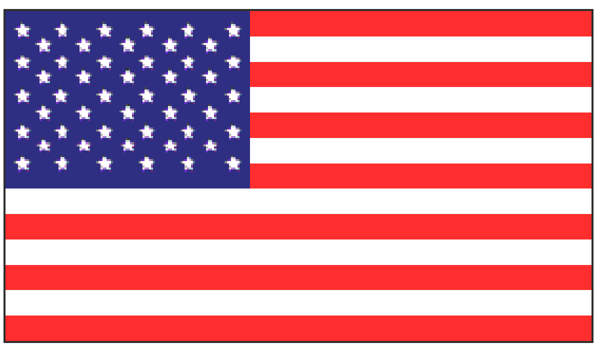
BINATIONAL STUDY REGARDING THE PRESENCE OF TOXIC SUBSTANCES IN THE LOWER COLORADO AND NEW RIVERS

ESTUDIO BINACIONAL SOBRE LA PRESENCIA DE SUSTANCIAS TOXICAS EN LAS AGUAS DEL BAJO RIO COLORADO Y DEL RIO NUEVO



Final Report, March 2003
Informe Final, Marzo de 2003

AUTHORITY

This study and report were undertaken by the United States and Mexico pursuant to the International Boundary and Water Commission Minute No. 289 entitled "Observation of the Quality of the Waters along the United States and Mexico Border" dated November 13, 1992.

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FOREWORD

This report is a joint document issued by the Governments of the United States and Mexico through their respective Sections of the International Boundary and Water Commission, the United States Environmental Protection Agency - Region IX, and the Comisión Nacional del Agua of Mexico. The governments of both countries thank the United States Geological Survey, the Arizona Department of Environmental Quality, the Arizona Department of Game and Fish, the California Department of Fish and Game, the California State Water Resources Control Board, the California Regional Water Quality Control Board, Colorado River Basin – Region 7, and the California Department of Health Services for their cooperation in the collection of monitoring data and drafting of the various sections of the report.

Copies of this report in English may be obtained from the United States Section, International Boundary and Water Commission, 4171 N. Mesa, Suite C-310, El Paso, Texas, 79902 or from the U.S. Environmental Protection Agency, Region IX, 75 Hawthorne St., San Francisco, CA 94105. The report in English may also be found on the Internet at http://www.epa.gov/surf/ and at http://www.ibwc.state.gov.

Copies of this report in Spanish may be obtained from the Comisión Internacional de Límites y Aguas, Sección Mexicana, Ave. Universidad No.2180, Cd. Juárez, Chihuahua CP 32310, or from the Comisión Nacional del Agua, Subdirección General Técnica, Gerencia de Saneamiento y Calidad del Agua, Ave. San Bernabé #549, Col. San Jerónimo Lídice, México, D.F. CP 10200.

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1. INTRODUCTION

1.1 Colorado River

The Colorado River Basin is the major river basin in the southwestern United States. It flows from the Rocky Mountains to the Gulf of California, draining 637,140 square kilometers (Km) (246,000 square miles) from seven states of the United States: Colorado, Wyoming, Utah, New Mexico, Nevada, Arizona, and California, as shown in Figure 1. It also flows through two Mexican states: Baja California and Sonora. The Colorado River conveys water some 2,044 Km (1,270 miles) from the western slope of the Rocky Mountains before forming the international boundary between the United States and Mexico between the Northerly International Boundary (NIB) near Yuma, Arizona and the Southerly International Boundary (SIB) near San Luis, Arizona. The international reach of the river covers a distance of 39 Km (25 miles). The river then flows an additional 160 Km (99 miles) in Mexico before emptying into the Gulf of California. The river is used for agricultural and domestic purposes and is particularly important for the arid regions of southern California and western Arizona, where it is the main water source. Natural flow of the Colorado River can fluctuate widely according to dry and wet years.

In 1922, the Colorado River Compact divided the beneficial consumptive use of the river's water equally between the upper and lower basin states based on an annual flow estimate of 18,500 million cubic meters (Mm^3) (15 million acre-feet). The upper basin states are Wyoming, Colorado, Utah, and New Mexico; the lower basin states are Nevada, Arizona, and California.

The 1944 United States-Mexico Treaty for utilization of the water in the Lower Colorado River allocates to Mexico an annual quantity of 1,850 Mm^3 (1.50 million acre-feet). In 1973, the International Boundary and Water Commission, United States and Mexico (IBWC) Minute No. 242 confirmed the process for the distribution of the waters to Mexico: 1,677 Mm^3 (1.36 million acre-feet) diverted at Morelos Dam and 173 Mm^3 (0.14 million acre-feet) at San Luis Rio Colorado, Sonora.

In the early 1960s, a decline in the quality of the Lower Colorado River water at the United States-Mexico border was identified as a problem. The sources of the degradation included irrigation return flows (salts and agrochemicals), groundwater (salts), and domestic wastewater (nutrients). The decline in water quality raised concerns as to possible adverse impacts to both humans and wildlife.

The Imperial/Mexicali Valley is separated from the Gulf of California by the Colorado River Delta. The Colorado River Delta is one of the world's great desert estuaries, bordered by extensive freshwater and tidal wetlands (Sykes, 1937; Leopold, 1949; Ezcurra et al. 1988; Felger, 1992; Zengel, 1995). Because of upstream water diversions and agricultural development, estuarine and wetlands areas have been reduced, thereby reducing the habitat for migrating and wintering waterfowl and unique and endangered species.

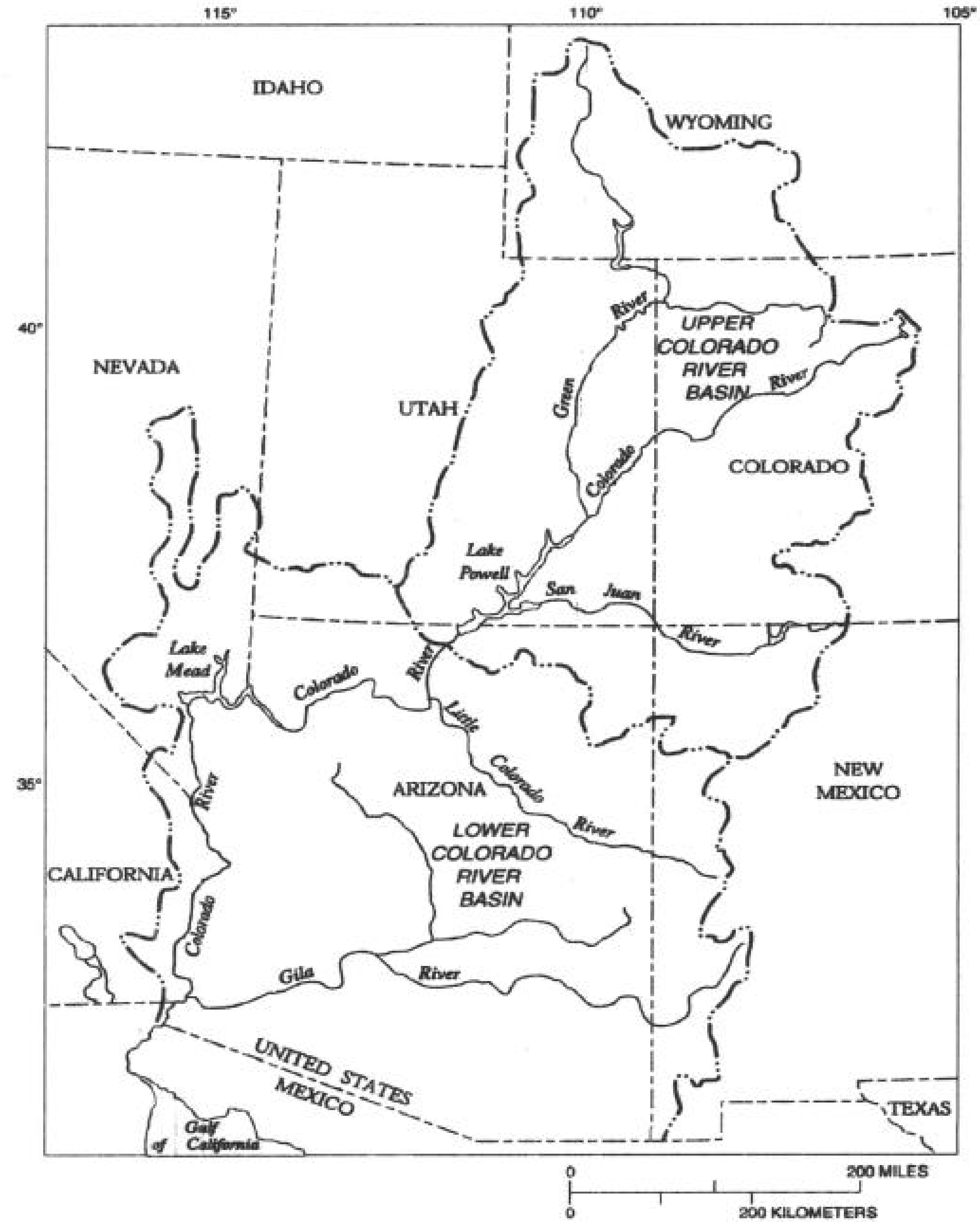

Figure 1. Colorado River Basin

Presently, the largest wetland area in the Colorado River Delta is the Ciénega de Santa Clara, historically a large overflow arm of the Colorado River. One of the main impacts to the original Ciénega de Santa Clara was a severely disrupted water supply due to construction of Hoover Dam on the Colorado River in 1935 (Sykes, 1937). Other adverse impacts on the Ciénega de Santa Clara have resulted from the reduction of freshwater flows and the discharge of salt-laden flows from the Wellton-Mohawk Bypass Drain (Wellton-Mohawk) (Zengel, et al. 1995).

Currently, the main water supply to the Ciénega de Santa Clara is the pumped drainage water from the Wellton-Mohawk Irrigation and Drainage District. It was intended that this discharge would continue only until completion of the Yuma Desalting Plant in Arizona. In 1992, the plant began operating at one-third capacity; however, in 1993, a 500-year flood occurred on the Gila River, resulting in a discharge of almost 6,150 Mm^3 (5 million acre-feet) of water into the Lower Colorado River. The lower salinity of the combined flows allowed the U.S. Bureau of Reclamation (USBR) to take the plant offline. According to the USBR, continued flow in the Colorado River and other factors have resulted in acceptable salinity levels at the international boundary making it unnecessary to operate the desalting plant. In the meantime, the Wellton-Mohawk continues to discharge into the Ciénega de Santa Clara.

1.2 New River

The New River originates 35.4 Km (22 miles) south of the international boundary. It flows into the United States at Calexico and travels 96.5 Km (60 miles) through the Imperial Valley before it discharges into the Salton Sea. The New River is the natural drain for Mexicali, Baja California. According to the California Regional Water Quality Control Board, Colorado River Basin, Region 7 (CRWQCB – Region 7), one-third of the New River's flow as it discharges into the Salton Sea comes from Mexico; the other two-thirds of the flow originates in the United States.

The Imperial/Mexicali Valley is in the southern part of a trough sometimes referred to as the Salton Sink that extends from the Gulf of California northward to the Coachella Valley. The trough was formed, at least in part, by subsidence along the San Andreas and San Jacinto faults. The trough has been filled over geologic time by marine and non-marine deposits. Overflow of the Colorado River in 1905-1907 and agricultural drainage since that time have brought the Salton Sea to its present level. According to the Imperial Irrigation District (IID), the water surface elevation is 69 meters (m) [227 feet (ft)] below sea level. The elevation of the land surface varies from about sea level near the U.S./Mexico border to 85 m (278 ft) below sea level at the Salton Sea. The Salton Sea is the largest inland water body in California, covering 932 square Km (360 square miles).

The IID reports that the salinity level of the Salton Sea is about 43,000-44,000 parts per million (ppm) which exceeds the salinity of ocean water (35,000 ppm). The water surface elevation of the Salton Sea has increased slightly over the last several decades due to increased inflow from the New and Alamo Rivers, and other climatological events. However, the high evaporation rate caused by the desert climate removes water from the Salton Sea, steadily increasing salinity levels.

1.3 Border Environmental Agreements

The La Paz Agreement (1983), the Integrated Environmental Plan for the U.S.-Mexico Border Area (First Stage, 1992), and the U.S.-Mexico Border XXI Program (1996) have helped to focus attention on environmental problems along the international boundary. The development of and commitment to agreements made in these documents have provided the motivation and framework for both countries to work together to solve mutual environmental problems in the border area.

The IBWC, within the context of agreements and understandings between the United States and Mexico, has monitored the flow of surface water along the U.S. - Mexico border for more than a century. During this time, both countries have signed IBWC Minutes. IBWC Minutes pertaining to the area of this study are listed in Table 1.

In Minute No. 289, both governments agreed to work together to investigate water quality along the border. Minute No. 289 provided the basis for the Binational Study Regarding the Presence of Toxic Substances in the Rio Grande/Rio Bravo and Its Tributaries Along the Boundary Portion Between the United States and Mexico.

Similarly, Minute No. 289 provided the basis for performing the present study on the Lower Colorado and New Rivers. In order to define study objectives, the IBWC called for a number of technical meetings of the responsible agencies in Mexico and the United States. The planning agencies for Mexico included the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT); Comisión Nacional del Agua (CNA); and the municipal and state agencies responsible for water management in the State of Baja California. For the United States, planning agencies included the U.S. Environmental Protection Agency (EPA) – Region IX, U.S. Geological Survey (USGS), U.S. Fish and Wildlife Service (USFWS), Arizona Department of Environmental Quality (ADEQ), Arizona Department of Game and Fish (ADGF), CRWQCB – Region 7, IID, California Department of Fish and Game (CDFG), and the California State Water Resources Control Board (CSWRCB). All planning agencies agreed to conduct the present study entitled, "Binational Study Regarding the Presence of Toxic Substances in the Lower Colorado and New Rivers."

1.4 Objective of the Study

The waters of the Lower Colorado River that flow into the border area are used for agricultural irrigation and potable water supply. A joint program was initiated to monitor the quality of water in this international stream. In addition, it was agreed that the New River would be monitored.

The objective of this study was to jointly investigate the presence of toxic substances in the Lower Colorado and New Rivers by analyzing toxic substances in water, bed sediment, suspended sediment, and fish tissue.

The Lower Colorado and New Rivers were sampled for a wide variety of contaminants and the results compared to existing standards and criteria. Data collected can be used as the baseline against which future changes may be assessed.

Table 1. IBWC Treaty Minutes Related to the Study Area

MINUTE		
No.	Title	Date
197	Adoption of rules for the operation and maintenance of the Morelos Diversion Dam on the Colorado River	June 30, 1951
242	Permanent and definitive solution to the international problem of the salinity of the Colorado River	August 30, 1973
261	Recommendations for the solution to the border sanitation problems	September 24, 1979
264	Recommendations for solution of the New River border sanitation problem at Calexico, California – Mexicali, Baja California	August 26, 1980
274	Joint project for the improvement of the quality of the waters of the New River at Calexico, California – Mexicali, Baja California	April 15, 1987
284	Rehabilitation of the Welton-Mohawk Bypass Drain In the Mexican Territory	January 18, 1991
288	Conceptual plan for the long term solution to the border sanitation problem of the New River at Calexico, California – Mexicali, Baja California	October 30, 1992
289	Observation of the quality of the waters along the United States and Mexico border	November 13, 1992
294	Facilities Planning Program for the Solution of Border Sanitation Problems	November 24, 1995

2.0 STUDY AREA DESCRIPTION

2.1 Hydrology

2.1.1 Lower Colorado River

From Laughlin, Nevada to the international boundary, the Lower Colorado River is regulated through a series of six dams: Davis, Parker, Headgate, Palo Verde, Imperial, and Laguna. The Davis and Parker dams are mid-size, concrete dams, which impound reservoirs creating Lake Mohave and Lake Havasu, respectively. Headgate, Palo Verde, Imperial and Laguna dams are considered water diversion structures. Natural tributaries to the Lower Colorado River are: the Bill Williams River which enters Lake Havasu near the Parker and Gila River, near Yuma, Arizona. The Gila River Basin is approximately 150,738 square Km (58,185 square miles).

Most of the area adjacent to the Lower Colorado River varies from arid to semi-arid, with little or no surface water. The rivers and creeks that flow between the California Coastal Mountain Range and the Sierra Madre Occidental eventually discharge into the Colorado River. Water from several rivers and creeks in the area is used for irrigation. The low humidity, high temperatures, dry soil, and intensive irrigation use generally cause these rivers and creeks to dry up before their waters reach the Colorado River (PIAF, 1992).

Sources of water that convey agricultural runoff in the Yuma area consist of the Yuma Main Drain (YMD), Wellton-Mohawk, and Gila River. Other sources of Colorado River water that are accountable to Mexico are the East and West Main Canal

River. Other sources of Colorado River water that are accountable to Mexico are the East and West Main Canal wasteways and the 242 Lateral. These flows are co-mingled into the Mexican canal called the Sánchez-Mejorada at the international boundary near San Luis, Arizona/Sonora, Rio Colorado.

2.1.2 New River

At the turn of the century, drainage from a high water table in the area of Cerro Prieto, Mexico flowed intermittently north in what was described as a small channel (Carpio-Obeso, 1997). In 1905-1906, the Colorado River overflowed and expanded an irrigation ditch cut made in the riverbank. Turning from its old channel, the entire Colorado River swept across the desert almost engulfing El Centro, California and turned northward into the Salton Sink depression, deepening the channel of what is now the New River. The river flowed for two years before it was diverted back into its old channel, filling the Salton Sea Sink to form the present-day Salton Sea. The New River flow now consists primarily of agricultural drainage from the Mexicali and Imperial Valleys as well as municipal and industrial wastewaters from both sides of the border. According to CNA's Programa Hidráulico, at the international boundary, the river has an average flow of 6.15 cubic meters per second (m^3/sec) [217 cubic feet per second (cfs)] of which approximately 75% is agricultural drainage from Irrigation District No. 014, and 25% is wastewater from Mexicali, Baja California. At its mouth emptying into the Salton Sea, 65% of the flow in the New River comes from the United States and 35% comes from Mexico.

2.2 Socioeconomic Characteristics

The main economic activity of the area surrounding the Lower Colorado and the New Rivers is irrigated agriculture, although industrial and commercial activity is rapidly expanding in Mexicali. Approximately 3,210 Mm^3 (2.6 million acre-feet) of Colorado River water is delivered annually via the All American Canal to 9 cities and approximately 204,500 hectares (ha) (500,000 acres) of agricultural lands in the Imperial Valley (IID, 1994). The canal has an overall length of 132 Km (82 miles) and begins at the Imperial Dam on the Colorado River about 32.2 Km (20 miles) northeast of Yuma, Arizona. It extends south and west following the United States - Mexico border, dropping 53.2 m (175 ft) between the Imperial Dam and its terminus at the West Side Main Canal. Approximately 80 m^3/sec is diverted at Morelos Dam through the Reforma Canal to Baja California, of which 88% is directed to the Mexicali Valley. The Reforma Canal has an overall length of 118 Km (73 miles), beginning at the Morelos Dam and ending at the Progreso Colonia. The irrigated surface of the Colorado District No. 014 is approximately 207,967 ha (513,678 acres).

Another important economic contributor is industrial activity. Maquiladora industries have moved to Baja California at a high rate. Among border cities, Mexicali ranks third in the number of maquiladoras. Most of the industrial plants operate under an agreement of production shared with parent firms in the United States. Maquiladoras must export all products, including any resulting hazardous waste, back to the country of origin of the raw materials. In Mexicali, most maquiladoras must return the hazardous waste to the United States. (Carpio-Obeso, 1993). In April 1994, the EPA requested information from parent companies in the United States that might own or operate facilities in the vicinity of Mexicali. EPA concluded that the information they received was inadequate to characterize fully the potential sources of industrial pollution in the New River. EPA also noted that a large portion of pollution in the New River comes from inadequately treated municipal wastewater.

2.3 Climate

Desert conditions are predominant in the region. The climate west of the Continental Divide is strongly influenced by a high-pressure cell over the eastern Pacific Ocean. During winter months, the Pacific High shifts southward, allowing rain storms originating in the region of the Aleutian Islands to move into California. However, the southward shift also tends to deflect these same winter storms from the study area. In the summer, a thermal low-pressure area develops over the Lower Colorado River Delta region.

Occasionally, moist air from the Pacific Ocean moves into this thermal low, producing monsoonal thunderstorm activity. Thus, the heaviest, albeit infrequent, precipitation in the study area occurs during the hot summer months (Hartmon, 1964). Almost all of the border area, from the Baja California/California region to the Sierra Madre Occidental has an average annual rainfall of less than 200 millimeters (mm) [7.9 inches (in)] (PIAF, 1992). The coasts of the Gulf of California have the lowest rainfall in Mexico, with annual averages of 40 mm (1.58 in).

Temperatures vary with elevation in the area between the Pacific Lowlands and the region Mesa Norte/Grandes Llanos. At elevations less than 800 m (2,624 ft) above sea level, the annual average temperature is 24°C (75.2°F).

The Imperial and Mexicali Valleys annually have more than 100 days with temperatures higher than 37.7°C (100°F). During the period of the study, the maximum temperature registered was 51°C (123.8°F) (Garcia-Cueto, personal communication, 1998).

While samples were being collected for this study, the average daily maximum temperature in the Mexicali Valley was 34.5°C (94 °F) in March; 47.5°C (118°F) in June and 28.7 °C (84 °F) in December 1995. The average daily maximum temperature for April 1996 was 40°C (104°F) (Hydrometric Station, CNA 1997).

2.4 Wildlife Habitat

More than 900 species of fish and marine mammals live in the Gulf of California. The ecosystems of the upper part of the Gulf of California and Colorado River Delta have great biological diversity and productivity. They support populations of vaquitas, totoabas, whales, and pupfish (the only native species remaining of eight documented as extant at the beginning of the twentieth century), as well as others. The Mexican government has established an Upper Gulf of California Biosphere Reserve to conserve the ecology of the region, promote sustainable development, and conduct scientific investigations of the Upper Gulf of California and Colorado River Delta (Diario Oficial, 1993). Biosphere reserves are areas of terrestrial and coastal ecosystems, which are internationally recognized within the framework of UNESCO's Man and Biosphere (MAB) Program. One of the objectives of the Upper Gulf Biosphere Reserve is to identify and protect critical habitats for endemic and endangered, rare, threatened, or vulnerable species (Diario Oficial, 1993).

The Upper Gulf of California and Colorado River Delta reserves have a total surface area of 9.34 billion ha (23 billion acres). Marine waters cover 60% of the Biosphere Reserve. Of the remaining 40% terrestrial area, 22% is within Sonora, 17% is within Baja California, and approximately 1% is in the Montague and Pelicanos Islands.

The Salton Sea National Wildlife Refuge (NWR) was created in 1930 as a wintering habitat for migratory waterfowl in the Pacific Flyway. The refuge consists of more than 18,225 ha (45,000 acres) including open-water areas, saline wetlands, and uplands. More than one million migratory waterfowl use the refuge each winter, including approximately 30,000 Canadian and snow geese and 60,000 ducks. During spring and summer, colonial birds using the NWR include great blue herons, cattle egrets, great egrets, and snowy egrets. Fish-eating birds include white pelicans, double crested cormorants, and eared grebes. Endangered species include the Yuma clapper rail, peregrine falcon, and California brown pelican. Other sensitive species occasionally using the NWR include whistling ducks, wood stork, long-billed curlew, mountain plover, and white faced ibis. Between August 15, 1996 and November 15, 1996, a massive die-off occurred, killing over 14,000 fish-eating birds of 65 species including 9,665 pelicans. The Salton Sea NWR reported that the cause of this die-off was attributed to avian botulism type C and indirectly to *Vibrio alginolyticus*. Botulism outbreaks typically occur in the summer when temperatures are high and stagnant (anaerobic) conditions prevail. Avian botulism is common worldwide and is not a threat to human health in the Salton Sea area. Other massive avian die-offs that have occurred in the Salton Sea area during the 1990s affected mainly eared grebes (unknown origin) and cormorants (Newcastle's virus).

3. PREVIOUS STUDIES

3.1 Lower Colorado River

The quality of the water in the Lower Colorado River has been monitored since 1892 according to Collingwood with continuous records dating from 1909. The earliest studies reported concentrations of suspended matter, total dissolved solids (TDS), and the major cations and anions. TDS concentrations were seasonally variable between about 250 milligrams per liter (mg/L) during spring runoff to about

1,200 mg/L in late summer to mid-winter. Suspended solids concentrations varied between 2,000-35,000 mg/L (Irelan, Burdge, 1971).

In 1976, McDonald and Loeltz reported a trend towards higher TDS concentrations over time. In the early 1950s, TDS at Imperial Dam averaged 706 mg/L, while in the early 1960s, concentrations were 824 mg/L. The trend was attributed to increased diversions during the 1960s for use in California.

In 1980, Klein and Bradford studied the effects of irrigation return flows on increasing salt loads in the Lower Colorado River. They found that TDS concentrations were about 900 mg/L at the NIB, consistent with the increasing trends observed in the 1950s and 1960s.

Bernal and Cervantes (1991), using data collected between 1902 and 1989, determined the annual average salinity of Colorado River water delivered to the Mexicali Valley. The salinity of the Colorado River was reported at 400 ppm in 1902, 600 ppm in 1932, 760 ppm in 1948, 800 ppm during the 60s, and 1050 ppm in 1995. This represents an increase of over 150% since the early 1900s.

