description: OPS PMT FOR 1SW001FA / CWSH TRAVELING SCREEN

6.5.2 PMT Comments

n/a

6.6 Historical Summary/Comments

Replaced Screen eco 3/27/98
RAN Screen approx 4 hrs. with Shear pin installed.

T/W 16466 / Due Date 5/16/98 / 16759 DD 5/17/98
124 FTLBS.

6.7 Post Work Reviews

6.7.1 Removed Item Control
(Work Group Supervisor)

- ☐ Rebuild AR/Task No. ____________
- ☐ Return to Vendor
- ☐ Scrap
- ☐ ~~Downgrade~~
- ☑ n/a

6.7.2 Section Review Wallace 5/6/98
Sig/Date

6.7.3 ISI Coordinator N/A
Sig/Date

6.7.4 QC ____________________
Sig/Date

6.7.5 ANII/ANI/AI ____________________
Sig/Date

APF 24E-001-01 Rev.0

BILL OF MATERIALS

1. EQUIPMENT ID NUMBER

Component: 1SW001FA

2. WORK DOCUMENT NUMBER

WP: 126386 Task: 1 Rev: 0

3. ITEM NO.	4. DESC. (INCLUDE CODE, CLASS SPEC & GRADE IF APPLICABLE	5. EQ Y/N	6. MAT.CODE NUMBER	7. LOT NO.	7. HEAT CODE	7. SERIAL NO.	7. ROS NO.	8. EXPIRATION DATE	9. QUANTITY REC.	9. QUANTITY USED	10. INIT/DATE *QC	
	BASKET,CS,24"W X 10`-0"LONG,W/#14 W&M(.080 DIA) 304SS WIRE, 3/8"SQ OPENINGS,F/ENVIREX TRAV SCREENS,DWG#H98955-5 MK.#100	N	41720030	147752	N/A	N/A	126386 010001	7/24/32	EA	3	N	RCQ 3/26/98
	BOLT ASSEMBLY,U,ZINC PLATED,3" PIPE,F/SPRAY PIPE SUPPORTON TRAVELING WATER SCREEN	N	41620972	N/A					EA		N	
	BOLT,U,5/8"-11,UPPER INTERMEDIATE SECTION,DWG# H98955-17REF#13,F/ENVIREX TRAVELING WATER SCREENS	N	41720039	N/A					EA		N	
	CHAIN,DRIVE,STRAND 21.01 FT LG,82 PITCHES,CHABELCO,F/TRAVELI NG SCREENS.	N	41720001	N/A					EA		N	
	CHAIN,REX CHABELCO,LEFT HAND,(2 FT LENGTHS),F/ENVIREX CWSH TRAVELING WATER SCREENS,DWG#H98955-2	N	41720067	N/A					EA		N	
	CHAIN,REX CHABELCO,RIGHT HAND,(2 FT LENGTHS),F/ENVIREX CWSH TRAVELING WATER SCREENS,DWG#H98955-2	N	41720008	N/A					EA		N	

	GASKET MATERIAL,COMPRESSED ASBESTOS FREE,1/16",GARLOCK 3000 BLUEGARD,NITRILE BINDER,(5' WIDE SHEETS)	N	51650029	149079	N/A	N/A	126386 010002	9/22/16	0 ASR EQ	1 ~~2 Ft~~ RD 3/26/98	N	RD 3/26/98
	INSERT,TOOTH,SS,W/FASTENERS ,F/ENVIREX CWSH/MUSH TRAVELING WATER SCREEN BASKET CHAIN SPROCKET(MC#41720071)	N	41720003	N/A					EA		N	
	LUBRICANT,ANTI-SEIZE,NICKLE GRAPHITE,FEL-PRO N-5000,(8OZ. CAN)	N	51500000	152634	N/A	N/A	710647	1/27/37	0 ASR EQ	1	N	RD 3/26/98
	LUBRICANT,GREASE,MOBIL SPECIAL,(120# PAIL)	N	91700025	148681	N/A	N/A	123462 010001	4/12/36	0 ASR EQ	1 Lb.	N	RD 3/26/98
	LUBRICANT,GREASE,MOBIL SPECIAL,(14 OZ CARTRIDGE),NLGI 2, PRODUCT#53030-3	N	51500074	N/A					EA		N	
	LUBRICANT,GREASE,MOBILUX EP2,(14 OZ CARTRIDGE)	N	51500076	144509	N/A	N/A	60608	01/02/01	0 ASR EQ	7/62	N	RD 3/26/98
	LUBRICANT,OIL,MOBILGEAR 629,(400#DRUM)	N	51500006	109628	N/A	N/A	200225	9/07/30	0 ASR EQ	1Gal	N	RD 3/26/98
	NUT,5/8",PART OF ITEM 5 OF DWG. 603-30227,F/REX CHABELCO2-7/16" DIA FOOT SHAFT ASSY	N	41720072	N/A					EA		N	
	NUT,HEX,3/8-16 UNC, COMM 18-8 SST	N	51201151	N/A					0 EA		N	
	NUT,HEX,JAM,1/2"-13,NYLOK,F/ENVIREX TRAVELING WATER SCREENS	N	41720033	N/A					EA		N	
	NUT,HEX,SS,5/8"-11,DWG# H98955-17 REF#2,F/ENVIREX TRAVELINGWATER SCREENS	N	41720055	N/A					EA		N	

	SCREEN,REX TRAVELING WATER,6 TOOTH,24"PITCH,3/8"CHAINSIDE BAR,W/CHAIN,BASKETS,HARDWARE&INTERMEDIATE FRAME,F/CIRC	N	41720074	155828	N/A	N/A	126386 010003	8/21/37	0 EA	1	N	RP 3/27/98
	SCREW CAP SOCKET HEAD 18-8 SS 3/8-16 X 1	N	01200075	N/A					0 EA		N	
	SCREW,CAP,5/8" X 2-1/2",ENVIREX,F/SCREEN WASH,ITEM 6 OF DWG# 603-30227	N	41720052	N/A					EA		N	
	SCREW,CAP,BASKET ATTACHMENT,SS,F/ENVIREX TRAVELING WATER SCREENS,DWG#H98955-17	N	41720010	N/A					EA		N	
	SCREW,CAP,FLAT HEAD,SS,5/8"-11 X 1-1/2",SLOTTED,DWG# H98955-17 REF#6,F/ENVIREX TRAVELING WATER SCREENS	N	41720057	N/A					EA		N	
	SCREW,CAP,HEX HEAD,3/8"-16 X 1-1/4",ZINC PLATED,DWG #H98955-17 REF#26,F/ENVIREX TRAVELING WATER SCREENS	N	41720043	N/A					0 EA		N	
	SCREW,CAP,HEX HEAD,3/8"-16 X 3/4",ZINC PLATED,DWG#H98955-17 REF#32,F/ENVIREX TRAVELING WATER SCREENS	N	41720035	N/A					0 EA		N	
	SCREW,CAP,HEX HEAD,5/8"-11 X 6",ZINC PLATED,DWG# 603-30227 IT#5,F/ENVIREX TRAVELING WATER SCREEN FOOTSHAFT ASSEMBLY	N	41720051	N/A					EA		N	
	SCREW,CAP,HEX HEAD,CS,5/8"-11 X 3",A307,ZINC PLATED, DWG #603-30227 IT#7,F/ENVIREX TRAVELING WATER SCREENS	N	41720053	N/A					EA		N	
	SCREW,CAP,HEX HEAD,SS,5/8"-11 X 1-1/2",DWG# H98955-17 REF#1,F/ENVIREX TRAVELING WATER SCREENS	N	41720054	N/A					EA		N	

	SCREW,CAP,HEX HEAD,SS,5/8"-11 X 1-3/4",DWG# H98955-17 REF#5,F/ENVIREX TRAVELING WATER SCREENS	N	41720056	N/A					EA		N	
	SEALANT,"FORM-A-GASKET",PERMATEX BLUE #6B,SILICONE,(3 OZ. TUBE)	N	01600096	N/A					0 ASR EQ		N	
	SEALANT,SILICONE,SILASTIC,CLEAR,DOW CORNING RTV-732,(10.3 OZ CARTRIDGE)	N	01600091	152649	N/A	N/A	801118	7/31/02	0 ASR EQ	1	N	ED 3/26/98
	WASHER,FLAT,SS, 3/8",COMM 18-8	N	51201142	N/A					0 EA		N	
	WASHER,LOCK,HELICAL SPRING,SS,5/8",18-8,F/ENVIREX TRAVELING WATER SCREENS	N	41720059	N/A					EA		N	
	WASHER,LOCK,SS,BASKET ATTACHMENT,SPIDER TYPE,IT#30,F/ENVIREX TRAVELING WATER SCREENS,DWG#H98955-17	N	41720009	N/A					EA		N	

MATERIAL SUBDIVISION RECORD; REQUIRED	**YES**	☐	**NO**	☐	

COMMENTS: 41720074 is being refurbished per work package 113388 RMS 5144.

N/A

QC COMPLETION REVIEW **DATE**

IMAGED 05/12/98

FME AREA REQUIREMENTS

Component or Location: 1SW001FA__________ Implementing Work Document #: 126386 task 1______

✓ IF REQUIRED (☒ are mandatory for that FMEA)		INIT/DATE COMPLETE	WHO INIT/DATES	REQUIREMENT
FMEA 1	FMEA 2			**PLAN FOR FMEA** • Identify specific requirements (not included on this form) in WPT instructions
*	☐	kbc 1/21/98	Planner	Identify if FMEA1 or FMEA2, including marking all of the applicable blocks of the FMEA column on this form.
yes / no ☐ *	yes / no ☐ ☐	kbc 1/21/98	Planner	Mark yes if QC is required OR mark no if QC is not required. Include QC inspection point in WPT instructions if needed.
				FME PRE JOB BRIEF • Review FME requirements from this form. • Review the following Foreign Material Minimization: 1. Inspect tools and equipment for proper operation and verify no loose or missing parts 2. Limit quantity of material taken into FMEA 3. Perform work outside FMEA if possible 4. Secure or remove loose objects on personnel 5. Use breach techniques that minimize debris 6. Check containers for cleanliness prior to storing system or component oil while performing work
☒	☒	RCJ 3/16/98	Supv/Dsgnee	Brief Work Crew on FME Requirements.
				POST AREA AND ESTABLISH BOUNDARY
☒	yes / no ☐ ☐	RCJ 3/16/98	Worker	Post using APF 12-003-04 or equivalent.
☒	yes / no ☐ ☐	RCJ 3/16/98	Worker	Establish boundary for the area. Limit the area to the direct opening as possible.
☒	yes / no ☐ ☐	N/A	Worker	Consider covering grating above the area.
☒	☐	RCJ 3/16/98	QC/Supv/ Designee	Verify FMEA is posted and boundaries established as required. When QC is not designated Then the work group designee is to perform
				INSPECT FOR CLEANLINESS PRIOR TO BREACH • Maintain a high level of general cleanliness at the FMEA.
☒	☒	RCJ 3/16/98	Worker	Remove unnecessary tools, equipment and materials from the FMEA.
☒	☒	RCJ 3/16/98	Supv/Dsgnee	Verify FMEA clean prior to system or component breach.
				INSPECT FOR CLEANLINESS AFTER SYSTEM BREACH • Inspect system or component for cleanliness each time the system or component is open. • Clean system or component upon each inspection if needed. • If FM found in system or component upon initial breach, notify supervisor and save FM retrieved. • Only initial system or component breach requires verification below.
☒	☒	RCJ 3/24/98	QC/Supv/ Designee	Verify internal FMEA is clean. (When QC is not designated Then the work group designee is to perform)
				LOG MATERIAL AND MONITOR AREA • Use the FME log when tools and materials are left in the area and are not immediately removed by the same individual placing the material in the area. NOTE: S/G primary manway or secondary handhole removal requires use of the FME log.
☒	yes / no ☐ ☐	RCJ 3/24/98	Supv/Dsgnee	Establish FME monitor. FME monitor may perform other functions.
☒	yes / no ☐ ☐	RCJ 3/24/98	Worker/monitor	Establish a log for Logging materials and tools using the FME Log, APF 12-003-03. *

* No Logging required.

FME AREA REQUIREMENTS

				FME COVERS (external) • System and component openings will be covered except when access to the opening is required. (Exceptions include rigid covers for large open systems such as spent fuel pool and transfer canal within design structures.) • Covers for openings >10" diameter must be rigid. • Covers for horizontal openings <10" diameter may be colored bags or material secured to the opening.
☒ ☛	☒ ☛	RD 3/24/98	Worker	Cover system or component opening. (☛exceptions are noted in the procedure)
				INTERNAL BARRIER • Establish the FME Log prior to installing an internal barrier. • Log the internal barrier as such on the FME Log.
yes / no ☐ ☒	yes / no ☐ ☐	N/A	Worker	Install internal barrier(s). Special instructions for fabrication and insertion of barrier are specified in the WPT instructions.
				SECURE TOOLS • Secure tools, equipment or other items which could fall into openings beyond reach with a lanyard or tagline where practical. • Use lanyards appropriate to FMEA condition. • Identify and log missing parts and tighten all loose parts.
☒	yes / no ☐ ☐	RD 3/24/98	Worker	Secure tools where practical.
				INSPECT FOR CLEANLINESS PRIOR TO FINAL CLOSURE • Remove all debris and residue generated from the work activity.
☒	☒	RD 3/24/98	Worker	Remove FME cover.
yes / no ☐ ☒	yes / no ☐ ☐	NA	Worker	Remove internal barrier if used.
☒	☒	RD 3/24/98	~~QC/Supv/~~ Designee	Verify system or component is free from foreign material. QC is required when specified in the WPT instructions as a QC inspection point
				FMEA CLOSE OUT • Ensure FMEA is restored to pre-work configuration and condition. • Report FME Log discrepancies to supervisor.
☒	☒	RD 3/26/98	Worker	Return system or component to plant configuration.
yes / no ☐ ☒	yes / no ☐ ☐	NA	Worker	Inspect tools and equipment for loose or missing parts
yes / no ☐ ☒	yes / no ☐ ☐	NA	Worker	Close out FME Log, if used.
☒	yes / no ☐ ☐	RD 3/26/98	Worker	Remove FMEA posting, if used.
☒	☒	RD 3/26/98	Supv/Dsgnee	Verify FMEA Close Out is complete.

If QC Involved: QC Completion Review NA /
signature date

Remarks:

ATTACHMENT B
(Page 1 of 1)
PROCEDURE SIGN-OFF SHEET

Work Package No. 126386-1 Equipment No. 1SW001FA

PROCEDURE STEP	OPERATION		INIT/DATE
6.7	Lubricant Type Identified		RD 3/26/98
	Location: Drive Chain Sump (where used on equipment)		
	Oil Type: Mobilgear 629		
6.9	Prerequisites satisfied		RD 3/26/98
7.1.1-3.a.	If required, valve CLOSED		NA
7.1.1-4.	Oil Plug re-installed		NA
7.1.1-7.	Bottle(s) labeled		NA
7.2.3	Oil Plug re-installed		RD 3/26/98
7.2.4	Verify lubricant		RD 3/26/98
		Verified:	WTH 3-26-98
7.2.5	Oil fill equipment is clean		RD 3/26/98
7.2.6-2/7.2.13	Quanity of Oil Added: 10 gal		RD 3/26/98
7.2.6-5/7.2.15	Oil Addition Complete		RD 3/26/98
8.2.1	Location/ N/A N/A		
		Verified:	N/A
8.2.2	Valve Restored & Number N/A	N/A Verified:	N/A
8.2.3	Connection(s) re-installed		NA
8.5	Restoration complete		RD 3/26/98

Remarks: ____________________

Maintenance Activity Complete R. Donnelly — Performer's Signature — 3/26/98 Date

Activity Completed Satisfactorily [signature] — Supervisor's Signature — 3/27/98 Date

- END -

ATTACHMENT A
(Page 1 of 1)
PROCEDURE SIGN-OFF SHEET

PROCEDURE STEP	**OPERATION**	**INIT/DATE**
6.4	Prerequisites completed	BLD / 3/25/98
7.1	Verify Prerequisites completed	RAS / 3-25-98
7.3	Visual Inspections	RCD / 3/26/98
7.4	Trough and holding basket	RCD / 3/26/98
7.5	Carrying Chain tautness	RCD / 3/26/98
7.6	Inspect Tooth Bolts, Basket Capscrews and the Headshaft Keys	RCD 3/26/98
7.7.1	Inspect and adjust Drive Chain	RCD 3/26/98
7.7.3	Check Drive Chain Sump Oil N/A Amount Used	RCD 3/26/98
7.8	Lubrication Complete	RCD / 3/26/98
7.9	Change Gear Reducing Oil when Required by the Work Instructions	N/A
8.4	Remove test shear pin and install origional shear pin	RCD / 3/27/98
8.7	Restoration complete	RCD / 3/27/98

Remarks: ______________________

Maintenance Activity Complete: R Donnelly / 3/27/98
Performer's Signature / Date

Maintenance Activity Completed Satisfactorily: [signature] / 3/27/98
Supervisor's Signature / Date

- END -

7. Available information on invasive or nuisance species observed in the facility's intake, JRR, CCL, or the Neosho River and available information on Wolf Creek Nuclear Operating Corporation (WCNOC) efforts to address this issue.

• Available water or sediment quality data for John Redmond Reservoir (JRR), Coffey County Lake (CCL), and Neosho River.

• Available information regarding local, state, or federal management measures for the JRR, CCL, and the Neosho River. This may include fisheries management, watershed management, flow regulation, etc.

• Any available documentation regarding minimum flows in the Neosho River.

• Available records regarding the operation of the intake screens at either the Neosho River or CCL screen houses as well as information on the ongoing and periodic maintenance that occurs on the screens.

• Available information on invasive or nuisance species observed in the facility's intake, JRR, CCL, or the Neosho River and available information on Wolf Creek Nuclear Operating Corporation (WCNOC) efforts to address this issue.

• Documentation regarding the WCNOC or Coffey County Sheriff's office management of the CCL access program.

• Examples of the fishery regulations developed by the Kansas Department of Wildlife & Parks for CCL.

• If available, information on any occurrences of the Topeka Shiner in the JRR, CCL, Neosho River, or any water bodies crossed by the facility's transmission lines.

• Section 2.5 of the ER (Wolf Creek Generating Station (WCGS), 1980) states that U.S. Fish and Wildlife Service (USFWS) and U.S. Geological Survey (USGS) recommended that additional data be obtained on the habitat requirements of the Neosho River madtoms. Please provide any new information related to these habitat requirements.

• Section 2.5 of the ER (WCGS, 1980) states that USFWS and USGS recommended that flows below the John Redmond Dam be increased during critical periods for the Neosho River madtoms. Please provide any new information related to this issue.

• If available, information on any occurrences of the Neosho river madtom in the JRR, CCL or Neosho river.

• If available, information on any occurrences of the Neosho mucket mussel in the JRR, CCL or Neosho river.

• Section 3.1.2 of the ER (WCGS, 1980) states that water is released to Wolf Creek infrequently. Please provide available records documenting these releases and/or information regarding the frequency of these releases.

• Details on the anti-scalants, dispersants, biocides, and corrosion inhibitors which are released into the circulating water system. Specifically, names of additives used, concentrations used, and frequency of application.

• System operating procedures for the circulating water system traveling screens.

Medenciy Charlie M

From: Scherich Kevin L
Sent: Thursday, January 25, 2007 6:32 PM
To: Medenciy Charlie M
Cc: Haines Daniel E; Hammond Robert A; Logsdon Ralph L; Womelsdorf Daniel J; Mosebey Dennis G; Sathiamoorthy Sitaraman; Scherich Kevin L
Subject: Item 33 response - License renewal environmental questions

Restated: Please provide any information on invasive or nuisance species observed in the facilities intake, JRR, CCL, or the Neosho River and WCNOC efforts to address this issue.

Clams were detected in the Neosho in August of 1986. They were found in CCL in 1991.

Treatment includes non-oxidizing biocide treatments three times per year. Also mechanical cleaning occurs for the Circ Water Screen House (CWSH) and Essential Service Water (ESW) intake structure once per cycle for ESW and once per year for the CWSH.

No zebra mussels have been detected in JRR, CCL or the Neosho River. Monitoring occurs for the intake structures and bays. CCL shorelines are examined for ZM evidence and several sediment monitors have been placed in CCL and at the Make Up Screen House on the Neosho River.

WCEM 05-012, Microfouling, Asiatic Clam and Zebra Mussel Control Program provides more details.
AI 07A-008, Lake Water Chemical Treatment Program provides overview and control to inhibit corrosion, deposition, and fouling in the Lake Water System.

Please consider attaching the reference documents with our response.

Kevin

Invasive or Nuisance Species

in the vicinity of

Wolf Creek Generating Station

Audit Needs request #33

> "Please provide any information on invasive or nuisance species observed in the facilities intake, JRR, CCL or Neosho River and WCNOC efforts to address this issue."

The invasive or nuisance species interactions with WCGS primarily involve Asiatic clams, for which in-plant treatments are used to control. Initial work included monitoring the distribution and abundance in the Neosho River and cooling lake.

WCNOC is involved regionally as partners with other utilities and government agencies to prevent the spread of other nuisance species, primarily zebra mussels. Currently zebra mussels do not occur in the immediate vicinity. Annual monitoring is conducted to confirm this. Preventive measures are in place at the public access point to Coffey County Lake.

Included in this package to demonstrate involvement and efforts to address this issue are:

1. Monitoring report summarizing Asiatic clam monitoring
2. Existing in plant treatment and planning efforts
3. Monitoring Report and Plan for zebra mussel presence
4. Kansas Aquatic Nuisance Species Management Plan, which WCNOC was a partner and supporter
5. Zebra mussel inspection checklist for inspection of all boats launched on CCL
6. Ad Hoc zebra mussel task force member list showing regional involvement.

DOCUMENT CONTROL NUMBER

WCEM 05-012

Document Control Revision

1

MICROFOULING, ASIATIC CLAM AND ZEBRA MUSSEL CONTROL PROGRAM
for

WOLF CREEK GENERATING STATION

WOLF CREEK NUCLEAR OPERATING CORPORATION
P. O. Box 411
Burlington, Kansas 66839

06/06

APPROVED: Robert Hammond

RELEASE DATE: DC30 6/22/2006

TABLE OF CONTENTS

MICROFOULING, ASIATIC CLAM AND ZEBRA MUSSEL CONTROL PROGRAM

OBJECTIVE: Provide a biocide treatment program to control microfouling, Asiatic clams and potential zebra mussel infestation in both internal plant equipment and water intake bays at Wolf Creek Generating Station.

1.0 PROGRAM TREATMENT BACKGROUND

1.1 Microfouling - A Background

Biofouling is a general term used to describe all forms of bacterial growth on surfaces in contact with cooling water. Microfouling is the more precise term used to describe the deposits caused by the growth of microbes such as bacteria, fungi and algae, and their products on the metal surfaces. The rate of growth and the composition of a microfouling film are influenced by environmental variables (water chemistry and temperature) and by the nature of the substratum.

In March 1984, tube leaks were discovered in the stator service water heat exchanger at Wolf Creek Generating Station (WCGS). Several of the 90/10 copper-nickel tubes were removed for inspection and were found to have pitting associated with significant corrosion layer on the interior walls. Kansas Gas Electric (KGE), an owner company, directed Bechtel, an architect and engineering firm, to determine the cause of the corrosion. Tube samples were sent to Bechtel's San Francisco office for analysis. The results indicated that microbiologically induced corrosion (MIC) was the cause. It was also determined that the water from Coffey County Lake (CCL), formerly called Wolf Creek Lake, was the source of the bacteria causing MIC. As a result of these findings, a MIC Task Force was established at WCGS to coordinate further investigations, cleanup, and repair.

During the 1984 summer, further inspections were made on the service water system. Additionally, a gaseous chlorine injection system was placed into service for the circulating water and service water systems. In August 1984, Bechtel issued the Final Report Concerning Microbiological Induced Corrosion at Wolf Creek Generating Station, which presented the history of the problem and recommendations. Bechtel reasoned at that time, that MIC had been eliminated at WCGS, and that if the report's recommendations were followed, recurrence could be prevented.

However, in September 1984, evidence of MIC was again found in component cooling water heat exchangers. It was determined that insufficient chlorination was the cause of MIC recurrence. Chlorine levels had been erratic, often undetectable, and the injection system had not functioned for several days. Since MIC was only found in the service water system, Bechtel recommended immediate chlorination of the system on a continuous basis. Because of the MIC problems found in the service water system, KGE and the Kansas Department of Health and Environment (KDHE) negotiated an agreement allowing operational latitude in the level of chlorination necessary to control MIC infestations. This agreement allowed the following chlorination regimen for WCGS service water system:

> Chlorine will be limited to 0.2 mg/L total residual chlorine (TRC) in the joint circulating water/service water effluent (outfall 003). This means that the TRC in the service water may be diluted 22 hours/day by unchlorinated circulating water. Also, approval for a 1.0 mg/L TRC limit in the service water being discharged to the Ultimate Heat Sink (eventually outfall 006) was subsequently requested for and obtained by KG & E from KDHE. *Note: These approved treatment regimens for the service water/essential service*

water were adopted in the WCGS National Pollution Discharge Elimination System (NPDES) permit issued by KDHE on February 15, 1989.

In October 1989, Wolf Creek Nuclear Operating Corporation (WCNOC) sought KDHE approval to start testing Betz C-74, a non-oxidizing biocide, in the essential service water system as a biofouling agent. KDHE granted WCNOC verbal approval to use Betz C-74 in November 1989.

1.2 Asiatic Clam (Corbicula) - A Background

The presence of the Asiatic clam has been a persistent problem in nuclear and non-nuclear power plants due to their potential to obstruct flow in plant cooling water systems. The Nuclear Regulatory Commission (NRC) determined that these blockage events represented a generic problem to safety components of nuclear power plants. As a result, the NRC issued Bulletin Number 81-03 in 1981, which required licensees and applicants to assess macrofouling potential.

In July 1989, the NRC issued Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment", to all holders of operating licenses or construction permits for nuclear power plants. This letter required power plants without an established Asiatic clam population in their cooling water source to monitor for initial presence. The scope of the required monitoring included visual inspections of intake structures for Asiatic clams each refueling cycle, and annual surveys of water and substrate.

At the time of Generic Letter 89-13, CCL did not have an established Asiatic clam population, but WCNOC was already monitoring for possible Asiatic clam infestation. This effort included monitoring intake structures and substrates. WCNOC responded to 89-13 by formalizing a macrofouling biocide treatment plan and inspections at the circulating water screenhouse (CWSH), essential service water (ESW), and the makeup water screenhouse (MUSH) intake structures. Annual substrate sampling in the lake continued.

In August 1986, Asiatic clams were found during WCNOC river monitoring studies at long-term monitoring sites above and below Wolf Creeks' confluence with the Neosho River. With the expansion of the Asiatic clam in the vicinity of WCGS, the monitoring effort for adults and sub-adults was increased. Since makeup water for CCL would be pumped from the Neosho River via the Makeup Screenhouse (MUSH), Asiatic clam movement into the lake was considered inevitable. *Note: Asiatic clams were found in CCL in June 1991.*

Most Asiatic clam studies have documented two distinct spawning periods, a spring peak from mid-May through mid-June and an autumn peak during mid-September through mid-October. Generally, water temperatures trigger the release of juveniles to the water column. Water temperatures rising above approximately 16°C have been correlated to juvenile releases in the spring. Most reported fall spawns occurred as water temperatures cooled to approximately 24°C.

Low adult Asiatic clam population densities and consequent low juvenile densities in CCL made detection difficult. This prevented forecasting distinct and specific spawning peaks for CCL. Nevertheless, the biology of these clams and a review of technical literature justified two target treatment periods. These were from mid-to late July and from early to mid-November. These periods will target any Asiatic clam that may make it into plant systems when they are most vulnerable to treatment chemicals. It will also prevent clams from growing large enough to resist treatment chemicals or cause clogging problems.

After the discovery of Asiatic clams in CCL, WCNOC requested approval from KDHE in November 1991, for an additional use of the non-oxidizing biocide, C-74. In this proposal, WCNOC requested that C-74 be used as a molluscicide for semiannual 24-hour treatments at both the service water system and the intake bays at the CWSH and the ESW pumphouse. *Note: The intake bays were expected to accumulate high concentrations of Asiatic clam adults, which would release juveniles directly into plant systems. This expectation became an actual threat, as supported by the Attachment 1.0, Refuel X Asiatic Clam Sample Results.* In December 1990, a written response from KDHE granted permission to WCNOC to use this new treatment regimen at WCGS.

In June 1997, WCNOC requested permission to treat the service water and essential service water systems with a non-oxidizing biocide three times a year instead of semiannual to compensate for decreased biocide effectiveness in lake water temperatures below 65 ^{0}F. This request was made because achieving 100% mortality was not always possible due to limits placed on the duration of the treatment and on the non-oxidizing biocide discharge concentration. KDHE approved WCNOC's request for the one additional non-oxidizing biocide treatment in December 1997. To offset mortality limitation caused by the cooler lake water temperatures, three non-oxidizing biocide treatments per year have been performed since 1997. *Note: Since the initial approval for using a non-oxidizing biocide to control macrofouling, the chemical name has been change several times. The non-oxidizing biocide has been known as C-74, CT-2, CT-1300, and H-130m.*

1.3 Zebra Mussel (Dreissena polymorpha) – A Background

Zebra mussels, a new threat to WCGS cooling systems are being addressed in this document with several considerations for additional chemical treatments. The introduction of zebra mussels to inland lakes and rivers has occurred by transport of recreational boats from infested waters. It is likely that zebra mussels will expand to Kansas and CCL through this dispersal mechanism. Water chemistry and temperature data indicate that CCL will provide favorable growing conditions for zebra mussels.

The main concern with zebra mussels, unlike Asiatic clams (which are bottom dwellers), is that they attach themselves to a hard surface or other zebra mussels at flow rates of less than 6 ft/sec and then grow and multiply rapidly. They spread both along a surface and outward in layers. Left unchecked, they can gradually reduce or even completely plug water flow pathways. Clumps of mussels can break off and flow downstream until they lodge in and foul small diameter components.

Zebra mussels do not spawn above 88^{0}F, spawn profusely between 50^{0}F and 60^{0}F and spawn at a substantially lower rate above 60^{0}F. Their upper survival limit appears to be approximately 88^{0}F. Detecting the initial expansion of zebra mussels to the Neosho River and CCL is important because zebra mussels can cause fouling problems by the second year after introduction.

Currently, there has not been any zebra mussels detected in CCL, but they were found as close as the El Dorado lake (approximately 70 miles away) in 2003. The first zebra mussels entering CCL will probably go undetected. Therefore, a philosophy of waiting until we know we have them could be costly.

2.0 PROGRAM CONTROL MEASURES

2.1 Microfouling Control Measures

(See Microfouling Assessment Section 3.1 below.)

2.2 Asiatic Clam Control Measures

The macrofouling control program has successfully mitigated fouling of heat exchangers by Asiatic clams. A review of macrofoul treatments indicates that good control has been achieved over the last nine years.

Historically, as part of normal maintenance activities, underwater inspections of intake structures were completed when practical. Procedural specifications required sediment samples from the intake bays to be collected by the divers and provided to Environmental Management to determine if Asiatic clams were present. Samples were sieved through a U.S. Standard No. 30 mesh screen and inspected for the presence of Asiatic clams. This practice has been discontinued for Asiatic Clam control since their population and growth rates have been established, reported and documented in Environmental Managements annual inspection reports and control plans. See Attachment 1.0

2.3 Zebra Mussel Control Measures

The current bleach/sodium bromide system used to treat the service water and ESW system is the primary means of defense for zebra mussels. Continuous treatment of Free Available Chlorine (FAC) levels greater then 0.5 mg/L will reduce the potential for zebra mussel settlement. Supplemental macrofoul treatments with non-oxidizing biocide will be continued with at least three treatments per year. The treatment regimens now used to control Asiatic clams will also control zebra mussels; the only difference being, that the duration of treatments may have to be continuous for up to 24 hours per day.

As in Section 2.2 above, zebra mussels are being monitored for their presence in the intake structures and bays. Zebra mussels are also being looked for along CCL shoreline. Additionally, several sediment monitors have been placed in the lake. Sediment monitors have also been placed at the Makeup Water Screen House (MUSH). See Attachment 3.0 for additional details on zebra mussel control measures that are being taken.

3.0 PROGRAM TREATMENT ASSESSMENT

3.1 Microfouling Assessment

Non-destructive inspections of the circulating water system has shown no biofouling in the condenser with the current established chlorination regimen designed to maintain a discharge effluent for outfall 003 of 0.2 mg/L total residual oxidant (TRO).

Note: *In 1996, a Technos System was installed on the condenser. This system recirculates sponge balls through the condenser waterboxes and tubes. The Technos System is designed to prevent under-deposit corrosion (MIC) by keeping the condenser tubes free of silt and scale.*

The combination of the Technos System; the circulating water flow rate (7 fps) through the condenser tubes; the chemical resonance time (15 minutes;) and the smaller bore tubes (1 1/4 " OD) in the condenser allow the current application of 0.2 mg/L TRO in the circulating water discharge to be effective.

The continued use of the NPDES permitted discharge concentration for service water/essential service water up to 1.0 mg/L TRO and the allowance of continuous chlorination for up to 22 hours has limited the growth of bacteria-causing MIC in the service water.

Note: *The lower flow rates in the service water/essential service water heat exchangers (< 3 fps) and the longer service water/essential service water piping runs between heat exchangers cause a higher chlorine demand for the service water system than for the circulating water system. Because of these features in the service water system, a higher disinfection concentration of chlorine and a longer injection period is required to maintain the system free of MIC.*

3.2 Asiatic Clam Assessment

Asiatic clam populations in the lake were very efficient at invading new areas, even though growth of large clams was uncommon. In CCL this was evidenced by the pioneering to the east shorelines and discharge area in 1992, the service spillway and intake area in 1993, all but the most northern areas of larger coves in 1994 and north of the causeway and more of the intake areas in 1995. The natural method used to invade new areas is the passive movement of free-floating juveniles at the mercy of water currents, including wave action. It is unlikely that movement into the discharge area occurred via juveniles passing through the plant because none should survive the elevated temperatures in the cooling water system. The 1995 data indicate that the clams now inhabit all of available habitat in the lake.

3.3 Zebra Mussel Assessment

Zebra mussels were not observed during 2005 monitoring of the Neosho River and Coffey County Lake (CCL). Monitoring was completed to provide early detection so that zebra mussel in the vicinity of Wolf Creek Generating Station (WCGS). Efforts included substrate and shoreline searches of the Neosho River upstream of John Redmond Reservoir (JRR) and immediately downstream of JRR in the vicinity of the Makeup-water Screen House (MUSH), where water is pumped from the Neosho River to CCL. Settlement monitors were placed and substrate scrapes were conducted at plant structures on the Neosho River and CCL. Inspections of fishing boats entering CCL will also continued through 2006.

Zebra mussels were discovered at El Dorado Lake on August 25, 2003, approximately 70 miles southwest of WCGS in the Walnut River drainage, which is immediately west of the Cottonwood/Neosho watershed. During 2005, the mussels expanded their range downstream to Oklahoma. None have been observed in the Neosho watershed.

The Neosho River and CCL would be conducive for zebra mussel survival and growth based on water quality conditions present. Introduction to CCL will most likely be caused by WCGS pumping activities from the Neosho River. Boat inspections will likely prevent mussel introduction via recreational boats. The 2005 monitoring in the Neosho River and CCL will continue through 2006. These efforts will help ensure that zebra mussels are detected as early as practical in the WCGS area.

4.0 MICROFOULING AND ASIATIC CLAM TREATMENT PROGRAM

4.1 Service Water System (See Tables 1.0 and 2.0 and/or Figure 1.0)

- Oxidizing biocide (sodium hypochlorite and sodium bromide) will be injected into the service water for up to 22 hours per day to control microfouling.
- For Asiatic clam control, continuous treatment up to 22 hours per day with oxidizing biocide will be used when CCL water is over 50^0 F to prevent settlement of larvae in piping and components.
- For future zebra mussel control, continuous treatment up to 24 hours per day with oxidizing biocide will be used when CCL water is over 50^0 F to prevent attachment of juveniles in piping and components.

4.2 Circulating Water System (See Tables 1.0 and 2.0 and/or Figure 1.0)

- The circulating water system will be treated with oxidizing biocide for two hours per day to control microfouling.

4.3 Essential Service Water System (See Tables 1.0 and 2.0 and/or Figure 1.0)

- The essential service water will be treated, when running, by injecting oxidizing biocide to maintain levels up to 1.0 mg/L TRO for several hours per day to control microfouling.
- The essential service water will be treated, when running, by injecting oxidizing biocide to maintain levels of at least 0.5 mg/L FAC continuously for macrofoul control.

4.4 Circulating Water Screenhouse (CWSH) Intake Bays (See Table 3.0 and/or Figure 1.0)

- Macrofoul control of the CWSH intake bays will be with periodic applications of non-oxidizing biocide to treat macrofouling organisms in the bays about two times per year.

4.5 Essential Service Water (ESW) Pumphouse Intake Bays (See Table 3.0 and/or Figure 1.0)

- Macrofoul control of the ESW intake bays and warming lines, when they are not being used, will be accomplished by injecting into each bay a continuous stream of treated service water.

4.6 Fire Protection System (See Table 4.0 and/or Figure 1.0)

- Continuous treatment of the jockey fire pump make up with non-oxidizing biocide.
- The fire protection yard loop will be protected by lay-up treatment with non-oxidizing biocide after system flushing and/or use.
- The fire pump inlets will be treated by CWSH intake bay treatments.

4.7 Make-Up Water Screenhouse (MUSH) Intake Bay (See Table 3.0)

- The MUSH intake bay will be treated off-line with non-oxidizing biocide to control macrofouling.

Table 1.0

Systems Being Treated With An Oxidizing Biocide (Sodium Hypochlorite and Sodium Bromide)

SYSTEM	FLOW (gpm) Min - Max	ESTIMATED INJECTION RATE	DURATION
Service Water	20,000 - 42,000	0.29 - 0.70 gpm 420 - 1008 gpd	Up to 22 hours/day for MIC and Macrofouling Treatment
Essential Service Water	12,000 - 15,000	0.10 - 0.25 gpm 144 - 360 gpd	Up to 22 hours/day for MIC and Macrofouling Treatment
Circulating Water	360,000 - 540,000	0.9 - 3.5 gpm 108 - 420 gpd	Up to 2 hours/day for MIC

Table 2.0

Systems Being Treated With A Non-Oxidizing Biocide (H-130M)

SYSTEM	FLOW (gpm) Min - Max	BIOCIDE CONCENTRATION	DURATION
Service Water/ Essential Service Water (A & B Trains)	6,000 - 8,000 Only one train at a time	4-6 ppm	12-24 hours/day for Macrofouling 3X/yr.*

* 3X/yr. = 3 times per year

Table 3.0

Intake Bay Treatments Using A Non-Oxidizing Biocide (H-130M))

SYSTEM	VOLUME Gallons	BIOCIDE CONCENTRATION	DURATION
CWSH Intake Bays (3)	360,000 each	4-8 ppm	12-24 hours/day for Macrofouling
Essential Service Water Intake Bays (2)	155,500 each	4-8 ppm	12-24 hours/day for Macrofouling
Make-Up Water Intake Bay (1)	178,000	4-8 ppm	12-24 hours/day for Macrofouling*

* Have not implemented

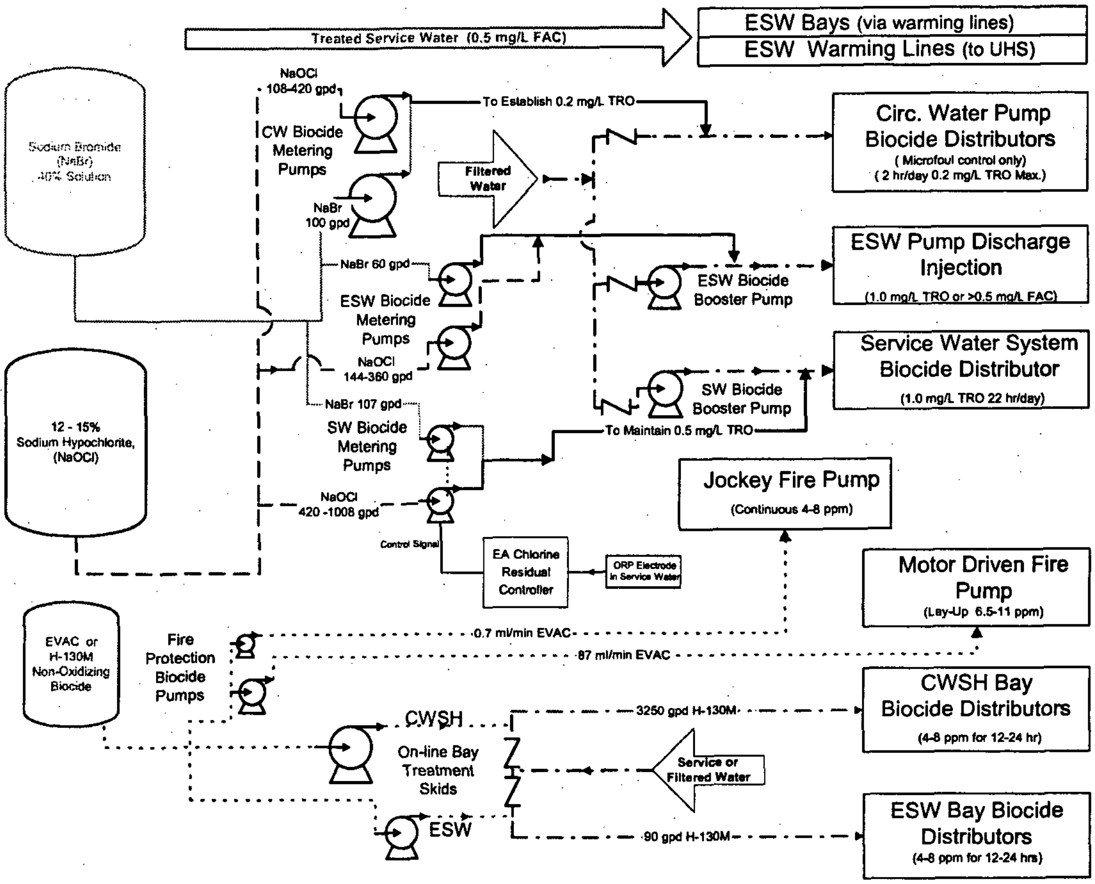
Table 4.0

Fire Protection System Treatment With A Non-Oxidizing Biocide (EVAC)

SYSTEM	COMPONENT	BIOCIDE CONCENTRATION	DURATION
Fire Protection System	Jockey Fire Pump (Make-Up)	6.5-11 ppm	Continuous
	Motor Driven Fire Pump (Yard Loop Lay-Up)	6.5-11 ppm	When Needed

Figure 1.0

MICROFOULING AND ASIATIC CLAM TREATMENT SKIDS AND INJECTION LOCATIONS



Note: *It is not likely that zebra mussel populations once established can be eradicated, but it may be possible to reduce the impact of zebra mussels by reducing population density. Lake level drawdowns, predators, parasites, diseases, bacterial toxins and time may help reduce zebra mussel impacts. Fish such as the common carp, channel catfish, blue catfish and freshwater drum have been known to feed on zebra mussels. Also, diving ducks and coots can be significant predators on zebra mussels but more thorough study is necessary to evaluate the extent of the predation.*

Time may also prove to be a beneficial factor in controlling invasive species. The Asiatic clam population in North America declined significantly 15 to 20 years after introduction and clam populations in southern U. S. lakes has decreased in density. Apparently, some predator is eating the small Asiatic clams because only a few five-millimeter shell or clams can be found. This same effect may also be seen with zebra mussels.

5.0 PROGRAM TREATMENT CHANGES

5.1 Nalco EVAC Biocide

WCGS has changed from using Calgon H-130M biocide to Nalco EVAC molluscicide for macrofoul treatments in the Fire Protection System. EVAC molluscicide is a endothall amine salt FIFRA-registered for use in industrial once-through and recirculating cooling water systems to effectively control macrofouling infestations, particularly established populations of zebra mussels. It also is effective in preventing settlement of the immature forms of zebra mussels.

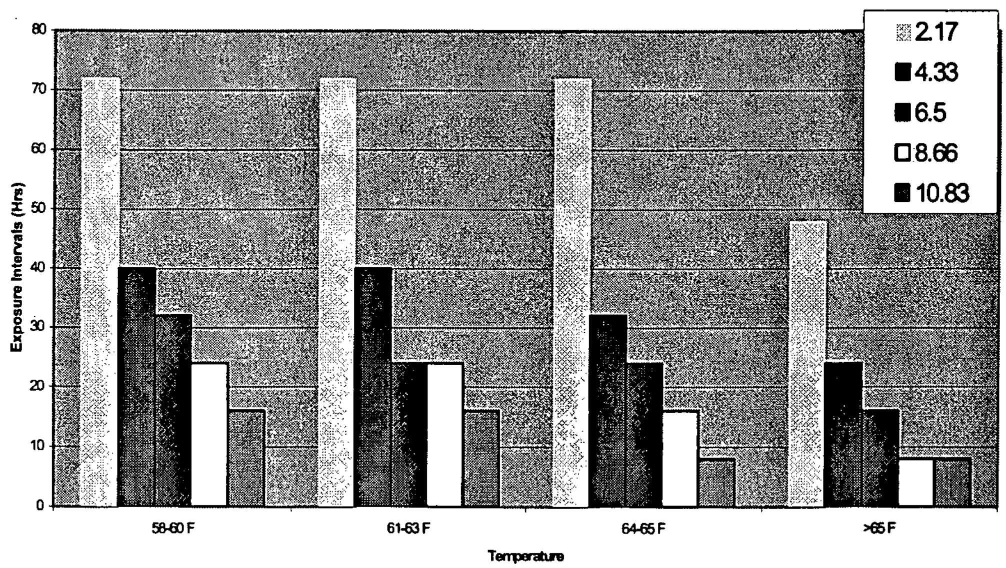
WATER TREATMENT CHEMICAL AQUATIC TOXICITY
COMPARISON BETWEEN EVAC and H-130M

Nalco EVAC		Calgon H-130M	
Mono (N,N-dimethylalkyl amine) salt of endothall	48 hr LC_{50} *Daphnia magna*: 0.10 ppm 96 hr LC_{50} fathead minnow: 0.25 ppm 96 hr LC_{50} bluegill sunfish: 0.51 ppm 96 hr LC_{50} Channel catfish: 0.60 ppm 96 hr LC_{50} rainbow trout: 0.30 ppm	Didecyldimethyl ammonium chloride	48 hr LC_{50} *Daphnia magna*: 0.19 ppm 96 hr LC_{50} mysid shrimp: 0.14 ppm 96 hr LC_{50} bluegill sunfish: 0.92 ppm 96 hr LC_{50} rainbow trout: 2.2 ppm

Note: In June 2005 a satisfactorily completed WET test on Outfall 003X was performed, which included rejected EVAC injection concentrations from the Fire Protection System to the circ water.

Biocide	Zebra Mussel In System Treatment Recommendations	Expected Discharge Concentration At Outfall 003X and 006A
Calgon H-130M	1-10 ppm for 24 hours	0.26 ppm
Nalco EVAC	6.5-11 ppm	Virtually undetectable

EVAC Dosage Requirements (ppm product) vs. Temperature



Note: It is not recommended to treat a water system below 60 F.

5.2 Biocide Low Pressure Neat Feed for Service and Circulating Water Systems

The existing vendor biocide feed equipment has experienced chronic leakage problems. Most leakage problems are in the solvent welded PVC piping connections, threaded PVC connections, and failed pump pressure retaining components. Another problem with the biocide feed system is calcium carbonate scale buildup in the feed piping due to high pH of the 12% NaOCl solution and the calcium hardness of CCL water, which is used for a dilution water carrier. The scale buildup in the feed piping, particularly the service water feed, causes higher system back pressure, decreased biocide feed rates, and the added time and expense of having to periodically perform chemical cleaning.

Corrective Action for the above-identified problems can be resolved with the implementation of Change Package (CP) 009890. The implementation of this CP would simplify the biocide feed system design and operation by providing a low-pressure neat feed injection point near the suction of each service water and circ water pumps.

ATTACHMENT 1.0

WOLF CREEK GENERATING STATION

ASIATIC CLAM (<u>CORBICULA FLUMINEA</u>) AND

ZEBRA MUSSEL (<u>DREISSENA POLYMORPHA</u>) MONITORING

OF

NEOSHO RIVER

AND

WOLF CREEK COOLING LAKE

1995 REPORT

ABSTRACT

The Corbicula population in the cooling lake expanded its range during 1995 to include nearly the entire lake. Future adult sampling in WCL is no longer necessary. Expansion along the east shorelines and into the northern reaches of the lake was found. Initial pioneering was most likely from makeup water pumping activities, which transported the clams as planktonic juveniles to WCL from the Neosho River.

The occurrence of a small number of planktonic juvenile clams in October sampling confirms the presence of a fall spawning period. With this data and the biology of the clams as cited in the literature, two in-plant treatment periods per year are recommended. The first in mid to late-July and the second early to mid-November. Now that a fall spawning period has been confirmed, planktonic juvenile sampling is not needed.

Zebra mussels were not found at the Neosho River monitoring sites or Wolf Creek Lake. The mussels were not known to inhabit any Kansas waters during 1995. However, because of the ability of these mussels to quickly inhabit and cause plant-clogging problems, increased monitoring for initial presence in the vicinity of Wolf Creek Generating Station is prudent.

1.0 INTRODUCTION

The purpose of this report is to interpret Asiatic clam (Corbicula fluminea) and zebra mussel (Dreissena polymorpha) data collected from Wolf Creek Lake (WCL) and Neosho River during 1995. Asiatic clam monitoring was completed by WCNOC in part to satisfy commitments made to the Nuclear Regulatory Commission (NRC) in response to Generic Letter 89-13. More importantly, this program was designed to supply population and life history data from local populations to be used to make future operational and chemical treatment decisions. Early detection of zebra mussels in the local region was important to allow preventative in-plant measures to be determined before clogging problems develop. To achieve these goals, the following objectives were established to:

1. determine the population density and distribution of benthic adult and sub-adult Corbicula in WCL,

2. determine the concentration and peak occurrence of planktonic Corbicula juveniles in WCL,

3. determine the presence of absence of zebra mussels at long term monitoring sites on the Neosho River.

1.1 BACKGROUND

1.1.1 Asiatic clam

Flow blockage of cooling water systems due to the presence of the Asiatic clam has been a persistent problem in nuclear and non-nuclear power plants. The NRC determined that blockage events such as this represented a generic problem to safety components of nuclear power plants after extensive blocking by Corbicula in containment coolers at Arkansas Nuclear One. As a result, the NRC issued Bulletin Number 81-03 (NRC 1981), which required licensees and applicants to assess macro-fouling potential. At that time, Corbicula were only known to exist at two localities in Kansas (Huggins et al 1981), which were in the Kansas River drainage, remote from WCGS. None were known to exist in the Neosho River drainage until 1984 when they were found at Chetopa, approximately 120 miles down-river from WCGS (Hartmann and Cope 1985). In August 1986, Corbicula were found during WCGS river monitoring studies at long-term monitoring sites above and below the Wolf Creek's confluence with the Neosho River.

With the expansion of Corbicula in the vicinity of WCGS, the monitoring effort for adults and sub-adults was increased. Since makeup water for WCL would be pumped from the Neosho River via the Makeup Screenhouse (MUSH), Corbicula movement into the lake was considered inevitable. However, immediate transport to the lake in this manner was not likely given that no Corbicula were present at the MUSH or upstream. Nevertheless, an extensive annual effort was initiated during the fall of 1986 to determine the densities and track the upstream expansion of the river's Corbicula population. At the same time, efforts in WCL were stepped up to identify early colonization and assess potential impacts to the operation of WCGS.

Continued industry incidences of bivalve macrofouling prompted the NRC in 1989 to issue Generic Letter 89-13 (NRC 1989). This letter required power plants without an established Corbicula population in their cooling water source to monitor for initial presence. The scope of the required monitoring included visual inspections of intake structures for Corbicula each refueling cycle, and annual surveys of water and substrate.

At the time of Generic Letter 89-13, the cooling source (WCL) for the power plant did not have an established Corbicula population, but the company was already monitoring for possible Corbicula establishment. This monitoring included intake structure inspections and substrate sampling, two of the three requirements specified in 89-13. WCNOC responded to 89-13 by formalizing Corbicula inspections at the Circulating Water Screenhouse (CWSH), Essential Service Water (ESW), and MUSH intake structures. Annual substrate sampling in the lake was continued.

Monitoring of the water column for juvenile Corbicula, the last of the 89-13 requirements, was not being completed at the time. In Wolf Creek's case due to low anticipated densities, juvenile monitoring was not considered efficient for detecting initial colonization, but it was considered valuable in determining spawning cycles once presence was known. Consequently, in its response to 89-13, WCNOC justified not initiating juvenile sampling until after Corbicula was known to exist in the lake. In lieu of this, WCNOC continued distribution monitoring in the Neosho River through 1993 to determine when WCL was most vulnerable to Corbicula establishment. After Corbicula was found in WCL during June 1991, juvenile monitoring was initiated.

1.1.2 Zebra Mussel

The life cycle and population characteristics of zebra mussels present serious clogging problems to power plant cooling systems. Zebra mussels have not been confirmed in Wolf Creek Lake, the Neosho River or in Kansas, but are present in the Arkansas River drainage in Oklahoma and Arkansas, and in the Mississippi River in eastern Missouri (Benson and Boydstun 1995). It is expected that the zebra mussel's spread to every habitable region is inevitable (Carlton 1993). The cooling lake is habitable and conducive to zebra mussel growth based on current lake chemistry (Table 1).

2.0 METHODS

2.1 ASIATIC CLAM

2.1.1 Adult Monitoring

Adult and sub-adult Corbicula distribution in the cooling lake was monitored during June and July concurrent with shoreline seining completed during the fisheries monitoring program. Twenty standard shoreline sites spread around the lake were observed for the presence of Corbicula. Most shoreline types common to WCL were searched. Incidental observations in other shoreline areas were also noted.

Substrate sampling consistent with past Corbicula monitoring was completed at the Makeup Discharge Structure (MUDS), Saddle Dam IV, Service Spillway, and the CWSH. Samples at each location were taken with a 530-cm² ponar dredge sampler and sieved through a U.S. Standard No. 30 mesh screen. Shell lengths and total number of live clams sampled were recorded. Water depth, water temperature, and substrate type were also noted.

As part of normal maintenance activities, underwater inspections of intake structures were to be completed when practical. Procedural specifications require sediment samples from the intake bays to be collected by the divers and provided to WCNOC Environmental Management to determine if Corbicula was present. Samples were sieved through a U.S. Standard No. 30 mesh screen and inspected for the presence of Corbicula.

2.1.2 Juvenile Monitoring

Density of planktonic, juvenile Corbicula in the cooling lake was monitored weekly from May one through July three, and from September four through October 30, 1995. All samples were taken immediately downstream of the MUDS. Five vertical or oblique tows depending on flow conditions from near the bottom to the surface were made with a 30 cm, 153 micron, conical, plankton net. Concentrated plankton samples were preserved in ten percent buffered formalin.

Samples were filtered and adjusted in the lab to a total volume of 50 ml or more depending on plankton density. Samples were then agitated, and enough one-milliliter aliquots to equal five percent of the adjusted volume were examined microscopically for Corbicula juveniles.

2.2 ZEBRA MUSSEL

The presence or absence of adult zebra mussels on the Neosho River were determined at two long term monitoring sites, one immediately upstream and the other immediately downstream of the confluence of Wolf Creek and the Neosho River. Available substrate (i.e. rocks, logs, debris) was searched, when river flow conditions permitted, starting in February, 1995 and bimonthly thereafter. Shorelines were also searched for zebra mussel shells. Each search effort consisted of approximately 30 man-minutes.

3.0 RESULTS AND DISCUSSION

3.1 ASIATIC CLAM

3.1.1 Adult Monitoring

Initial expectations were that Corbicula would be detected in the John Redmond Reservoir spillway before being found in the cooling lake (WCNOC 1990). This did not happen as the first evidence of Corbicula pioneering into WCL was found on June 27, 1991 before discovery at John Redmond. Shells were found at an established shoreline-seining site as part of the fisheries monitoring program. This was an area characterized by clay/gravel substrate with moderate wave action. Subsequent observations in 1991 revealed specimens at two other locations along the west shoreline of WCL. During 1992, Corbicula expanded into the discharge and east shoreline areas of the lake. They expanded into the service spillway, CWSH and intake areas in 1993. In 1994, continued expansion in the intake, discharge, and northern areas of the lake was evident. Expansion in 1995 included areas north of the causeway and the northernmost segments of the intake area. The clams now inhabit virtually all of WCL.

No diver samples were searched during 1995. Past monitoring has shown Corbicula presence already in the CWSH and ESW. A biobox sample and a service water heat exchanger were found to have clams inhabiting them in 1994.

Corbicula densities in the substrate of WCL remained at similar levels since 1992. Live specimens were sampled in the ponar grab samples at every location (Table 2). The initial high concentration of 22 clams/m^2 measured at Saddle Dam IV in 1991 did not persist. Since 1992, the concentrations at all sampling sites ranged from 0.7 to 4.7 clams/m^2.

The length frequency distribution of Corbicula collected in 1995 at all sampling sites in the lake showed a population dominated by young individuals, which was the same as past results. Live adults representing two and three year-old size classes (about 16 mm and 25 mm, respectively) were rarely collected. These sizes typically clog plant-cooling systems. This indicates that the lake has not provided optimum conditions for Corbicula population development. Many shell fragments were apparent in the samples indicating some predation, probably freshwater drum. Mortality rates are normally high, but clams up to five years old (Britton and Morton 1982) can be expected to be represented. The cooling lake's population appeared similar to that reported for Corbicula below the Kentucky Dam on the Tennessee River where the dominant size class from that population shifted to individuals less than 12.3 mm (Sickel 1986). This size distribution was indicative of newly invading populations with high fecundity, rapid maturation, and short life spans.

3.1.2 Juvenile Monitoring

Corbicula populations in the lake were very efficient at invading new areas, even though growth of large clams was uncommon. In the cooling lake this was evidenced by the pioneering to the east shorelines and discharge area in 1992, the service spillway and intake area in 1993, all but the most northern areas of larger coves in 1994 and north of the causeway and more of the intake areas in 1995. The natural method used to invade new areas is the passive movement of free-floating juveniles at the mercy of water currents, including wave action. It is unlikely that movement into the discharge area occurred via juveniles passing through the plant because none should survive the elevated temperatures in the cooling water system. The 1995 data indicate that the clams now inhabit all of available habitat in the lake. It took them five years to do this. Future distribution monitoring is not necessary.

Juvenile monitoring attempted to measure the densities of the free-floating juveniles in the lake, but because clam densities were still low, few specimens were sampled. The 1994 and 1995 efforts were able to identify a June spawning period as well as the occurrence of juveniles during the fall in the MUDS area (Table 3). Sampling this area was done to compensate for the low concentration of planktonic juveniles at other areas.

Most but not all studies have documented two distinct spawning periods. In Lake Sangchris, a power plant cooling lake in Illinois, a spring peak from mid-May through mid-June and an autumn peak during mid-September through mid-October were evident (Dreier and Tranquilli 1981). For the Altahama River in Georgia, a mid-May and early-October peak was reported (Sickel 1979). Similar spawning peak timing was found for Corbicula in the Delta-Mendota Canal in California (Eng 1979). Williams and McMahon (1986) showed similar peaks adjacent to Henley Power Station on Lake Arlington in Texas, although extending into winter longer. Contrary to these studies, Bickle (1966, as cited in Eng 1979) found only one mid-summer spawn in Kentucky. Generally, water temperatures trigger the release of juveniles to the water column. Water temperatures rising above approximately 16°C have been correlated to juvenile releases in the spring (Eng 1979, Sickel 1979, Drier and Tranquilli 1981). Most reported fall spawns occurred as water temperatures cooled to approximately 24°C.

Fall treatment in plant systems is justified based on the 1995 juvenile monitoring and available literature. Low adult and consequent low juvenile numbers in WCL made sampling difficult. This prevented forecasting distinct spawning peaks based on water temperatures as the literature indicates (see above references). Nevertheless, the biology of these clams compared with the juvenile monitoring data justifies two target treatment periods. These are from mid to late July and from early to mid November. These periods will target any Corbicula that may make it into plant systems when they are most vulnerable to treatment chemicals. It will also prevent clams from growing large enough to resist treatment chemicals or cause clogging problems.

3.2 ZEBRA MUSSEL

There were no zebra mussels found immediately upstream and downstream at long term monitoring sites on the Neosho River. High river flows during the first one-half of 1995 made searches difficult. During October, lower flows allowed efficient searches for the mussel on submerged rocks and debris. The river's shoreline was also easily searched.

Introduction of zebra mussels to inland lakes can occur by transport of recreational boats from infested waters. It is likely that zebra mussels will expand to Kansas and Wolf Creek Lake through this dispersal mechanism. Water chemistry and temperature data indicate that most of the cooling lake will provide favorable growing conditions for zebra mussels. Detecting the initial expansion of zebra mussels to the Neosho River and Wolf Creek Lake is important because zebra mussels can cause fouling problems by the second year after introduction

(Claudi and Mackie, 1994). Therefore, it is prudent to increase monitoring for the initial presence of these mussels in the vicinity of Wolf Creek Generating Station.

4.0 CONCLUSIONS AND MANAGEMENT IMPLICATIONS

The Corbicula population in the cooling lake expanded its range to include nearly the entire lake. Consequently, continued sampling of WCL for adult clams is not necessary. Expansion along the east shorelines and into the northern reaches of the lake was found. Initial pioneering was most likely from makeup water pumping activities, which transported the clams as planktonic juveniles to WCL from the Neosho River. Clam sizes commonly found in the lake were smaller than sizes typically clogging plant-cooling systems (3/4 to 1 1/4 inch).

The occurrence of a small number of planktonic juvenile clams in October sampling confirms the presence of a fall spawning period. With this data and the biology of the clams as cited in the literature, two in-plant treatment periods per year are recommended. The first in mid to late-July and the second in early to mid-November. Continued juvenile sampling is unnecessary because the fall spawning period has been identified.

Zebra mussels were not found at the Neosho River monitoring sites or Wolf Creek Lake. The mussels were not known to inhabit any Kansas waters during 1995. Increased monitoring for the initial presence of these mussels in the vicinity of Wolf Creek Generating Station is prudent.

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TABLE 1. Growth of Zebra Mussels in Relation to Water Quality Criteria in Wolf Creek.

Criteria *	no survival	poor growth	mod. growth	good growth	best growth	WCL--1993
alkalinity (mg CaCO3/L)	0 to 17	18 to 25	36 to 87	88 to 122	>122	134 to 145
calcium (mg/L)	5 to 6	10 to 11	25 to 26	35 to > 35		34 to 44
conductivity (umhos/cm)	0 to 210	220 to 360	370 to 820	830 to 1,100	>1,100	370 to 530
pH	0 to 6.8	6.9 to 7.4	7.5 to 7.8	7.9 to 8.0	>8.0	7.7 to 8.4
temperature (degrees C.)	<-2 or > 40	0-8 to 28-30	9-12 to 25-27	13-17 to 21-24	18-20	2 to 32

* As cited in Claudi and Mackie, 1993

TABLE 2. Summary of 1995 Ponar Grab Samples for Asiatic Clams in Wolf Creek Lake.