In 1968 the Federal Water Pollution Control Administration conducted an investigation of the water quality of the Lower Colorado River and concluded that pollution problems were caused by the use of pesticides on irrigated lands in both Arizona and California from Parker Dam to the SIB. In 1973, (when analytical detection limits for pesticides were higher than they are today) EPA analyzed water samples and channel catfish at 17 stations along the Lower Colorado River between Parker Dam and the NIB. The study concluded that organophosphate and carbamate pesticides were not present in the water in sufficient concentrations to be harmful to fish. The study further concluded that pesticide pollution was not a problem in the Lower Colorado River.

In 1986-87, Setmire, Wolfe, and Stroud studied concentrations of trace elements and pesticides in water, bed sediment, and biota from areas near the Salton Sea and in the Imperial Valley. This study found that elevated dissolved selenium concentrations were present in tile drains, while the highest concentrations associated with bed sediments were from samples taken within the Salton Sea. Organochlorine pesticide residues were detected in bottom sediment throughout the study area. Selenium concentrations in waterfowl were elevated.

In 1988, Radtke, Kepner, and Effertz presented analytical results for selected inorganic and synthetic organic constituents in water, bottom sediment, and biota from areas near the Lower Colorado River. With the exception of selenium and DDE, this study found the samples to be relatively free of high concentrations of toxic constituents that could be a threat to humans, fish, and wildlife. Dissolved selenium concentrations exceeded the 75% national baseline, while bottom sediment concentrations exceeded the 95% national baseline. Thorium and uranium concentrations in bottom sediment also exceeded the 95% national baseline.

Setmire and others (1993) reported results for a detailed study in the Salton Sea area. Biological sampling and analysis showed that contaminants including selenium, boron, and DDE were accumulating in tissues of migratory and resident birds. A total of 19 organochlorine pesticides, other than DDT and its metabolites DDD and DDE, were also detected in biota at concentrations greater than 0.01 microgram per gram (µg/g) wet weight (data in Schroeder and others, 1993).

In 1995, Baldys, Ham, and Fossum reported an increasing trend for dissolved sulfate, total lead, and total ammonia plus organic nitrogen at the mouth of the Gila River.

In 1995, Tadayon and others studied water quality, bed sediment, and biota in the Arizona Yuma Valley. Samples were collected and analyzed for selected inorganic and organic constituents. TDS concentrations ranged from 712 to 3,000 mg/L. A significant percentage of samples collected had dissolved concentrations of selenium, lead, and mercury that exceeded aquatic life criteria. The only synthetic organochlorine compound found in bed sediment was p,p'-DDE, which was also present in all fish and bird samples. Common carp (*Cyprinus carpio*) collected from the YMD near San Luis, Arizona had the highest mean concentrations of aluminum and chromium ever recorded in Arizona.

Some of the studies conducted in the early 1990s in the Lower Colorado River by Mexican researchers (most notably Gutiérrez-Galindo) show high trace metal concentrations in clams. The trace metal concentrations included copper at 51µg/g dry weight, zinc at 163 µg/g and manganese at 171 µg/g.

3.2 New River

Several previous studies have been conducted on the New River which are relevant to this study. In 1971, Irwin studied the water quality in tributaries to the Salton Sea. The study determined concentrations of TDS, nitrogen, phosphorus, and selected pesticides at several sites in the IID drainage system. Sampling locations included the East Highline Canal, three along the New River, four along the Alamo River, and a background site on the All American Canal. Samples were collected monthly for one year between 1969 and 1970. Analyses were conducted for 12 commonly used agricultural pesticides. Measurable concentrations of DDT and its metabolites were present in both the Alamo and New Rivers, reflecting the use of DDT in both the United States and Mexico at that time.

In 1977-78, Setmire conducted studies on the New River that focused primarily on oxygen and oxygen demand. He attributed low oxygen in the river to the discharge of sewage from Mexicali. Analysis of samples collected from the New River at Calexico indicated excessive organic matter as the major water quality problem. Complete depletion of dissolved oxygen extended 26 miles downstream from the international boundary during the summer of 1977.

Eccles (1979) studied the aerial and temporal distribution of selected pesticides in the agricultural drains of

California's Imperial Valley. Sampling included water and bed sediment from agricultural drainage channels, subsurface drain water from field tile-drainage lines, irrigation tailwater, and water in the drains directly exposed to drift from aerial application of pesticides. Classes of pesticides analyzed included organochlorine and organophosphate insecticides and herbicides. Median aqueousconcentrations of pesticides most frequently detected were DDE at 0.03 micrograms per liter (µg/L); 2,4-D at 0.22 µg/L; endosulfan at 0.17 µg/L; diazinon at 0.18 µg/L; ethyl parathion at 0.28 µg/L; and methyl parathion at 0.10 µg/L. The minimum detection limit for most of the pesticides analyzed was 0.01 µg/L in water.

In 1985, the CRWQCB collected samples from a variety of sources and locations in the Imperial Valley for selenium analysis by the California Department of Water Resources (data presented in Setmire, et al. 1990). The data indicated that agricultural tile drains were the main source of selenium in the New and Alamo Rivers. Elevated concentrations of selenium also have been detected in San Felipe Creek at 29 µg/L (Gruenberg, CRWQCB, written communication, 1987) and 20 µg/L (USGS data from April 2, 1992).

The CRWQCB conducted additional studies in June 1986. Samples from 119 tile drains and 36 other collector drains and river sites in the Salton Sea area showed that selenium concentrations were highest in tile drains, less than 10 µg/L in collector drains, and less than 2 µg/L in the Colorado River and Salton Sea. Cooke and Bruland (1987) measured selenium concentrations of about 1 µg/L in the Salton Sea. Setmire (1993 et al.) reported selenium concentrations up to 300 µg/L in tile drains, but less only 2 µg/L in water from the Salton Sea (Schroeder et al., 1993). In contrast to the pattern for water, the highest bed sediment selenium concentration, at 3.3 milligrams per kilogram (mg/kg), was found in a composite sample from the Salton Sea.

Several researchers (Koranda, 1979, White, 1987, Setmire et al., 1990 and 1993, and Schroeder et al., 1993) have reported high selenium concentrations in biota in the Imperial Valley. Koranda reported mean selenium concentrations in the livers of wintering waterfowl as 15 µg/g in green-winged teal, 15.6 µg/g in shovelers, 11.2 µg/g in pintails, and 49.5 µg/g in ruddy ducks. In 1987, White reported fish species from the Salton Sea, including tilapia, with the highest average selenium concentration in liver tissues (6.8 µg/g). Mean muscle-tissue selenium concentrations of 3.1 µg/g were reported in corvina, 3.5 µg/g in tilapia, and 3.9 µg/g in croaker.

In 1987, the CDFG reported selenium in four bird species in the Imperial Valley. Selenium concentrations in liver tissue were 3.1 µg/g for the lesser scaup, 9.7 µg/g for the double-crested cormorant, 5.2 µg/g for the black-necked stilt, and 1.3 µg/g for the wigeon. In muscle tissue, selenium concentrations were 1.2 µg/g for the lesser scaup, and 0.89 µg/g for the wigeon.

Setmire and others (1990) reported that selenium concentrations in tilapia and corvina ranged from 3.5 to 20 µg/g. The mean concentration of 10.5 µg/g exceeded the safe level for consumption of fish by humans. In waterfowl, selenium was detected in livers at concentrations as high as 42 µg/g in cormorants. Mercury was another trace element reported by Setmire with liver tissue concentrations ranging from 2.2 to 49 µg/g.

Setmire and others (1993) found that bioaccumulation through the food chain results in selenium levels that could affect reproduction in fish-eating birds, shorebirds, and the endangered Yuma clapper rail.

Organochlorine pesticides in biota have been reported by historical and recent studies conducted in the Imperial Valley. High DDE concentrations were observed in water-bird eggs collected in 1985 by H.M. Ohlendorf, USFWS. Setmire et al. (1993) detected a total of 19 organochlorine pesticides, in addition to DDT and its metabolites in biota, but only DDE, toxaphene, and hexachlorobenzene were reported at levels greater than 1 µg/g dry weight. The most frequently detected pesticide residues in biota were DDT metabolites (at 96%), dieldrin (at 60%) and DCPA (at 64 %).

Recent studies have found a number of currently used pesticides in surface waters throughout the Salton Sea area. Concentrations measured in the early spring of 1992 (R. A. Schroeder, USGS, written communication, 1992) were either below or only slightly above detection limits in non-agricultural areas outside the Imperial Valley, such as Salt Creek and San Felipe Creek, and in the Salton Sea itself. In contrast, several pesticides were found at well above detection levels in all samples from surface drainage channels within the Imperial Valley and from the New and Alamo Rivers. Monthly monitoring during 1994 at several sites in the Alamo River for the CRWQCB (Carol DeGirogio, UC Davis, written communication, 1995) found concentrations comparable to those reported by earlier studies. Pesticides in the Alamo River displayed a bimodal pattern similar to that previously observed by Eccles (1979), with highest concentrations occurring in late winter/early spring and fall thereby following the seasonal pattern of agricultural application. Concurrent bioassays using *Ceriodaphnia dubia* attributed toxicity response that closely correlated with concentrations of 3 organophosphates (diazinon, malation, and chlorpyrifos) and 2 carbamates (carbaryl and carbofuran).

4. METHODOLOGY

Two teams consisting of staff from agencies in the United States and Mexico conducted the study. The agencies participating on the United States team included: USGS, CRWQCB - Region 7, ADEQ, ADGF, CDFG, EPA - Region IX, CSWRCB, and the United States Section of the IBWC (USIBWC). The agencies participating on the Mexican team included: CNA Oficina Central, CNA Gerencia Regional Península de Baja California, and Comisión Internacional de Límites y Aguas (CILA), Sección Mexicana. Both teams worked together to collect samples at predetermined monitoring sites.

The study teams, through the

international coordination of the IBWC, collaborated to develop a sampling plan described in the March 22, 1995 "Joint Report of the Principal Engineers Relative to the Joint Program to Determine the Presence of Toxic Substances in the Waters of the Lower Colorado and the New Rivers**."** Study participants collected water, suspended sediment, and bed sediment samples which were split in the field between the teams and later analyzed using each agency's established laboratories and methodologies. Fish samples were collected by CRWQCB at the New River near the international boundary, and by the ADGF in the YMD in the Lower Colorado River. CDFG personnel sampled all other stations.

The U.S. team performed analyses on water samples for trace elements**,** extractable organic compounds**,** pesticides**,** major nutrients, general water quality parameters**,** and volatile organic compounds (VOCs). The U.S. analyses performed on suspended sediment and bed sediment samples included trace elements, extractable organic compounds and chlorinated organic compounds. The U.S. team also performed analyses to determine bioaccumulation in fish tissue and aquatic toxicity.

The Mexican team performed analyses of trace elements, major nutrients, general water quality parameters, and VOCs in water, and of trace elements in bed sediment**.**

4.1 Sampling Sites

On the Lower Colorado River, samples were taken from three sites in June 1995, and from the same three sites plus two additional sites in December 1995. On the New River, samples were taken from three sites in March 1995 and from the same three sites again in April 1996. The locations of the monitoring sites are shown in Figure 2.

4.1.1 Lower Colorado River

The Lower Colorado River was sampled at the following three sites in June and December 1995:

1. <u>All American Canal (32°52'34"N; 114°28'13"W, near Imperial Dam).</u> This site is 1,820 m (5,970 ft) downstream from the canal intake at the west end of Imperial Dam and 22 Km (13.7 miles) upstream from the turnout to the Yuma Main Canal. This site was selected because it receives natural discharges from the Lower Colorado River Basin as well as return flows from various upstream users, including several agricultural valleys adjacent to the Lower Colorado River. This canal carries the Imperial Valley's main agricultural and drinking water supply.

2. <u>Lower Colorado River at the NIB (32°42'30"N; 114°43'30"W).</u> This site is 8 Km (5 miles) west of Yuma, Arizona and 1.8 Km (1.1 miles) upstream from Morelos Dam. The site represents the water delivered to Mexico. This water is the primary source of drinking water for several Mexican communities in Baja California along the U.S.-Mexico border.

3. <u>Yuma Main Drain (32°29'20"N; 114°47'15"W).</u> This site is just north of the international boundary. The drain receives Colorado River water, groundwater from a nearby well field in the United States, and agricultural

drainage from the Yuma Valley.

The following two additional sites were sampled in December 1995:

4. Gila River (32°42'03"N; 114°33'10"W). This site is approximately 300 m (984 ft) upstream from its confluence with the Colorado River. The Gila River was sampled to ascertain its effect on the Colorado River at the NIB. The water in this tributary to the Colorado River contains primarily return flows from the Wellton-Mohawk Irrigation and Drainage District.

5. Wellton-Mohawk Bypass Drain (32°48'08"N; 114°29'23"W) at the international boundary. This site was selected because it receives agricultural drainage from the Wellton-Mohawk Irrigation and Drainage District and treated wastewater from San Luis, Arizona. These waters flow through Mexico into the Ciénega de Santa Clara.

4.1.2 New River

The New River was sampled at the following three sites in March 1995 and April 1996:

1. Mexicali (32°39'46"N; 115°29'48"W). This site is 206 m (676 ft) south of the international boundary and upstream from the discharge from the Mexicali I wastewater treatment lagoons. River flow at this point is comprised of agricultural drainage and untreated or partially treated industrial and municipal wastewater discharges from Mexicali.

2. Calexico (32°39'58"N; 115°30'09"W). This site is located approximately 420 m (1328 ft) north of the international boundary and downstream of the discharge from the Mexicali I wastewater treatment lagoons.

3. Westmorland (33°06'17"N; 115°39'48"W). This site represents the water quality in the New River at its mouth emptying into the Salton Sea.

4.2 Sample Collection

4.2.1 Cleaning of Equipment

The collection and processing equipment for water, suspended sediment, and bed sediment samples analyzed by both teams was cleaned in the USGS Laboratory in San Diego before being taken to the field sites. The equipment was also cleaned in the field immediately following sample collection and processing. Precleaning involved soaking for at least 30 minutes in a diluted phosphate-free detergent solution. The equipment was then scrubbed with a nonmetallic brush, followed by rinsing with tap water to remove all detergent residues. Leachable metals were removed from nonmetallic equipment by soaking in five percent hydrochloric acid (HCl) with occasional swirling, followed by three rinses with deionized water. The equipment used for pesticide processing was then rinsed with a minimum volume of pesticide-grade methanol and allowed to air dry. After drying, the equipment used for inorganic sampling was sealed in plastic bags and the equipment for organic sampling was sealed in aluminum foil for transport to the sampling sites.

Equipment used for processing the organic carbon samples was baked at 450° C for two hours, or was cleaned using de-ionized water.

4.3 Sampling Procedure

The samples that were obtained include water, suspended sediment, bed sediment, and biota. Following are the procedures used for sampling each medium.

4.3.1 Water and Suspended Sediment

Water and suspended sediment samples were collected by the two study teams using the equal-discharge-increment sampling method described by Edwards and Glysson (1988). The stream flow discharge distribution across the stream cross-section was determined prior to sample collection. The stream cross-section was divided into 5 horizontal sections through which equal percentages of the stream discharged.

A sampling location was selected at the estimated midpoint of flow for each horizontal section and a depth-integrated (vertical) sample of the stream flow was collected.

Samples for chemical analyses were collected using either a DH-81 or a D-77 sampler equipped with a Teflon bottle, cap, and nozzle. The individual vertical samples were composited in the bucket of a polyethylene churn prior to splitting for inorganic chemical and physical analyses. Samples for analysis of pesticides and extractable organic compounds were distributed into precleaned glass bottles directly from Teflon sampling bottle. Samples for suspended sediment concentration and size analysis were collected using a DH-49 sampler equipped with 500-milliliter (mL) glass bottles. One bottle was collected for each vertical segment and analyzed separately to determine the quantity and size distribution of suspended sediment at each sampling site.

Analysis for organic contaminants in suspended sediment required more sediment mass than could be collected using the sampling procedure just described. For these samples, a cleaned stainless-steel submersible pump equipped with Teflon tubing was submersed into the stream flow at the sampling location to 60 percent of total depth (slightly below mid-depth). Water was then pumped into cleaned glass carboy (5-gallon capacity). Approximately 200 liters (L) were collected. The suspended sediment was isolated by tangential-flow filtration which captured the fine clay and colloidal, as well as coarse, material (Rees and Ranville, 1990). Nominal pore size of the filters was 0.005 micrometer (µm).

Samples for VOCs also were collected using a submersible pump to pump the water directly into sample bottles and vials.

The U.S. team field spiked its samples with deuterated compounds to measure

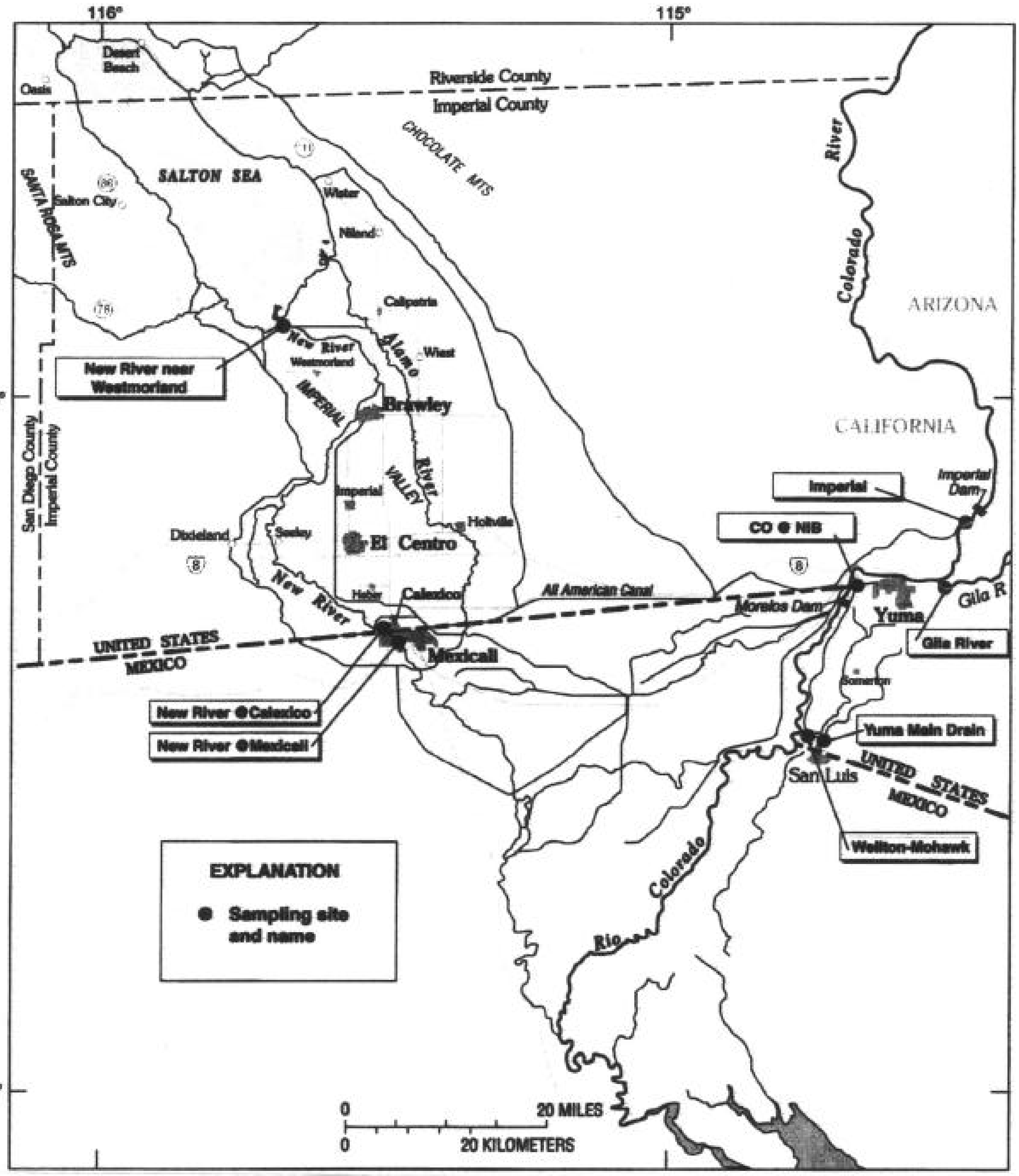

Figure 2. Location of Binational Sampling Sites

field plus laboratory recovery (and added a few drops of HCl as a preservative). The spiked surrogates were d5-chlorobenzene and the d6-benzene. Samples were placed in a 40-mL vial with a Teflon-lined, septum-screw cap.

Aliquots (ranging from 125 mL to 1 L) for water quality analyses, laboratory conductivity, laboratory alkalinity, field conductivity and field pH were split from the composite sample prior to further processing.

During splitting, suspended sediments were kept in suspension by churning at a rate of 10 centimeters per second (cm/sec). Sample collection and splitting were done while the churn splitter was enclosed in plastic bags or was within an enclosed processing chamber to minimize atmospheric contamination.

Samples for dissolved inorganic analyses that required filtration also were processed within an enclosed chamber using a precleaned disposable 0.45-µm capsule filter. The capsule filter was attached to a length of precleaned "C-flex" tubing fitted into a peristaltic pump head and 1 L of deionized water was pumped through the filter. Excess deionized water was drained from the intake side of the tubing and a small volume of the sample was then pumped through the tubing to displace any residual deionized water. The filtrate was used to rinse each bottle 3 times before the bottles were filled. Aliquots for anions, TDS, cations, nutrients, and field alkalinity were processed using this filtration procedure. Aliquots for analysis of major cations and trace elements were acidified to pH 2 using ultra-grade nitric acid. Aliquots for determination of nutrients were preserved by addition of mercuric chloride and chilled to $4^{o}C$.

Samples for organic carbon analysis were taken directly from the Teflon sampling bottle and processed within an enclosed chamber using a stainless-steel pressure filter assembly fitted with a 47-mm diameter, 0.45-µm silver membrane filter. The filter was rinsed with 25 mL of organic-free deionized water and the rinse was discarded. The sample was placed into the filter assembly, then forced through the filter under pressure using a nitrogen tank and regulator. The first 25 mL of filtered sample was discarded, and the subsequent filtrate was collected in precleaned glass bottles and chilled to $4^{o}C$.

4.3.2 Bed Sediment Samples

Sediments carried by streams are deposited in areas where the stream velocity is lower than in adjacent areas. Generally, these depositional areas are on the inside bend of a stream or in areas downstream from obstacles such as boulders, sand bars, bridges, or shallow waters near the bank. Bed sediment is used to monitor trace metals and hydrophobic organic contaminants in streams because a large fraction of the total mass of these contaminants is usually associated with fine-grained sediments, including clays and silts. Consequently, even though concentrations of contaminants in water may be low, bed sediment (and suspended sediment) may still contain high concentrations.

In addition to enhancing sensitivity, bed sediments provide a measure of water quality conditions over an extended period of time. Point source contributions of many contaminants are often intermittent and the contaminants may not be detected in single or periodic water samples. When combined with biological tissue analysis, bed sediment concentrations provide a useful measure of the potential bioaccumulation of trace elements and hydrophobic organic contaminants.

Bed sediment samples were collected using techniques described in Shelton and Capel (1994) from depositional areas close to the cross-sections used for the water and suspended sediment samples. A stainless-steel Ekman dredge was used by first opening and locking the jaws. The dredge was lowered to the bed, and a messenger was deployed to close the jaws. The filled dredge was retrieved to the surface where it was opened and its contents composited in a glass bowl with other dredged cores until at least 1.5 L of wet sediment was collected. The composited cores were homogenized, then forced through a cleaned 2-mm stainless steel screen to remove rocks, twigs, benthic macroorganisms, and other debris. The screened sediment was then transferred to cleaned jars for shipment to each country's laboratories for analysis. Glass jars were used for organic analysis samples, and plastic jars for trace element analysis samples. Samples for analysis of organic compounds were chilled to $4^{o}C$.

4.3.3 Biota

Samples were collected at four sites in Imperial County, California and at one site in Yuma County, Arizona. The ADGF collected samples at the Arizona site. CRWQCB staff collected samples in the New River near the international boundary. The CDFG sampled all the other sites.

Samples were collected using a Smith-Root SR-16E electrofishing boat; variable mesh, woven and monofilament gill nets; baited hoop nets measuring 3 feet in diameter with 1 inch square mesh; hook and line; or beach seines of varying lengths, widths and material. Collected fish were kept in clean stainless steel buckets until they could be double-wrapped in extra-heavy duty aluminum foil, labeled, and packed in dry ice.

Composite samples, using up to six fish of the same species and similar size, were collected whenever possible. Collection of the same species of forage and predator fish from each station for two sample collections was attempted. Only one carp was caught in the New River near the international boundary. Collections at the YMD and All American Canal resulted in two different species of predator fish (largemouth bass and channel catfish) for the two collections at each station.

4.4 Field Measurements

Measurements of specific conductance, water temperature, dissolved oxygen (DO), pH, and alkalinity were taken in the field immediately after collection of the samples. Water temperature and DO were measured directly in the stream. Specific conductance, pH and alkalinity were measured in aliquots split from the composited samples. These constituents were measured using standard techniques described in Shelton (1994).

4.5 Laboratory Analyses

Teams from each country performed laboratory analyses on water and bed sediment samples. For suspended sediment and biota samples, only the United States team performed the analyses.

The procedures and techniques for the laboratory analyses are described in detail in the analytical references and appendices. The following is a brief description of the laboratory procedures used for this study.

4.5.1 Water and Sediment

In the United States, dissolved inorganic and organic constituents were analyzed by the USGS's National Water Quality Laboratory (NWQL). Concentrations of major anions were determined using ion chromatography. Concentrations of major cations and trace metals were determined using either inductively coupled plasma - mass spectrometry (ICP-MS) or atomic absorption (AA). Samples collected for aqueous pesticide analysis were processed by first removing suspended sediment by filtration through a 0.7 μm baked glass filter, and then pumping the filtrate through columns for sorption of the pesticides onto solid phase cartridges. The extract from the C-18 SPE cartridge was analyzed by gas chromatography - mass spectrometry (GC-MS); the extract from the Carbopack B SPE cartridge was analyzed by HPLC with ultraviolet (UV) detection. Concentrations of VOCs were determined using GC-MS.

The USGS Branch of Geochemistry Analytical Laboratories determined inorganic composition of the suspended and bed sediments. The procedure involved complete digestion of the sediments with acids followed by analysis using ICP for all but a few of the elements. Organic compounds in bed and suspended sediment were determined by the NWQL by first extracting the sediments with organic solvents, purifying and concentrating the extract, then analyzing by GC-Electron Capture Detection (ECD) for organochlorines and by GC-MS for other organic compounds.

In Mexico, the water samples were analyzed in two different laboratories. Trace elements were analyzed in the Central Laboratory of the Sanitation and Water Quality Management, applying the method NMX AA 051/1980 (atomic absorption spectrometry). The Baja California State Laboratory performed conventional constituent analyses such as: oil and grease (NMX AA 005/1980), DO, chemical oxygen demand (COD), biochemical oxygen demand (BOD), turbidity, hardness, alkalinity, suspended solids, total solids, conductivity, total coliform, and organic and ammonium nitrogen and organophosphates, in accordance with Official Mexican Norm NOM-001-ECOL-1994. A private certified laboratory conducted the special analysis. U.S. EPA method 524.2 was used for the identification and simultaneous measurement of purgeable VOCs in water. The compounds were determined by capillary column gas chromatography (GC) interfaced to a mass spectrometer (MS). EPA Method 525.2 was used for a wide range of organic compounds that are efficiently partitioned from the water sample onto a C_{18} organic phase chemically bonded to a solid silica matrix in a cartridge or disk, using liquid-solid extraction (LSE). The sample extracted is introduced into a high-resolution fused silica capillary column of a GC/MS system for the determination of the compounds. It was applied for the determination of compounds from municipal and industrial discharges using EPA Method 624. EPA Method 8080 was used for the analysis of organochlorine pesticides and PCBs.

4.5.2 Biota

A detailed description of procedures and techniques used for this study can be found in the CDFG Laboratory Quality Assurance Program Plan of 1990. Appendix A provides a summary of the laboratory procedures used by the CDFG's Water Pollution Control Laboratory.

4.6 Quality Assurance

Sources of variability and bias introduced by sample collection and processing affect the interpretation of water-quality data. The use of blanks throughout the sampling and analysis helps to identify possible sources of variability and bias in the data. Field blanks are designed to demonstrate that equipment-cleaning protocols adequately remove residual contamination from previous use, that sampling and sample-processing procedures do not result in contamination, and that equipment handling and transport between periods of sample collection do not introduce contamination. Preparation of field blanks for organic analysis involves processing a volume of organic-free deionized water through all sample equipment that might be in contact with the sample during processing. Field blanks for major ions, trace elements, and nutrients are collected using the same approach, but substituting inorganic-free deionized water.

Sample replicates are designed to provide information needed to estimate the precision of concentration values determined from the combined sample processing and analysis, and to evaluate the consistency of identifying target analytes for pesticides. Each replicate aliquot of a sample from the splitter is processed immediately in succession using the same equipment, placed in the same type of bottle, and processed, stored, and shipped in the same way.
Field-matrix spikes were prepared by adding spike surrogates provided by the USGS NWQL to vials used for VOC analysis. The laboratory also adds surrogate compounds to check performance for other organic analyses.

The general quality assurance procedures described above are well suited to monitoring programs involving the collection of many samples. However, they are well beyond the resources available for a study such as this one in which few samples are collected but many constituents are analyzed. Therefore, this study relies instead on the fact that a large number of studies using the same sampling and analytical procedures nationwide and locally have successfully collected and analyzed blanks, replicates, and spikes. Those methods are documented in the USGS National Field Manual and updates. The U.S. laboratory also maintains an internal quality assurance program for which about 10 percent of all analyses consist of quality control samples. Because the collection and chemical analysis of suspended sediment does not have a published standard method, details are provided in this report. Comparison of trace element concentrations on filtrates from the capsule filter (0.45 µm) and the tangential-flow membranes (0.005 µm) indicates that most of the iron, manganese, and aluminum that passes through the 0.45 µm filter (conventionally defined as dissolved) was actually colloidal and was retained on the tangential flow membranes.

All chemical data generated by the U.S. from this study have been stored electronically and can be retrieved from the USGS National Water Information System (NWIS) database. The database also contains information on analytical method, reporting (detection) level, and precision (significant figures) associated with each sample (R. A. Schroeder, USGS, 1999 communication). The CDFG conducted the quality assurance for biota analyses. Ten percent of the samples and matrix spikes were analyzed in duplicate to determine precision. To protect sample integrity, all materials coming in contact with samples during laboratory operations were analyzed for trace element and organic chemical content. To ensure accuracy, matrix spike and reference materials from the National Institute of Standards and Technology (NIST) and the National Research Council of Canada were analyzed.

5. RESULTS

The environmental media sampled in the study were: water, suspended sediment, bed sediment, and fish tissue. Aquatic toxicity tests also were performed.

Appendix A.3 lists the schedules and method reporting limits (MRLs) used by U.S. laboratories for water, suspended and bed sediment results reported in Appendix C.

5.1 Water Chemistry

5.1.1 Total Dissolved Solids and Sediment Loads

The results are presented in Table 2 and summarized below.

Lower Colorado River

The All American Canal site was sampled on June 6, 1995 and December 4, 1995. On June 6, the canal flow was 203 m^3/sec (7,170 cfs) with a TDS concentration of 832 mg/L and a suspended sediment concentration of 24 mg/L. These values correspond to a load of 14,600 metric tons of TDS per day and 421 metric tons of suspended sediment per day. On December 4, 1995, the canal flow was 138 m^3/sec (4,871 cfs); the TDS concentration was 822 mg/L; and the suspended sediment concentration was 9 mg/L. These values correspond to a TDS load of 9,800 metric tons per day and a suspended sediment load of 107 metric tons per day.

The NIB was sampled on June 13, 1995 and December 5, 1995. River flow on June 13 was 93 m^3/sec (3,280 cfs) with a TDS concentration of 732 mg/L and a suspended sediment concentration of 562 mg/L. On June 13, the Colorado River at the NIB was carrying 5,880 metric tons of TDS per day and 4,516 metric tons of suspended sediment per day. On December 5, river flow was 46 m^3/sec (1,624 cfs) with a TDS concentration of 988 mg/L and a suspended sediment concentration of 144 mg/L. These data equate to a load of 3,927 metric tons of TDS per day and 572 metric tons of suspended sediment per day.

The YMD was sampled on June 20, and December 6, 1995. On June 20, drain flow was 4.4 m^3/sec (155 cfs) with a TDS concentration of 1,420 mg/L and a suspended sediment concentration of 109 mg/L. The YMD was carrying 540 metric tons per day of TDS and 33 metric tons per day of suspended sediment. On December 6, the flow was 3.98 m^3/sec (141 cfs), with a TDS concentration of 1,490 mg/L and suspended sediment concentration of 89 mg/L. The YMD was carrying 512 metric tons per day of TDS and 31 metric tons per day of suspended sediment.

The Gila River was sampled on December 5, 1995 and the Wellton-Mohawk was sampled on December 6, 1995. Only a limited suite of analytes was measured and analyzed for the samples taken at these two sites because they were not part of the original experimental protocol. The TDS concentrations in water from the Gila River and Wellton-Mohawk were 1,830 mg/L, and 2,940 mg/L, respectively. The flow measurement of Gila River was 4.2 m^3/sec (148 cfs), with a suspended sediment concentration of 46 mg/L. The Gila River was carrying 664 metric tons per day of TDS and 17 metric tons per day of suspended sediment. On the Wellton-Mohawk, the flow measurement was 3.8 m^3/sec (134 cfs) with a suspended sediment concentration of 145 mg/L.

The TDS load was 965 metric tons per day and the suspended sediment load was 48 metric tons per day.

New River

Samples were collected from the New River between March 22 and 28, 1995, and between April 9 and 11, 1996. The river flow during the 1995 sampling at the Mexicali site was 5.3 m^3/sec (187 cfs), with a TDS concentration of 3,910 mg/L and 16 mg/L of suspended sediment. The New River at the Mexicali site carried 1,800 metric tons per day of TDS and 7.4 metric tons per day of suspended sediment. Flow at the Calexico site was 6 m^3/sec (212 cfs), with a TDS concentration of 3,450 mg/L and 13 mg/L of suspended sediment. The New River at the Calexico site carried 1,788 metric tons per day of TDS and 6.7 metric tons per day of suspended sediment. At the Westmorland site (New River mouth to the Salton Sea) the flow had increased to 21 m^3/sec (742 cfs). The TDS concentration had decreased to 2,740 mg/L, while the suspended sediment concentration increased to 451 mg/L at the mouth. The New River at its mouth carried 4,970 metric tons per day of TDS and 818 metric tons per day of suspended sediment.

During the 1996 sampling event, the river flow at the Mexicali site was 4.1 m^3/sec (145 cfs), with a TDS concentration of 3,880 mg/L and 26 mg/L of suspended sediment. At this site, the river carried 1,374 metric tons per day of TDS and 9.2 metric tons per day of suspended sediment. At the Calexico site the flow was 5 m^3/sec (177 cfs) with concentrations of 3,230 mg/L of TDS and 27 mg/L of suspended sediment. The loads were 1,395 metric tons per day of TDS and 12 metric tons per day of suspended sediment. At the Westmorland site the flow was 22 m^3/sec (777 cfs) with concentrations of 2,500 mg/L of TDS and 831 mg/L of suspended sediment. The loads were 4,752 metric tons per day of TDS and 1,580 metric tons per day of suspended sediment.

Flow in the New River increased between the Mexicali and Calexico sites by 13 percent in the 1995 sample and by 22 percent in the 1996 sample, reflecting discharge of wastewater from the Mexicali I treatment lagoons. The discharge of wastewater resulted in a decrease in TDS of 12 and 22 percent between the two sites in 1995 and 1996, respectively. Further decreases in TDS occur as the New River is diluted by agricultural tailwater in the Imperial Valley. The tailwater carries with it considerable suspended sediment causing a greater than 10-fold increase in suspended sediment concentration by the time the New River reaches the Salton Sea.

5.1.2 Measured Constituents

Anions and Cations

Data for major anions and cations are illustrated in Figure 3 using Stiff diagrams. Inspection of the Stiff diagrams for the All American Canal (both sampling dates) and the Colorado River at the NIB (12/05/95 sample) indicates that these samples are of the same general type: dominated by sodium, potassium, and calcium with sulfate as the dominant anion. The All American Canal samples show little chemical variability. In contrast, the Colorado River at the NIB does vary with time as shown in the June 13, 1995 sample diagram. This water is a sodium potassium chloride type with much lower relative concentrations of sulfate and calcium. The Gila River was contributing considerable Colorado River flow at the time of this sampling event. The chemical properties of water collected from the YMD, like those of water collected from the All American Canal, did not change during this study. The water is similar to that in the Lower Colorado River. There are slightly higher relative concentrations of sodium and chloride suggesting these salts are contributed by agricultural activities in the Yuma Valley.

Water collected from the Gila River had higher TDS concentrations than either the Colorado River at the NIB or the All American Canal. The Stiff diagram indicates that most of the added TDS is sodium chloride.

Water collected from the Wellton-Mohawk, as indicated by the Stiff diagram, had a chemical character that

Table 2.
Discharge and Sediment Loads

RIVER	SITE	FLOW (m^3/sec)		DISSOLVED SOLIDS (mg/L)		SUSPENDED SOLIDS (mg/L)		DISSOLVED SOLIDS (Ton/day)		SUSPENDED SOLIDS (Ton/day)	
		SAMPLING EVENT		SAMPLING EVENT		SAMPLING EVENT		SAMPLING EVENT		SAMPLING EVENT	
		1	2	1	2	1	2	1	2	1	2
Colorado River	All American Canal	203	138	832	822	24	9	14,600	9,800	421	107
	Gila River		4.2		1,830		46		664		17
	Yuma Drain	4.4	3.98	1,420	1,490	109	89	540	512	33	31
	NIB	93	46	732	988	562	144	5,880	3,927	4,516	572
	Wellton-Mohawk		3.8		2,940		145		965		48
New River	Mexicali	5.3	4.1	3,910	3,880	16	26	1,800	1,374	7.4	9.2
	Calexico	6	5	3,450	3,230	13	27	1,788	1,395	6.7	12
	Westmorland	21	22	2,740	2,500	451	831	4,970	4,752	818	1,580

1 and 2 correspond to the first and second sampling events.
Ton/day= metric tons per day

appeared to be a mixture of water from the Colorado River and Gila River. The sodium and chloride concentrations were elevated compared to both river samples, but there are relatively more sulfates than were present in the Gila River, consistent with a contribution from the Colorado River in December 1995.

Inspection of the Stiff diagrams for all the New River sites during both sampling periods indicates that the water type does not change appreciably with either time or distance downstream from Mexicali. The water chemistry is dominated by sodium chloride, and the underlying chemical signature of the Colorado River can be seen. As stated earlier in the discussion of stream loading, it appears that considerable sodium chloride is being added to the parent Colorado River water as a result of water usage (principally agriculture). The increased relative concentration of sulfate in samples from the New River at its mouth reflects contributions from Colorado River water brought to the Imperial Valley by the All American Canal.

Isotopes

Data for stable isotopes of hydrogen and oxygen in water are plotted in Figure 4. Most data for the Colorado River (All American Canal, Colorado River at the NIB, and the YMD) plot in a tight cluster in the lower center of the figure. Data for the New River plot in a looser cluster in the same area. And, data for the Gila River plot more towards the center (are comparatively heavier in deuterium and oxygen-18). The clustering of the data suggests that most Colorado River samples and all New River samples originate from the same source. The looser data cluster for the New River reflects widely varying contributions from highly saline agricultural drainwater, and agricultural tailwater, stormwater, and municipal wastewater.

Data for the Gila River sample indicate that its source water is from local precipitation that fell at a lower altitude and lower latitude than the source water for the Colorado River and New River.

Stable isotopes of water are an especially sensitive indication of the Gila River contribution to the Lower Colorado between Imperial Dam (represented by the All American Canal) and the Colorado River at the NIB during June 1995. While there exists only a slight decrease in salinity accompanied by some enrichment in chloride and depletion in sulfate, a more than 20 permil (–96.5 to –73.7 permil) decrease in delta deuterium occurs as a result of discharge from the Gila River at this time.

The anomalous conditions that existed in June 1995 also have an effect on tritium levels in the Lower Colorado River, which are much higher in the All American Canal [52.4 picocuries per liter (pCi/L)] than downstream at the Gila River at the NIB (25.3 pCi/L). In 1994, Michel and Schroeder reported that normally, tritium concentrations in the New River system will be slightly higher than in the All American Canal because of the contribution of older, higher tritium concentration, subsurface drainwater from the Mexicali/Imperial Valley.

Trace Elements

Laboratories of both countries analyzed trace elements in the water column. Appendix C, Tables C.1.1 and C.2.1 show the results of trace elements analyses for the Colorado River and New River samples, respectively.

Sixteen trace elements were detected in the Lower Colorado River: aluminum, arsenic, barium, boron, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, uranium, vanadium and zinc. Nineteen trace elements were detected in the New River: aluminum, antimony, arsenic, barium, boron, cadmium, chromium, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, uranium, vanadium and zinc.

These trace elements occur naturally in soils and their dissolved concentration in surface water is controlled by sorption/desorption reactions with soils, bottom material, and suspended sediment as well as biological activity.

For these reasons, it is difficult to determine whether elevated aqueous concentrations are the result of human activity or natural processes. Bottom material, suspended sediment, and biota are generally more reliable indicators of natural or human activity.

Concentrations of trace elements exceeding water quality criteria used for this study are discussed in Chapter 6.

Extractable Organic Compounds

Data for extractable organic compounds from the Lower Colorado River and New River are reported in Appendix C, Tables C.1.2 and C.2.2. None of these pollutants were detected by the U.S. team in any of the water samples collected for this study.

Pesticides

The U.S. team performed water analyses for pesticides using two different methods: C-18 SPE Cartridge with GC-MS analysis (Appendix C, Tables C.1.3 and C.2.3), and Carbopack B SPE Cartridge with HPLC-UV analysis (Appendix C, Tables C.1.4 and C.2.4).
C-18 method pesticides detected in samples from the Lower Colorado River monitoring stations, except the All American Canal where none were detected, included: chlorpyrifos, EPTC, simazine, diazinon, atrazine, pronamide, and DCPA (Table C.1.3). Carbopak pesticides were not detected in samples from the Lower Colorado River monitoring stations (Table C.1.4).

In the New River, C-18 method pesticides detected included: simazine, fonofos, chlorpyrifos, malathion, diazinon, atrazine, metribuzinsencor, trifluralin, linuron, EPTC, benfluralin, disulfoton, DCPA, and pendimethalin (Table C.2.3). Carbopak pesticides (many of which are herbicides) detected included linuron, 2,4-D, carbofuran, bromoxynil, and diuron. These were all detected in samples collected at the Westmorland site (Table C.2.4).

Major Nutrients and General Water Quality Parameters

Both the U.S. team and the Mexican team analyzed major nutrients and general water quality parameters in both

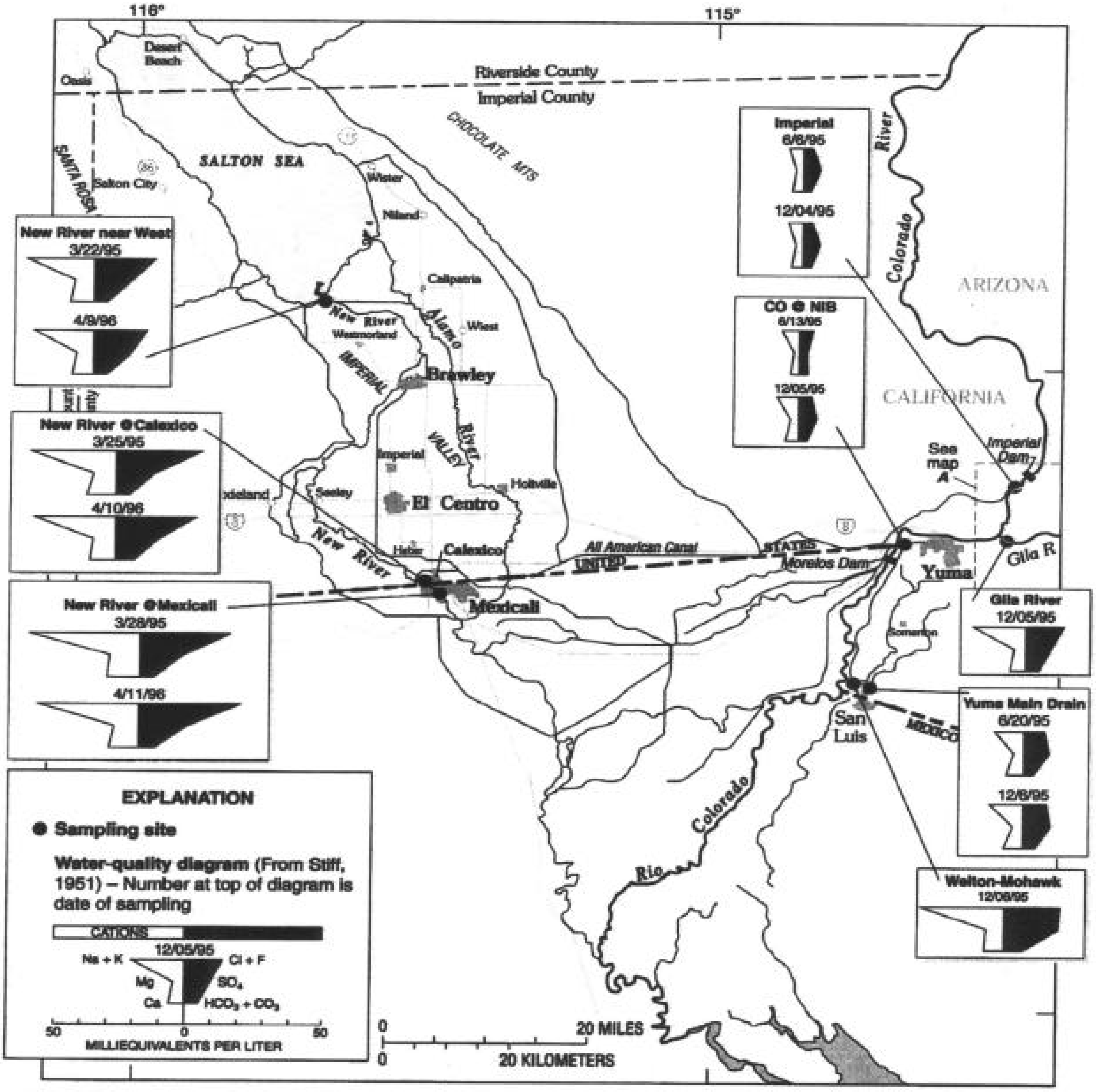

Figure 3. Chemical Characteristics of Water at the Binational Sampling Sites

river systems. Results for major nutrients are reported in Appendix C, Tables C.1.5 and C.2.5. Those for general water quality parameters are reported in Tables C.1.6 and C.2.6. Concentrations of nutrients and general water quality parameters exceeding water quality criteria used for this study are discussed in Chapter 6.

Volatile Organic Compounds

Neither team detected any of the target VOCs in the Lower Colorado River (Appendix C, Table C.1.13). In the New River, the U.S. team detected toluene, 1,4 dichlorobenzene (DCB), and xylene (Appendix C, Table C.2.13).

5.2 Sediment

5.2.1 Constituents Associated with Suspended Sediment

The suspended sediment samples for chemical analyses were collected by the USGS during the first sampling event at all sites. There were no suspended sediment analyses performed for the Gila River and the Wellton-Mohawk, as these sites were added to the second sampling event. Of 41 trace elements scanned in suspended sediment samples, 35 were detected in the Lower Colorado River and in the New River (Appendix C, Tables C.1.7 and C.2.7, respectively). All elements were detected in suspended sediment samples from either river except for tantalum, bismuth, europium, holmium, tin, and gold.

Suspended sediments carried by water in the All American Canal, the Colorado River at the NIB, and the YMD generally had higher concentrations of barium, manganese and molybdenum, than did sediments carried by water in the New River. Suspended sediments carried by the New River generally had higher concentrations of cadmium, copper, lead, silver, and zinc than did suspended sediments carried by water in the All American Canal, the Colorado River at the NIB, and the YMD.

Of a total of 64 extractable organic compounds scanned in the suspended sediment, 5 compounds were detected in the Lower Colorado River, and 8 compounds were detected in the New River.

The compounds identified in the Lower Colorado River include: dioctylphthalate at the NIB and the YMD; 2,6-dimethyl naphthalene in the All American Canal, at the NIB, and in the YMD; phenol in the All American Canal and the YMD; bis-2-ethylhexyl phthalate in the All American Canal, at the NIB, and in the YMD; and butylbenzyl phthalate in the All American Canal and the YMD (Appendix C, Table C.1.8).

The compounds detected in the New River were: dibutylphthalate at Westmorland; dioctylphthlate at Mexicali and Calexico; 2,6-dimethyl naphthalene at Mexicali, Calexico and Westmorland; phenol at Mexicali and Calexico; bis-2-ethylhexyl phthalate at Westmorland; butylbenzyl phthalate at Westmorland; p-cresol at Calexico and Westmorland; and dibenz-(a,h)-anthracene at Calexico (Appendix C, Table C.2.8).

There were 32 organochlorine compounds analyzed in suspended sediment. The organochlorine compounds identified in the Lower

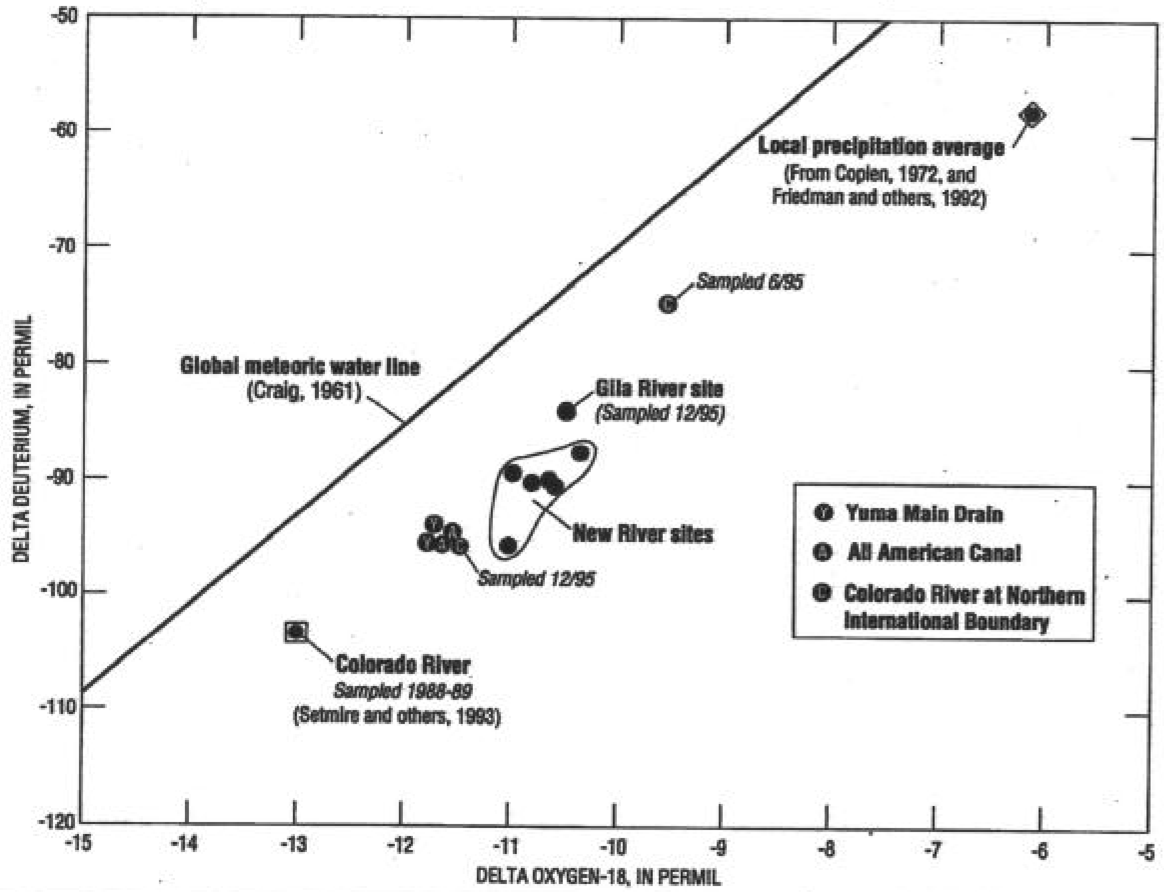

Figure 4. Plot of Hydrogen- and Oxygen-Isotope Ratios

Colorado River included: DDT and its metabolites at the NIB and in the YMD; and dieldrin in the YMD (Appendix C, Table C.1.9). In the New River, identified organochlorines included: trans-nonachlor, cis-chlordane, and trans-chlordane at Mexicali; DCPA at Westmorland; and DDT and its metabolites at Mexicali, Calexico, and Westmorland (Appendix C, Table C.2.9).