Location	Replicate	Water Depth (ft)	Substrate Type*	Water Temp ^0C	Live Clams
MUDS	1	2.0	Detritus/Silt	6	0
	2	2.0	Detritus/Silt	6	0
	3	2.0	Silt	6	0
	4	2.0	Gravel/Silt	6	0
	5	2.0	Silt/Detritus	6	1
	6	2.0	Silt/Detritus	6	0
	7	2.0	Silt/Detritus	6	0
	8	2.0	Silt/Detritus	6	0
Service Spillway	1	16.0	Silt/Detritus	10	0
	2	16.0	Silt/Detritus	10	0
	3	16.0	Silt/Detritus	10	0
	4	16.0	Silt/Detritus	10	0
	5	8.0	Soil/Course silt	10	1
	6	8.0	Soil/Course silt	10	0
	7	8.0	Soil/Course silt	10	0
	8	8.0	Soil/Course silt	10	0
CWSH	1	10.0	Silt/Detritus	9	0
	2	10.0	Silt/Detritus	9	0
	3	10.0	Silt/Detritus	9	1
	4	3.0	Silt/Sand/Gravel	9	2
	5	4.0	Gravel/Silt	9	0
	6	4.0	Gravel/Silt	9	1
	7	4.0	Gravel/Silt	9	1
	8	4.0	Gravel/Silt	9	0
Saddle Dam IV	1	4	Silt/Detritus/Gravel	10	0
	2	4	Silt/Detritus/Gravel	10	0
	3	4	Silt/Detritus/Gravel	10	0
	4	4	Silt/Detritus/Gravel	10	1
	5	4.5	Silt/Detritus	10	0
	6	4.5	Silt/Detritus	10	0
	7	4.5	Silt/Detritus	10	0
	8	4.5	Silt/Detritus	10	0

* In order of dominance.

TABLE 3. Planktonic Juvenile Asiatic Clam (Corbicula fluminea) Data from Wolf Creek Lake in 1995.

Date	Water Temp (^0C)	Sample Volume (M^3)	Number Clams
5/3	14	0.71	1
5/10	14	0.71	0
5/18	17	0.71	0
5/24	21	0.71	0
6/1	22	0.90	0
6/7	29	0.90	1
6/15	29	0.90	0
6/23	33	0.90	0
6/30	-	0.90	0
7/7	30	0.90	0
9/8	24	0.55	0
9/15	26	0.55	0
9/22	19	0.55	0
9/29	21	0.55	0
10/6	17	0.55	0
10/13	18	0.55	0
10/20	13	0.54	0
10/27	11	2.70	2
11/10	9	2.70	0
		Total 17.48 m^3	

ATTACHMENT 2.0

ZEBRA MUSSEL (*Dreissena polymorpha) MONITORING*

Near WOLF CREEK GENERATING STATION

2003 REPORT and 2004 PLANS

Prepared by:		1/21/04
	Dan Haines	Date
Supervisor Regulatory Support Approval:		1/21/04
	Robert Hammond	Date
Manager Regulatory Affairs Approval:		01/21/04
	Kevin Moles	Date

Executive Summary

Zebra mussels were not observed during 2003 monitoring of the Neosho River and Wolf Creek Lake (WCL). This document presents the monitoring results in 2003 and plans for 2004. Monitoring was completed to provide early detection so that zebra mussel prevention plans can be initiated at Wolf Creek Generating Station (WCGS). Monitoring included substrate and shoreline searches of the Neosho River upstream of John Redmond Reservoir (JRR) and immediately downstream of JRR in the vicinity of the Makeup-water Screen House (MUSH), where water is pumped from the Neosho River to WCL. Settlement monitors were placed and substrate scrapes were conducted at plant structures on the Neosho River and WCL. Inspections of fishing boats were also continued through 2003.

As a result of zebra mussels being discovered at El Dorado Lake on August 25, 2003, boat inspection forms were updated and lake attendant training was completed to ensure awareness of the increased potential for zebra mussels. El Dorado Lake, approximately 80 miles southwest of WCGS, is in the Walnut River drainage, which is immediately west of the Cottonwood/Neosho drainage. This places potential sources of zebra mussels for transport to the Neosho River and WCL much closer than previously, which was north central Oklahoma. Zebra mussels were also found in 2003 at two new inland lakes by Tulsa, Oklahoma.

The Neosho River and WCL would be conducive for zebra mussel survival and growth based on water quality conditions present. Introduction to WCL will most likely be caused by WCGS pumping activities from the Neosho River. Boat inspections will likely prevent mussel introduction via recreational boats. Monitoring in the Neosho River and WCL will be increased by initiating planktonic veliger sampling in 2004. Contact with the Kansas Department of Wildlife and Parks and the Kansas Department of Health and Environment will continue to enhance monitoring and maintain awareness of mussel range extension in the area. These efforts will help ensure that zebra mussels are detected as early as practical in the WCGS area.

1.0 INTRODUCTION

Zebra Mussels were not found during 2003 monitoring of the Neosho River and Wolf Creek Lake (WCL). This document presents the results from 2003, and monitoring plans for 2004. The objective of the monitoring program is to determine the presence or absence of zebra mussels in the Neosho River and WCL.

Early detection of zebra mussels in the local region is important in order to implement control measures before the mussels affect WCGS systems. The mussels can cause fouling problems by the second year after introduction (Claudi and Mackie 1994). Zebra mussel introduction to WCL will most likely be by pumping from the Neosho River via the MUSH, from being transported on recreational boats, or from fish stocking activities.

Dispersal overland into three regional inland lakes was discovered during 2003. Two lakes in northeast Oklahoma, Oologah and A. B. Jewel, were found to have zebra mussels in the spring. The third was El Dorado Lake in south-central Kansas, where zebra mussels were discovered during August 2003. Zebra mussel presence in El Dorado Lake and the Walnut River drainage, which is adjacent the Cottonwood/Neosho River drainage, is a concern for WCGS. As a testament of potential dispersal into Missouri lakes, a marina employee found zebra mussels on a recreational boat in February 2000, before the boat was launched at Lake of the Ozarks.

The zebra mussel is present in the Arkansas River drainage in Oklahoma and Arkansas, and in the Mississippi River in eastern Missouri. One adult zebra mussel was found on a trash rack at a power plant intake along the Missouri River near Sioux City, Iowa in April 1999, and was likely transported by barge traffic. Evidence of zebra mussels has been reported in the Kansas City area (New York Sea Grant, 2001). Dead zebra mussel shells were found by the Kansas City Board of Public Utilities within cooling water strainers at the Quindero Electric Generating Plant located along the Missouri River. In addition, zebra mussel shells were found in a fish tank used at a fishing tournament at Milford Lake by Junction City, Kansas. However, it could not be confirmed that the specimens came from Milford Lake (S. Adams, KDWP personal communication). It is expected that the zebra mussel will inevitably spread to every habitable region in the United States (Carlton 1993).

Early detection of zebra mussels in the local region is important in order to implement control measures before the mussels affect WCGS systems. The mussels can cause fouling problems by the second year after introduction (Claudi and Mackie 1994). Zebra mussel introduction to WCL will most likely be by pumping from the Neosho River via the MUSH, however, potential for introduction via recreational boats has increased due to mussel presence in El Dorado Lake.

Consequently, boat inspections at the Coffey County lake access park will be continued as a preventative measure. To enhance early detections, monitoring will be increased by adding plankton sampling of the Neosho River and WCL.

2.0 2002 MONITORING METHODS

2.1 NEOSHO RIVER

Shoreline and substrate searches in the Neosho River were completed in October 2003 (Table 1). Scrapes of the concrete surfaces of the MUSH were also completed. These searches were scheduled after the 2003 growing season to increase the likelihood of detecting adult specimens. The searches consisted of close examination of rocks, vegetation, logs and deposited debris for the presence of either attached live or dead zebra mussel shells. Two locations were searched, one upstream of JRR at

Hartford, and the second adjacent to the MUSH, downstream of JRR. The search effort at each location was conducted for a minimum of 30 man-minutes.

Available water quality parameters for the Neosho River (WCNOC 1988) were reviewed and compared with parameters cited as optimal for zebra mussel habitation (Claudi and Mackie, 1994). This comparison was completed to determine the potential for mussel survival and growth if introduced to the Neosho River.

Periphyton samplers (Hester-Dendy multiple plate sampler) with a 0.13m^2 surface area were placed at the MUSH beginning in May, then retrieved and inspected monthly through November 2003.

2.2 WOLF CREEK LAKE

Shoreline and substrate searches in WCL were completed in a similar manner as in the Neosho River during October and November 2003 (Table1). A total of 15 shoreline locations were searched for approximately 30 man-minutes each. The shoreline areas adjacent to the Make-up Discharge Structure (MUDS) and the Circulating Water Screen House (CWSH) were primary search sites. Search sites consisted of areas of wave deposition where dead zebra mussel shells would be concentrated. Rip-rap and rock substrate areas were also searched because these were considered suitable zebra mussel habitat (Claudi and Mackie 1994).

Underwater scrapes for attached zebra mussels from the CWSH, MUDS, Service Spillway and Essential Service Water Screenhouse (ESWS) were completed concurrent with the substrate searches.

Periphyton samplers (Hester-Dendy multiple plate samplers) with a 0.13m^2 surface area were placed on the MUDS and CWSH during May, then retrieved and inspected monthly through November 2003 (Table 1).

Boat inspections for zebra mussels were continued at the lake access park. Park attendants were trained a second time on zebra mussel identification and to ensure their awareness of increased mussel potential due to the El Dorado Lake find. A checklist was revised and provided to aid the inspections.

Available water quality parameters for WCL were reviewed and compared with parameters cited as optimal for zebra mussel habitation (Claudi and Mackie, 1994). This comparison was completed to determine the potential for mussel survival and growth if introduced to WCL.

3.0 2002 MONITORING RESULTS

3.1 NEOSHO RIVER

Zebra mussels were not found at the monitoring sites during the shoreline and substrate searches in the Neosho River (Table 1). Search conditions were ideal due to low river flows. No zebra mussels were found in the substrate scrapes or on the settlement monitors at the MUSH.

Conditions conducive for zebra mussel survival were prevalent in the Neosho River (Table 2). The most limiting factor appears to be conductivity, which is only conducive to moderate growth of zebra mussels in the Neosho River. All other parameters indicate that the mussels could have good to optimum growth potential.

3.2 WOLF CREEK LAKE

Zebra mussels were not found at any of the shoreline areas searched on WCL (Table 1). Low lake level conditions exposed large areas of shore, which enhanced search efforts. Previously submerged substrate was easily searched for zebra mussels. No zebra mussels were found from the MUDS, CWSH, ESW, or Service Spillway underwater scrapes. No mussels were found on the CWSH or MUDS settlement monitors.

Periodic observations and interviews of the County park attendants indicate that boat inspections should be effective in preventing introduction of zebra mussels via fishing boats. Anglers were routinely required to empty live wells and either dry or disinfect their boats before being allowed on the lake. Most anglers understood the need to prevent mussel spread and willingly participated.

Water quality parameters in WCL should generally promote good to optimum growth of zebra mussels (Table 2). Conductivity may limit the mussels to moderate growth, which is similar to that in the Neosho River. The most limiting factor in WCL may be temperature. Prolonged periods with water temperatures above 32°C (90° F) may prevent zebra mussel infestations (Claudi and Mackie, 1994). The WCL frequently exceeds 90° F in areas influenced by the heated effluent from WCGS; however, surface water temperatures have remained below 90° F within the cooling water intake area.

4.0 CONCLUSIONS AND MANAGEMENT IMPLICATIONS

Zebra mussels were not observed in the vicinity of WCGS. While it likely takes numerous introductions to establish a viable population of zebra mussels in an isolated lake, zebra mussels readily populate lakes connected to rivers with upstream zebra mussel populations (Johnson 1997). The WCL can be considered as connected to the Neosho River, due to MUSH operation. Consequently, it is important to continue monitoring the river to attempt to detect initial zebra mussel presence. This will allow for treatment options to be considered before zebra mussels inhabit WCL.

Direct introductions of zebra mussels to WCL could occur from infested recreational boats and bait buckets (Tyus et al 1994), consequently, continued monitoring and boat inspections at WCL is important for prevention and/or early detection. With these transport vectors, zebra mussels could become established in WCL before in the Neosho River. The public access to WCL continues to make dispersal of zebra mussels by recreational boats a potential threat to WCGS. Chance of this has been increased due to mussel establishment in El Dorado Lake. Assessment of boater addresses during 2003 indicates that El Dorado area boaters visiting WCL was 1 in 15, compared with 1 in 620 from Oklahoma, previously the closest zebra mussel infested area.

5.0 2003 MONITORING AND PREVENTION PLANS

5.1 SHORELINE SEARCHES

A search of the natural substrates and shorelines will be conducted in the Neosho River upstream of JRR at Hartford, Kansas, and downstream of the reservoir at the MUSH. Each location will be searched for at a minimum of 30 man-minutes. Suitable deposition areas will be searched for the presence of zebra mussel shells. Substrates of suitable pools, eddies, or other slack water areas will be searched for the presence of attached mussels. These searches will be conducted during low flow conditions to ensure safe access to as much of the river channel as possible. Larger mussels will increase the ability of the searchers to detect early colonization. Consequently, the searches will be conducted beginning after August 2004.

Substrate and shoreline searches will be conducted in WCL at a minimum of 15 locations similar to past years. Search effort will be a minimum of 30 man-minutes at each location. Two locations will be in the vicinity of the MUDS and CWSH. The remainder will be concentrated in areas where waves deposit shells and debris, or in areas of suitable zebra mussel habitat. Larger mussels will increase the ability of the searchers to detect early colonization. Consequently, the searches will be conducted after August 2004.

Presence or absence of zebra mussels at each site will be recorded (see attached data sheet). Length, width and height of a representative sample will be measured to the nearest millimeter if complete zebra mussels are found. This will aid in determining age, and thus the approximate year of initial colonization.

5.2 SUSTRATE SCRAPES

Underwater scrapes of attached organisms will be inspected for zebra mussels from the CWSH, MUDS, MUSH, Service Spillway, and Essential Service Water Screenhouse using equipment similar to that described in Allen (1997). These scrapes will be completed after August 2004.

5.3 SETTLEMENT MONITORS

Periphyton samplers similar to Hester-Dendy multiple plate samplers ($0.13m^2$ surface area), will be placed in the Neosho River adjacent to the MUSH, and in WCL adjacent to the MUDS and CWSH. These samplers will be placed during May 2003. Each sampler will be retrieved and inspected for attached juvenile zebra mussels monthly through November 2004.

5.4 PLANKTONIC VELIGER MONITORING

Planktonic monitoring for zebra mussel veligers will be initiated in the Neosho River at the MUSH area, and in WCL at the CWSH. Monitoring effort will begin in May and consist of two replicate samples, monthly through November 2004. Each replicate will consist of filtering a minimum of 500 gallons of source water through a 64-micron plankton net. Plankton samples will be viewed for the presence of zebra mussel veligers using a cross-polarization microscopy technique similar to that described by Johnson (1995). All plankton will be viewed in samples with low plankton densities. For samples with high plankton or debris densities, sufficient aliquots will be viewed to equal a minimum of five percent of the total concentrated sample volume. Plankton in the concentrated samples will be allowed to settle, with the sub-samples being taken from the settled plankton. This technique will increase the chance of detecting veligers in the samples. Samples will be viewed magnified from 30 to 50 times. The purpose of these samples is qualitative. If mussels are detected, then quantitative sampling may be completed if density estimates are necessary.

5.5 RECREATIONAL BOAT INSPECTIONS

Boats accessing the lake at the public access park will be inspected for the presence of zebra mussels prior to launching. Environmental Management will work with the Coffey County Sheriff's Department to periodically ensure that boat inspections are being effective. Park attendants will continue to use the attached checklist, or a comparable replacement, through 2004. Inspections are recommended to continue until monitoring confirms zebra mussel establishment in the lake.

6.0 LITERATURE CITED

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Table 1. Summary of 2003 zebra mussel monitoring results for the Neosho River and Wolf Creek Lake.

Location	Date	Substrate	Water Temp (°F.)	Zebra Mussels
Neosho River				
Substrate searches				
Hartford	10/24/03	Bedrock/gravel/rubble	62	none
MUSH	10/24/03	Bedrock/shale/rubble	63	
Substrate scrapes				
MUSH	10/24/03	Concrete	63	
Settlement monitor				
MUSH	5/28-6/11	na	na	
	6/12-7/16			
	7/16-8/25			
	8/25-9/16			
	9/16-10/17			
	10/17-11/28			
Wolf Creek Lake				
Substrate searches				
MUDS south shore	10/23/03	Riprap/clay/silt	65	None
West Service Spillway	10/24/03	Gravel/rubble	64	
Main Dam SW	10/28/03	Rock/rubble/gravel	60	
Saddle Dam IV, S		Clay/gravel/riprap	60	
Saddle Dam IV, N		Clay/gravel/riprap	60	
East shore, FAS 10		Rock/silt/clay	60	
East shore CWSH		Rock/silt/clay	60	
OCAB point	10/29/03	Rock/Clay	64	
Iseman cove W shore		Rock/silt/clay	64	
Allen point		Rock/clay	64	
Allen cove point SW		Rock/rubble	64	
East Service Spillway		Rock/riprap	66	
Winn point	11/19/03	Rock	57	
Reinker road		Rock/gravel/clay	55	
ESWS north shore		Riprap/clay/gravel	53	
Substrate scrapes				
MUDS	10/23/03	Concrete	65	
Service Spillway	10/24/03		64	
CWSH	10/28/03		60	
ESWS	11/19/03		53	
Settlement monitors				
CWSH	5/28-6/11	na	na	None
	6/12-7/24			
	7/24-8/25			
	8/25-9/28			
	9/28-10/30			
	10/30-11/28			
MUDS	5/28-6/11			
	6/12-7/18			
	7/24-8/25			
	8/25-9/23			
	9/23-10/23			
	10/23-11/28			

Table 2. Growth Potential of Zebra Mussels in Relation to Water Quality Criteria in the Neosho River and Wolf Creek Lake.

Criteria (1)	no survival	poor growth	mod. growth	good growth	best growth	WCL (2)	Neosho River (3)
alkalinity (mg CaCO3/L)	0 - 17	18 - 25	36 - 87	88 - 122	>122	134 - 145	250
calcium (mg/L)	5 - 6	10 - 11	25 - 26	26 - 35	>35	34 - 44	52
conductivity (umhos/cm)	0 - 210	220 - 360	370 - 820	830 - 1,100	>1,100	370 - 530	417
pH	0 - 6.8	6.9 - 7.4	7.5 - 7.8	7.9 - 8.0	>8.0	7.7 - 8.4	7.8
temperature (degrees C.)	<-2 or > 40	0-8 and 28-30	9-12 or 25-27	13-17 or 21-24	18-20	2 to 32	30.5 summer max

(1) Claudi and Mackie, 1994
(2) Unpublished water quality data for WCL during 1993.
(3) 1987 data from WCNOC, 1988

Zebra Mussel Monitoring Sheet

Date

	LOCATION	Water temp	Substrate	#	Shell length	Shell height	Shell width
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							

Zebra mussel inspection checklist
Coffey County Lake

Boat Owner: ______________________ Date: ______________________

The purpose of this inspection is to prevent the introduction of zebra mussels into Coffey County Lake by boats. Zebra mussels have the potential to cause adverse impacts to the lake's fishery and to the efficient operation of Wolf Creek Generating Station.

All boats should be inspected prior to entry for the following:

1. a. Are all live wells dry? Yes _____ No _____

   b. If no, then owner **must** follow preventive methods recommended by the Kansas Department of Wildlife and Parks (KDWP) before launching. See current Fishing Regulations Summary or available brochure.

2. a. Is the bilge and/or boat floor dry? Yes _____ No _____

   b. If no, then owner **must** follow preventive methods recommended by the KDWP before launching.

3. a. Is the trailer free of attached vegetation or debris? Yes _____ No _____

   b. If no, owner **must** remove before launching.

4. a. Has the engine cooling system been drained? Yes _____ No _____

   b. If no, then owner **must** follow preventive methods recommended by the KDWP before launching.

5. a. Is the boat hull and motor free of attached zebra mussels? Yes _____ No _____

   b. If no, **do not allow** boat to be launched. Contact the KDWP as directed in the current Kansas Fishing Regulations Summary or brochures, and inform WCNOC 364-8831, ext 4672 or 4059.

6. a. Remind anglers that Coffey County Resolution 620 prohibits the placing or dumping of bait buckets into the lake. Yes _____ No _____

Inspector: ______________________

ATTACHMENT 3.0

ZEBRA MUSSEL (*Dreissena polymorpha*) *MONITORING*

Near WOLF CREEK GENERATING STATION

2005 REPORT and 2006 PLANS

Prepared by:		3/22/06
	Dan Haines	Date
Supervisor Regulatory Support Approval:		3/23/06
	Robert Hammond	Date
Manager Regulatory Affairs Approval:		03/23/06
	Kevin J. Moles	Date

Executive Summary

Zebra mussels were not observed during 2005 monitoring of the Neosho River and Coffey County Lake (CCL). Monitoring was completed to provide early detection so that zebra mussel in the vicinity of Wolf Creek Generating Station (WCGS). Efforts included substrate and shoreline searches of the Neosho River upstream of John Redmond Reservoir (JRR) and immediately downstream of JRR in the vicinity of the Makeup-water Screen House (MUSH), where water is pumped from the Neosho River to CCL. Settlement monitors were placed and substrate scrapes were conducted at plant structures on the Neosho River and CCL. Inspections of fishing boats were also continued through 2005.

Zebra mussels were discovered at El Dorado Lake on August 25, 2003, approximately 80 miles southwest of WCGS in the Walnut River drainage, which is immediately west of the Cottonwood/Neosho watershed. During 2005, the mussels expanded their range downstream to Oklahoma. None have been observed in the Neosho watershed.

The Neosho River and CCL would be conducive for zebra mussel survival and growth based on water quality conditions present. Introduction to CCL will most likely be caused by WCGS pumping activities from the Neosho River. Boat inspections will likely prevent mussel introduction via recreational boats. The 2005 monitoring in the Neosho River and CCL will continue through 2006. These efforts will help ensure that zebra mussels are detected as early as practical in the WCGS area.

INTRODUCTION

Zebra Mussels were not found during 2005 monitoring of the Neosho River and Coffey County Lake (CCL). This document presents the results from 2005, and monitoring plans for 2006. The objective of the monitoring program is to determine the presence or absence of zebra mussels in the Neosho River and CCL.

Zebra mussels were discovered at El Dorado Lake on August 25, 2003, approximately 80 miles southwest of WCGS in the Walnut River drainage, which is immediately west of the Cottonwood/Neosho watershed. During 2005, the mussels expanded their range downstream to Oklahoma. None have been observed in the Neosho watershed in Kansas.

Regionally, zebra mussel is present in the Arkansas River drainage in Oklahoma and Arkansas, and in the Mississippi River in eastern Missouri. One adult zebra mussel was found on a trash rack at a power plant intake along the Missouri River near Sioux City, Iowa in April 1999, and was likely transported by barge traffic. Evidence of zebra mussels has been reported in the Kansas City area. Dead zebra mussel shells were found by the Kansas City Board of Public Utilities within cooling water strainers at the Quindero Electric Generating Plant located along the Missouri River. No other sighting was reported during 2005.

Early detection of zebra mussels in the local region is important in order to implement control measures before the mussels affect WCGS systems. The mussels can cause fouling problems by the second year after introduction. Zebra mussel introduction to CCL will most likely be by pumping from the Neosho River via the MUSH, however, potential for introduction via recreational boats has increased due to mussel presence in El Dorado Lake. Consequently, boat inspections at CCL access park will be continued as a preventative measure.

2005 MONITORING METHODS

NEOSHO RIVER

Shoreline and substrate searches in the Neosho River were during late 2004 (Table 1). Scrapes of the concrete surfaces of the MUSH were also completed. The searches consisted of close examination of rocks, vegetation, logs and deposited debris for the presence of either attached live or dead zebra mussel shells.

Zebra mussel settlement monitors (Portland sampler) provided by the Kansas Department of Wildlife and Parks (KDWP) were used through 2005. Samplers were retrieved and inspected monthly through November 2005.

COFFEY COUNTY LAKE

Shoreline and substrate searches in CCL were completed in a similar manner as in the Neosho River during late 2005 (Table1). A total of 16 shoreline locations were searched and included areas adjacent to the Make-up Discharge Structure (MUDS) and the Circulating Water Screen House (CWSH). Search sites consisted of areas of wave deposition where dead zebra mussel shells would be concentrated. Rip-rap and rock substrate areas were also searched because these were considered suitable zebra mussel habitat.

Underwater scrapes for attached zebra mussels from the CWSH, MUDS, Service Spillway and Essential Service Water Screenhouse (ESWS) were completed concurrent with the substrate searches.

Settlement monitors provided by the KDWP were placed at the MUDS and CWSH inspected monthly through November 2005 (Table 1).

Boat inspections for zebra mussels were continued at the lake access park. Park attendants were trained a second time on zebra mussel identification and to ensure their awareness of increased mussel potential due to the El Dorado Lake find. A checklist was revised and provided to aid the inspections.

2005 MONITORING RESULTS

NEOSHO RIVER

Zebra mussels were not found at the monitoring sites during the shoreline and substrate searches in the Neosho River (Table 1). Search conditions were ideal due to low river flows. No zebra mussels were found in the substrate scrapes or on the settlement monitors at the MUSH.

COFFEY COUNTY LAKE

Zebra mussels were not found at any of the shoreline areas searched on CCL (Table 1). No zebra mussels were found from the MUDS, CWSH, ESW, or Service Spillway underwater scrapes. No mussels were found on the CWSH or MUDS settlement monitors.

Periodic observations and interviews of the County park attendants indicate that boat inspections should be effective in preventing introduction of zebra mussels via fishing boats. Anglers were routinely required to empty live wells and either dry or disinfect their boats before being allowed on the lake. Most anglers understood the need to prevent mussel spread and willingly participated.

Boaters were asked where they used their boat last to determine the relative risk of transporting zebra mussels to the lake. From these data, anglers previously used their boats in 105 different lakes, eight of which were confirmed or suspected to have potential zebra mussel's populations present. These lakes ranged from El Dorado Lake, Kansas to Lake Erie, Ohio. Of the 712 boats, which were previously on other water bodies other than CCL, 19 had come from where zebra presence was known. This is 206 percent. Of these, four boats were previously in infested waters within one week of coming to CCL. (0.5 percent). Five days is recommended by KDWP as an appropriate drying time to adequately prevent zebra mussels from being transported to new lakes. Inspections confirmed that these four boats were dry, live wells were dry, and no adults were attached on the boats.

2006 MONITORING AND PREVENTION PLANS

SHORELINE SEARCHES

A search of the natural substrates and shorelines will be conducted in the Neosho River upstream of JRR at Hartford, Kansas, and downstream of the reservoir at the MUSH. Suitable deposition areas will be searched for the presence of zebra mussel shells. Substrates of suitable pools, eddies, or other slack water areas will be searched for the presence of attached mussels. Larger mussels will increase the ability of the searchers to detect early colonization. Consequently, the searches will be conducted beginning after August 2006.

Substrate and shoreline searches will be conducted in CCL at a minimum of 15 locations similar to past years. Searches will be in areas where waves deposit shells and debris, or in areas of suitable zebra mussel habitat. Larger mussels will increase the ability of the searchers to detect early colonization. Consequently, the searches will be conducted after August 2006.

SUBSTRATE SCRAPES

Underwater scrapes of attached organisms will be inspected for zebra mussels from the CWSH, MUDS, MUSH, Service Spillway, and Essential Service Water Screenhouse. These scrapes will be completed after August 2006.

SETTLEMENT MONITORS

Samplers to detect zebra mussel settlement provided by KDWP will be placed in the Neosho River adjacent to the MUSH, and in CCL adjacent to the MUDS and CWSH. These samplers will be placed during May 2006 and inspected for attached juvenile zebra mussels monthly through November 2006.

PLANKTONIC VELIGER MONITORING

Planktonic monitoring for zebra mussel veligers will be completed in the Neosho River at the MUSH area, and in CCL at the CWSH. Samples will be taken monthly beginning in May and continuing through November 2006. A 64-micron plankton net used to collect plankton samples to be viewed for the presence of zebra mussel veligers using a cross-polarization microscopy technique. The purpose of these samples is qualitative. If mussels are detected, then quantitative sampling may be completed if density estimates are necessary.

RECREATIONAL BOAT INSPECTIONS

Boats accessing the lake at the public access park will be inspected for the presence of zebra mussels prior to launching. Environmental Management will work with the Coffey County Sheriff's Department to periodically ensure that boat inspections are being effective. Park attendants will continue to use the attached checklist, or a comparable replacement, through 2006. Inspections will continue until monitoring confirms zebra mussel establishment in the lake.

Table 1. Summary of 2005 zebra mussel monitoring results for the Neosho River and Wolf Creek Lake.

Location	Date	Substrate	Water Temp (°F.)	Zebra Mussels
Neosho River				
Substrate searches				
Hartford	11/905	Bedrock/gravel/rubble	56	none
MUSH	11/9/05	Bedrock/shale/rubble	56	
Substrate scrapes				
MUSH	11/9/05	Concrete	56	
Settlement monitor				
MUSH	4/30-5/31	na	na	none
	5/31-6/23			lost to flows
	6/23-7/25			lost to flows
	7/25-8/26			none
	8/26-9/27			
	9/27-10/26			
	10/26-11/9			
Planktonic veligers				
MUSH	5/31/05	na		none
	6/23/05			
	7/25/05			
	8/26/05			
	9/27/05			
	10/26/05			
	11/9/05			
Coffey County Lake				
Substrate searches				
Dew Point area	10/17/05	Clay /gravel	60	none
NE Baffle Dike A	10/17/05	Riprap/gravel		
East CWSH	11/30/05	Riprap/gravel	42	
West CWSH	11/30/05	Riprap/gravel	42	
East CWSH	11/30/05	Riprap/gravel	42	
North ESW	11/30/05	Riprap/gravel	42	
East Service Spillway	11/30/05	Riprap/gravel		
West Service Spillwayt	11/30/05	Riprap/gravel		
Main Dam	11/30/05	Riprap		
West Main Dam	12/1/05	Riprap/gravel		
South Saddle Dam IV		Riprap/gravel		
North Saddle Dam IV		Riprap/gravel		
South MUDS		Riprap/clay		
North MUDS		Riprap/clay		
South Reinker Road		Gravel/clay		
North Reinker Road		Gravel/clay		
Substrate scrapes				
MUDS	11/30/04	Concrete	42	none
Service Spillway	11/30/04		42	
CWSH	11/30/04			
ESWS	11/30/04		55	

Table 1 (cont)

Location	Date	Substrate	Water Temp (°F.)	Zebra Mussels
Settlement monitors				
CWSH	4/30-5/31	na	na	None
	5/31-6/23			
	6/23-7/25			
	7/25-8/26			
	8/26-9/27			
	9/27-10/26			
	10/26-11/9			
MUDS	4/30-5/31			
	5/31-6/23			
	6/23-7/25			
	7/25-8/26			
	8/26-9/27			
	9/27-10/26			
	10/26-11/9			

ZEBRA MUSSEL (*Dreissena polymorpha*) *MONITORING*

near WOLF CREEK GENERATING STATION

2005 REPORT and 2006 PLANS

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	Dan Haines	**Date**
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SHORELINE SEARCHES

A search of the natural substrates and shorelines will be conducted in the Neosho River upstream of JRR at Hartford, Kansas, and downstream of the reservoir at the MUSH. Suitable deposition areas will be searched for the presence of zebra mussel shells. Substrates of suitable pools, eddies, or other slack water areas will be searched for the presence of attached mussels. Larger mussels will increase the ability of the searchers to detect early colonization. Consequently, the searches will be conducted beginning after August 2006.

Substrate and shoreline searches will be conducted in CCL at a minimum of 15 locations similar to past years. Searches will be in areas where waves deposit shells and debris, or in areas of suitable zebra mussel habitat. Larger mussels will increase the ability of the searchers to detect early colonization. Consequently, the searches will be conducted after August 2006.

SUBSTRATE SCRAPES

Underwater scrapes of attached organisms will be inspected for zebra mussels from the CWSH, MUDS, MUSH, Service Spillway, and Essential Service Water Screenhouse. These scrapes will be completed after August 2006.

SETTLEMENT MONITORS

Samplers to detect zebra mussel settlement provided by KDWP will be placed in the Neosho River adjacent to the MUSH, and in CCL adjacent to the MUDS and CWSH. These samplers will be placed during May 2006 and inspected for attached juvenile zebra mussels monthly through November 2006.

PLANKTONIC VELIGER MONITORING

Planktonic monitoring for zebra mussel veligers will be completed in the Neosho River at the MUSH area, and in CCL at the CWSH. Samples will be taken monthly beginning in May and continuing through November 2006. A 64 micron plankton net used to collect plankton samples to be viewed for the presence of zebra mussel veligers using a cross-polarization microscopy technique. The purpose of these samples is qualitative. If mussels are detected, then quantitative sampling may be completed if density estimates are necessary.

RECREATIONAL BOAT INSPECTIONS

Boats accessing the lake at the public access park will be inspected for the presence of zebra mussels prior to launching. Environmental Management will work with the Coffey County Sheriff's Department to periodically ensure that boat inspections are being effective. Park attendants will continue to use the attached checklist, or a comparable replacement, through 2006. Inspections will continue until monitoring confirms zebra mussel establishment in the lake.

Table 1. Summary of 2005 zebra mussel monitoring results for the Neosho River and Wolf Creek Lake.

Location	Date	Substrate	Water Temp (°F.)	Zebra Mussels
Neosho River				
Substrate searches				
Hartford	11/905	Bedrock/gravel/rubble	56	none
MUSH	11/9/05	Bedrock/shale/rubble	56	
Substrate scrapes				
MUSH	11/9/05	Concrete	56	
Settlement monitor				
MUSH	4/30-5/31	na	na	none
	5/31-6/23			lost to flows
	6/23-7/25			lost to flows
	7/25-8/26			none
	8/26-9/27			
	9/27-10/26			
	10/26-11/9			
Planktonic veligers				
MUSH	5/31/05	na		none
	6/23/05			
	7/25/05			
	8/26/05			
	9/27/05			
	10/26/05			
	11/9/05			
Coffey County Lake				
Substrate searches				
Dew Point area	10/17/05	Clay /gravel	60	none
NE Baffle Dike A	10/17/05	Riprap/gravel		
East CWSH	11/30/05	Riprap/gravel	42	
West CWSH	11/30/05	Riprap/gravel	42	
East CWSH	11/30/05	Riprap/gravel	42	
North ESW	11/30/05	Riprap/gravel	42	
East Service Spillway	11/30/05	Riprap/gravel		
West Service Spillway	11/30/05	Riprap/gravel		
Main Dam	11/30/05	Riprap		
West Main Dam	12/1/05	Riprap/gravel		
South Saddle Dam IV		Riprap/gravel		
North Saddle Dam IV		Riprap/gravel		
South MUDS		Riprap/clay		
North MUDS		Riprap/clay		
South Reinker Road		Gravel/clay		
North Reinker Road		Gravel/clay		
Substrate scrapes				
MUDS	11/30/04	Concrete	42	none
Service Spillway	11/30/04		42	
CWSH	11/30/04			
ESWS	11/30/04		55	

Table 1 (cont)

Location	Date	Substrate	Water Temp (°F.)	Zebra Mussels
Settlement monitors				
CWSH	4/30-5/31	na	na	None
	5/31-6/23			
	6/23-7/25			
	7/25-8/26			
	8/26-9/27			
	9/27-10/26			
	10/26-11/9			
MUDS	4/30-5/31			
	5/31-6/23			
	6/23-7/25			
	7/25-8/26			
	8/26-9/27			
	9/27-10/26			
	10/26-11/9			

Table 2. Number of boat trips and lakes where previously used just prior to launching at Coffey County Lake.

Previous water bodies that boats visiting Coffey County Lake were in, and time since in another water body

Lake last in	# boats from Zebra area	Watch for Zebra infested	Here same day	Here day after	Came here within prev week	Came here within prev month	In zebra water > month ago
Confirmed Zebra mussel waters							
Arkansas river	1				1		
Dardenelle AR	1					1	
El Dorado	8			[illegible]	2	2	3
Grand Lake OK	3					1	2
Kaw Reservoir OK	1					1	
Lake Erie	1					1	
Muskogee OK	1					1	
Missouri River	3					3	
Lakes considered at risk of getting zebra mussels							
Beaver Lake AR		2			1	1	
Bull Shoals MO, AR		1			1		
Cheney		10		2		7	1
Council Grove		2			1	1	
Desota NB		1			1		
Fall river		6			1	5	
Lake-of-the-Ozarks MO		8			2	6	
Marion		7		1	3	2	1
Mark Twain MO		1				1	
Milford		25		[illegible]	8	11	4
Spavinaw OK		1				1	
Other Lakes							
Atchison Co St lake					1		
Banner Creek				1	3	7	
Big Hill					1	4	1

Legend:
- very high potential
- high potential
- medium potential
- not likely, or no way

Blue Springs MO				1		2	
Bluestem Lake NB							1
Bone Creek					1	4	
Bourbon Co St Lake						1	
Branched Oak NB							1
Brown Co St Lake							1
Bucyrus					1		
Butler Co State Fishing Lake				1	2	2	
Carbondale				1	1	4	
Cedar Bluff						1	
Cedar Valley, Garnett					1	3	
Chase Co St Fishing Lake					1	3	1
Clinton				2	11	19	4
Concordia							1
Cowley Co St lake					1		
Douglass Co St lake						2	
Fort Scott lake				1		1	1
Franklin Co St lake					1		
Gardner				1	2	3	1
Garnett					3	5	
Gridley				1	1	3	
Harrison Co Lake MO						1	
Hillsdale			2	10	29	48	2
Jeffery EC			1		1	2	1
John Redmond			8		1	7	
Johnson Co Park					1	1	
Kanopolis						2	
Kill Creek Lake							1
La Cygne				4	12	15	3
Lake Shawnee				4	6	6	
Lake Viking MO				1		1	
Leavenworth Lake					2	7	
Lebo lake				1		1	

Lonestar				1	3	4	
Long View MO					2		
Louisberg						1	
Lovewell						1	
Lyon Co St lake						1	
Madison City lake						2	
Mapleleaf MO						1	
McConahey NB							1
Melvern			2	16	23	44	13
Middle Creek				4	3	4	
Moline City					2	1	
Montgomery Co St Lake						1	
Montrose MO					1		
Mozingo, Maryville MO					1		
Neosho River						1	1
North Iowa IA							1
Olathe					1	1	
Osage City					1		
Osage Co St lake						1	
Paola				1	1	1	
Perry				1	13	13	2
Pomme de Terre MO					2		
Pomona			2	2	7	7	1
Pony Express MO						1	
Pottawatomie Co St lake					1		
Private pond				1	3		
Shawnee Co St lake						1	
Shawnee Mission					1	2	
Smithville MO			2	6	12	8	2
St Paul							1
Stockton MO					3	2	2
Sugar Valley					2		
Table Rock AR					2	11	

Tanglewood					1			
Tannycomo MO				1		1	3	
Tennessee State							1	
Texas				1				
Texoma OK						1	1	
Tonganoxie						1		
Toronto			[illegible]		1	1	1	
Total								
Truman MO				1	4	10	4	
Wagon Train NB						1		
Wellington						[illegible]		
Werspahn NB					1			
Wilson Co St lake			[illegible]					
Wilson Reservoir					1	6		
Woodson St Fishing Lake				2	1	2		
Wyandotte Co St.lake				3	2	4		
Yates Center				2	3	3		
TOTAL	19	64	29	77	202	340	64	712
%	2.7	9.0	4.1	10.8	28.4	47.8	9.0	

Criteria: Red if from known zebra area, and recent enough for zebra survival likely. Orange if from zebra area, with zebra survival probable, or from other lakes during same day. Yellow if from zebra areas, with zebra survival possible, but not likely, or from other lakes the previous day. Others not much potential for zebra transport.

KANSAS AQUATIC NUISANCE SPECIES MANAGEMENT PLAN

K
Aquatic
Nuisance
Species
A
S

State of Kansas
Kathleen Sebelius, Governor

Kansas Department of Wildlife & Parks
J. Michael Hayden, Secretary

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Approved by Kathleen Sebelius, Governor

04/26/09
Date

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EXECUTIVE SUMMARY

Aquatic Nuisance Species (ANS) are a source of significant ecological and socio-economic problems throughout North America. Kansas's aquatic ecosystems have already been invaded by ANS such as zebra mussels, white perch, and purple loosestrife. While their initial impacts have been limited and localized, there is little doubt that these and other ANS pose a serious threat to Kansas water resources. The importance of Kansas's aquatic resources requires a coherent response to the threat posed by ANS. Using guidance from the National ANS Task Force and other accepted state agency plans, this management plan was developed to establish management actions to address the prevention, control, and effects of non-indigenous aquatic nuisance species that have invaded or may invade Kansas waters. The Kansas non-indigenous aquatic nuisance species management plan serves as the initial step in establishing a program to specifically address ANS issues in Kansas.

The development of a state ANS management plan, as called for in Section 1204 of the Non-indigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990, provides an opportunity for federal cost-share support for implementation of the plan. NANPCA, reauthorized in 1996 as the National Invasive Species Act (NISA), specifies that state plans identify feasible, cost-effective management practices and measures that can be implemented by the state to prevent and control ANS infestations in an environmentally sound manner.

The goals of this ANS management plan are:

1. To prevent new introductions of ANS to Kansas.

2. To prevent dispersal of established populations of ANS into uninfested waters in Kansas.

3. To eradicate or control to minimize the adverse ecological, economic, social, and public health effects of ANS in an environmentally sound manner.

4. To educate all aquatic users of ANS risks and how to reduce the harmful impacts.

5. To support research on ANS in Kansas, and develop systems to disseminate information.

Included in this plan are discussions of existing problems; a summary of federal, regional, and state policy; a list of non-indigenous species known to exist in Kansas; identification of existing priority ANS; and a discussion of regional ANS that pose a threat to Kansas aquatic ecosystems.

To ensure that the goals of this plan are being effectively addressed, a procedure for monitoring and evaluating the implementation of strategies and tasks will be initiated. This evaluation will focus on the feasibility and cost-effectiveness of management activities. The plan is a working document and will be periodically updated and expanded based upon the experience gained from implementation, scientific research, and new tools as they become available.

The effort to develop a state ANS management plan for Kansas was led by the Department of Wildlife and Parks in conjunction with personnel from other government agencies and private organizations (Appendix D). Public comments were solicited from local governments, regional entities, public and private organizations, and resource user groups that have expertise and interest in the control of ANS. Comments were considered, and revisions have been made to the plan.

INTRODUCTION

Non-indigenous aquatic nuisance species (ANS) are the cause of significant ecological and socio-economic problems for water users in North America. ANS have spread beyond historic ranges and have adversely affected infested waters by threatening the integrity of the water resources. Since non-indigenous ANS have few natural controls in their new habitats, they spread rapidly, destroying native plant and animal habitat, threaten the diversity and abundance of native species, and damage industrial, agricultural, and recreational activities dependent on surface waters.

A number of these ANS have become established in the United States and represent a threat to the nation's aquatic resources. As the introduction and spread of ANS continues, the associated problems intensify and create a wide variety of ecological and socio-economic problems for water users. In 1990, the Non-indigenous Aquatic Nuisance Prevention and Control Act (NANPCA) was passed to address ANS problems in the United States. This legislation provided an opportunity for federal cost-share support for implementation of state plans. While programs created by this legislation were initially aimed at problems in the Great Lakes region, reauthorization of NANPCA in 1996 as the National Invasive Species Act (NISA) established a national goal of preventing new ANS introductions and limiting the dispersal of existing ANS in all of the states. NISA specifies that state plans identify feasible, cost-effective management practices and measures that can be implemented by the state to prevent and control ANS infestations in a manner that is environmentally sound. Approval of a state ANS management plan by the Federal Aquatic Nuisance Species Task Force is required for Kansas to be eligible for federal cost-share support.

According to Rendall (1997), the following points must be considered in addressing ANS issues and establishing ANS management programs. These points have provided guidance in the development of this ANS long-term management plan.

- There are many pathways of introduction and spread for ANS, most of which are related to human activities, both accidental and intentional. New species continue to be introduced and spread within North America through these pathways.

- Introductions have many costs associated with them: control and management costs; long-term ecosystem changes; and loss of recreational opportunities.

- Often there are few, if any, acceptable controls available for use in natural water bodies once ANS become established.

- Once species are successfully introduced, any control efforts will be very expensive and eradication very unlikely.

- Prevention is the best course of action. Management plans, education programs, and regulations are strategies that can help prevent the spread of ANS.

The coordinated efforts contained within this plan are designed to protect residents of Kansas and the state's aquatic resources from the multitude of potential losses associated with ANS plants and animals. This management plan focuses on preventing the accidental introductions of new ANS, limiting the spread of existing ANS, and controlling or eradicating ANS where environmentally and economically feasible. The intentional introduction of non-indigenous species for aquaculture, commercial, or recreational purposes is addressed to insure that these beneficial introductions do not result in accidental ANS introductions, and to improve information sharing among those agencies responsible for regulation of intentional introductions.

It is the intent of the State of Kansas to prepare for the introduction of destructive ANS currently found in regional waters and take measures to prevent their infestation of state water bodies. With the recent introduction of one of the most destructive ANS, the zebra mussel *Dreissena polymorpha*, it is realized that a coordinated and effective effort to address this and other ANS introductions is necessary. Kansas has the opportunity to develop a program to allow the state to quickly and effectively deal with both existing and potential ANS threats before they cause significant environmental and economic damage.

In the United States, control of the zebra mussel cost municipalities and industries almost $70 million a year between 1989 and 1995 (U.S. General Accounting Office 2001). Over the next 10 years, the zebra mussel invasion will cost an estimated $3.1 billion including cost to industry, recreation, and fisheries (Preliminary Report of the U.S. Commission on Ocean Policy, governors' draft 2004). The costs and effects of exotics in Kansas have not been determined precisely; however costs are incurred in two main categories. First is the loss in potential economic output, such as reductions in aquaculture, fisheries, and crop production. Second is the direct cost of combating and mitigating the impacts of invasion, including all forms of quarantine, control, and eradication (Mack et al. 2000).

The Aquatic Nuisance Species committee was responsible for developing the Kansas ANS management plan. Members of the committee assumed an active role in preparation for the plan by reviewing draft plans and providing guidance. A list of the committee members is provided in Appendix D. The Kansas Department of Wildlife and Parks (KDWP) was the lead agency assigned to coordinate the drafting of the plan. Public comments were solicited from local governments, regional entities, public and private organizations, and resource user groups that have expertise and interest in the control of ANS. Comments were considered and revisions have been made to the plan.

This ANS management plan was developed primarily to serve as an essential guide to state agencies, local governments, public and private organizations, and aquatic resource user groups in developing management strategies, designing public awareness/educational materials, and prioritizing activities related to ANS issues. While the Department of Wildlife and Parks will be the state agency responsible for administration of this plan, it is expected that there will be broad participation in ANS programs and activities by various state and local entities. The ANS plan for Kansas will provide guidance in coordinating these programs and activities.

The Kansas ANS management plan will be reviewed and revised annually or more frequently if needed to address the unexpected arrival of new ANS. Advances in knowledge of ANS management techniques could warrant alterations in proposed management strategies. The specific tasks employed to accomplish the goals and objectives of the plan must remain flexible to assure efficiency and effectiveness. While this version of the plan is a good starting point for identifying and integrating existing ANS programs, and implementing new programs, future editions will be necessary to achieve Kansas's ANS management goals.

ANS AUTHORITITES AND PROGRAMS

STATE

The State of Kansas currently has a limited number of statutory and regulatory authorities to addresses or potentially address the issue of prevention and control of ANS. Those that exist were developed in response to individual target species and specific concerns as they arose. Kansas does not have a comprehensive, coordinated, and vigorously enforced policy framework to deal with ANS and their affects. For this reason, one objective of Kansas's ANS management plan is to identify gaps within state policies and statutes and develop recommendations for improvements. Such improvements may entail developing new legislation and regulations, revising existing authorities, and developing methods for improving enforcement, coordination, and information dissemination regarding new or existing authorities.

Department of Wildlife & Parks

The mission of the Kansas Department of Wildlife and Parks is to conserve and enhance Kansas' natural heritage, its wildlife, and its habitats. KDWP's underlying philosophy is to manage natural systems properly by striking a balance between natural resource integrity and human benefits.

The following existing policies have been administered by the Department of Wildlife and Parks and identified relative to Kansas's management of ANS are:

1. Prohibited species list, permit requirement, and restrictions (KAR 115-18-10)

Prohibits the importation, possession, or release of the following species:

a. walking catfish *Clarias batrachus*
b. silver carp *Hypophthalmichthys molitrix*
c. bighead carp *Aristichthys nobilis*
d. black carp *Mylopharyngodon piceus*
e. snakehead fish Channidae family
f. zebra mussel *Dreissena polymorpha*
g. quagga mussel *Dreissena bugensis*

h. round goby *Neogobius melanostomus*
i. New Zealand mudsnail *Potamopyrgus antipodarum*

2. Prohibited release of exotics (KAR 115-20-3)

Prohibits the release of all exotic wildlife onto the lands or into the waters of the state.

3. Prohibited stocking (KAR 115-8-12)

Prohibits stocking or releasing of wildlife on department lands or waters and specifies authorization structure.

4. Prohibited transfer of baitfish (KAR 115-8-6)

Fishing bait may be used only in the water where taken.

Department of Agriculture

The Kansas Department of Agriculture (KDA) is a regulatory agency established to ensure a safe meat, milk and egg supply; responsible and judicious use of pesticides and nutrients; the protection of Kansas' natural and cultivated plants; integrity of weighing and measuring devices in commerce; and that the state's waters are put to beneficial use. In 2002 the KDA issued the first ANS plant quarantine in Kansas by levying quarantine on purple loosestrife *Lythrum salicaria* (KSA 2-2113). In January 2004, the KDA enacted a quarantine for all federally listed noxious weeds including 19 aquatic plants, representing the first large scale effort to control ANS plants into and within the State of Kansas.

Department of Health and Environment

The mission of the Kansas Department of Health and Environment (KDHE) is to optimize the promotion and protection of the health of Kansans through efficient and effective public health programs and services and through preservation, protection, and remediation of natural resources of the environment. KDHE has not officially addressed ANS and has historically only documented presence of ANS in field notes that are maintained in a searchable computer database. The Chemical Control Act identifies that KDHE has regulatory control over toxins that potentially may be used to control ANS.

Kansas Water Office

The Kansas Water Office develops the Kansas Water Plan, which is revised annually and approved by the Kansas Water Authority. The Kansas Water Plan is the tool used in Kansas to address current water issues and to plan for future water quality and quantity needs. The State Water Resource Planning Act (KSA 82a-901a) declares that "the state can best achieve the proper utilization and control of the water resources of the state through comprehensive planning which coordinates and provides guidance for the management, conservation, and development of the state's water resources." This is accomplished through development of the Kansas Water

Plan. The Kansas Water Plan is based upon a comprehensive, watershed oriented approach to planning. The planning process is designed to be comprehensive, coordinated, and continuous.

The Kansas Water Office has no specific statutory authority to address ANS. However, because the Kansas Water Plan is watershed based, basin specific ANS issues can be included in the Plan. A basin plan can include a management strategy for addressing an ANS including technical information and public education.

FEDERAL

The current federal effort regarding the management of ANS is a patchwork of laws, regulations, policies, and programs. At least 20 agencies currently work at researching and controlling non-indigenous species. Federal laws that apply directly to the introduction of non-indigenous species include the Lacey Act, the Federal Noxious Weed Act, the Federal Seed Act, the Federal Plant Protection Act of 2000, the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990, and the National Invasive Species Act of 1996. The Endangered Species Act could also have indirect application if an ANS was shown to threaten the survival of a federally listed species, such as the neosho mucket *Lampsilis rafinesqueana* or the Topeka shiner *Notropis topeka*. A description of federal agencies with programs specific to Kansas ANS follows.

U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service (USFWS) provides federal funding for implementation of state and regional ANS management plans that have been approved by the Aquatic Nuisance Species Task Force (ANSTF). One of the major USFWS efforts on ANS is the 100th Meridian Initiative. The goals of this Initiative are to 1) prevent the spread of zebra mussels and other ANS in the 100th meridian jurisdictions and west and 2) monitor and control zebra mussels and other ANS if detected in these areas. These goals will be attained through the implementation of the following six components: 1) information and education, 2) voluntary boat inspections and boater surveys, 3) involvement of those who haul boats for commercial purposes, 4) monitoring, 5) rapid response, and 6) evaluation. This initiative represents the first large-scale focused and coordinated effort, working with federal, state, provincial and tribal entities, potentially affected industries, and other interested parties to begin addressing the pathway to prevent the spread of zebra mussels. The success of this Initiative depends on the commitment of these groups to combat the spread of this destructive invader.

U.S. Corps of Engineers

It is the policy of the Corps of Engineers to develop, control, maintain, and conserve the nation's water resources in accordance with the laws and policies established by Congress and the Administration. The Corps' Zebra Mussel Research Program (ZMRP) was authorized by the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990, Public Law 101-646, and is the only federally authorized research program for the development of technology to control zebra mussels. The Corps ANS programs were integrated into the ANS Task Force to ensure total coordination and leveraging to address all ANS issues.

U.S. Coast Guard

The U.S. Coast Guard gets its authority to regulate ballast water and ANS from NANPCA and NISA. NANPCA directed the Coast Guard to issue regulations and guidelines to control the introduction and spread of ANS in the Great Lakes ecosystem. It also required an assessment of ballast water management practices in all U.S. ports. NISA tasked the Coast Guard with establishing a voluntary ballast water management (BWM) program for virtually all U.S. ports. The Coast Guard's BWM program is the primary emphasis related to ANS in the inland river system. Current Coast Guard efforts include establishing mandatory BWM standards and practices, establishing a program to approve ballast water treatment technologies, establishing penalties for failure to submit required reports, and increasing the applicability to all ships with ballast water tanks bound for all ports or places in U.S. waters.

REGIONAL

The Western Regional Panel

The Western Regional Panel (WRP) on ANS was formed under a provision of NISA. The WRP was formed to help limit the introduction, spread, and impacts of ANS into western North America. This panel includes representatives from federal, state, tribal, Canadian provincial, local agencies, and from private environmental and commercial interests.

The Mississippi River Basin Regional Panel

The Mississippi River Basin Regional Panel (MRBP) on ANS was formed under a provision of NISA to identify priorities for activities, develop and submit recommendations to the national ANSTF, coordinate aquatic nuisance species program activities, advise public and private interests on control efforts, and submit an annual report to the ANSTF describing prevention, research, and control activities in the Mississippi River Basin. This panel includes representatives from federal, state, tribal, and local agencies and from private environmental and commercial interests.

Western Governors Association

The Western Governors Association (WGA) is developing a new program to address undesirable non-indigenous aquatic and terrestrial species in the West because of the significant economic and ecological harm they cause. WGA has formed a working group of state and federal agencies, industry, non-governmental organizations and academia to develop Western strategies to limit the spread of these species.

PROBLEMS AND CONCERNS

Several ANS have already been introduced and dispersed in Kansas by various pathways. The environmental and socio-economic costs resulting from ANS infestations will only continue to rise with further introductions. Although an awareness of the problems caused by ANS is emerging, the solutions are often not readily available. This comprehensive state plan for the management of ANS provides guidance for preparing management actions to address the prevention, control and impacts of ANS that have or may invade and alter the aquatic resources of Kansas.

A newly introduced species can disrupt the natural ecosystems by altering the composition, density, and interactions of native species. A lack of natural controls may allow a new population to increase at an exponential rate and disrupt native species as the introduced species may prey upon, out compete, or transmit disease to the native species. This disruption can cause significant alterations to food webs, nutrient dynamics, and biodiversity. Changes in the ecology of lakes and rivers, degraded habitat value in infested waters, and stunted fish populations may also result from the disruption caused by a newly introduced species.

ANS not only represent a potential threat to the environment; they threaten industry and the economy. These negative impacts include:

- decreased property values
- decreased recreational opportunities
- decreased water quality
- fouled water intakes
- frequently burned-out irrigation and water pumps
- impacts on power generation
- impeded water flow and decreased efficiency of water delivery systems
- increased risk of flooding due to increased biomass in water or clogging lake outlets

The number of new ANS introductions in Kansas will continue to grow as new and existing ANS become established in Midwestern states, especially those that border Kansas. There are several major pathways through which ANS are introduced, but most are the result of human activities both intentional and unintentional. Pathways of introduction into water bodies include aquaculture, aquarium trade, commercial navigation, transport via vessel fouling, recreational boating and fishing, sale of bait fish, research activities, and distribution through interconnected waterways. In Kansas, there is limited regulation of these pathways.

Non-indigenous Aquatic Animals

A draft list of non-indigenous aquatic animals in Kansas is included in Appendix A and is based on existing data. As such, the list is undoubtedly incomplete as information on non-indigenous aquatic animals in Kansas is limited. The following ANS species are considered of special concern in Kansas; bighead carp, black carp, exotic waterflea, New Zealand mudsnail, round goby, rudd, ruffe, rusty crayfish, silver carp, spiny waterflea, white perch, and zebra mussel. Currently, the zebra mussel, white perch, bighead carp, silver carp, black carp, and New Zealand mudsnail are considered priority species. A discussion of each species follows.

Bighead carp *Hypophthalmichthys nobilis.* The bighead carp is a large-bodied planktivore endemic to eastern China. In 1973, an aquaculturist introduced bighead carp into Arkansas in an attempt to improve water quality in production ponds (Freeze and Henderson 1982). In 1974, regulations were mandated to restrict bighead carp stocking into Arkansas public waters to reduce the probability of accidental introductions. Despite these regulations, bighead carp escaped from aquaculture facilities and subsequently dispersed upstream into the Mississippi and

Missouri River systems. Currently, bighead carp are present in 19 states (Benson et al. 2001; Fuller et al. 1999). While no data are presently available concerning the effects of this species on river ecosystems and their fisheries, observed habitat preferences suggest that bighead carp may directly affect populations of paddlefish *Polyodon spathula*, and other commercially valuable filter feeders (Tucker et al. 1998). Bighead carp are currently found in Kansas waters but do not appear to be causing any severe problems at this point. This situation may change as bighead carp become more widespread in Kansas. Monitoring of this species will be needed.

Black carp *Mylopharyngodon piceus*. The black carp is a large river fish native to Pacific drainages in eastern Asia. Black carp entered the United States in the early 1970s as a contaminant in imported grass carp *Ctenopharyngodon idella* and are currently being maintained in research and fish production facilities in seven states including two that border Kansas (U.S. Fish and Wildlife Service 2002). Approximately 30 black carp escaped from a fish farm in Missouri into the Osage River, Missouri River basin, in April 1994. The first specimen reported from the wild was captured in March 2003 from Horseshoe Lake, Illinois. A second specimen was captured from the wild in the lower Red River, Louisiana in April 2004 (Nico and Fuller 2004). Black carp are likely to survive in the wild and spread throughout the Mississippi drainage. Black carp are molluscivores but also feed on freshwater shrimp, crayfish, and insects thus competing for food with native fish and wildlife species (Nico and Williams 1996). If black carp become established in North American ecosystems, their feeding habits could drastically modify the ecological balance and forever change the native aquatic system's aesthetic, recreational, and economical values. This species would also be especially harmful to native unionid mussels, a taxonomic group that is already imperiled throughout its native range. The potential ecological harm posed by black carp and their current proximity to Kansas make it a significant threat that warrants attention.

Exotic waterflea *Daphnia lumholtzi*. Native to Africa, Australia, and India, this species was first discovered in 1990 in Texas. It has since been found in several Midwestern states including Kansas. The continuing discovery of *D. lumholtzi* in new locations could be due to contaminated stockings of fish through international commercial trade. At the same time, the close proximity of affected reservoirs might lead to the conclusion that *D. lumholtzi* may have spread by recreational boating from the initially infested reservoirs (Benson et al. 2005). Analyses of pre-invasion zooplankton communities indicate that *D. lumholtzi* may be invading reservoirs in which native *Daphnia* species are rare. While the long-term effects of the invasion of *D. lumholtzi* are unknown, it has the potential to dominate late summer zooplankton communities in eastern Kansas reservoirs (Dzialowski et al. 2000). The presence of *D. lumholtzi* in some Kansas reservoirs indicates a need to monitor invaded reservoirs to document the range expansion and determine the long-term implications of the introduction of this invader.

New Zealand mudsnail *Potamopyrgus antipodarum*. Native to New Zealand, this species was discovered in North America in 1987 and has rapidly spread throughout the western United States. It is a parthenogenetic livebearer with a high reproductive potential. Mature New Zealand mudsnails (NZMS) average 5 mm in length; juveniles are much smaller, making them difficult to notice on gear. NZMS populations can reach densities greater than 100,000/m^2 in suitable habitat. The highest recorded densities reported are 800,000/m^2 in Lake Zurich, Switzerland, where this species colonized the entire lake in less than seven years (Richards

2002). To date, few data have been reported or research conducted on the impacts of the New Zealand mudsnail on native macroinvertebrate populations or aquatic ecosystems. Concern about the potential impacts of the NZMS on native species, fisheries and aquatic ecosystems in the western United States has been generated by the rapid spread of this species. NZMS degrade habitat with their high reproductive capacity and the subsequent impacts on invertebrate food sources. Its spread into new systems is considered to be primarily human-caused and unintentional transport by people is probably the primary vector for the spread of NZMS. The New Zealand mudsnail has not been reported in Kansas, but is considered a priority species because of the late 2004 introduction into Colorado.

Round goby *Neogobius melanostomus.* The round goby was introduced via ballast water into the St. Clair River, near Detroit in 1990 and has spread into Lake Erie and Lake Michigan where the largest populations are found. The primary concern with the round goby is the tremendous range expansion exhibited since its introduction in 1990. It is an aggressive fish and feeds voraciously upon bottom-feeding fishes (e.g., darters and logperch) (Corkum et al.1998), snails, mussels, and aquatic insects. The Great Lakes fisheries, particularly those in Lake Michigan and Lake Erie, are threatened by this ANS due to its robust characteristics and ability to displace native species from prime habitat and spawning areas (MacInnis et al. 2000). While the round goby has not been reported in Kansas waters, the rapid spread of this species in the Great Lakes and the Illinois River suggests that it possesses a significant threat to all Midwestern states.

Rudd *Scardinius erythrophthalmus.* Introduced into the United States in the early 1900s as baitfish, this Eurasian native is found in 20 states, including Kansas (Nico and Fuller 2003). Similar in appearance to the golden shiner *Notemigonus crysoleucas,* the rudd is capable of growing to 20 inches in length. Currently, the rudd is one of the most rapidly spreading non-indigenous fishes in the United States. The greatest threat posed by the rudd is its ability to hybridize with the golden shiner which may endanger that species' genetic integrity (Burkhead and Williams 1991). While little is known about the threat posed by rudd, its occurrence in several Kansas reservoirs suggests the need to monitor this ANS.