5.2.2 Constituents Associated with Bed Sediment

Trace elements in bed sediment were analyzed by the U.S. and Mexican teams.

In the Lower Colorado River, 36 of 44 trace elements were detected by the U.S. team (Appendix C, Table C.1.10). All elements were detected in the All American Canal, the NIB or the YMD except for bismuth, europium, gold, holmium, mercury, molybdenum, tantalum, and tin.

In the New River, 37 of the 44 trace elements were detected by the U.S. team (Appendix C, Table C.2.10). The 7 elements not detected in samples from Mexicali, Calexico and Westmorland were beryllium, bismuth, europium, gold, holmium, tantalum, and tin. During the second sampling phase in the 3 New River stations, the U.S. team detected 25 trace elements in sediment.

The trace elements detected in the All American Canal bed sediment by the Mexican team were arsenic, barium, lead, and nickel. In the New River bed, sediment samples, chromium, copper, iron, lithium, magnesium, and manganese were detected by the Mexican team.

In the New River bed sediment, concentrations of barium, cadmium, copper, lead, selenium, and zinc were generally higher than in bed sediment from the Lower Colorado River. Concentrations of barium and copper increase in samples from Mexicali north to Westmorland, while concentrations of cadmium, lead, selenium, and zinc decrease.

The U.S. team calculated estimated concentrations for 13 extractable organic compounds from bed sediment samples collected at the Lower Colorado River stations. Concentrations of phenol were measured from samples collected at the NIB (Appendix C, Table C.1.11).

For the New River, the U.S. team detected 23 extractable organic compounds in bed sediment during the first sampling phase, and 20 during the second sampling phase (Appendix C, Table C.2.11). The majority of these compounds were detected in samples collected at the Mexicali and Calexico stations.

Thirty-two organochlorine compounds were analyzed by the U.S. team in bed sediment samples from both rivers. For the Lower Colorado River, the only organochlorine compound identified was DDT and its metabolites (in the YMD) (Appendix C, Table, C.1.12).

In the New River, the U.S. team detected 4 compounds including trans-nonachlor, cis- and trans-chlordane, and DDE during the first phase of sampling (Appendix C, Table C.2.12). During the second sampling effort, 7 compounds including trans-nonachlor, cis- and trans-chlordane, DDE, DDT, cis-permethrin, and PCB were detected in the New River.

5.3 Bioaccumulation

Bioaccumulation is the total concentration of potentially toxic chemicals in an organism. Bioaccumulation is the process by which chemicals present at low concentrations in water can become concentrated in organisms by many orders of magnitude. Evidence of toxic constituents in fish and aquatic organisms may indicate the presence of contaminants at problematic concentrations in the aquatic environment.

It is important to note that the number of samples obtained and analyzed at each site in this study in a single year is not large enough to provide a statistical basis for making definitive statements about toxic substance concentrations. Moreover, different aquatic organisms tend to bioaccumulate a particular toxic substance in water to different levels. Therefore, the values reported in this study should be understood to indicate the presence of constituents of concern in the water.

5.3.1 Fish Tissue

Tissue concentrations for both trace elements and organic chemicals are reported on a wet weight or fresh weight basis. Trace elements are reported in mg/Kg or ppm and organic chemicals are reported in µg/Kg or parts per billion (ppb). Wet weight measures are the preferred measure because all standards for human health and predator protection are based on wet weight measures. Wet weight measures also better reflect the exposure of predators or humans to actual concentrations in freshly caught fish. However, it is noted that trace element residues are often reported on a dry weight basis (for fish as well as other biota), and organic residues are sometimes adjusted for lipid content. Therefore, appropriate adjustments may be necessary to make comparisons to other data.

Summaries of the fish tissue analytical procedures for pesticides and polychlorinated biphenyls (PCBs), and trace elements are in Appendix A.1 and Appendix A.2, respectively.

Organic chemical and trace element concentrations reported in fish tissue and compared with screening values, action levels, and guidelines are summarized in Table 3 (Summary of Organochlorine Pesticide Data), Table 4 (Summary of Organophosphate Pesticide and PCB Data), and Table 5 (Summary of Trace Element Data). The data sets containing fish tissue bioaccumulation monitoring and quality assurance results are found in Appendix B. The criteria against which the tissue data are compared to are discussed in Chapter 6.

The quantitation limit (QL) is defined as the level above which quantitative results may be accepted given a specified degree of confidence. Appendix D contains the Maximum Tissue Residue Levels (MTRLs) for carcinogens and non-carcinogens for synthetic organic compounds and trace elements analyzed in fish tissue for this study.

5.3.2 Fish Lipids

Organochlorine chemicals concentrate in

lipids due to their hydrophobicity. The data for concentrations of these chemicals found in fish lipids during this study are provided in Appendix E.

5.4 Aquatic Toxicity

Aquatic toxicity tests use standardized, surrogate aquatic vertebrates, invertebrates, and plants to assess the aggregate toxicity of the tested water. In these tests, chambers are filled with the ambient water samples and an additional chamber is filled with standard control water. Test organisms are added to each chamber and are observed at specified intervals until the test is complete. Results from the chambers filled with ambient water are compared to the control to determine statistical significance.

Water samples collected as part of the study were assessed using short-term chronic toxicity test protocols recommended by EPA. Three test species (a fish, *Pimephales promelas;* an invertebrate, *Ceriodaphnia dubia*; and an alga, *Seleanstrum capricornutum*) were used. A fourth species, the invertebrate *Neomysis mercedis*, was added after the first sampling event (in March 1995) as the waters of the Lower Colorado and New Rivers have higher levels of salt than many rivers, and *Neomysis mercedis* is more salt tolerant than *Ceriodaphnia dubia.* The tests using fish were observed for two endpoints, larval survival and growth. The tests using *Ceriodaphnia dubia* were observed for survival and reproduction. Only one endpoint, survival, was recorded in tests using *Neomysis mercedis*. The tests using algae were observed for growth.

Samples were collected on two occasions from both the Lower Colorado River and the New River. During each event, samples from the various monitoring locations were collected within a few days of each other. Samples were not collected from the same parcel of water as it moved downstream, therefore, the ability to draw conclusions about the spatial or temporal extent of any observed toxicity is limited.

Aquatic toxicity tests do not identify the specific chemical or chemicals responsible for the observed toxicity. In 1991 and 1992, EPA established a series of Toxicity Identification Evaluation (TIE) procedures that can be used to identify the specific chemicals.

Certain TIE procedures were used at times during the study to evaluate which class of chemicals might be causing toxicity. Aliquots of the test water were treated in specific ways to remove certain classes of chemicals selectively and were then tested again for toxicity. If the test water was no longer toxic after a particular treatment, it was an indication that the toxicity was caused by the class of chemicals removed by that treatment. Some of the treatments used in the TIE process are described in Table 6.

5.4.1 Lower Colorado River

Aquatic toxicity tests were performed by the U.S. team on samples collected from the Lower Colorado River in June 1995 and December 1995. Samples were collected at three sites: the All American Canal, the NIB, and the YMD.

Results of the toxicity testing on the Lower Colorado River are presented in

Table 7. In December 1995, significant toxicity to *Ceriodaphnia* was observed in the sample collected from the YMD (none of the test organisms survived). Slight, but statistically significant, inhibition of fish growth was observed in the samples from the All American Canal and the NIB. No other statistically significant toxicity was observed.

The source of toxicity in the YMD in December 1995 was evaluated using TIE procedures. The California Department of Pesticide Regulation (CDPR) and USGS analyzed selected samples for certain pesticides to assist in the TIE analyses. The test water was no longer toxic following elution through a chemical column that selectively adsorbed organophosphate materials. Also a water sample became toxic when the materials removed by the chemical column were reintroduced. These results indicate that the source of toxicity was an organophosphate. Chlorpyrifos, an organophosphate pesticide, was detected in this sample (Appendix C, Table C.1.3).

5.4.2 New River

Aquatic toxicity tests were performed by the U.S. team on samples collected from the New River as part of this study in March 1995 and April 1996. Samples were collected at three sites: Mexicali, Calexico, and Westmorland.

Results of the toxicity testing on the New River are presented in Table 8. In March 1995, significant toxicity to *Ceriodaphnia* was observed in the sample collected from Mexicali (none of the test organisms survived). In April 1996, slight, but statistically significant inhibition of fish growth was observed in the samples from Calexico and Westmorland. No other statistically significant toxicity was observed.

The source of the inhibition of fish growth at Calexico and Westmoreland in April 1996 was investigated using TIE procedures, but the results were inconclusive.

6. EVALUATION OF RESULTS

This chapter evaluates the analytical results presented in Chapter 5, primarily discussing exceedences of water quality criteria adopted by the U.S. or Mexico.

6.1 Ambient Water-Quality Criteria

Both the U.S. and Mexico have established ambient water-quality criteria. In the U.S., there are two types of ambient water-quality criteria: those for the protection of human health and those for the protection of aquatic organisms. In Mexico, Criterios Ecológicos de Calidad del Agua (CECA) (ecological water quality criteria) have been developed for drinking water, contact recreation, agricultural irrigation, stock animal, and aquatic life uses. The U.S. and Mexican criteria are presented, along with the data, in the tables in Appendix C.

6.1.1 Human Health Criteria

EPA has developed national recommended water quality criteria for the protection of human health. These recommended criteria provide guidance to U.S. states in adopting enforceable water quality standards under the U.S. Clean Water Act.

Table 3. Summary of Organochlorine Pesticide Data – Comparison with Screening Values, Action Levels, and Guidelines

Station Name	Collection Date	Species [1]	Total Chlordane	Total DDT	Dieldrin	Endosulfan (I and II)	Hexa - cloro-benzene	Lindane	Toxaphene
			ppb (ng/g) Fresh Weight						
New River/Westmorland	06/16/95	CP	**12**	**845**	**6.2**	10			**100**
New River/Westmorland	06/16/95	CCF	**67**	**1196**	**32**	51			**750**
New River/Westmorland	04/10/96	CP	**44.3**	**798**	**14**	**102**	3.9		**270**
New River/Westmorland	04/10/96	CCF	**37.8**	**797**	**27**	**168**	4.2		**290**
New River/Int'l Boundary	06/28/95	CP	**125.7**	**294**	**7.8**		**10**	**4.2**	**120**
All American Canal/d/s Imperial Dam	06/14/95	CCF	**10**	**85**					
All American Canal/d/s Imperial Dam	06/14/95	CP	**23.3**	**271**					
All American Canal/d/s Imperial Dam	12/05/95	CP	**8**	**263**					
All American Canal/d/s Imperial Dam	12/05/95	LMB		12					
Yuma Main Drain/Outlet	06/21/95	CP	**12.9**	**616**	**9.0**	**190**			**140**
Yuma Main Drain/Outlet	06/21/95	LMB		**110**					
Yuma Main Drain/Outlet	04/09/96	CP	**18.1**	**1809**	**8.8**				**410**
Yuma Main Drain/Outlet	04/10/96	CCF	**14.3**	**1037**	**6.1**				**420**
Colorado River/Int'l. Boundary	06/13/95	CP		**220**		6.5			**130**
Colorado River/Int'l. Boundary	06/13/95	LMB		**36**					
Colorado River/Int'l. Boundary	12/05/95	CP		**220**		8.0			
Colorado River/Int'l. Boundary	12/05/95	LMB		**57**					
US EPA Screening Values (SVs) [2]			**80**	**300**	**7.0**	60,000	70	80	**100**
US FDA Action Level for Freshwater and Marine Fish			300	5000	300	---	---	---	5000
NAS Recommended Guideline			**100**	**1000**	100	**100**	---	100	**100**
Maximum Tissue Residue Levels (MTRLs) [3]			**1.1**	**32**	**0.65**	250	**6.0**	**2.5**	**8.8**

[1] Fish species: CP (carp); CCF(channel catfish); LMB (largemouth bass)
[2] Screening Values are recommended by the US EPA for use in State fish/shellfish consumption advisory programs for the general adult population.
[3] Developed by CA State Water Resources Control Board and used as alert levels or guidelines indicating water bodies with potential human health concerns.

Table 4. Summary of Organophosphate Pesticide and PCB (Aroclors) Data –Comparison with Screening Values, Action Levels, and Guidelines

Station Name	Collection Date	Species [1]	ppb (ng/g) Fresh Weight Chlorpyrifos	Diazinon	Total PCBs
New River/Westmorland	06/16/95	CP			**120**
New River/Westmorland	06/16/95	CCF	17		**79**
New River/Westmorland	04/10/96	CP			**360**
New River/Westmorland	04/10/96	CCF			**91**
New River/Int'l. Boundary	06/28/95	CP	46	65	**120**
All American Canal/d/s Imperial Dam	06/14/95	CCF			**43***
All American Canal/d/s Imperial Dam	12/05/95	CP			**124**
All American Canal/d/s Imperial Dam	12/05/95	LMB			
Yuma Main Drain/Outlet	06/21/95	CP			**35***
Yuma Main Drain/Outlet	06/21/95	LMB			**9.5***
Yuma Main Drain/Outlet	04/09/96	CP			**110**
Yuma Main Drain/Outlet	04/10/96	CCF			**69**
Colorado River/Int'l. Boundary	06/13/95	CP			**21***
Colorado River/Int'l. Boundary	06/13/95	LMB			
Colorado River/Int'l. Boundary	12/05/95	CP			**22***
Colorado River/Int'l. Boundary	12/05/95	LMB			**12***
US EPA Screening Values[2]			30,000	900	**10**
US FDA Action Level for Freshwater and Marine Fish				---	2000
NAS Recommended Guideline			---	---	500
Maximum Tissue Residue Levels (MTRLs)[3]			---	---	**2.2**

1 Fish species: CP (carp); CCF (channel catfish); LMB (largemouth bass)
[2]Screening Values are recommended by the US EPA for use in State fish/shellfish consumption advisory programs for the general adult population.
[3] Developed by CA State Water Resources Control Board and used as alert levels or guidelines indicating water bodies with potential human health concerns.
*Note: The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

Table 5. Summary of Trace Element Data - Comparison with Screening Values, Action Levels, and Guidelines

Station Name	Collection Date	Species [1]	Arsenic	Mercury	Selenium
			ppm (µg/g) Fresh Weight		
New River/Westmorland	06/16/95	CP	0.06	0.28	1.5
New River/Westmorland	06/16/95	CCF		0.18	0.58
New River/Westmorland	04/10/96	CP	0.11	0.28	1.5
New River/Westmorland	04/10/96	CCF	0.06	0.08	0.8
New River/International Boundary	06/28/95	CP	0.06	0.31	1.0
All American Canal/d/s Imperial Dam	06/14/95	CCF	0.16	0.03	0.72
All American Canal/d/s Imperial Dam	06/14/95	CP	**0.52**	0.09	1.4
All American Canal/d/s Imperial Dam	12/05/95	CP	**0.36**	0.10	1.2
All American Canal/d/s Imperial Dam	12/05/95	LMB	0.08	0.02	**2.1**
Yuma Main Drain/Outlet	06/21/95	CP	0.16	0.03	0.88
Yuma Main Drain/Outlet	06/21/95	LMB	0.11	0.03	0.74
Yuma Main Drain/Outlet	04/09/96	CP	0.17	0.05	1.0
Yuma Main Drain/Outlet	04/10/96	CCF	0.07	0.05	0.5
Colorado River/ Int'l. Boundary	06/13/95	CP	0.20	0.14	0.78
Colorado River/Int'l. Boundary	06/13/95	LMB	0.06	0.26	1.0
Colorado River/Int'l. Boundary	12/05/95	CP	0.14	0.30	0.75
Colorado River/Int'l. Boundary	12/05/95	LMB	0.09	0.46	0.76
US EPA Screening Values[2]			3	0.6	50
US FDA Action Level for Freshwater and Marine Fish			---	1.0	---
NAS Recommended Guideline			---	0.5	---
Median International Standards for Trace Elements			1.5	0.5	**2.0**
Maximum Tissue Residue Levels (MTRLs)[3]			**0.2**	1.0	---

[1] Fish species: CP (carp); CCF (channel catfish); LMB (largemouth bass)
[2]Screening Values are recommended by the US EPA for use in State fish/shellfish consumption advisory programs for the general adult population.
[3]Developed by CA State Water Resources Control Board and used as alert levels or guidelines indicating water bodies with potential human health concerns.

Table 6. Summary and Interpretation of TIE Procedures

Procedure	Interpretation
Baseline/Ambient	To verify original toxicity using TIE
pH 3	To determine toxicity from metals and organic acids and bases To determine the presence of organics hydrolyzed at low pHs (i.e. diazinon) as related to toxicity
pH 11	To determine toxicity from metals and organic acids and bases To determine the presence of organics hydrolyzed at high pHs (i.e. carbofuran) as related to toxicity
Aeration	Used to determine toxicity from volatile or oxidizable compounds
EDTA chelation	To determine toxicity from certain cationic metals including: aluminum, barium, cadmium, cobalt, copper, iron, lead, manganese (II), nickel and zinc
$Na_2S_2O_3$	To determine toxicity from chlorine and some cationic metals including: copper (II), silver (I) and mercury (II)
C_8 or C_{18} SPE	To determine toxicity from non-polar organics
Methanol Add-back	To remove toxicants bound by the SPE column. The methanol eluate is added back to control water to determine if toxicity can be returned following toxicant removal from the column
Piperonyl butoxide (PBO)	To determine the toxicity from metabolically activated compounds that are metabolized via mixed function oxidases (i.e. chlorpyrifos, diazinon and malathion)

These recommendations are commonly called EPA human-health criteria, and consist of ambient concentrations that, for non- carcinogens, prevent adverse health effects in humans, and for suspected or proven carcinogens, represent various levels of incremental cancer risk.

Two categories of human health criteria have been developed, on the basis of assumed routes of exposure. The first assumes that the ambient water is used as a drinking water supply and as the water from which aquatic organisms are harvested and consumed by humans.

The second assumes that only aquatic organisms found in the ambient water are harvested and consumed by humans.

The appropriate EPA human health criteria for comparison to results from the Lower Colorado River are those based on consumption of water and aquatic organisms, as the Lower Colorado River is used as a drinking water supply. Neither California nor Baja California has identified drinking water supply as a use to be protected on the New River, so the results for the New River have been compared to EPA human health criteria based on consumption of aquatic organisms only. Although these criteria are used as a basis for comparison, it should not be assumed that consumption of aquatic organisms from the New River is safe.

The EPA human health criteria used in this report were published in the Federal Register on December 10, 1998 (Vol.

63, No. 237, page 68354).

In addition to ambient water quality criteria, the U.S. has established limits for drinking water which apply after treatment. The Maximum Contaminant Levels (MCLs) are federally enforceable limits for contaminants in drinking water established as National Primary Drinking Water Regulations (NPDWRs), and adopted either by the California Department of Health Services or by EPA. MCLs are based on adverse health effects resulting from long term water consumption. Ambient waters that exceed MCLs can still be safe sources of drinking water if the water is adequately treated prior to delivery for use.

The results for the Lower Colorado River, but not those for the New River, have been compared to MCLs, as the Lower Colorado River is used as a drinking water supply. The MCLs used in this report are described in Drinking Water Standards and Health Advisories Table prepared by EPA - Region 9 in January 1999.

For Mexico, permissible levels of parameters and substances found in water, and other water characterizations such as color, odor, taste, pH, etc. have been defined, and the regulating agencies are able to designate water bodies as usable for drinking water supply, primary contact recreation, agricultural irrigation, stock animals, and aquaculture. These parameters define the minimum required quality for the different uses.

In establishing the permissible levels of parameters and substances in water, consideration is given to the wide variations in water quality of natural water bodies and their present degree of contamination. Also, consideration is given to the different water uses and the necessary environmental conditions for the normal development of organisms in an ecosystem, and to the effects caused by variations of the physical, chemical and biological water characteristics on different species.

The appropriate CECA standards for comparison to results from the Lower Colorado River are those based on protection of the following uses: drinking water supply, agricultural irrigation, stock animals, fresh water aquatic life, and, where developed, contact recreation. And, although Mexico considers the New River to be a drain, it was determined that the appropriate CECA standards for comparison to results from the New River are those based on the protection of fresh water aquatic life use.

6.1.2 Aquatic Life Criteria

EPA has developed national recommended water quality criteria for protection of aquatic life in freshwater and saltwater. Despite high ambient salinity, both the Lower Colorado and the New Rivers are considered freshwater ecosystems. These recommended criteria provide guidance to U.S. states in adopting enforceable water quality standards under the U.S. Clean Water Act. These recommendations are commonly called EPA aquatic life criteria, and are expressed in terms of acute short term

Table 7. Aquatic Toxicity Analysis Results of Lower Colorado River Water Samples

Organism	All American Canal	NIB	YMD		All American Canal	NIB	YMD
Date	***6/6/95***	***6/13/95***	***6/20/95***		***12/4/95***	***12/5/95***	***12/6/95***
I. CERIODAPHNIA TEST							
Ceriodaphnia dubia in test river waters:							
Percent organisms surviving	90%	90%	100%		100%	100%	**0%**
Number of young produced (average)	31.4	23.9	22.4		43.1	30.8	na
Ceriodaphnia dubia in control lab waters:							
Percent organisms surviving	100%	90%	100%		100%	100%	100%
Number of young produced (average)	21.9	15.7	19.9		17.1	23	16.5
II. FATHEAD MINNOW TEST							
Fathead minnows in test river waters:							
Percent organisms surviving	100%	100%	97.5%		85%	92.5%	92.5%
Growth per individual (mg.)	0.52	0.66	0.80		0.61	0.66	0.68
Fathead minnows in control lab waters:							
Percent organisms surviving	100%	100%	100%		95%	97.5%	100%
Growth per individual (mg.)	0.53	0.65	0.78		0.69	0.71	0.66
III. GREEN ALGAE TEST							
Algae in test river waters:							
Algae cells counted	1,580,000	1,420,000	1,860,000		3,060,000	2,420,000	864,000
Algae in control lab waters:							
Algae cells counted	1,410,000	1,230,000	610,000		1,590,000	1,360,000	1,400,000
IV. NEOMYSIS TEST (SALT TOLERANT)							
Neomysis in test river waters:							
Neomysis survival after 4 days	100%	66%	50%		83%	92%	91%
Neomysis in salinity control lab waters:							
Neomysis survival after 4 days	100%	75%	42%		100%	100%	100%

Table 8. Aquatic Toxicity Analysis Results of New River Water Samples

Organism	Mexicali	Calexico	Westmorland	Mexicali	Calexico	Westmorland
Date	***3/28/95***	***3/25/95***	***3/22/95***	***4/11/96***	***4/10/96***	***4/9/96***
I. CERIODAPHNIA TEST						
Ceriodaphnia dubia in test river waters:						
Percent organisms surviving	**0%**	100%	100%	90%	100%	100%
Number of young produced (average)	None	34.0	29.5	41.8	33.2	28.9
Ceriodaphnia dubia in control lab waters:						
Percent organisms surviving	100%	100%	100%	90%	90%	100%
Number of young produced (average)	25.6	25.6	24.8	42.4	42.4	29.4
II. FATHEAD MINNOW TEST						
Fathead minnows in test river waters:						
Percent organisms surviving	100%	95%	92.5%	100%	100%	100%
Growth per individual (mg.)	0.40	0.35	0.42	0.63	0.53	0.52
Fathead minnows in control lab waters:						
Percent organisms surviving	100%	100%	97.50%	100%	100%	100%
Growth per individual (mg.)	0.38	0.38	0.41	0.62	0.62	0.62
III. GREEN ALGAE TEST						
Algae in test river waters:						
Algae cells counted	2,470,000	3,020,000	822,000	3,740,000	3,110,000	3,890,000
Algae in control lab waters:						
Algae cells counted	903,000	903,000	391,000	918,000	918,000	1,050,000
IV. NEOMYSIS TEST (SALT TOLERANT)						
Neomysis in test river waters:						
Neomysis survival after 4 days	Not done	Not done	Not done	100%	100%	100%
Neomysis in salinity control lab waters:						
Neomysis survival after 4 days	Not done	Not done	Not done	100%	100%	100%

exposure, called the "criteria maximum concentration" (CMC), and chronic long term exposure, called the "criteria continuous concentration" (CCC). Chronic criteria apply to a four-day average concentration, rather than a one-time sampling event as was the procedure for the present study.