Ruffe *Gymnocephalus cernuus.* The ruffe was introduced to North America in the 1980s in ballast water of a seagoing vessel. Since its introduction, the ruffe has become established in the nearshore waters of western Lake Superior, with an estimated average rate of range expansion of 18 shoreline miles per year. By the fall of 1994, ruffe populations were found in Michigan waters of Lake Superior and in August of 1995, three ruffe were discovered in a commercial harbor in northern Lake Huron, more than 300 miles east of the previously known range. The ruffe matures quickly, has a high reproductive capacity, and adapts to a wide variety of environments. It is considered a serious threat to commercial and sport fishing. It also has the potential to seriously disrupt the delicate predator-prey balance vital to sustaining a healthy fishery (McLean et al. 1995). While there are no reports of ruffe in Kansas, this highly adaptable species poses a threat similar to that of the round goby.

Rusty crayfish *Orconectes rusticus.* The native range of the rusty crayfish is Illinois, Indiana, and Ohio. However, in recent years its distribution has expanded because of the use of live crayfish as bait by anglers. When introduced into new habitats, it quickly displaces native crayfish and becomes over-abundant. As a result of its voracious appetite, it competes with other aquatic organisms for food. The rusty crayfish's feeding behavior includes consumption of submerged aquatic vegetation. Large populations can adversely impact native plant populations (Lodge et al. 2000). The rusty crayfish has not been found in Kansas, but it has been transplanted to new waters in neighboring states where self-sustaining populations have become established. The species warrants attention.

Silver carp *Hypophthalmichthys molitrix.* Silver carp were imported and stocked for phytoplankton control in eutrophic water bodies and also as a food fish. It was first brought into the United States in 1973 when a private fish farmer imported silver carp into Arkansas. By 1980 the species was discovered in natural waters, probably a result of escapes from fish hatcheries and other types of aquaculture facilities (Freeze and Henderson 1982). In numbers, the silver carp has the potential to cause enormous damage to native species because it feeds on plankton required by larval fish and native mussels. Presently, silver carp have been recorded in 12 states including Kansas (Benson et al. 2001). Although they have been found in Kansas, silver carp do not appear to be causing any severe problems at this point. This situation could change as silver carp become more widespread. Monitoring of this species will be needed.

Spiny waterflea *Bythotrephes cederstroemi.* The spiny waterflea, likely a ballast water introduction, is a tiny crustacean with a sharply barbed tail spine. The northern European native was first found in Lake Huron in 1984. The spiny waterflea is now found throughout the Great Lakes and in some inland lakes (Parker et al. 2001). Although scientists do not know exactly what effect this invader will have on aquatic ecosystems, resource managers suspect that the spiny waterflea will compete directly with other zooplankton or larval fish for food (Lehman 1991). The spiny waterflea has not been reported in Kansas but warrants continued attention to determine the significance of this threat.

White perch *Morone americana.* A native to the Atlantic coast region of North America, the white perch invaded the Great Lakes in the 1950s through the Welland and Erie canals (Boileau 1985). Since its arrival, it has been associated with declines in both walleye *Sander vitreus* and white bass *Morone chrysops* populations in those areas where it has become well-established due to predation on the eggs of both species. White perch also feed heavily on baitfish utilized by other game species. It is known to hybridize with white bass, resulting in the dilution of the gene pools of both species (Madenjian et al. 2000). White perch have established populations in Wilson and Cheney Reservoirs in Kansas thus as a priority species, demand immediate attention and management.

Zebra mussel *Dreissena polymorpha.* The zebra mussel is one of the best known invaders of the Great Lakes region and other areas of the country where it has spread. Since introduction into the United States, this aquatic nuisance species has caused serious economic and ecosystem impacts and prompted passage of federal ANS legislation. The zebra mussel, a highly opportunistic mollusk, reproduces rapidly, and consumes large quantities of microscopic aquatic plants and animals from the water column (Trometer et al. 1999). The potential impact on fisheries can be profound. Reductions in density and biomass of the zooplankton community may result in reduced growth or abundance of age-0 fish. The first year of a fishes' life is a time when it is most vulnerable to predation; reduced growth rates at this age may extend this period of vulnerability (Wu and Culver 1991). Economic impacts are as pervasive as the ecosystem impacts. Due to zebra mussels in intake/discharge pipes, Great Lakes municipalities, utilities, and industries have incurred significant costs associated with monitoring, cleaning, and controlling infestations. According to a recent economic impact study, each of 84 Great Lakes water users reported average total expenditures of $513,600 over the five-year period from 1989 to 1994 (Hushak et al. 1995). Nationwide expenditures to control zebra mussels in water intake pipes, water filtration equipment, and electric generating plants are estimated at $3.1 billion over 10 years (U.S. Congress Office of Technology Assessment 1993). Commercial and recreational vessels and beach areas also are vulnerable to the negative impacts of the zebra mussel. Zebra mussels are currently found in El Dorado Reservoir, the Walnut River below El Dorado Reservoir, and have been reported in Cheney Reservoir in Kansas. Currently, there is no evidence that they have expanded their range into other water bodies within Kansas. Considered a priority species, zebra mussels represent a serious threat to Kansas's aquatic resources and deserve immediate management action.

Non-indigenous Aquatic Plants

A draft list of non-indigenous aquatic plants in Kansas is included in Appendix B. Species listed have a wetland indicator status of "facultative wetland" or "obligate" in USFWS Region 5. This list is incomplete as information on non-indigenous aquatic plants in Kansas is limited. The following ANS species are considered of special concern in Kansas; purple loosestrife, curly-leaf pondweed, Eurasian watermilfoil, hydrilla, and saltcedar. Currently, Eurasian watermilfoil, purple loosestrife, and saltcedar are considered priority species. A discussion of each species follows.

Curly-leaf pondweed *Potamogeton crispus.* Curly-leaf pondweed, a perennial, rooted, submerged aquatic vascular plant is a native to Eurasia, Africa, and Australia. By 1950, curly-leaf pondweed had infested most of the United States. In the spring, it forms dense mats that interfere with recreation and limit the growth of native aquatic plants. The reproductive ecology of this species is poorly known. By the end of the growing season, curly-leaf pondweed senesces and forms vegetative propagules called turions. Turions are dispersed by water movement throughout a water body and may also be transferred to uninfested waters. The turions germinate in the fall, beginning a new life cycle. (Sastroutomo 1981). Although not widespread, curly-leaf pondweed has been reported in Kansas waters and may pose a significant threat to native vegetation.

Eurasian watermilfoil *Myriophyllum spicatum.* Eurasian watermilfoil, a submerged aquatic plant from Europe, Asia, and northern Africa, is spreading rapidly throughout the United States. It has been reported in 33 states including Kansas. Eurasian watermilfoil is capable of growing under a wide range of environmental conditions and on a variety of bottom substrates. It typically grows in shallow water, but in clear water conditions it can inhabit water up to 30 feet deep. Eurasian watermilfoil's surface canopy can out-compete and eliminate native aquatic vegetation, as well as threaten native fish and wildlife populations (Smith and Barko 1990; Valley and Bremigan 2002). The plant disperses primarily by vegetative propagation through stem fragmentation. Boat propellers and trailers are a major source of long-distance spread of Eurasian watermilfoil (Westbrooks 1998).

Hydrilla ***Hydrilla verticillata.*** Hydrilla, a submerged, perennial plant is native to Asia, but has spread into Europe, Australia, New Zealand, the Pacific Islands, Africa, South America and North America. This plant was first introduced into Florida waters in the early 1960s and now occurs in almost all of the Gulf and Atlantic coast states and on the west coast in California and Washington (Westbrooks 1998). A highly prolific aquatic plant, hydrilla can out-compete native vegetation by photosynthesizing under low light conditions and can form a thick free-floating mat (Tate et al. 2003). Hydrilla causes major problems with water use. In drainage and irrigation canals, it greatly reduces flow and causes clogging, which can result in flooding and damage to canal banks, structures, and pumps. Hydrilla also has negative effects on fish populations in addition to a decreased recreational opportunity. Excessive vegetation decreases growth and condition of adult fish (Colle and Shireman 1980), and extremely high amounts of hydrilla (>80% coverage) may decrease angler harvest and effort (Colle et al. 1987). Hydrilla is most likely to spread when plant fragments are carried along with recreational boats into new habitat. Hydrilla has not been detected in Kansas, surveillance efforts have been limited.

Purple loosestrife ***Lythrum salicaria.*** Purple loosestrife is an invasive wetland perennial from Europe and Asia. It became established in North America in the early 1800s via ship ballast, as a medicinal herb, and ornamental plant (Westbrooks 1998). When growing conditions are optimal, initial loosestrife infestations are followed by dramatic population increases. In one growing season, an individual plant may produce over one million seeds, which can remain viable for several years (Welling and Becker 1990). The seeds appear to be moved easily by water, vehicles, and wildlife, and germination can occur under a wide range of temperatures, pH, nutrient levels, and soil types (Shamsi and Whitehead 1974; Keddy and Constabel 1986; Mitich 1999). Once established, purple loosestrife often readily spreads to additional wetland sites. Seed germination occurs in such high densities that seedlings of native plants are frequently suppressed, resulting in eventual creation of a purple loosestrife monoculture (Gardner et al. 2001). While currently present in Kansas, purple loosestrife has yet to cause the level of ecological disruption that other states have experienced.

Saltcedar ***Tamarix spp.*** Saltcedar is a small tree or large shrub that was introduced into the United States in the early 1800s as an ornamental, for use in wind breaks, or to stabilize eroding stream banks. One mature plant can produce one-half million seeds each year. After summer rains, saltcedar seedlings quickly colonize moist areas due to the constant availability of seeds. The plant's ability to exploit suitable germinating conditions over a long time period gives saltcedar a considerable advantage over native riparian species. Mature plants can sprout vegetatively after fire, flood, or treatment with herbicides and can adapt to wide variations in soil and mineral gradients (Westbrooks 1998). Large saltcedar plants can use up to 200 gallons of water a day, reducing and even eliminating water flow in streams and rivers. Saltcedar is capable of forming dense monocultures and dramatically changing vegetation structure, animal species diversity, soil salinity, and hydrology of sites where it has become dominant (Sher et al. 2002). Saltcedar has been reported in Kansas, and is a severe threat to the structure and stability of native plant communities. It warrants control; eradication techniques need to be investigated.

STATUS OF AQUATIC NUISANCE SPECIES IN KANSAS

All non-indigenous species affect native species and habitat in some manner, but not all of them pose a significant threat, and some provide an economic and recreational benefit in certain areas. It is a difficult task to predict the effects that species will have once they are introduced. Although ANS problems are relatively new to Kansas, four (purple loosestrife, saltcedar, white perch, and zebra mussel) of the special concern species mentioned in the previous text have become established and are beginning to pose threats to aquatic ecosystems. Other ANS that have been reported in Kansas that have not yet become serious problems include bighead carp, curly-leaf pondweed, rudd, and silver carp. These species are currently considered priority ANS in Kansas. Additional ANS exist in bordering states and pose additional threats to Kansas's water resources.

Priorities for Action

Often many efforts to address ANS problems are implemented after the species has arrived and become widely distributed. As a result, these efforts are often reactive and ineffective. The purpose of this management plan is to expand the scope of efforts in Kansas to deal with the threats posed by all ANS. The goal of this management plan is to implement a coordinated strategy designed to minimize the risk of further ANS introductions into Kansas through all known pathways, develop funding mechanisms to implement and staff a Kansas ANS management program, where practical, stop the spread of ANS already present and eradicate or control ANS to a minimal level of impact. By forming this management plan, it is expected that the problems other states have experienced can be minimized or completely avoided. Initially, this plan will focus on the priority species listed below. As this program evolves, the focus will shift to the development and implementation of new programs designed to prevent or control the introduction of new ANS to Kansas.

Priority Species

The management actions outlined in this plan focus on the following priority species. By addressing pathways of introduction for priority species, the introduction of other lower priority or perhaps unidentified ANS may also be prevented since they may share common pathways of introduction.

- bighead carp *Hypophthalmichthys nobilis*
- black carp *Mylopharyngodon piceus*
- Eurasian watermilfoil *Myriophyllum spicatum*
- New Zealand mudsnail *Potamopyrgus antipodarum*
- purple loosestrife *Lythrum salicaria*
- saltcedar *Tamarix* spp.
- silver carp *Hypophthalmichthys molitrix*
- white perch *Morone americana*
- zebra mussel *Dreissena polymorpha*

MANAGEMENT ACTIONS

The goal of the Kansas ANS management plan is to minimize the harmful ecological, economic, and social affect of ANS through prevention and management of introduction, population growth, and dispersal of ANS into, within, and from Kansas. The goal will be achieved through implementation of a plan that will emphasize prevention of introductions while effectively addressing established ANS populations. The introduction of ANS into state waters may cause environmental, socio-economic, and possible public health effects. Several damaging ANS already have been introduced into Kansas, and new introductions are highly likely. An effective management plan must:

- require an impact assessment and review for all aquatic non-indigenous species prior to their importation, transport, or use in Kansas;
- allow for early detection;
- include development of contingency plans;
- permit appropriate and timely management response to new and existing populations;
- protect and restore native plant and animal communities;
- provide for easy access to accurate and up to date species distribution and management information;
- incorporate education and research elements;
- recommend funding levels adequate for effective implementation;
- produce agency collaboration through an invasive species council;
- facilitate inter-jurisdictional coordination with state and federal agencies; and
- seek cooperative solutions with the private sector and user groups.

It is impossible to address all potential invaders, their impacts, and the constraints and contingencies that may develop. Consequently, this plan is intended to be adaptable to changing circumstances to avoid a delayed response approach that often limits the vision and opportunity for the prevention of new introductions, leaving the state with ANS management problems that are economically costly, technically challenging, and possibly unfeasible to solve. To effectively address ANS problems in Kansas, prevention of new ANS introductions and control of existing ANS populations is essential.

Management Objectives

OBJECTIVE 1: Coordinate and implement a comprehensive management plan.
1A. Problem: There is no clear authority or agency in Kansas charged with limiting and managing ANS. Kansas needs an organized and centralized approach to ANS management to prevent duplication of effort and eliminate gaps in coverage of ANS issues. State ANS management efforts need to be coordinated with regional and national efforts. Currently, most management activities are focused on isolated problems and not concerned with addressing the

issue of ANS comprehensively. The lack of coordination, oversight, and funding has allowed ANS to become established in Kansas and continues to allow for new introductions. Gaps in ANS management include: unclear authorities, uncoordinated state activities, and staffing and funding shortages.

1A1. Strategic Action: Implement a Kansas ANS management program and coordinate activities.

Task 1A1a: Receive approval of the ANS management plan for Kansas from the Natural Resources Sub-Cabinet.

Task 1A1b: Receive approval of the ANS management plan for Kansas from the governor.

Task 1A1c: Receive approval of the ANS management plan for Kansas from the Kansas Wildlife and Parks Commission.

Task 1A1d: Receive approval for the ANS management plan for Kansas from the Federal Aquatic Nuisance Species Task Force.

Task 1A1e: Implement the Kansas ANS management plan.

Strategic Action 1A2: Create and fund an ANS coordinator position using ANS Task Force monies and matching funds.

Task 1A2a: Hire a coordinator (1.0 FTE) for the Kansas Aquatic Nuisance Species Program. This position will coordinate and direct the Kansas Aquatic Nuisance Species Program out of the KDWP Emporia Research and Survey Office.

Strategic Action 1A3: Coordinate all ANS management programs and activities within Kansas and collaborate with regional and national ANS programs.

Task 1A3a: The Kansas Aquatic Nuisance Species Program coordinator will identify key personnel in state and federal government and private entities for ANS responsibilities.

Task 1A3b: Work to ensure that the ANS strategy is coherent and consistent throughout Kansas.

Task 1A3c: Establish working partnerships with ANS management programs in regional states to facilitate the sharing of data and coordination of management activities.

Task 1A3d: Participate in regional and national forums to ensure that ANS efforts in Kansas remain current and are coordinated with regional and national programs.

Task 1A3e: Conduct an annual forum focused on ANS in Kansas and potential management alternatives.

Strategic Action 1A4: Develop a permanent funding mechanism for ANS management in Kansas.

Task 1A4a: Explore ideas for permanent funding of ANS management activities.

Task 1A4b: Work with the Kansas legislature to establish a permanent funding mechanism for ANS management activities in Kansas.

OBJECTIVE 2: Prevent the introduction of new ANS into Kansas waters.

2A. Problem: There are several pathways by which new species can arrive in Kansas. Implementation of a program that reviews and regulates which species are intentionally allowed into Kansas, and monitors the pathways by which species can be unintentionally transported into the state, is necessary to slow the rate at which new species become established. Understanding how various pathways function as conduits for ANS into Kansas is critical for intercepting species and preventing introductions. Prevention is the most cost effective and environmentally sound method of addressing this problem. Kansas has no comprehensive program to prevent new ANS introductions or address new species if one should arrive.

Strategic Action 2A1: Identify ANS that have the greatest potential to infest Kansas aquatic resources and identify existing and potential pathways that facilitate new ANS introductions.

Task 2A1a: Generate a regional list of ANS and evaluate the potential threat posed to Kansas by each.

Task 2A1b: Compile movement information of ANS on a regional level and predict the potential for possible invasion into Kansas waters.

Task 2A1c: Identify existing and potential transport pathways that would facilitate the introduction of these ANS into Kansas.

Strategic Action 2A2: Establish approaches to facilitate legislative, regulatory, and other actions needed to prevent new ANS introductions in Kansas and promote rules that establish the state's authority to control these introductions.

Task 2A2a: Determine statutory authority for ANS issues.

Task 2A2b: Prohibit the importation of non-indigenous aquatic species based upon their invasive potential.

Task 2A2c: Develop a list of approved species that may be imported into Kansas.

Task 2A2d: Examine existing ANS regulations and determine their effectiveness and revise when necessary.

Task 2A2e: Establish penalties for illegal introductions of ANS into Kansas waters.

Task 2A2f: Participate in regional and national forums to ensure coordinated efforts to prevent the introduction of new ANS into Kansas.

OBJECTIVE 3: Detect, monitor, and eradicate ANS.

3A. Problem: Kansas must be able to rapidly detect new ANS invasions and the spread of established ANS so emergency response plans can be implemented while there is potential to eradicate the problem species. Once invasive species have arrived, a brief window of opportunity exists to eradicate small pioneering populations exists. By initiating detection and monitoring programs, Kansas will be able to discover and manage pioneering infestations at a point when the species can possibly be eradicated in a cost effective manner.

Strategic Action 3A1: Implement a surveillance program.

Task 3A1a: Conduct annual surveys on state waters to determine the occurrence and distribution of ANS.

Task 3A1b: Encourage and train citizen-monitoring networks to work in cooperation with state agencies.

Task 3A1c: Develop and distribute a complete listing of ANS existing in Kansas based on survey data.

Strategic Action 3A2: Develop an early response device for detected and potential invasive species.

Task 3A2a: Prioritize regional species that merit ANS management if introduced into Kansas.

Task 3A2b: Develop a rapid response plan for all ANS detected or those ANS that immediately pose a threat to Kansas.

Task 3A2c: Identify funding sources for implementing rapid response plan actions.

Strategic Action 3A3: Eradicate pioneering populations of ANS.

Task 3A3a: Develop and implement an eradication and management program for pioneering ANS.

Task 3A3b: Establish cooperative policies with states sharing watersheds for eradication and to limit the spread of regional ANS populations.

OBJECTIVE 4: Control and eradicate established ANS that have significant impacts.
4A. Problem: Established ANS populations can spread to uninfested waters, thereby increasing their potential for economic and ecological damage. Management activities are most effective when they are directed at limiting the affects of a population or stopping that population from spreading to new waterbodies.

Strategic Action 4A1: Limit the dispersal of established ANS to new waterbodies or to new areas of a waterbody.

Task 4A1a: Establish protocols that will provide guidance in designing and implementing control and eradication strategies.

Task 4A1b: Support scientific research between state and federal agencies and academic institutions that investigate potential control strategies and associated environmental impacts.

Task 4A1c: Ensure that the control strategies developed and implemented by the state are done in coordination with federal agencies, local governments, interjurisdictional organizations and other appropriate entities.

Task 4A1d: Ensure that control strategies are based on the best available scientific information and conducted in an environmentally sound manner.

Task 4A1e: Develop guidelines to ensure the cleaning of water-based equipment that may accidentally spread ANS when moved from infested to uninfested waters.

Strategic Action 4A2: Develop means of adapting human activities to accommodate infestations of ANS.

Task 4A2a: Support scientific research between state and federal agencies and academic institutions that investigate potential means of adapting human activities to accommodate infestations of ANS where eradication or control is not feasible.

OBJECTIVE 5: Educate resource user groups about the risks and impacts of ANS and how to reduce the harmful impacts.
5A. Problem: New ANS introductions occur through a variety of pathways, most of which are closely related to human activities. Although some education programs include ANS information, public awareness of these issues and threats in Kansas are inadequate.

Strategic Action 5A1: Develop and distribute ANS educational materials to increase awareness of the ANS problem.

Task 5A1a: Develop and distribute educational materials to educate what ANS are, the problems they cause, and the avenues available for the public to help address the issue.
Task 5A1b: Develop and distribute ANS fact sheets and ID cards describing the methods to prevent their spread. Materials will include a contact number of where to report potential sightings.
Task 5A1c: Incorporate ANS information into boater safety classes.
Task 5A1d: Produce periodic press releases and public service announcements on specific ANS threats.
Task 5A1e: Create web-based media concerning ANS.
Task 5A1f: Develop ANS curriculum materials to be tied to existing Kansas Wildlife and Parks environmental science curriculum.
Task 5A1g: Make presentations on ANS issues to aquatic resource user groups.
Task 5A1h: Maintain and upgrade ANS information on the Kansas Wildlife and Parks agency website
Task 5A1i: Continue to include information on ANS in state hunting, fishing, and boating regulations.

Strategic Action 5A2: Develop and distribute ANS educational materials targeted at specific, public pathways of introductions.

Task 5A2a: Install appropriate signage at all infested waterbodies along with buoys to encourage public awareness of ANS.
Task 5A2b: Create a pamphlet about the spread of ANS via the release of aquarium animals and aquatic ornamental plants. The brochure will identify ANS, the laws regulating them, and their harmful effects in natural systems. Distribute the brochure to pet stores, garden centers, and bait dealers for distribution to customers.
Task 5A2c: Distribute ANS educational materials to the recreational boating industry (i.e. marinas and boat dealers), and include materials with special event permits.
Task 5A2d: Distribute ANS educational materials to aquaculture industry.
Task 5A2e: Distribute ANS educational materials to aquatic user groups (i.e. dive clubs, angling clubs, sailing clubs, etc.).

Strategic Action 5A3: Develop and distribute ANS identification and management information to resource agency staff.

Task 5A3a: Distribute ANS educational materials to all Kansas resource agency field staff, municipalities using surface water supplies, city park departments, county conservation boards, Coast Guard Auxiliary groups, and other entities with aquatic resource management responsibilities.
Task 5A3b: Organize and facilitate ANS identification workshops for state aquatic resource managers.
Task 5A3c: Develop and maintain a list of experts to whom ANS samples can be sent for identification. This list will be published on state agency websites for easy access.

OBJECTIVE 6: Support research on ANS in Kansas, and develop efficient systems to disseminate information to research and management communities.

6A. Problem: Little is known about the effects of ANS in Kansas. Research questions relevant to the ANS problem include determining the risks associated with each pathway of ANS introductions, the environmental conditions which must be necessary for certain ANS to become established in Kansas waters, the likely interactions between ANS and native species, and which management options will provide the best results in controlling or eradicating ANS populations. Research is needed to quantify and clarify the effect ANS poses to Kansas water resources.

Strategic Action 6A1: Support research that identifies, predicts, and prioritizes potential ANS introductions.

Task 6A1a: Identify life histories and impacts of introduced aquatic plants and animals.

Task 6A1b: Identify critical data needed to prevent the introduction of new ANS.

Task 6A1c: Attend scientific and technical conferences addressing the mechanisms by which new ANS spread.

Task 6A1d: Monitor ongoing research efforts attempting to develop control mechanisms for new ANS.

Strategic Action 6A2: Support research management alternatives for their effect on ANS and native species.

Task 6A2a: Investigate the relationship between human-induced disturbance of aquatic and riparian systems and ANS invasion, establishment, and impacts.

Task 6A2b: Investigate new and innovative methods of managing ANS.

Strategic Action 6A3: Facilitate the collection and dispersal of information, research, and data on ANS in Kansas.

Task 6A3a: Utilize existing field personnel to document the distribution and abundance of ANS.

Task 6A3b: Create a database of interested parties to receive annual ANS updates.

Task 6A3c: Utilize the internet to distribute information and research findings via an agency website.

IMPLEMENTATION TABLE

Plan #	Strategic Actions/Tasks Description	Funds Source	Lead Agency	Cooperative Agency	Recent ($000/FTE's) FY03	Recent ($000/FTE's) FY04	Planned ($000/FTE's) FY05	Planned ($000/FTE's) FY06	Planned ($000/FTE's) FY07
Objective 1: Coordinate and implement a comprehensive management plan									
1A1	**Implement a state ANS management program**								
1A1a	Receive plan approval by Natural Resources Sub-Cabinet	State	KDWP	KDHE,KDA					
1A1b	Receive plan approval by Kansas Governor	State	KDWP	KDHE,KDA					
1A1c	Receive plan approval by KDWP commission	State	KDWP						
1A1d	Receive plan approval by Federal ANSTF	State	KDWP	FWS					
1A1e	Implement the Kansas ANS management plan	State & Fed	KDWP	various		128/1	140/1	140/1	140/1
1A2	**Create and Fund ANS coordinator position**								
1A2a	Hire a program coordinator	State	KDWP			55/1	55/1	55/1	55/1
1A3	**Coordinate ANS activities with regional/national programs**								
1A3a	Identify key personnel with ANS responsibilities	State	KDWP	various					
1A3b	Ensure coherent ANS strategy	State	KDWP	various					
1A3c	Establish partnerships for data sharing	State	KDWP	various					
1A3d	Participate in national and regional coordination forums	State	KDWP						
1A3e	Conduct annual ANS forum in KS	State	KDWP	various			5/1	5/1	5/1
1A4	**Develop a permanent funding mechanism for ANS management in Kansas**								
1A4a	Explore ideas for permanent funding	State	KDWP	various					
1A4b	Establish permanent funding with KS Legislature	State	KDWP	KDHE, KDA, KWO					
Objective 2: Prevent the introduction of new ANS into Kansas waters									
2A1	**Identify ANS with greatest potential to infest Kansas**								
2A1a	Generate regional listing of ANS	State	KDWP	KDHE, KDA, KBS					
2A1b	Compile data on regional scale movement of ANS	State	KDWP	KDHE, KDA, KBS					
2A1c	Identify ANS transport mechanisms	State	KDWP	various					
2A2	**Establish approaches to prevent new ANS introductions**								
2A2a	Determine statutory authority	State	KDWP	various					
2A2b	Prohibit transport of invasive ANS	State & Fed	KDWP	various					
2A2c	Develop list of approved species for import	State	KDWP	various					
2A2d	Examine ANS regulations and revise as needed	State	KDWP	KDHE, KDA					
2A2e	Establish penalties for illegal introductions of ANS	State	KDWP	KDHE, KDA					
2A2f	Participate in regional and national forums for prevention	various	KDWP	various					

Table Legend: COE-United States Army Corps of Engineers, FWS-United States Fish and Wildlife Service, KBS-Kansas Biological Survey, KDA-Kansas Department of Agriculture, KDHE-Kansas Department of Health & Environment, KDWP-Kansas Department of Wildlife & Parks, KWO-Kansas Water Office, MRBP-Mississippi River Basin Panel on Aquatic Nuisance Species, Various-includes numerous interested parties both public and private, WGA-Western Governors Association, WRP-Western Regional Panel

IMPLEMENTATION TABLE

Plan #	Strategic Actions/Tasks Description	Funds Source	Lead Agency	Cooperative Agency	Recent ($000/FTE's) FY03	FY04	Planned ($000/FTE's) FY05	FY06	FY07
OBJECTIVE 3: Detect, monitor, and eradicate ANS									
3A1	**Implement a surveillance program**								
3A1a	Conduct annual surveys for distribution data	State	KDWP	KDHE, KDA, KBS	4/0	15/0	15/0	15/0	15/0
3A1b	Encourage monitoring networks and coordination	State	KDWP	various					
3A1c	Distribute list of ANS in Kansas	State	KDWP						
3A2	**Develop early response device**								
3A2a	Prioritize regional ANS that merit management	State	KDWP	WRP, MRBP, WGA					
3A2b	Develop rapid response plan for priority species	State	KDWP	various					
3A2c	Identify funding sources for plan action implementation	State	KDWP	various	1/0	2/0			
3A3	**Eradicate pioneering ANS populations**								
3A3a	Develop eradication program for pioneering ANS	State	KDWP	KDHE, KDA					
3A3b	Establish policies for shared watersheds	State	KDWP	various					
OBJECTIVE 4: Control and eradicate established ANS that have significant impacts									
4A1	**Limit dispersal of established ANS**								
4A1a	Establish control protocol	State	KDWP	KDHE, KDA					
4A1b	Support research for control mechanisms	various	KDWP	various					
4A1c	Ensure coordinated control strategies	State	KDWP	various					
4A1d	Ensure environmentally sound control strategies	State	KDWP	various					
4A1e	Develop cleaning guidelines for equipment	State	KDWP	KDHE, KDA, KBS					
4A2	**Develop means of adapting human activities**								
4A2a	Support research to adapt human activities	various	KDWP	various					

Table Legend: COE-United States Army Corps of Engineers,,FWS-United States Fish and Wildlife Service, KBS-Kansas Biological Survey, KDA-Kansas Department of Agriculture, KDHE-Kansas Department of Health & Environment, KDWP-Kansas Department of Wildlife & Parks, KWO-Kansas Water Office, MRBP-Mississippi River Basin Panel on Aquatic Nuisance Species, Various-includes numerous interested parties both public and private, WGA-Western Governors Association, WRP-Western Regional Panel.

IMPLEMENTATION TABLE

Plan #	Strategic Actions/Tasks Description	Funds Source	Lead Agency	Cooperative Agency	Recent ($000/FTE's) FY03	FY04	Planned ($000/FTE's) FY05	FY06	FY07
OBJECTIVE 5: Educate users of risks and how to reduce the harmful impacts									
5A1	**Develop and distribute ANS educational materials**								
5A1a	Develop ANS educational materials to raise awareness	State	KDWP	various	1/0	10/0			
5A1b	Develop ANS prevention fact sheets and ID cards	State	KDWP	various		3/0			
5A1c	Incorporate ANS information into boater safety classes	State	KDWP						
5A1d	Produce PSA's and press releases	State	KDWP	various					
5A1e	Create web based media on ANS	State	KDWP	various					
5A1f	Develop ANS curriculum	State	KDWP	KDHE, KDA					
5A1g	Present ANS issues and information to interested groups	State	KDWP	various	1/0	1/0			
5A1h	Maintain ANS information database on KDWP website	State	KDWP						
5A1i	Include ANS information in regulation booklets	State	KDWP						
5A2	**Develop and distribute ANS educational materials targeted at public pathways of introduction**								
5A2a	Install appropriate signage at infested waterbodies	State	KDWP		1/0	5/0			
5A2b	Distribute ANS dispersal information to aquatic dealers	State	KDWP						
5A2c	Distribute ANS materials to recreational boat industry	State	KDWP						
5A2d	Distribute ANS materials to aquaculture industry	State	KDWP						
5A2e	Distribute ANS materials to aquatic user groups	State	KDWP	COE					
5A3	**Develop and distribute ANS identification and management information to resource agency staff**								
5A3a	Distribute ANS material to aquatic resource managers	State	KDWP	various					
5A3b	Facilitate ANS ID workshops for resource managers	State	KDWP	various					
5A3c	Develop list of ANS experts for ID	State	KDWP	various					

Table Legend: COE-United States Army Corps of Engineers, FWS-United States Fish and Wildlife Service, KBS-Kansas Biological Survey, KDA-Kansas Department of Agriculture, KDHE-Kansas Department of Health & Environment, KDWP-Kansas Department of Wildlife & Parks, KWO-Kansas Water Office, MRBP-Mississippi River Basin Panel on Aquatic Nuisance Species, Various-includes numerous interested parties both public and private, WGA-Western Governors Association, WRP-Western Regional Panel.

IMPLEMENTATION TABLE

Strategic Actions/Tasks		Funds	Lead	Cooperative	Recent ($000/FTE's)		Planned ($000/FTE's)		
Plan #	Description	Source	Agency	Agency	FY03	FY04	FY05	FY06	FY07
OBJECTIVE 6: Support research on ANS in Kansas, and develop systems to disseminate information									
6A1	**Support research that identifies, predicts, and prioritizes potential ANS introductions**								
6A1a	Identify life histories and impacts of introduced ANS	State	KDWP	KDHE, KDA, KBS					
6A1b	Identify critical data to prevent the introduction of ANS	State	KDWP	KDHE, KDA, KBS, COE		30/0			
6A1c	Attend conferences on the mechanisms of ANS spread	various	KDWP	various	1/0	2/0			
6A1d	Monitor research efforts to develop ANS control methods	various	KDWP	various					
6A2	**Support research management alternatives for their effect on ANS and native species**								
6A2a	Investigate human-induced disturbance and ANS invasion	various	KDWP	various					
6A2b	Investigate new and innovative methods to manage ANS	various	KDWP	KDHE, KDA, KBS					
6A3	**Facilitate the collection and dispersal of information, research, and data on ANS in Kansas**								
6A3a	Utilize existing field personnel to document ANS	State	KDWP	various		5/0			
6A3b	Identify interested parties to receive annual ANS updates	State	KDWP	various					
6A3c	Utilize the internet to distribute research findings	State	KDWP	various					

Table Legend: COE-United States Army Corps of Engineers, FWS-United States Fish and Wildlife Service, KBS-Kansas Biological Survey, KDA-Kansas Department of Agriculture, KDHE-Kansas Department of Health & Environment, KDWP-Kansas Department of Wildlife & Parks, KWO-Kansas Water Office, MRBP-Mississippi River Basin Panel on Aquatic Nuisance Species, Various-includes numerous interested parties both public and private, WGA-Western Governors Association, WRP-Western Regional Panel.

GLOSSARY

Accidental introduction: An introduction of non-indigenous aquatic species that occurs as the result of activities other than the purposeful or intentional introduction of the species involved, such as the transport of non-indigenous species in ballast water or in water used to transport fish, mollusks, or crustaceans for aquaculture or other purposes.

Aquatic nuisance species (ANS): A non-indigenous species that threatens the diversity and abundance of native species or the ecological stability of infested waters, or commercial, agricultural, or recreational activities dependant on such waters.

Baitfish: Fish species commonly sold for use as bait for recreational fishing.

Ballast water: Any water or associated sediments used to manipulate the trim and stability of a vessel.

Control: Limiting the distribution and abundance of a species.

Ecological integrity: The extent to which an ecosystem has been altered by human behavior; an ecosystem with minimal impact from human activity has a high level of integrity; an ecosystem that has been substantially altered by human activity has a low level of integrity.

Environmentally sound: Methods, efforts, actions, or programs to prevent introductions or to control infestations of ANS that minimize adverse environmental impacts.

Eradicate: The act or process of eliminating an ANS.

Exotic: Any species or other biological material that enters an ecosystem beyond its historic range on the continent.

Great Lakes: Lake Ontario, Lake Erie, Lake Huron (including Lake St. Clair), Lake Michigan, Lake Superior, and the connecting channels (Saint Mary's River, Saint Clair River, Detroit River, Niagara River, and Saint Lawrence River to the Canadian Border), and includes all other bodies of water within the drainage basin of such lakes and connecting channels.

Infested: Any waterbody where an aquatic nuisance species is known to occur.

Intentional introduction: All or part of the process by which a non-indigenous species is purposefully introduced into a new area.

Native: A plant or animal species that naturally occurs in Kansas and has not been introduced from another state or continent.

Non-indigenous species: Any species or other variable biological material that enters an ecosystem beyond its historic range.

Pioneer infestation: A small ANS colony that has spread to a new area from an established colony.

Population: A group of individual plant or animal species occupying a particular area at the same time.

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APPENDIX A
Non-indigenous aquatic animals

Common Name	Scientific Name
Amphibians	
Dusky Salamander	*Desmognathus fuscus*
Green tree frog	*Hyla cinerea*
Wood Frog	*Rana sylvatica*
Fish	
Bighead carp*	*Hypophthalmichthys nobilis*
Black crappie	*Pomoxis nigromaculatus*
Blue tilapia	*Oreochromis aureus*
Brown bullhead	*Ameiurus nebulosus*
Common carp	*Cyprinus carpio*
Goldfish	*Carassius auratus*
Grass carp	*Ctenopharyngodon idella*
Mosquitofish	*Gambusia affinis*
Northern Pike	*Esox lucius*
Palmetto bass	*Morone hybrid*
Rainbow smelt	*Osmerus mordax*
Rainbow trout	*Oncorhynchus mykiss*
Redear sunfish	*Lepomis microlophus*
Red River Shiner	*Notropis bairdi*
Rock bass	*Ambloplites rupestris*
Rudd	*Scardinius erythrophthalmus*
Saugeye	*Sander hybrid*
Silver carp*	*Hypophthalmichthys molitrix*
Striped bass	*Morone saxatilis*
Threadfin shad	*Dorosoma petenense*
White perch*	*Morone americana*
Yellow bass	*Morone mississippiensis*
Yellow perch	*Perca flavenscens*
Invertebrates	
Asian clam	*Corbicula fluminea*
Freshwater jellyfish	*Craspedacusta sowerbyii*
Exotic waterflea	*Daphnia lumholtzi*
Zebra mussel*	*Dreissena polymorpha*

* Denotes priority species.

APPENDIX B
Non-indigenous aquatic plants

Common name	Scientific name
American sloughgrass	*Beckmannia syzigachne*
American wisteria	*Wisteria frutescens*
Annual rabbit's-foot grass	*Polypogon monspeliensis*
Blue water speedwell	*Veronica anagallis-aquatica*
Brazilian waterweed	*Egeria densa*
Broadleaved peppergrass	*Lepidium latifolium*
Carolina fanwort	*Cabomba caroliniana*
Common barnyard grass	*Echinochloa crusgalli*
Common velvet grass	*Holcus lanatus*
Creeping bent grass	*Agrostis stolonifera*
Creeping yellowcress	*Rorippa sylvestris*
Curly dock	*Rumex crispus*
Curly pondweed	*Potamogeton crispus*
Eurasian watermilfoil*	*Myriophyllum spicatum*
Garden orache	*Atriplex hortensis*
Garlic mustard	*Alliaria petiolata*
Glinus	*Glinus lotoides*
Indian heliotrope	*Heliotropium indicum*
Jungle rice	*Echinochloa colona*
Lady's thumb smartweed	*Persicaria maculosa*
Meadow foxtail	*Alopecurus pratensis*
Moneywort	*Lysimachia nummularia*
Mouse foxtail	*Alopecurus myosuroides*
Narrow leaf cattail	*Typha angustifolia*
Narrowleaf dock	*Rumex stenophyllus*
Water lettuce	*Pistia stratiotes*
Oakleaf goosefoot	*Chenopodium glaucum*
Parrot's feather	*Myriophyllum aquaticum*
Prickly sowthistle	*Sonchus asper*
Prostrate knotweed	*Polygonum aviculare*
Purple loosestrife*	*Lythrum salicaria*
Ravennagrass	*Saccharum ravennae*
Red goosefoot	*Chenopodium rubrum*
Red orache	*Atriplex rosea*
Rough blue grass	*Poa trivialis*
Saltcedar*	*Tamarix spp.*

*Denotes priority species

APPENDIX B (continued)
Non-indigenous aquatic plants

Common name	Scientific name
Schreber's watershield	*Brasenia schreberi*
Seaside heliotrope	*Heliotropium curassavicum*
Tall buttercup	*Ranunculus acris*
Thymeleaf speedwell	*Veronica serpyllifolia*
Watercress	*Nasturtium officinale*
Water hyacinth	*Eichhornia crassipes*
Water pepper smartweed	*Persicaria hydropiper*
Weeping willow	*Salix babylonica*
Yellow iris	*Iris pseudacorus*

*Denotes priority species.

APPENDIX C
Acronyms Defined

Acronym	Definition
ANS	Aquatic Nuisance Species
ANSTF	Aquatic Nuisance Species Task Force
BWM	Ballast Water Management
FTE	Full Time Employee
KAR	Kansas Administrative Regulation
KDA	Kansas Department of Agriculture
KDWP	Kansas Department of Wildlife & Parks
KDHE	Kansas Department of Health & Environment
KSA	Kansas Statutory Authority
MRBP	Mississippi River Basin Regional Panel
NANPCA	Non-indigenous Aquatic Nuisance Prevention and Control Act
NISA	National Invasive Species Act
NZMS	New Zealand Mudsnail
USFWS	U.S. Fish and Wildlife Service
WGA	Western Governors Association
WRP	Western Regional Panel
ZMRP	Zebra Mussel Research Program

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APPENDIX E
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Kansas ANS Management Program

Report to the Aquatic Nuisance Species Task Force on Kansas ANS management for federal Fiscal Year 2006

Submitted on November 30, 2006 by: Jason Goeckler ANS Coordinator

1.0 ANS Program Summary

The Kansas Aquatic Nuisance Species Management Plan was approved by the ANSTF in May 2005. The goals of the plan are to prevent new introductions of ANS to Kansas, prevent dispersal of established populations of ANS, eradicate or control to minimize the adverse ecological, economic, social, and public heath effects of ANS, educate all aquatic users of ANS risks, and to support research ANS in Kansas. The coordinated efforts contained within the plan are designed to protect residents of Kansas and the state's aquatic resources from the multitude of potential losses associated with ANS plants and animals.

2.0 Major Accomplishments

(DM) Continue to monitor zebra mussel reproduction in El Dorado Reservoir with monthly plankton tows. Record veliger densities were observed in July 2006 (236 veligers/L). Settling structures have also been deployed to determine daily settlement rates.

(R) Research is also being conducted to determine risk of zebra mussel transport from El Dorado Reservoir via recreational boaters. Survey will also evaluate educational campaign effectiveness. To date, the range of zebra mussel has not expanded within Kansas.

(EO) Continue to distribute educational materials to El Dorado Reservoir users. A new flyer was developed for distribution to all lake users (campers, boaters, anglers, day-users, etc.).

(DM) Continue to monitor (Portland samplers and/or plankton tows) all department waters and the Kansas/Missouri River @ KC for presence of zebra mussels. No new introductions discovered.

(EO) Numerous ANS press releases were produced including front page coverage in the Wichita newspaper. Also, included large section in fishing regulations dedicated to ANS.

(R) Conducted boater surveys as part of the 100th Meridian survey program.

(DM) Surveyed silver carp in the Kansas River.

(CM) Participated in regional zebra mussel forum for surface water users (municipalities and industry).

(DM) Continue to investigate zebra mussel report from Cheney Reservoir. In Aug. 2004, plankton tows (taken by Oklahoma biologists) revealed veligers to be present. All subsequent samples have been negative for veligers. No adults have been found. This lake is no longer considered infested.

(CM) For department use, we have implemented a 'triploid only' grass carp program.

(P) Added the requirement that fishing tournament directors must certify that all 'bass pass' registered tournament participants are 'ANS free'.

(P) Implemented HACCP for department fish imports.

(EO) Zebra mussel information was posted on popular fishing websites.

(EO) Stop Aquatic Hitchhiker signs have been placed at all boat ramps across Kansas.

(EO) Distributed educational material to Kansas bait dealers about the emerging fish virus Viral Hemorrhagic Septicemia.

(CM) White perch were added to the prohibited species list.

(P) HACCP training was provided to multi-agency and multi-state natural resource management staff.

Programmatic Needs

The primary programmatic need is for additional funding for ANS management. Available funds limit all ANS activities within the program. Continual drop in federal funds through the ANSTF limits funds available for operations and in the future will likely be inadequate to cover the salary of the ANS Coordinator. More stable funding is essential for further development and success of the program.

Although our ANS management plan was approved in 2005, funding by the ANSTF was not realized until September 2006. Due to the late arrival of ANSTF funds, much of the ANS management activities for FY06 were funded by state funds, local donations, and other grants. While the balance of the ANSTF grant was not spent in FY06, ANSTF funding is greatly needed and will be used in the months to come for plan implementation.

1 P = Prevention; DM = Detection & Monitoring; CM = Control & Management; EO = Education & Outreach; R = Research

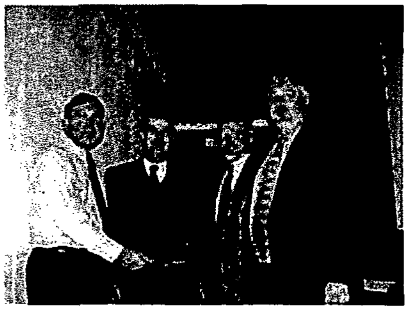
7

Updated: 4/29/05

ANS Program Donors

The Kansas Department of Wildlife and Parks would like to recognize our partners in protecting the natural resources of Kansas. Partnerships with Westar Energy Green Team, Great Plains Energy, Wolf Creek Nuclear Operating Corporation, and the Friends of El Dorado Lake have made the Kansas Aquatic Nuisance Species Program an effective tool to combat invasive species in Kansas. The willingness of these partners to support our ANS program demonstrates their commitment to protect the residents of Kansas and the state's aquatic resources from the multitude of potential losses associated with ANS plants and animals.

Wolf Creek Nuclear Operating Corp



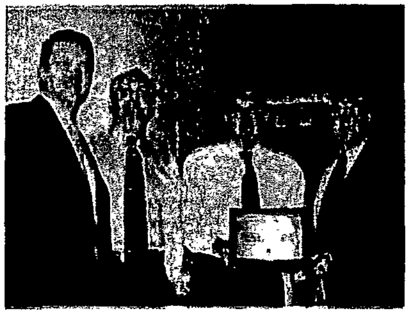
Pictured (left to right): Secretary J. Michael Hayden, Matt Sunseri, Dan Haines, and Bob Hammond.

Great Plains Energy

Pictured (left to right): Secretary J. Michael Hayden and Joe Werner.

Westar Energy

Friends of El Dorado Lake



Pictured (left to right): Doug Sterbenz, Brad Loveless, Secretary J. Michael Hayden, and Chuck Hodson.

Pictured (left to right): Secretary J. Michael Hayden and Casey Smithson.

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Email Page

Zebra mussel inspection checklist
Coffey County Lake

Boat Owner: ______________________ Date: ________________

The purpose of this inspection is to prevent the introduction of zebra mussels into Coffey County Lake by boats. Zebra mussels have the potential to cause adverse impacts to the lake's fishery and to the efficient operation of Wolf Creek Generating Station.

What water-body has the boat been in last? ________________________________

When? ________________________________

If last in Coffey County Lake, then further inspection NOT required.
All other boats should be inspected prior to entry for the following:

1.	a.	**Are all live wells dry?**	Yes ____	No ____
	b.	If no, then owner **must** follow preventive methods recommended by the Kansas Department of Wildlife and Parks (KDWP) before launching. See current Fishing Regulations Summary or available brochure.		
2.	a.	**Is the bilge and/or boat floor dry?**	Yes ____	No ____
	b.	If no, then owner **must** follow preventive methods recommended by the KDWP before launching.		
3.	a.	**Is the trailer free of attached vegetation or debris?**	Yes ____	No ____
	b.	If no, owner **must** remove before launching.		
4.	a.	**Has the engine cooling system been drained?**	Yes ____	No ____
	b.	If no, then owner **must** follow preventive methods recommended by the KDWP before launching.		
5.	a.	**Is the boat hull and motor free of attached zebra mussels?**	Yes ____	No ____
	b.	If no, **do not allow** boat to be launched. Contact the KDWP as directed in the current Kansas Fishing Regulations Summary or brochures, and inform WCNOC 364-8831, ext 4672 or 4059.		
6.	a.	**Remind anglers that Coffey County Resolution 620 prohibits the placing or dumping of bait buckets into the lake.**	Yes ____	No ____

Inspector: ______________________________

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Haines Daniel E

From: Haines Daniel E
Sent: Monday, August 07, 2006 11:23 AM
To: Abel Robert M; 'jboak@nalco.com'; 'dcboes@nppd.com'; 'wildcat@eldoks.com'; 'dbuehler@ottawakansas.net'; 'pchaffee@hughes.net'; 'scinelli@bpu.com'; 'william.g.covington@usace.army.mil'; 'rjdyer@nppd.com'; 'james.d.franz@usace.army.mil'; 'dogarbe@wconc.com'; 'jasong@wp.state.ks.us'; Haines Daniel E; 'charles.d.hall@usace.army.mil'; Hammond Robert A; Hedstrom Bradley L; 'mwhegeman@ci.lawrence.us'; 'eheitmann@nalco.com'; Jensen Tammy J; 'michael.katzman@kcpl.com'; 'everett.laney@usace.army.mil'; 'robin.leutzinger@westarenergy.com'; Logsdon Ralph L; 'brad.loveless@wr.com'; 'rmonk@bpu.com'; 'kmgehri@nppd.com'; 'leonpayne@earthlink.net'; 'bperry@eldoks.com'; 'daphelps@wcnoc.com'; 'dwight.pierce@wr.com'; 'rrhodes@emporia.ws'; 'scott.a.rice@usace.army.mil'; 'krwadn01@msn.com'; Sathiamoorthy Sitaraman; Scherich Kevin L; 'tstahl@kdhe.state.ks.us'; Stone Damon L; 'rtallant@nalco.com'; 'joe.werner@kcpl.com'; 'jtw@ksu.edu'; 'rbrown@bpu.com'; 'ssteineger@bpu.com'; 'tom_brown@wr.com'; 'pteneyck@nalco.com'; 'dcarlson@kdhe.state.ks.us'; 'kdaggett@bpu.com'; 'wjelzinga@mactec.com'; 'c.ralph@yahoo.com'; 'dbaker@kwo.state.ks.us'; 'kwhealy@ci.lawrence.ks.us'; 'iolawtr@iolaks.com'; 'cbesch@waterone.org'; 'marc.chester@swt03.usace.army.mil'; 'icherko@oppd.com'; 'tdukarski@oppd.com'; 'tarmstr@entergy.com'; 'staseks@dteenergy.com'
Cc: Moles Kevin J
Subject: Zebra Mussel Meeting Attendees

Folks,

The zebra mussel meeting hosted at Wolf Creek Generating Station on 8/3/06 was well attended, and information exchange was great. Now we know who each other is, and how each of us may be impacted by zebra mussels. Attached is the attendee list that was promised, as well as other contacts that were not able to make the meeting. We plan to stay in touch as zebras potentially spread in the area.

Thanks,
Dan Haines
Environmental Biologist
Wolf Creek Nuclear Operating Corporation
620-364-8831

Wolf Creek 06
zebra 8-03 mtg a...

8-03 meeting RSVP

Zebra Mussel Meeting
Wolf Creek Generating Station
August 3, 2006
Meeting Attendees

Name		Organization	Address	Phone	E-Mail
Abel	Robin	Kan-Seal	1000 S. 4th, Burlington, KS 66839	620-364-3600	roabel@wcnoc.com
Boak	Jim	NALCO	1601 W. Diehl, Naperville Illinois	630-305-2221	jboak@nalco.com
Boes	Doug	Cooper Nuclear Station	72676 648A Ave, Brownville, NE 68321	402-825-2874	dcboes@nppd.com
Bookout	Kurt	City of El Dorado	380 E. Central, El Dorado, KS 67042	316-321-9100	wildcat@eldoks.com
Buehler	David	City of Ottawa	101 S. Hichory	785-229-3690	dbuehler@ottawakansas.net
Chaffee	Pamela	U.S. Coast Guard Aux	847 N. 1909 Rd., Lecompton, KS 66050	785-550-4074	pchaffee@hughes.net
Cinelli	Susan	KC Board of Public Utilities	4301 Brenner Rd, Kansas City, KS 66104	913-573-9274	scinelli@bpu.com
Covington	Glenn	Kansas City, Corp of Engineers	601 E. 12th St. Kansas City, MO 64106	816-389-3141	william.g.covington@usace.army
Dyer	Ray	Cooper Nuclear Station	72676 648A Ave, Brownville, NE 68321	402-825-2923	rjdyer@nppd.com
Franz	Jim	Melvern Corp of Engineers	31051 Melvern Lake Parkway, Melvern, KS 66510	785-549-3318	james.d.franz@usace.army.mil
Garbe	Don	Wolf Creek Nuclear Operating Corp	1550 Oxen Ln, Burlington, KS 66839	620-364-8831	dogarbe@wconc.com
Goeckler	Jason	Kansas Dept Wildlife & Parks	1830 Merchant St, PO Box 1525, Emporia, KS	620-342-0658	jasong@wp.state.ks.us
Haines	Dan	Wolf Creek Nuclear Operating Corp	1550 Oxen Ln, Burlington, KS 66839	620-364-8831	dahaine@wcnoc.com
Hall	Charles	Melvern Corp of Engineers	31051 Melvern Lake Parkway, Melvern, KS 66510	785-549-3318	charles.d.hall@usace.army.mil
Hammond	Bob	Wolf Creek Nuclear Operating Corp	1550 Oxen Ln, Burlington, KS 66839	620-364-8831	rohammo@wcnoc.com
Hedstrom	Brad	Wolf Creek Nuclear Operating Corp	1550 Oxen Ln, Burlington, KS 66839	620-364-8831	brhedst@wcnoc.com
Hegeman	Michael	City of Lawrence	PO Box 708 Lawrence, KS 66047	785-832-7851	mwhegeman@ci.lawrence.us
Heitmann	Erik	NALCO	12705 Pembroke Ln, Leawood, KS	913-908-8063	eheitmann@nalco.com
Jensen	Tammy	Wolf Creek Nuclear Operating Corp	1550 Oxen Ln, Burlington, KS 66839	620-364-8831	tajense@wcnoc.com
Katzman	Michael	Kansas City Power & Light	PO Box 418679 Kansas City, MO 64141	816-654-1665	michael.katzman@kcpl.com
Laney	Everett	Tulsa, Corp of Engineers	1645 S. 101 E. Ave Tulsa, OK	918-669-7411	everett.laney@usace.army.mil
Leutzinger	Robin	Westar Energy	25905 Jeffrey Rd, St Marys, KS 66536	785-456-6146	robin.leutzinger@westarenergy.c
Logsdon	Ralph	Wolf Creek Nuclear Operating Corp	1550 Oxen Ln, Burlington, KS 66839	620-364-8831	ralogsd@wcnoc.com
Loveless	Brad	Westar Energy	122 SW 2nd St, Topeka, KS 66603	785-575-8115	brad.loveless@wr.com
Monk	Rick	KC Board of Public Utilities	300 N. 65th St, Kansas City, KS 66102	913-573-9805	rmonk@bpu.com
Ohrablo	Kristine	Cooper Nuclear Station	72676 648A Ave, Brownville, NE 68321	402-825-5746	kmgehri@nppd.com
Payne	Leon	Kan-Seal	PO Box 453, Burlington, KS 66839	620-964-3600	leonpayne@earthlink.net
Perry	Brett	City of El Dorado	380 E. Central, El Dorado, KS 67042	316-321-9100	bperry@eldoks.com
Phelps	David	Westar Energy	818Kansas Ave, Topeka, KS	620-364-2231	daphelps@wcnoc.com
Pierce	Dwight	Westar Energy	6001 N. 151st St. West, Colwich, KS	316-291-8660	dwight.pierce@wr.com
Rhodes	Ron	City of Emporia	2910 W. 24th, Emporia, Ks 66801	620-340-6370	rrhodes@emporia.ws

8-03 meeting RSVP

Rice	Scott	Melvern Corp of Engineers	31051 Melvern Lake Parkway, Melvern, KS 66510	785-549-3318	scott.a.rice@usace.army.mil
Rogge	Fred	Cottonwood/Neosho Water Assurance	212 SW 7th, Topeka, KS 66605	785-232-9947	krwadn01@msn.com
Sathiamoorth	Sathy	Wolf Creek Nuclear Operating Corp	1550 Oxen Ln, Burlington, KS 66839	620-364-8831	sisathi@wcnoc.com
Scherich	Kevin	Wolf Creek Nuclear Operating Corp	1550 Oxen Ln, Burlington, KS 66839	620-364-8831	kescher@wcnoc.com
Stahl	Tony	Kansas Dept of Health and Env	100 SW Jackson St., Topeka, KS 66610	785-296-5578	tstahl@kdhe.state.ks.us
Stone	Damon	Wolf Creek Nuclear Operating Corp	1550 Oxen Ln, Burlington, KS 66839	620-364-8831	dastone@wcnoc.com
Tallant	Bob	NALCO	14205 W. 72nd Tr, Shawnee, KS	913-226-0444	rtallant@nalco.com
Werner	Joe	Kansas City Power & Light	PO Box 418679 Kansas City, MO 64141	816-654-1741	joe.werner@kcpl.com
Wilson	Jeff	Wolf Creek Nuclear Operating Corp	120 Dobbin Rd, Burlington, KS 66839	620-341-2543	jtw@ksu.edu

Interested Participants Unable to Attend

Name		**Organization**	**Address**	**Phone**	**E-Mail**
Brown	Rhonda	KC Board of Public Utilities	KC, KS		rbrown@bpu.com
Steineger	Sarah	KC Board of Public Utilities	300 N. 65th St., Kansas City KS 66102	913-573-9818	ssteineger@bpu.com
Brown	Tom	Westar Energy	818 Kansas Ave., Topeka KS 66614	785-575-1548	tom_brown@wr.com
Ten Eyck	Peter	NALCO	416 Fox Meadow Dr., Wexford PA 15090	412-576-5221	pteneyck@nalco.com
Carlson	Don	Kansas Dept of Health and Env	1000 SW Jackson St., Topeka KS	785-296-5547	dcarlson@kdhe.state.ks.us
Daggett	Kristina	KC Board of Public Utilities	300 N. 65th St., Kansas City KS 66102	913-573-9805	kdaggett@bpu.com
Elzinga	Bill	MACTEC	3199 Riverport Tech Center Dr. St. Louis MO 6304	314-209-5957	wjelzinga@mactec.com
Ralph	Connie	Public Wholesale WSD # 12	Melvern, KS	620-757-1794	c.ralph@yahoo.com
Baker	Debra	Kansas Water Office	901 S. Kansas Ave, Topeka, KS 66612		dbaker@kwo.state.ks.us
Whealy	Keith	City of Lawrence			kwhealy@ci.lawrence.ks.us
Ross	Toby	City of Iola		620-365-9578	iolawtr@iolaks.com
Besch	Cheryl	Water Dist No 1, Johnson County	7601 Holiday Dr., Kansas City, KS 66106	913-895-5838	cbesch@waterone.org
Chester	Marc	Kansas Area Oper Prog Mgr, Corp of E	Burlington, Kansas	620-364-8613	marc.chester@swt03.usace.army
Cherko	Igor	Omaha Public Power District		402-636-2505	icherko@oppd.com
Dukarski	Tim	Fort Calhoun, Omaha PPD		402-533-7126	tdukarski@oppd.com
Armstrong	Tom	Arkansas Nuclear One, Entergy		479-858-3555	tarmstr@entergy.com
Stasek	Stanley	DTE Energy, Fermi Station	6400 N. Dixie Hwy, Newport, MI 48166	734-586-4445	staseks@dteenergy.com

8. Documentation regarding the WCNOC or Coffey County Sheriff's office management of the CCL access program.

• Available water or sediment quality data for John Redmond Reservoir (JRR), Coffey County Lake (CCL), and Neosho River.

• Available information regarding local, state, or federal management measures for the JRR, CCL, and the Neosho River. This may include fisheries management, watershed management, flow regulation, etc.

• Any available documentation regarding minimum flows in the Neosho River.

• Available records regarding the operation of the intake screens at either the Neosho River or CCL screen houses as well as information on the ongoing and periodic maintenance that occurs on the screens.

• Available information on invasive or nuisance species observed in the facility's intake, JRR, CCL, or the Neosho River and available information on Wolf Creek Nuclear Operating Corporation (WCNOC) efforts to address this issue.

4 • Documentation regarding the WCNOC or Coffey County Sheriff's office management of the CCL access program.

• Examples of the fishery regulations developed by the Kansas Department of Wildlife & Parks for CCL.

• If available, information on any occurrences of the Topeka Shiner in the JRR, CCL, Neosho River, or any water bodies crossed by the facility's transmission lines.

• Section 2.5 of the ER (Wolf Creek Generating Station (WCGS), 1980) states that U.S. Fish and Wildlife Service (USFWS) and U.S. Geological Survey (USGS) recommended that additional data be obtained on the habitat requirements of the Neosho River madtoms. Please provide any new information related to these habitat requirements.

• Section 2.5 of the ER (WCGS, 1980) states that USFWS and USGS recommended that flows below the John Redmond Dam be increased during critical periods for the Neosho River madtoms. Please provide any new information related to this issue.

• If available, information on any occurrences of the Neosho river madtom in the JRR, CCL or Neosho river.

• If available, information on any occurrences of the Neosho mucket mussel in the JRR, CCL or Neosho river.

• Section 3.1.2 of the ER (WCGS, 1980) states that water is released to Wolf Creek infrequently. Please provide available records documenting these releases and/or information regarding the frequency of these releases.

• Details on the anti-scalants, dispersants, biocides, and corrosion inhibitors which are released into the circulating water system. Specifically, names of additives used, concentrations used, and frequency of application.

• System operating procedures for the circulating water system traveling screens.

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding is entered into this 20 day of June, 1996, among the following parties: KANSAS GAS AND ELECTRIC COMPANY, KANSAS CITY POWER & LIGHT COMPANY and KANSAS ELECTRIC POWER COOPERATIVE, INC. (referred to as "OWNERS"); WOLF CREEK NUCLEAR OPERATING CORPORATION (referred to as "WCNOC"); the KANSAS DEPARTMENT OF WILDLIFE AND PARKS (referred to as "DEPARTMENT" or "STATE"); and COFFEY COUNTY, KANSAS (referred to as "COUNTY").