The EPA aquatic life criteria used in this report were published in the Federal Register on December 10, 1998 (Vol. 63, No. 237, page 68354).

For the protection of aquatic life, the results from the Lower Colorado River and the New River were compared to the CECA standards for fresh water aquatic life.

Freshwater aquatic life criteria for certain metals are sometimes expressed as a function of hardness. Hardness is a measure of calcium (Ca) and magnesium (Mg), and of strontium (Sr), iron (Fe), aluminum (Al), zinc (Zn), and manganese (Mn) if found in significant concentrations. Hardness levels in water are reported in terms of the concentration of calcium carbonate ($CaCO_3$). Organisms typically are able to tolerate higher concentrations of metals before experiencing toxic symptoms as ambient water hardness increases. Results for total hardness in samples from the Lower Colorado and the New Rivers are reported in Appendix C, Tables C.1.6 and C.2.6, respectively.

6.2 Water Chemistry

6.2.1 Total Dissolved Solids

Lower Colorado River

The TDS in the Lower Colorado River generally increases downstream due to the contribution of salt-laden discharges. The difference in TDS between the All American Canal and the NIB can be attributed to the influence of the Gila River. The first sampling event showed a reduction in TDS from the All American Canal to the NIB (Table C.1.6). This reduction was the result of a lower TDS input from the Gila River resulting from an unusually large and extended period of flooding. In the second sampling event, the 20% increase in TDS at the NIB is most likely the result of the high TDS inflow from the Gila River. These results parallel the analysis of Stiff diagrams, which suggest that the Gila River alters the water chemistry of the Lower Colorado River downstream of the All American Canal.

The Wellton-Mohawk discharges to the Ciénega de Santa Clara, an estuarine wetland area. There are no TDS criteria for discharges to the Ciénega de Santa Clara.

New River

In the New River, TDS concentrations decreased in the downstream direction from Mexicali to Westmorland (Table C.2.6).

According to U.S. data, TDS concentrations were shown to decline from levels near 4000 mg/L at Mexicali to below 2,800 mg/L at Westmorland. This decline may reflect the addition of lower salinity agricultural drainage from the Imperial Valley. In addition, assuming the water in the river at Mexicali is derived from the Colorado River at the NIB, there is a four-fold increase in dissolved solids concentration through its use in Mexico. Similarly, assuming that water in the All American Canal is the source water in the United States and that water present in the New River at its mouth is a simple mixture of the water delivered at Calexico and return water from the Imperial Valley, there is a three-fold increase in dissolved solids concentration by its usage in Imperial Valley. The majority of the suspended sediment load in the New River is a result of agricultural practices in the Imperial Valley.

6.2.2 Measured Constituents Exceeding Criteria

<u>Trace Elements</u>

The trace elements found by the U.S. and Mexico during this study are shown in Appendix C, Table C.1.1 for the Lower Colorado River and Table C.2.1 for the New River.

While the analyses detected many of the trace elements in water samples from both rivers (Section 5.1.2), only those trace metal concentrations that exceeded criteria used for this study are discussed below.

Barium. According to data reported by the U.S., concentrations of barium ranging from 35 to 139 µg/L were detected at all of the Lower Colorado River stations during both sampling events. In all cases, these results exceeded the CECA fresh water aquatic life standard of 10 µg/L. Barium is an alkaline earth metal used in industrial products such as electronic tubes. All water or acid soluble barium compounds are toxic. Concentrations of barium found did not exceed the human health protection standards used for this study.

Boron. As reported by the U.S. during the second sampling phase, 1300 µg/L of boron was detected at the Wellton-Mohawk which exceeded the CECA standards for drinking water (1000 µg/L) and agricultural irrigation (700 µg/L). Boron is naturally occurring, is soluble in water, and is used in alloys to harden other metals. It is also used in the preparation of soaps, softeners, enamels, glass, and pottery.

Cadmium. The Mexican team detected cadmium in the New River at concentrations ranging from 18.5 to 31.9 µg/L, at the three New River stations during the second sampling event. These results exceeded the EPA aquatic life CMC (4.3 µg/L) and CCC (2.2 µg/L) standards. Cadmium is naturally occurring, and coal and mineral fertilizers contain some cadmium. Cadmium has many industrial uses and is found in many consumer products including batteries, pigments, photoelectric cells, metal alloys and coatings, and plastics. Cadmium can enter the environment from coal burning, and metal plating industry and wastewater treatment plant (WWTP) effluents. It is very persistent in water, bioaccumulates in tissue, and can cause high acute and chronic toxicity to aquatic life. Concentrations of cadmium found did not exceed the human health protection standards used for this study.

Copper. According to data reported by the U.S., concentrations of copper at the Gila River (15.0 µg/L) and the Wellton-Mohawk (16.0 µg/L) during the second sampling event exceeded the EPA aquatic life CMC (13 µg/L) and CCC (9 µg/L) standards. In the New River, a U.S. reported concentration of 10.0 µg/L of copper from the Mexicali station during the second phase exceeded the EPA aquatic life CCC standard of 9 µg/L. Copper is extremely common in rocks and soil, is found in industrial and municipal WWTP discharges and atmospheric fallout. It is used in industries including smelting and refining, copper wire mills, coal burning, and iron and steel production. Copper enters natural waterways through runoff, and industrial and municipal discharges. Concentrations of copper found did not exceed the human health protection standards used for this study.

Lead. According to data reported by Mexico during the second sampling phase, concentrations of lead from the Gila River (8.0 µg/L), the YMD (7.0 µg/L), and the Wellton-Mohawk (17.0 µg/L) exceeded one or both of the following standards: EPA aquatic life CCC (2.5 µg/L); and EPA drinking water MCL (15 µg/L). In the New River, according to data reported by Mexico for both phases, lead concentrations ranged from 27 to 37 µg/L at the three sampling stations. These results also exceeded the EPA aquatic life CCC standard of 2.5 µg/L. Lead is a major constituent of more than 200 minerals and is used in pipe, paint, pigments, alloys, storage batteries, ceramics, electronic devices, and plastics. Lead is a teratogen that reaches the environment through urban runoff, lead dust, and industrial and municipal WWTP discharges.

Manganese. Based on data reported by the U.S. at the Gila River during the second sampling event, the concentration of manganese (225.0 µg/L) exceeded the EPA water and organism (50 µg/L) and drinking water MCL (50 µg/L) standards, and the CECA drinking water standard of 100 µg/L. In the New River, data reported by the U.S. and Mexico for the three sampling stations during both phases ranged from 110 to 230 µg/L. These results exceeded the EPA organism only standard of 100 µg/L. Manganese is a widely distributed and abundant element and occurs in minute quantities in water, plants and animals. It is used in the manufacturing of steel and is a constituent of several alloys.

Mercury. The U.S. reported a concentration of 1.2 µg/L for inorganic mercury at the YMD during the first sampling event. This result exceeded: the EPA aquatic life CCC (0.77 µg/L); the EPA water and organism (0.050 µg/L); the CECA drinking water (1 µg/L); and the CECA fresh water aquatic life (0.01 µg/L) standards. In the New River, mercury was detected by Mexico during the second sampling phase at the Mexicali station at a concentration of 1.4 µg/L. This result exceeded: the EPA aquatic life CCC (0.77 µg/L); the EPA organism only (0.051 µg/L); and the CECA fresh water aquatic life (0.01 µg/L) standards. Mercury is naturally occurring and has urban and industrial sources. Mercury has many products (chlorine and caustic soda, electrical components, industrial control instruments, pharmaceuticals) and uses (pulp and paper manufacturing, mining, and general laboratory uses). Several forms ranging from elemental to dissolved organic and inorganic occur in the environment. Certain. microorganisms have the ability to convert the organic and inorganic forms into highly toxic forms, making all forms of mercury highly hazardous to the environment.

Nickel. A U.S. reported concentration of 11.0 µg/L of nickel from the YMD during the first sampling event exceeded the CECA drinking water standard of 10 µg/L. Nickel is the 24th most abundant mineral and can be found in all soils. Nickel is combined with other metals to form alloys for stainless steel, coins, jewelry, plumbing, heating equipment, gas-turbine engines, and electrodes. Nickel is also used in plating, ceramics, and some batteries. Nickel is one of the most common metals found in surface water, and is produced from burning coal and other fossil fuels. It is a carcinogen found in industrial discharges which binds with soil or sediment particles. Nickel does not bioaccumulate in fish tissue, however, it can cause high acute and chronic toxicity in aquatic life.

Selenium. The EPA aquatic life CCC for selenium of 5.0 µg/L was exceeded at the Gila River during the second sampling phase with a U.S. reported concentration of 7.0 µg/L. The major sources of selenium are the weathering of rocks, rainfall, and runoff. Selenium is present in coal and fuel oil, and is produced in mining and smelting of certain ores. It is used in photocopying, and the manufacturing of glass, electronic devices, pigments, dyes, and insecticides. Selenium is found in industrial and municipal WWTP discharges. While trace amounts are essential for plants and animals, selenium can cause high acute and chronic toxicity in aquatic life.

Major Nutrients and General Water Quality Parameters

Although the focus of this study was the analysis of toxic substances, background data was gathered for a number of other constituents, including major nutrients. As expected, major nutrient concentrations in the Lower Colorado River are low but do show a slight downstream increase associated with the contribution of the Gila River and YMD. In the New River, discharge from the Mexicali I wastewater lagoons causes an increase in carbon, nitrogen, and phosphorus concentrations between Mexicali and Calexico. Further increase in nitrogen concentration occurs as a result of agricultural runoff in the Imperial Valley, and the form of nitrogen changes from reduced to primarily oxidized (nitrate). Nutrient concentrations in the New River are sufficient to promote algal growth, resulting in virtually complete reduction in oxygen levels at Calexico and some distance downstream. The sources of these nutrients are treated, partially treated and untreated industrial and municipal wastewater, and agricultural drainage.

A concentration of 0.08 mg/L ammonia nitrogen was reported by the U.S. from the YMD during the first sampling event which exceeded the CECA fresh water aquatic life standard of 0.06 mg/L (Appendix C, Table C.1.5). This standard was also exceeded during the second sampling phase at the NIB as reported by the U.S. and Mexico with reported concentrations of 0.10 mg/L and 0.37 mg/L, respectively. It is the unionized percent of the ammonia nitrogen that can be toxic to fish.

Dissolved phosphorus concentrations reported by the U.S. ranged from 0.01 to

0.03 mg/L at all of the Lower Colorado River stations, with the exception of the Wellton-Mohawk station, during both sampling events. These results exceeded the CECA fresh water aquatic life standard of 0.0001 mg/L for dissolved phosphorus.

For the New River, results reported by the U.S. and Mexico for ammonia nitrogen ranged from 2.0 to 6.8 mg/L at all three stations during both sampling events (Appendix C, Table C.2.5). These results also exceeded the CECA fresh water aquatic life standard of 0.06 mg/L.

Dissolved phosphorus concentrations reported by the U.S. ranged from 0.6 to 1.3 mg/L at all three New River stations during both sampling events. These results also exceeded the CECA fresh water aquatic life standard of 0.0001 mg/L.

The following discussion is based on data contained in Appendix C, Table C.1.6, Lower Colorado River, General Water Quality Parameters.

TDS data reported by the U.S. and Mexico from the first and second sampling events at all of the Lower Colorado River stations ranged from 666 to 2940 mg/L. These results indicated that CECA standards for drinking water (500 mg/L), agricultural use (500 mg/L), and in some cases stock animal use (1000 mg/L) were exceeded.

According to data reported by Mexico, the pH standards established for EPA aquatic life CCC (6.5-9) and drinking water MCL (6.5-8.5) were not met one time at the NIB with a result of 6.1 during the second sampling event.

According to data reported by the U.S. and Mexico, chloride concentrations from the NIB and YMD during the first sampling event, and from the Gila River, NIB, YMD, and Wellton-Mohawk during the second sampling event ranged from 155 to 740 mg/L. At these stations, these results exceeded one or more of the following standards: EPA aquatic life CCC (230 mg/L); CECA drinking water (250 mg/L); CECA agricultural use (147.5 mg/L); and CECA aquatic life (250 mg/L).

Sulfate data reported by the U.S. and Mexico from both sampling events at all of the Lower Colorado River stations ranged from 47 to 970 mg/L. These results indicated that, at times, one or more of the following standards were exceeded: CECA drinking water (500 mg/L); CECA agricultural use (130 mg/L); and CECA aquatic life (0.005 mg/L).

According to data reported by the U.S., the fluoride standard established for CECA drinking water (1.5 mg/L) was exceeded one time at the Wellton-Mohawk with a result of 1.7 mg/L during the second sampling event.

Based on data reported by the U.S. and Mexico, the EPA aquatic life CCC standard for alkalinity (20 mg/L) was exceeded at all of the Lower Colorado River stations during both sampling events with results ranging from 146 to 319 mg/L.

According to data reported by the U.S., the suspended sediment standard established for CECA drinking water (500 mg/L) was exceeded one time at the NIB during the first sampling event with a result of 562 mg/L.

A cyanide concentration of 0.1 mg/L was reported by the U.S. at the YMD from the first sampling event which exceeded the CECA standards for contact recreation (0.02 mg/L), agricultural use (0.02 mg/L), and fresh water aquatic life (0.005 mg/L). Most cyanides come from industrial sources (gold extraction, electroplating, and casehardening of steel) however, small amounts are naturally occurring. While extremely poisonous, cyanide does not bioaccumulate in fish tissue, and some small organisms in water and soil can convert certain cyanides to less harmful chemicals.

To meet the CECA standard for drinking water, oil and grease must not be present in ambient water. According to data reported by Mexico, this standard was exceeded at the All American Canal, the NIB and the YMD during the first sampling event with results ranging from 0.75 to 9.87 mg/L.

Data for phenols reported by the U.S. exceeded the CECA standards for drinking water (0.3 mg/L), contact recreation (0.001 mg/L), and fresh water aquatic life (0.1 mg/L) during the second sampling event at the All American Canal, the NIB, the YMD, and the Wellton-Mohawk. Phenol results ranged from 1.0 to 3.0 mg/L. Phenol is a common component of oil refinery wastes and is produced in the conversion of coal into gaseous or liquid fuels. Phenol enters the environment from oil refinery discharges, coal conversion plants, industrial and municipal WWTP effluent, and spills.

According to data reported by Mexico from both sampling events, the CECA fecal coliform standard for drinking water [1000 most probable number (MPN)/100 mL] was exceeded in the YMD and the Gila River. Fecal coliform results at these sites ranged from 3000 to 9300 MPN/100 mL.

The following discussion is based on data contained in Appendix C, Table C.2.6, New River, General Water Quality Parameters.

According to data reported by the U.S. and Mexico, chloride concentrations from Mexicali, Calexico, and Westmorland during both sampling events ranged from 720 to 1400 mg/L. At times, these results exceeded one or more of the following standards: EPA aquatic life CMC (860 mg/L) and CCC (230 mg/L); and CECA fresh water aquatic life (250 mg/L).

Sulfate data reported by the U.S. and Mexico from both sampling events at all of the New River stations ranged from 395 to 910 mg/L. These results exceeded the CECA standard for fresh water aquatic life (0.005 mg/L).

Based on data reported by the U.S. and Mexico, the EPA aquatic life CCC standard for alkalinity (20 mg/L) was exceeded at all of the New River stations during both sampling events, with results ranging from 236 to 429 mg/L.

The CECA fresh water aquatic life minimum standard for DO of 5.0 mg/L was not met at the Mexicali or Calexico stations as reported by Mexico. DO results ranged from 0.2 to 2.33 mg/L during both sampling events.

A number of pathogenic (disease-causing) viruses, bacteria, and protozoans can enter a water body via fecal contamination. Human illness can result from drinking or swimming in water that contains pathogens, or from eating shellfish harvested from such waters. (Volunteer Monitor Newsletter, 1998).

Both total and fecal coliforms have been used as indicator organisms since the 1920s by agencies charged with protecting public health. The total coliform group is not very useful for testing recreational or shellfishing waters as some species in this group are naturally found in plant material or soil. Thus, their presence does not necessarily indicate fecal contamination. However, total coliforms are useful for testing drinking water, where contamination by soil or plant material would be a problem.

A more fecal-specific indicator is the fecal coliform group, which is a subgroup of the total coliforms. Fecal coliforms are widely used to test recreational waters, and they are the only indicator approved by the U.S. for classifying shellfishing waters.

Other constituents including extractable organic compounds, pesticides, and VOCs were detected in water samples from both rivers, however, none exceeded the corresponding water quality criteria used for this study.

6.3 Sediment

Although no standards have been developed in either country for toxic constituents sorbed on either suspended or bed sediments, sampling and analysis were performed to establish background levels (Appendix C, Tables C.1.7, C.1.8, C.1.9, C.1.10, C.1.11, C.1.12, C.2.7, C.2.8, C.2.9, C.2.10, C.2.11, and C.2.12). Normalizing trace element to aluminum ratios is a useful way to establish human effects and such comparisons show the influence of several trace elements common to urban environments at the Mexicali and Calexico sites. However, as the New River flows through the Imperial Valley, input from the surrounding soil results in "natural" levels in the suspended sediment (and also in bottom material).

The majority of extractable organic compounds detected in sediment samples at the Mexicali and Calexico stations also reflect the input typical of an urban environment. The compounds are no longer detected at the Westmorland site because of the large input of soil carried in agricultural runoff in the Imperial Valley.

Constituents sorbed on suspended sediment can be bioaccumulated by aquatic organisms to high enough concentrations to result in toxic effects. Constituents sorbed on bed sediment can be bioaccumulated if such sediment is disturbed and resuspended in the water column.

6.4 Bioaccumulation

Bioaccumulation can result in adverse effects on fish and other food chain species, including humans, from the consumption of fish exposed to contaminated sediments or water.

Results of fish tissue analyses were compared to criteria such as U.S. Food and Drug Administration (FDA) Action

Levels, EPA Screening Values (SVs) for target analytes, Median International Standards (MIS) for trace elements, National Academy of Sciences (NAS) recommended guidelines for predator protection, CSWRCB Maximum Tissue Residue Levels (MTRLs), and CSWRCB Elevated Data Levels (EDLs). In general, FDA action levels, EPA SVs for target analytes, and MIS are considered more important for critical human health criteria. NAS guidelines for predator protection, MTRLs (relatively new human health related criteria), and CSWRCB EDLs are considered separately.

FDA Action Levels were not exceeded in any of the samples analyzed during this study. EPA SVs were exceeded at: Westmorland (total DDT, dieldrin, total PCBs, and toxaphene); Calexico (total chlordane, dieldrin, total PCBs, and toxaphene); NIB (toxaphene); YMD (total DDT, dieldrin, total PCBs, and toxaphene); and All American Canal (total PCBs) (Tables 3 and 4). NAS guidelines for organic chemicals were exceeded at: Westmorland (total DDT, endosulfan, and toxaphene); Calexico (total chlordane, toxaphene); NIB (toxaphene); and YMD (total DDT and toxaphene) (Table 3).

Selenium concentrations exceeded the MIS in largemouth bass collected from the All American Canal downstream from Imperial Dam (Table 5). Arsenic concentrations exceeded the MTRL in two samples from the All American Canal (Table 5).

All of the samples collected from the 5 sites exceeded the MTRL for total PCBs (Table 4). All but one of the 17 samples collected from the 5 sites exceeded the MTRL for total DDT (Table 3). MTRLs were also exceeded for total chlordane, dieldrin, hexachlorobenzene, lindane, and toxaphene (Table 3).

Additional information on some of the constituents that exceeded established criteria for fish tissue is provided below.

Arsenic can bioaccumulate in fish and enters the environment from use as a pesticide, and through industrial and municipal WWTP effluent, emissions from coal fired power plants, and natural processes. Zinc can build up in fish tissues and other organisms and enters the environment through natural processes, mining, steel production, coal and waste burning.

Chlordane is a carcinogen which bioaccumulates in fish, birds, and animals. It enters the aquatic environment from urban and agricultural runoff, breaks down very slowly, and does not readily dissolve in water. In 1988, EPA banned all uses of chlordane.

DDT and its metabolites build up in plants and in the fatty tissues of fish, birds, and animals. DDT is very persistent in soil and, due to damage to wildlife and potential harm to human health, DDT was banned in the U.S. in 1972 and in Mexico in 1983. Dieldrin accumulates in fat and leaves the body very slowly. The U.S. banned all uses of dieldrin in 1987. Endosulfan bioaccumulates in the bodies of fish and other organisms primarily through spraying on farm crops. Endosulfan does not readily dissolve in water and is persistent in soil for many years.

PCBs bioaccumulate in fish and other aquatic organisms at levels that can be thousands of times higher than in water. PCBs enter the environment through leaking industrial and electrical equipment, industrial discharges, spills, and leaching from landfills and previously contaminated sediments. PCBs adhere tightly to soil, are very persistent, and have carcinogenic and teratogenic properties. The U.S. stopped manufacturing PCBs (used in coolants, insulating materials, and lubricants in electrical equipment) in 1977 because of health effects. Pre-1977 products including old fluorescent lighting fixtures, electrical devices and appliances with PCB capacitors, old microscope oil, and hydraulic fluids still contain PCBs.

6.5 Aquatic Toxicity

6.5.1 Lower Colorado River

As discussed in Chapter 5, slight, but statistically significant inhibition of fish growth was observed in samples from the Lower Colorado River at NIB and All American Canal. Although conclusions cannot be drawn from limited testing, any indication of a toxic response in surface water is cause for further investigation. Toxicity in December 1995 associated with an organophosphate pesticide in the YMD likely resulted from agricultural practices. The corresponding water column sample for this sampling location and date was found to contain 0.1 µg/L of chlorpyrifos (Table C.1.3)

6.5.2 New River

Toxicity to *Ceriodaphnia* in March 1995 at Mexicali was not evident in the corresponding first phase testing at Calexico, or in the second phase testing during 1996. The corresponding water column sample for this location and date was found to contain 0.024 µg/L of chlorpyrifos, 0.044 µg/L of malathion, 0.055 µg/L of diazinon, 0.014 µg/L of EPTC, and 0.005 µg/L of DCPA (Table C.2.3).

It is interesting to note that except for the March 1995 toxicity to *Ceriodaphnia*, the results of aquatic testing for the Lower Colorado and New Rivers are not significantly different.

7. CONCLUSIONS AND RECOMMENDATIONS

Water quantity and quality in the Lower Colorado River and the New River have been the subject of various interstate and international agreements. Water quality evaluation criteria are based on the water-use designation assigned to a water body by the appropriate agency. The water-use designation for a water body may differ depending on which state or country assigns the designation. The different use designations complicated the interpretive analysis of data collected in the present study, as the criteria are not uniformly defined.

Data collected during this study indicate that total dissolved solids, trace elements, and nutrients from agricultural, domestic, and industrial activities, and some general water quality indicators are the constituents of greatest concern.

Several elements were identified in surface water that may be of potential concern including barium, boron, cadmium, copper, lead, manganese, mercury, nickel, and selenium. Trace elements were also detected in suspended and bed sediment, however, standards have not been developed by EPA or Mexico for elements in these media.

To evaluate potential ecological or human health effects from these elements, data are needed for the detected oxidation state and chemical form of elements such as arsenic, chromium and selenium. Future monitoring programs should include oxidation state analyses for redox sensitive elements, and should include the use of geochemical modeling to determine the form in which the metals (metal salts) may be found in the particular waterbody. These data can then be evaluated to determine if an ecological or human health hazard exists.

Extractable organic compounds were not detected in water samples from either river during this study. These compounds were detected in suspended and bed sediment samples from both rivers. Standards have not been developed by EPA or Mexico for compounds in these media. It is noted that the organic compounds that were detected are typical of those in industrial urban environments, and in many water bodies, are present at much higher concentrations in bed material from receiving water bodies (i.e., reservoirs, lakes, and bays) than reported here.

Pesticide residues found in water-column samples from both rivers did not exceed established standards. Pesticides and other chlorinated organic compounds were detected in suspended- and bed-sediment samples from both rivers. EPA or Mexico has not developed standards for compounds in these media. Organochlorine compounds are of particular concern as they are persistent in the environment. Some of the organochlorine compounds that were detected have been banned for use for many years.

Concentrations of nutrients and general water quality parameters exceeded standards developed by EPA and Mexico in water samples collected throughout this study. Fecal contamination was reported by Mexico in both rivers. The New River exhibited much higher concentrations than the Lower Colorado River, with a maximum of 4,600,000 MPN/100 mL at Westmorland versus a maximum of 9,300 MPN/100 mL at the YMD.

With respect to on-going, routine water quality monitoring programs, it is recommended that responsible agencies include testing for *E. coli* as an indicator species as: it is more fecal-specific (occurs only in the feces of warm-blooded mammals); and EPA studies published in 1986 showed that in fresh water *E. coli* correlated more closely with illnesses related to direct body contact (i.e. swimming). For these reasons, EPA began recommending that states use *E. coli* as an indicator for freshwater recreational areas. Concurrent testing for fecal coliform could also be performed so that new data is comparable to historical data. Although routine monitoring is not practical, additional testing should be done for a broad array of human viruses and bacteria as part of a special assessment similar to this one for chemical toxicants.

VOCs were not detected in surface water samples from stations in the Lower Colorado River, but were detected at very low levels in water samples from Mexicali and Calexico on the New River. Detected concentrations did not exceed established U.S. or Mexican standards.

Routine physical and chemical characteristic monitoring should be continued (monthly 8-hour composite sampling) as well as quarterly VOC analyses to investigate industrial discharges.