WHEREAS, the OWNERS jointly own a tract of land (referred to as the "Land") approximately 10,500 acres in size in Coffey County, Kansas, described in greater detail on Exhibit 1 attached and incorporated herein, on which is located the Wolf Creek Generating Station (referred to as "WCGS"), and which includes a cooling lake (referred to as the "Lake") approximately 5,090 acres in size; and

WHEREAS, WCNOC, a wholly-owned subsidiary of the OWNERS, operates and maintains WCGS, and controls and manages the Land and the Lake, as agent for the OWNERS; and

WHEREAS, the OWNERS desire to open portions of the Land and the Lake for public recreation and fishing to enable the public to enjoy the recreation potential of this natural resource insofar as such use is compatible with the requirements for generation and transmission of electricity and conservation of natural resources; and

WHEREAS, the DEPARTMENT is responsible for development of facilities for outdoor recreation and for administration and enforcement of rules and regulations relating to fishing on waters under its jurisdiction; and

WHEREAS, the COUNTY, recognizing the economic benefits that will accrue to it as a result of opening the Lake to public fishing, is willing to participate in the project by improving the Lake access road and by establishing, operating and maintaining a reservation system for use by members of the public desiring to fish on the Lake; and

WHEREAS, the Parties recognize that there is a demand by the public to fish on the Lake, and that such demand may be in excess of the level of demand that would promote the efficient operation of WCGS and preserve the Lake as a quality fishery;

NOW, THEREFORE, in consideration of the premises and of the mutual covenants set forth below, the Parties agree as follows:

1. Development of Land Management Areas. The Parties agree to the development, administration and enforcement of the land and water management area described below in subparagraph (a) and depicted in Exhibit 2 attached and incorporated herein, for the purpose of demonstrating the compatibility of industrial, agricultural, soil and water conservation practices, and recreational uses of the Land, excluding, however, the land and facilities described below in subparagraph (b). The Parties' obligations for development, administration and enforcement of the land and water management areas are conditioned on the DEPARTMENT's obtaining approval of a federal Sport Fish Restoration Grant application described in Paragraph 4(a) below.

a. Wolf Creek Recreational Area: This Area includes the Lake; the Public Access Area in the Southwest 1/4 of Section 1, T21S, R15E; and the Environmental Education Area in portions of Sections 24, 25, and 26 in T20S, R15E. Effective on a date to be agreed to by the Parties, presently expected to be in the first half of 1996, the OWNERS will open Wolf Creek Recreational Area for public recreation to include only fishing, boating (for purposes of fishing), picnicking, hiking, nature study, and viewing and enjoying scenic sites.

b. Wolf Creek Industrial Area: This Area includes all the land above the surface of the water in Section 7, T21S, R16E, in which the WCGS and supporting facilities are located. Because this Area is used intensively for industrial purposes, it will not be available for public recreational use or access. The Area also includes all other portions of the Land, not described in subparagraph (a) above, either which the OWNERS have leased to third parties for agricultural purposes, or which, because of their remoteness, inaccessibility or private use, will not be available for public recreational use.

2. Recreational Activities.

a. Schedule for Public Availability. Recreational activities in the Lake and Public Access Area described in Paragraph 1(a) above will be allowed from sunrise to sunset on a schedule reflecting public use six days per week ("Public Days") and no public use one weekday per week ("Wolf Creek Day"); reasonable efforts will be made to conduct maintenance on such day to maximize public benefit on other days.

(i) Designation of Wolf Creek Day. Wednesday shall be the Wolf Creek Day during the first year of operation of the Public Access Area. Thereafter, WCNOC shall designate the Wolf Creek Day on a yearly basis by so notifying the DEPARTMENT and COUNTY at least four months in advance of each succeeding operating year. If no such day is designated by WCNOC, then such day shall be conclusively presumed to be Wednesday. The OWNERS and WCNOC shall have sole discretion to determine the use to be made of the Lake and Public Access Area on the Wolf Creek Day; provided that such use is in conformity with state fishing regulations and related DEPARTMENT orders which specify length and creel limits for this particular facility.

(ii) Designation of Tournament Days. In addition, WCNOC may designate, with four months advance notice to the DEPARTMENT and the COUNTY, four Saturdays per year, two in the spring and two in the fall ("Tournament Days"), during which the Lake will be open only to organizations for the purpose of conducting bona fide fishing tournaments. WCNOC, the DEPARTMENT and the COUNTY shall agree on criteria for determining what organizations will qualify to participate in Tournament Days. Reservations for use of the Lake on Tournament Days shall be made by lottery selection to be administered by WCNOC. Use of the Lake on Tournament Days shall be subject to all other rules set forth herein.

b. Public Availability of Reservation System. To ensure that the public at large is afforded access to the Lake and Public Access Area all other days of the week, 100% of the available reservations shall be made available to the general public.

c. Open and Restricted Areas of the Lake. Shoreline fishing will be allowed in the Public Access Area. Boat fishing will be allowed in all areas of the Lake except for areas marked on Exhibit 2 as "No Public Access." WCNOC and the DEPARTMENT may agree to restrict access to other discrete areas of the Lake for wildlife or environmental protection purposes (e.g., to safeguard habitat for identified eagle nesting areas). In its sole discretion, WCNOC may temporarily (i.e., for no longer than 60 days) restrict access to other discrete areas of the Lake for WCGS operational purposes. Such areas may include the immediate vicinities of the Makeup Water Discharge Structure, the Main Dam and the Spillway. If WCNOC desires temporarily to restrict access to such areas for greater than 60 days, it shall negotiate with the DEPARTMENT to reach a mutually agreeable period of time for access restriction, the safe and efficient operation of WCGS being the determining criterion.

3. Operational Criteria. WCNOC and the DEPARTMENT annually will agree on the following lake operational criteria: number of boats and persons allowed on the Lake per day, fish size and possession limits to be promulgated and enforced by the DEPARTMENT, and other operational rules and regulations. Such operational criteria shall be established to accomplish the following goals, listed in order of priority: (1) promoting the safe and efficient operation of WCGS, (2) preserving the Lake as a quality fishery, and (3) to the extent not inconsistent with the first two goals, making the Lake available to as many members of the public as practicable. In the event that WCNOC and the DEPARTMENT are unable to agree on the above lake operational criteria, WCNOC's recommendations shall control with regard to priority (1), and the DEPARTMENT's recommendations will control with regard to priority (2). If WCNOC, in its sole discretion, deems it necessary for WCGS operational purposes in order to maintain the safe and efficient operation of WCGS, WCNOC may, after giving 30 days prior notice to the other parties, temporarily suspend public access to the Lake for a period of time necessary to restore the safe and efficient operation of WCGS, such suspension not to exceed one year. If the DEPARTMENT reasonably determines that the operational rules and regulations established by WCNOC, due to the priority given to the safe and efficient operation of WCGS, are incompatible with the DEPARTMENT's statutory or regulatory authority, then

the DEPARTMENT may terminate this Memorandum of Understanding upon giving WCNOC 60 days written notice, and in such event OWNERS will reimburse to the DEPARTMENT an amount equal to the original cost less depreciation (at a rate of 5% per year) of the physical facilities described in Paragraph 4(a) below.

4. New Facilities, Improvements, Reservation System, and Reporting.

a. WCNOC will be responsible for procuring design and construction of public access facilities in Wolf Creek Recreational Area in the Public Access Area and on the Lake. The design and location of such facilities will be agreed to by the OWNERS, WCNOC and the DEPARTMENT, and will place emphasis on safety first, then accessibility and convenience. The design will include roads, boat ramps, dock, breakwater, parking lot, restrooms, registration office, fencing and gates, and a buoy system on the Lake marking various "no access" areas. Such design and construction will comply with applicable provisions of the Americans with Disabilities Act (42 U.S.C. 12101, *et seq.*) ("ADA") and the Kansas Architectural Accessibility Act (K.S.A. 58-1301, *et seq.*). WCNOC also will cause the purchase and installation of up to two additional sirens, at locations on the Land subsequently to be identified, for purposes of maintaining WCNOC's compliance with the Wolf Creek Emergency Plan. The DEPARTMENT will apply to, and endeavor to obtain from, the U.S. Fish and Wildlife Service's Federal Aid in Sport Fish Restoration Program for a Sport Fish Assistance Grant, not to exceed $600,000 for the State's 1996 fiscal year, to pay for the cost of the above facilities, and the Parties' obligations under this Memorandum of Understanding are conditioned upon the Department's obtaining approval of such application. With regard to construction and operation of the Public Access Area and operation of the public use areas of the Lake, WCNOC will follow all applicable federal rules and regulations and will make all applicable assurances inherent when using federal aid funding. The DEPARTMENT will provide appropriate Sport Fish Restoration signs to be installed in the Public Access Area. All such new facilities and improvements will become the property of the OWNERS on completion of construction and installation.

b. The COUNTY will, at its cost, improve the Lake access road, consisting of approximately one mile of 15th Street N.E., eastward from U.S. Highway 75 along the southern boundary line of Section 2, T21S, R15E, and up to 800 feet of an extension of Native Road north from 15th Street N.E., to the Public Access Area entrance. The COUNTY, also at its cost, and in consultation with WCNOC and the DEPARTMENT, will cause to be developed, installed, operated and maintained a reservation system for use by members of the public desiring to fish on the Lake. Operation of the reservation system will not discriminate in the selection of anglers by reason of race, color or national origin, sex, handicap, age, or religion. Such reservation system shall remain operational for so long as the Lake is open to the public and public demand to fish on the Lake makes the system necessary. Any fees collected from said reservations will be used to partially or fully offset costs of the County.

c. WCNOC, in consultation with the DEPARTMENTand the COUNTY, will operate, administer and maintain Wolf Creek Recreational Area including the Public Access Area and all improvements thereon, all at WCNOC's cost.

d. WCNOC and the COUNTY will provide the DEPARTMENT with annual data on fish surveys, creel surveys and public use.

5. <u>Term</u>. Subject to Paragraph 6 below, OWNERS and WCNOC agree to keep Wolf Creek Recreational Area open for public fishing and to operate and maintain the facilities and

improvements thereon for a term of 20 years from the date of opening. Such term will be extended by the same number of days by which public access to the facility is temporarily suspended as a result of industrial necessity.

6. Altering of Improvements, and Early Termination of Public Use. OWNERS and WCNOC agree not to remove, dismantle or destroy any improvement or program funded in whole or in part hereunder without the prior written approval of the DEPARTMENT. However, in the event that the OWNERS elect to build additional generating units on the Land requiring the use of part or all of Wolf Creek Recreational Area, or in the event that the OWNERS desire or should be required by any regulatory agency to undertake any WCGS operating changes or construction that conflict with the presently contemplated public use of part or all of Wolf Creek Recreational Area, or in the event that it becomes necessary for the OWNERS to permanently shut down or abandon electric power station operations at WCGS, or in the event that the protection currently afforded the OWNERS and WCNOC under K.S.A. 58-3201, *et seq.*, are, in the sole opinion of OWNERS or WCNOC, reduced by legislative or court action, then in any such event OWNERS may terminate this Memorandum of Understanding upon giving 60 days prior written notice to the DEPARTMENT. In the event of early termination pursuant to this Paragraph, OWNERS will reimburse to the DEPARTMENT an amount equal to the original cost less depreciation (at a rate of 5% per year) of the physical facilities described in Paragraph 4(a) above.

7. Fish Stocking. WCNOC shall retain responsibility for stocking fish into the Lake.

8. Limitation of Liability. It is understood that the OWNERS and WCNOC enjoy the protection from liability provided by K.S.A. 58-3201, *et seq.*, as amended, and the

DEPARTMENT and the COUNTY enjoy the protection from liability provided by the Kansas Tort Claims Act, K.S.A. 75-6101, *et seq*. Neither the STATE, COUNTY, nor any agency thereof shall hold harmless or indemnify any party beyond that liability incurred under K.S.A. 75-6101, *et seq*.

9. Amendments. No amendment hereto shall be effective unless expressly agreed to in writing by all Parties.

10. Additional Contractual Provisions Required by State Law.

a. Terms Herein Controlling Provisions. It is expressly agreed that the terms of each and every provision in this Paragraph 10 shall prevail and control over the terms of any other conflicting provision in this Memorandum of Understanding and in any other document relating to and a part of the Memorandum of Understanding.

b. Agreement with Kansas Law. All contractual agreements shall be subject to, governed by and construed according to the laws of the State of Kansas.

c. Termination Due to Lack of Funding Appropriation. If, in the judgment of the Director of Accounts and Reports, Department of Administration of the STATE, sufficient funds are not appropriated or available to continue the STATE's functions described herein after the first year this Memorandum of Understanding is in effect, STATE may terminate this Memorandum of Understanding at the end of its then current fiscal year. STATE agrees to give written notice of termination to the other parties at least 60 days prior to the end of its then current fiscal year. Termination of this Memorandum of Understanding pursuant to this Paragraph shall not cause any penalty to be charged to the DEPARTMENT. Likewise, it shall not require OWNERS to reimburse the DEPARTMENT for the undepreciated cost of the physical facilities, provided that OWNERS continue to allow general public recreational use and to operate and maintain the facilities at Wolf Creek Recreational Area, in keeping with other terms and conditions of this Memorandum of Understanding, for the remainder of the initial 20-year term hereof.

d. Anti-Discrimination Clause. The parties agree, with regard to performance of obligations under this Memorandum of Understanding, (1) to comply with the Kansas Act Against Discrimination (K.S.A. 44-1001, *et seq.*), the Kansas Age Discrimination in Employment Act (K.S.A. 44-1111, *et seq.*), applicable provisions of the Americans With Disabilities Act (42 U.S.C. 12101, *et seq.*) ("ADA") and the Kansas Architectural Accessibility Act (K.S.A. 58-1301, *et seq.*) ("KAAA"), and to not discriminate against any person because of race, religion, color, sex, disability, national origin or ancestry, or age in the admission or access to, or treatment or employment in, its programs or activities; (2) to include in all solicitations or advertisements for employees, the phrase "equal opportunity employer"; (3) to comply with the reporting requirements set out at K.S.A. 44-1031 and K.S.A. 44-1116; (4) to include the provisions of K.S.A. 44-1030(a)(1) through (4) in every subcontract or purchase order for goods or services procured in furtherance of this Memorandum of Understanding so that they are binding upon such subcontractor or vendor; (5) that a failure to comply with the reporting requirements of (3) above or if a party is found guilty of any violation of such acts by the Kansas Human Rights Commission, such violation shall constitute a breach of contract; (6) if the contracting agencies determine that a party has violated applicable provisions of ADA, that violation shall constitute a breach of contract; (7) if (5) or (6) occurs, the Memorandum of

Understanding may be canceled, terminated or suspended in whole or in part by the STATE or the COUNTY.

e. Acceptance of Memorandum of Understanding. This Memorandum of Understanding shall not be considered accepted, approved or otherwise effective until the statutorily required approvals and certifications have been given.

f. Arbitration, Damages, Warranties. Notwithstanding any language to the contrary, no interpretation shall be allowed to find the STATE, the COUNTY or any agency thereof has agreed to binding arbitration, or the payment of damages or penalties upon the occurrence of a contingency. Further, the STATE and the COUNTY shall not agree to pay attorney fees and late payment charges beyond those available under the Kansas Prompt Payment Act (K.S.A. 75-6403), and no provision will be given effect which attempts to exclude, modify, disclaim or otherwise attempt to limit implied warranties of merchantability and fitness for a particular purpose.

g. Representatives' Authority To Contract. By signing this document, the representatives of the parties thereby represent that such persons are duly authorized by the party to execute this document on behalf of the party and that the parties agree to be bound by the provisions thereof.

h. Responsibility for Taxes. The STATE and the COUNTY shall not be responsible for, nor indemnify OWNERS or WCNOC for any federal, state or local taxes which may be imposed or levied upon the subject matter of this Memorandum of Understanding.

i. Insurance. The STATE and the COUNTY shall not be required to purchase any insurance against loss or damage to any personal property to which this Memorandum of

Understanding relates, nor shall this Memorandum of Understanding require the STATE or the COUNTY to establish a "self-insurance" fund to protect against any such loss or damage. Subject to the provisions of the Kansas Tort Claims Act (K.S.A. 75-6101, *et seq.*), the OWNERS shall bear the risk of any loss or damage to any personal property in which the OWNERS hold title.

j. Audit. No party to the Memorandum of Understanding shall prohibit or prevent the Legislative Division of Post Audit from having access pursuant to K.S.A. 46-1101, *et seq.*, to any records, documents, or other information -- confidential or otherwise -- regarding or relating to the execution and/or performance of this Memorandum of Understanding. WCNOC will retain pertinent records related to this project for three years or as long as WCNOC record-keeping policies require, whichever is longer. WCNOC shall ensure that any contractors performing construction on this project are advised of this record retention requirement and are obligated to appropriately retain pertinent records. Records related to this project shall be subject to review by the Director of the U.S. Fish and Wildlife Service, the Secretary of Interior, the Comptroller General of the United States, or any of their authorized representatives.

k. Procurement Provisions. WCNOC will ensure that the spirit of applicable federal procurement regulations (43 CFR 12.76) will be followed with regard to construction purchase orders and contracts related to this project. Exhibit 3 attached and incorporated herein summarizes the manner in which WCNOC will cause procurement to be accomplished for this project.

The Parties have caused this Memorandum of Understanding to be executed by their duly authorized representatives as of the day first written above.

KANSAS DEPARTMENT OF WILDLIFE AND PARKS

By: Steven Williams

KANSAS GAS AND ELECTRIC COMPANY

By: William B. Moore

COFFEY COUNTY, KANSAS

By: William Knapp

KANSAS CITY POWER & LIGHT COMPANY

By: Frank L. Branca

WOLF CREEK NUCLEAR OPERATING CORPORATION

By: [illegible signature]

KANSAS ELECTRIC POWER COOPERATIVE, INC.

By: Stephen [illegible]

WOLF CREEK GENERATING STATION
COFFEY COUNTY, KANSAS

PERIMETER DESCRIPTION

The Wolf Creek Generating Station site in Coffey County, Kansas, consists of land and easements within the following perimeter description:

Beginning at the W 1/4 Cor Sec 24-T20S-R15E, thence East to the NE Cor W 1/2 W 1/2 SE 1/4 of said Sec 24, thence South to the SE Cor W 1/2 NW 1/4 NW 1/4 Sec 25-T20S-R15E, thence West to the West line of NE 1/4 of said Sec 25, thence South to the S 1/4 Cor said Sec 25, thence West to a point 797.8 feet East of the NW Cor NW 1/4 Sec 36-T20S-R15E, thence South 520 feet, thence Southeasterly to a point 1020 feet West of the SE Cor N 1/2 NW 1/4 of said Sec 36, thence South 200 Feet, thence West 621.85 feet, thence South 1198.97 feet, thence Southeasterly 350.7 feet to a point 180 feet South of the NE Cor W 1/2 SW 1/4 of said Section 36, thence South to the NE Cor SW 1/4 SW 1/4 of said Sec 36, thence East to the East line of W 1/2 of said Sec 36, thence South to the S 1/4 Cor of said Sec 36, thence East to the SW Cor E 1/2 SE 1/4 SE 1/4 of said Sec 36, thence North to the NW Cor E 1/2 SE 1/4 SE 1/4 of said Sec 36,

thence East to the NE Cor W 1/2 SW 1/4 SW 1/4 Sec 31-T20S-R16E, thence South to the SE Cor of said W 1/2 SW 1/4 SW 1/4, thence East to the NE Cor Sec 6-T21S-R16E, thence South to the NW Cor S 1/2 N 1/2 Sec 5-T21S-R16E, thence East to the NE Cor SW 1/4 NW 1/4 Sec 4-T21S-R16E, thence South to the SE Cor SW 1/4 SW 1/4 of said Sec 4, thence West to the NE Cor Sec 8-T21S-R16E, thence South to the SE Cor of said Sec 8, thence West 1704.96 feet, thence South to the North line S 1/2 NE 1/4 Sec 17-T21S-R16E, thence East to the NE Cor S 1/2 NW 1/4 Sec 16-T21S R16E, thence South to the S 1/4 Cor Sec 21-T21S-R16E, thence West to a point 450 feet West of SE Cor Sec. 20-T21S-R16E, thence South to a point 450 feet West of the E 1/4 Cor Sec 29-T21S-R16E, thence West to the center of said Sec 29, thence South to the SE Cor N 1/2 SW 1/4 of said Sec 29, thence West to the SW Cor of said N 1/2 SW 1/4, thence North to the SE Cor of the North 70 acres of the SE 1/4 Sec 30-T21S-R16E, thence West to the SW Cor of the North 70 acres of said SE 1/4, thence North to the center of said Sec 30, thence West to the W 1/4 Cor of said Sec 30, thence North to the NW Cor of said Sec 30,

thence West to the SW Cor E 1/2 E 1/2 SE 1/4 of Sec 24-T21S-R15E, thence North to the NW Cor of said E 1/2 E 1/2 SE 1/4, thence East to the SE Cor NE 1/4 of said Sec 24, thence North to the SE Cor NE 1/4 SE 1/4 Sec 13-T21S-R15E, thence West to the SW Cor of said NE 1/4 SE 1/4, thence North to the NW Cor of said NE 1/4 SE 1/4, thence West to the center of said Sec 13, thence North to the N 1/4 Cor said Sec 13, thence West to the SW Cor SE 1/4 SW 1/4 of Sec 12-T21S-R15E, thence North to the NW Cor of said SE 1/4 SW 1/4, thence West to the SW Cor NW 1/4 SW 1/4 of said Sec 12, thence North to the NW Cor of said Sec 12, thence West to the SW Cor E 1/2 SE 1/4 Sec 2-T21S-R15E, thence North 1700 feet, thence West 670 feet, thence North to the North line S 1/2 NE 1/4 of said Sec 2, thence West to the NW Cor S 1/2 NE 1/4 of said Sec 2, thence North to a point 1050 feet South of the North line of said Sec 2,thence West 600 feet, thence North to a point 720 feet West of NE Cor SE 1/4 Sec 34-T20S-R15E, thence East to the center of Sec 35-T20S-R15E, thence North to the center of Sec 26-T20S-R15E, thence East to the SE Cor W 1/2 SE 1/4 NE 1/4 of said Sec 26, thence North to the NE Cor of said W 1/2 SE 1/4 NE 1/4, thence East to the East line of said Sec 26, thence North to the W 1/4 Cor Sec 24-T20S-R15E, being the point of beginning, except Stringtown Cemetery and except a tract in the NE 1/4 NE 1/4 Sec 1-T21S-R15E described as beginning at a point 1060.0 feet South of NE Cor said NE 1/4, thence West 446.9 feet, thence South 730.0 feet, thence East 446.0 feet, thence North 726.2 feet to point of beginning.

With respect to the following properties, which are contained within the above perimeter description, said properties are held by way of an easement acquired by way of condemnation and are subject to certain rights of reversion:

The Southeast 1/4 of the Southwest 1/4 of Section 35-T20S-R15E;

A tract in Section 1-T21S-R15E described as commencing at a point situated in the center of Wolf Creek about 41 rods West of the Southeast corner of said Section 1 thence West on said section line to another point in the center of said Wolf Creek, thence down the center of said creek to the place of beginning;

The East 1/2 of the Northwest 1/4, the East 1/2 of the Southwest 1/4, the Northwest 1/4 of the Southwest 1/4, the West 1/2 of the Northeast 1/4 and the Northeast 1/4 of the Northeast 1/4 of Section 12-T21S-R15E, except that part of the North 1/2 of the Northeast 1/4 of Section 12 lying North of Wolf Creek;

The North 1/2 of the Southwest 1/4 of the Northeast 1/4 and the Southwest 1/4 of the Southwest 1/4 of the Northeast 1/4 of Section 30-T21S-R16E;

The West 1/2 of the Northwest 1/4 of Section 29 and the Southeast 1/4 of the Northeast 1/4 and the Southeast 1/4 of the Southwest 1/4 of the Northeast 1/4 of Section 30, all in T21S-R16E;

The South 1/2 of the Southwest 1/4 of Section 19-T21S-R16E, except tract 16 rods by 20 rods for school located in Southeast corner thereof.

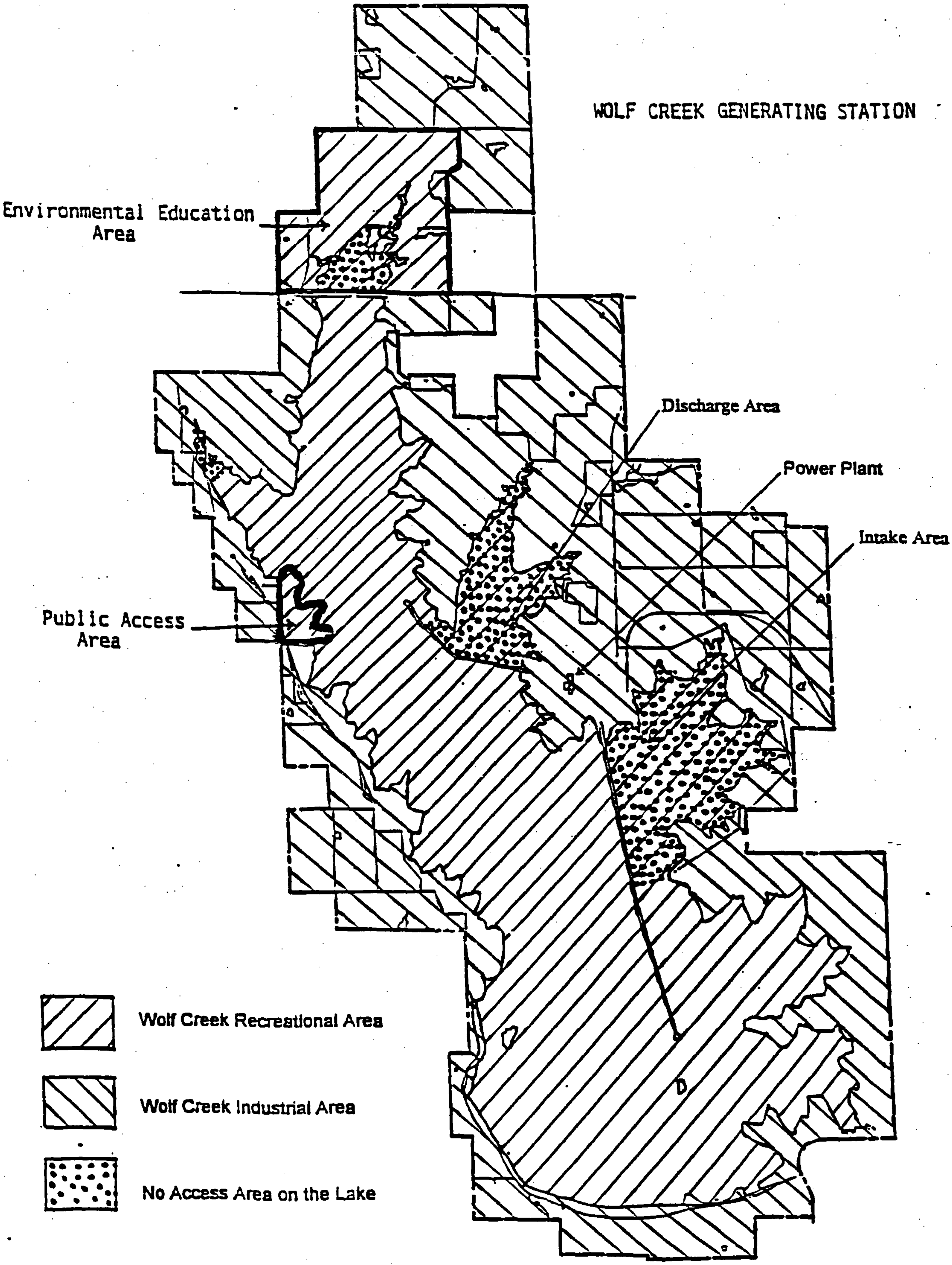
WOLF CREEK GENERATING STATION
Environmental Education Area
Discharge Area
Power Plant
Intake Area
Public Access Area
Wolf Creek Recreational Area
Wolf Creek Industrial Area
No Access Area on the Lake

EXHIBIT 2

WOLF CREEK LAKE PUBLIC ACCESS FACILITY
CONSTRUCTION PROCUREMENT PROGRAM
(Patterned after 43 CFR §12.76)

A. Procurement Standards.

1. A contract administration system is in place to ensure that contractors perform in accordance with contracts and purchase orders.
2. A written code of ethics prohibits real, apparent or potential conflicts of interest in the process of awarding contracts.
3. Procurement procedures provide for a review of proposed procurements to avoid purchase of unnecessary or duplicative items.
4. State and local intergovernmental agreements are encouraged to promote economy.
5. Use of excess and surplus property is encouraged over purchase of new property.
6. Value engineering clauses are encouraged in construction contracts of sufficient size to effect cost reductions.
7. Contracts will be awarded only to contractors with the ability to perform successfully.
8. Project records will be retained in sufficient detail to allow a review of the procurement process and related decision making.
9. Time and material contracts are prohibited unless no other alternative is suitable and the contract contains a ceiling price.
10. A procedure is in place to (a) settle all contractual and administrative issues arising from procurements, and (b) provide a means for protest resolution. The U.S. Fish and Wildlife Service ("Federal Agency") will be notified of all protests.

B. Competition.

1. All procurement transactions will be conducted in a manner providing full and open competition. Restrictions such as the following will be avoided: imposition of unreasonable requirements, unnecessary experience and excessive bonding, noncompetitive pricing practices, noncompetitive awards to consultants on a retainer, organizational conflicts of interest, "brand name" requirements, and any other arbitrary action.
2. No in-state or local geographical preferences will be allowed.
3. Written selection procedures incorporate clear and accurate descriptions of technical requirements without unduly restricting competition.

C. Methods of procurement to be followed.

1. *Small purchase procedures.* Simple and informal procedures will be followed for purchases not exceeding $100,000. These procedures entail obtaining price or rate quotes from an adequate number of qualified sources.
2. *Sealed bids.* The preferred method if conditions of (a) below are met. Bids are publicly solicited and a firm fixed-price contract (lump sum or unit price) is awarded to the responsible bidder whose bid, conforming with all the material terms and conditions of the invitation for bids, is the lowest in price.

a. The following conditions should be met for sealed bidding to be feasible:
    (i) A complete, adequate and realistic specification or purchase description is available.
    (ii) Two or more responsible bidders are able and willing to compete.
    (iii) The purchase lends itself to a firm fixed-price contract, and selection can be made principally on the basis of price.

b. If sealed bids are used, the following requirements apply:
    (i) Publicly advertised invitation for bids; bids solicited from an adequate number of known suppliers; sufficient time is allowed for bid preparation prior to opening.
    (ii) Invitation for bids will include any specifications and pertinent attachments and shall define the items/services sought in order for the bidder to properly respond.
    (iii) Bids will be publicly opened at a time and place specified in the bid invitation.
    (iv) A firm fixed-price contract award will be made in writing to the lowest responsive and responsible bidder. Factors such as discounts, transportation cost and life cycle costs shall be considered in determining which bid is lowest.

3. *Competitive proposals.* Normally used when sealed bids are not appropriate. May result in either a fixed-price or cost-reimbursement type contract. The following requirements apply:

a. Requests for proposals will be publicized and will identify all evaluation factors and their relative importance.

b. Proposals will be solicited from an adequate number of qualified sources.

c. A method is in place to technically evaluate all proposals and to select awardees.

d. Awards will be made to the responsible firm whose proposal is most advantageous to the program, with price and other factors considered.

e. Regarding architect/engineering firms only, selection may be based on evaluation of each firm's qualifications, with the most qualified being selected, subject to negotiation of fair and reasonable compensation. Price need not be used as a selection factor.

4. *Non-competitive proposals.* A proposal is solicited from only one source or, after solicitation from a number of sources, competition is deemed inadequate.

a. This method may be used only when a contract award is infeasible under *small purchase procedures*, *sealed bids* or *competitive proposals*, and one of the following applies:
    (i) item is available only from a single source;
    (ii) emergency will not permit delay in procurement;
    (iii) the Federal Agency authorizes non-competitive proposals; or
    (iv) after solicitation of a number of proposals, competition is deemed inadequate.

b. Verification is required of proposed cost data, projections of the data, and the evaluation of elements of costs and profit.

c. The Federal Agency may require that the proposal be submitted to the Agency for pre-award review in accordance with Section F below.

D. Contracting with small and minority firms, women's business enterprise and labor surplus area firms (collectively, "firms").

1. The following affirmative steps will be taken to assure that these firms will be used when possible:

a. Place such firms on solicitation lists.

b. Assure that such firms are solicited when they are potential sources.

c. When economically feasible, divide total requirements into smaller tasks/quantities to permit maximum participation by such firms.

d. When the requirement permits, establish a delivery schedule which encourages participation by such firms.

E. Contract cost and price.

1. Cost or price analysis will be performed in every procurement action including contract modifications. Degree of analysis will depend on the facts, but at a minimum, an independent estimate will be made prior to receiving bids. A cost analysis will be necessary when adequate price competition is lacking, and for sole source purchases, unless price reasonableness can be established based on a catalogue or other means of determining market price of commercially available items.

2. Profit will be negotiated as a separate element of the price for each contract in which there is no price competition and in all cases where cost analysis is performed.

3. Costs or prices based on estimated costs for contracts will be allowable only to the extent that costs incurred or cost estimates included in negotiated prices are consistent with federal cost principles (43 CFR §12.62) or in-house cost principles that comply with federal cost principles.

4. Cost plus a percentage of cost will not be used.

F. Federal Agency review.

1. Technical specifications on proposed procurements will be provided to the Federal Agency on the Agency's request. The request generally will occur prior to the time specifications are incorporated into a solicitation document.

2. Procurement documents will be provided to the Federal Agency on the Agency's request.

3. Federal Agency review will not be required if the Agency determines that purchaser's procurement systems comply with the standards of 43 CFR §12.76. Purchaser may self-certify that its systems are in compliance.

G. Bonding requirements.

No contractor bonding is required for purchases costing less than $25,000 (construction contracts) and less than $100,000 (contracts other than construction contracts). For

purchases costing greater than the above threshold amounts, the Federal Agency may determine that purchaser's bonding requirements are sufficient to protect the Agency's interest. If no such determination is made, the following minimum requirements apply:
1. *Bid guarantee from each bidder equal to 5% of the bid price.* May be in the form of a bid bond, certified check, or other negotiable instrument accompanying the bid as assurance that bidder will execute required contractual documents within time specified.
2. *Contractor's performance bond for 100% of contract price.* Secures fulfillment of contractor's obligations under the contract.
3. *Contractor's payment bond for 100% of contract price.* Secures contractor's payment of all persons supplying labor or materials for the contracted work.

H. Contract provisions.

The following provisions must be included in applicable procurement contracts for the project:
1. Administrative, contractual or legal remedies in instances where contractors violate or breach contract terms. Sanctions or penalties as may be appropriate. (Contracts exceeding $100,000 in cost.)
2. Ability for purchaser to terminate for cause and for convenience, including the manner termination will be effected and the basis for settlement. (Contracts exceeding $10,000 in cost.)
3. Compliance with Executive Order 11246 of September 24, 1965 ("Equal Employment Opportunity"), as amended by Executive Order 11375 of October 13, 1967, and as supplemented in U.S. Dept. of Labor regulations (41 CFR Chapter 60). (Construction contracts exceeding $10,000.)
4. Compliance with Copeland "Anti-Kickback" Act (18 U.S.C. 874) as supplemented by U.S. Dept. of Labor regulations (29 CFR Part 3). (All construction or repair contracts.)
5. Compliance with Davis-Bacon Act (40 U.S.C. 276a to 276a-7) as supplemented by U.S. Dept. of Labor regulations (29 CFR Part 5). (Construction contracts exceeding $2000 when required by Federal grant program legislation.)
6. Compliance with Sections 103 and 107 of the Contract Work Hours and Safety Standards Act (40 U.S.C. 327-330) as supplemented by U.S. Dept. of Labor regulations (29 CFR Part 5). (Construction contracts exceeding $2000, and other contracts exceeding $2500 which involve employment of mechanics or laborers.)
7. Notice of Federal Agency requirements and regulations regarding:
    a. reporting,
    b. patent rights as to inventions arising or developed in the course of the contract,
    c. copyright and rights in data.
8. Access by the purchaser, the Federal Agency, the U.S. Comptroller General, or their representatives, to any books and records of the contractor which are pertinent to the contract for the purpose of making audit, examination, excerpts and transcriptions.
9. Retention of all required records for three years after purchaser makes final payments and all other pending matters are closed.
10. Compliance with all applicable standards, orders, or requirements issued under §306 of the Clean Air Act (42 U.S.C. 1857[h]), §508 of the Clean Water Act (33 U.S.C.

1368), Executive Order 11738, and Environmental Protection Agency regulations (40 CFR Part 15). (Contracts exceeding $100,000.)

11. Mandatory standards and policies relating to energy efficiency which are contained in the Kansas energy conservation plan issued in compliance with the Energy Policy and Conservation Act (P.L. 94-163, 89 Stat. 871).

AMENDMENT NO. 1 TO
MEMORANDUM OF UNDERSTANDING

This Amendment No 1 to Memorandum of Understanding is entered into this 4 day of May, 1998. among the following parties: KANSAS GAS AND ELECTRIC COMPANY, KANSAS CITY POWER & LIGHT COMPANY and KANSAS ELECTRIC POWER COOPERATIVE, INC. (referred to as "OWNERS"); WOLF CREEK NUCLEAR OPERATING CORPORATION (referred to as "WCNOC"); the KANSAS DEPARTMENT OF WILDLIFE AND PARKS (referred to as "DEPARTMENT" or "STATE"); and COFFEY COUNTY, KANSAS (referred to as "COUNTY").

WHEREAS, the Parties entered into a Memorandum of Understanding dated June 20, 1996 (referred to as "MOU"), for the purpose of developing and operating recreational public use facilities on the cooling lake for Wolf Creek Generating Station (referred to as "Lake") and adjoining areas; and

WHEREAS, the Parties now desire to amend the MOU to eliminate the reservation system and to transfer responsibility for managing public use of the Lake.

NOW, THEREFORE, in consideration of the premises and of the mutual covenants set forth below, the Parties agree as follows:

1. Paragraph 2.a. of the MOU is amended to read as follows:

   "2.a. Schedule for Public Availability. Recreational activities in the Lake and Public Access Area described in Paragraph 1(a) above will be allowed from sunrise to sunset daily."

2. Paragraphs 2.a.(i), 2.a.(ii) and 2.b. of the MOU are deleted in their entirety.

3. Paragraph 3 of the MOU is amended first by designating the text following the paragraph title as subparagraph "a." At the end of that subparagraph is added a new subparagraph "b" to read as follows:

"b. In consultation with the DEPARTMENT, the COUNTY will establish and enforce additional operational criteria, not inconsistent with the provisions of this Memorandum of Understanding, which will promote the safe use of the Lake by the public."

4. Paragraph 4.b. of the MOU is amended to read as follows:

"4.b. The COUNTY will, at its cost, improve the Lake access road, consisting of approximately one mile of 15th Street N.E., eastward from U.S. Highway 75 along the southern boundary line of Section 2, T21S, R15E, and up to 800 feet of an extension of Native Road north from 15th Street N.E., to the Public Access Area entrance. Effective on or about June 4, 1998, the COUNTY will assume responsibility for operation, administration and management of public access on the Lake in accordance with a separate Lease and Agreement among the OWNERS, WCNOC and the COUNTY. WCNOC annually will provide $100,000 to the COUNTY, either by direct payment or by payment through a third party trust agreement, to fund the COUNTY's activities related to operation, administration and management of public access on the Lake."

5. Paragraph 4.c. of the MOU is amended to read as follows:

"4.c. In consultation with the DEPARTMENT, WCNOC will maintain the Wolf Creek Recreational Area including the Public Access Area and all improvements thereon, except for those facilities described in Paragraph 4.e., at WCNOC's cost."

6. Paragraph 4.d. of the MOU is amended to read as follows:

   "4.d. The COUNTY will provide the DEPARTMENT with annual data on creel surveys and public use. WCNOC will provide the DEPARTMENT with annual data on fish surveys."

7. New Paragraph 4.e. is added to the MOU as follows:

   "4.e. The DEPARTMENT will transfer to the control of the DEPARTMENT's Coffey County agent a boat of sufficient design and size for patrol and rescue on the Lake. At the DEPARTMENT's cost, such boat will be stationed at the Lake, and may be used by the COUNTY, for as long as this MOU is in effect. Further, the DEPARTMENT, at its cost, will cause to be installed and maintained at the Lake a mooring facility for the boat. Such mooring facility will at a minimum include an individual slip on the water with a cover for the boat and a protective shelter over the boat."

8. Paragraph 5 of the MOU is amended to read as follows:

   "5. Term. Subject to Paragraph 6 below, OWNERS and WCNOC agree to keep Wolf Creek Recreational Area open for public fishing and to operate and maintain, or cause to be operated and maintained, the facilities and improvements thereon for an initial term to expire on April 30, 2017. Such term will be extended by the same number of days by which public access to the facility is temporarily suspended as a result of industrial necessity."

9. All sections of the MOU not amended by this Amendment No. 1 shall remain in full force and effect.

IN WITNESS WHEREOF, the Parties have caused this Amendment No. 1 to Memorandum of Understanding to be executed by their duly authorized representatives as of the day first written above.

COFFEY COUNTY, KANSAS

By: ______________________
Gene L. Merry

KANSAS GAS AND ELECTRIC COMPANY

By: ______________________
Richard D. Terrill
Secretary and Treasurer

KANSAS DEPARTMENT OF WILDLIFE AND PARKS

By: ______________________
Steve Williams

KANSAS CITY POWER & LIGHT COMPANY

By: ______________________
Richard A. Spring

WOLF CREEK NUCLEAR OPERATING CORPORATION

By: ______________________
Gary D. Boyer

KANSAS ELECTRIC POWER COOPERATIVE, INC.

By: ______________________
Stephen E. Parr

LEASE and AGREEMENT

This Lease and Agreement is entered into this 4th day of May, 1998, among the following parties: KANSAS GAS AND ELECTRIC COMPANY, KANSAS CITY POWER & LIGHT COMPANY and KANSAS ELECTRIC POWER COOPERATIVE, INC. (referred to as "OWNERS"); WOLF CREEK NUCLEAR OPERATING CORPORATION (referred to as "WCNOC"); and COFFEY COUNTY, KANSAS (referred to as "COUNTY").

WHEREAS, the OWNERS jointly own a tract of land (referred to as the "Land") approximately 10,500 acres in size in Coffey County, Kansas, described in greater detail on Exhibit 1 and illustrated in Exhibit 2, both attached and incorporated herein, on which is located the Wolf Creek Generating Station (referred to as "WCGS"), and which includes a cooling lake (referred to as the "Lake") approximately 5,090 acres in size, and a Public Access Area approximately thirty-six acres in size in the Southwest ¼ of Section 1, T21S, R15E, Coffey County, Kansas; and

WHEREAS, WCNOC, a wholly-owned subsidiary of the OWNERS, operates and maintains WCGS, and controls and manages the Land, the Lake and the Public Access Area, as agent for the OWNERS; and

WHEREAS, the Parties, along with the Kansas Department of Wildlife and Parks (referred to as "KDWP"), entered into a Memorandum of Understanding dated June 20, 1996 (referred to as "MOU"), for the purpose of developing and operating recreational public use facilities on the Lake and adjoining areas; and

WHEREAS, the Parties desire that the County administer public access to and use of the Lake in a manner that will permit the public safely to enjoy the recreational potential of the Lake.

NOW, THEREFORE, in consideration of the premises and of the mutual covenants set forth below, the Parties agree as follows:

1. Lease. In consideration of One Dollar and other valuable consideration, receipt of which is hereby acknowledged, OWNERS hereby grant to COUNTY a lease of the Lake's Public Access Area, specifically, that part of the Southwest 1/4 of Section 1, T21S, R15E, Coffey County, Kansas, above the surface of the Lake, excluding the south 512 feet of the quarter section, and all improvements thereon, subject to the terms and conditions set forth below, and subject to the terms and conditions of the MOU as it may be amended from time to time, the MOU and amendments being incorporated herein by reference.

2. License. For the same consideration, OWNERS also grant to COUNTY a license to go onto any portion of the Lake at any time during the term of this Lease and Agreement for the purpose of carrying out the COUNTY's responsibilities hereunder.

3. Term. The term of this Lease and Agreement shall be for a period co-existent with the term of the MOU, i.e., from the date of execution hereof until April 30, 2017 , such term to be extended by the same number of days by which public access to the facility is temporarily suspended as a result of industrial necessity (Para. 5 of the MOU).

4. Early Termination. The Owners may terminate this Lease and Agreement before the end of the term hereof for the same reasons for which they may terminate the MOU. Specifically, in the event that the OWNERS elect to build additional generating units on the Land requiring the use of part or all of the Public Access Area, or in the event that the OWNERS desire or should be required by any regulatory agency to undertake any WCGS operating changes or construction that conflict with the presently contemplated public use of part or all of the area available for public use, or in the event that it becomes necessary for the OWNERS to

permanently shut down or abandon electric power station operations at WCGS, then in any such event OWNERS may terminate this Lease and Agreement upon giving 60 days prior written notice to the COUNTY (Para. 6 of the MOU). If sufficient funds are not appropriated or available to continue the COUNTY's functions described herein. or for any other reason, the COUNTY reserves the right to terminate this Lease and Agreement before the term hereof. upon giving 120 days prior written notice to the OWNERS.

5. Administration and Management of Public Access. Subject to the MOU, the COUNTY will assume responsibility for operation. administration and management of public access on the Lake. To this end the COUNTY will develop, implement and enforce acceptable rules for public use of the Lake. The rules will be consistent with those set forth in the MOU and any amendments thereto. and with all applicable laws and regulations relating to fishing and boating. The rules will be designed to minimize the likelihood of accidents and injuries on the Lake, particularly with regard to high winds in the area of the Lake. The rules may include provisions for temporarily closing the Lake when weather conditions so dictate. The rules will not be in conflict with or interfere with WCNOC's operation of WCGS and all functions related to that operation. The COUNTY will maintain a full-time presence at the Public Access Area or on the Lake, and will utilize a boat of sufficient design and size provided by KDWP and located on or at the Lake for patrolling and rescue. The COUNTY will not charge members of the public a fee to enter the premises or to use the Lake.

6. Reimbursement of COUNTY Costs. WCNOC annually will provide $100,000 to the COUNTY, either by direct payment or by payment through a third party trust agreement, to fund the COUNTY's activities related to operation, administration and management of public access on the Lake. For the first year's funding, WCNOC will provide to the COUNTY an installment

payment of $50,000 within ten days after both parties execute this Lease and Agreement, and two additional installment payments of $25,000 each to be paid on the first business day of the months which begin the third and fourth quarters of the first year of this Lease and Agreement. For subsequent years, WCNOC will provide to the COUNTY four quarterly installments of $25,000 each to be paid on the first business day of the months which begin each quarter of the fiscal year of this Lease and Agreement. Should this Lease and Agreement be terminated on a date other than its annual anniversary date, WCNOC's annual funding responsibility will be prorated accordingly.

7. Facility Maintenance and Repair; Utilities. WCNOC will provide, at its cost, all necessary maintenance and repair of physical facilities (except the facility for housing/launching the boat referred to in Paragraph 5 above, which will be maintained and repaired by the KDWP), and all utilities, at the Public Access Area.

8. Improvements and Modifications. WCNOC will be responsible for making any improvements to the Public Access Area (except the facility for housing/launching the boat referred to in Paragraph 5 above, which will be installed by the KDWP). The COUNTY will not make any modifications to the facilities without WCNOC's prior consent.

9. Independent Contractor Status of COUNTY. Neither the OWNERS nor WCNOC will have any authority to direct the manner or method in which the COUNTY carries out its responsibilities under this Lease and Agreement. Under no circumstances will the COUNTY be deemed to be an agent of the OWNERS or WCNOC, it being the intent of the parties that the COUNTY shall have the status of independent contractor of the OWNERS and WCNOC.

10. Taxes. The OWNERS will pay all property taxes on realty which is the subject of this Lease and Agreement.

11. Right of Entry. The OWNERS and WCNOC retain the right to enter on the leased premises at any time and for any purpose.

12. Assignment. The COUNTY may not assign its rights and responsibilities under this Lease and Agreement without the prior written consent of OWNERS and WCNOC. and any such assignment shall be consistent with the MOU.

IN WITNESS WHEREOF, the Parties have caused this Lease and Agreement to be executed by their duly authorized representatives as of the day first written above.

COFFEY COUNTY, KANSAS

By: Gene L. Merry
Gene L. Merry

KANSAS GAS AND ELECTRIC COMPANY

By: Richard D. Terrill
Richard D. Terrill
Secretary and Treasurer

WOLF CREEK NUCLEAR OPERATING CORPORATION

By: Gary D. Boyer
Gary D. Boyer

KANSAS CITY POWER & LIGHT COMPANY

By: Richard A. Spring
Richard A. Spring

KANSAS ELECTRIC POWER COOPERATIVE, INC.

By: Stephen E. Parr
Stephen E. Parr

RESOLUTION NO. 619

A RESOLUTION ESTABLISHING THE COFFEY COUNTY LAKE AND AUTHORIZING AND APPROVING A LEASE AND AGREEMENT RELATED THERETO.

WHEREAS, the Board of County Commissioners of Coffey County, Kansas (hereinafter "the Board") is the governing body of Coffey County, Kansas (hereinafter "the County"), and is charged with the ultimate responsibility for governing the affairs of the County; and

WHEREAS, the Board is authorized by K.S.A. 19-2803c *et seq*., to establish and maintain a county public lake and to take and acquire title to lands, including any and all rights thereon, for the purpose of establishing said lake; and

WHEREAS, the Board deems it advisable and in the best interests of the County to establish a county public lake; and

WHEREAS, the Board deems it advisable and in the best interests of the County to enter into a Lease and Agreement with Kansas Gas and Electric Company, Kansas City Power & Light Company, and Kansas Electric Power Cooperative, Inc. (hereinafter "the Owners") and Wolf Creek Nuclear Operating Corporation (hereinafter "WCNOC") whereby the Owners agree to lease to the County the area commonly known as the Wolf Creek Public Access Area, and to grant to the County a license to go onto the lake at Wolf Creek Generating Station, and the County agrees to assume responsibility for the operation, administration and management of public access on and to the lake.

NOW THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF COFFEY COUNTY, KANSAS, AS FOLLOWS:

1. There shall be, and hereby is, established the Coffey County Lake (hereinafter "the Lake").

2. That the Lease and Agreement, dated May 4, 1998, shall be, and hereby is approved and the Board, on behalf of the County, is authorized to execute and enter into said Lease and Agreement.

3. That the area of the Lake shall be the area specifically set forth in the aforementioned Lease and Agreement.

4. That the County shall operate, administer, manage and maintain the Lake consistent with the terms of the aforementioned Lease and Agreement, with any agreements referenced therein and with any reasonable rules and regulations promulgated by the Board regulating and licensing the use and enjoyment of the public on and to the Lake.

5. This Resolution shall be effective from and after its adoption by the Board of County Commissioners of Coffey County, Kansas.

ADOPTED THIS 4th DAY OF May, 1998.

Resolution No. 619
Page 2

BOARD OF COUNTY COMMISSIONERS,
COFFEY COUNTY, KANSAS

Gene L. Merry, Chairman

Johnnie R. Sleezer, Member

Timothy A. Sipe, Member

Perry Powell, Member

William Knapp, Member

SEAL
COFFEY COUNTY, KANSAS

ATTEST:

Vernon Birk

Vernon Birk, County Clerk

APPROVED AS TO FORM:

Douglas P. Witteman, County Attorney

RESOLUTION NO. 620

A RESOLUTION ESTABLISHING RULES AND REGULATIONS REGULATING THE USE AND ENJOYMENT OF THE COFFEY COUNTY LAKE AND ESTABLISHING PENALTIES FOR VIOLATION THEREOF.

WHEREAS, the Board of County Commissioners of Coffey County, Kansas (hereinafter "the Board") is the governing body of Coffey County, Kansas (hereinafter "the County"), and is charged with the ultimate responsibility of governing the affairs of the County; and

WHEREAS, pursuant to Resolution No. 619, the County established the Coffey County Lake (hereinafter "the Lake"); and

WHEREAS, pursuant to K.S.A. 19-2803a and K.S.A. 19-2803d, the Board is authorized to establish reasonable rules and regulations, subject to the rules and regulations of the Secretary of Wildlife and Parks, regulating and licensing the use and enjoyment of the Lake by the public, and for the preservation and protection of the Lake and to establish penalties for violation thereof.

WHEREAS, the Board deems it to be advisable and in the best interests of the County to establish reasonable rules and regulations regulating the use and enjoyment of the Lake by the public and for the preservation and protection of the Lake and to establish penalties for violation thereof.

NOW THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF COFFEY COUNTY, KANSAS, THAT THE FOLLOWING RULES AND REGULATIONS REGULATING THE USE AND ENJOYMENT OF THE COFFEY COUNTY LAKE BY THE PUBLIC BE ADOPTED AS FOLLOWS:

1. All pertinent rules and regulations promulgated by the Kansas Secretary of Wildlife and Parks, including fish length and creel limits for the Lake, and any penalties established for violation thereof, shall be applicable and enforceable on or at the Lake.

2. State fishing license requirements are in effect at the Lake.

3. The Lake will be open for public fishing. Shoreline fishing is allowed in the designated area only. Shoreline fishing in any area other than the designated area is prohibited. Boats are allowed in designated areas and for fishing purposes only and all boats must be motorized. Non-motorized boats, boating in any area other than the designated areas and boating for other than fishing purposes are prohibited.

4. No reservations are required to gain access to the Lake, however, the Lake may only be accessed and entered at the Public Access Area located near 15th Road and Native Road. Any other public access or entry to the Lake is prohibited.

5. All guests must check in and check out at the gate house. All persons must be checked out no later than 30 minutes after sunset.

6. Prior to entering the Lake all bilges, live wells or cooling systems must be drained. Placing or dumping bait buckets into the Lake is prohibited.

7. Fishing on the Lake is permitted from sunrise to sunset. Fishing from sunset to sunrise is prohibited.

8. All persons in a boat on the Lake are required to wear a U.S. Coast Guard approved Type I, II, III, or V personal flotation device at all times. Persons are prohibited from being in a boat on the Lake if they are not wearing an approved flotation device.

9. The Lake will, under normal conditions, be open from sunrise to sunset. The Lake is subject to being closed to boat access under the following conditions:

October 15th through April 14th

If during any given day, there is a forecast for the following day, for sustained wind speeds of twenty (20) miles per hour or greater from any northerly direction (i.e. northeasterly through northwesterly) or for sustained wind speeds of twenty-five (25) miles per hour or greater from any other direction, the Lake may be closed on that day for which said sustained wind speeds have been forecast.

April 15th through October 14th

If during any given day, there is a forecast for the following day, for sustained wind speeds of thirty (30) miles per hour or greater from any direction, the Lake may be closed on that day for which said sustained wind speeds have been forecast.

If during any day (year round) that the Lake is open, sustained wind speeds at the Lake are in excess of the above limits, the Lake may be closed to further boats. Boats that are already on the Lake shall, upon being notified that the Lake is closed, immediately exit the Lake.

A person shall be prohibited from placing a boat on the Lake at any time the Lake is closed. A person shall be prohibited from remaining on the Lake, upon being notified that the Lake is being closed due to wind or other conditions.

The County reserves the right to close or limit access to the Lake, whenever it deems the same to be necessary or appropriate, or whenever state or federal regulatory requirements imposed on the Owners/Operators of Wolf Creek Generating Station make it necessary to close or limit access to the Lake.

10. It shall be unlawful for any person to do any act declared to be prohibited by this Resolution. Any person committing an act hereby deemed unlawful shall be guilty of a misdemeanor and upon conviction thereof shall be punished by a fine not exceeding $100 or commitment to the county jail for a period not exceeding thirty (30) days or both such fine and imprisonment. The County reserves the right to require any person committing an unlawful act to leave the Lake.

11. The substance of the rules and regulations set out herein, together with the penalty for violations thereof, shall be conspicuously posted at the entrance to the Lake.

12. This Resolution shall become effective from and after its adoption by the Board and after its publication once each week in a newspaper of general circulation in the County for three consecutive weeks.

ADOPTED THIS 7 DAY OF May, 1998.

BOARD OF COUNTY COMMISSIONERS,
COFFEY COUNTY, KANSAS

Gene L. Merry, Chairman

Johnnie R. Sleezer, Member

Timothy A. Sipe, Member

Perry Powell, Member

William Knapp, Member

ATTEST:

Vernon Birk

Vernon Birk, County Clerk

OFFICE OF COUNTY CLERK
SEAL
COFFEY COUNTY KANSAS

APPROVED AS TO FORM:

Douglas P. Witteman, County Attorney

RESOLUTION NO. 621

A RESOLUTION ESTABLISHING THE COFFEY COUNTY LAKE OPERATIONS FUND, A RESERVE FUND TO PROPERLY ACCOUNT FOR THE RECEIPT AND DISBURSAL OF MONIES ASSOCIATED WITH THE ESTABLISHMENT, OPERATION, ADMINISTRATION, MANAGEMENT AND MAINTENANCE OF THE COFFEY COUNTY LAKE.

WHEREAS, the Board of County Commissioners of Coffey County, Kansas (hereinafter "the Board") is the governing Body of Coffey County, Kansas (hereinafter "the County"), and is charged with the ultimate responsibility for accounting for the funds of the County; and

WHEREAS, pursuant to Resolution No. 619, the County established the Coffey County Lake (hereinafter "the Lake") and entered into a Lease and Agreement whereby the County obtained a leasehold interest in the area commonly known as the Wolf Creek Lake and Public Access Area and agreed to operate, administer, manage and maintain the Lake; and

WHEREAS, pursuant to K.S.A. 19-2803c *et seq*., the Board is authorized to raise revenue and receive donations and bequests of money and property for the purpose of establishing and maintaining a county public lake; and

WHEREAS, the Board deems it advisable and in the best interests of the County to establish a reserve fund to properly account for monies received and disbursed in association with the establishment, operation, administration, management and maintenance of the Lake; and

WHEREAS, the Board is authorized and has the power to establish this reserve fund by virtue of K.S.A. 2803c *et seq*. and its home rule powers as set forth in K.S.A. 19-101a.

NOW THEREFORE, BE IT RESOLVED BY THE BOARD OF COUNTY COMMISSIONERS OF COFFEY COUNTY, KANSAS, AS FOLLOWS:

1. That there shall be, and hereby is, established a reserve fund to be called the Coffey County Lake Operations Fund (hereinafter "the Fund").

2. That the Fund shall be used to properly account for the receipt and disbursal of monies related to the establishment, operation, administration, management and maintenance of the Coffey County Lake.

3. That this Fund shall receive monies from any legally available sources including, but not limited to, any monies received by the County pursuant to the terms of the Lease and Agreement approved pursuant to Resolution No. 619.

4. That if the Fund is subsequently deemed by the Board to no longer be necessary, the Fund may be abolished by Resolution, and any monies remaining therein shall be disbursed to the General Fund of the County.

Resolution No. 621
Page 2

5. That this Resolution shall be effective from and after its approval by the Board and its publication one (1) time in a newspaper of general circulation in the County.

ADOPTED THIS 4 DAY OF May, 1998.

BOARD OF COUNTY COMMISSIONERS,
COFFEY COUNTY, KANSAS

Gene L. Merry, Chairman

Johnnie R. Sleezer, Member

Timothy A. Sipe, Member

Perry Powell, Member

William Knapp, Member

OFFICE COUNTY CLERK SEAL COFFEY COUNTY KANSAS

ATTEST:

Vernon Birk, County Clerk

APPROVED AS TO FORM:

Douglas P. Witteman, County Attorney

WOLF CREEK GENERATING STATION
COFFEY COUNTY, KANSAS

PERIMETER DESCRIPTION

The Wolf Creek Generating Station site in Coffey County, Kansas, consists of land and easements within the following perimeter description:

Beginning at the W 1/4 Cor Sec 24-T20S-R15E, thence East to the NE Cor W 1/2 W 1/2 SE 1/4 of said Sec 24, thence South to the SE Cor W 1/2 NW 1/4 NW 1/4 Sec 25-T20S-R15E, thence West to the West line of NE 1/4 of said Sec 25, thence South to the S 1/4 Cor said Sec 25, thence West to a point 797.8 feet East of the NW Cor NW 1/4 Sec 36-T20S-R15E, thence South 520 feet, thence Southeasterly to a point 1020 feet West of the SE Cor N 1/2 NW 1/4 of said Sec 36, thence South 200 Feet, thence West 621.85 feet, thence South 1198.97 feet, thence Southeasterly 350.7 feet to a point 180 feet South of the NE Cor W 1/2 SW 1/4 of said Section 36, thence South to the NE Cor SW 1/4 SW 1/4 of said Sec 36, thence East to the East line of W 1/2 of said Sec 36, thence South to the S 1/4 Cor of said Sec 36, thence East to the SW Cor E 1/2 SE 1/4 SE 1/4 of said Sec 36, thence North to the NW Cor E 1/2 SE 1/4 SE 1/4 of said Sec 36,

thence East to the NE Cor W 1/2 SW 1/4 SW 1/4 Sec 31-T20S-R16E, thence South to the SE Cor of said W 1/2 SW 1/4 SW 1/4, thence East to the NE Cor Sec 6-T21S-R16E, thence South to the NW Cor S 1/2 N 1/2 Sec 5-T21S-R16E, thence East to the NE Cor SW 1/4 NW 1/4 Sec 4-T21S-R16E, thence South to the SE Cor SW 1/4 SW 1/4 of said Sec 4, thence West to the NE Cor Sec 8-T21S-R16E, thence South to the SE Cor of said Sec 8, thence West 1704.96 feet, thence South to the North line S 1/2 NE 1/4 Sec 17-T21S-R16E, thence East to the NE Cor S 1/2 NW 1/4 Sec 16-T21S R16E, thence South to the S 1/4 Cor Sec 21-T21S-R16E, thence West to a point 450 feet West of SE Cor Sec. 20-T21S-R16E, thence South to a point 450 feet West of the E 1/4 Cor Sec 29-T21S-R16E, thence West to the center of said Sec 29, thence South to the SE Cor N 1/2 SW 1/4 of said Sec 29, thence West to the SW Cor of said N 1/2 SW 1/4, thence North to the SE Cor of the North 70 acres of the SE 1/4 Sec 30-T21S-R16E, thence West to the SW Cor of the North 70 acres of said SE 1/4, thence North to the center of said Sec 30, thence West to the W 1/4 Cor of said Sec 30, thence North to the NW Cor of said Sec 30,

thence West to the SW Cor E 1/2 E 1/2 SE 1/4 of Sec 24-T21S-R15E, thence North to the NW Cor of said E 1/2 E 1/2 SE 1/4, thence East to the SE Cor NE 1/4 of said Sec 24, thence North to the SE Cor NE 1/4 SE 1/4 Sec 13-T21S-R15E, thence West to the SW Cor of said NE 1/4 SE 1/4, thence North to the NW Cor of said NE 1/4 SE 1/4, thence West to the center of said Sec 13, thence North to the N 1/4 Cor said Sec 13, thence West to the SW Cor SE 1/4 SW 1/4 of Sec 12-T21S-R15E, thence North to the NW Cor of said SE 1/4 SW 1/4, thence West to the SW Cor NW 1/4 SW 1/4 of said Sec 12, thence North to the NW Cor of said Sec 12, thence West to the SW Cor E 1/2 SE 1/4 Sec 2-T21S-R15E, thence North 1700 feet, thence West 670 feet, thence North to the North line S 1/2 NE 1/4 of said Sec 2, thence West to the NW Cor S 1/2 NE 1/4 of said Sec 2, thence North to a point 1050 feet South of the North line of said Sec 2,thence West 600 feet, thence North to a point 720 feet West of NE Cor SE 1/4 Sec 34-T20S-R15E, thence East to the center of Sec 35-T20S-R15E, thence North to the center of Sec 26-T20S-R15E, thence East to the SE Cor W 1/2 SE 1/4 NE 1/4 of said Sec 26, thence North to the NE Cor of said W 1/2 SE 1/4 NE 1/4, thence East to the East line of said Sec 26, thence North to the W 1/4 Cor Sec 24-T20S-R15E, being the point of beginning, except Stringtown Cemetery and except a tract in the NE 1/4 NE 1/4 Sec 1-T21S-R15E described as beginning at a point 1060.0 feet South of NE Cor said NE 1/4, thence West 446.9 feet, thence South 730.0 feet, thence East 446.0 feet, thence North 726.2 feet to point of beginning.