Aquatic toxicity, most likely due to chlorpyrifos, was observed one time during this study in the YMD, and one time at the Mexicali sampling station (causative constituent unknown).

Bioaccumulation monitoring results demonstrated many exceedences of established criteria for acceptable levels in fish tissue throughout the study area. Carcinogenic, non-carcinogenic, and synthetic organic compounds were detected in biological tissue samples from both rivers.

Routine toxicity testing and biological tissue analyses should be continued, as should yearly bed-sediment sampling, to establish a database against which to compare results of future studies. Sampling sites for biological tissue sampling should be chosen based on the likelihood of aquatic organism consumption by humans at the locations.

Pesticide applications are seasonal, and a pesticide-monitoring program (as well as toxicity testing) should be established that is consistent with seasonal application schedules. Design of the monitoring program should consider identifying sources, where possible, so that appropriate control measures can be established.

7.1 Lower Colorado River

Total dissolved solids concentrations are a major concern for users of Lower Colorado River water. Data collected as part of this study clearly show that contributions from the tributary Gila River can affect overall water quality being delivered to Mexico. Few data are available to evaluate Gila River contributions, and future monitoring programs should include at least one site to create a more robust data set for evaluation.

Routine monitoring of nutrient species should be continued. Data collected in this study suggest that organic nitrogen concentrations and phosphorus may occasionally exceed criteria. More data are needed to determine if this is a transitory problem, or is more endemic, requiring regulatory oversight.

Use of best management practices (BMPs) should be encouraged in both countries. Sources that contribute dissolved solids should be identified, and where possible, controlled. Data on pesticide and fertilizer application rates and schedules should be shared between the two countries. Future monitoring programs should be designed to collect data so that the effects of these applications on the receiving water bodies and related ecosystems can be assessed.

7.2 New River

Of major concern to downstream New River users in the United States is the wastewater contribution at Mexicali. Continued, routine monitoring is needed for wastewater constituents, including nutrient and salt loads, oxygen demand, and pathogenic bacteria and viruses.

The city of Mexicali presently treats a portion of its wastewater at the Mexicali I Zaragoza treatment facility and a small amount at the Gonzalez Ortega plant. The capacity of these plants is insufficient to provide adequate treatment to the total wastewater flow produced by Mexicali. As a result, part of the wastewater is discharged untreated into the New River, causing a degradation of the water quality of that watercourse.

The Mexicali Wastewater Facilities Planning Project, prepared under a boundary-wide program administered by the IBWC, under the authority of IBWC Minute No. 294, with funds from the EPA, addresses present and future improvements in wastewater infrastructure to satisfy the needs of Mexicali residents and to improve the environmental quality of the New River. The project called for making immediate improvements to the existing Mexicali wastewater system and for exploring options for a long-term solution to Mexicali's deficiencies in wastewater infrastructure.

A facility plan was prepared that examined the technical, financial, and environmental aspects of various project options. The long-term facilities planning project, called the Mexicali II Project, includes construction of a 20 million gallon per day (mgd) wastewater treatment plant, a pump station and a force main conveyance facility from the pump station to the treatment plant. The plant can later be expanded to treat up to 40 mgd [1.76 cubic meters per second (cms)].

At present, construction has been completed on the pump station component of the project. Purchase of the pipe for the force main component is complete. However, due to opposition from the local residents, the construction contract of the proposed wastewater treatment plant has been suspended. Government officials are currently reviewing proposed alternatives for the location of the new Mexicali II treatment plant. Initiation of the selected alternative could begin in late 2003. Efforts will be made to implement the qualitative and the quantitative standards established in IBWC Minute No. 264 for biochemical oxygen demand, chemical oxygen demand, pH, dissolved oxygen, and fecal coliform.

A group of other projects, Mexicali I, managed by the North American Development Bank (NADBank) to improve the collection system and renovate and expand the Zaragoza Wastewater Treatment Plant began in late 2000.

VOCs have been identified at very low concentrations in the New River. These compounds tend to have highly variable concentrations depending on when samples are collected relative to releases and relative to atmospheric and hydraulic conditions at the time samples are collected. Concentrations of VOCs should continue to be monitored in waste discharge streams to identify industrial discharges and chemical spills. Responsible U.S. agencies will continue to be notified by the IBWC of spills and by-passes that occur in Mexicali which will impact the New River.

Bioaccumulation monitoring analyses demonstrated many exceedences of established criteria for acceptable levels in fish tissue in the New River.

In order to address concerns about contaminant sources from both countries, all responsible agencies will: continue to collect ambient water quality data; agree to exchange data collected unilaterally with the other country and interested individuals upon completion of quality assurance/quality control procedures established by the data generating country; participate in binational technical workgroups to share relevant, project-specific (i.e. Salton Sea, Colorado River Delta, and Ciénega de Santa Clara) and general information; assist with community-based efforts to provide information on public health protection; and support facility planning efforts to formulate solutions to the identified water quality problems.

APPENDIX A

SUMMARY OF LABORATORY PROCEDURES

APPENDIX A.1

Summary of Fish Tissue Extraction and Analysis Procedures for Pesticides and PCBs

A fish tissue homogenate sample is extracted with acetonitrile in an 8oz. glass Qorpak wide mouth bottle. The extracted sample is filtered and the filtrate is partitioned with petroleum ether. The petroleum ether extract is eluted through a Florisil column to remove lipids and fractionate the sample extract into four fractions to simplify the chromatography. The Florisil columns are eluted with petroleum ether (Fraction 1), 6% ethyl ether (Fraction 2), 15% ethyl ether (Fraction 3), and 50% ethyl ether (Fraction 4). The fractions are concentrated to an appropriate volume using a Zymark Turbovap II concentrator prior to analysis by gas chromatography. A mixture of synthetic organic standards is eluted through the florisil column to determine the recovery and separation characteristics of the column. Method quantitation limits for target compounds are reported on the following page.

Distribution of Synthetic Organic Compounds among Four Fractions of Standard Florisil® Column

(0%) Fraction 1	(6%) Fraction 2	(15%) Fraction 3	(50%) Fraction 4
HCH, alpha*	HCH, alpha*	Dacthal	Endosulfan II
aldrin	HCH, beta	Diazinon	Endosulfan Sulfate
Chlordene, alpha	HCH, gamma	Dichlorobenzophenone, p,p’	
Chlordene, gamma	HCH, delta	dieldrin	
DDE, o,p’	chlorbenside	endosulfan I	
DDE p,p’	cis-chlordane	endrin	
DDMU, p,p’*	trans-chlordane	malathion	
DDT, o,p’	chlorpyrifos	oxadiazon	
DDT, p,p’*	DDD, o,p’*	Parathion, ethyl	
heptachlor	DDD, p,p’	Parathion, methyl	
hexachorobenzene	DDMU p,p’*	Tetradifon (tedion)	
trans-nonachlor	DDT, p,p’*		
PCB 1248	dicofol (kelthane)		
PCB 1254	ethion		
PCB 1260	heptachlor epoxide		
	methoxychlor		
	cis-nonachlor		
	oxychlordane		
	toxaphene		

APPENDIX A.1 (continued)

Quantitation Limits for Synthetic Organic Compounds and Trace Elements Analyzed in Flesh

Compound	Quantitation Limit (µg/kg, ppb wet weight)
aldrin	5
chlorbenside	50
cis-chlordane	5
trans-chlordane	5
chlordene, alpha	5
chlordene, gamma	5
chlorpyrifos	10
dacthal	5
DDD, o,'p	10
DDD, p,p'	10
DDE, o,p'	10
DDE, p,p'	5
DDMU,p,p'	15
DDT, o,p'	10
DDT, p,p'	10
diazinon	50
dichlorobenzophenone-p,p'	30
dicofol (Kelthane)	100
dieldrin	5
endosulfan I	5
endosulfan II	70
endosulfan sulfate	85
endrin	15
ethion	20
HCH, alpha	2
HCH, beta	10
HCH, gamma	2
HCH, delta	5
heptachlor	5
heptachlor epoxide	5
HCB	2
methoxychlor	15
cis-nonachlor	5
trans-nonachlor	5
oxadiazon	5
oxychlordane	5
parathion, ethyl	10
parathion, methyl	10
PCB 1248	50
PCB 1254	50
PCB 1260	50
tetradifon (Tedion)	10
toxaphene	100

APPENDIX A.2

Trace Element Digestion Techniques and Quantitation Limits in Fish Tissue

Element	Digestion Techniques	Instrumental Analysis	Quantitation Limits (µg/g, ppm wet weight)
Arsenic	Dry Ash w/$Mg(NO_3)_2 6H_2 0$	$NaBH_4$ Reduction A.A.	0.05
Mercury	HNO_3 reflux	Cold Vapor A.A.	0.02
Copper	HNO_3 reflux	Flame A.A. or Graphite Furnace	0.02
Zinc	HNO_3 reflux	Flame A.A.	0.05
Cadmium	HNO_3 reflux	Graphite Furnace (Ammonium phosphate/magnesium nitrate)	0.01
Chromium	HNO_3 reflux	Graphite Furnace	0.02
Lead	HNO_3 reflux	Graphite Furnace (Ammonium phosphate/magnesium nitrate)	0.1
Nickel	HNO_3 reflux	Graphite Furnace	0.1
Selenium	Dry Ash w/$Mg(NO_3)_2 6H_2O$	$NaBH_4$ Reduction A.A.	0.05
Silver	HNO_3 reflux	Graphite Furnace	0.02

APPENDIX A.3
SCHEDULES AND METHOD REPORTING LIMITS (MRLs) FOR U.S. LABORATORIES

WATER

SCHEDULE 2703
Trace elements in water filtered through a 0.45 µm-filter

COMPOUND NAME, ANALYTICAL TECHNIQUE	MRL (µg/L)
Arsenic, DIS	1
Aluminum, DIS, ICP/MS	1
Antimony. DIS, ICP/MS	1
Barium, DIS, ICP/MS	1
Beryllium, DIS, ICP/MS	1
Cadmium, DIS, ICP/MS	1
Chromium, DIS, ICP/MS	1
Cobalt, DIS, ICP/MS	1
Cooper, DIS, ICP/MS	1
Lead, DIS, ICP/MS	1
Manganese, DIS, ICP/MS	1
Molybdenum, DIS, ICP/MS	1
Nickel, DIS, ICP/MS	1
Selenium, DIS	1
Silver, DIS, ICP/MS	1
Uranium, DIS, ICP/MS	1
Zinc, DIS, ICP/MS	1

SCHEDULE 2750
Major inorganics in water

COMPOUND NAME, ANALYTICAL TECHNIQUE	MRL
Chloride, DIS	0.1 mg/L
ROE DIS @ 180°C	1 mg/L
Potassium, DIS	0.1 mg/L
pH laboratory	
Specific conductance, lab	1 µS/cm
Alkalinity, as $CaCO_3$, lab	1 mg/L
Iron, DIS	3 µg/L
Manganese, DIS	1 µg/L
Calcium, DIS	.02 mg/L
Magnesium, DIS	.01
Silica, DIS	.01
Sodium, DIS	.20
Bromide, DIS	.01
Sulfate, DIS	.10
Fluoride, DIS	.10

SCHEDULE 2702
Nutrients in water

COMPOUND NAME, ANALYTICAL TECHNIQUE	MRL (mg/L)
Nitrogen, nitrite as N,DIS	0.01
Phosphorus, orthophosphate, as P, DIS	0.01
Nitrogen, nitrate +nitrite, as N, DIS	0.05

Nitrogen, ammonia, as N, DIS	0.01
Phosphorus, as P, DIS	0.01
Nitrogen, ammonia +organic, as N. DIS	0.20
Nitrogen, ammonia +organic, as N total	0.20
Phosphorus, as P total	0.01

SCHEDULE 2075

Gross Organics in water

Carbon, organic, dissolved (DOC)	0.10 µg/L
Carbon, organic, suspended (SOC)	0.10

SCHEDULE 2090

Volatile organic compounds at 0.20µg/L by purge and trap GC/MS plus library search of nontarget constituents

COMPOUND NAME	MRL (µg/L)
Benzene	0.2
Benzene,1,2,3 trichloro-	0.2
Benzene,1,2,4 trichloro-	0.2
Benzene, 1,2,4 trimethyl-	0.2
Benzene,1,2 Dichloro-	0.2
Benzene,1,3,5 trimethyl-	0.2
Benzene,1,3 Dichloro	0.2
Benzene,1,4 Dichloro-	0.2
Benzene, 1-chloro-2-methyl-	0.2
Benzene, 1- chloro -4 methyl-	0.2
Benzene, Isopropyl-	0.2
Benzene, Bromo-	0.2
Benzene, Chloro-	0.2
Benzene, dimethyl-(Xylene)	0.2
Benzene, Ethyl-	0.2
Benzene, 1-Methyl-4 isopropyl-	0.2
Benzene, Methyl (toluene)	0.2
Benzene, n-butyl-	0.2
Benzene, n-propyl-	0.2
Benzene, sec-butyl-	0.2
Benzene, ter-butyl-	0.2
Ethane, 1,1,1,2-tetrachloro	0.2
Ethane 1,1,1,1-trichloro-	0.2
Ethane 1,1,2,2 Tetrachloro-	0.2
Ethane, 1,1,2- Trichloro	0.2
Ethane, 1,1-Dichloro	0.2
Ethane, 1,2-Dibromo (EDB)	0.2
Ethane 1,2, Dichloro	0.2
Ethane, Chloro	0.2
Ethane, Trichlorotrifluoro-	0.2
Ethylene, 1,1-Dichloro	0.2
Ethylene, Chloro (vinyl Chloride)	0.2
Ethylene, cis-1,2-Dichloro	0.2
Ethylene, tetrachloro-	0.2
Ethylene, trans-1,2 dichloro	0.2
Ethylene, trichloro	0.2
Hexachlorobutadiene	0.2
Methane, bromo	0.2
Methane, bromochloro-	0.2
Methane, chloro	0.2

Methane, dibromo	0.2
Methane, Dibromochloro	0.2
Methane, Dichloro	0.2
Methane dichlorobromo	0.2
Methane, dichlrodifluoro-	0.2
Methane, tetrachloro-	0.2
Methane, tribromo- (Bromoform)	0.2
Methane, Trichloro- (Chloroform)	0.2
Methane, trichlorofluoro-	0.2
Propene,2 methoxy-2methyl	0.2
Naphthalene	0.2
Propane,1,2,3 Trichloro	0.2
Propane 1,2, Dibromo-3-chloro (DBCP)	0.2
Propane, 1,2 Dichloro	0.2
Propane, 1,3 Dichloro-	0.2
Propane 2,2, Dichloro-	0.2
Propene 1,1, Dichloro-	0.2
Propene, cis-1,2-Dichloro-	0.2
Propene, trans-1,3-dichloro-	0.2
Styrene	0.2

SCHEDULE 1385

Extractable Priority Pollutants. Organic compounds, acid and base/neutral, total recoverable. GC/MS

COMPOUND NAME	MRL (µg/L)
4-Chloro-3methylphenol	30
2-Chlorophenol	5
2,4 Dichlorophenol	5
2,4,6 Trichlorophenol	20
2,4-Dimethylphenol	5
4,6-Dinitro-2-methylphenol	30
2,4 Dinitrophenol	20
2-Nitrophenol	5
4-Nitrophenol	30
Pentachlorophenol	30
Phenol	5
Acenaphthene	5
Acenphtylene	5
Anthracene	5
Benzidine	40
Benzo[a]anthracene	10
Benzo[b]fluoranthene	10
Benzo[k]fluoranthene	10
Benzo[a]pyrene	10
Benzo[g,h,i]perylene	10
Butyl benzyl phtalate	5
Bis(2-chloroethoxy) methane	5
Bis (2-chloroethyl) ether	5
Bis (2-chloropropyl) ether	5
4-Bromophenylphenyether	5
2-Chloronaphthalene	5
4-Chloropehylphenyether	5
Chrysene	10
1,2,5,6-Dibenz[a,h]anthracene	10
Di-n-butyl phtalate	5

1,2, Dichlorobenzene	5
1,3 Dichlorobenzene	5
1,4 Dichlorobenzene	5
3,3,Dichlorobenzidine	20
Diethyl phtalate	5
Dimethyl phtalate	5
2,4, Dinitrotoluene	5
2,6-Dinitrotoluene	5
Di-n-octyl phtalate	10
Bis (2-ethylhexyl) phtalate	5
Fluorene	5
Fluoranthene	5
Hexachlorobenzene	5
Hexachlorobutadiene	5
Hexachlorocyclopentadiene	5
Hexachloroethane	5
Indeno(1,2,3-cd) pyrene	10
Isophorone	5
Naphthalene	5
Nitrobenzene	5
n- Nitrosodimethylyamine	5
n-Nitrosodiphenylamine	5
n- Nitrosodi-n-propylamine	5
Phenanthrene	5
Pyrene	5
1,2,4 Trichlorobenzene	5
1,2-Diphenyhydrazine	5

SCHEDULE 2001

Pesticides in filtered water extract on C-18 SPE cartridge and analyzed by GC/MS.

COMPOUND NAME	MRL (µg/L)
Alachlor	0.009
Atrazine-desethyl-	0.007
Atrazine	0.017
Azinphos-Methyl-	0.038
Benfluralin	0.013
Butylate	0.008
Carbaryl	0.046
Carbofuran	0.013
chlorpyrifos	0.005
Cyanazine	0.013
DCPA	0.004
DDE-p.p’	0.010
Diazinon	0.008
Dieldrin	0.008
Diethylaniline	0.006
Dimethoate	0.024
Disulfoton	0.028
EPTC	0.005
Ethafluralin	0.013
Ethoprop	0.012
Fonofos	0.008
HCH-alfa	0.007
HCH-gama	0.011
Linuron	0.039

Malathion	0.010
Metolachlor	0.009
Metribuzin	0.012
Molinate	0.007
Napropamide	0.010
Parathion-ethyl-	0.022
Parathion, methyl-	0.035
Pebulate	0.009
Pendimethalin	0.018
Permethrin-cis	0.019
Phorate	0.011
Pronamide	0.009
Prometon	0.008
Propachlor	0.015
Propanil	0.016
Propargite	0.006
Simazine	0.008
Thiobenacarb	0.008
Tebuthiuron	0.015
Terbacil	0.030
Terbufos	0.012
Triallate	0.008
Trifluralin	0.012

SCHEDULE 2050

Pesticides in filtered water extract on Carbopack B SPE and analyzed by HPLC

COMPOUND NAME	MRL (µg/L)
2,4,5-T	0.05
2,4 D	0.05
2,4-DB	0.05
Acifluorfen	0.05
Aldicarb	0.05
Aldicarb sulfone	0.05
Aldicarb sulfoxide	0.05
Bentazon	0.05
Bromacil	0.05
Bromoxynil	0.05
Carbaryl	0.05
Carbofuran	0.05
Carbofuran 3-hydroxy	0.05
Chloramben	0.05
Chlorothalonil	0.05
Clopyralid	0.05
Dacthal, Mono acid	0.05
Dicamba	0.05
Dichllobenil	0.05
Dichlorprop	0.05
Dinoseb	0.05
Diuron	0.05
DNOC	0.05
Esfenvalerate	0.05
Fenuron	0.05
Fluometuron	0.05
Linuron	0.05
MCPA	0.05

MCPB	0.05
Methiocarb	0.05
Methomyl	0.05
1-Naphthol	0.05
Neburon	0.05
Norflurazon	0.05
Oryzalin	0.05
Oxamyl	0.05
Picloram	0.05
Propham	0.05
Propoxur	0.05
Silvex	0.05
Triclopyr	0.05

SEDIMENTS

SCHEDULE 2400
Trace elements in bed sediments

COMPOUND NAME, ANALYTICAL TECHNIQUE	LLD (dry wt)
Aluminum, ICP	0.05%
Calcium, ICP	0.05
Iron, ICP	0.05
Potassium, ICP	0.05
Magnesium, ICP	0.005
Sodium, ICP	0.005
Phosphorous, ICP	0.005
Titanium, ICP	0.005
Gold, ICP	8 µg/g
Barium, ICP	1
Beryllium, ICP	1
Bismuth, ICP	10
Cerium, ICP	4
Cobalt, ICP	1
Chromium, ICP	1
Copper, ICP	1
Europium, ICP	2
Gallium, ICP	4
Holmium, ICP	4 µg/g
Lanthanum, ICP	2
Lithium, ICP	2
Manganese, ICP	4
Molybdenum, ICP	2
Niobium, ICP	4
Neodymium, ICP	4
Nickel, ICP	2
Lead, ICP	4
Scandium, ICP	2
Tin, ICP	10
Strontium, ICP	2
Tantalum, ICP	40
Thorium, ICP	4
Vanadium, ICP	2
Yttrium, ICP	2
Ytterbium, ICP	1
Zinc, ICP	4

Silver, GFAA	0 .1
Cadmium, GFAA	0 .1
Mercury, CVAA	0 .02
Arsenic, HA	0 .1
Antimony, HA	0.1
Selenium, HA	0.1
Uranium, DNAA	0.05
Thorium, DNAA	1
Sulfur, IR	0.05
Carbon, total	0.01
Carbon, organic	0.01

SCHEDULE 1386

Organic compounds acid and base/neutral recoverable from bottom material

	MRL (µg/kg)
4-Chloro-3methylphenol	600
2-Chlorophenol	200
2,4Dichlorophenol	200
2,4 Dimethylphenol	200
2-Methyl-4,6 dinitrophenol	600
2,4 Dinitrophenol	600
2-Nitrophenol	200
4-Nitrophenol	600
Pentachlorophenol	600
Phenol	200
2,4,6 Trichlophenol	600
Acenaphtalene	200
Acenaphthylene	200
Anthracene	200
Benzo[a]anthracene	400
Benzo[b]fluoranthene	400
Benzo[k]fluoranthene	400
Benzo[a]pyrene	400
Benzo[g,h,i]perylene	400
Butyl benzyl phtalate	200
Bis(2-chloroethoxy) methane	200
Bis (2-chloroethyl) ether	200
Bis (2-chloropropyl) ether	200
4-Bromophenylphenyether	200
2-Chloronaphthalene	200
4-Chloropehylphenyether	200
Chrysene	400
1,2,5,6-Dibenz[a,h]anthracene	400
Di-n-butyl phtalate	200
1,2, Dichlorobenzene	200
1,3 Dichlorobenzene	200
1,4 Dichlorobenzene	200
Diethyl phthalate	200
Dimethyl phthalate	200
2,4, Dinitrotoluene	200
2,6-Dinitrotoluene	200
Di-n-octyl phtalate	200
Bis (2-ethylhexyl) phtalate	200
Fluorene	200
Fluoranthene	200

Hexachlorobenzene	200
Hexachlorobutadiene	200
Hexachlorocyclopentadiene	200
Hexachloroethane	200
Indeno(1,2,3-cd) pyrene	400
Isophorone	200
Naphthalene	200
Nitrobenzene	200
n- Nitrosodimethylyamine	200
n-Nitrosodiphenylamine	200
n- Nitrosodi-n-propylamine	200
Phenanthrene	200
Pyrene	200
1,2,4 Trichlorobenzene	200

SCHEDULE 2501

Chlorinated organic compounds

	MRL (µg/kg)
Aldrin	1
Chlordane, cis	1
Chlordane, trans	1
Chloroneb	5
DCPA	5
DDD,o.p'	1
DDD, p,p'	1
DDE, o,p'	1
DDT,o,p'	2
DDT,p,p'	2
Dieldrin	1
Endosulfan I	1
Endrin	2
HCB, alpha,	1
HCH, beta-	1
HCH, gamma	1
Heptachlor	1
Heptachlor epoxide	1
Hexachlorobenzene	1
Isodrin	1
Methoxychlor, o,p'	5
Methoxychlor, pp	5
Mirex	1
Nonachlor, cis	1
Nonachlor, trans	1
Oxychlordane	1
PCB's total	50
Pentachloroanisole	1
Permetrin, cis -	5
Permetrin, trans	5
Toxaphene	200

SCHEDULE 2502

Base-neutral Acid (BNA) semivolatile organic compounds in bed sediments

	MRL (µg/kg)
Acenaphthylene	50
Acenaphthene	50
Acridine	50

Amine, n-Nitroso-Di-n-Propyl	50
Amine, n-Nitroso-diphenyl-	50
Anthracene	50
Anthracene, 3- Methyl	50
Benzo[a]anthracene	50
Dibenzo[a,h]anthracene	50
Anthraquinone	50
Benzene,1,2,4 trichloro-	50
Benzene, 1,2 dichloro-	50
Benzene, 1,3 dichloro	50
Benzene, 1,4 dichloro	50
Azobenzene	50
Nitrobenzene	50
Pentachlorobenzene	50
Pentachloronitrobenzene	50
Hexachlorocyclobutadiene	50
9H-Carbazole	50
Chrysene	50
p-cresol	50
Dibenzothiophene	50
Hexachloroethane	M-del
4-Bromophenylphenyl-ether	50
4- Chlorophenylphenyl-ether	50
bis (2Chloroethyl)-ether	50
bis (2Chloroisopropyl)ether	50
Fluoranthene	50
Benzo[b]fluoranthene	50
Benzo[k]fluoranthene	50
9H-Fluorene,1 Methyl-	50
9H Fluorene	50
Hexchlorocyclopentadiene	M-Del
Isophorone	50
Methane, bis (2-chloroethoxy)-	50
Naphthalene	50
Naphthalene, 2 Chloro	50
Naphthalene, 1,2 dimethyl	50
Naphthalene, 1,6 dimethyl	50
Naphthalene, 2,6 dimethyl	50
Naphthalene, 2 ethyl	50
Naphthalene,2,3,6 trimethyl	50
Pentachloroanisole	50
Benzo[g,h,I] perylene	50
Phenanthrene	50
Phenanthrene, 1 methyl	50
Phenanthrene,4,5 Methylene	50
Phenantridine	50
Phenol	50
2,4 dinitrophenol	M-Del
2 methyl-4,6 dinitrophenol	M-Del
2,3,5,6 tetramethylphenol	M-Del
2-Nitrophenol	M-Del
4-Nitrophenol	M-Del
2,4,6 trichlorophenol	M-Del
3,5 Dimethyl phenol	50
Phenol, 4-Chloro-3Mthyl	M-Del
2,4 Dichlorophenol	M-Del

2,4,6 trimethyl phenol	50
C8 Alkyl- phenol	50
Pentachlorphenol	M-Del
Phthalate, bis (2Ethylhexyl)	50
Phthalate, buylbenzyl	50
Phtahalate, Di-n-butyl	50
Phthalate, Di-n-octyl	50
Phthalate, Diethyl	50
Phthalate, Dimethyl	50
Pyrene	50
Pyrene, 1-Methyl	50
Benzo[a]pyrene	50
Indeno [1,2,3-cd] pyrene	50
2,2, Biquinoline	50
Benzo[c]quinoline	50
Isoquinoline	50
2,4 Dinitrotoluene	50
2,6 Dinitrotoluene	50

APPENDIX B

BIOACCUMULATION MONITORING

And
QUALITY ASSURANCE RESULTS

Toxic Substances Bioaccumulation Monitoring
Summary of Data
Synthetic Organic Chemicals in Fish Tissue

Bottle Number:		**24.1.F.95**	**24.2.F.95**	**24.11.F.95**	**24.12.F.95**
Station Name:		**Yuma Main Drain/**	**Yuma Main Drain/**	**Yuma Main Drain/**	**Yuma Main Drain/**
		Outlet	**Outlet**	**Outlet**	**Outlet**
Date of Collection:		**6/21/95**	**6/21/95**	**4/10/96**	**4/10/96**
Species:		**Carp**	**Largemout Bass**	**Carp**	**Channel Catfish**
Tissue Type:		**Flesh**	**Flesh**	**Flesh**	**Flesh**
	Fresh Weight	**Fresh Weight**	**Fresh Weight**	**Fresh Weight**	**Fresh Weight**
	Quantitation Limit (MQL)	**Concentration**	**Concentration**	**Concentration**	**Concentration**
COMPOUND	**ppb (ng/g)**	**ppb (ng/g)**	**ppb (ng/g)**	**ppb (ng/g)**	**ppb (ng/g)**
aldrin	5	ND	ND	ND	ND
cis-chlordane	5	<MQL	<MQL	**6.1**	**5.8**
trans-chlordane	5	<MQL	<MQL	<MQL	<MQL
oxychlordane	5	<MQL	ND	<MQL	ND
cis-nonachlor	5	<MQL	<MQL	<MQL	<MQL
trans-nonachlor	5	<MQL	<MQL	**12**	**8.5**
alpha chlordene	5	ND	ND	ND	ND
gamma chlordene	5	ND	ND	ND	ND
chlorpyrifos	10	<MQL	ND	ND	ND
dicofol	100	ND	ND	ND	ND
dichlorobenzophenone	30	ND	ND	ND	ND
dacthal	5	<MQL	ND	**11**	**7.4**
diazinon	50	ND	ND	ND	<MQL
dieldrin	5	**9.0**	<MQL	**8.8**	**6.1**
endosulfan I	5	**140**	<MQL	<MQL	<MQL
endosulfan II	35	**50**	<MQL	<MQL	ND
endosulfan sulfate	40	**51**	<MQL	<MQL	ND
endrin	15	ND	ND	ND	ND
ethion	20	<MQL	ND	<MQL	<MQL
alpha HCH	2	ND	ND	ND	ND
beta HCH	10	ND	ND	ND	ND
gamma HCH	2	ND	ND	ND	ND
delta HCH	5	ND	ND	ND	ND
o,p'-DDD	10	<MQL	<MQL	**12**	<MQL
p,p'-DDD	10	**26**	<MQL	**61**	**50**
o,p'-DDE	10	<MQL	ND	**14**	**14**
p,p'-DDE	5	**590**	**110**	**1700**	940
p,p'-DDMU	15	<MQL	ND	**22**	<MQL
o,p'-DDT	10	ND	ND	<MQL	<MQL
p,p'-DDT	10	<MQL	<MQL	<MQL	**33**
heptachlor	5	ND	ND	ND	ND
heptachlor epoxide	5	ND	ND	ND	ND
hexachlorobenzene	2	ND	ND	<MQL	<MQL
methoxychlor	15	ND	ND	ND	<MQL
oxadiazon	5	ND	ND	ND	ND
ethyl parathion	10	ND	ND	ND	ND
methyl parathion	10	ND	ND	ND	ND
PCB 1248	50	ND	ND	ND	ND
PCB 1254	50	<MQL	<MQL	**110**	**69**
PCB 1260	50	<MQL	ND	<MQL	<MQL
tetradifon	10	ND	ND	ND	ND
toxaphene	100	**140**	ND	**410**	**420**
% Lipid		2.47	0.165	2.23	1.83
% Moisture		78.3	78.8	78.7	78.2

APPENDIX B.1

Bottle Number:		24.3.F.95	24.4.F.95	24.6.F.95	24.5.F.95
Station Name:		**Colorado River/ Internat'l Boundary**	**Colorado River/ Internat'l Boundary**	**Colorado River/ Internat'l Boundary**	**Colorado River/ Internat'l Boundary**
Collection Date:		**6/13/95**	**6/13/95**	**12/5/95**	**12/5/95**
Species:		**Carp**	**Large Mouth Bass**	**Carp**	**Largemouth Bass**
Tissue Type:		**Flesh**	**Flesh**	**Flesh**	**Flesh**
	Fresh Weight	**Fresh Weight**	**Fresh Weight**	**Fresh Weight**	**Fresh Weight**
	Quantitation Limit (MQL)	**Concentration**	**Concentration**	**Concentration**	**Concentration**
COMPOUND	**ppb (ng/g)**	**ppb (ng/g)**	**ppb (ng/g)**	**ppb (ng/g)**	**ppb (ng/g)**
aldrin	5	ND	ND	ND	ND
cis-chlordane	5	<MQL	ND	<MQL	ND
trans-chlordane	5	<MQL	ND	<MQL	<MQL
oxychlordane	5	ND	ND	ND	ND
cis-nonachlor	5	<MQL	ND	<MQL	ND
trans-nonachlor	5	<MQL	<MQL	<MQL	<MQL
alpha chlordene	5	ND	ND	ND	ND
gamma chlordene	5	ND	ND	ND	ND
chlorpyrifos	10	<MQL	ND	<MQL	ND
dicofol	100	ND	ND	ND	ND
dichlorobenzophenone	30	ND	ND	ND	ND
dacthal	5	<MQL	<MQL	**7.3**	<MQL
diazinon	50	ND	<MQL	<MQL	ND
dieldrin	5	<MQL	<MQL	<MQL	ND
endosulfan I	5	**6.5**	ND	**8.0**	ND
endosulfan II	35	ND	ND	ND	ND
endosulfan sulfate	40	<MQL	<MQL	<MQL	ND
endrin	15	ND	ND	ND	ND
ethion	20	ND	ND	ND	ND
alpha HCH	2	ND	ND	ND	ND
beta HCH	10	ND	ND	ND	ND
gamma HCH	2	ND	ND	ND	ND
delta HCH	5	ND	ND	ND	ND
o,p'-DDD	10	<MQL	ND	<MQL	ND
p,p'-DDD	10	<MQL	<MQL	<MQL	<MQL
o,p'-DDE	10	ND	ND	ND	ND
p,p'-DDE	5	**220**	**36**	**220**	**57**
p,p'-DDMU	15	<MQL	ND	<MQL	ND
o,p'-DDT	10	ND	ND	ND	ND
p,p'-DDT	10	<MQL	ND	<MQL	ND
heptachlor	5	ND	ND	ND	ND
heptachlor epoxide	5	ND	ND	ND	ND
hexachlorobenzene	2	ND	<MQL	ND	ND
methoxychlor	15	ND	ND	<MQL	ND
oxadiazon	5	ND	ND	<MQL	ND
ethyl parathion	10	ND	ND	<MQL	ND
methyl parathion	10	ND	ND	ND	ND
PCB 1248	50	ND	ND	ND	ND
PCB 1254	50	<MQL	ND	<MQL	<MQL
PCB 1260	50	<MQL	ND	<MQL	ND
tetradifon	10	ND	<MQL	<MQL	ND
toxaphene	100	**130**	ND	<MQL	ND
% Lipid		7.20	0.262	2.69	0.673
% Moisture		74.1	79.5	78.5	78.0

APPENDIX B.1

Bottle Number:		27.2.F.95	27.1.F.95	27.5.F.95	27.6.F.95
Station Name:		New River/	New River/	New River/	New River/
		Westmorland	Westmorland	Westmorland	Westmorland
Date of Collection:		6/16/95	6/16/95	4/10/96	4/10/96
Species:		Carp	Channel Catfish	Carp	Channel Catfish
Tissue Type:		Flesh	Flesh	Flesh	Flesh
	Fresh Weight	Fresh Weight	Fresh Weight	Fresh Weight	Fresh Weight
	Quantitation Limit (MQL)	Concentration	Concentration	Concentration	Concentration
COMPOUND	ppb (ng/g)	ppb (ng/g)	ppb (ng/g)	ppb (ng/g)	ppb (ng/g)
Aldrin	5	ND	<MQL	<MQL	ND
cis-chlordane	5	<MQL	**19**	**13**	**11**
trans-chlordane	5	<MQL	**14**	**10**	**8.3**
oxychlordane	5	ND	<MQL	<MQL	<MQL
cis-nonachlor	5	<MQL	**10**	**7.3**	**5.5**
trans-nonachlor	5	<MQL	**24**	**14**	**13**
alpha chlordene	5	ND	<MQL	<MQL	<MQL
gamma chlordene	5	ND	<MQL	<MQL	<MQL
chlorpyrifos	10	<MQL	**17**	<MQL	<MQL
dicofol	100	ND	ND	ND	ND
dichlorobenzophenone	30	ND	ND	ND	ND
dacthal	5	**6.5**	**25**	**98**	**120**
diazinon	50	ND	ND	ND	<MQL
dieldrin	5	**6.2**	**32**	**14**	**27**
endosulfan I	5	**6.8**	**37**	**63**	**110**
endosulfan II	35	<MQL	<MQL	**39**	**58**
endosulfan sulfate	40	<MQL	<MQL	<MQL	<MQL
endrin	15	ND	<MQL	<MQL	<MQL
ethion	20	ND	<MQL	<MQL	<MQL
alpha HCH	2	ND	ND	ND	ND
beta HCH	10	ND	ND	ND	ND
gamma HCH	2	ND	ND	ND	<MQL
delta HCH	5	ND	ND	ND	ND
o,p'-DDD	10	<MQL	<MQL	**14**	<MQL
p,p'-DDD	10	**15**	**61**	**58**	**41**
o,p'-DDE	10	<MQL	<MQL	<MQL	<MQL
p,p'-DDE	5	**830**	**1100**	**710**	**740**
p,p'-DDMU	15	<MQL	**16**	**16**	<MQL
o,p'-DDT	10	ND	<MQL	<MQL	<MQL
p,p'-DDT	10	ND	**19**	<MQL	**16**
heptachlor	5	ND	ND	ND	ND
heptachlor epoxide	5	ND	ND	ND	ND
hexachlorobenzene	2	<MQL	ND	**3.9**	**4.2**
methoxychlor	15	ND	<MQL	ND	<MQL
oxadiazon	5	ND	ND	ND	ND
ethyl parathion	10	ND	ND	ND	ND
methyl parathion	10	ND	ND	ND	ND
PCB 1248	50	ND	ND	<MQL	<MQL
PCB 1254	50	<MQL	<MQL	**110**	<MQL
PCB 1260	50	**120**	**79**	**250**	**91**
tetradifon	10	ND	ND	ND	ND
toxaphene	100	**100**	**750**	**270**	**290**
% Lipid		0.567	2.89	2.29	3.54
% Moisture		79.8	78.8	78.4	77.9

APPENDIX B.1

Bottle Number:		**355.2.F.95**	**355.1.F.95**	**355.3.F.95**	**355.4.F.95**
Station Name:		**All American Can./ d/s Imperial Dam**	**All American Can./ d/s Imperial Dam**	**All American Can./ d/s Imperial Dam**	**All American Can./ d/s Imperial Dam**
Collection Date:		**6/14/95**	**6/14/95**	**12/5/95**	**12/5/95**
Species:		**Carp**	**Channel Catfish**	**Carp**	**Largemouth Bass**
Tissue Type:		**Flesh**	**Flesh**	**Flesh**	**Flesh**
	Fresh Weight	**Fresh Weight**	**Fresh Weight**	**Fresh Weight**	**Fresh Weight**
	Quantitation Limit (MQL)	**Concentration**	**Concentration**	**Concentration**	**Concentration**
COMPOUND	**ppb (ng/g)**	**ppb (ng/g)**	**ppb (ng/g)**	**ppb (ng/g)**	**ppb (ng/g)**
aldrin	5	<MQL	ND	ND	ND
cis-chlordane	5	**5.9**	<MQL	<MQL	ND
trans-chlordane	5	<MQL	<MQL	<MQL	ND
oxychlordane	5	ND	ND	ND	ND
cis-nonachlor	5	**7.5**	<MQL	<MQL	ND
trans-nonachlor	5	**9.9**	<MQL	**8.0**	ND
alpha chlordene	5	ND	ND	ND	ND
gamma chlordene	5	ND	ND	ND	ND
chlorpyrifos	10	<MQL	<MQL	ND	ND
dicofol	100	ND	ND	ND	ND
dichlorobenzophenone	30	ND	ND	ND	ND
dacthal	5	ND	<MQL	<MQL	<MQL
diazinon	50	ND	<MQL	ND	ND
dieldrin	5	<MQL	<MQL	<MQL	ND
endosulfan I	5	ND	<MQL	<MQL	ND
endosulfan II	35	ND	ND	ND	ND
endosulfan sulfate	40	ND	ND	ND	ND
endrin	15	ND	ND	ND	ND
ethion	20	ND	ND	ND	ND
alpha HCH	2	ND	ND	ND	ND
beta HCH	10	ND	ND	ND	ND
gamma HCH	2	ND	ND	ND	ND
delta HCH	5	ND	ND	ND	ND
o,p'-DDD	10	<MQL	<MQL	<MQL	ND
p,p'-DDD	10	**21**	**11**	**13**	ND
o,p'-DDE	10	<MQL	<MQL	<MQL	ND
p,p'-DDE	5	**250**	**74**	**250**	**12**
p,p'-DDMU	15	<MQL	ND	<MQL	ND
o,p'-DDT	10	ND	ND	ND	ND
p,p'-DDT	10	<MQL	<MQL	<MQL	ND
heptachlor	5	ND	ND	ND	ND
heptachlor epoxide	5	ND	ND	ND	ND
hexachlorobenzene	2	<MQL	ND	ND	ND
methoxychlor	15	ND	ND	ND	ND
oxadiazon	5	ND	ND	ND	ND
ethyl parathion	10	ND	ND	ND	ND
methyl parathion	10	ND	ND	ND	ND
PCB 1248	50	ND	ND	ND	ND
PCB 1254	50	**84**	<MQL	**70**	ND
PCB 1260	50	**50**	<MQL	**54**	ND
tetradifon	10	ND	ND	ND	ND
toxaphene	100	<MQL	<MQL	<MQL	ND
% Lipid		8.34	4.93	2.71	0.078
% Moisture		72.1	76.3	78.1	80.8

APPENDIX B.1

Bottle Number:		**27.3.F.95**
Station Name:		**New River/**
		Internat'l Boundry
Date of Collection:		**6/28/95**
Species		**Carp**
Tissue Type:		**Flesh**
	Fresh Weight	**Fresh Weight**
	Quantitation Limit (MQL)	**Concentration**
COMPOUND	**ppb (ng/g)**	**ppb (ng/g)**
aldrin	5	<MQL
cis-chlordane	5	**39**
trans-chlordane	5	**32**
oxychlordane	5	<MQL
cis-nonachlor	5	**12**
trans-nonachlor	5	**29**
alpha chlordene	5	**5**
gamma chlordene	5	**8.7**
chlorpyrifos	10	**46**
dicofol	100	ND
dichlorobenzophenone	30	ND
dacthal	5	**5.9**
diazinon	50	**65**
dieldrin	5	**7.8**
endosulfan I	5	<MQL
endosulfan II	35	ND
endosulfan sulfate	40	ND
endrin	15	ND
ethion	20	ND
alpha HCH	2	<MQL
beta HCH	10	ND
gamma HCH	2	**4.2**
delta HCH	5	ND
o,p'-DDD	10	**20**
p,p'-DDD	10	**94**
o,p'-DDE	10	<MQL
p,p'-DDE	5	**180**
p,p'-DDMU	15	<MQL
o,p'-DDT	10	<MQL
p,p'-DDT	10	<MQL
heptachlor	5	ND
heptachlor epoxide	5	<MQL
hexachlorobenzene	2	**10**
methoxychlor	15	ND
oxadiazon	5	ND
ethyl parathion	10	ND
methyl parathion	10	ND
PCB 1248	50	**180**
PCB 1254	50	**98**
PCB 1260	50	<MQL
tetradifon	10	ND
toxaphene	100	**120**
% Lipid		6.15
% Moisture		74.1

APPENDIX B.2

Toxic Substances Bioaccumulation Monitoring
Summary of Data
Trace Elements in Fish Tissue (ppm, wet weight)

Collection Date:		6/14/1995		6/14/1995		6/14/1995		6/14/1995	
Species:		Channel Catfish		Channel Catfish		Channel Catfish		Carp	
Tissue Type:		Flesh		Flesh		Liver		Flesh	
		Fresh Weight		**Fresh Weight**		**Fresh Weight**		**Fresh Weight**	
	Fresh Weight	**Concentration**		**Concentration**		**Concentration**		**Concentration**	
	Quantitation Limit (MQL)	**ppm (ug/g)**		**ppm (ug/g)**		**ppm (ug/g)**		**ppm (ug/g)**	
ELEMENTS	**ppm (ug/g)**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Mercury	0.02	**0.03**		0.02		NA		**0.09**	
Selenium	0.05	**0.72**		NA		NA		**1.4**	
Arsenic	0.05	**0.16**		NA		NA		**0.52**	
Cadmium	0.01	<MQL		<MQL		NA		<MQL	
Nickel	0.1	<MQL		ND		NA		<MQL	
Silver	0.02	NA		NA		ND		NA	
Chromium	0.02	NA		NA		0.02	Blank (0.02)	NA	
Copper	0.05	NA		NA		**2**		NA	
Lead	0.1	NA		NA		<MQL		NA	
Zinc	0.3	NA		NA		**20**		NA	
Percent Moisture		76.3		NA(IS)		77.0		72.1	

ND = not detected
NA = not analyzed
NA(IS) = not analyzed due to insufficient sample
For all elements, except for copper and silver, the MQL (method quantification limit) equals the MDL (method detection limit).
The MQL for silver is 0.02 ppm; the MDL for silver is 0.01 ppm; the MQL for copper is 0.05; the MDL for copper is 0.02.
Method blanks contain 0.02 ppm chromium.

Station Name: All American Canal – d/s Imperial Dam

APPENDIX B.2

Toxic Substances Bioaccumulation
Summary of Data
Trace Elements in Fish Tissue (ppm, wet weight)

Collection Date:		12/5/1995		12/5/1995		12/5/1995	
Species:		Carp		Largemouth Bass		Largemouth Bass	
Tissue Type:		Flesh		Flesh		Liver	
	Fresh Weight Quantitation Limit (MQL) ppm (ug/g)	**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**	
ELEMENTS		**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Mercury	0.02	**0.1**		0.02		NA	
Selenium	0.05	**1.2**		**2.1**		NA	
Arsenic	0.05	**0.36**		**0.08**		NA	
Cadmium	0.01	<MQL		ND		NA	
Nickel	0.1	<MQL		<MQL		NA	
Silver	0.02	NA		NA		<MQL	
Chromium	0.02	NA		NA		0.02	Blank (0.02)
Copper	0.05	NA		NA		**7.2**	
Lead	0.1	NA		NA		<MQL	
Zinc	0.3	NA		NA		**24**	
Percent Moisture		78.1		80.8		80.7	

ND = not detected
NA = not analyzed
NA(IS) = not analyzed due to insufficient sample
For all elements, except for copper and silver, the MQL (method quantification limit) equals the MDL (method detection limit).
The MQL for silver is 0.02 ppm; the MDL for silver is 0.01 ppm; the MQL for copper is 0.05; the MDL for copper is 0.02.
Method blanks contain 0.02 ppm chromium.

All American Canal – d/s Imperial Dam

APPENDIX B.2

Toxic Substances Bioaccumulation
Summary of Data
Trace Elements in Fish Tissue (ppm, wet weight)

Collection Date:		6/13/1995		6/13/1995		6/13/1995			6/13/1995	
Species:		Carp		Carp		Largemouth Bass		Largemouth Bass		
Tissue Type:		Flesh		Flesh		Flesh		Liver		
	Fresh Weight Quantitation Limit (MQL)	**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**		
ELEMENTS	**ppm (ug/g)**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	
Mercury	0.02	0.14		0.14		0.26		NA		
Selenium	0.05	0.78		0.8		1		NA		
Arsenic	0.05	0.2		0.21		0.06		NA		
Cadmium	0.01	<MQL		<MQL		ND		NA		
Nickel	0.1	<MQL		<MQL		<MQL		NA		
Silver	0.02	NA		NA		NA		0.008		
Chromium	0.02	NA		NA		NA		0.02	Blank (0.02)	
Copper	0.05	NA		NA		NA		9.4		
Lead	0.1	NA		NA		NA		<MQL		
Zinc	0.3	NA		NA		NA		22		
Percent Moisture		74.1		74.1		79.5		79.1		

ND = not detected
NA = not analyzed
NA(IS) = not analyzed due to insufficient sample
For all elements, except for copper and silver, the MQL (method quantification limit) equals the MDL (method detection limit).
The MQL for silver is 0.02 ppm; the MDL for silver is 0.01 ppm; the MQL for copper is 0.05; the MDL for copper is 0.02.
Method blanks contain 0.02 ppm chromium.

APPENDIX B.2

Toxic Substances Bioaccumulation
Summary of Data
Trace Elements in Fish Tissue (ppm, wet weight)

Collection Date:		6/13/1995		12/5/1995		12/5/1995		12/5/1995	
Species:		Largemouth Bass		Largemouth Bass		Largemouth Bass		Carp	
Tissue Type:		Liver		Flesh		Liver		Flesh	
		Fresh Weight Concentration ppm (ug/g)		**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**	
ELEMENTS	**Fresh Weight Quantitation Limit (MQL) ppm (ug/g)**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Mercury	0.02	NA		0.46		NA		0.3	
Selenium	0.05	NA		0.76		NA		0.75	
Arsenic	0.05	NA		0.09		NA		0.14	
Cadmium	0.01	NA		ND		NA		<MQL	
Nickel	0.1	NA		<MQL		NA		<MQL	
Silver	0.02	<MQL		NA		<MQL		NA	
Chromium	0.02	0.02		NA		<MQL		NA	
Copper	0.05	9.1		NA		4.2		NA	
Lead	0.1	<MQL		NA		<MQL		NA	
Zinc	0.3	21		NA		20		NA	
Percent Moisture		79.2		78		76.8		78.5	

ND = not detected

NA = not analyzed

NA(IS) = not analyzed due to insufficient sample

For all elements, except for copper and silver, the MQL (method quantification limit) equals the MDL (method detection limit).

The MQL for silver is 0.02 ppm; the MDL for silver is 0.01 ppm; the MQL for copper is 0.05; the MDL for copper is 0.02.

Method blanks contain 0.02 ppm chromium.

APPENDIX B.2

Toxic Substances Bioaccumulation
Summary of Data
Trace Elements in Fish Tissue (ppm, wet weight)

Collection Date:		6/16/1995		6/16/1995		6/16/1995		6/28/1995	
Species:		Channel Catfish		Channel Catfish		Carp		Carp	
Tissue Type:		Flesh		Liver		Flesh		Flesh	
	Fresh Weight Quantitation Limit (MQL)	**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**	
ELEMENTS	**ppm (ug/g)**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Mercury	0.02	0.18		NA		0.28		0.31	
Selenium	0.05	0.58		NA		1.5		1	
Arsenic	0.05	<MQL		NA		0.06		0.06	
Cadmium	0.01	<MQL		NA		<MQL		ND	
Nickel	0.1	<MQL		NA		<MQL		<MQL	
Silver	0.02	NA		<MQL		NA		NA	
Chromium	0.02	NA		0.02	Blank (0.02)	NA		NA	
Copper	0.05	NA		1.8		NA		NA	
Lead	0.1	NA		<MQL		NA		NA	
Zinc	0.3	NA		21		NA		NA	
Percent Moisture		78.8		80.8		79.9		74.1	

ND = not detected
NA = not analyzed
NA(IS) = not analyzed due to insufficient sample
For all elements, except for copper and silver, the MQL (method quantification limit) equals the MDL (method detection limit).
The MQL for silver is 0.02 ppm; the MDL for silver is 0.01 ppm; the MQL for copper is 0.05; the MDL for copper is 0.02.
Method blanks contain 0.02 ppm chromium.