With respect to the following properties, which are contained within the above perimeter description, said properties are held by way of an easement acquired by way of condemnation and are subject to certain rights of reversion:

The Southeast 1/4 of the Southwest 1/4 of Section 35-T20S-R15E;

A tract in Section 1-T21S-R15E described as commencing at a point situated in the center of Wolf Creek about 41 rods West of the Southeast corner of said Section 1 thence West on said section line to another point in the center of said Wolf Creek, thence down the center of said creek to the place of beginning;

The East 1/2 of the Northwest 1/4, the East 1/2 of the Southwest 1/4, the Northwest 1/4 of the Southwest 1/4, the West 1/2 of the Northeast 1/4 and the Northeast 1/4 of the Northeast 1/4 of Section 12-T21S-R15E, except that part of the North 1/2 of the Northeast 1/4 of Section 12 lying North of Wolf Creek;

The North 1/2 of the Southwest 1/4 of the Northeast 1/4 and the Southwest 1/4 of the Southwest 1/4 of the Northeast 1/4 of Section 30-T21S-R16E;

The West 1/2 of the Northwest 1/4 of Section 29 and the Southeast 1/4 of the Northeast 1/4 and the Southeast 1/4 of the Southwest 1/4 of the Northeast 1/4 of Section 30, all in T21S-R16E;

The South 1/2 of the Southwest 1/4 of Section 19-T21S-R16E, except tract 16 rods by 20 rods for school located in Southeast corner thereof.

WOLF CREEK GENERATING STATION

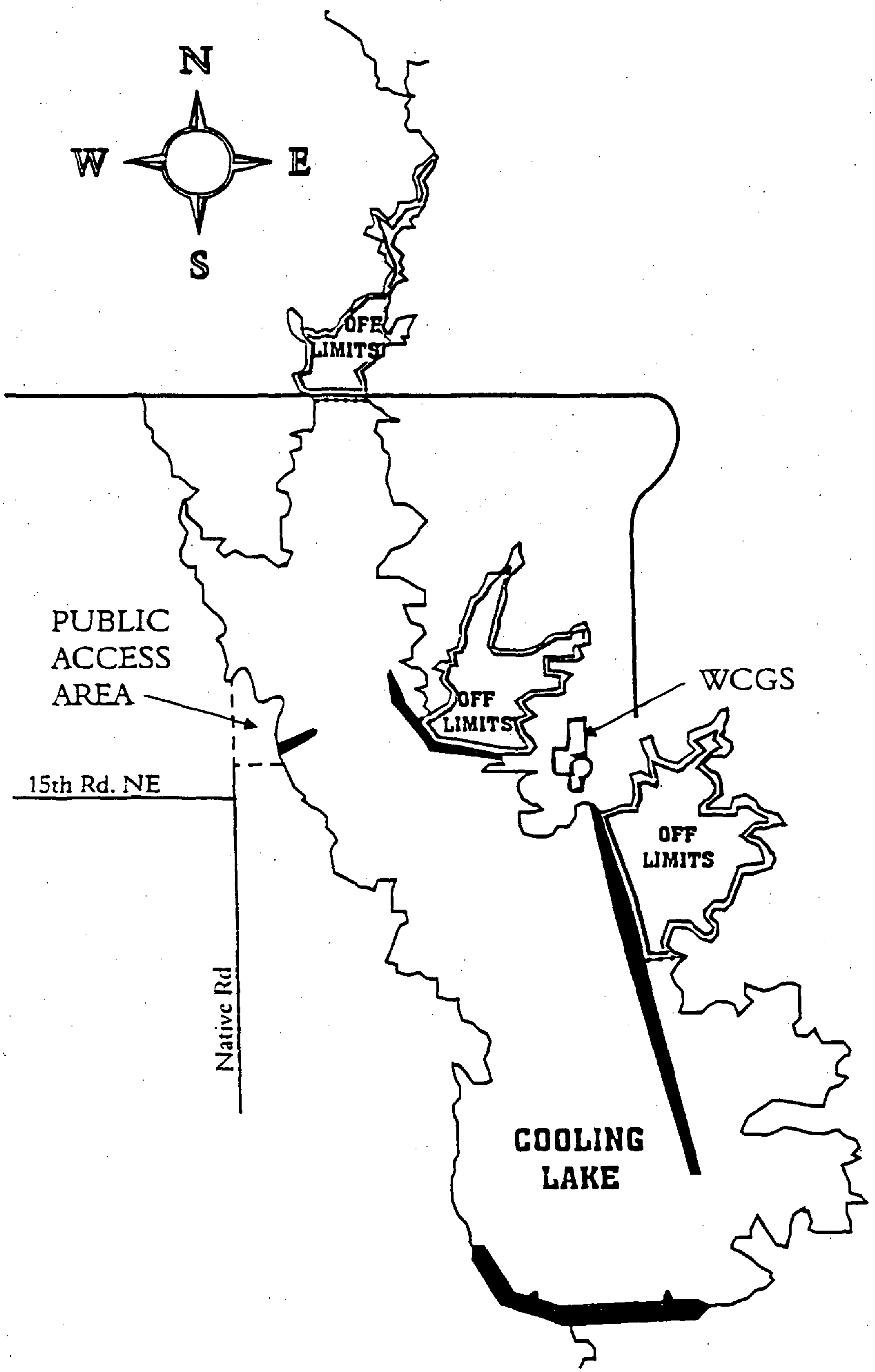

Exhibit 2

9. Examples of the fishery regulations developed by the Kansas Department of Wildlife & Parks for CCL.

- Available water or sediment quality data for John Redmond Reservoir (JRR), Coffey County Lake (CCL), and Neosho River.

- Available information regarding local, state, or federal management measures for the JRR, CCL, and the Neosho River. This may include fisheries management, watershed management, flow regulation, etc.

- Any available documentation regarding minimum flows in the Neosho River.

- Available records regarding the operation of the intake screens at either the Neosho River or CCL screen houses as well as information on the ongoing and periodic maintenance that occurs on the screens.

- Available information on invasive or nuisance species observed in the facility's intake, JRR, CCL, or the Neosho River and available information on Wolf Creek Nuclear Operating Corporation (WCNOC) efforts to address this issue.

- Documentation regarding the WCNOC or Coffey County Sheriff's office management of the CCL access program.

- Examples of the fishery regulations developed by the Kansas Department of Wildlife & Parks for CCL.

- If available, information on any occurrences of the Topeka Shiner in the JRR, CCL, Neosho River, or any water bodies crossed by the facility's transmission lines.

- Section 2.5 of the ER (Wolf Creek Generating Station (WCGS), 1980) states that U.S. Fish and Wildlife Service (USFWS) and U.S. Geological Survey (USGS) recommended that additional data be obtained on the habitat requirements of the Neosho River madtoms. Please provide any new information related to these habitat requirements.

- Section 2.5 of the ER (WCGS, 1980) states that USFWS and USGS recommended that flows below the John Redmond Dam be increased during critical periods for the Neosho River madtoms. Please provide any new information related to this issue.

- If available, information on any occurrences of the Neosho river madtom in the JRR, CCL or Neosho river.

- If available, information on any occurrences of the Neosho mucket mussel in the JRR, CCL or Neosho river.

- Section 3.1.2 of the ER (WCGS, 1980) states that water is released to Wolf Creek infrequently. Please provide available records documenting these releases and/or information regarding the frequency of these releases.

- Details on the anti-scalants, dispersants, biocides, and corrosion inhibitors which are released into the circulating water system. Specifically, names of additives used, concentrations used, and frequency of application.

- System operating procedures for the circulating water system traveling screens.

WCNOC and KDWP Fishery Regulation Development

Audit Needs request #35

> "Please provide an example of the fishery regulations developed by the KDWP for CCL."

Fishery regulations are developed per the MOU for lake access (see ~~# 34~~ previous question). Typically, WCNOC or KDWP initiates a proposed change. Once agreed, the change is presented to the KDWP Commission, and then made enforceable by KDWP Secretary's order. Examples of proposal and responses are attached.

WOLF CREEK
NUCLEAR OPERATING CORPORATION

9

Warren B. Wood
General Counsel and Secretary

August 10, 1995

GC 95-0132
File No. 40.004.01
21.3

Kansas Department of Wildlife and Parks
Route 2, Box 54A
Pratt, Kansas 67124-9599

Attention: Mr. Doug Nygren:

Subject: Proposed Wolf Creek Lake Angling Regulations

Dear Mr. Nygren:

Wolf Creek Nuclear Operating Corporation (WCNOC) proposes that the angling regulations that appear on Exhibit 1 attached to this letter be adopted by the Kansas Department of Wildlife and Parks (KDWP) beginning in 1996 for Wolf Creek Lake. These regulations were designed by WCNOC and KDWP biological staff with the primary goal of preserving the existing fishery. This fishery supports power plant operation by biologically controlling excessive numbers of gizzard shad in the cooling lake. The proposed regulations will also allow for a small amount of harvest from a primarily catch-and-release fishery that many anglers can enjoy for a long time.

We look forward to working with KDWP to provide this recreational opportunity to the general public. If you have any questions on the proposed regulations, please feel free to contact Brad Loveless (316) 364-8831 extension 4530.

Very truly yours,

Warren B. Wood

Warren B. Wood

WBW/jaf

cc: Leonard Jirak (KDWP)
James Cambell (Coffey County Attorney)

P.O. Box 411 / Burlington, KS 66839 / Phone: (316) 364-4105

EXHIBIT 1 to GC 95-0132

PROPOSED CREEL AND SIZE REGULATIONS FOR WOLF CREEK LAKE

August 8, 1995

Species	Maximum Daily Creel	Minimum Total Length (inches)
Channel, blue and flathead catfish (any combination)	2	any size
White bass	2	14
Wiper hybrid	1	24
Largemouth bass	1	21
Smallmouth bass	1	18
Crappie (black or white)	2	14
Walleye	1	21

No creel or minimum length limits will be imposed on any other species.

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WOLF CREEK
NUCLEAR OPERATING CORPORATION

June 23, 1998

RP 98-0132

Coffey County Commission
Jon Hotaling
Director Coffey County Economic Development
110 South Sixth
Burlington, KS 66839

SUBJECT: Approval for Fish Feeder Placement on Coffey County Lake

Dear Mr. Hotaling:

Wolf Creek Nuclear Operating Corporation has reviewed and hereby approves the Coffey County Commission's request to place two automatic fish feeders at the lake access area. We concluded that the feeders would not adversely impact the current fishery's ability to control shad, thus would not jeopardize the safe and efficient operation of Wolf Creek Generating Station. This conclusion is based on the following:

1. the two feeders would be placed along the shoreline accessible to shoreline anglers,

2. the feeders would attract and increase harvest potential for primarily channel catfish and common carp, neither of which are considered important shad predators,

3. and, the feeders' inputs to the lake would be localized, thus would not adversely change the overall biomass of fish in the lake.

We understand that the feeders would be purchased and maintained by Coffey County, with no commitment from WCNOC. Thank you for considering our needs with regard to the fishery. If any questions arise, please feel free to contact Dan Haines at 364-8831, extension 4672.

Yours truly,

John W. Johnson

John W. Johnson
Manager Resource Protection

JWJ/llk

cc: Leonard Jirak

9

WOLF CREEK
NUCLEAR OPERATING CORPORATION

August 4, 1998

RP 98-0160

Kansas Department of Wildlife and Parks
540 16th RD NW
Hartford, Kansas 66854-9305

Attention: Leonard Jirak, District Fisheries Biologist

Subject: Response to Proposed Fish Limit Changes for Coffey County Lake

Dear Mr. Jirak:

We have reviewed the fish creel and length limit changes you proposed and accept, with qualifications, all except for crappie. The proposed changes were reviewed with respect to the fishery's continued contribution to the safe and efficient operation of the power plant. Below are the changes, and brief justifications for each:

Walleye: **Current: 1/day ≥21"**
Proposed: 2/day ≥18"

WCNOC has no objection to making this change. Good recruitment (evidenced by a proportional stock density index of 30 % from 1997 gill net samples) coupled with a poor condition index (W_r of 79 from spring 1998 sampling results) indicates room for increased harvest. This apparent surplus of walleye could be removed without jeopardizing the population's ability to help consume year-to-year fluctuations in gizzard shad production.

Crappie: **Current: 2/day ≥14"**
Proposed: 2/day ≥12"

WCNOC desires to maintain the current 14 inch minimum length limit at this time. White crappie is the dominant crappie in the lake and its population is characterized by consistent, high percentages of larger individuals (proportional stock density index typically > 90 percent since 1985, spring fyke and fall gill net samples). Creel survey results followed netting efforts closely showing greater than 88% of all white crappie that were released by anglers in 1997 were ≥ 12 inches. Relative low densities of small crappie are further evidenced by consistent, long term recruitment to ≥ 12 inches with good condition indices (spring and fall sample Wr's typically >95). In addition, occasional dominant year classes, common of many crappie populations, appear to be lacking in the lake. These conditions indicate to us low intraspecific competition, which is unusual and likely caused by high predation rates on young crappie. We believe that the potential exists, especially in light of unlimited angler numbers expected in the future, that exposing crappie < 14 inches to harvest may jeopardize current production, and thus the population's contribution to gizzard shad consumption.

WCNOC has no objection, however, to raising the current creel limit of two/day up to five/day ≥14 inches. The length limit will protect the fish important to WCNOC.

White bass: **Current: 2/day > 14"**
Proposed: 5/day >12".

WCNOC has no objection to this change. Brief modeling indicated that loss of wipers due to angler mis-identification will not adversely impact the population. Known 1997 harvest rates, and past wiper stocking records were used. Assumptions were; a 50% angler mis-identification rate, natural mortality rates based on past wiper year class longevity in the lake, and an increase in harvest corresponding to the proposed increase in the creel limit.

Smallmouth bass: **Current: 1/day ≥ 18"**
Proposed: 1 over and 2 under, or 2 in combination/day < 13" or ≥18".

WCNOC has no objection to this change. As with walleye, good recruitment (proportional stock density typically around 50%) coupled with a poor condition index (Wr of 84 from spring electrofishing samples) indicates room for a higher harvest rate. WCNOC agrees that a greater number of smallmouth could be removed without jeopardizing the populations contribution in maintaining low gizzard shad numbers.

Please feel free to contact Dan Haines at (316)364-8831, ext. 4672 if you have questions on our response. Thank you for your interest in the fishery.

Sincerely,

John W. Johnson

John W. Johnson

JWJ/jaf

cc: Doug Nygren, KDWP
Larry Tieman, KDWP

9

Kansas Department of Wildlife and Parks
Home office
540 16th Road
Hartford, Kansas 66854

99-01036

MEMORANDUM

TO: Dan Haines

FROM: Leonard Jirak, District Fisheries Biologist

SUBJECT: Change in Catfish Creel at Coffey County Lake

DATE: June 28, 1999

Due to the success of the change in creel limits at Coffey County lake during this past year, I would like to propose a change in the catfish creel limit for the year 2000 from 2 to 5 fish per day Could you please consider this change and run it through the necessary channels to get the ball rolling as the year 2000 is only 5 short months away. Hopefully, this will be plenty of notice and this will be met with little opposition. Channel catfish have not been a target species at the lake with only 504 being harvested in the first 5 months of 1999. I would like to see a total of one channel catfish harvested per acre per year. Feel free to contact me with any questions or concerns that you may have. Thanks Leonard.

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WOLF CREEK
NUCLEAR OPERATING CORPORATION

August 4, 1999

RP 99-0119

Kansas Department of Wildlife and Parks
540 16th Road
Hartford, Kansas 66854

Attention: Leonard Jirak, District Fisheries Biologist

Subject: Response to Change in Catfish Creel Proposal for Coffey County Lake

Dear Mr Jirak:

We have reviewed your proposal to increase the catfish daily creel limit in Coffey County Lake from two to five fish, and foresee no problems. The proposed change was reviewed with respect to the fishery's continued contribution to the safe and efficient operation of the power plant. Our conclusion was based on the low body condition index (W_r of 79 from fall 1998 sampling results) for channel catfish, which indicates room for increased harvest. In addition, catfish are not typically efficient gizzard shad predators.

If you have any questions, please feel free to contact Dan Haines at (316) 364-8831, ext. 4672. Thank you for your interest and cooperation.

Sincerely,

John W. Johnson

JWJ/jaf

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WOLF CREEK
NUCLEAR OPERATING CORPORATION

September 21, 2000
RP 00-0266

Kansas Department of Wildlife and Parks
540 16th RD NW
Hartford, Kansas 66854-9305

Attention: Mr. Leonard Jirak, District Fisheries Biologist

Reference: Letter dated August 18, 2000, from Kansas Department of Wildlife and Parks to Wolf Creek Nuclear Operating Corporation

Subject: Response to 2001 Proposed Fish Limit Changes for Coffey County Lake

Dear Mr. Jirak;

Wolf Creek Nuclear Operating Corporation (WCNOC) has reviewed your proposal to change creel and length limits for Coffey County Lake (CCL), and agree with that proposed for walleye. However, monitoring at CCL shows that the change proposed for smallmouth bass should be modified.

Your proposed change for the daily walleye creel is to allow one fish under, and one fish over 18 inches to be harvested. WCNOC agrees that the change is justified based on high densities, and less than optimum body conditions (W_r of 81, 1999 monitoring). Based on past monitoring data, we would prefer that the average walleye body condition be in the fair range (W_r range from 86 to 93). Your proposal will remove a portion of the medium sized fish, thus decreasing the competition for available prey, improving body conditions, and growth. As you stated, your proposal will require annual scrutiny, especially if angler numbers increase.

For smallmouth bass, WCNOC agrees that increased harvest is possible, but does not agree with your proposal of two fish under 18 inches. Alternatively, WCNOC proposes changing the daily creel and length limit for smallmouth bass to two fish per day, either under 13 or over 16 inches. Past monitoring suggests that fair to good body conditions would be preferred (W_r range from 90 to 95). Electrofishing results from 1999 show that the intermediate fish (13-16 inches) were within our suggested preferred range, but the larger individuals were of lesser condition (W_r of 85). WCNOC contends that exposing all fish under 18 inches to harvest has the potential for harvest of sizes and numbers greater than needed to accomplish the suggested preferred body conditions. We prefer that harvest be from the larger of the intermediate fish, leaving the bulk of the brood-sized fish in the lake.

If you have any questions, please contact Dan Haines at (316) 364-8831, extension 4672.

John W. Johnson

John W. Johnson

JWJ/jaf

CC: Doug Nygren, KDWP, Pratt
Larry Tieman, KDWP, Chanute

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STATE OF KANSAS

DEPARTMENT OF WILDLIFE & PARKS

Region 5 Office
1500 W. 7th, PO Box 777
Chanute, KS 66720
316/431-0380 FAX 316/431-0381

00-00147

Dan Haines
Wolf Creek Generating Station
1550 Oxen Lane NE CC-EM
Burlington, KS 66839

August 18, 2000

Dear Mr.Haines,

Now that we have several years of experience in public fishing at Coffey County Lake it is once again time to evaluate the harvest regulations and their impact on the fish population. The changes that were made in 1999 and 2000 have worked well and directed increased harvest at the target species. There has been a big increase in the harvest of channel catfish and white bass so far this year. Unfortunately there has not been an adequate harvest of walleye to improve growth rates and body condition, the same holds true for the smallmouth bass. There were 1,699 walleye and 472 small mouth bass harvested in 1999. Harvest needs to increase dramatically for one year to break up the stockpile of smallmouth and walleye. Regulations could be changed again (at the beginning of the year) to reflect best management goals as soon as improvements are documented. As of now we are aware of the slow growth and poor condition factors on the largemouth bass, walleye, and small mouth bass. Growth and condition appears to be excellent for crappie and good for wipers, white bass and catfish.

To improve the situation I am proposing to you a regulation change to one walleye under 18 inches in the creel and one over. On small mouth bass 2 fish in the daily creel under 18 inches and none over. This would keep a few larger small mouth in the lake and move harvest to the smaller ones. The goal is for a harvest of 5,000 walleye and 2,500 smallmouth during 2001. Any impact should be visible during the fall 2001 sample and provide information regulation changes for the 2002 season.

More information on use and harvest can be found in the 1999 progress and management report that I sent you earlier this summer. This proposal should meet the power plant management objectives and public sportfishing needs. If you want to discuss this proposal and offer other ideas please fell free to call.

Sincerely,

Leonard Jirak

cc: Dan Williamson
John Johnson
Larry Tiemann

H-3 D G E D 2 0 0 3 \ 0 9 \ 0 4

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WOLF CREEK
NUCLEAR OPERATING CORPORATION

Kevin J. Moles
Manager Regulatory Affairs

August 20, 2003

RA 03-0101

Kansas Department of Wildlife and Parks
540 16th Road NW
Hartford, Kansas 66854

Attention: Mr. Leonard Jirak, District Fisheries Biologist

Subject: Special Length Limits for Governor's Fishing Classic Tournament

Dear Mr Jirak:

Wolf Creek Nuclear Operating Corporation (WCNOC) has been requested to review a reduction of the fish length limits to enhance the annual Governor's Fishing Classic tournament. It is WCNOC's judgment that reducing the length limit for smallmouth bass and walleye during the one-day tournament will not jeopardize WCNOC's fishery management objectives. WCNOC recommends allowing tournament weigh-in of smallmouth bass longer than 16 inches, and walleye longer than 18 inches.

If you have any questions, please contact Dan Haines at (620) 364-8831, extension 4672.

Sincerely,

Kevin J Moles

Kevin J. Moles

KJM/rlg

9

WOLF CREEK
NUCLEAR OPERATING CORPORATION

AUG 26 2002

RA 02-0009

Mr. Leonard Jirak
Fishery Biologist
Kansas Department of Wildlife and Parks
540 16th Road NW
Hartford, KS 66854

Subject: Approval of 2003 Fishing Regulation Changes for Coffey County Lake

Dear Mr. Jirak:

Wolf Creek Nuclear Operating Corporation (WCNOC) has reviewed your recommended fishing regulation changes for Coffey County Lake for 2003 and accepts them as proposed. The changes should not adversely impact the fishery's ability to maintain low gizzard shad densities, which is important for efficient plant operations. WCNOC reserves the option, however, to alter the fishing regulations if future data indicate impacts greater than expected.

Your recommendations and WCNOC's reasons for acceptance are as follows:

Walleye – protected slot limit of 18-26" with a creel of two per day outside the slot

Data indicates high recruitment and intraspecific competition has been typical for the lake. Assuming angler pressure will remain similar to past years, allowing greater numbers of walleye <18" should decrease competition, thus increasing growth rates.

Smallmouth bass – protected slot limit of 16-20" with a creel of two per day outside the slot

As with walleye, recruitment and intraspecific competition appears high. Harvesting greater numbers should help increase growth. Because most smallmouth bass anglers practice "catch and release," a large increase in harvest is not expected.

White bass – minimum length limit of 12" with unlimited creel above the length limit

Review of available literature and data indicates that the white bass population in the lake has recruitment and mortality rates similar with area lakes, but possibly not as cyclic. Recruitment of dominant year classes that naturally fade in about 4–5 years has been typical. Unlimited harvest of older white bass should allow anglers access to fish that had been lost to natural mortality in the past. The 12" minimum length limit should continue to aid anglers in identifying wiper hybrids from white bass, which are difficult to distinguish.

WCNOC appreciates your interest in improving the fishery. If you have any questions, please contact Dan Haines at (620) 364-8831, extension 4672.

Sincerely,

Karl A. (Tony) Harris
Manager Regulatory Affairs

KAH/deh

cc:
Doug Nygren, KDWP, Pratt
Larry Tiemann, KDWP, Chanute
Jon Hotaling, Coffey County Economic Development
Randy Rogers, Coffey County Sheriff's Department

8/15/02 9

STATE OF KANSAS

DEPARTMENT OF WILDLIFE & PARKS

Region 5 Office
1500 W. 7th, PO Box 777
Chanute, KS 66720
316/431-0380 FAX 316/431-0381

02-00569

Leonard Jirak, Fisheries Biologist
540 16th Rd NW
Hartford, Kansas 66854
(620)364-5552

Dan Haines
Wolf Creek Nuclear Operating Corporation
Burlington, Kansas 66839

Mr.Haines,

I am recommending that the following fishing regulations should be implimented at Coffey County Fishing Lake:

Walleye - protected slot limit of 18-26" with a creel of 2 per day outside the slot

Smallmouth Bass - protected slot limit of 16-20" with a creel of 2 per day outside the slot

White Bass - length limit of 12" with unlimited creel above the length limit

A response is requested within two weeks of recieving this letter so the changes can be workshoped at the next Kansas Department of Wildlife and Parks Commission meeting. Thank you for your efforts and cooperation in providing a high quality fishery in Kansas.

Sincerly,

Leonard Jirak

CC: Doug Nygren and Larry Tiemann

ENVIRONMENTAL MANAGEMENT ROUTING FORM

INCOMING CORRESPONDENCE

A. Letter Number: 02-00569 **Date Received:** 8/15/02

B. Responsible Person: Dan Haines

C. Subject: Fishing Regulations at Coffey County Lake

D. FROM: Leonard Jirak/Department of Wildlife & Parks

E. Comments:

F. [X] **Document Services (CC-DS)**

G. Personal Copies

Name

H. TE File Number: 42085 (Original)

I. Reviewed by Supervisor Regulatory Support:

IMAGED 07/11/2005

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WOLF CREEK
NUCLEAR OPERATING CORPORATION

Kevin J. Moles
Manager Regulatory Affairs

JUL 06 2005
RA 05-0080

Kansas Department of Wildlife and Parks
540 16th Road
Hartford, Kansas 66854

Attention: Mr. Leonard Jirak, District Fisheries Biologist

Subject: Fish Creel and Length Limit Changes for 2006 at Coffey County Lake

Dear Mr. Jirak:

Wolf Creek Nuclear Operating Corporation (WCNOC) proposes that the fish creel and length limits for Coffey County Lake be changed for the species below:

1. Increase of the creel limit for crappie greater than 14 inches from two to ten fish per day to increase angler use and increase harvest of older crappie.

2. Increase the catfish creel limit from five to ten fish per day. This includes channel and blue catfish (single species or in combination). This would make the limits consistent with the Kansas Department of Wildlife and Parks (KDWP) statewide creel limits. Catfish are not considered a significant predator of gizzard shad.

3. Creel limits for flathead catfish should remain at five fish per day to stay consistent with current KDWP statewide creel limits.

4. Decrease the wiper length limit from 24 to 21 inches to increase harvest of older fish.

These changes are not expected to impact the fisheries' benefit to the operation of Wolf Creek Generating Station. If you have any question, please contact Dan Haines at (620) 364-8831, extension 4672.

Sincerely,

Robert Hammond FOR:

Kevin J. Moles

cc. Mr. Larry Tieman, KDWP

KJM/deh

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IMAGED 08/02/2005

Kansas Department of Wildlife and Parks

05-00380

7-20-05

Leonard Jirak
District Fisheries Biologist
Hartford

Wolf Creek
Nuclear Operating Corporation
P.O. Box 411
Burlington, Kansas 66839

Attention: Mr. Kevin J Moles, Manager Regulatory Affairs

Subject: Fish Creel and Length Limit Changes for 2006 at Coffey County Lake

Dear Mr. Moles:

I agree with most of the Wolf Creek Nuclear Operation Corporation recommendations on the fish length and creel limits for Coffey County Lake, the only exception would be the Crappie Creel. My comments are as follows.

1. To increase the creel of Crappie over 14 inches from to two to ten per day. I disagree mainly because there is a very limited number of crappie over 14 inches in the lake. Most of the time anglers are fortunate to catch one over the length limit according to the creel reports taken at the lake. There would most likely not be an increase in the number of crappie harvested during the year. There are 200 to 400 harvest per year now. The only that increasing the creel would do would increase angler expectations without any results. This would most likely lead to more disappointment and complaints. The lake has poor crappie recruitment and serves as a trophy crappie lake and I feel it would be good to keep it that way.

2. I agree with the increase in the catfish creel limit increase to 10 per day.

3. I agree that the flathead limit should stay at 5 per day.

4. I agree with the change in the wiper length limit to 21 inches and would recommend 2 per day in the creel since it appears recruitment from past stockings is good and the fish can be replaced.

Please review my comments with your staff and let me know what you think about my recommendations. If you have any questions, please have your staff or you contact me at 620-364-8831.

Sincerely,

Leonard Jirak

cc. Dan Haines, Robert Hammond

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WOLF CREEK
NUCLEAR OPERATING CORPORATION

Kevin J. Moles
Manager Regulatory Affairs

AUG 02 2005

RA 05-0090

Kansas Department of Wildlife and Parks
540 16th Road
Hartford, Kansas 66854

Attention: Mr. Leonard Jirak, District Fisheries Biologist

Subject: Response to Fish Creel and Length Limit Changes for 2006 at Coffey County Lake (CCL)

Dear Mr. Jirak:

Wolf Creek Nuclear Operating Corporation (WCNOC) has reviewed the proposed fish regulation changes, and has the following positions:

1. For the proposed crappie creel limit change from two to ten fish per day, WCNOC will defer to KDWPs' judgment. WCNOC feels that the current 14-inch length limit for crappie will continue to be sufficient to manage the population to benefit safe and efficient operation of the plant. Thus, angler interactions are the issue, for which KDWP has more expertise.

2. For the proposed wiper hybrid changes, it is agreed that reducing the length limit from 24 to 21 inches is appropriate. However, WCNOC feels it is necessary at this time to maintain the current creel of one wiper hybrid per day. It is true that past recruitment has been sufficient, however, replacement stocking must be budgeted with other plant priorities. The proposed length limit change will also expose them to increased harvest. Therefore, it is important to limit wiper removal by creel regulation until impacts from reduced length limits can be assessed.

3. It is agreed that the channel and blue catfish creel limit can be increased to ten fish per day, in any combination, to be consistent with statewide regulations. Flathead catfish creel would remain at five per day, also to be consistent with statewide regulations.

If you have any question, please contact Dan Haines at (620) 364-8831, extension 4672.

Sincerely,

Kevin J. Moles

Kevin J. Moles

cc. Mr. Larry Tieman, KDWP

KJM/deh

IMAGED 03/21/2006

3/9/06

06-00113 9

Kansas Department of Wildlife and Parks

Leonard Jirak
District Fisheries Biologist
Hartford

Wolf Creek
Nuclear Operating Corporation
P.O. Box 411
Burlington, Kansas 66839

Attention: Dan Haines

Subject: Fish for trades.

Dear Mr. Haines,

As I mentioned in our telephone conversations I an requesting on behalf of Kansas Wildlife and Parks to capture 60-70 adult smallmouth bass and some walleye from Coffey County lake to use for a trade to private growers for fathead minnows to use in the walleye rearing pond at John Redmond Lake and for 100,000 blue catfish fry that will go to the Farlington hatchery. We have been worked this in the past and it has greatly benefitted the Kansas fishery resources. We could use this as your spring sample on smallmouth bass by taking lengths and weights on the smallmouth we capture.

Sincerely,

Leonard Jirak

cc.

10. If available, information on any occurrences of the Topeka Shiner in the JRR, CCL, Neosho River, or any water bodies crossed by the facility's transmission lines.

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• Available water or sediment quality data for John Redmond Reservoir (JRR), Coffey County Lake (CCL), and Neosho River.

• Available information regarding local, state, or federal management measures for the JRR, CCL, and the Neosho River. This may include fisheries management, watershed management, flow regulation, etc.

• Any available documentation regarding minimum flows in the Neosho River.

• Available records regarding the operation of the intake screens at either the Neosho River or CCL screen houses as well as information on the ongoing and periodic maintenance that occurs on the screens.

• Available information on invasive or nuisance species observed in the facility's intake, JRR, CCL, or the Neosho River and available information on Wolf Creek Nuclear Operating Corporation (WCNOC) efforts to address this issue.

• Documentation regarding the WCNOC or Coffey County Sheriff's office management of the CCL access program.

• Examples of the fishery regulations developed by the Kansas Department of Wildlife & Parks for CCL.

10 • If available, information on any occurrences of the Topeka Shiner in the JRR, CCL, Neosho River, or any water bodies crossed by the facility's transmission lines.

• Section 2.5 of the ER (Wolf Creek Generating Station (WCGS), 1980) states that U.S. Fish and Wildlife Service (USFWS) and U.S. Geological Survey (USGS) recommended that additional data be obtained on the habitat requirements of the Neosho River madtoms. Please provide any new information related to these habitat requirements.

• Section 2.5 of the ER (WCGS, 1980) states that USFWS and USGS recommended that flows below the John Redmond Dam be increased during critical periods for the Neosho River madtoms. Please provide any new information related to this issue.

• If available, information on any occurrences of the Neosho river madtom in the JRR, CCL or Neosho river.

• If available, information on any occurrences of the Neosho mucket mussel in the JRR, CCL or Neosho river.

• Section 3.1.2 of the ER (WCGS, 1980) states that water is released to Wolf Creek infrequently. Please provide available records documenting these releases and/or information regarding the frequency of these releases.

• Details on the anti-scalants, dispersants, biocides, and corrosion inhibitors which are released into the circulating water system. Specifically, names of additives used, concentrations used, and frequency of application.

• System operating procedures for the circulating water system traveling screens.

Aquatic Ecology

Audit Needs request #37

> "Is the applicant aware of any occurrences of the Topeka Shiner in the JRR, CCL, Neosho River, or any other water bodies crossed by the facilities transmission lines?"

The Topeka shiner (*Notropis topeka*) is not known to exist in John Redmond Reservoir (JRR), Coffey County Lake (CCL), or the Neosho River. Habitats for this species includes small, low order, prairie streams with good water quality, relatively cool water temperatures, and low fish diversity. These streams generally maintain perennial flow but may become intermittent during summer, but typically influenced by groundwater flow, or springs (Mammoliti 2004). Such habitats are not present in JRR, CCL, and Neosho River.

The Topeka shiner was not sampled in streams traversed by the Wolf Creek – Rose Hill 345 Kv transmission line (Kansas Department of Wildlife and Parks, KDWP, 2006). None are known top occur within Coffey County. The transmission line corridor within Greenwood and Butler Counties traverses through the Verdigris, Fall, and Walnut River watersheds. Kansas has designated portions of these two counties as Topeka shiner critical habitat (KDWP 2004). These critical habitats are all within the Cottonwood River watershed, which is not traversed by the transmission line (see attached maps).

This species is listed as threatened in Kansas, and federally listed as endangered. Kansas has designated critical habitat for this species. There are federally designated critical habitats, but not within Kansas.

In summary, the Topeka shiner is not known to exist in JRR, CCL, the Neosho River, or any water bodies traversed by the transmission lines associated with Wolf Creek Generating Station.

Literature cited (all attached)

KDWP, 2006. KDWP Stream Monitoring and Assessment Program Sub Watershed Report – February 2006. Applicable sections. Available through KDWP Environmental Services, or via KDWP website at http://www.kdwp.state.ks.us/news/other_services/stream_assessment_and_monitoring_program.

KDWP, 2004. Topeka shiner (*Notropis topeka*). Species information at http://www.kdwp.state.ks.us/news/other_services/threatened_and_endangered_species/threatened_and_endangered_species/species_information/topeka_shiner .Accessed 2/7/07.

Mammoliti, C. 2004. Recovery Plan for the Topeka shiner (*Notropis topeka*) in Kansas. Prepared for KDWP by The Watershed Institute, Tertra Tech EM Inc. Topeka, Kansas.

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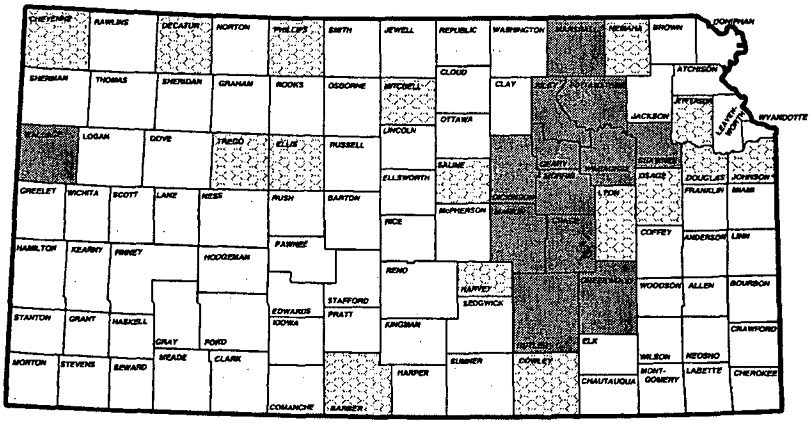
TOPEKA SHINER

Notropis topeka

RANGE MAP



STATUS

MAP KEY

- Probable Historic Range
- Known Historic Range
- Designated Critical Habitat

SPECIES DESCRIPTION

This Topeka shiner is a small minnow, not exceeding 3 inches in length. Silvery-sided with a well- defined dark stripe along the side. The tail fin has a black wedge-shaped spot at the base, other fins are plain. Breeding males exhibit reddish-orange coloration on all fins.

Historically, records show that this species was located in all but the southwest part of Kansas. Now it is mainly found in the Flint Hills in east central Kansas and in Wallace County in the far western part of the state. This species lives near the headwaters of small prairie streams with high water quality and cool temperatures. These streams generally exhibit intermittent flow during summer, however pools are maintained by spring or groundwater percolation. The substrates of these streams are most often clean gravel, however bedrock and clay hardpan overlain by a thin silt layer are not uncommon. Topeka shiners most often occur in pool and run areas.

SPECIES PROTECTION AND CRITICAL HABITATS

Topeka Shiners are protected by the Kansas Nongame and Endangered Species Conservation Act, the Federal Endangered Species Act, and state and federal regulations applicable to those acts. Any time an eligible project is proposed that will impact the species' preferred habitats within its probable range, the project sponsor must contact the Environmental Services Section, Kansas Department of Wildlife and Parks, 512 SE 25th Ave., Pratt, Kansas 67124-8174. Department personnel can then advise the project sponsor on permit requirements.

DESIGNATED CRITICAL HABITATS

As defined by Kansas Administrative Regulations, critical habitats include those areas documented as currently supporting self-sustaining population(s) of any threatened or endangered species of wildlife as well as those areas determined by the Kansas Department of Wildlife and Parks to be essential for the conservation of any threatened or endangered species of wildlife. Currently, the following areas are designated critical for Topeka Shiners:

(1) Thurman Creek and its tributaries in Chase County from where it enters the South Fork Cottonwood River (Sec. 28, T22S, R8E) upstream to its headwaters (Sec. 34, T22S, R9E).

(2) Thurman Creek and its tributaries in Greenwood County from where it crosses the Chase/Greenwood County line (Sec. 2, T23S, R8E) upstream to its headwaters (Sec. 20, T23S, R9E).

(3) South Fork Cottonwood River and its tributaries in Butler County from the Butler/Chase County line (Sec. 4, T23S, R8E) upstream to its headwaters (Sec. 21, T23S, R8E).

(4) Mercer Creek and its tributaries in Chase County from where it enters the South Fork Cottonwood River (Sec. 8, T22S, R8E) upstream to the Chase/Butler County line (Sec. 31, T22S, R8E).

(5) Little Cedar Creek and its tributaries in Chase County from where it enters the South Fork Cottonwood River (Sec. 8, T22S, R8E) upstream to its headwaters (Sec. 7, T22S, R8E).

[redacted]

(6) Jacob Creek and its tributaries in Chase County from where it crosses the Chase/Lyon County line (Sec. 36, T19S, R9E) upstream to its headwaters (Sec. 25, T20S, R9E).

(7) Gannon Creek and its tributaries in Chase County from where it enters Diamond Creek (Sec. 10, T19S, R7E) upstream to its headwaters (Sec. 11, T18S, R7E).

(8) Schaffer Creek and its tributaries in Chase County from where it enters Diamond Creek (Sec. 19, T18S, R7E) upstream to its headwaters in Morris County (Sec. 28, T17S, R7E).

(9) Collett Creek and its tributaries in Chase County from where it enters Middle Creek (Sec. 18, T19S, R7E) upstream to its headwaters (Sec. 27, T18S, R6E).

(10) Cary Creek and its tributaries in Dickinson County from where it crosses the Dickinson/Geary County line (Sec. 6, T14S, R5E) upstream to its headwaters (Sec. 33, T15S, R3E).

(11) West Branch Lyon Creek and its tributaries in Dickinson County from where it enters Lyon Creek (Sec. 2, T15S, R4E) upstream to its headwaters (Sec. 16, T16S, R3E).

(12) North Elm Creek and its tributaries in Marshall County from where it enters the Big Blue River (Sec. 14, T1S, R7E) upstream to its headwaters (Sec. 19, T1S, R9E).

(13) Mulberry Creek and its tributaries in Morris County from where it enters Six-mile Creek (Sec. 21, T17S, R6E) upstream to its headwaters (Sec. 25, T17S, R5E).

(14) Clear Fork Creek and its tributaries in Pottawatomie County from where it crosses the Pottawatomie/Marshall County line (Sec. 2, T6S, R9E) upstream to its headwaters (Sec. 28, T6S, R10E).

(15) Deep Creek main stem in Riley County from where it crosses the Riley/Wabaunsee County line (Sec. 22, T10S, R9E) upstream to Interstate Highway 70 (Sec. 25, T11S, R9E).

(16) Mission Creek main stem in Shawnee County from where it crosses State Highway 4 (Sec. 9, T12S, R14E) upstream into Wabaunsee County through Sec. 2, T13S, R12E.

(17) Mill Creek and its tributaries in Wabaunsee County from where it crosses Interstate Highway 70 (Sec. 27, T11S, R11E) upstream to where it crosses State Highway 99 (Sec. 26, T13S, R10E).

(18) Mulberry Creek main stem in Wabaunsee County from where it enters Mill Creek (Sec. 25, T11S, R11E) upstream to its headwaters (Sec. 6, T11S, R11E).

(19) Willow Creek main stem in Wallace County from where it enters the Smoky Hill River (Sec. 17, T13S, R41W) upstream through Sec. 3, T13S, R41W.

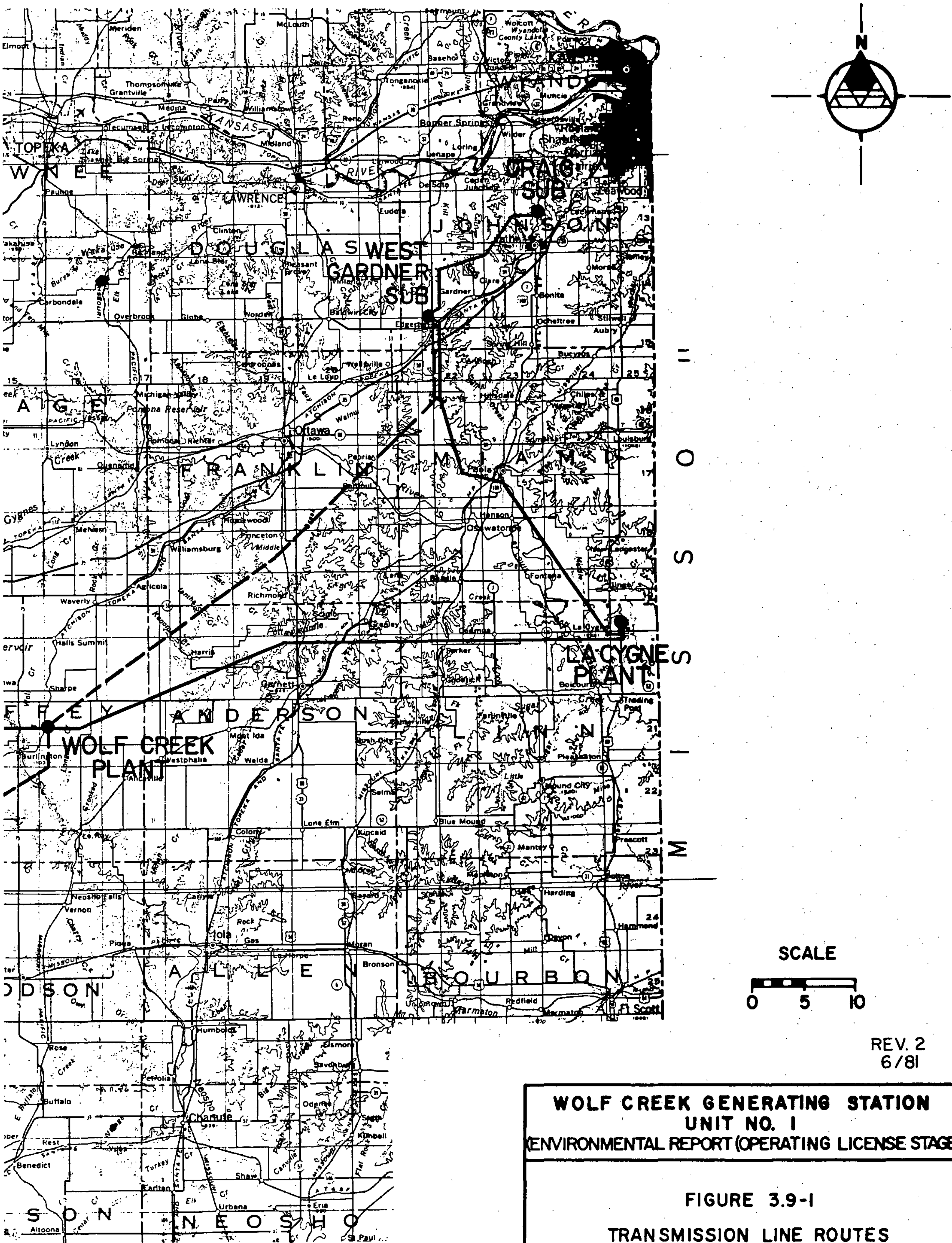
Numerous main stem and tributary reaches of: Rock Creek, Sharpes Creek, Bloody Creek, Crocker Creek, Fox Creek, Diamond Creek and Middle Creek in Chase County; Lyon Creek in Dickinson County; Davis Creek, Thomas Creek and Dry Creek in Geary County; Mud Creek and Middle Creek in Marion County; Diamond Creek in Morris County; Walnut Creek, Wildcat Creek, Little Arkansas Creek and Seven-mile Creek in Riley County. Detailed maps showing specific designated stream reaches in these counties are maintained in the Environmental Services Section, Pratt Operations Office.

10

Attached maps include:

1. Transmission route from Environmental Report , Operating License Stage

2. County maps showing water body names acquired through http://ga2.er.usgs.gov/kswater/index.cfm



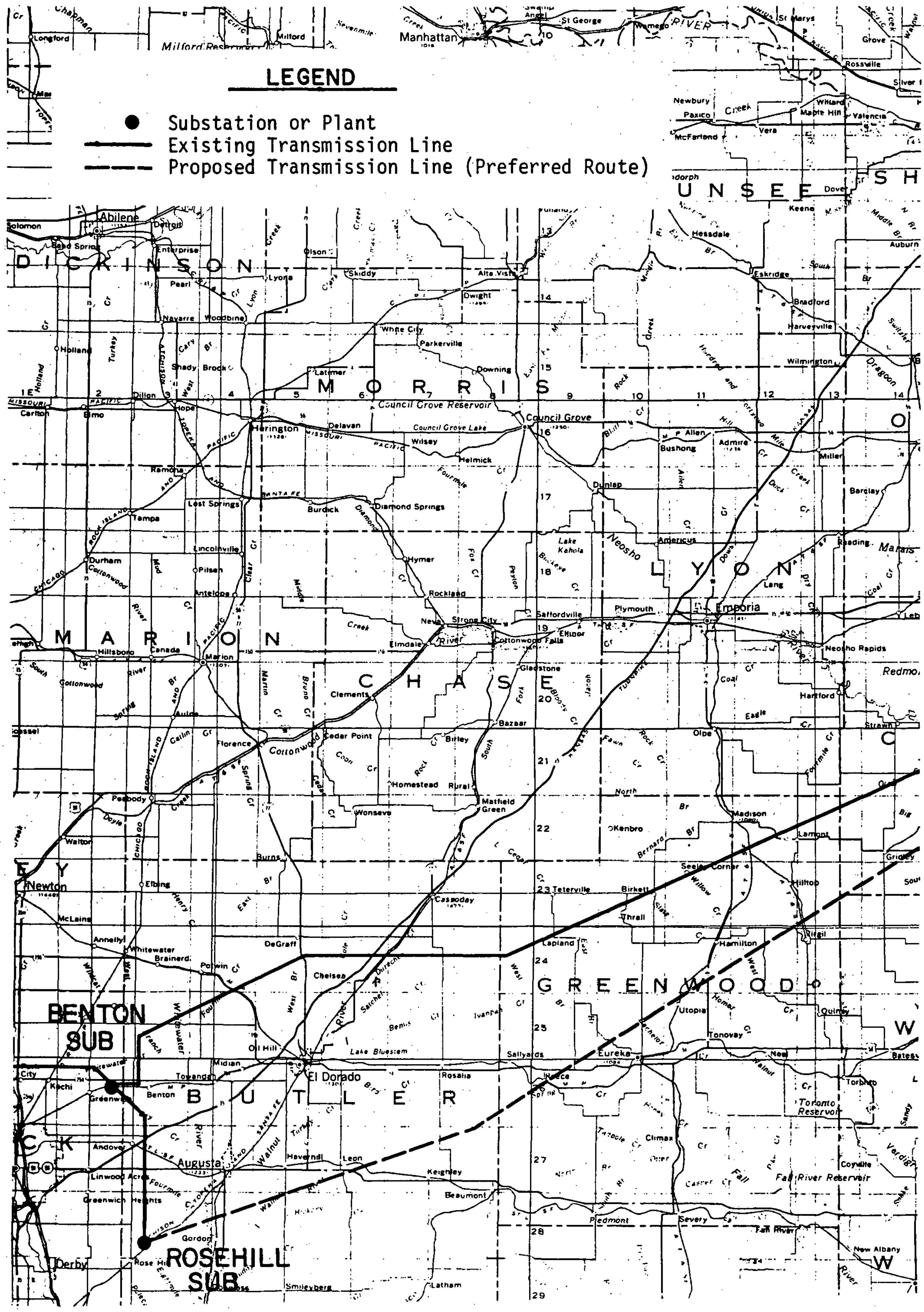
REV. 2
6/81

WOLF CREEK GENERATING STATION
UNIT NO. 1
(ENVIRONMENTAL REPORT (OPERATING LICENSE STAGE)

FIGURE 3.9-1

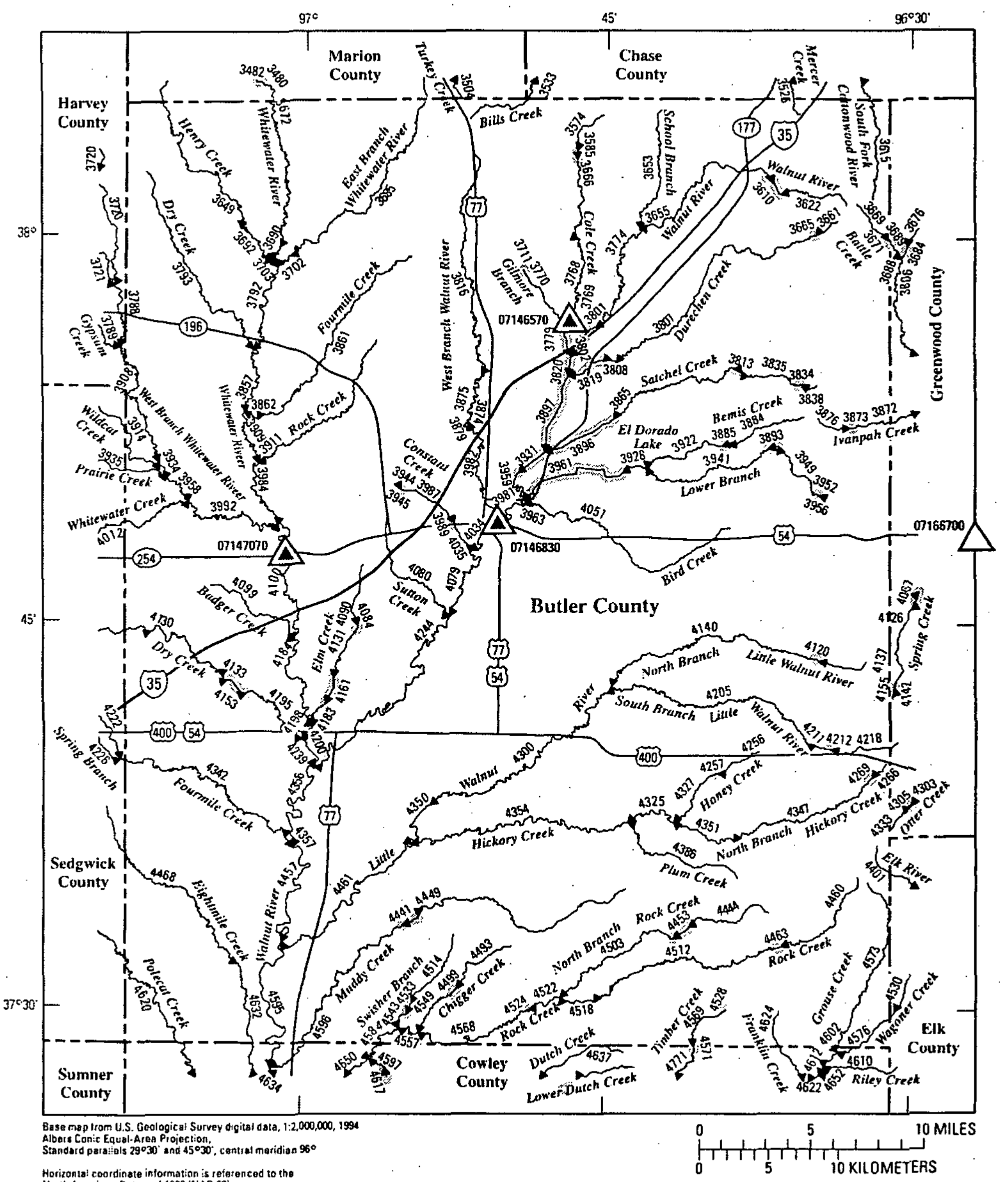
TRANSMISSION LINE ROUTES

SLB 6-1-79



LEGEND
Substation or Plant
Existing Transmission Line
Proposed Transmission Line (Preferred Route)
BENTON SUB
ROSEHILL SUB
DICKINSON
MORRIS
MARION
CHASE
LYON
GREENWOOD
BUTLER
Manhattan
Abilene
Council Grove
Emporia
Herington
Marion
Hillsboro
Peabody
Newton
El Dorado
Augusta
Eureka
Benton
Andover
Derby
Cassoday
Strong City
Cottonwood Falls
Florence
Madison
Council Grove Reservoir
Toronto Reservoir
Fall River Reservoir
Milford Reservoir

10



EXPLANATION

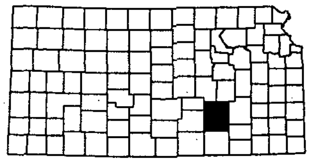
4620 Location of streamflow-statistics determination site (small triangle) and associated identification number—small triangle points in downstream direction

07146830 ▲ U.S. Geological Survey streamflow-gaging station and number used for estimates of flow duration

07166700 △ U.S. Geological Survey streamflow-gaging station and number used for estimates of peak-discharge frequency values

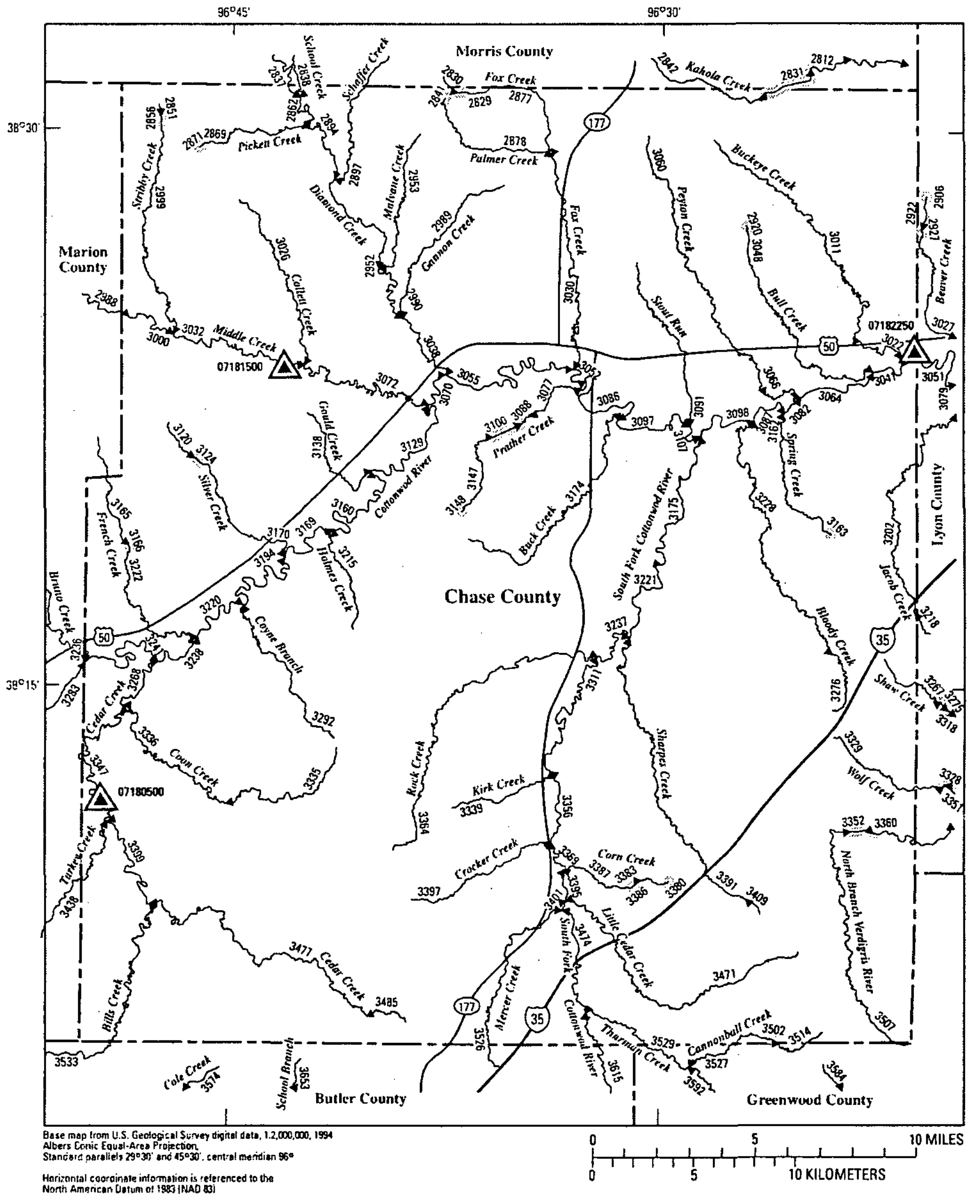
4617 Lake and determination site identification number

KANSAS



Index map

Figure 18. Location of streamflow-statistics determination sites, associated identification numbers, and U.S. Geological Survey streamflow-gaging stations used in the flow-duration and peak-discharge frequency analyses for Butler County.



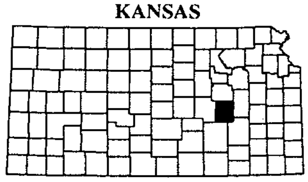
EXPLANATION

4773 Location of streamflow-statistics determination site (small triangle) and associated identification number—small triangle points in downstream direction

07182250 ▲ U.S. Geological Survey streamflow-gaging station and number used for estimates of flow duration

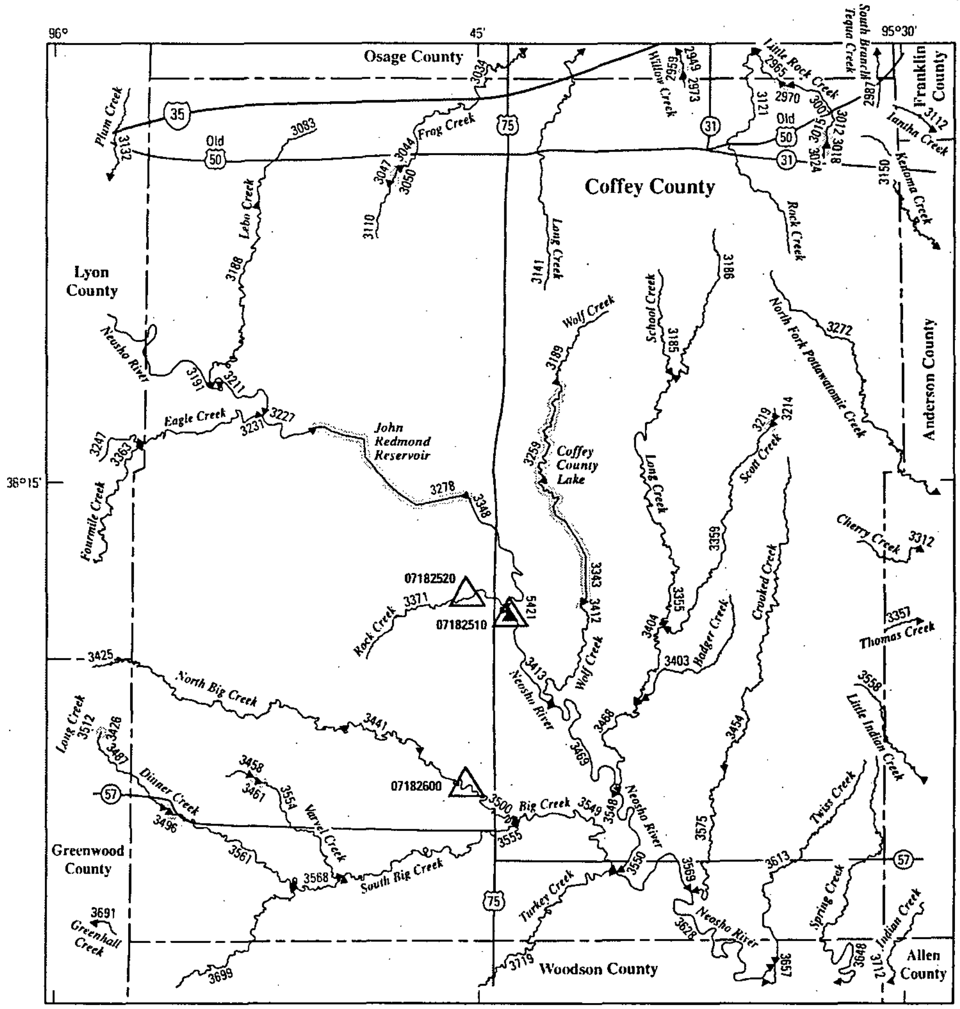
07181500 △ U.S. Geological Survey streamflow-gaging station and number used for estimates of peak-discharge frequency values

3502 Lake and determination site identification number



Index map

Figure 19. Location of streamflow-statistics determination sites, associated identification numbers, and U.S. Geological Survey streamflow-gaging stations used in the flow-duration and peak-discharge frequency analyses for Chase County.



Base map from U.S. Geological Survey digital data, 1:2,000,000, 1994
Albers Conic Equal-Area Projection,
Standard parallels 29°30' and 45°30', central meridian 96°

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83)

EXPLANATION

3699 Location of streamflow-statistics determination site (small triangle) and associated identification number—small triangle points in downstream direction

07182510 U.S. Geological Survey streamflow-gaging station and number used for estimates of flow duration

07182600 U.S. Geological Survey streamflow-gaging station and number used for estimates of peak-discharge frequency values

3343 Lake and determination site identification number

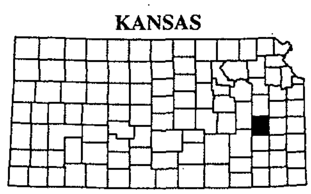
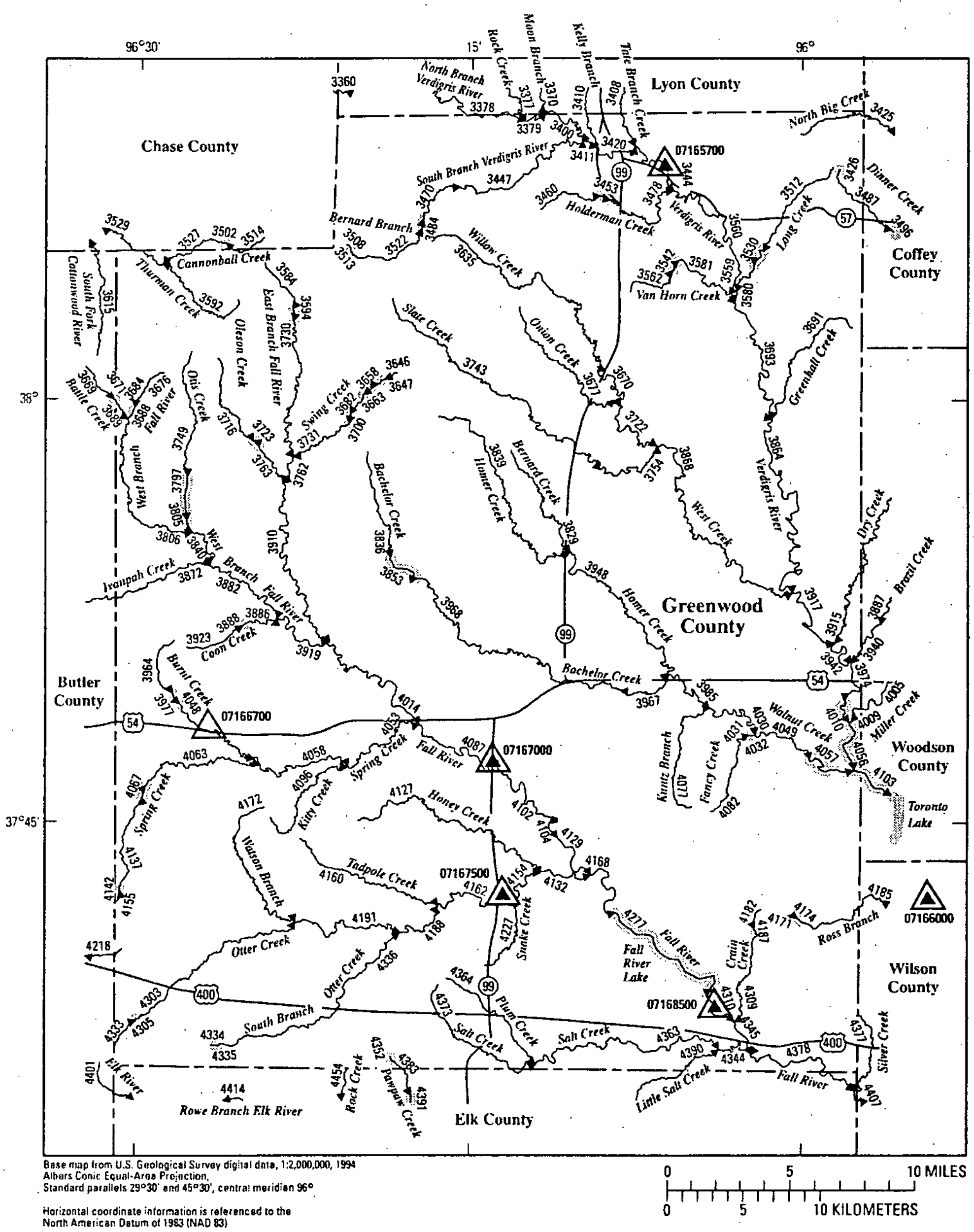


Figure 26. Location of streamflow-statistics determination sites, associated identification numbers, and U.S. Geological Survey streamflow-gaging stations used in the flow-duration and peak-discharge frequency analyses for Coffey County.



EXPLANATION

4414 Location of streamflow-statistics determination site (small triangle) and associated identification number—small triangle points in downstream direction

07167500 U.S. Geological Survey streamflow-gaging station and number used for estimates of flow duration

07166700 U.S. Geological Survey streamflow-gaging station and number used for estimates of peak-discharge frequency values

4391 Lake and determination site identification number

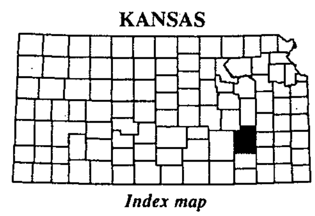
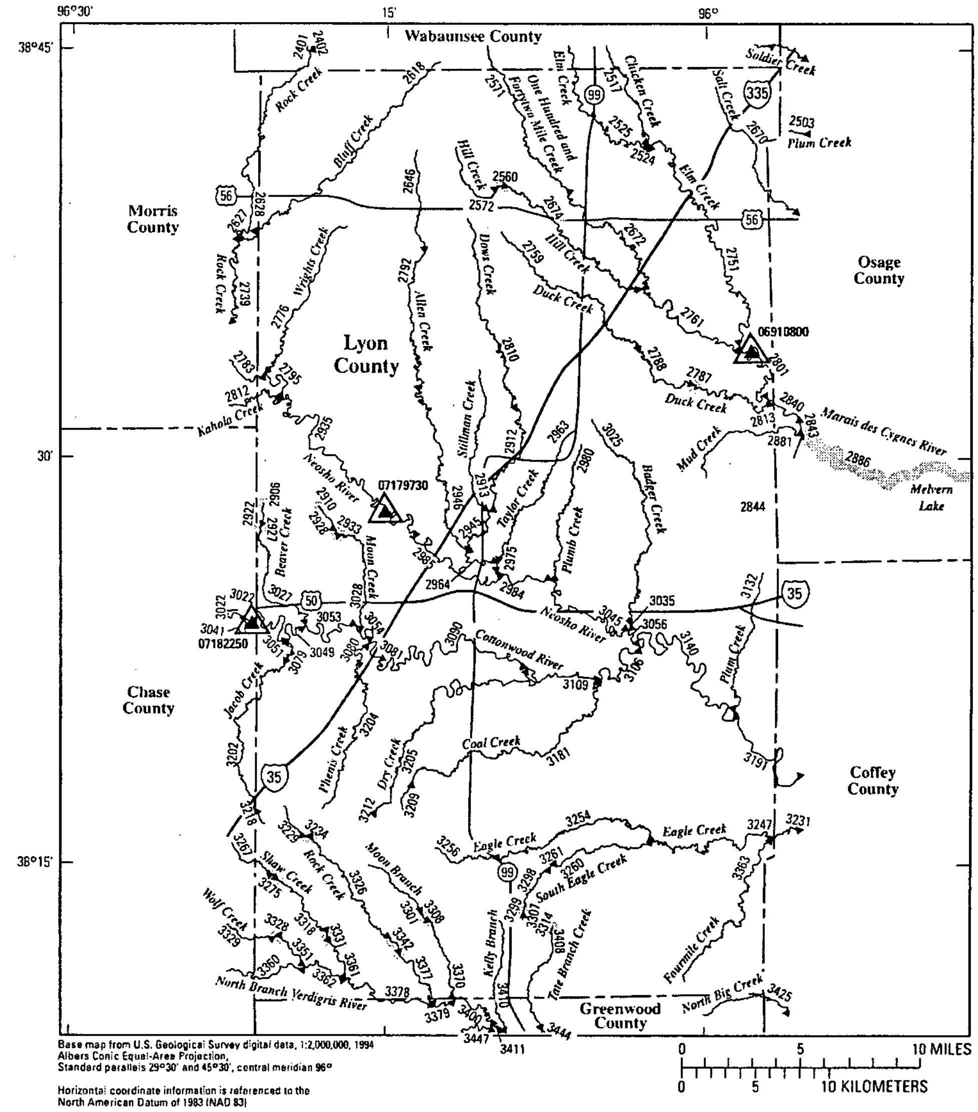


Figure 47. Location of streamflow-statistics determination sites, associated identification numbers, and U.S. Geological Survey streamflow-gaging stations used in the flow-duration and peak-discharge frequency analyses for Greenwood County.



EXPLANATION

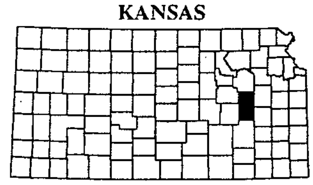
3330 Location of streamflow-statistics determination site (small triangle) and associated identification number—small triangle points in downstream direction

07179730 ▲ U.S. Geological Survey streamflow-gaging station and number used for estimates of flow duration

07182250 △ U.S. Geological Survey streamflow-gaging station and number used for estimates of peak-discharge frequency values

3342 Lake and determination site identification number

KANSAS



Index map

Figure 66. Location of streamflow-statistics determination sites, associated identification numbers, and U.S. Geological Survey streamflow-gaging stations used in the flow-duration and peak-discharge frequency analyses for Lyon County.

10

Recovery Plan

for the

Topeka shiner (*Notropis topeka*)

in Kansas

Prepared by

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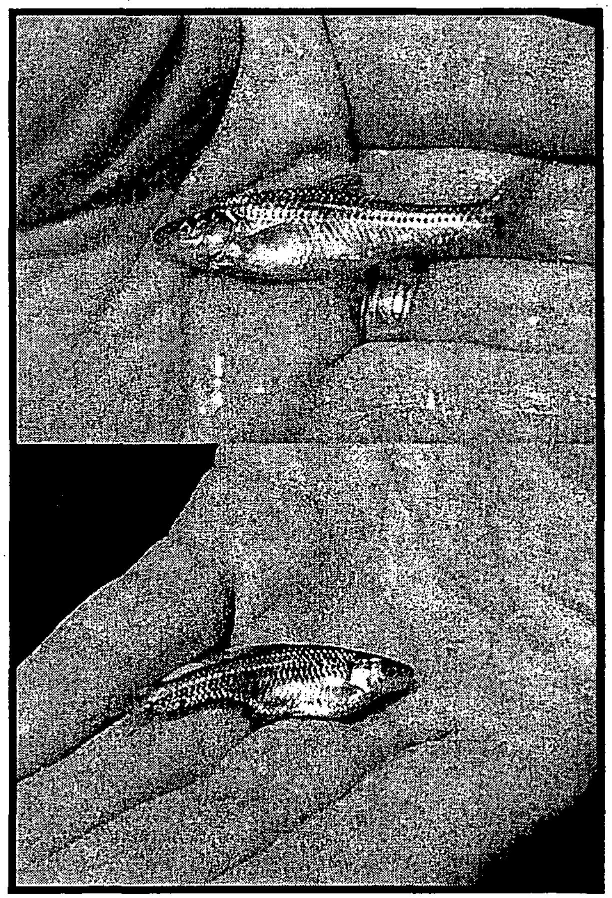
April, 2004

Approved: J. Michael Hayden **Date:** 5/17/04
J. Michael Hayden
Secretary of the Kansas Department of Wildlife & Parks

Recovery Plan
for
the Topeka Shiner (*Notropis topeka*)
in Kansas



Prepared by:

Chris Mammoliti, Aquatic Ecologist
The Watershed Institute
Tetra Tech EM Inc.

DISCLAIMER: This recovery plan outlines actions believed reasonable to maintain and/or restore self-sustaining populations of the state-threatened, federally-endangered Topeka shiner (*Notropis topeka*). However, budgetary constraints and/or social concerns may impede or delay progress toward the stated recovery objectives. While implementation tasks have been proposed and scheduled over a five year period, it will likely take much longer to reverse the current trend of declining populations and ongoing habitat degradation. This recovery plan does not obligate other state or federal government agencies, non-government organizations, or private individuals to undertake specific tasks and may not represent the views or the official positions of any individuals, agencies, or organizations involved in the development of this plan. Approved recovery plans are subject to modification based on new findings, changes in species status, and the completion of recovery tasks. By approving this document, the Secretary of the Kansas Department of Wildlife and Parks certifies that the data used in its development represents the best scientific and commercial data available at the time it was written.

ACKNOWLEDGMENTS: As required through K.S.A. 32-960a(b), whenever a species is added to the list of threatened or endangered species, the secretary shall establish a volunteer local advisory committee composed of members broadly representative of the area(s) affected by the addition of the species to the list. The advisory committee is to work with the Department to adapt the recovery plan and disseminate information to the public. The Department greatly appreciates the invaluable assistance provided by the following members of the Topeka Shiner Advisory Committee:

Dr. David Edds
Division of Biological Sciences
Emporia State University

Dr. Keith Gido
Division of Biology
Kansas State University

Robert Glanville
Board of Directors
State Association of Kansas Watersheds

Duane Hund
Contracting Officer
Mill Creek Watershed Joint District #85

Paul Jones
Road Supervisor
Chase County, Kansas

Dale Lambley
Special Assistant
Kansas Department of Agriculture

Jim Peterson
Environmental Scientist
Kansas Department of Transportation

George Poland, Board Member
Lyon Creek WJD #41
Private Landowner, Dickinson Co.

Keith Schultz
Mill Creek WJD #85
Private Landowner, Wabaunsee Co.

Kevin Shamburg, P.E.
Kansas Livestock Association
KLA Environmental Services

Steve Swaffar
Natural Resources Division
Kansas Farm Bureau

Greg Wingfield
Ecologist
The Nature Conservancy

Suggested citation: Mammoliti, C. S. 2004. Recovery plan for the Topeka shiner (*Notropis topeka*) in Kansas. Kansas Department of Wildlife & Parks, Pratt, Kansas. 50pp.

TABLE OF CONTENTS

I. INTRODUCTION

On December 15, 1998, the United States Fish and Wildlife Service determined the Topeka shiner (*Notropis topeka*) to be an endangered species under the authority of the Endangered Species Act of 1973 (USFWS, 1998). In a subsequent action, a task force commissioned by the Kansas Department of Wildlife & Parks (KDWP), finalized recommendations to Department administration for listing the Topeka shiner as a threatened species under the Kansas Nongame and Endangered Species Conservation Act of 1975. Final action on this listing was published in the Kansas Register, Vol. 18, No. 45, November 11, 1999. By authority granted under K.S.A. 32-960(a), the KDWP is required to develop recovery plans for threatened, endangered, and species in need of conservation (SINC). Recovery planning is governed by K.A.R. 115-15-4 and is defined as "a designated strategy or methodology that, if funded and implemented, is reasonably expected to lead to the eventual restoration, maintenance, or delisting of a species." This recovery plan identifies immediate needs for the conservation and restoration of the Topeka shiner, and actions to address those needs.

II. SPECIES ACCOUNT

A. *Current Description*: The Topeka shiner is a small, stout-bodied minnow, not exceeding 3 inches in length at maturity. The head is short with a small, terminal mouth. The snout is rounded and shorter than or nearly equal to the eye diameter. The dorsal fin is large, plain, originates over the insertion of the pectoral fins, and contains 8 rays. The pectoral, pelvic, and anal fins are also plain and contain 7, 8, and 13 rays respectively. There is a distinct, chevron-shaped spot at the base of the caudal fin. Dorsally the body is olive-green, with a distinct dark stripe preceding the dorsal fin. There are 32 to 37 lateral line scales and a dusky stripe extending the entire length of the lateral line. The scales above this line are darkly outlined, giving a cross-hatched appearance. Below the lateral line, the body lacks pigment, appearing silvery-white. Breeding males display red-orange fins and orange-tinted cheeks and opercles (Cross and Collins, 1995).

B. *Life History*: Early studies indicated that Topeka shiners were benthic insectivores, feeding primarily on midges (chironomids), true flies (dipterans), and mayflies (ephemeropterans), with zooplankters (cladocerans and copepods) also contributing to their diet (Cross and Collins, 1995; Kerns and Bonneau, 2002). More recent studies have found feeding at a variety of trophic levels and diverse food use by the Topeka shiner. Stark et al. (2002) observed Topeka shiners consuming eggs from fathead minnow nests in Willow Creek, Wallace County, Kansas. In Minnesota, food included several kinds of zooplankton, a variety of immature aquatic insects, larval fish, algal and vascular plant matter, including seed capsules (Hatch and Besaw, 1998). These authors suggested that Topeka shiners function both as benthic and nektonic feeders and may also feed from the surfaces of aquatic plants. Topeka shiners have also been observed feeding on surface-dwelling insects (Mammoliti, unpubl. observations, 1998).

Topeka shiners spawn in pool habitats, over green sunfish *(Lepomis cyanellus*) and orangespotted sunfish (*Lepomis humilis*) nests, from late May to August in Kansas and Missouri (Cross and Collins, 1995; Pflieger, 1997; Kerns and Bonneau, 2002). Stark et al. (2002) observed Topeka shiners spawning on the periphery of green sunfish nests and suggested that the habitats provided by these nests are important for the reproductive success of Topeka shiners. These same authors reported aggregations of Topeka shiners in close association with fathead minnow and orangespotted sunfish nests, but no spawning activities were observed. In Minnesota, Hatch (2001) found that Topeka shiners utilized rubble, boulder, and concrete rip-rap at the margins of pools and slow runs. Several authors have reported the defense of small territories by breeding male Topeka shiners (Pflieger, 1997; Katula, 1998; Hatch, 2001; Kerns and Bonneau, 2002; Stark et al., 2002). In Jack Creek, Chase County, Kansas, two male Topeka shiners were observed defending a longear sunfish (*Lepomis megalotis*) nest as the male sunfish loafed nearby (Mammoliti, unpubl. observations, 1998). Other authors have noted upstream movement as reproductive behavior in Topeka shiners (Minckley and Cross, 1959; Kerns, 1983; Barber, 1986).

The Topeka shiner is a short-lived species, rarely surviving to their third summer (Minckley and Cross, 1959; Kerns, 1983; Cross and Collins, 1995; Pflieger, 1997; Hatch, 2001). While they mature at 12-14 months of age (Kerns, 1983; Cross and Collins, 1995; Pflieger, 1997), size seems to be the primary determining factor rather than age (Kerns, 1983). Based on ovarian development, Hatch (2001) suggested that Topeka shiners are multiple-clutch spawners.

The Topeka shiner is primarily a schooling fish and found throughout the water column. Pflieger (1997) noted that the species schooled with other cyprinids in midwater or near the surface. Other studies have reported Topeka shiners schooling in the lower portion of the water column with central stonerollers (*Campostoma anomalum*) (Kerns, 1983; Stark et al., 1999). While typical of small, headwater streams, the species is occasionally reported from larger streams, downstream of known populations (Kerns, 1983; Tabor, pers. comm., 1999). A study conducted in the upper Cottonwood River Basin of the Kansas Flint Hills, reported that Topeka shiner populations were comprised of two groups of individuals: a larger sedentary group and a smaller mobile group (Barber, 1986). In the spring, as precipitation and water temperatures increased, adults males tended to move upstream or downstream. In many instances, the fish later moved back to their original pool. Young-of-the-year fish tended to move downstream in the fall. Others have reported displacement of fish downstream during periods of high flow (Cross, pers. comm., 1994; Tabor, pers. comm., 1994). Kerns and Leon (1982) reported the collection of a single adult Topeka shiner in Buck Creek, Jefferson County, Kansas. While the authors considered it a small probability that this individual was a vagrant, entering Buck Creek via the Kansas River, subsequent surveys have failed to document other specimens. Although it is evident that the species has some capacity to disperse, at present, the degree of dispersal and its ability to "tributary hop" is unknown. Metcalf (1966) suggested that populations found in short, direct tributaries of the Missouri River were evidence of an historic dispersal eastward by "tributary hopping." However, Deacon and Metcalf (1961) found the Topeka shiner to be one of several fishes having a lesser capacity for dispersal after drought conditions. In addition, a range-wide genetic analysis suggested that successful migration, even between adjacent populations, is fairly rare and that movement over long distances is unlikely (Michels, 2000).

C. <u>Habitat</u>: Topeka shiners are typically found in small, low order, prairie streams with good water quality, relatively cool water temperatures, and low fish diversity (Minckley and Cross, 1959; Barber, 1986; Cross and Collins, 1995; Pflieger, 1997). Although Topeka shiners can tolerate a range of water temperatures, cooler, spring-maintained systems are considered optimum (Cross and Collins, 1995; Pflieger, 1997). The stream may or may not be bordered by trees. These streams generally maintain perennial flow but may become intermittent during summer. Everman and Cox (1896), reporting on surveys from the Nebraska portion of the Big Blue River watershed, collected Topeka shiners in "pond-like, isolated portions of streams which dry up in parts of their course during dry weather." Minckley and Cross (1959) found Topeka shiners "almost exclusively in quiet, open pools of small, clear streams that drain upland prairies." They also noted that even when streams approach intermittency the "pools are maintained at fairly stable levels by percolation through the gravel or by springs." Similar habitat characteristics are described for populations in Missouri by Pflieger (1997). Although characteristic of pools with stable water levels, it appears that the Topeka shiner is well adapted for the periodic drought conditions common to prairie streams. For example, Kerns (1983) found that even though mortality of several species was high in desiccating pools, juvenile Topeka shiners seemed especially drought resistant. In South Dakota, Blausey (2001) found that runs were the dominant habitat type associated with Topeka shiner presence although higher densities of the species were collected in pools.

In Kansas, Missouri, and South Dakota, Topeka shiners typically occur in streams with clean gravel, cobble, or sand bottoms (Pflieger, 1971; Kerns, 1983; Barber, 1986; Cross and Collins, 1995; Pflieger, 1997; Blausey, 2001). However, bedrock and clay hardpan covered by a thin layer of silt are not uncommon (Minckley and Cross, 1959). In western Kansas pools containing Topeka shiners, Stark et al. (2002) determined the primary substrate to be coarse sand overlain by silt and detritus. Similarly, Michl and Peters (1993) reported the collection of Topeka shiners from a Nebraska stream having a sand and detritus substrate. While main channel areas may be typical of Kansas and Missouri populations, Topeka shiners in Minnesota and Iowa appear to be more abundant in off-channel oxbows and excavated pools (Menzel, pers. comm., 1999; Hatch, 2001). These seasonally flooded habitats also appear to have a connection with the water table, enabling temperature and dissolved oxygen to stay within the tolerance levels of the species during dry periods. It is also suggested that the groundwater connection may prevent complete freezing of these pools in winter. Groundwater availability was a primary predictor of Topeka shiner presence in South Dakota (Blausey, 2001).

Recently, the species has been found to exist at some stream sites with degraded water quality characterized by excessive sedimentation (Tabor, pers. comm., 1995; Berry, pers. comm., 2000, Hatch, pers. comm., 2000). It is unknown whether the species utilizes these locations year-round, for portions of the year, or were vagrants.

III. SPECIES DISTRIBUTION

A. *Historical*: Historically, the Topeka shiner was widespread and abundant in headwater streams throughout the prairie region of the central United States. It's range included portions of Kansas, Missouri, Nebraska, Iowa, South Dakota, and Minnesota (Johnson, 1942; Harlan and Speaker, 1956; Bailey and Allum, 1962; Cross and Collins, 1995; Pflieger, 1997; Eddy and Underhill, 1976). The species is known from the Smoky Hill, Saline, Solomon, Upper Republican, Big Blue, Nemaha, and Lower Kansas watersheds in the Kansas River Basin in northern Kansas; the

Neosho, Walnut, and Lower Arkansas watersheds in the Arkansas River Basin in southcentral Kansas; the Missouri, Grand, Lamine, Chariton, Des Moines, Loutre, Middle, Hundred and Two, and Blue watersheds in the Missouri River Basin in central and northern Missouri; the Big Blue, Elkhorn, Missouri, and Loup watersheds in Nebraska; the Des Moines, Raccoon, Boone, Missouri, Big Sioux, Cedar, Shell Rock, Rock, and Iowa watersheds in Iowa; the Big Sioux, Vermillion, and James watersheds in eastern South Dakota and; the Des Moines, Cedar, and Rock watersheds in southwestern Minnesota. The species has exhibited major declines in distribution and abundance throughout its historic range. The number of historic known occurrences of Topeka shiners has been reduced by approximately 80 percent, with approximately 50 percent of this decline occurring within the last 40-50 years (USFWS, 2001).

In Kansas, the earliest reported records of the Topeka shiner (1882-1889) were exclusively from areas other than the Flint Hills (Minckley and Cross, 1959). Subsequent habitat modifications, both natural and human-induced, have reversed this situation. As noted by Cross and Moss (1987), the species began to decline throughout the central and western portions of the Kansas River basin in the early 1900's. While the species was reported from the Solomon and Smoky Hill River basins in 1885, it had disappeared before 1935. Similarly, the last record of the species from the Arkansas River basin, excluding the Cottonwood River watershed, was 1891 near Wichita (Cross and Moss, 1987). Minckley and Cross (1959) noted that the Topeka shiner had disappeared from Shunganunga Creek, the type locality, by 1951. Populations known from the Wakarusa River watershed were apparently extirpated during the 1970's (Cross, pers. comm., 1995). Although the Topeka shiner was reported from Dragoon Creek in 1942 (Marais des Cygnes River basin) and Cherry Creek in 1947 (Upper Republican River basin), subsequent surveys have not documented their continued presence (KDWP, unpublished locational records). Documentation of Topeka shiner occurrence in Flint Hills streams was first reported in the 1950's (Cross, 1954).

B. *Current*: At the present time, Topeka shiners exist as fragmented populations within a small portion of its historic range. During the 1990's and early 2000's, extensive surveys have occurred throughout the known range of the species. Currently, the species still occurs at isolated locations in the Smoky Hill, Big Blue, and Lower Kansas watersheds in the Kansas River Basin in northern Kansas; the Neosho watershed in the Arkansas River Basin in southcentral Kansas; the Missouri, Grand, Lamine, Chariton, and Des Moines watersheds in the Missouri River Basin in central and northern Missouri; the Elkhorn and Loup watersheds in Nebraska; the Des Moines, Raccoon, Boone, Big Sioux, and Rock watersheds in Iowa; the Big Sioux, Vermillion, and James watersheds in eastern South Dakota and; the Big Sioux and Rock watersheds in southwestern Minnesota.

In Kansas, the species is almost exclusively restricted to tributary streams in, or very near the Flint Hills, with the exception of one remnant population in western Kansas. Topeka shiners are currently known to occur in the mainstem or tributaries of the following Kansas stream systems: Bloody Creek, South Fork, Middle Creek, Diamond Creek, Fox Creek, and Mud Creek in the Cottonwood River watershed (Neosho River basin); Willow Creek and Lyons Creek in the Smoky Hill River basin; Clark's Creek, Seven-mile Creek, Wildcat Creek, Deep Creek, Mill Creek and Mission Creek in the Lower Kansas River basin; Walnut Creek, Carnahan Creek, Clear Fork Creek and North Elm Creek in the Big Blue River basin. The remnant population in Willow Creek (Wallace County, Kansas) is the last remaining occurrence on the High Plains and separated from core populations by approximately 450 kilometers, two federal reservoirs, and many miles of dewatered stream channel. Michels (2000) found this population to be genetically distinct from the core populations located in eastern Kansas. Stark et al. (1999) gave credit to the good stewardship of local landowners for the continued existence of Topeka shiners in Willow Creek.

Until recently, Topeka shiner populations inhabiting streams draining into Tuttle Creek Reservoir were considered extirpated due to reservoir construction. In pre-construction surveys, Minckley (1959) found the Topeka shiner to be locally common in upland streams. Later surveys failed to document the species. The recent capture of a single adult Topeka shiner in Walnut Creek and in Carnahan Creek (Tabor, pers. comm, 1993; Schrank et al., 2000) indicates the need for additional survey work within this basin. Similarly, by 1959 the species was considered extirpated from Wildcat Creek due to sedimentation from agricultural and urban development (Minckley and Cross, 1959). Extensive recent surveys of Wildcat Creek and it's tributaries have documented the continued presence Topeka shiners within the watershed (Mammoliti, unpubl. observations, 1996; Quist, 1999). Current populations in Kansas exist almost entirely on privately-owned land. Exceptions are populations on lands in public ownership: Deep Creek (KDWP); Mission Creek (Wabaunsee County); three unnamed tributaries on the Tallgrass National Prairie Park (National Park Service); Seven-mile Creek, Wildcat Creek, and Little Arkansas Creek (Ft. Riley, Department of Defense). Two populations occur on properties owned by conservation organizations: South Fork River (The Nature Conservancy) and Rock Springs Creek (Kansas 4-H Foundation).

Due to a lack of recent survey data, the status of Topeka shiner populations in the following streams is unknown: *Cottonwood River basin* - Sharpes Creek, Crocker Creek, and Den Creek in the South Fork Cottonwood watershed; Pickett Creek in the Diamond Creek watershed; Jacob's Creek and Cedar Creek, direct tributaries to the Cottonwood River; *Lower Kansas River basin* - Thomas Creek in the Clark's Creek watershed; Swede Creek in the McDowell Creek watershed.

Based on current knowledge, populations of the Topeka shiner are assumed extirpated from the following streams: *Cottonwood River basin* - Stribby Creek and three additional tributaries in the Middle Creek watershed; *Smoky Hill River basin* - Saline River; North Fork Solomon River; Big Creek; Lime Creek in the Lyons Creek watershed; *Lower Arkansas River basin* - Elm Creek and Little Mule Creek in the Medicine River watershed; Timber Creek in the Walnut River watershed; Sand Creek in the Little Arkansas watershed; *Upper Republican River basin* - Sappa Creek and Cherry Creek; *Kansas/Lower Republican basin* - Mill Creek (Riley Co.) and the South Fork Black Vermillion in the Big Blue River watershed; Dry Creek in the Mill Creek watershed (Wabaunsee Co.); Buck Creek, Blacksmith Creek and Shunganunga Creek, direct tributaries to the Kansas River; Strowbridge Creek, Deer Creek, Rock Creek, Bury's Creek, and Camp Creek in the Wakarusa River watershed; Tomahawk Creek in the Blue River watershed; *Marais des Cygnes River basin* - Dragoon Creek.

IV. REASONS FOR DECLINE

No one factor can be considered the sole cause for the decline of the Topeka shiner throughout its range. The decline most likely results from a variety land use changes that have caused the destruction, degradation, modification, and fragmentation of essential habitat features. Factors considered to be detrimental to the species include: historic climate changes, intensive cultivation, domestic and livestock pollution, tributary impoundment, urbanization, and highway construction (Minckley and Cross, 1959; Deacon, 1961; Cross and Moss, 1987; Pflieger, 1997; USFWS, 1998; Gelwicks and Bruenderman, 1996; Missouri Department of Conservation, 1999; Schrank et al., 2000). Although many hypotheses on species decline have been advanced over the years, little quantitative data exist relating the influence of landscape-level features on Topeka shiner distribution.

Historic changes in climate have led to reduced average runoff and instability of water tables leading to more frequent intermittency of streams and higher water temperature in residual pools (Minckley and Cross, 1959). These effects have been magnified by the cultivation of prairies causing many streams to cease flow and become warm and turbid during summer months (USFWS, 1998). Minckley and Cross (1959) reported that watersheds with a high level of cultivation, and subsequent sedimentation were unsuitable for the species. In Kansas, sedimentation and eutrophication resulting from intensive agricultural development is considered the most damaging impact to Topeka shiner habitat west of the Flint Hills. The majority of populations occurring in western Kansas existed in areas now characterized by intensively cultivated row crop farming. By 1935, most of these western Kansas populations were believed extirpated (Cross and Moss, 1987). Eberle et al. (1989) compared past and recent assemblages of fish inhabiting Big Creek, Ellis County, Kansas. Five species of fish, including the Topeka shiner, were considered extirpated due to increased turbidity and siltation of the creek from cultivated land. Pflieger (1997) considered increased sedimentation from intensive row crop production and the more widespread application of pesticides to be reasons for the decline of the Topeka shiner habitat in Missouri. Menzel et al. (1984) noted the intensive row crop activity, accelerated rates of soil erosion, and in-channel sedimentation throughout many Iowa streams encompassed by the former range of the species. Blausey (2001) found Topeka shiners to be absent from streams with a high percentage of finer substrates. In contrast, shallow rocky soils and numerous limestone exposures allow little cultivation in the Flint Hills of Kansas. As a result, the streams are bordered primarily by grasslands. Similarly, the Willow Creek population occurs in an area bordered by grasslands with little cultivated crop land (Stark et al., 1999).

Other studies indicate that some of the areas where depletion of the species has occurred also coincide with areas having naturally poor aquifers or increased irrigation withdrawals affecting the quantity of water (Minckley and Cross, 1959; Cross, 1970; Cross and Moss, 1987). Cross and Braasch (1968) noted that feedlot operations on or near streams impacted prairie fish due to organic input and eutrophication of the system. The establishment of large, confined livestock operations were considered to be one factor that may have reduced the amount of Topeka shiner habitat in Missouri (Pflieger, 1997). Overgrazing riparian zones and the removal of riparian vegetation will also increase the eutrophication and sedimentation of a stream system by reducing the filtration of overland runoff (Manci, 1989; Zale et al., 1989; Missouri Department of Conservation, 1999). In South Dakota, Blausey (2001) found that as livestock grazing increased, Topeka shiner presence decreased. Although not specifically implicated in the decline of Topeka shiners, these activities diminish the physical and chemical habitat quality of streams within the species' range. In addition, it is thought that several populations of Topeka shiners were extirpated as a result of highway construction and urbanization (Minckley and Cross, 1959; Pflieger, 1997; Mammoliti, 2002). Due to ongoing urban development, the Missouri Department of Conservation has adopted specific strategies to minimize the effects of urbanization on watersheds containing Topeka shiners (Missouri Department of Conservation, 1999). In Kansas, urbanization is considered to be the primary factor in the extirpation of Topeka shiners from Shunganunga Creek (Shawnee Co.), their type locality, and from reaches of Wildcat Creek (Riley Co.).

The construction of small, mainstem impoundments is considered to be a significant factor in the decline of Topeka shiners (Pflieger, 1997; USFWS, 2001). Deacon (1961) suggested that small impoundments block the movement of Topeka shiners, thus eliminating upstream recolonization following droughts. Prophet et al. (1981) stated that a proposed plan to construct watershed impoundments may constitute a serious threat to the continued prominence of the Topeka shiner in the South Fork River basin, Chase County, Kansas. The Kansas Department of Health and Environment (1981), in conjunction with the Natural Resource Conservation Service (formerly Soil Conservation Service), conducted a study to determine the effects of small watershed dams on intermittent stream communities. This study noted that 12 species, including four cyprinids, were less abundant below impoundments, and three species, including the Topeka shiner, were absent below impoundments when compared with nearby control streams. Comparisons between fish populations above impoundments and in the upper portions of control streams revealed that eight species, including the Topeka shiner, were less abundant in impounded streams. Layher (1993) noted that five cyprinids present in 1983 and 1984 (including the Topeka shiner) were absent from Stribby Creek, Chase County, Kansas following impoundment. In a quantitative assessment, Schrank et al. (2001) determined that the number of small impoundments within a watershed was associated with the extirpation of Topeka shiners in Kansas. A recent literature review suggests a negative relationship between impoundments and obligate stream species such as the Topeka shiner (Mammoliti, 2002). Similar situations have been noted in Missouri and Iowa (Pflieger, 1997; Missouri Department of Conservation, 1999).

Large mainstem impoundments have also been implicated as a factor in the decline of the Topeka shiner. The completion of Clinton Reservoir coincided with the large scale development of tributary impoundments throughout the upper Wakarusa River watershed. Currently, all populations previously known from the Wakarusa River watershed are believed extirpated. Although the Topeka shiner still exists in two tributaries (Walnut Creek, Carnahan Creek) to Tuttle Creek Reservoir, other recently extant populations are believed to be extirpated (Fancy Creek, Mill Creek). In recent surveys of Walnut Creek and Carnahan Creek, only a single Topeka shiner was captured from each stream (Schrank et al., 2001; Kansas Department of Wildlife & Parks, 2003).

It has also been noted that the introduction of game fish into small impoundments increases the vulnerability of Topeka shiners to predation hazards in the stream above and below the impoundment. In a comparative study, the Kansas Department of Health and Environment (1981) found that predacious game species increased in abundance, and several cyprinid species, including the Topeka shiner, decreased in abundance upstream and downstream from dam sites following impoundment. Topeka shiners have also been reported extirpated from a small impoundment and tributary stream, which previously lacked largemouth bass (*Micropterus salmoides*), shortly after that species was stocked (Prophet et al., 1981). Layher (1993) noted that after impoundment, largemouth bass were found in Stribby Creek pools, both upstream and downstream from the dam while cyprinid species were essentially absent from these same pools. No cyprinids were absent from control stream samples during this study. Schrank et al. (2001) found that increasing catch per effort of largemouth bass in pools was an important predictor of the extirpation of Topeka shiners. The authors were unable to determine whether largemouth bass were influencing Topeka shiners through direct predation or whether the presence of largemouth bass was indicative of other changes in the stream or watershed, such as tributary impoundment. In Missouri, competition with introduced nongame species (western mosquitofish, *Gambusia affinis*; blackstripe topminnow, *Fundulus notatus*) has been cited as a possible reason for the decline of Topeka shiners (Pflieger, 1997). Although the absence of Topeka shiners from historic locations, which now contain these introduced species, has been documented in Kansas, the extent of potential competition among them has not been documented.

In Kansas, a substantial watershed dam construction program has developed to prevent or reduce damages caused by floodwater, scour erosion, and excessive sedimentation. This program is authorized and funded through the federal Watershed Protection and Flood Prevention Act (Public Law 83-566) and the Kansas Watershed District Act (K.S.A. 24-1201 thru 24-1237). At present, there are 86 organized watershed districts in Kansas which cover 11.5 million acres (22 percent) of the state. To date, there are approximatley 3,600 small flood control dams proposed for construction in approved watershed district plans. Of that number, approximately 1,100 have been constructed. Within the current range of the Topeka shiner, six organized watershed districts are actively pursuing impoundment construction. These activities are occurring within the Diamond Creek, Middle Creek, Jacob's Creek, South Fork Cottonwood River, Mill Creek, and Lyons Creek watersheds. In these drainage areas, 88 impoundments have been constructed with an additional 109 proposed for construction. However, the governing bodies for Mill Creek, Middle Creek, and Diamond Creek have entered into separate conservation agreements with the United States Fish &Wildlife Service and KDWP to conserve the species. These agreements allow for continued dam construction in portions of the basin without Topeka shiners or in areas where there are less viable populations, but eliminates construction in areas with viable populations. These agreements also allow for ongoing population monitoring and habitat enhancements throughout the occupied segments of each watershed. A conservation agreement between the South Fork board of directors, USFWS, and KDWP is in development. Currently, no agreement has been pursued by the Lyons Creek or Jacob's Creek watershed districts. While recent surveys indicate that Topeka shiners are present within the Lyons Creek watershed, no data are available for Jacob's Creek.

Stream channelization may also contribute to the decline of Topeka shiner populations. In Kansas, stream channelization occurs throughout the range of the Topeka shiner but is typically limited to short modifications associated with road and bridge construction. Intensive channelization of low order streams is considered to be an important factor in the drastic decline of Topeka shiners in Iowa (Menzel and Fierstine, 1976). Blausey (2001) noted the absence of Topeka shiners in channelized reaches of the Vermillion River basin of South Dakota. An additional factor having the same general effect as channelization is the extraction of gravel by dredging or scraping. The Missouri Department of Conservation considers eliminating or minimizing both activities as an important component of their efforts to stabilize and enhance Topeka shiner populations in that state (Missouri Department of Conservation, 1999). Although the effect of channelization and gravel extraction on fisheries resources has been well documented in the literature, little has been published about these effects in Kansas. In general, these activities significantly degrade in-channel habitat conditions by altering bank stability, channel width and depth, flow patterns and bedload transport, reducing water quality, deep pool habitats, instream debris, and woody riparian vegetation (Simpson et al., 1982; Zale et al., 1989; Kanehl and Lyons, 1992; Brown and Lytle, 1992). Currently, extensive gravel extraction occurs in the Mill Creek watershed (Wabaunsee County), and moderate levels of extraction occur in the South Fork Cottonwood (Chase County) and Deep Creek (Riley County) watersheds. Little is known about the level of gravel extraction in other Topeka shiner watersheds.

V. RECOVERY

A. <u>*Objective*</u>: The goals of this recovery plan are to: 1) stabilize, protect, and enhance existing populations of Topeka shiner and its habitat in Kansas; 2) identify unoccupied areas of historic habitat capable of supporting, or capable of being restored to support the species, and reintroduce populations to these areas; 3) downlist and delist the species as identified by criteria outlined in this section.

B. <u>*Recovery Units*</u>: This plan identifies four separate and distinct recovery units (RU) in Kansas: Lower Kansas River Basin, Blue River Basin, Cottonwood River Basin, Willow Creek/Upper Smoky Hill River Basin (Appendix A, Figure 1). The boundaries of each RU are based on watershed units, the genetic variability between existing populations, and the degree of geographic isolation. Each RU supports known populations and contains habitat features that provide the physiological, behavioral, and ecological requirements essential for the species. Conservation of the known populations within each RU is considered critical for the survival and recovery of the species. The reestablishment of additional populations within each RU is necessary for the eventual delisting of the species. Enhancement of habitat conditions and reestablishment of Topeka shiner populations in watersheds with only historic records will be undertaken if further investigation concludes this activity to be feasible and/or an important component of species recovery. The following is a general description of each RU:

1. <u>Lower Kansas River Basin</u> - All direct and indirect tributaries to the Kansas River from its confluence with the Missouri River, Wyandotte County to: Kanopolis Dam on the Smoky

Hill River, Ellsworth County; Wilson Dam on the Saline River, Russell County; Glen Elder Dam on the Solomon River, Mitchell County; Milford Dam on the Republican River, Geary County; and Tuttle Creek Dam on the Blue River. This basin contains multiple populations and variable habitat conditions.

2. Big Blue River Basin - All direct and indirect tributaries to the Big Blue River from the flood pool of Tuttle Creek Reservoir upstream to their headwaters and/or to the Kansas/Nebraska border. This basin contains multiple populations and variable habitat conditions.

3. Cottonwood River Basin - All direct and indirect tributaries to the Cottonwood River upstream from its confluence with the Neosho River, Lyon County, to its headwaters. This basin contains multiple populations and variable habitat conditions.

4. Willow Creek/Upper Smoky Hill River Basin - All direct and indirect tributaries to the Smoky Hill River from Cedar Bluff Dam, Trego County, to the Kansas/Colorado border. This basin has one isolated population and minimal habitat availability.

C. *Criteria*: The following recovery criteria are established to guide downlisting or delisting decisions. Baseline population levels will be used to determine if populations are stable, increasing, or decreasing. To determine population distribution, abundance, and trends, scientifically sound monitoring protocols have been developed and made a part of this plan (Appendix B). Reclassification of the species from threatened to species in need of conservation (SINC) will be recognized as achieved when:

1. All naturally occurring populations within the Lower Kansas, Big Blue, and Cottonwood river basins are determined to be stable or increasing over a period of 10 years.

2. A minimum of 8 reintroduction efforts in the Lower Kansas (3), Big Blue (2), and Cottonwood (3) river basins have been implemented and actively monitored for three years.

3. The natural population in Willow Creek (Wallace County) is determined to be stable or increasing over a period of 10 years; and a minimum of two reintroduction efforts have been implemented in the Upper Smoky Hill river basin and actively monitored for a minimum of three years.

Delisting of the species will be undertaken when:

1. All populations (natural and reintroduced) in the Lower Kansas, Big Blue, Cottonwood, and Upper Smoky Hill river basins are determined to be stable or increasing for a period of 10 years.

VI. NARRATIVE OUTLINE

The following narrative outline briefly describes the action items that, if implemented, will result in achieving the Recovery Plan objective. The chronological sequence of action items does not indicate the relative priority of an item.

1. Protect existing populations and occupied habitats in the Primary Recovery Units.

Preservation of existing populations and essential habitat features is critical to success of this recovery effort.

1.1 Identify state and federal conservation programs to enhance, conserve, and mitigate Topeka shiner habitat. As the majority of the known populations and critical habitat are on privately owned streams, existing conservation programs that target and fund water quality or habitat improvement measures on private land should be encouraged.

1.1.1 Determine priority watersheds within each PRU for implementation of conservation strategies that address the individual factors identified under "**Reasons For Decline**."

1.1.2 Identify and prioritize specific stream reaches and/or sites to implement appropriate conservation practices.

1.1.3 Monitor the implementation of conservation practices to determine their effect on habitat features and Topeka shiner populations.

1.1.4 Seek assistance from producer organizations such as the Kansas Farm Bureau and Kansas Livestock Association as well as local Conservation Districts to encourage member participation in conservation programs in priority watersheds.

1.1.5 Utilize the expertise within existing government agencies such as the Natural Resources Conservation Service, the United States Fish & Wildlife Service, the Kansas State Conservation Commission, and the Kansas Department of Agriculture to apply appropriate conservation programs in priority watersheds.

1.2 Enter into conservation agreements (i.e. safe harbor, no take) with federal and state agencies, political subdivisions of the state, and private landowners to carry out management actions that meets the goals of recovery. Landowner concern about the regulatory burden of an endangered species being discovered or introduced on their property is a deterrent to habitat enhancement and species reestablishment. Conservation agreements provide assurance to landowners by allowing specific management activities without penalties of law enforcement action or permitting requirements.

1.2.1 Develop/promote incentive programs that encourage landowner participation in conservation agreements.

1.3 Utilize existing state and federal regulatory authority to protect the species and its habitats. Habitat and water quality degradation are the primary factors impacting Topeka shiners. Enforcement of current laws and regulations that address environmental protection is essential to successful recovery.

2. Conduct studies on the life history, ecological requirements, population dynamics, and community interactions of the Topeka shiner. Additional information regarding Topeka shiner biology, competitive interactions with associated native and introduced species, and limiting habitat factors is needed to meet recovery goals.

2.1 Update distributional data with additional sampling in unsurveyed stream reaches. Fill in distributional data gaps using Aquatic Gap analysis developed by Kansas State University.

2.2 Determine population dynamics and mobility of the species. The size and extent of Topeka shiner populations are not well quantified. Due to a lack of information on the mobility and/or transitory nature of the species, population stability appears weak.

2.2.1 Determine habitat preferences and recruitment rates for early life stages. Well developed studies that assess the spatial distribution, growth, and survival of young-of-year Topeka shiner will improve conservation efforts.

2.2.2 Determine dispersal characteristics of populations and barriers to movement. Analyses of immigration/emigration, distance of movement, seasonal hydrologic influences, channel morphology, natural and man-made barriers to movement will assist understanding of distinct populations for conservation management.

2.2.3 Determine food habits, preferences, and availability.

2.2.4 Determine the extent and effect of interspecific competition and predation between Topeka shiners and other native and introduced species. The introduction of exotic, non-native and native, piscivorous fish species has been identified as one reason for the decline of the Topeka shiner. Also, little data exists regarding the relationships among Topeka shiner and associated native stream species.

2.2.5 Determine and quantify physical and chemical habitat characteristics, and limiting factors to reproduction and recruitment.

2.2.6 Determine the impacts of stream alterations including increased sediment and nutrient input, gravel excavation, tributary impoundment, and road and bridge construction on the species.

2.3 Continue genetic studies to define population boundaries and genetic limitations that may impact the species. Further genetic analysis should be the basis for defining conservation units and maintaining the historical geographic distribution.

3. Develop a plan to implement long-term monitoring of populations and habitats. A long-term monitoring program must be developed, funded, and implemented to determine population status and trends. The plan must provide sufficient statistical power to allow classification of Topeka shiner populations as stable, increasing, or decreasing.

3.1 Monitor annually Topeka shiner populations and instream habitats within all occupied habitats of each PRU.

3.2 Develop an instream habitat and riparian assessment methodology to quantify conditions and trends as they relate to Topeka shiner conservation.

4. Initiate reintroduction efforts in suitable, non-occupied habitats within each PRU. To meet recovery goals and achieve downlisting/delisting of the species, additional populations must be established.

4.1 Determine the minimum number of individuals, age structure, and male/female ratios required to ensure population viability.

4.2 Develop criteria to identify and evaluate potential reintroduction sites. Criteria should take into account the source stock of Topeka shiners, geographic location and connectivity to other populations, physical and chemical habitat features (including habitat stability), presence of associated stream fishes, and availability of preferred food items.

4.3 Establish priority sites for reintroduction based upon established criteria.

4.4 Continue development of culture techniques to produce fish for reestablishment efforts.

4.5 Monitor all reintroduced populations to determine success/failure. Monitoring should follow the methodologies and procedures established under Section 3.

5. Develop and implement a public awareness and educational program about the Topeka shiner. Public interest and support of the proposed recovery actions are essential to the success of this plan and the continued survival of the Topeka shiner.

    5.1 Develop articles, notices, and informational material regarding the status of the Topeka shiner recovery effort. The use of news releases, magazine articles, brochures, and the Department web site will achieve a wide distribution of information related to the species and its recovery.

    5.2 Develop various visual aids to highlight the species, its needs, and recovery efforts. Slide and/or video presentations, posters, and trading cards developed and made available to landowners, educators, District Biologists, legislators, producer and environmental organizations will provide basic educational information.

        5.2.1 Provide input and support for educational programs such as StreamLink and Project Wet.

    5.3 Work directly with local organizations and landowners to develop pilot projects that restore water quality and enhance habitat conditions for the species. Projects should not only convey a benefit to the Topeka shiner but also benefits to producers and the local community.

    5.4 Develop a program to recognize landowners whose stewardship has provided relatively intact stream systems that maintain Topeka shiner populations.

6. Implement an adaptive management program to ensure that appropriate actions are taken to attain recovery and eventual downlisting of the species. As additional information becomes available, this recovery plan may require amendment to order to recover the species while minimizing economic and social impacts.

    6.1 Maintain a volunteer advisory committee composed of members representative of the areas affected by recovery actions, other governmental resources agencies, and species experts from academia. Involvement of the advisory committee may include: review of research proposals, evaluation of recovery actions, amendments to the recovery plan, evaluation of new data, prioritization of pilot projects and reintroduction efforts.

    6.2 Review and revise research and management activities to further define the needs and threats to the Topeka shiner.

    6.3 Reevaluate recovery criteria and implementation actions every five years and recommend appropriate amendments. The recovery plan will only be as effective as the method of evaluation. Periodic review is needed to determine if objectives and tasks are in line with current research knowledge. Delisting the species is dependent on successfully meeting the recovery criteria of stabilizing existing populations and the reestablishment of the species in new portions of its historic range. Recurrent evaluation is necessary to determine if recovery criteria have been met.

VII. IMPLEMENTATION TASKS

The schedule found in Appendix C is a guide for implementing the action items (tasks) identified in Part VI of this plan. The schedule indicates task priorities, task numbers, task description, task duration, and estimated costs. It should be noted that not all the monetary needs involved in recovery are known. Therefore, Part VII reflects the total estimated financial requirements for research and data collection, and administrative actions. Other costs will be determined as specific action items are undertaken.

The tasks necessary to recover the Topeka shiner are ranked in three categories:

Priority 1 - an action that must be taken to prevent a species from irreversible decline or extirpation.

Priority 2 - an action that must be taken to prevent a further decline in species abundance, range, or other negative impacts to a species short of extirpation.

Priority 3 - all other actions necessary to meet recovery objectives.

VIII. DESIGNATED CRITICAL HABITAT

Under K.A.R. 115-15-4(c)(1)(E), a recovery plan shall include critical habitat designations required for conservation of the species under consideration. Critical habitat is defined as: a) specific areas documented as currently providing essential physical and biological features and supporting a self-sustaining population of a listed species; or b) specific areas not documented as currently supporting a listed species, but determined essential for the listed species by the Secretary (K.A.R. 115-15-3). Operationally, documentation relies on occurrence records of the species or identification of the essential habitat requirements as obtained through field assessment and scientific studies conducted by KDWP, state universities, and other qualified individuals or organizations.

For a particular area to be designated, the following criteria are considered:

1) Is the candidate area within the listed species current probable range?
2) Are there documented occurrence records of the species within the past 35 years?
3) Are there documented historic (greater than 35 years old) occurrence records?
4) Does the candidate area possess those habitat features known to be essential to support a population of the species?
5) Does the species occur in the state as a migrant, seasonal resident, or permanent

resident?

For a permanent resident species such as the Topeka shiner, a candidate area must meet criteria 1 and 4 before further consideration as critical habitat. If the candidate area also meets criteria 2, it is then designated as critical habitat. In cases where only historical occurrence records exist, professional judgement by KDWP personnel is utilized to determine whether a population is likely to occur. If so, the candidate area is designated critical habitat.

Stream habitat conditions in Kansas are dynamic and fish species may move from one area to another over time. These movement patterns will vary seasonally with changing hydrologic conditions, community interactions, and reproductive behavior. Species adapted to intermittent flow typically spawn in headwater pools, and several authors have noted the importance of intermittent streams as nursery areas for juveniles and fry (Erman and Leidy, 1975; Williams and Coad, 1979; Barber, 1986; Zale and others, 1989; Liechti, 1994; Kerns and Bonneau, 2002; Mammoliti, 2002). Of specific interest for this recovery plan, upstream movement as reproductive behavior has been documented in Topeka shiners (Minckley and Cross, 1959; Barber, 1986; Kerns and Bonneau, 2002). As such, for candidate areas meeting the above criteria, all perennial and many intermittent reaches upstream of the most downstream point of known or historic occurrence were designated critical habitat for the Topeka shiner. Some upstream, intermittent areas were not designated based on knowledge of topographic or hydrologic factors that prohibit use by the Topeka shiner. In addition, significant consideration was given to those stream segments proposed by the USFWS as federal critical habitat (USFWS, 2002).

To reduce the impact of habitat fragmentation within a watershed, critical habitat was designated for certain reaches of larger streams to maintain connectivity between tributary sub-populations. For example, while there are no records of Topeka shiner in the Diamond Creek mainstem, the designated reach constitutes a pathway for movement among several tributaries with known occurrences. The Diamond Creek mainstem provides a connection for the exchange of individuals between populations, colonization of new areas, and recolonization of areas where localized extirpation may occur. Should the reach between populated tributaries serve as a barrier, the isolated populations are then exposed to an increased risk of extirpation from random environmental fluctuations. As habitat fragmentation is considered by some to be the most basic threat to many species, the concept of habitat connectivity was applied throughout the process of critical habitat designation.

Currently, the following areas are proposed for formal designation as critical habitat for Topeka Shiners:

A. ***Cottonwood River Basin*** (Appendix A, Figure 2)

<u>South Fork Cottonwood Complex</u> - This system is characterized by high-quality aquatic habitat draining large tracts of tallgrass prairie. Portions of the bottomland along the South Fork are utilized for row crop agriculture. Numerous tributary streams are known to contain

populations of the Topeka shiner. A plan to construct flood control impoundments throughout the system has been partially implemented but is currently on hold pending development and approval of a Conservation Agreement.

Thurman Creek mainstem from where it enters the South Fork Cottonwood River (Sec. 28, T22S, R8E,Chase County) upstream through Sec. 17, T23S, R9E, Greenwood County.

An unnamed tributary from its point of entry to Thurman Creek (Sec. 1, T23S, R8E, Greenwood County) upstream through Sec. 5, T23S, R9E (Greenwood County) and Sec. 32, T22S, R9E (Chase County).

South Fork Cottonwood River mainstem in Chase County from its point of exit at Sec. 33, T20S, R8E, upstream through Sec. 21, T23S, R8E, Butler County.

Mercer Creek mainstem and its three major tributaries (including Jack Creek) in Chase County from where it enters the South Fork Cottonwood River (Sec. 8, T22S, R8E) upstream to the Chase/Butler County line Sec. 31, T22S, R8E and through Sec. 14 and 26, T22S, R7E and Sec. 30, T22S, R8E.

Crocker Creek mainstem and its major tributary in Chase County from where it enters the South Fork Cottonwood River (Sec. 31, T21S, R8E) upstream through Sec. 1, T22S, R7E and Sec. 36, T21S, R7E.

Rock Creek mainstem in Chase County from where it enters the South Fork at Sec. 33, T20S, R8E upstream through Sec. 1, T21S, R7E.

An unnamed tributary from where it enters Rock Creek (Sec. 1, T21S, R7E) upstream through Sec. 4 and 9, T21S, R7E.

Den Creek mainstem in Chase County from where it enters Rock Creek (Sec. 31, T20S, R8E) upstream through Sec. 23, T20S, R7E.

Little Cedar Creek mainstem and one minor tributary in Chase County from where it enters the South Fork Cottonwood River (Sec. 8, T22S, R8E) upstream through Sec. 23 and 24, T22S, R9E.

Shaw Creek mainstem in Chase County from where it enters Little Cedar Creek (Sec. 16, T22S, R8E) upstream through Sec. 14, T22S, R8E.

Sharpes Creek mainstem in Chase County from where it enters the South Fork (Sec. 34, T20S, R8E) upstream through Sec. 36, T21S, R8E.

<ins>Fox Creek Complex</ins> - This system is characterized by high-quality aquatic habitat draining

the lower reaches of the Fox Creek watershed. All designated reaches occur on the Tallgrass Prairie National Preserve which is managed by the United States National Park Service.

Fox Creek mainstem from its point of exit at Sec. 8, T19S, R8E (Chase County) upstream through Sec. 29, T18S, R8E.

An unnamed tributary on the Tallgrass Prairie National Preserve from where it enters Fox Creek (Sec. 29, T18S, R8E) upstream to its headwaters.

An unnamed tributary on the Tallgrass National Prairie Preserve from where it enters Fox Creek (Sec. 32, T18S, R8E) upstream to its headwaters.

Diamond Creek Complex - This system includes the mid- and lower reaches of Diamond Creek and several major tributaries. The area is characterized by high-quality aquatic habitat draining large tracts of tallgrass prairie. Recent collection records exist. A plan for tributary impoundment is partially implemented with remaining development governed by an approved Conservation Agreement.

Diamond Creek mainstem from where it enters the Cottonwood River (Sec. 14, T19S, R7E, Chase County) upstream to its confluence with Sixmile Creek (Sec. 22, T17S, R6E, Morris County).

An unnamed tributary to Diamond Creek in Chase County from their confluence (Sec. 9, T19S, R7E) upstream to the western line of Section 9.

Gannon Creek mainstem and its major upper tributary in Chase County from where it enters Diamond Creek (Sec. 10, T19S, R7E) upstream to its headwaters (Sec. 11 and 24, T18S, R7E).

Mulvane Creek mainstem in Chase County from where it enters Diamond Creek (Sec. 33, T18S, R7E) upstream through Sec. 16, T18S, R6E.

Schaffer Creek mainstem in Chase County from where it enters Diamond Creek (Sec. 19, T18S, R7E) upstream to where it crosses the Chase/Morris County line (Sec. 4, T18S, R7E).

Dodds Creek mainstem in Morris County from its confluence with Diamond Creek (Sec. 26, T17S, R6E) upstream through Sec. 1, T17S, R6E.

Sixmile Creek mainstem in Morris County from where it enters Diamond Creek (Sec. 22, T17S, R6E) upstream to its confluence with Mulberry Creek (Sec. 21, T17S, R6E).

Mulberry Creek mainstem and two of its upper tributaries in Morris County from where it enters Sixmile Creek (Sec. 21, T17S, R6E) upstream through Sec. 30, T17S, R6E.

An unnamed tributary to Diamond Creek in Morris County from their confluence (Sec. 35, T17S, R6E) upstream to its headwaters (Sec. 33, T17S, R6E).

Middle Creek Complex - This system includes the mid-reaches and tributaries of Middle Creek. It is characterized by high-quality aquatic habitat draining large tracts of tallgrass prairie. A plan for tributary impoundment is partially implemented with remaining development governed by an approved Conservation Agreement.

Middle Creek mainstem in Chase County from its point of exit at Sec. 19, T19S, R7E, upstream through Sec. 8, T19S, R6E.

Collett Creek mainstem and its major upper tributaries in Chase County from where it enters Middle Creek (Sec. 18, T19S, R7E) upstream through Sec. 27, T18S, R6E.

An unnamed tributary in Chase County from where is enters Middle Creek (Sec. 10, T19S, R6E) upstream through Sec. 33 and 34, T18S, R6E.

Other Direct Cottonwood River Tributaries - These areas consist of high-quality aquatic habitat draining large tracts of tallgrass prairie.

Bloody Creek mainstem in Chase County from where it enters Sec. 29, T19S, R9E upstream through Sec. 3, T21S, R9E.

An unnamed tributary in Chase County from where it enters the Cottonwood River (Sec. 13, T19S, R7E) upstream to its headwaters on the Tallgrass Prairie National Park (Sec. 30, T18S-R8E).

Mud Creek mainstem in Marion County beginning from its point of exit at Sec. 13, T19S, R3E, upstream through Sec. 28, T18S, R3E.

B. ***Lower Kansas River Basin*** (Appendix A, Figure 3)

Lyon Creek Complex - This system contains a wide range of aquatic habitat quality. The basin is a mixture of native grasslands, domestic grass pasture, and row crop agriculture. A plan for tributary impoundment is partially implemented with remaining development on hold pending development and approval of a approved Conservation Agreement (Appendix A, Figure 3a).

Lyon Creek main stem from its point of exit at Sec. 31, T13S, R5E (Geary County) upstream to its confluence with West Branch Lyon Creek (Sec. 2, T15S, R4E, Dickinson County).

Unnamed tributary in Dickinson County from where it enters Lyon Creek (Sec. 8, T16S, R4E) upstream through Sec. 26, T16S, R3E.

Unnamed tributary in Dickinson County from where it enters the above unnamed tributary (Sec. 18, T16S, R4E) upstream through Sec. 13, T16S, R3E.

Rock Springs Creek from where it enters Lyon Creek (Sec. 31, T13S, R5E, Geary County) upstream through Sec. 5, T14S, R5E, Dickinson County.

Cary Creek main stem from where it enters Lyon Creek (Sec. 31, T13S, R5E, Geary County) upstream through Sec. 28, T15S, R3E, Dickinson County.

Unnamed tributary from where it enters Cary Creek (Sec. 19, T14S, R4E, Dickinson County) upstream through Sec. 24, T14S, R3E, Dickinson County.

West Branch Lyon Creek main stem in Dickinson County from where it enters Lyon Creek (Sec. 2, T15S, R4E) upstream through Sec. 16, T16S, R3E.

Unnamed tributary in Dickinson County from where it enters the West Branch Lyon Creek (Sec. 19, T15S, R4E) upstream through Sec. 24, T15S, R3E.

Unnamed tributary in Dickinson County from where it enters the West Branch Lyon Creek (Sec. 36, T15S, R3E) upstream through Sec. 35, T15S, R3E.

<u>Clark's Creek Complex</u> - This system is characterized by high-quality aquatic habitat draining tallgrass prairie uplands and moderately cultivated bottomlands (Appendix A, Figure 3a).

Clark's Creek main stem from its confluence with Dry Creek (Sec. 23, T12S, R6E, Geary County) upstream to its confluence with Thomas Creek (Sec. 34, T12S, R6E).

Thomas Creek mainstem from where it enters Clark's Creek (Sec. 34, T12S, R6E, Geary County) upstream to the Geary/Morris County line (Sec. 34, T13S, R6E).

Davis Creek mainstem from where it enters Thomas Creek (Sec. 2, T13S, R6E, Geary County) upstream through Sec. 31, T13S, R7E.

Dry Creek mainstem and one major tributary (West Branch) from where it enters Clark's Creek (Sec. 23, T12S, R6E, Geary County) upstream through Sec. 21 and 22, T13S, R7E.

<u>Fort Riley Complex</u> - This system includes Wildcat Creek and one major tributary and Sevenmile Creek a direct tributary to the Kansas River. The area contains high-quality aquatic habitat with widely varying land uses. The majority of this system is contained within the Fort Riley Military Reservation (Appendix A, Figure 3b).

Wildcat Creek mainstem from its point of exit at Sec. 16, T10S, R7E, Riley County, upstream to U.S. Highway 77 (Sec. 3, T9S, R5E).

Little Arkansas Creek mainstem and one major tributary from where it enters Wildcat Creek (Sec. 28, T9S, R6E, Riley County) upstream through Sec. 24, T9S, R5E.

Sevenmile Creek mainstem from its point of exit at Sec. 36, T10S, R6E, Riley County, upstream through Sec. 18, T10S, R6E.

Deep Creek Complex - This area is characterized by high-quality aquatic habitat draining tallgrass prairie uplands and moderately cultivated bottomlands (Appendix A, Figure 3c). Deep Creek main stem from where it exits Riley County (Sec. 22, T10S, R9E) upstream to Interstate Highway 70 (Sec. 25, T11S, R9E).

School Creek from where it enters Deep Creek (Sec. 6, T11S, R9E, Riley County) upstream through Sec. 2, T11S, R8E.

Mill Creek Complex - This area is characterized by high-quality aquatic habitat draining large tracts of tallgrass prairie uplands and extensively cultivated bottomlands. A plan for tributary impoundment is partially implemented with remaining development governed by an approved Conservation Agreement (Appendix A, Figure 3c).

Mill Creek main stem in Wabaunsee County from it's confluence with Mulberry Creek (Sec. 25, T11S, R11E) upstream to its confluence with the West Branch Mill Creek and the South Branch Mill Creek (Sec. 15, T12S, R10E).

Mulberry Creek main stem in Wabaunsee County from where it enters Mill Creek (Sec. 25, T11S, R11E) upstream through Sec. 10, T11S, R11E.

Snokomo Creek mainstem in Wabaunsee County from where it enters Mill Creek (Sec. 25, T11S, R11E) upstream through Sec. 18, T12S, R12E.

Spring Creek main stem in Wabaunsee County from where it enters Mill Creek (Sec. 28, T11S, R11E) upstream through Sec. 21, T11S, R11E.

Kuenzli Creek main stem in Wabaunsee County from where it enters Mill Creek (Sec. 33, T11S, R11E) upstream through Sec. 21, T12S, R11E.

Paw Paw Creek main stem in Wabaunsee County from where it enters Mill Creek (Sec. 31, T11S, R11E) upstream through Sec. 11, T11S, R10E.

Pretty Creek main stem in Wabaunsee County from where it enters Mill Creek (Sec. 36, T11S, R10E) upstream to Kansas Highway 99 (Sec. 22, T11S, R10E).

Hendricks Creek main stem in Wabaunsee County from where it enters Mill Creek (Sec. 2, T12S, R10E) upstream through Sec. 31, T11S, R10E.

West Branch Mill Creek main stem in Wabaunsee County from its confluence with South Branch Mill Creek (Sec. 15, T12S, R10E) upstream through Sec. 19, T13S, R9E.

Loire Creek main stem in Wabaunsee County from where it enters West Branch Mill Creek (Sec. 29, T12S, R10E) upstream through Sec. 2, T12S, R9E.

Illinois Creek main stem in Wabaunsee County from where it enters West Branch Mill Creek (Sec. 30, T12S, R10E) upstream through Sec. 24, T13S, R9E.

Spring Creek main stem in Wabaunsee County from where it enters West Branch Mill Creek (Sec. 30, T12S, R10E) upstream through Sec. 21, T12S, R9E.

South Branch Mill Creek main stem in Wabaunsee County from its confluence with West Branch Mill Creek (Sec. 15, T12S, R10E) upstream to Kansas Highway 4/99 (Sec. 26, T13S, R10E).

East Branch Mill Creek main stem in Wabaunsee County from its confluence with South Branch Mill Creek (Sec. 35, T12S, R10E) upstream through Sec. 22, T13S, R11E.

Nehring Creek main stem in Wabaunsee County from where it enters East Branch Mill Creek (Sec. 1, T13S, R10E) upstream through Sec. 15, T13S, R11E.

Mission Creek - This area is characterized by high-quality aquatic habitat draining tallgrass prairie uplands and moderately cultivated bottomlands (Appendix A, Figure 3c).

Mission Creek main stem from where it crosses State Highway 4 (Sec. 9, T12S, R14E, Shawnee County) upstream through Sec. 2, T13S, R12E, Wabaunsee County.

C. ***Blue River Basin*** (Appendix A, Figure 3b)

Big Blue River Complex - This system includes four widely separate and geographically isolated streams having varying habitat quality. North Elm Creek is a direct tributary to the Big Blue River with row crop agriculture as the predominant land use within the watershed. Habitat quality is moderately degraded by sedimentation. Clear Fork Creek is a tributary to the Black Vermillion and located upstream of the Tuttle Creek Reservoir flood pool. This area is characterized by high-quality aquatic habitat draining tallgrass prairie uplands and moderately cultivated bottomlands. Walnut Creek is characterized by good quality aquatic habitat draining tallgrass prairie uplands and moderately cultivated bottomlands. This stream is a direct tributary to Fancy Creek and its lower reaches are occasionally inundated by the Tuttle Creek Reservoir flood pool. Carnahan Creek is characterized by good quality aquatic habitat draining tallgrass prairie uplands. This stream drains directly into Tuttle Creek Reservoir and its lower reaches are occasionally inundated by the Tuttle Creek Reservoir flood pool.

North Elm Creek main stem in Marshall County from where it enters the Big Blue River (Sec. 11, T1S, R7E) upstream through Sec. 21, T1S, R8E.

Clear Fork Creek main stem from its confluence with Jim Creek (Sec. 17, T5S, R9E, Marshall County) upstream through Sec. 18, T6S, R10E, Pottawatomie County.

Walnut Creek main stem from its point of exit at Sec. 19, T7S, R6E, Riley County, upstream through Sec. 1, T8S, R5E.

Carnahan Creek main stem from its point of exit at Sec. 14, T8S, R7E, Pottawatomie County, upstream through Sec. 31, T7S, R8E.

D. ***Willow Creek/Upper Smoky Hill Basin*** (Appendix A, Figure 4)

The available habitat in this system is restricted to a series of spring fed pools. The land use in the watershed is primarily shortgrass prairie with sporadic irrigated and dryland row crop production.

Willow Creek main stem in Wallace County from where it enters the Smoky Hill River (Sec. 17, T13S, R41W) upstream through Sec. 3, T13S, R41W.

IX. CONSERVATION ASSISTANCE PROGRAMS

Although the Kansas Department of Wildlife & Parks will have primary responsibility for implementation of this recovery plan, other State, Federal, and local government agencies, private organizations and private landowners will play a fundamental role in the success of this effort. Of primary importance will be the involvement of private landowners, utilizing existing conservation programs. Funding is currently available for a wide variety of watershed enhancement projects from state and federal conservation programs that will benefit the recovery of the Topeka shiner. The following is a brief description of organizations and their programs that can provide for incentive-based opportunities on private lands.

A. <u>Federal Agencies</u>

Natural Resources Conservation Service - The NRCS is an agency of the U.S. Department of Agriculture whose mission is to provide leadership and assistance in the conservation of soil and water resources. The NRCS oversees a variety of programs and practices that would provide conservation benefits to the Topeka shiner.

Conservation Reserve Program: CRP encourages landowners to convert highly erodible cropland or other environmentally sensitive land to permanent vegetative cover, such as native grasses, wildlife plantings, trees, filterstrips, and/or riparian buffers. Farmers receive and annual rental payment for the term of the multi-year contract. Cost sharing is provided to establish the vegetative cover. Implementation of this program in Topeka shiner watersheds would reduce sedimentation and nutrient impact from cropland runoff.

Environmental Quality Incentives Program: EQIP is a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible national goals. EQIP offers financial and technical help to assist eligible participants install or implement structural and management practices on eligible agricultural land. Program objectives are achieved through the implementation of a conservation plan, which includes structural, vegetative, and land management practices. Incentive payments may be made to implement one or more eligible practices such as animal waste storage systems, nutrient and manure management, irrigation water management, terraces, filterstrips, tree planting, and wildlife habitat management. Implementation of this program in Topeka shiner watersheds would reduce sedimentation and nutrient impacts from cropland and/or animal feeding facilities.

Forestry Incentives Program: FIP provides forest maintenance and reforestation practices that encourage numerous natural resource benefits, including reduced wind and soil erosion and enhanced water quality and wildlife habitat. Available practices under FIP are conversion from nonforest land into forest land (tree planting), improved forest management; and site preparation for natural regeneration. These practices would reduce sedimentation and nutrient inputs from adjacent agricultural land.

Soil and Water Conservation Assistance: SWCA provides cost share and incentive payments to farmers and ranchers to voluntarily address threats to soil, water, and related natural resources, including grazing land, wetlands, and wildlife habitat. SWCA will help landowners comply with Federal and state environmental laws and make beneficial, cost-effective changes to cropping systems, grazing management, nutrient management, and irrigation.

Wildlife Habitat Incentives Program: WHIP is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. Up to 15% of funds made available annually to a State may be used for increased cost-share payments to participants who restore and protect essential wildlife habitat using a WHIP agreement with a duration of at least 15 years. Essential habitats are those areas designated as "critical habitat" by the USFWS or the appropriate State wildlife agency. WHIP may pay up to 100% of the eligible costs associated with implementation of practices that develop or improve essential habitats for at-risk species.

United States Fish and Wildlife Service - The USFWS is an agency of the U.S. Department of the Interior. Protecting endangered and threatened species and restoring them to a secure status is a primary role of this agency. The USFWS oversees several programs that would provide funding for conservation of the Topeka shiner.

Partners for Fish and Wildlife: Partners is a voluntary program to encourage cooperation and financial incentives to restore degraded or marginal habitats for fish and wildlife benefits. In Kansas, the program has been used to cost share alternative livestock watering facilities and bank stabilization in streams known to support Topeka shiners.

Endangered Species Habitat Planning and Habitat Acquisition: These two programs were established to help reduce the conflicts between the conservation of threatened and endangered species and land development and use. Under the Habitat Conservation Plan Land Acquisition Program, the Service provides grants to States or Territories for land acquisitions associated with approved Habitat Conservation Plans. The Habitat Conservation Planning Assistance Program provides grants to States and Territories to support the development of Habitat Conservation Plans, through support of baseline surveys and inventories, document preparation, outreach, and similar planning activities.

Private Stewardship Program: PSP provides grants and other assistance on a competitive basis to individuals and groups engaged in local, private, and voluntary conservation efforts that benefit federally listed, proposed, or candidate species, or other at-risk species. A ten percent (10%) match of cash or through in-kind contributions is required. The program is available to private landowners and their partners.

Cooperative Endangered Species Conservation Fund (Section 6 of the ESA): Section 6 funding is available to provide grants to States and Territories to participate in a wide array of voluntary conservation and research projects for candidate, proposed and listed species. KDWP is cost-sharing three Section 6 projects from 2002 through 2004 regarding Topeka shiner research and management. The status and a brief description of these projects can be found in Appendix E.

B. *State Agencies*

Kansas State Conservation Commission - The SCC works with the 105 local conservation districts, the 86 organized watershed districts and state and federal agencies, to administer programs that improve water quality, reduce soil erosion, conserve water and reduce flood potential. The SCC programs are designed to assist local entities and individuals with financial assistance and technical expertise regarding natural resource concerns.

Water Quality Buffer Initiative: The goal of the WQBI is to enhance participation under the

federal Conservation Reserve Program (CRP) for the installation of riparian forests buffers and grass filter strips. The state provides per acre rental payments supplementing federal rental payments received through the CRP to restore water quality in high priority watersheds.

Water Quality Best Management Practices: WQBMP provides cost-share assistance to landowners for the installation of Best Management Practices (BMP's) to protect or improve water quality. These practices address projects related to: erosion/sediment control; livestock waste management; rangeland management; riparian area protection; forest buffer; wetland development/restoration.

Water Resources Cost-Share Program: WRCSP provides state financial assistance to landowners for the establishment of enduring water conservation practices to protect and improve water quality. Practices include: tree planting, fencing, waterways. The assistance is provided through policies established by local conservation districts.

Non-point Source Pollution Control Fund: NPSPCF provides financial assistance for NPS pollution control practices such as riparian buffers and streambank stabilization. Funding is provided to local conservation districts and allocated through established policies.

Riparian and Wetland Protection Program: RWPP is designed to protect and restore riparian areas and wetlands through comprehensive conservation plans. Financial and technical assistance are available for projects such as alternative livestock water supplies, riparian fencing, tree plantings, and streambank stabilization.

Stream Rehabilitation Program: SHP provides financial assistance for planning and implementing approved stream rehabilitation projects. This program addresses streams that have been adversely modified by channel modification.

Kansas Forest Service - The KFS promotes long-term sustainability of forest resources by encouraging landowners to actively manage their woodlands and windbreaks. The KFS provides technical and financial assistance, and publications to rural landowners for windbreak design, timber management, disease diagnosis, timber harvest information, timber marking, and wildlife habitat.

Forest Land Enhancement Program: FLEP covers 75% of the cost to plant trees and manage woodlands and windbreaks to enhance the productivity of timber, fish, wildlife habitat, soil and water quality, wetlands, and recreational resources. FLEP 5 (Water Quality Improvement and Watershed Protection) includes tree planting adjacent to streams and rivers to improve water quality and protect riparian areas.

Kansas Department of Health and Environment - The Watershed Management Section within the KDHE Division of Environment implements Section 319 of the Clean Water Act, coordinating programs designed to eliminate or minimize nonpoint source pollution. The section develops and reviews strategies, management plans, local environmental protection plans, and county environmental codes intended to control pollution.

Clean Water Neighbors: CWN provides small grants ($5,000 maximum) to implement projects that demonstrate nonpoint source pollution control practices. Examples of physical measures that are eligible for funding include: biotechnical streambank stabilization; construction of small wetlands; and revegetation of bare soils. Forty percent of the project cost must be supplied by the grant applicant.

Stream Stewardship Program: SSP operates similarly to CWN but is restricted to projects that demonstrate riparian area management for water quality protection. Eligible projects include: riparian buffer strips; biotechnical streambank stabilization; livestock management in riparian areas; stream restoration; and wetland creation or restoration.

X. KDWP MONITORING, RESEARCH, AND REGULATORY ROLE

A. Monitoring and Research: In 1994, Kansas Department of Wildlife and Parks started an extensive statewide stream survey program. The major purpose of the program is to document the current range and distribution of lotic aquatic species. Other objectives include: establish recent baseline data on stream fishes and macroinvertebrates to enhance stream management decisions, assess the effects of human disturbances on stream communities, and assess overall physical, chemical, and biological health of Kansas streams and examine these relationships.

A portion of our program involves extensive three-year surveys in each major river basin. Basin surveys allow for a comprehensive review of the status of lotic aquatic species. Other surveys are statewide or very localized. The statewide or local surveys are generally tied to specific research goals, such as "Status of rare fish and mussel species in Kansas streams."

KDWP uses standard methods for stream surveys designed by the Environmental Protection Agency for their Regional-Environmental Monitoring and Assessment Program. Our methods are slightly modified. The major parameters we measure include water chemistry, physical habitat variables, and fish and macroinvertebrate community characteristics. All data are kept in a geo-referenced database. From 1994 through 2003 KDWP has conducted stream surveys on approximately 100 sites per year. The number of sites sampled each year depend on grant fund availability.

Because relatively few statewide surveys have been conducted in Kansas, especially in the last 20 years, the stream survey program has increased the knowledge of known ranges and distributions of fishes and macroinvertebrates. Through statewide sampling efforts, the stream surveys help to increase the likelihood of detecting peripheral populations or new locations of the Topeka shiner thus furthering our understanding of the population structure and distribution of this species. The Stream Survey Program is an ongoing effort and is dependent on grant support and federal cost-sharing. KDWP's plan is to continue to survey and expand on the aforementioned aquatic knowledge. The Department plans on adding long-term monitoring sites to examine changes in lotic aquatic communities over time. These monitoring efforts could include basins where the Topeka shiner currently occurs.

B. Regulatory Role: State and federally listed species are protected in Kansas as designated by the Kansas Nongame and Endangered Species Conservation Act of 1975 (Kansas Statutes Annotated 32-957 through 963, 32-1009 through 1012, and 32-1033). The Act was implemented to protect species listed as threatened (T), endangered (E), or species in need of conservation (SINC) within Kansas. The act places the responsibility for identifying and undertaking appropriate conservation measures for T and E species directly upon the Department of Wildlife and Parks through regulations (Kansas Administrative Regulations 115-15-1 through 4). The Department must also undertake efforts to conserve listed species and pursue increasing their populations to the point they are no longer listed as T or E.

K.S.A. 32-963 and K.A.R. 115-15-3 require the Department of Wildlife and Parks to issue special action permits for activities that affect species listed as T and E where an action means "an activity resulting in the physical alteration of a listed species' critical habitat, physical disturbance of a listed species, or destruction of individuals of a listed species." These activities must be publicly funded, state or federally assisted, or require a permit from another state or federal government agency to be included as activities that fall under the Department's regulatory purview where action permits could be required. Critical habitats are defined in K.A.R. 115-15-3 and are defined as either of the following: specific areas documented as currently providing essential physical and biological features and supporting a self-sustaining population of a listed species; or specific areas not documented as currently supporting a listed species, but determined essential for the listed species by the secretary. Critical habitats are designated by the Department.

The Department's Environmental Services Section (ESS) is responsible for reviewing proposed activities that fall under KDWP's regulatory purview. ESS personnel conduct environmental reviews of these projects including potential effects to T and E species and state-designated critical habitats. ESS personnel issue action permits for activities that will affect listed species or their critical habitats. Special conditions are incorporated into the aforementioned permits to help offset negative effects to listed species and critical habitats. Permit conditions can limit where and when (e.g., spawning date restrictions) construction activities occur and require restoration, creation, and perpetual protection of existing habitats. The Department can refuse to issue action permits for activities that affect listed species and critical habitats if these activities cannot be adequately mitigated to offset the negative effects to a listed species and its critical habitats.

Each calendar year, ESS personnel conduct environmental reviews for approximately 750 new proposed activities that fall under the Department's regulatory purview. Since the Topeka shiner was listed at the state level on 11 November 1999 and through 31 December

2003, ESS personnel have conducted environmental reviews for 2,814 new proposed activities of which 59 included the shiner as a species of concern. Of those 59 projects, only 5 required an action permit by the Department. This represents only 0.08% of the environmental review projects in which the shiner was considered as a species of concern and 0.002% of the total new proposed activities since the shiner was listed in Kansas.

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Appendix A

Figures

FIGURE 1. Recovery Units

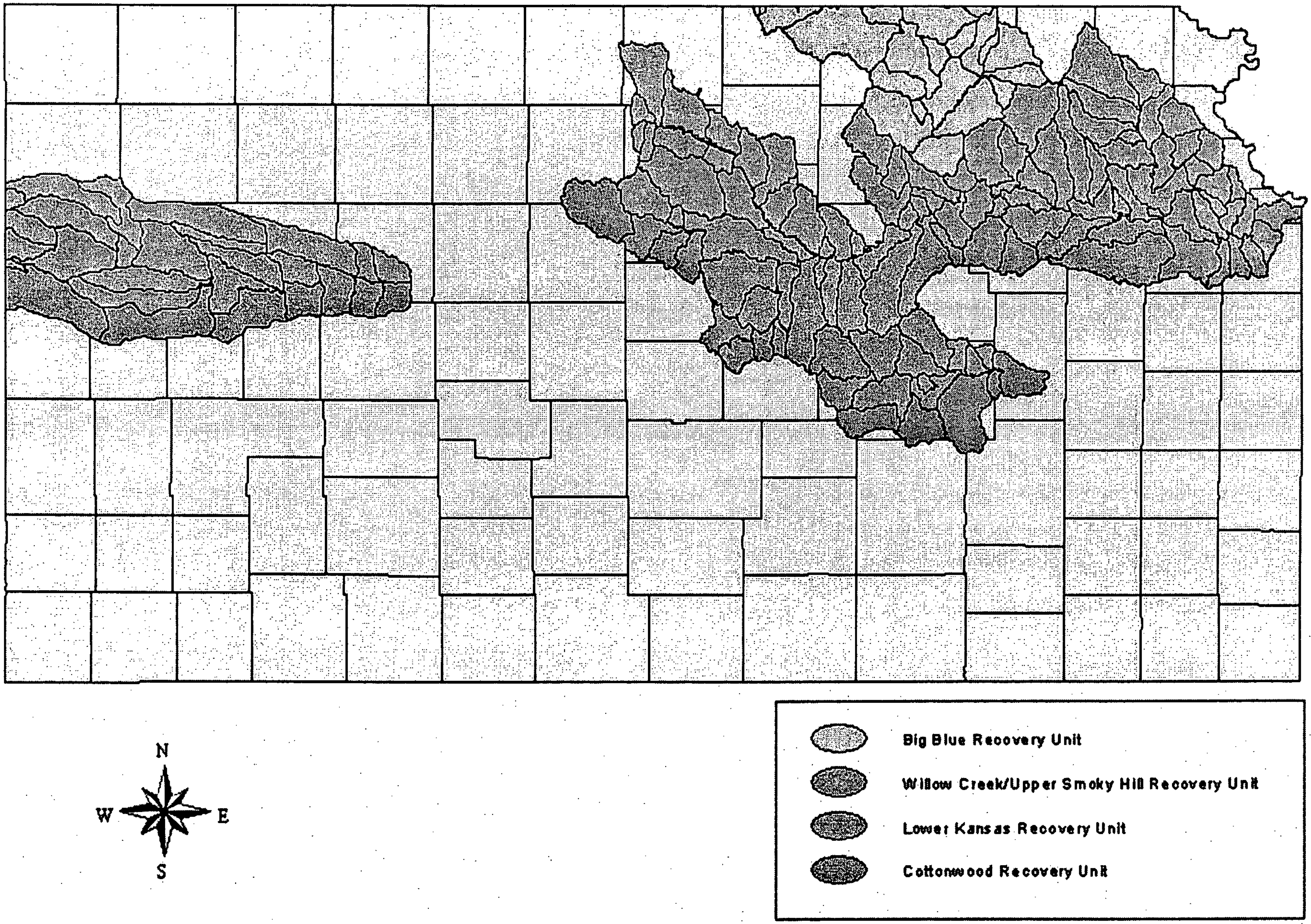


FIGURE 2. Cottonwood River Basin - Designated Critical Habitat Reaches.

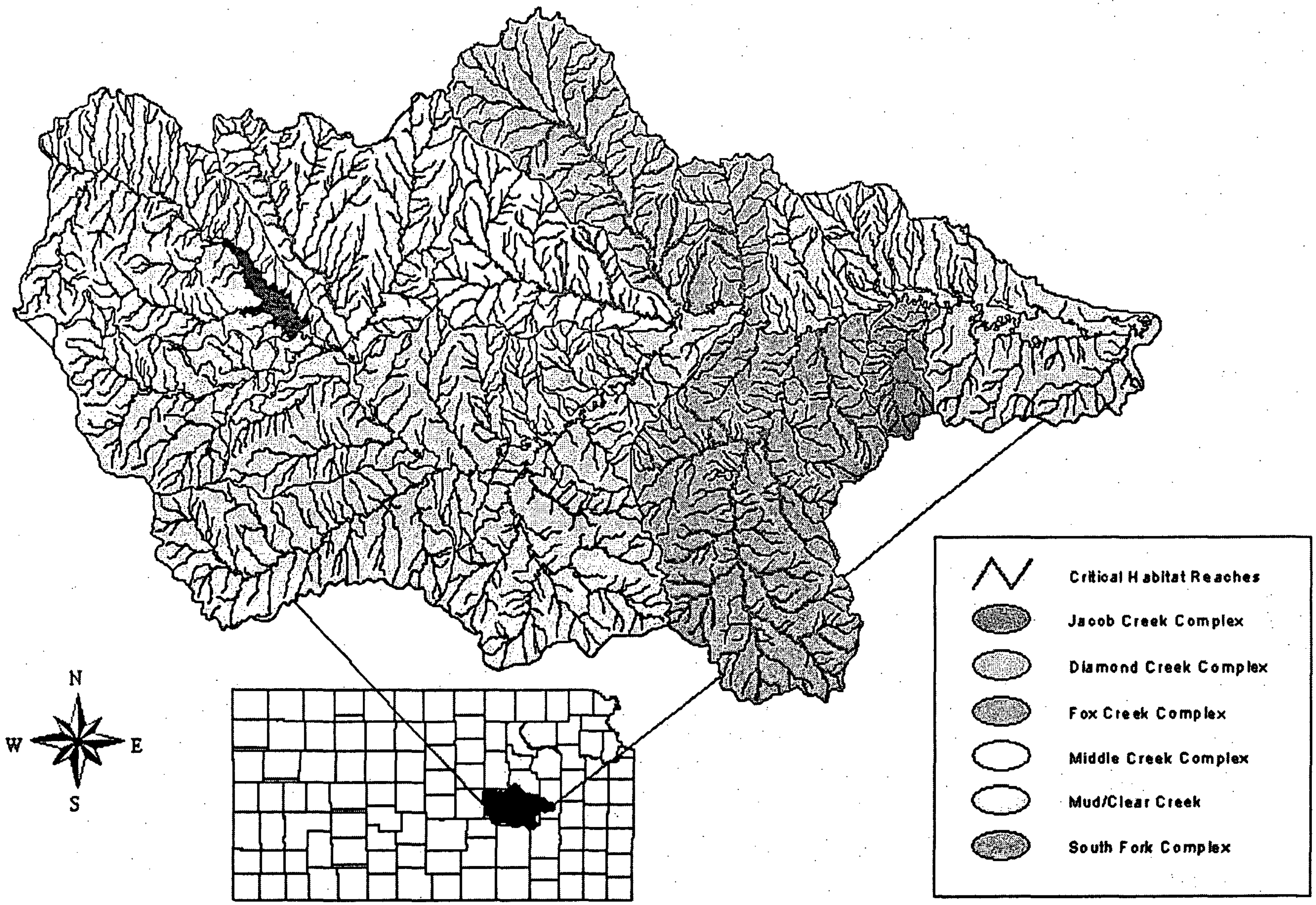


FIGURE 3. Lower Kansas River and Big Blue River Basins - Designated Critical Habitats.

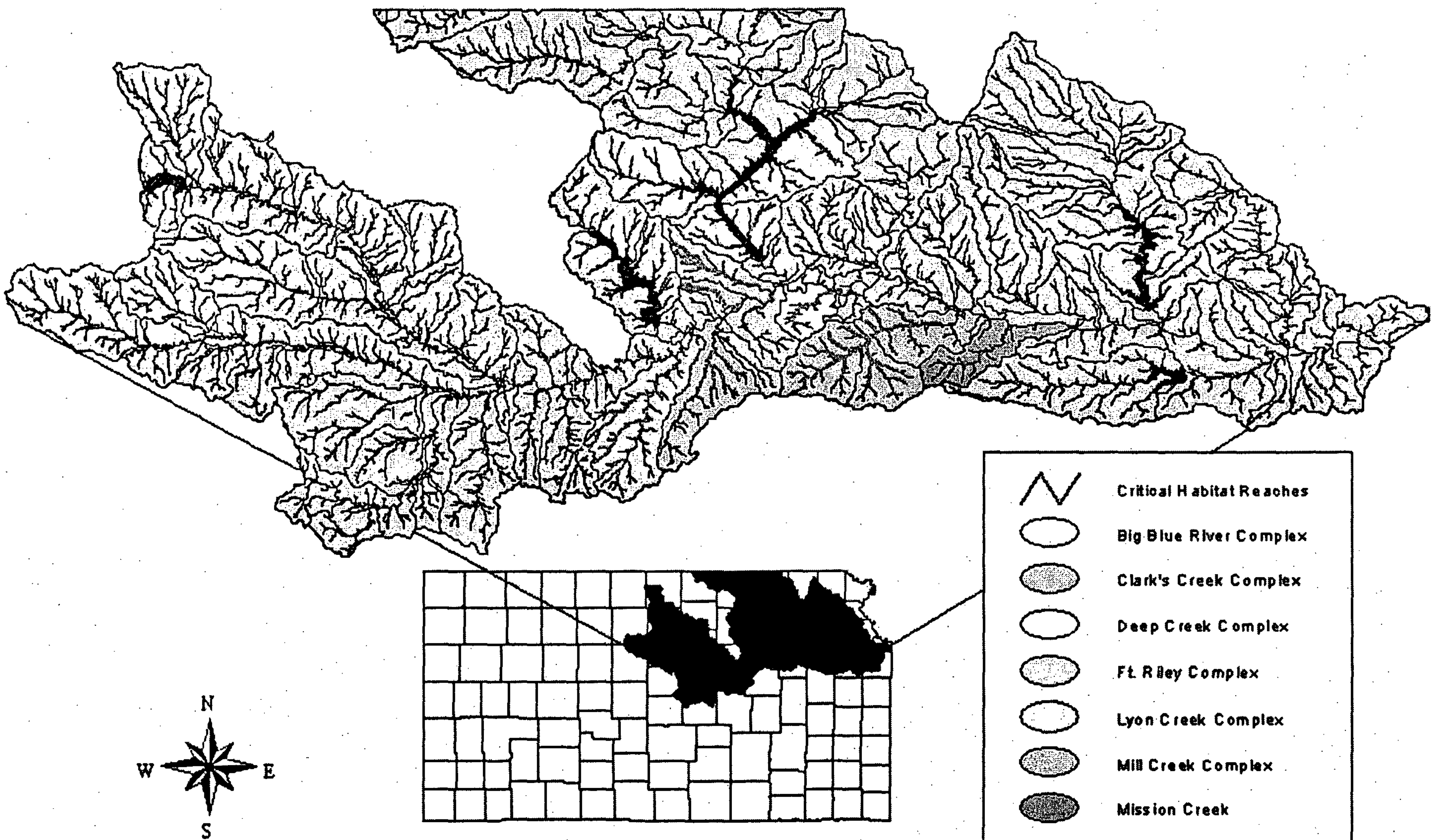


FIGURE 3a. Lyon Creek and Clark's Creek - Designated Critical Habitats.

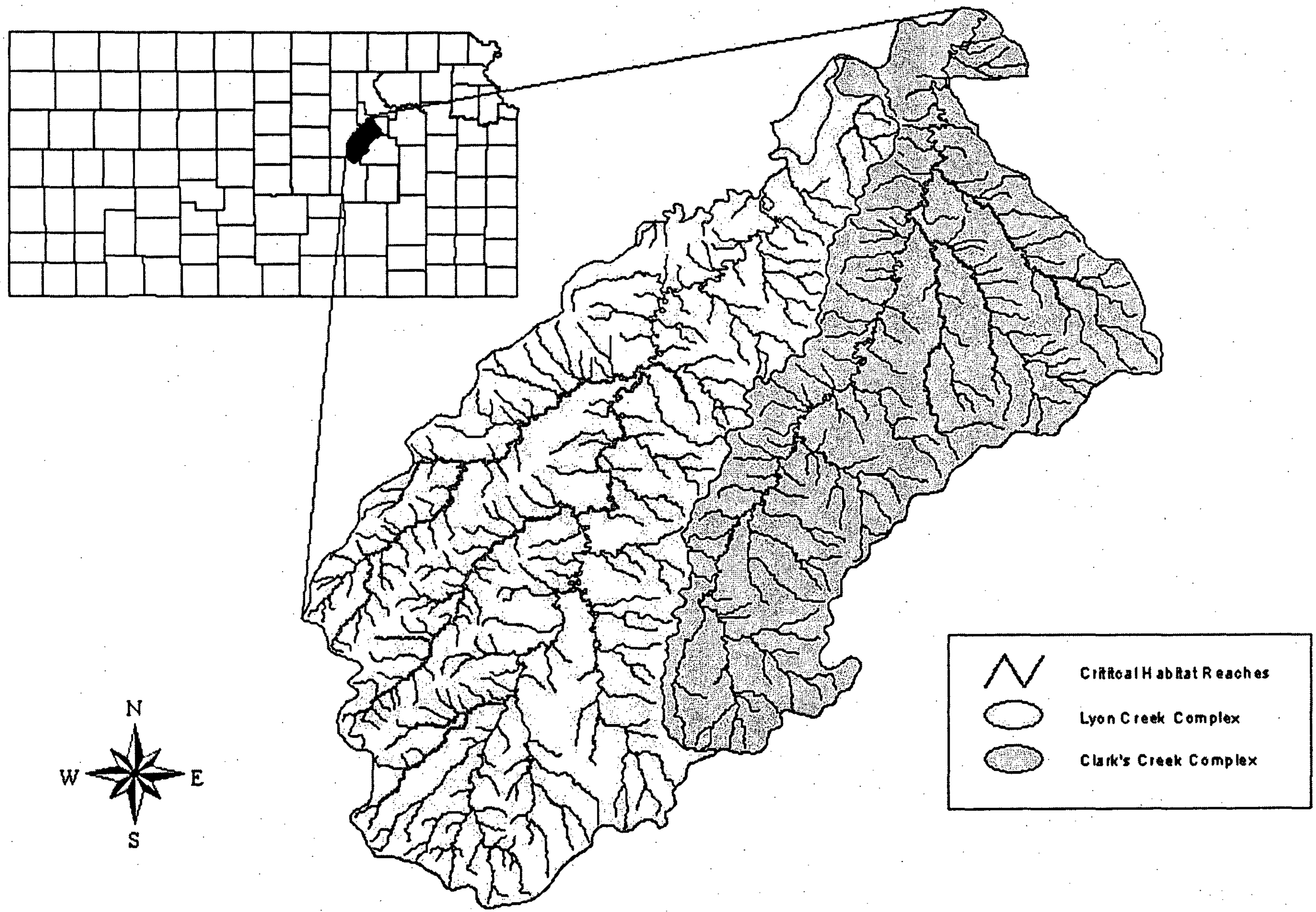


FIGURE 3b. Fort Riley and Big Blue River Basin - Designated Critical Habitats.

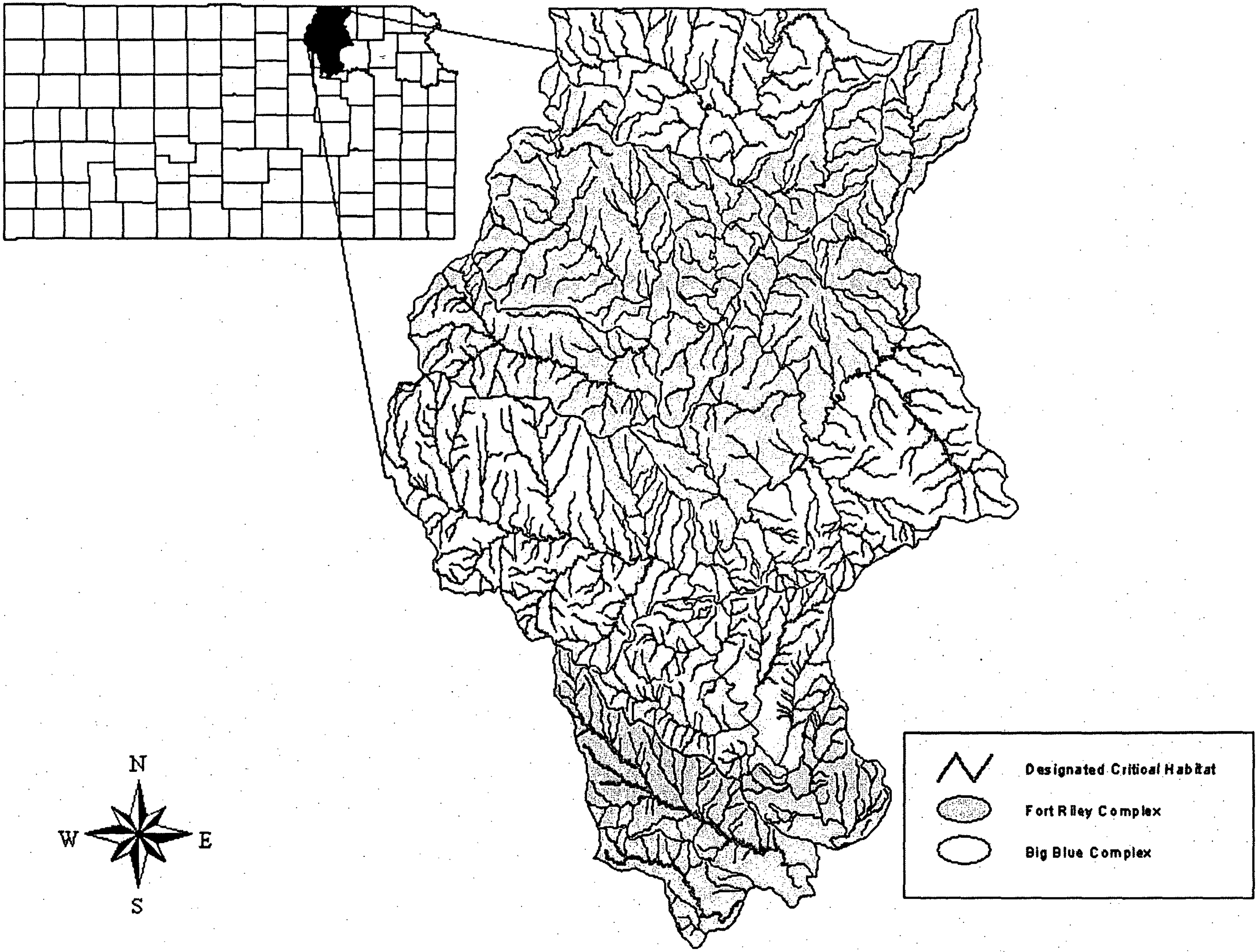


FIGURE 3c. Deep Creek, Mill Creek, and Mission Creek - Designated Critical Habitats.

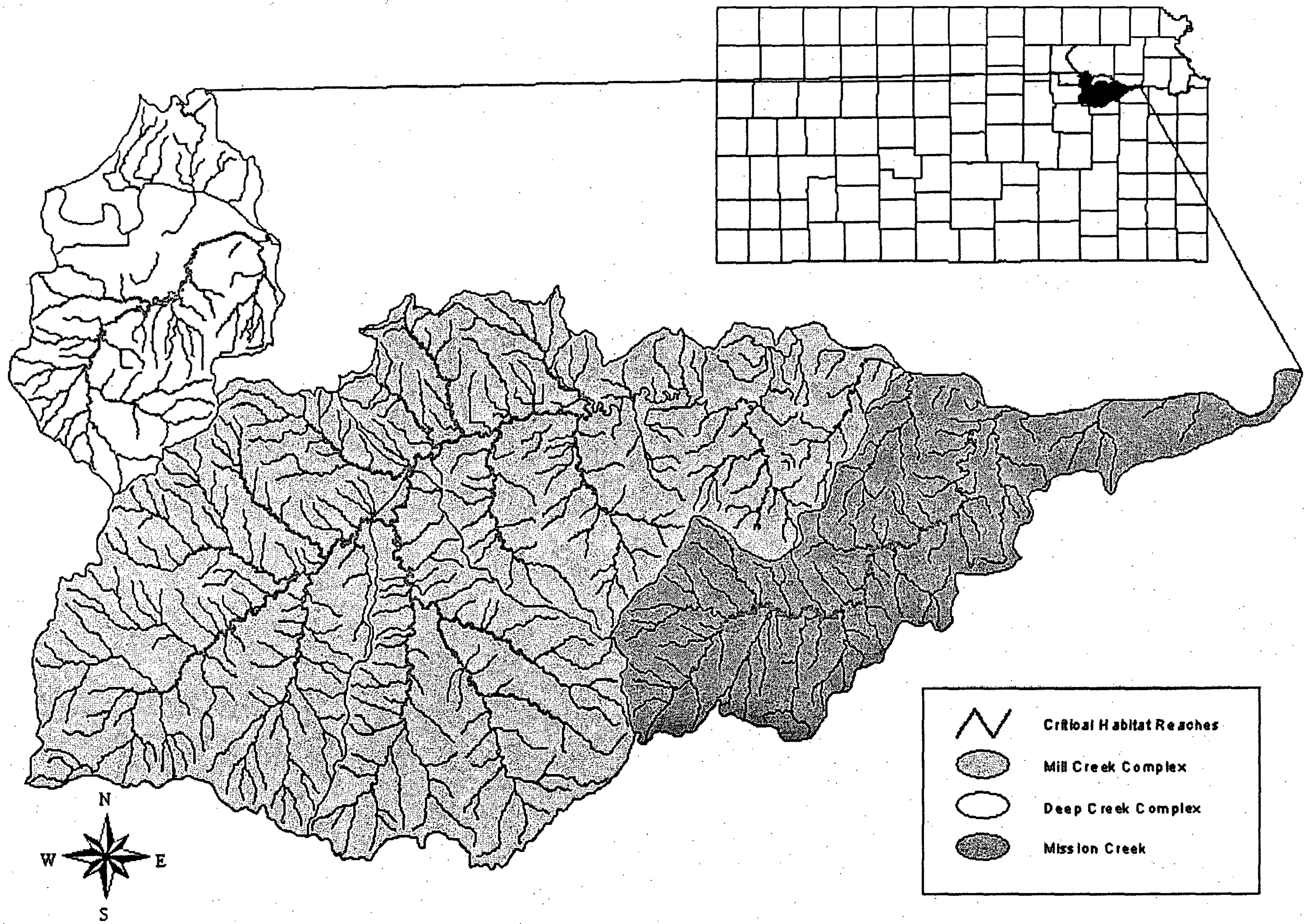
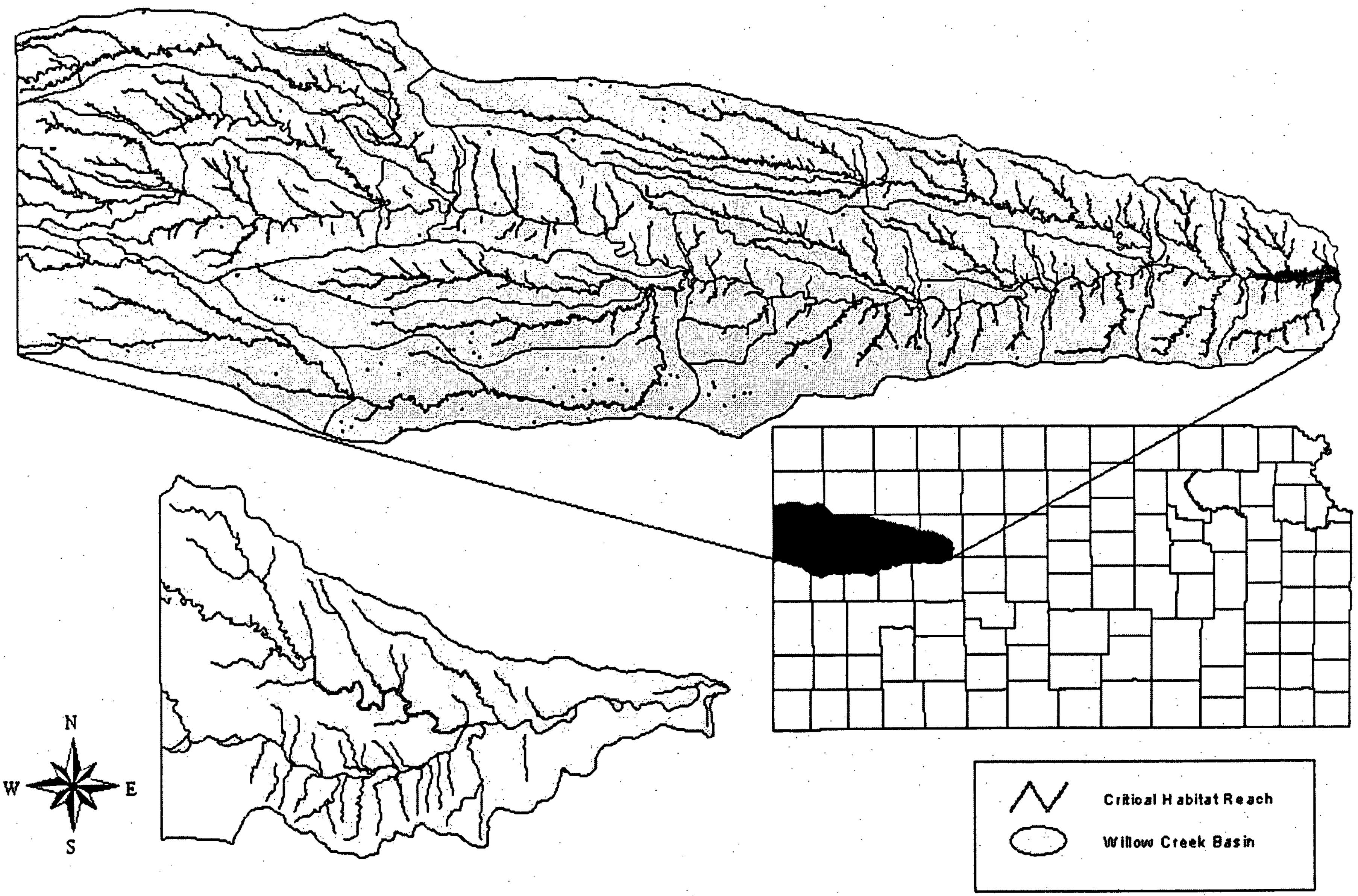


FIGURE 4. Willow Creek/Upper Smoky Hill River Basin - Designated Critical Habitat.



Appendix B

Long Term Monitoring Protocols

LONG-TERM MONITORING

Population monitoring is necessary to estimate the current population status, evaluate the success of recovery efforts, and to guide down listing or delisting decisions. Monitoring activities will be focused on each recovery unit and located within sub-watersheds known to currently support Topeka shiners and streams identified by the Kansas Aquatic Gap program as having the requisite habitat features, based on statistical models, for the species. Due to the paucity of relative abundance data, and the highly cyclic nature of Topeka shiner populations, we have made the assumption that species presence and spatial extent are more useful determinants of population stability than mean abundance values. Therefore, this monitoring strategy is based upon historical presence/absence data from fisheries surveys within watersheds known to support populations of the Topeka shiner. These data were obtained from a variety of published and unpublished collection records dated from 1953 through 2003. See below for all data sources reviewed.

We were able to obtain fish collection information at 677 locations throughout the identified recovery units. We documented 307 fish collections within Topeka shiner watersheds in the Lower Kansas River basin. Of these, Topeka shiners were collected at 129 (42%) sites. We found 306 documented collection records in the Cottonwood River basin. Topeka shiners were collected at 100 (33%) of the sites. While numerous fish collections have been conducted in the Big Blue River basin, we selected only those having predominantly gravel substrates (Minckley and Cross, 1959; Gido et al., 2002). We documented 64 fish collections in gravel bottom streams, 21 (33%) of which contained Topeka shiners. For this monitoring strategy, we have designated the percent occurrence for each basin as the baseline to compare future surveys and determine population trends. We have assumed that 7.0% or less variation around the baseline percentage occurrence is sufficient to conclude a stable population. Greater than 7.0% variation will be considered as either an increasing or decreasing population. We calculated the required sample size based on a binomial distribution with the probability of occurrence equal to our baseline percentage and 7.0% as the coefficient of variation. This calculation yielded a sample size of 420 pools within the Big Blue River basin, 420 within the Cottonwood River basin, and 275 pools within the Lower Kansas River basin.

We propose to accomplish this level of sampling with two consecutive 5-year efforts. We intend to stratify each recovery unit by sub-watersheds known to support Topeka shiner populations. Within each sub-watershed, sample reaches of one kilometer will be delineated and randomly selected. We will randomly select new reaches within each sub-watershed each year for five consecutive years. Within each random reach, we will sample five pools documenting the fisheries' community as well as select physical and chemical habitat features. By sampling 17 reaches per year in the Big Blue and Cottonwood, and 11 reaches per year in the Lower Kansas, we will meet the required sample size for each recovery unit (17 reaches x 5 pools x 5 years = 425 pools; 11 reaches x 5 pools x 5 years = 275 pools). Beginning year six, we will repeat the previous survey. While the reaches sampled will remain the same, we will not require fixed pool sites within the reach. Due to the changing nature of flow conditions in areas known to support Topeka shiners, we believe that sliding pool sites within the reach will give needed flexibility. Data analysis will be ongoing but determinations on population stability will not occur until the two 5-year surveys have been completed.

In addition to the above referenced monitoring, we will conduct an ongoing assessment of Topeka shiners in the Willow Creek/Upper Smoky Hill Recovery Unit. Willow Creek contains the only known extant population of Topeka shiners on the High Plains of Kansas. While individuals may occasionally be found throughout an approximate 8.5 km of Willow Creek, the primary population appears restricted to a 500-meter, spring-fed reach. Due to the limited spatial extent of Topeka shiners within the Recovery Unit, we will rely on mean relative abundance data to evaluate population trends. During a 7-year period (1994-2000), the Department surveyed Willow Creek on five separate occasions. A total of 4299 fish were collected, 530 of which were Topeka shiners. Based on these data, we will consider a mean relative abundance value of 12.0 to constitute a stable population. An annual survey of all permanent pools within the primary population concentration of Willow Creek will be conducted for a period of 10 years. The relative abundance values will be calculated and analyzed at the end of this time period to determine population trend.

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Appendix C

Implementation Tasks/Schedule

Implementation tasks for recovery of the Topeka shiner in Kansas. Task numbers correspond with those in Section VI - Narrative Outline.

Priority No.	Task Number	Task Description	Task Duration (Years)	Cost Estimate (in $1,000 units)					
				Total Costs	FY05	FY06	FY07	FY08	FY09
1	1.1.1	Determine priority watersheds within each PRU for conservation strategies.	1	1	1				
1	1.1.2	Identify and prioritize specific stream reaches for conservation strategies.	1	1	1				
1	1.1.3	Monitor the implementation of conservation strategies.	ongoing*	4.5			1.5	1.5	1.5
1	1.1.4	Seek assistance from producer organizations.	ongoing	2.5	0.5	0.5	0.5	0.5	0.5
1	1.1.5	Use agency expertise in application of appropriate conservation programs.	ongoing	TBD**					
1	1.2.1	Develop incentive programs that encourage landowner participation.	ongoing*	TBD**					
1	1.3	Use existing regulatory authority to protect the species and its habitats.	ongoing	TBD**					
1	2.1	Update distributional data.	ongoing	5	1	1	1	1	1
2	2.2.1	Determine habitat preferences and recruitment for early life stages.	2	36		18	18		
3	2.2.2	Determine dispersal characteristics and barriers to movement.	2	36				18	18
3	2.2.3	Determine food habits, preferences, and availability.	2	36				18	18
1	2.2.4	Determine the extent and effect of competition and predation.	2	36	18	18			
2	2.2.5	Quantify physical and chemical habitat characteristics, and limiting factors.	4	72		18	18	18	18
2	2.2.6	Determine the impacts of man-made stream alterations.	4	72		18	18	18	18

*This activity is contingent on availability of funding and personnel.
**To be determined.

Priority No.	Task Number	Task Description	Task Duration (Years)	Cost Estimate (in $1,000 units)					
				Total Costs	FY05	FY06	FY07	FY08	FY09
3	2.3	Continue genetic studies to define population boundaries.	2	TBD**					
2	3.1	Annually monitor populations and habitats.	ongoing*	40	8	8	8	8	8
2	3.2	Develop instream habitat assessment methodology.	1	1	1				
3	4.1	Determine the minimum number of individuals required for viable population.	3	TBD**					
3	4.2	Develop criteria to evaluate potential reintroduction sites.	1	1	1				
3	4.3	Establish priority sites for reintroduction.	1	2.5	2.5				
3	4.4	Continue development of culture techniques.	2	50	25	25			
3	4.5	Monitor all reintroduced populations.	ongoing*	7.5			2.5	2.5	2.5
1	5.1	Develop educational and informational material regarding species status.	ongoing*	6	4	0.5	0.5	0.5	0.5
2	5.2.1	Provide support for educational programs (StreamLink, Project Wet).	TBD**	TBD**					
1	5.3	Develop pilot habitat enhancement programs with local entities/landowners.	ongoing*	TBD**					
1	5.4	Develop a landowner recognition program.	1	1.25	0.25	0.25	0.25	0.25	0.25
3	6.1	Maintain advisory committee.	ongoing	TBD**					
3	6.2	Review research and management activities.	ongoing*	TBD**					
3	6.3	Reevaluate recovery criteria every five years.	ongoing	TBD**					

*This activity is contingent on availability of funding and personnel.
**To be determined.

Appendix D

Section 6 Projects Regarding Topeka Shiner Research and Management in Kansas (2002-2004)

KS culture techniques for production of Topeka shiner, Notropis topeka (Gilbert, 1884) in aquatic mecocosms.

Frank deNoyelles (Principal Investigator)
Kansas Biological Survey
2021 Constant Ave.
Lawrence, KS 66047-3729

Preliminary results of this work demonstrated the practical feasibility of propagating and rearing Topeka shiners in captivity. Indicators of habitat variables that favor reproduction were identified. Eight ponds and eight tanks were paired for comparison of reproductive success across manipulated conditions involving different substrate types and presence/absence of associated sunfish. Objectives of the study were to: 1) determine spawning requirements including obligate associations, habitat requirements, and temperature preferences; 2) refine captive rearing methods, establish captive populations; 3) produce Topeka shiners for experimental and recovery purposes; 4) develop a protocol for bringing Topeka shiners from the wild into captivity; and 5) develop culture techniques for Topeka shiners using individuals from abundant populations before relocation of critically endangered populations to captivity.

This project has been funded for one year under Section 6, continued a second year through The University of Kansas. Continuation for the third year's research is pending the approval of funding from University sources.

Effects of largemouth bass on habitat use by Topeka shiners, red shiners, and bluntnose minnows: implications for susceptibility to predation.

Dr. Keith Gido (Principal Investigator)
Kansas Cooperative Fish and Wildlife Research Unit
Kansas State University, Division of Biology
205 Leasure Hall
Manhattan, KS 66506

The objectives of this project were to: 1) determine if habitat use overlaps spatially among Topeka shiner, red shiner, bluntnose minnow and largemouth bass, and 2) determine if Topeka shiners are more susceptible to predation by largemouth bass than red shiners or bluntnose minnows.

One year of Section 6 funded research on this project was completed (2003). Preliminary results show that Topeka shiners respond differently to predators than other stream minnows. There are plans to continue this project pending funds from other sources.

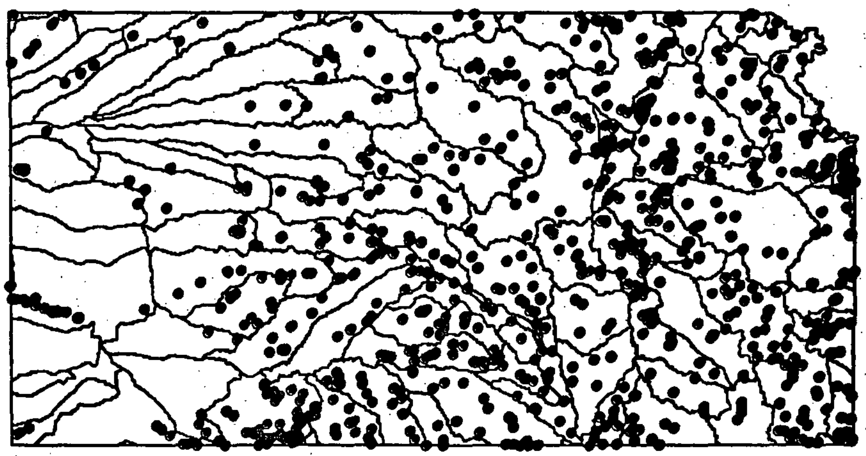
Development of a safe harbor refuge for the genetically distinct population of Topeka shiners in Willow Creek, Wallace County, Kansas.

Dr. Bill Stark (Principal Investigator)
Department of Biological Sciences
Ft. Hays State Univ.
Hays, KS 67601

The objectives of this proposed study are to: 1) establish a safe harbor on publicly held lands for a portion of the Willow Creek population of Topeka shiners, and 2) evaluate the success of the reintroduction of Topeka shiners in the safe harbor to ensure the reintroduced population does become self-sustaining. The reintroduction of Willow Creek individuals to Bureau of Reclamation property downstream of the Cedar Bluff Reservoir (Trego County, Kansas) is planned. Proposed habitat modifications on the stream include current deflecting logs to simulate riffle-run complexes similar to those found on Willow Creek. Funding for this project has been extended pending the results of ESA Section 7 consultations.

10

Kansas Department of Wildlife & Parks
Stream Monitoring and Assessment Program
SUB-WATERSHED REPORT
February 2006



Prepared for:

Kansas Alliance for Wetlands and Streams
P.O. Box 236
McPherson, Kansas 67460-0236

KAWS

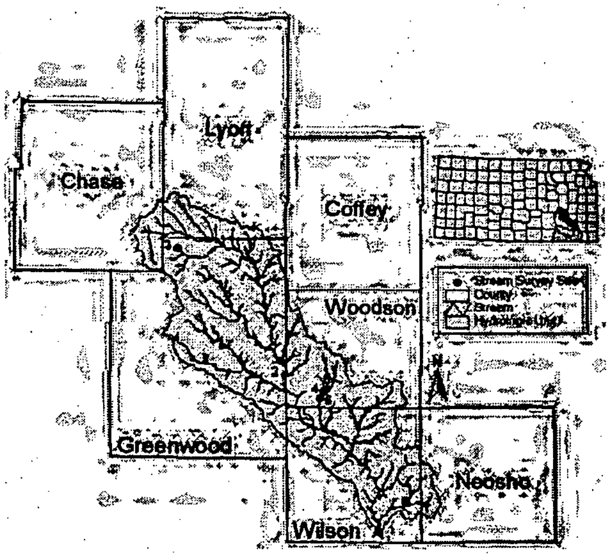
Prepared by:

KANSAS WILDLIFE & PARKS

Kansas Department of Wildlife & Parks
Environmental Services Section
Stream Monitoring and Assessment Program
512 SE 25th Ave.
Pratt, KS 67124

Verdigris River Basin
HUC 11070101

LOCATION



- This HUC consists of 6 sites (7 samples).
- Sites were surveyed between 1995-2003.

BIOLOGICAL HIGHLIGHTS

- 2 samples were not impacted by nutrient and oxygen demanding pollutants, 1 sample was moderately impacted, and 4 samples were highly impacted (see figure 1).
- The overall MBI value for this HUC was 5.94, indicating high impact from nutrient and oxygen demanding pollutants.
- 47 species of fish were surveyed (see fish species collected, page 2)
- 20 species of freshwater mussels were surveyed (see mussel species collected, page 3)
    - SINC – creeper, deertoe, fatmucket, washboard, yellow sandshell

Site #	Stream Name	Co	Yr	Insect Rich	EPT	MBI	Fish Rich
1	Chetopa	WL	96	10	*	7.19	20
2	Verdigris	GW	97	20	0.775	4.15	30
3	SB Verdigris Trib	GW	95	5	*	8.67	8
3			95	9	*	4.04	7
4	Sandy	WO	01	22	0.599	5.13	23
5	Sandy	WO	03	25	0.124	7.78	28
6	Sandy	WO	03	25	0.178	7.6	30

*Fewer than 100 individual insects collected
Highlighted rows represent different sampling events at the same location; Rich = richness

SUMMARY

- This HUC could be considered to be in good condition based on the information available at this time.
- Efforts should be utilized to further study the SINC mussel populations within this area.
- Additional surveys should be performed as the opportunities arise and conditions permit to further assess the biological integrity of this HUC and gain more data.
- A water quality table is presented on page 2

Image 1. Verdigris River, Greenwood Co.

Verdigris River Basin
HUC 11070101

Water Quality Table

Site#	H20 Temp C	Conductivity mS	Turbidity FTU	TDS mg/l	Dissolved Oxygen mg/l	pH	Alkalinity mg/l	Chlorides mg/l	Ammonia mg/l	Nitrates mg/l	Phosphorus mg/l
1	26	520	51	249	4.4	7.84	148	3.9	0.02	0	0.01
2	23	576	53	276	5.3	6.7	156	9.3	0.03	2.2	0.05
3	25	770	13	390	6.5	7.92	NA	NA	NA	NA	NA
3	20	860	11	440	4.2	7.54	NA	NA	NA	NA	NA
4	27	NA	30	NA	6.4	8.3	92	14	0.06	2.3	0.03
5	24	214	19	151	4.8	7.6	110	19	0.05	0.3	0
6	25	196	31	93.5	4.1	7.4	64	7	0.11	0.3	0.02

TDS = total dissolved solids

Fish Species Collected

black buffalo
black bullhead
black crappie
blackstripe topminnow
bluegill
bluegill X green sunfish hybrid
bluntface shiner
bluntnose minnow
brook silverside
bullhead minnow
central stoneroller
channel catfish
channel darter
common carp
fantail darter
fathead minnow
flathead catfish
freckled madtom
freshwater drum
ghost shiner
gizzard shad
golden redhorse
golden shiner
green sunfish
largemouth bass
logperch
longear sunfish
longnose gar
orangespotted sunfish
orangethroat darter
red shiner
redear sunfish
redfin darter
redfin shiner
river carpsucker
rosyface shiner
shorthead redhorse
shortnose gar
slenderhead darter
slim minnow
smallmouth buffalo
spotted bass
stonecat
suckermouth minnow
western mosquitofish
white bass
white crappie
yellow bullhead

Verdigris River Basin
HUC 11070101

Mussel Species Collected

Asian clam	lilliput	pondmussel
bleufer	mapleleaf	threehorn wartyback
creeper	paper pondshell	threeridge
deertoe	pimpleback	washboard
fatmucket	pink papershell	white heelsplitter
fragile papershell	pistolgrip	yellow sandshell
giant floater	plain pocketbook	

Verdigris River Basin
HUC 11070101

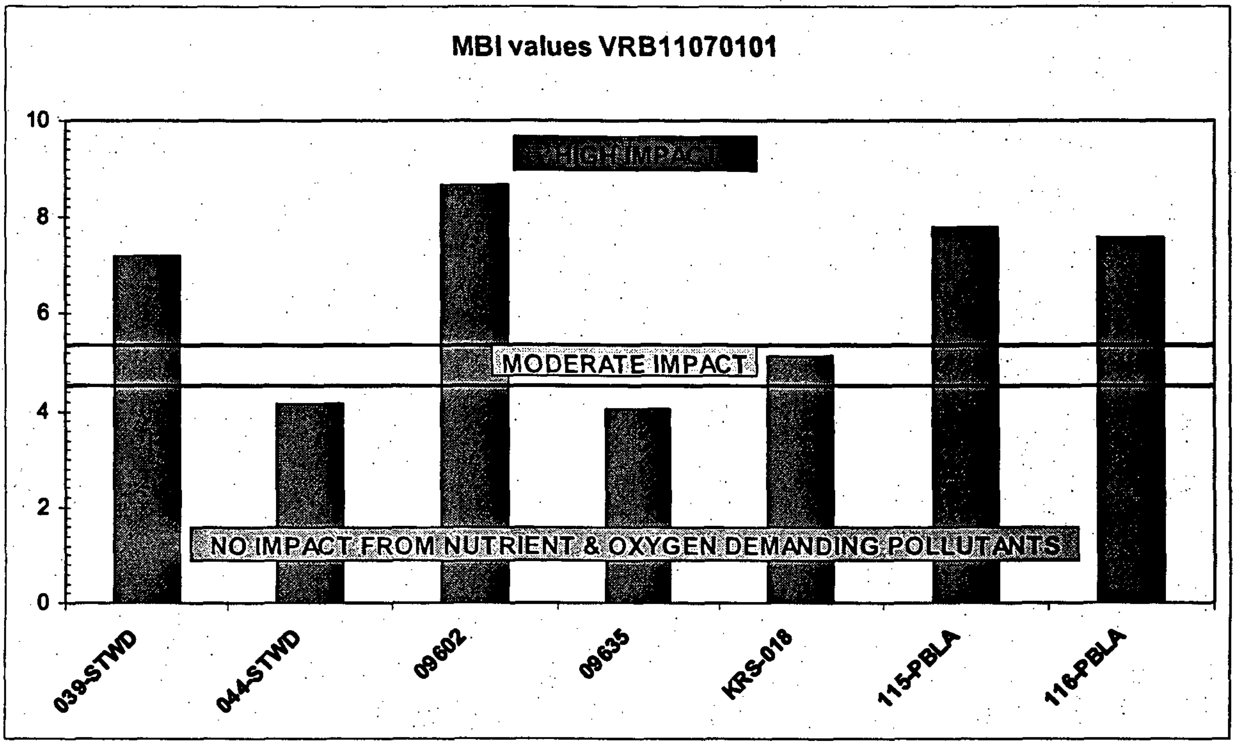


Figure 1. Graph of MBI values for HUC 11070101

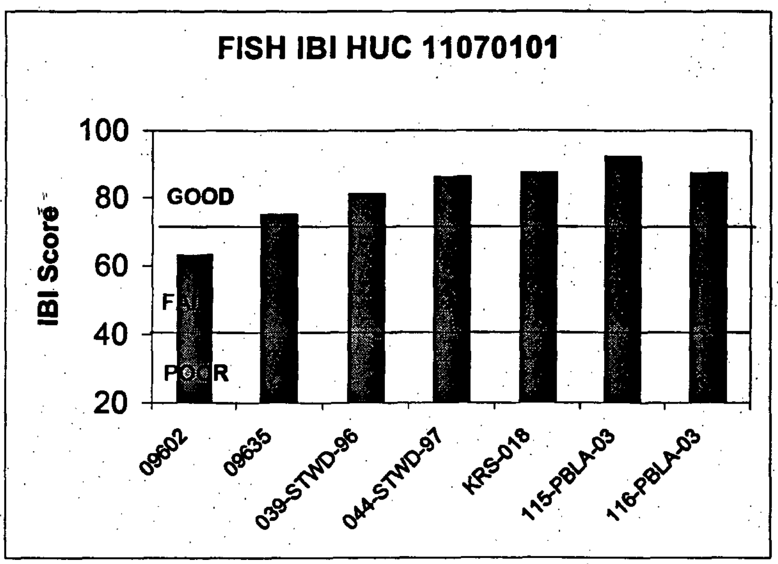
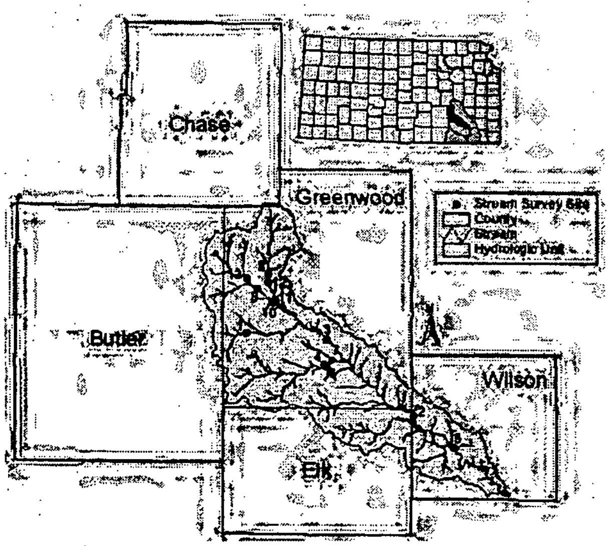


Figure 2. Graph of IBI values for HUC 11070101

Verdigris River Basin
HUC 11070102

LOCATION



- This HUC consists of 13 sites (14 samples).
- Sites were surveyed between 1994-2003.

BIOLOGICAL HIGHLIGHTS

- 3 samples were not impacted by nutrient and oxygen demanding pollutants, 7 samples were moderately impacted, 4 samples were highly impacted (see figure 1).
- The overall MBI value for this HUC was 5.22, indicating moderate impact from nutrient and oxygen demanding pollutants.
- 49 species of fish were surveyed (see fish species collected, page 2).
    - SINC – banded darter, spotted sucker
    - Record of a yellow perch collected
- 32 species of freshwater mussels were surveyed (see mussel species collected, page 3)
    - Endangered – Neosho mucket, western fanshell
    - Threatened – flutedshell, Ouachita kidneyshell
    - SINC – creeper, deertoe, fatmucket, fawnsfoot, round pigtoe, Wabash pigtoe, washboard, yellow sandshell

Site #	Stream Name	Co	Yr	Insect Rich	EPT	MBI	Fish Rich
1	Spring	GW	96	15	0.168	7.35	26
2	Fall	WL	97	12	0.654	3.38	21
3	Fall	GW	97	17	0.668	3.81	28
4	Otter	GW	00	21	0.444	5.17	27
5	Fall	WL	00	17	0.322	6.75	17
6	Otter	GW	94	24	0.158	8.08	25
6			00	17	0.388	4.18	26
7	Honey	GW	03	30	0.517	4.82	35
8	EB Fall	GW	03	21	0.671	5.21	28
9	WB Fall	GW	03	28	0.486	4.98	25
10	WB Fall	GW	03	22	0.389	5.35	27
11	EB Fall	GW	03	28	0.397	5.24	31
12	EB Fall	GW	03	20	0.424	6.76	29
13	WB Fall	GW	03	19	0.556	5.39	27

*Fewer than 100 individual insects collected
Highlighted rows represent different sampling events at the same location; Rich = richness

SUMMARY

- This HUC could be considered to be in good condition based on the information available at this time.
- Protection efforts should be utilized to maintain the threatened flutedshell and Ouachita kidneyshell mussels, and the endangered Neosho mucket and western fanshell mussels.
- Efforts should be utilized to further study the SINC mussel and fish populations within this area.
- Additional surveys should be performed as the opportunities arise and conditions permit to further assess the biological integrity of this HUC and gain more data.
- A water quality table is presented on page 2

Stream Photo (see page 3)

Verdigris River Basin
HUC 11070102

Water Quality Table

Site#	H20 Temp C	Conductivity mS	Turbidity FTU	TDS mg/l	Dissolved Oxygen mg/l	pH	Alkalinity mg/l	Chlorides mg/l	Ammonia mg/l	Nitrates mg/l	Phosphorus mg/l
1	21	437	39	208	8.5	7.82	191	20.1	0.03	1.6	0.02
2	27	357	53	170	6.5	7.14	56	4.4	0.04	2.4	0.03
3	24	428	33	204	7	6.85	146	20.3	0.07	0.6	0.05
4	23	327	63	156	7.5	NA	140	8	0.11	1	0.04
5	26	512	12	244	4.1	NA	175	13	0.07	4.4	0.15
6	24	500	16	250	3.9	6.96	NA	NA	NA	NA	NA
6	28	604	25	278	8.1	8.2	285	17	0.05	1.9	0.06
7	25	627	21	305	3.4	7.8	25.8	0.1	0.03	0	0.01
8	27	686	14	334	2.8	8.1	18.5	1.6	0.02	0.2	0.01
9	28	914	NA	448	3.5	8.1	19.3	7.4	0.01	0	0
10	29	742	11	362	4	8.1	14.9	2.3	0	0.9	0.01
11	28	669	26	325	2.5	8.2	13.7	1.9	0.01	0.1	0.01
12	26	819	14	400	2.9	7.6	3.4	0.3	0.03	0.3	0.01
13	24	607	12	295	3.1	7.7	13	0.1	0.03	0.2	0.01

TDS = total dissolved solids

Fish Species Collected

banded darter
black buffalo
blackstripe topminnow
bluegill
bluntface shiner
bluntnose minnow
brook silverside
bullhead minnow
carmine shiner
central stoneroller
channel catfish
channel darter
common carp
fathead minnow
flathead catfish
freckled madtom
freshwater drum
gizzard shad
golden redhorse
golden shiner
green sunfish
green sunfish X bluegill hybrid
largemouth bass
logperch
longear sunfish
longnose gar
mimic shiner
orangespotted sunfish
orangespotted X longear sunfish hybrid
orangethroat darter
quillback
red shiner
redear sunfish
redear X green sunfish hybrid
redfin darter
redfin shiner
river carpsucker
rosyface shiner
shorthead redhorse
slenderhead darter
slim minnow
smallmouth buffalo
spotted bass
spotted sucker
stonecat
suckermouth minnow
western mosquitofish
white bass
white crappie
yellow bullhead
yellow perch

Verdigris River Basin
HUC 11070102

Mussel Species Collected

Asian clam	fluted shell	paper pondshell	threeridge
black sandshell	fragile papershell	pimpleback	Wabash pigtoe
bleufer	giant floater	pistolgrip	washboard
creeper	lilliput	plain pocketbook	western fanshell
deertoe	mapleleaf	pondhorn	white heelsplitter
fatmucket	monkeyface	pondmussel	yellow sandshell
fawnsfoot	Neosho mucket	round pigtoe	
fingernail clam	Ouachita kidneyshell	threehorn wartyback	

Image 1. Fall River, Greenwood Co.

Verdigris River Basin
HUC 11070102

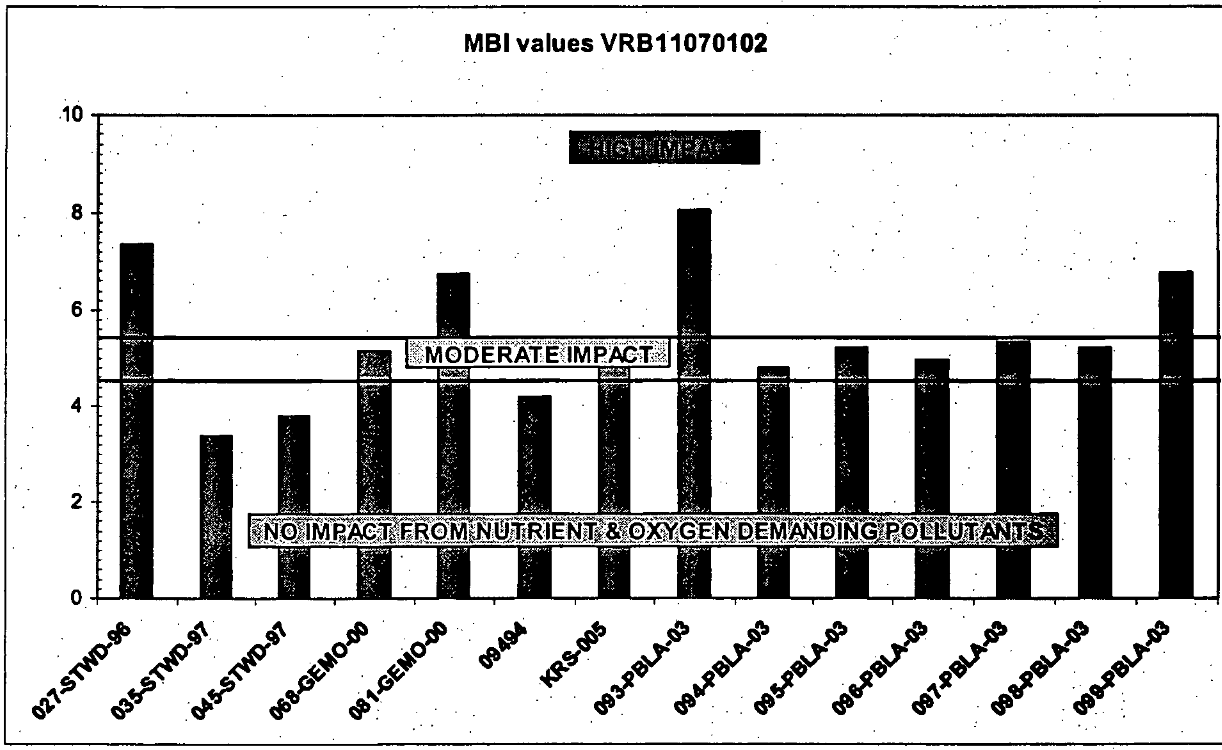


Figure 1. Graph of MBI values for HUC 11070102

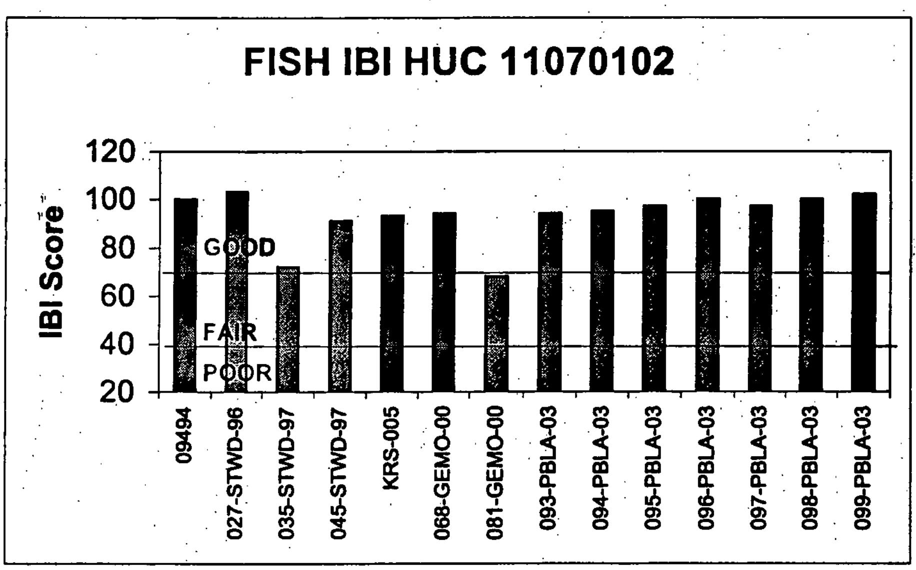
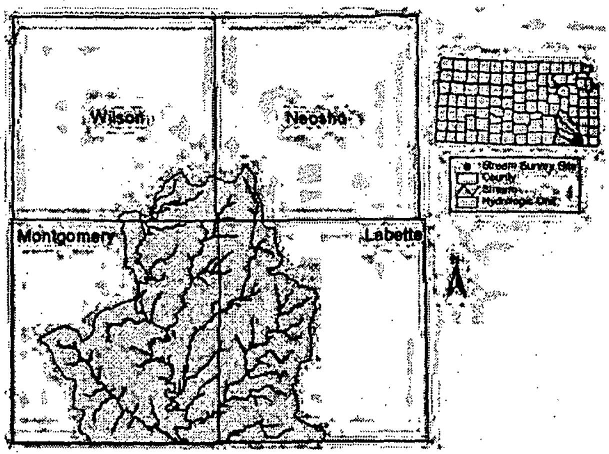


Figure 2. Graph of IBI values for HUC 11070102

Verdigris River Basin
HUC 11070103

LOCATION



- This HUC consists of 1 sites (1 sample).
- Site was surveyed in 1996.

BIOLOGICAL HIGHLIGHTS

- The only sample within this area was moderately impacted by nutrient and oxygen demanding pollutants (see figure 1). The MBI value for this area was 4.52.
- 43 species of fish were sampled in this HUC (see fish species collected, page 2)
  - SINC – spotted sucker
- 15 species of freshwater mussels were surveyed (see mussel species collected, page 2)
  - Threatened – Ouachita kidneyshell
  - SINC – round pigtoe, Wabash pigtoe, yellow sandshell

Site #	Stream Name	Co	Yr	Insect Rich	EPT	MBI	Fish Rich
1	Verdigris	MG	96	19	0.821	4.52	43

*Fewer than 100 individual insects collected
Highlighted rows represent different sampling events at the same location; Rich = richness

SUMMARY

- This HUC could be considered to be in good condition based on the information available at this time.
- Efforts should be utilized to further study the SINC mussel and fish populations within this area.
- Protection efforts should be utilized to maintain the Ouachita kidneyshell population.
- Additional surveys should be performed as the opportunities arise and conditions permit to further assess the biological integrity of this HUC and gain more data.
- A water quality table is presented on page 2

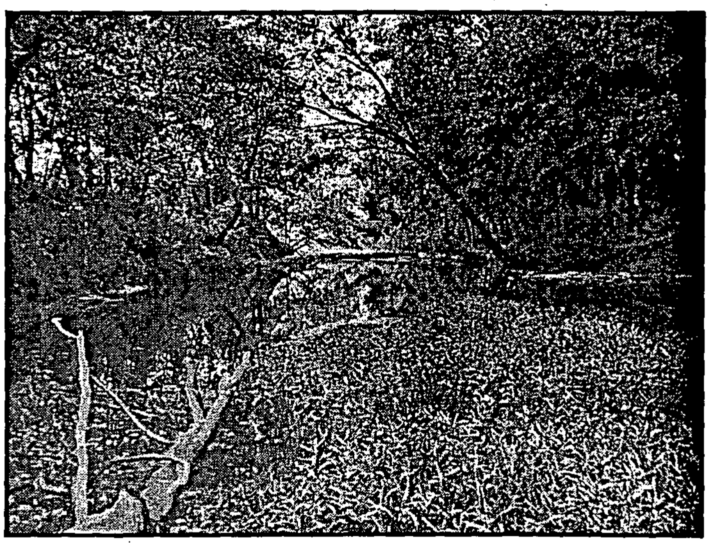


Image 1. Drum Creek, Montgomery Co.

Verdigris River Basin
HUC 11070103

Water Quality Table

Site#	H20 Temp C	Conductivity mS	Turbidity FTU	TDS mg/l	Dissolved Oxygen mg/l	pH	Alkalinity mg/l	Chlorides mg/l	Ammonia mg/l	Nitrates mg/l	Phosphorus mg/l
1	25	432	33	207	6	7.66	110	5	0.02	1.3	0.04

TDS = total dissolved solids

Fish Species Collected

bigmouth buffalo
black buffalo
black bullhead
black crappie
bluegill
bluegill X warmouth hybrid
bluntface shiner
bluntnose minnow
brook silverside
bullhead minnow
central stoneroller
channel catfish
channel darter
common carp
flathead catfish
freckled madtom
freshwater drum
ghost shiner
gizzard shad
golden redhorse
green sunfish
largemouth bass
logperch
longear sunfish
longnose gar
orangespotted sunfish
orangethroat darter
red shiner
redear sunfish
redfin shiner
river carpsucker
shorthead redhorse
slenderhead darter
slim minnow
smallmouth buffalo
smallmouth X black buffalo hybrid
spotted bass
spotted sucker
stonecat
suckermouth minnow
warmouth
western mosquitofish
white bass
white crappie
yellow bullhead

Mussel Species Collected

black sandshell
bleufer
fragile papershell
mapleleaf
monkeyface
Ouachita kidneyshell
pimpleback
pistolgrip
plain pocketbook
round pigtoe
threehorn wartyback
threeridge
Wabash pigtoe
white heelsplitter
yellow sandshell

Verdigris River Basin
HUC 11070103

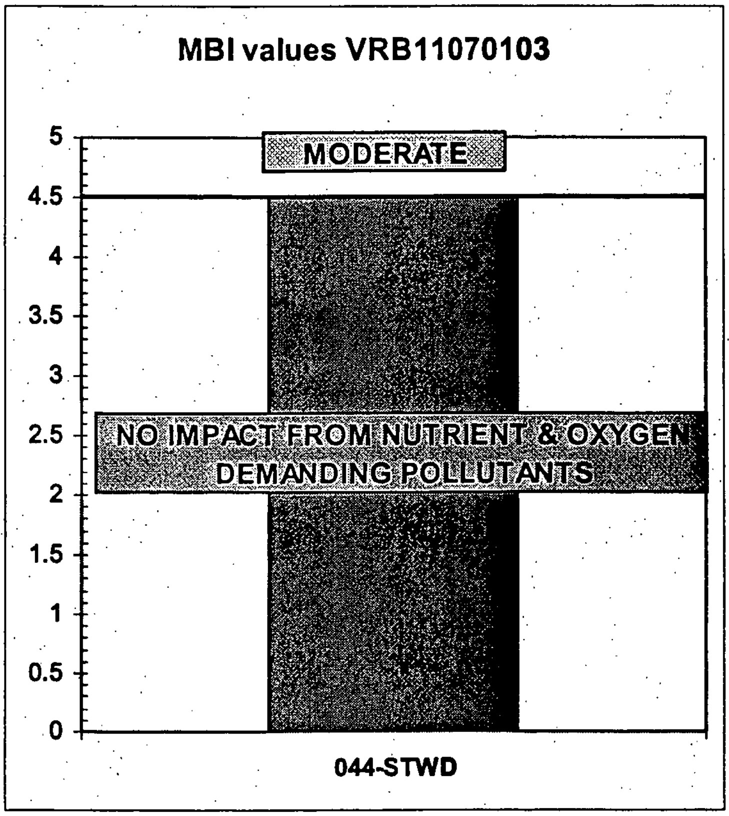


Figure 1. Graph of MBI value for HUC 11070103

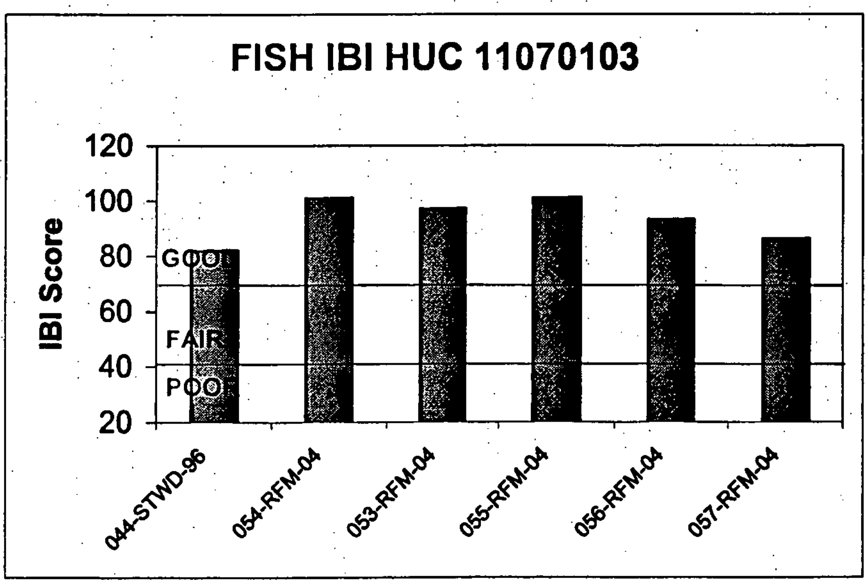
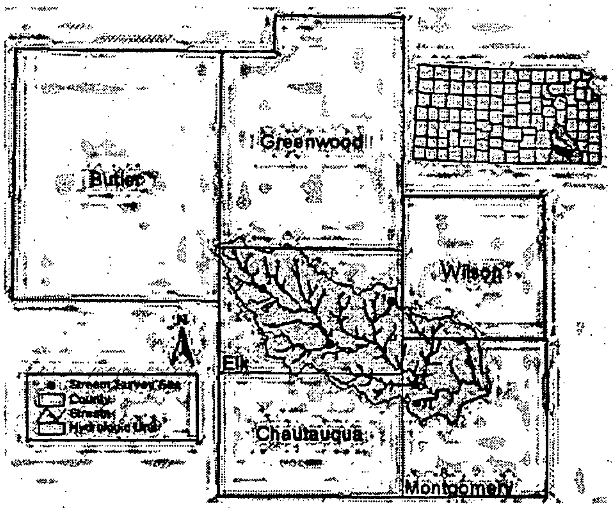


Figure 2. Graph of IBI values for HUC 11070103

Verdigris River Basin
HUC 11070104

LOCATION



- This HUC consists of 5 sites (7 samples).
- Sites were surveyed between 1994-2001.

BIOLOGICAL HIGHLIGHTS

- 4 samples were moderately impacted by nutrient and oxygen demanding pollutants, 3 samples were highly impacted (see figure 1)
- The overall MBI value for this HUC was 5.5, indicating high impact from nutrient and oxygen demanding pollutants.
- 41 species of fish were surveyed (see fish species collected, page 2)
- 22 species of freshwater mussels were surveyed (see mussel species collected, page 2)
    - SINC – creeper, deertoe, fatmucket, Wabash pigtoe, yellow sandshell

Site #	Stream Name	Co	Yr	Insect Rich	EPT	MBI	Fish Rich
1	E Painterhood	EK	94	12	*	5.1	14
1			00	8	*	6.1	15
2	Elk	EK	97	15	0.676	5.2	25
3	Elk	MG	96	13	0.649	4.51	32
4	Elk	EK	00	23	0.505	5.43	26
5	Card	MG	95	11	*	7.03	4
5			01	6	*	9.5	1

*Fewer than 100 individual insects collected
Highlighted rows represent different sampling events at the same location; Rich = richness

SUMMARY

- This HUC could be considered to be in good condition based on the information available at this time.
- Efforts should be utilized to further study the SINC mussel populations within this area.
- Additional surveys should be performed as the opportunities arise and conditions permit to further assess the biological integrity of this HUC and gain more data.
- A water quality table is presented on page 2

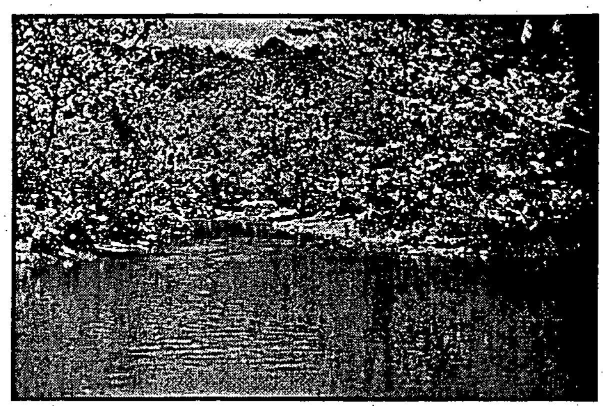


Image 1. Elk River, Elk Co.

Verdigris River Basin
HUC 11070104

Water Quality Table

Site#	H20 Temp C	Conductivity mS	Turbidity FTU	TDS mg/l	Dissolved Oxygen mg/l	pH	Alkalinity mg/l	Chlorides mg/l	Ammonia mg/l	Nitrates mg/l	Phosphorus mg/l
1	24	209	42	102	7.9	8	105	49	0.12	2.2	0.05
1	24	240	22	130	8	6.97	NA	NA	NA	NA	NA
2	24	427	14	202	6.6	7.16	139	2.9	0.06	0.5	0.01
3	22	458	23	218	10.4	7.67	183	6.9	0.1	0.1	0.03
4	28	438	28	209	6.4	NA	183	10	0.09	0	0.01
5	25	NA	106	NA	1.2	8.2	215	73	0.55	2.4	0.11
5	21	920	265	460	5.2	7.58	NA	NA	NA	NA	NA

TDS = total dissolved solids

Fish Species Collected

bigeye shiner
bigmouth buffalo
black bullhead
blackstripe topminnow
bluegill
bluntface shiner
bluntnose minnow
brook silverside
bullhead minnow
central stoneroller
channel catfish
channel darter
common carp
flathead catfish
freckled madtom
freshwater drum
gizzard shad
golden redhorse
golden shiner
green sunfish
largemouth bass
logperch
longear sunfish
longnose gar
mimic shiner
orangespotted sunfish
orangethroat darter
red shiner
redfin darter
redfin shiner
shorthead redhorse
slenderhead darter
slim minnow
smallmouth buffalo
spotted bass
stonecat
warmouth
western mosquitofish
white bass
white crappie
yellow bullhead

Mussel Species Collected

Asian clam
bleufer
creeper
deertoe
fatmucket
fingernail clam
fragile papershell
giant floater
lilliput
mapleleaf
paper pondshell
pimpleback
pink papershell
pistolgrip
plain pocketbook
Pondhorn
pondmussel
threehorn wartyback
threeridge
Wabash pigtoe
white heelsplitter
yellow sandshell

Verdigris River Basin
HUC 11070104

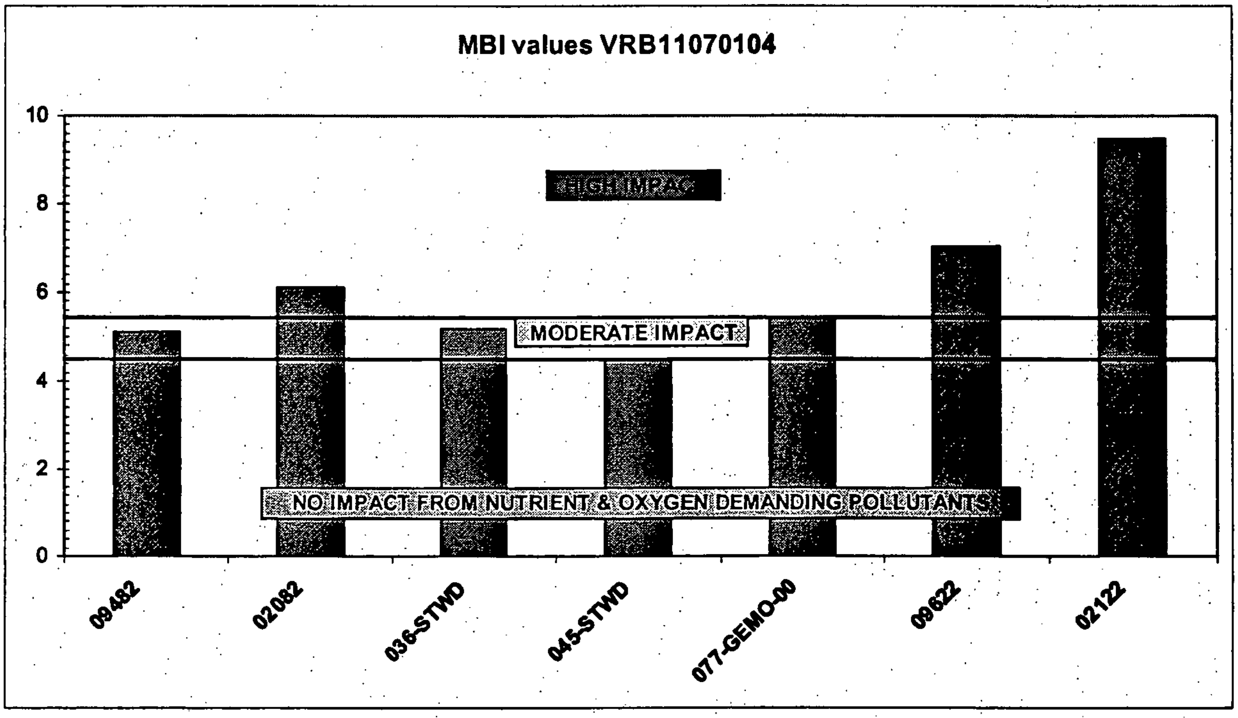


Figure 1. Graph of MBI values for HUC 11070104

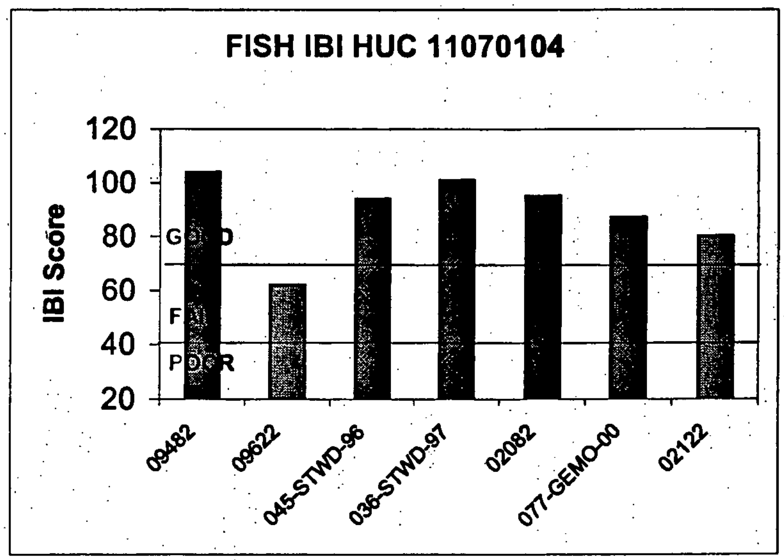
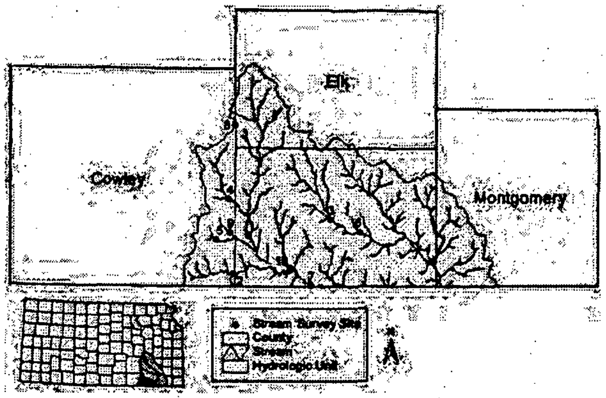


Figure 2. Graph of IBI values for HUC 11070104

SUB-WATERSHED REPORT

Verdigris River Basin
HUC 11070106

LOCATION



- This HUC consists of 10 sites (14 samples).
- Sites were surveyed between 1995-2001.

BIOLOGICAL HIGHLIGHTS

- 3 samples were not impacted by nutrient and oxygen demanding pollutants, 4 samples were moderately impacted, and 7 samples were highly impacted (see figure 1)
- 43 species of fish were surveyed (see fish species collected, page 2)
- 23 species of freshwater mussels were surveyed (see mussel species collected, page 3)
    - Endangered – Neosho mucket
    - Threatened – Ouachita kidneyshell
    - SINC – creeper, deertoe, fatmucket, round pigtoe, Wabash pigtoe, yellow sandshell

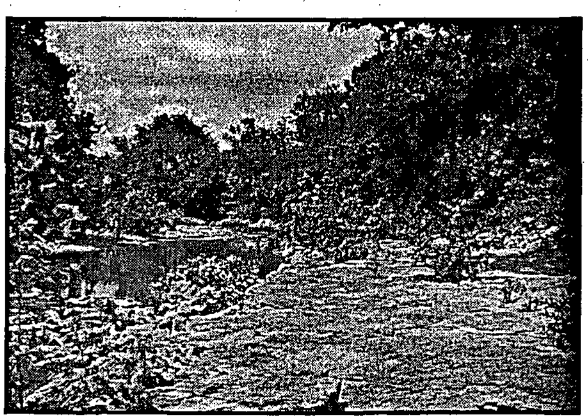


Image 1. Caney River, Chautauqua Co.

Site #	Stream Name	Co	Yr	Insect Rich	EPT	MBI	Fish Rich
1	Caney	CQ	97	21	0.559	4.47	25
1			00	24	0.547	5.11	28
2	Rock	CL	97	16	0.785	4.43	26
3	Middle Caney	CQ	96	18	0.074	8.03	31
4	Otter	CL	96	18	*	7.08	18
5	Cedar	CL	96	10	0.059	8.26	20
6	Middle Caney	CQ	00	21	0.659	5.27	27
7	Caney	CQ	00	21	0.431	5.83	29
8	Spring	CL	95	5	*	4.77	3
8			01	13	0.025	9.01	2
9	N Cedar Trib	CL	95	9	*	4.83	
9			01	10	*	8.39	2
10	Caney	CQ	95	16	*	3.93	27
10			01	24	0.079	6.54	26

*Fewer than 100 individual insects collected
Highlighted rows represent different sampling events at the same location; Rich = richness

SUMMARY

- This HUC could be considered to be in fair to good condition based on the information available at this time.
- Protection efforts should be utilized to maintain the endangered Neosho mucket population and the threatened Ouachita kidneyshell.
- Efforts should be utilized to further study the SINC mussel populations within this area.
- Additional surveys should be performed as the opportunities arise and conditions permit to further assess the biological integrity of this HUC and gain more data.
- A water quality table is presented on page 2

Verdigris River Basin
HUC 11070106

Water Quality Table

Site#	H20 Temp C	Conductivity mS	Turbidity FTU	TDS mg/l	Dissolved Oxygen mg/l	pH	Alkalinity mg/l	Chlorides mg/l	Ammonia mg/l	Nitrates mg/l	Phosphorus mg/l
1	27	454	16	275	7.3	6.95	124	0	0.01	1.3	0.12
1	26	470	12	225	7.1	NA	200	15	0.03	0.5	0.02
2	25	380	7	190	5.5	7.05	93	6.3	0.01	0.2	0.01
3	27	400	31	190	5.8	7.65	152	1.1	0.08	0.8	0.02
4	26	466	13	220	6.7	7.76	130	6.7	0.03	0	0.02
5	26	717	19	342	6.1	7.56	134	8.5	0.03	0.4	0.02
6	25	502	12	237	7.4	NA	205	53	0.06	0.7	0.02
7	28	442	15	210	8.2	NA	182	28	0.03	0	0.02
8	19	1300	NA	6.02	9.1	8.2	209	40	0.04	1.1	0.02
8	19	450	30	230	6.3	7.76	NA	NA	NA	NA	NA
9	20	3890	45	207	9.7	8.5	54	8	0.02	1.3	0.01
9	25	350	42	180	3.9	7.7	NA	NA	NA	NA	NA
10	23	350	75	170	5.4	7.23	NA	NA	NA	NA	NA
10	24	486	9	231	3.1	8	164	38	0.03	2	0.02

TDS = total dissolved solids

Fish Species Collected

bigeye shiner
black buffalo
blackstripe topminnow
bluegill
bluntface shiner
bluntnose minnow
brook silverside
bullhead minnow
central stoneroller
channel catfish
channel darter
common carp
flathead catfish
freckled madtom
freshwater drum
gizzard shad
golden redhorse
green sunfish
inland silverside
largemouth bass
logperch
longear sunfish
longnose gar
mimic shiner
orangespotted sunfish
orangethroat darter
red shiner
redfin darter
redfin shiner
river carpsucker
rosyface shiner
shorthead redhorse
shortnose gar
slenderhead darter
slim minnow
smallmouth buffalo
spotted bass
suckermouth minnow
warmouth
western mosquitofish
white bass
white crappie
yellow bullhead

Verdigris River Basin
HUC 11070106

Mussel Species Collected

- Asian clam
- bleufer
- creeper
- deertoe
- fatmucket
- fingernail clam
- fragile papershell
- giant floater
- lilliput
- mapleleaf
- Neosho mucket
- Ouachita kidneyshell
- pimpleback
- pistolgrip
- plain pocketbook
- pondhorn
- pondmussel
- round pigtoe
- threehorn wartyback
- threeridge
- Wabash pigtoe
- white heelsplitter
- yellow sandshell

Verdigris River Basin
HUC 11070106

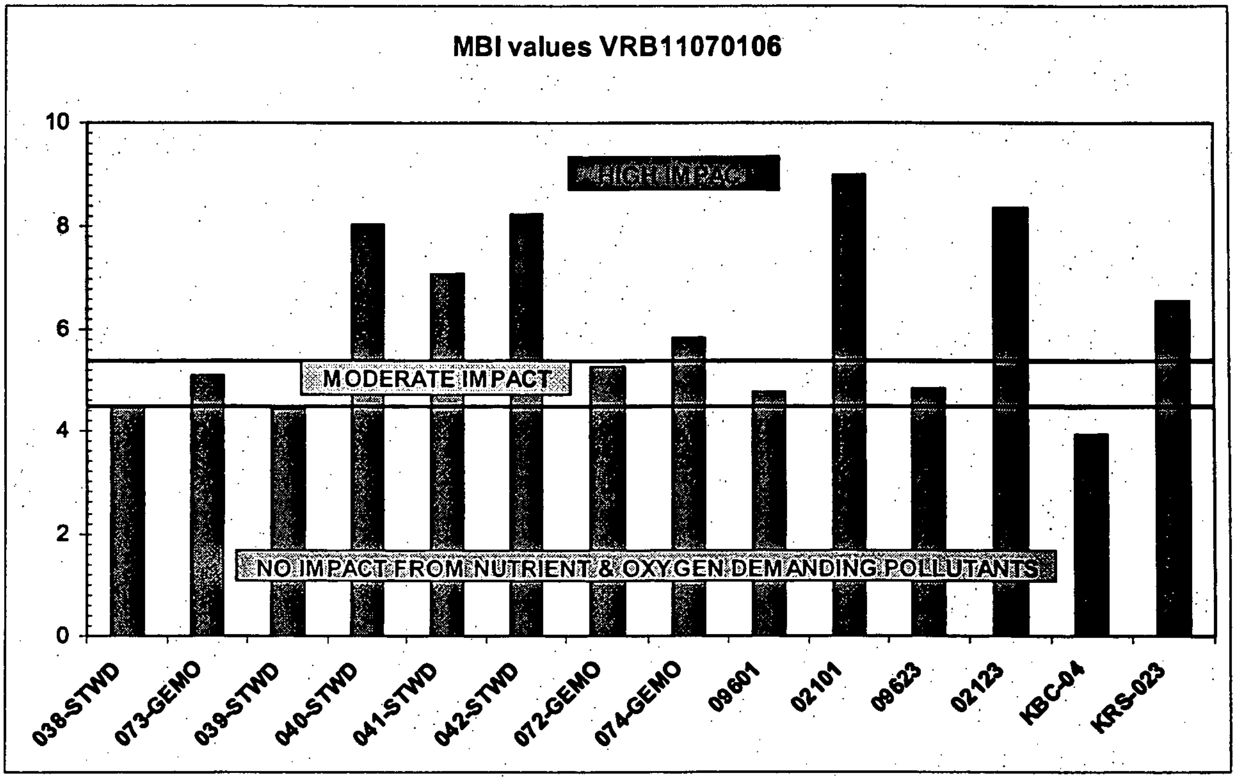


Figure 1. Graph of MBI values for HUC 11070106

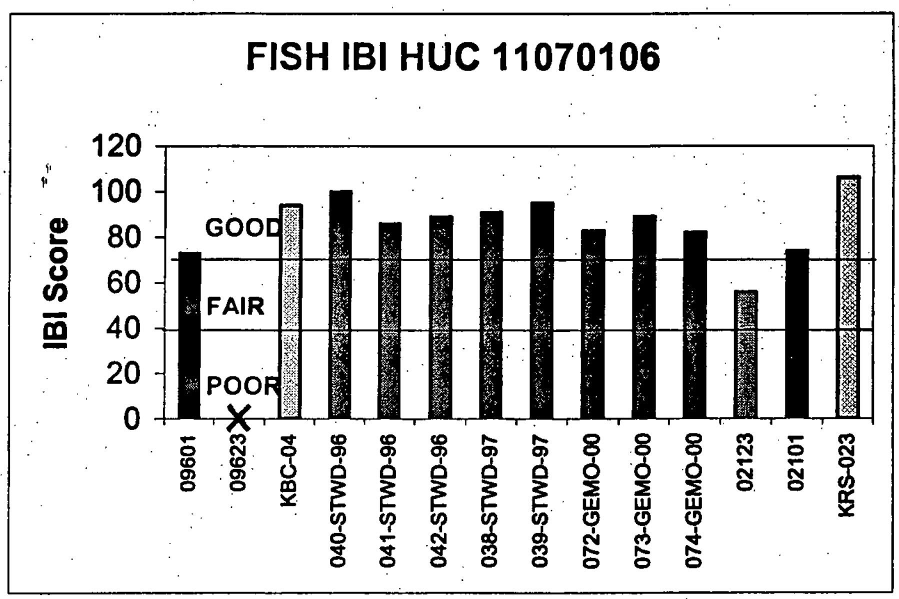
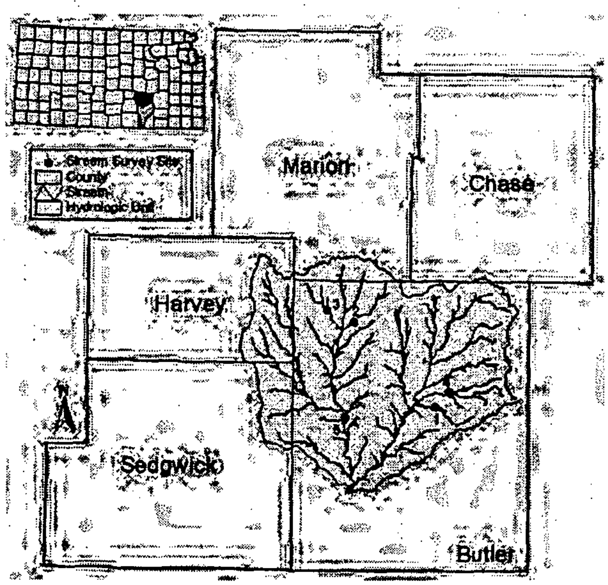


Figure 2. Graph of IBI values for HUC 11070106

SUB-WATERSHED REPORT

Walnut River Basin
HUC 11030017

LOCATION



- This HUC consists of 5 sites (6 samples).
- Sites were surveyed between 1994-2000.

BIOLOGICAL HIGHLIGHTS

- 1 sample was moderately impacted by nutrient and oxygen demanding pollutants, 5 samples were highly impacted (see figure 1)
- The overall MBI value for this HUC was 5.81, indicating high impact from nutrient and oxygen demanding pollutants.
- 38 species of fish were surveyed (see fish species collected, page 2).
  - SINC – spotted sucker
- 17 species of mussels were surveyed (see mussel species collected, page 2)
  - SINC – creeper, deertoe, fatmucket, Wabash pigtoe

Site #	Stream Name	Co	Yr	Insect Rich	EPT	MBI	Fish Rich
1	Bird	BU	97	15	0.250	9.32	12
2	EB Whitewater	BU	97	17	0.317	8.23	14
3	Henry	BU	96	11	0.222	8.79	16
4	Bemis	BU	94	7	*	7.25	24
4			00	7	*	7.37	13
5	Whitewater	BU	00	18	0.458	4.52	17

*Fewer than 100 individual insects collected
Highlighted rows represent different sampling events at the same location; Rich = richness

SUMMARY

- This HUC could be considered to be in fair condition based on the information available at this time.
- Efforts should be utilized to further study the SINC mussel and fish populations within this area.
- Additional surveys should be performed as the opportunities arise and conditions permit to further assess the biological integrity of this HUC and gain more data.
- A water quality table is presented on page 2

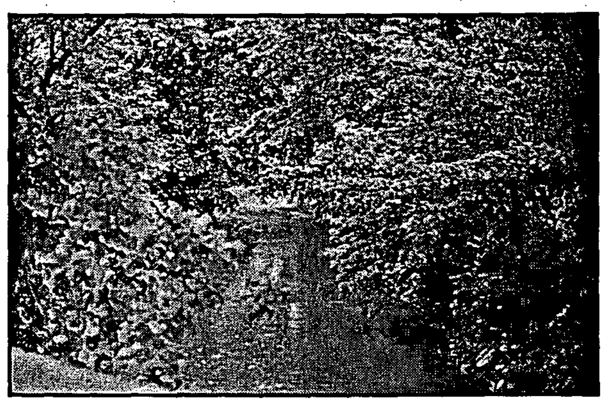


Image 1. Bird Creek, Butler Co.

Walnut River Basin
HUC 11030017

Water Quality Table

Site#	H20 Temp C	Conductivity mS	Turbidity FTU	TDS mg/l	Dissolved Oxygen mg/l	pH	Alkalinity mg/l	Chlorides mg/l	Ammonia mg/l	Nitrates mg/l	Phosphorus mg/l
1	16	355	70	170	5.3	7.76	173	53	0.01	2.6	0.11
2	16	437	191	210	7.7	8.8	136	23	0.11	10	0.59
3	15	1272	23	601	3	7.84	309	9.6	NA	0.6	0.55
4	24	453	18	222	5.3	8.1	205	15	0.05	2	0.07
4	24	410	32	210	7.9	7.48	NA	NA	NA	NA	NA
5	26	1126	39	545	5.5	NA	225	96	0.07	2.7	0.22

TDS = total dissolved solids

Fish Species Collected

black bullhead
black crappie
blackstripe topminnow
bluegill
bluntnose minnow
brook silverside
bullhead minnow
central stoneroller
channel catfish
common carp
fathead minnow
flathead catfish
freckled madtom
freshwater drum
gizzard shad
golden redhorse
golden shiner
green sunfish
largemouth bass
logperch
longear sunfish
longnose gar
orangespotted sunfish
orangethroat darter
red shiner
redfin shiner
river carpsucker
rosyface shiner
sand shiner
shorthead redhorse
slenderhead darter
smallmouth buffalo
spotted sucker
suckermouth minnow
walleye
western mosquitofish
white bass
yellow bullhead

Mussel Species Collected

Asian clam
bleufer
creeper
deertoe
fatmucket
fingernail clam
fragile papershell
giant floater
mapleleaf
pimpleback
pistolgrip
plain pocketbook
pondhorn
pondmussel
threeridge
Wabash pigtoe
white heelsplitter

Walnut River Basin
HUC 11030017

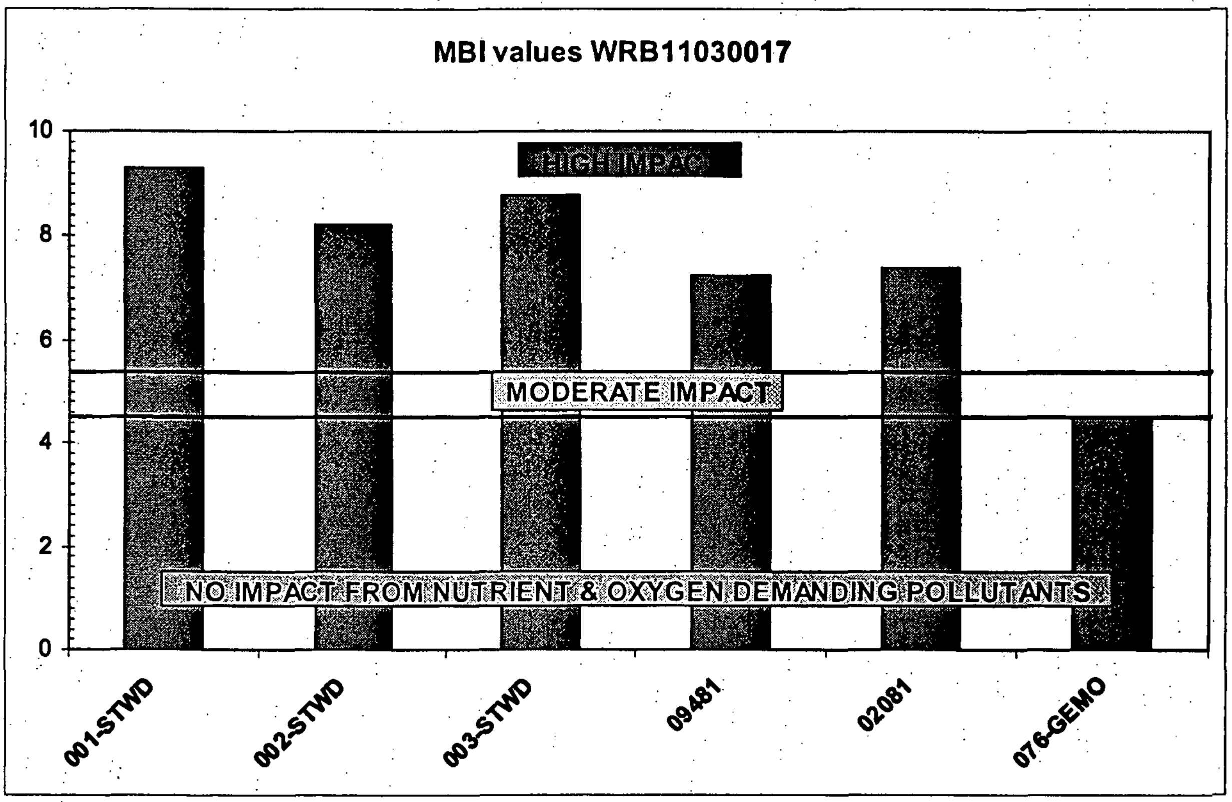


Figure 1. Graph of MBI values for HUC 11030017

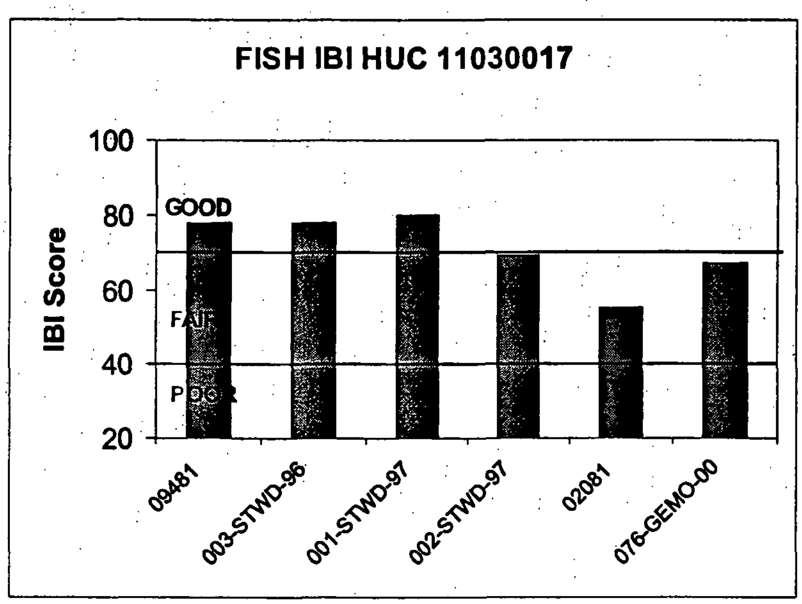
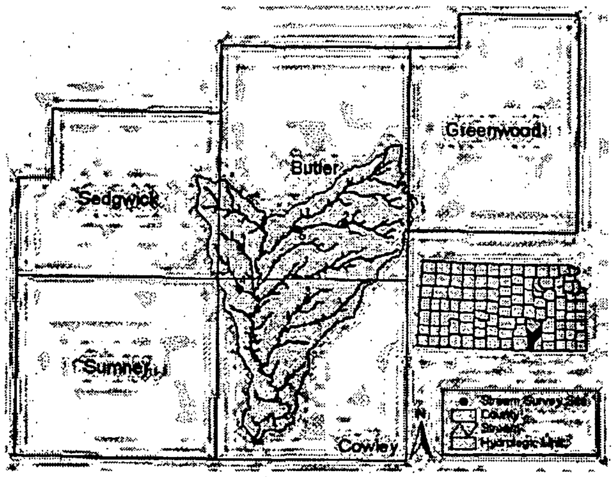


Figure 2. Graph of IBI values for HUC 11030017

Walnut River Basin
HUC 11030018

LOCATION



Site #	Stream Name	Co	Yr	Insect Rich	EPT	MBI	Fish Rich
1	Eight Mile	BU	96	8	0.097	10.02	16
2	Hickory	BU	96	12	0.040	7.48	23
3	Dutch	CL	96	13	0.180	5.07	22
4	Polecat	CL	96	13	0.300	5.68	21
5	Hickory	BU	03	20	0.643	4.47	23

*Fewer than 100 individual insects collected
Highlighted rows represent different sampling events at the same location; Rich = richness

- This HUC consists of 5 sites (5 samples).
- Sites were surveyed between 1996-2003.

BIOLOGICAL HIGHLIGHTS

- 1 sample was not impacted by nutrient and oxygen demanding pollutants, 1 sample was moderately impacted, and 3 samples were highly impacted (see figure 1).
- The overall MBI value for this HUC was 7.55, indicating high impact from nutrient and oxygen demanding pollutants.
- 37 species of fish were surveyed within this area (see fish species collected, page 2)
- 12 species of freshwater mussel were surveyed (see mussel species collected, page 2)
    - SINC – creeper, Wabash pigtoe

SUMMARY

- This HUC could be considered to be in good condition based on the information available at this time.
- Efforts should be utilized to further study the SINC mussel populations within this area.
- Additional surveys should be performed as the opportunities arise and conditions permit to further assess the biological integrity of this HUC and gain more data.
- A water quality table is presented on page 2

Walnut River Basin
HUC 11030018

Water Quality Table

Site#	H20 Temp C	Conductivity mS	Turbidity FTU	TDS mg/l	Dissolved Oxygen mg/l	pH	Alkalinity mg/l	Chlorides mg/l	Ammonia mg/l	Nitrates mg/l	Phosphorus mg/l
1	15	1889	25	928	2.2	7.8	259	7.3	NA	0	0.9
2	25	530	27	255	5.3	7.63	NA	5.5	0.03	1.1	0.12
3	21	236	342	112	8.6	7.74	NA	8	0.4	30.5	0.08
4	22	346	192	164	6.6	7.73	NA	2.3	0.21	15.4	0.14
5	24	615	26	299	3.2	7.7	5.6	0.1	0.06	0.3	0.01

TDS = total dissolved solids

Fish Species Collected

bigmouth buffalo
black bullhead
black crappie
blackstripe topminnow
bluegill
bluntnose minnow
brook silverside
bullhead minnow
central stoneroller
channel catfish
channel darter
common carp
fathead minnow
flathead catfish
freckled madtom
gizzard shad
golden redhorse
golden shiner
green sunfish
largemouth bass
logperch
longear sunfish
orangespotted sunfish
orangethroat darter
red shiner
redfin shiner
rosyface shiner
sand shiner
shorthead redhorse
slenderhead darter
slim minnow
spotted bass
stonecat
suckermouth minnow
western mosquitofish
white crappie
yellow bullhead

Mussel Species Collected

Asian clam
creeper
fragile papershell
giant floater
mapleleaf
pimpleback
pistolgrip
pondhorn
pondmussel
threeridge
Wabash pigtoe
white heelsplitter

Walnut River Basin
HUC 11030018

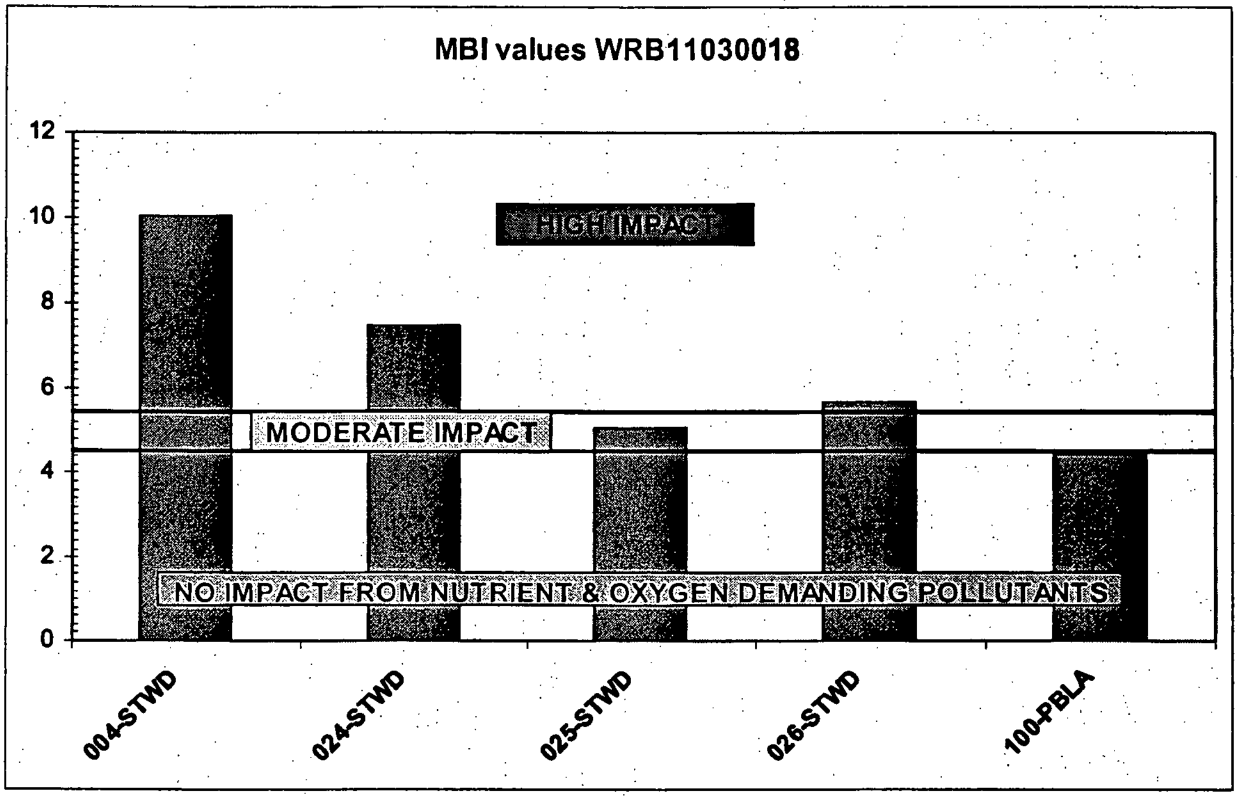


Figure 1. Graph of MBI values for HUC 11030018

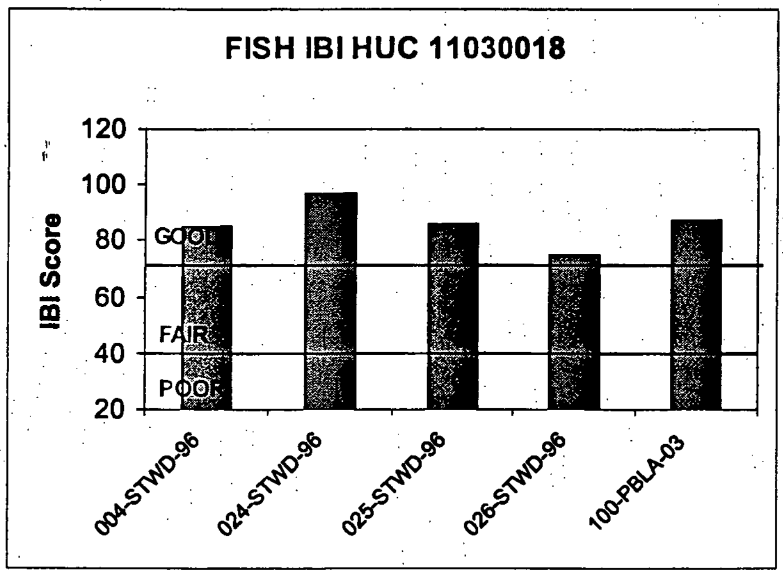


Figure 2. Graph of IBI values for HUC 11030018