New River - Westmorland

APPENDIX B.2

Toxic Substances Bioaccumulation
Summary of Data
Trace Elements in Fish Tissue (ppm, wet weight)

Collection Date:		4/10/1996		4/10/1996		4/10/1996		4/10/1996	
Species:		Carp		Carp		Channel Catfish		Channel Catfish	
Tissue Type:		Flesh		Flesh		Flesh		Liver	
		Fresh Weight Concentration ppm (ug/g)		**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**	
ELEMENTS	**Fresh Weight Quantitation Limit (MQL) ppm (ug/g)**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Mercury	0.02	0.28		0.27		0.08		NA	
Selenium	0.05	1.5		1.5		0.8		NA	
Arsenic	0.05	0.11		0.09		0.06		NA	
Cadmium	0.01	<MQL		<MQL		ND		NA	
Nickel	0.1	<MQL		ND		ND		NA	
Silver	0.02	NA		NA		NA		ND	
Chromium	0.02	NA		NA		NA		0.02	Blank (0.02)
Copper	0.05	NA		NA		NA		2.3	
Lead	0.1	NA		NA		NA		0.06	<MQL
Zinc	0.3	NA		NA		NA		21	
Percent Moisture		78.4		78.3		77.9		81.3	

ND = not detected
NA = not analyzed
NA(IS) = not analyzed due to insufficient sample
For all elements, except for copper and silver, the MQL (method quantification limit) equals the MDL (method detection limit).
The MQL for silver is 0.02 ppm; the MDL for silver is 0.01 ppm; the MQL for copper is 0.05; the MDL for copper is 0.02.
Method blanks contain 0.02 ppm chromium.

New River - Westmorland

APPENDIX B.2

Toxic Substances Bioaccumulation
Summary of Data
Trace Elements in Fish Tissue (ppm, wet weight)

Collection Date:		6/21/1995		6/21/1995		6/21/1995		4/10/1996	
Species:		Carp		Largemouth Bass		Largemouth Bass		Carp	
Tissue Type:		Flesh		Flesh		Liver		Flesh	
	Fresh Weight Quantitation Limit (MQL) ppm (ug/g)	**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**		**Fresh Weight Concentration ppm (ug/g)**	
ELEMENTS		**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**	**Result**	**Qualifier**
Mercury	0.02	0.03		0.03		NA		0.05	
Selenium	0.05	0.88		0.74		NA		1	
Arsenic	0.05	0.16		0.11		NA		0.17	
Cadmium	0.01	<MQL		<MQL		NA		<MQL	
Nickel	0.1	<MQL		<MQL		NA		<MQL	
Silver	0.02	NA		NA		<MQL		NA	
Chromium	0.02	NA		NA		0.03	Blank (0.02)	NA	
Copper	0.05	NA		NA		4.6		NA	
Lead	0.1	NA		NA		<MQL		NA	
Zinc	0.3	NA		NA		28		NA	
Percent Moisture		78.3		78.8		77.3		78.7	

ND = not detected
NA = not analyzed
NA(IS) = not analyzed due to insufficient sample
For all elements, except for copper and silver, the MQL (method quantification limit) equals the MDL (method detection limit).
The MQL for silver is 0.02 ppm; the MDL for silver is 0.01 ppm; the MQL for copper is 0.05; the MDL for copper is 0.02.
Method blanks contain 0.02 ppm chromium.

Yuma Main Drain

APPENDIX B.2

Toxic Substances Bioaccumulation
Summary of Data
Trace Elements in Fish Tissue (ppm, wet weight)

Collection Date:		4/10/1996		4/12/1996	
Species:		Channel Catfish		Carp	
Tissue Type:		Flesh		Flesh	
		Fresh Weight Concentration ppm (ug/g)		**Fresh Weight Concentration ppm (ug/g)**	
ELEMENTS	**Fresh Weight Quantitation Limit (MQL) ppm (ug/g)**	**Result**	**Qualifier**	**Result**	**Qualifier**
Mercury	0.02	0.05		NA	
Selenium	0.05	0.5		NA	
Arsenic	0.05	0.07		NA	
Cadmium	0.01	<MQL		NA	
Nickel	0.1	<MQL		NA	
Silver	0.02	NA		<MQL	
Chromium	0.02	NA		0.04	Blank (0.02)
Copper	0.05	NA		2.1	
Lead	0.1	NA		<MQL	
Zinc	0.3	NA		22	
Percent Moisture		78.2		81.5	

ND = not detected
NA = not analyzed
NA(IS) = not analyzed due to insufficient sample
For all elements, except for copper and silver, the MQL (method quantification limit) equals the MDL (method detection limit).
The MQL for silver is 0.02 ppm; the MDL for silver is 0.01 ppm; the MQL for copper is 0.05; the MDL for copper is 0.02.
Method blanks contain 0.02 ppm chromium.

Yuma Main Drain

APPENDIX B.3

Toxic Substances Bioaccumulation Monitoring
Summary of QA/QC Data
Pesticide MS/MSD Recoveries

	Matrix Spike	Matrix Spike Duplicate
Date of Collection:	6/13/1995	6/13/1995
Species:	Largemouth Bass	Largemouth Bass
Tissue Type:	Flesh	Flesh
COMPOUND	**Percent Recovered**	**Percent Recovered**
aldrin	59	69
cis-chlordane	73	95
trans-chlordane	72	94
oxychlordane	68	92
cis-nonachlor	82	98
trans-nonachlor	74	81
alpha chlordene	62	71
gamma chlordene	62	63
chlorpyrifos	55	68
dicofol	48	51
dichlorobenzophenone	96	110
dacthal	100	108
diazinon	84	95
dieldrin	103	113
endosulfan I	96	105
endosulfan II	116	122
endosulfan sulfate	116	119
endrin	104	120
ethion	37	46
alpha HCH	63	74
beta HCH	61	81
gamma HCH	64	81
delta HCH	65	80
o,p'-DDD	83	99
p,p'-DDD	82	96
o,p'-DDE	71	62
p,p'-DDE	68	71
p,p'-DDMU	63	76
o,p'-DDT	55	46
p,p'-DDT	82	95
heptachlor	38	42
heptachlor epoxide	74	94
hexachlorobenzene	50	47
methoxychlor	92	101
oxidiazon	104	114
ethyl parathion	82	95
methyl parathion	59	67
tetradifon	103	123
Surrogates:		
DBOB	57.8	65
DCB	91	102
DBCE	108	120
Average:	76.2	86.6
Standard Deviation:	20.6	23.2

Colorado River International Boundary

APPENDIX B.4

Pesticide MS/MSD Precision

	Matrix Spike	Matrix Spike Duplicate	
Date of Collection:	6/13/1995	6/13/1995	
Species:	Largemouth Bass	Largemouth Bass	
Tissue Type:	Flesh	Flesh	
COMPOUND	**Fresh Weight Concentration ppb (ng/g)**	**Fresh Weight Concentration ppb (ng/g)**	**RPD**
aldrin	24.1	27.1	12
cis-chlordane	25.4	31.6	22
trans-chlordane	23.1	28.7	22
oxychlordane	22.3	28.8	25
cis-nonachlor	42.1	48	13
trans-nonachlor	30.8	32.1	4
alpha chlordene	25.2	27.6	9
gamma chlordene	29.6	28.5	4
chlorpyrifos	50.3	59.3	16
dicofol	53.4	54.1	1
dichlorobenzophenone	111	125	12
dacthal	46.4	48	3
diazinon	770	832	8
dieldrin	46.2	48.7	5
endosulfan I	37.9	39.6	4
endosulfan II	49.7	49.9	0
endosulfan sulfate	90.2	88.9	1
endrin	36.3	39.8	9
ethion	82.4	96.7	16
alpha HCH	10.6	11.8	11
beta HCH	31.9	40.8	24
gamma HCH	15.7	19	19
delta HCH	21.2	24.8	16
o,p'-DDD	73.7	84.2	13
p,p'-DDD	77.2	85.3	10
o,p'-DDE	56.5	47.2	18
p,p'-DDE	89.2	89.5	0
p,p'-DDMU	101	115	13
o,p'-DDT	47.2	37.8	22
p,p'-DDT	174	192	10
heptachlor	14.8	15.6	5
heptachlor epoxide	24.9	30.2	19
hexachlorobenzene	12.9	11.6	11
methoxychlor	170	180	6
oxidiazon	104	109	5
ethyl parathion	120	133	10
methyl parathion	53	57.5	8
tetradifon	94.4	107	13
% Lipid	0.287	0.278	0.01
% Moisture	79.8	79.6	0.25

RPD = Relative Percent Difference

Colorado River International Boundary

APPENDIX B.5

Duplicate Sample Precision

Species:		Carp	Carp	
Tissue Type:		Flesh	Flesh	
COMPOUND	**Fresh Weight Quantitation Limit (MQL) ppb (ng/g)**	**Fresh Weight Concentration ppb (ng/g)**	**Fresh Weight Concentration ppb (ng/g)**	**RPD**
aldrin	5			
cis-chlordane	5	0.99	0.7	34
trans-chlordane	5	0.91	0.87	4.5
oxychlordane	5			
cis-nonachlor	5	0.61	0.65	6.3
trans-nonachlor	5	1.6	1.9	17
alpha chlordene	5			
gamma chlordene	5			
chlorpyrifos	10	1.3	1.4	7.4
dicofol	100			
dichlorobenzophenone	30			
dacthal	5	1.8	1.1	48
diazinon	50			
dieldrin	5	3.6	3.2	12
endosulfan I	5	6.5	5.3	20
endosulfan II	35			
endosulfan sulfate	40	3.6	3.6	0
endrin	15			
ethion	20			
alpha HCH	2			
beta HCH	10			
gamma HCH	2			
delta HCH	5			
o,p'-DDD	10	1.9	0.68	95
p,p'-DDD	10	9.5	7.5	24
o,p'-DDE	10		0.44	100
p,p'-DDE	5	220	220	0
p,p'-DDMU	15	3.5	3.2	9
o,p'-DDT	10			
p,p'-DDT	10	1.7	1.1	43
heptachlor	5			
heptachlor epoxide	5			
hexachlorobenzene	2			
methoxychlor	15			
oxidiazon	5			
ethyl parathion	10			
methyl parathion	10			
PCB 1248	50			
PCB 1254	50			
PCB 1260	50			
tetradifon	10			
toxaphene	100	130	130	0
% Lipid		7.2	7.39	2.6
% Moisture		74.1	74.1	0

RPD = Relative Percent Difference

Colorado River International Boundary

APPENDIX B.5

Duplicate Sample Precision

Species:		Carp	Carp	
Tissue Type:		Flesh	Flesh	
COMPOUND	**Fresh Weight Quantitation Limit (MQL) ppb (ng/g)**	**Fresh Weight Concentration ppb (ng/g)**	**Fresh Weight Concentration ppb (ng/g)**	**RPD**
aldrin	5			
cis-chlordane	5	13	11	17
trans-chlordane	5	10	8.9	12
oxychlordane	5			
cis-nonachlor	5	7.3	6.8	7.1
trans-nonachlor	5	14	15	6.9
alpha chlordene	5			
gamma chlordene	5			
chlorpyrifos	10			
dicofol	100			
dichlorobenzophenone	30			
dacthal	5	98	110	12
diazinon	50			
dieldrin	5	14	17	19
endosulfan I	5	63	74	16
endosulfan II	35			
endosulfan sulfate	40			
endrin	15			
ethion	20			
alpha HCH	2			
beta HCH	10			
gamma HCH	2			
delta HCH	5			
o,p'-DDD	10	14	14	0
p,p'-DDD	10	58	56	3.5
o,p'-DDE	10			
p,p'-DDE	5	710	740	4.1
p,p'-DDMU	15	16	17	6.1
o,p'-DDT	10			
p,p'-DDT	10			
heptachlor	5			
heptachlor epoxide	5			
hexachlorobenzene	2	3.9	4.7	19
methoxychlor	15			
oxidiazon	5			
ethyl parathion	10			
methyl parathion	10			
PCB 1248	50			
PCB 1254	50	110	120	8.7
PCB 1260	50	250	260	3.9
tetradifon	10			
toxaphene	100	270	300	11
% Lipid		2.29	2.29	0
% Moisture		78.4	78.3	0.1

RPD = Relative Percent Difference

New River – Westmorland

APPENDIX B.6

Toxic Substances Bioaccumulation Monitoring
Summary of QA/QC Data

Recovery of Surrogate Standards

Bottle Number	Percent DBOB Recovered	Percent DCB Recovered	Percent DBCE Recovered
24.1.F.95	74	115	74
24.2.F.95	71	118	129
34.3.F.95	62	117	106
24.3.F.95 DUP	68	114	112
27.1.F.95	66	123	82
27.2.F.9527.3.F.95	70	138	127
27.3.F.95	69	123	108
355.1.F.95	63	112	81
24.4.F.95	64	110	108
24.4.F.95 MS	59	95	106
24.4.F.95 MSD	66	102	120
355.2.F.95	60	111	87
24.5.F.95	60	113	95
24.6.F.95	60	107	70
355.3.F.95	61	109	75
355.4.F.95	58	96	120
24.11.F.95	62	112	88
24.12.F.95	68	111	89
27.5.F.95	61	107	68
27.5.F.95 DUP	68	112	103
27.6.F.95	66	103	105
Std. Dev.	4.4	9.4	18.6
Mean:	65	112	98

DBOB = dibromo -octafluorobiphenyl
DCB = decachlorobiphenyl (#209)
DBCE = dibutylchlorendate

APPENDIX B. 7

Toxic Substances Bioaccumulation Monitoring
Summary of QA/QC Data
Method Blank Analysis Results

Date of Collection: Species: Tissue Type:			Method Blank
		Fresh Weight	**Fresh Weight**
		Quantitation Limit (MQL)	**Concentration**
COMPOUND	**CAS**	**ppb (ng/g)**	**ppb (ng/g)**
aldrin		5	ND
cis -chlordane		5	ND
trans-chlordane		5	ND
oxychlordane		5	ND
cis -nonachlor		5	ND
trans-nonachlor		5	ND
alpha chlordene		5	ND
gamma chlordene		5	ND
chlorpyrifos		10	ND
dicofol		100	ND
dichlorobenzophenone		30	ND
dacthal		5	ND
diazinon		50	ND
dieldrin		5	ND
endosulfan I		5	ND
endosulfan II		35	ND
endosulfan sulfate		40	ND
endrin		15	ND
ethion		20	ND
alpha HCH		2	ND
beta HCH		10	ND
gamma HCH		2	ND
delta HCH		5	ND
o,p'-DDD		10	ND
p,p'-DDD		10	ND
o,p'-DDE		10	ND
p,p'-DDE		5	ND
p,p'-DDMU		15	ND
o,p'-DDT		10	ND
p,p'-DDT		10	ND
heptachlor		5	ND
heptachlor epoxide		5	ND
hexachlorobenzene		2	ND
methoxychlor		15	ND
oxidiazon		5	ND
ethyl parathion		10	ND
methyl parathion		10	ND
PCB 1248		50	ND
PCB 1254		50	ND
PCB 1260		50	ND
tetradifon		10	ND
toxaphene		100	ND

APPENDIX B.8

Toxic Substances Bioaccumulation Monitoring
Summary of QA/QC Data
Trace Element Blanks, SRMs, Matrix Spikes

MERCURY	**Certified Value**	EMAP **Range (+/- 15 %)**	**Set 1 ppm**		**Set 2 ppm**		**Set 3 ppm**	**Set 4 ppm**
DOLT-2	1.99 ppm	(1.60- 2.40)	2.01		1.95		2.01	1.96
DORM-1	0.798 ppm	(0.615- 1.00)	0.76		0.73		0.785	0.741
Blanks:			0.01/0.00		0.00/0.00	(MDL= 0.02 ppm)	0.00/0.00	0.00/0.00
Matrix Spike:	% Recovery		88.60%		91.30%		91.70%	86.50%

SELENIUM	**Certified Value**	**EMAP Range (+/- 15 %)**	**Set 2 ppm**		**Set 3 ppm**	
DOLT-2	6.06 ppm	(4.73- 7.53)	5.26		5.54	
DORM-1	1.62 ppm	(1.28- 2.00)	1.42		1.43	
1566a	2.21 ppm	(1.67- 2.82)	2		1.94	
Blanks:			0.02/0.02	(MDL= 0.05 ppm)	0.02/0.01	(MDL= 0.05 ppm)
Matrix Spike:	% Recovery		92.1%;96.3%		87.5%;79.5%	

ARSENIC	**Certified Value**	**EMAP Range (+/- 15 %)**	**Set 2 ppm**		**Set 3 ppm**	
DOLT-2	16.6 ppm	(13.2- 20.4)	14.5		15.5	
DORM-1	17.7 ppm	(13.3- 22.8)	16.3		15.5	
1566a	14.0 ppm	(10.9- 17.5)	13.6		12.7	
Blanks:			0.01/0.01	(MDL= 0.05 ppm)	0.01/0.02	(MDL= 0.05 ppm)
Matrix Spike:	% Recovery		85.8%;94.6%		90.2%;95%	

APPENDIX B.8

Toxic Substances Bioaccumulation Monitoring
Summary of QA/QC Data
Trace Element Blanks, SRMs, Matrix Spikes

CADMIUM	**Certified Value**	**EMAP Range (+/- 15 %)**	**Set 5 ppm**		**Set 7 ppm**		**Set 12 ppm**
DOLT-2	20.8 ppm	(17.2/ 24.5)	not analyzed		19.3		NA
DORM-1	0.086 ppm	(0.063- 0.113)	0.093		0.089		0.064
1566a	4.15 ppm	(3.20- 5.21)	4.12		4.27	(MDL= 0.01 ppm)	4.31
Blanks:			0.002/0.001		0.005/0.001		0.000/0.000
Matrix Spike:	% Recovery		90.20%		91.70%		99.70%

NICKEL	**Certified Value**	**EMAP Range (+/- 15 %)**	**Set5 ppm**		**Set 7 ppm**		**Set 12 ppm**
DOLT-2	0.20 ppm	(0.153/ 0.253)	not analyzed		0.234		NA
DORM-1	1.20 ppm	(0.766- 1.72)	1.11		1.17		1.34
1566a	2.25 ppm	(1.54- 3.09)	2.43		2.38		7.34
Blanks:			0.000/0.000		0.011/0.014	(MDL= 0.1 ppm)	0.004/0.000
Matrix Spike:	% Recovery		97.50%		98.60%		106%

SILVER	**Certified Value**	**EMAP Range (+/- 15 %)**	**Set 4 ppm**		**Set 6 ppm**
1566a	1.68 ppm	(1.30- 2.10)	1.48		1.57
Blanks:			0.000/0.000		0.000/0.000
Matrix Spike:	% Recovery		79.20%		89.60%

CHROMIUM	**Certified Value**	**EMAP Range (+/- 15 %)**	**Set 4 ppm**		**Set 6 ppm**	
DOLT-2	0.37 ppm	(0.246- 0.518)	0.474		0.808	
1566a	1.43 ppm	(0824- 2.17)	1.25		1.36	
Blanks:			0.02/0.02	(MDL= 0.02 ppm)	0.02/0.02	(MDL= 0.02 ppm)
Matrix Spike:	% Recovery		107%		104%	

APPENDIX B.8

Toxic Substances Bioaccumulation Monitoring
Summary of QA/QC Data
Trace Element Blanks, SRMs, Matrix Spikes

COPPER	**Certified Value**	**EMAP Range (+/- 15 %)**	**Set 4 ppm**		**Set 6 ppm**	
DOLT-2	25.8 ppm	(21.0- 30.9)	25.8		26.8	
1566a	5.22 ppm	(52.7- 81.2)	65		70.5	
Blanks:			0.05/0.02	(MDL= 0.02 ppm)	0.05/0.04	(MDL= 0.02 ppm)
Matrix Spike:	% Recovery		104%		96.50%	

LEAD	**Certified Value**	**EMAP Range (+/- 15 %)**	**Set 4 ppm**		**Set 6 ppm**	
DOLT-2	0.22 ppm	(0.17- 0.276)	0.368		0.492	
1566a	0.371 ppm	(0.303- 0.443)	0.481		0.0404	
Blanks:			0.9/0.2	(MDL= 0.1 ppm)	0.015/0.026	(MDL= 0.1 ppm)
Matrix Spike:	% Recovery		105%		105%	

ZINC	**Certified Value**	**EMAP Range (+/- 15 %)**	**Set 4 ppm**		**Set 6 ppm**	
DOLT-2	85.8 ppm	(70.8- 101)	81.7		87.4	
1566a	830 ppm	(657- 1020)	839		835	
Blanks:			2.3/0.4	(MDL=0.3 ppm)	0.2/0.3	(MDL=0.3 ppm)
Matrix Spike:	% Recovery		109%		500%	

APPENDIX B.9
Toxic Substances Bioaccumulation Monitoring
Summary of QA/QC Data
Trace Element Duplicate Sample Precision

Collection Date:		6/14/1995	6/14/1995	
Species:		Channel Catfish	Channel Catfish	
Tissue Type:		Flesh	Flesh	
ELEMENTS	**Fresh Weight Quantitation Limit (MQL) ppm (ug/g)**	**Fresh Weight Concentration ppm (ug/g)**	**Fresh Weight Concentration ppm (ug/g)**	**RPD**
		Result	**Result**	
Mercury	0.02	0.03	0.02	40
Selenium	0.05	0.72	NA	
Arsenic	0.05	0.16	NA	
Cadmium	0.01	ND	ND	
Nickel	0.1	ND	ND	
Silver	0.02	NA	NA	
Chromium	0.02	NA	NA	
Copper	0.05	NA	NA	
Lead	0.1	NA	NA	
Zinc	0.05	NA	NA	
Percent Moisture:		76.3	NA (IS)	

ND = not detected
NA = not analyzed
IS = insufficient sample
RPD = Relative Percent Difference

Site Name: All American Canal – d/s Imperial Dam

APPENDIX B.9

Toxic Substances Bioaccumulation Monitoring
Summary of QA/QC Data
Trace Element Duplicate Sample Precision

Collection Date:		6/13/1995	6/13/1995	
Species:		Carp	Carp	
Tissue Type:		Flesh	Flesh	
ELEMENTS	**Fresh Weight Quantitation Limit (MQL) ppm (ug/g)**	**Fresh Weight Concentration ppm (ug/g)**	**Fresh Weight Concentration ppm (ug/g)**	**RPD**
		Result	**Result**	
Mercury	0.02	0.14	0.14	0
Selenium	0.05	0.78	0.8	2.5
Arsenic	0.05	0.2	0.21	4.9
Cadmium	0.01	ND	ND	
Nickel	0.1	ND	ND	
Silver	0.02	NA	NA	
Chromium	0.02	NA	NA	
Copper	0.05	NA	NA	
Lead	0.1	NA	NA	
Zinc	0.05	NA	NA	
Percent Moisture:		74.1	74.1	0

ND = not detected

NA = not analyzed

RPD = Relative Percent Difference

Collection Date:		6/13/1995	6/13/1995	
Species:		Largemouth Bass	Largemouth Bass	
Tissue Type:		Liver	Liver	
ELEMENTS	**Fresh Weight Quantitation Limit (MQL) ppm (ug/g)**	**Fresh Weight Concentration ppm (ug/g)**	**Fresh Weight Concentration ppm (ug/g)**	**RPD**
		Result	**Resut**	
Mercury	0.02	NA	NA	
Selenium	0.05	NA	NA	
Arsenic	0.05	NA	NA	
Cadmium	0.01	NA	NA	
Nickel	0.1	NA	NA	
Silver	0.02	ND	ND	
Chromium	0.02	0.02	0.02	0
Copper	0.05	9.4	9.1	3.2
Lead	0.1	ND	ND	
Zinc	0.05	22	21	4.7
Percent Moisture:		79.1	79.2	0.1

ND = not detected

NA = not analyzed

RPD = Relative Percent Difference

Site Name: Colorado River – International Boundary

APPENDIX B.9

Toxic Substances Bioaccumulation Monitoring
Summary of QA/QC Data

Trace Element Duplicate Sample Precision

Collection Date:		4/10/1995	4/10/1995	
Species:		Carp	Carp	
Tissue Type:		Flesh	Flesh	
ELEMENTS	**Fresh Weight Quantitation Limit (MQL) ppm (ug/g)**	**Fresh Weight Concentration ppm (ug/g)**	**Fresh Weight Concentration ppm (ug/g)**	**RPD**
		Result	**Result**	
Mercury	0.02	0.28	0.27	3.6
Selenium	0.05	1.5	1.5	0
Arsenic	0.05	0.11	0.09	20
Cadmium	0.01	ND	ND	
Nickel	0.1	ND	ND	
Silver	0.02	NA	NA	
Chromium	0.02	NA	NA	
Copper	0.05	NA	NA	
Lead	0.1	NA	NA	
Zinc	0.05	NA	NA	
Percent Moisture:		78.5	78.3	0.3

ND = not detected
NA = not analyzed
RPD = Relative Percent Difference

Site Name: New River - Westmorland

APPENDIX C

ANALYSIS RESULTS

Lower Colorado River
Trace Elements in Water Column

CONSTITUENT (µg/L)	Exceeds Any Criterion	Chemical Abstracts Service No.	All American Canal		Northerly International Boundary		Yuma Main Drain		CMC (µg/L)	CCC (µg/L)	Water & Organism (µg/L)	MCL (µg/L)	CECA agua potable (µg/L)	CECA agrícola (µg/L)	CECA pecuario (µg/L)	CECA vida acuática (dulce) (µg/L)
Date			***06/06/95***		***06/13/95***		***06/20/95***									
			USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**								
Aluminum		7429905	7.0	<1100	9.0	na	5.0	na	750	87		50-200	20	5000	5000	50
Antimony		7440360	nd	na	nd	na	nd	na			14	6	100	100		90
Arsenic		7440382	2.0	na	8.0	na	3.0	na	340	150		50	50	100	200	200
Barium	x	7440393	**139.0**	<1000	**68.0**	na	**78.0**	na			1000	2000	1000			**10**
Beryllium		7440417	nd	na	nd	na	nd	na				4	0.07		100	1
Cadmium		7440439	nd	na	nd	na	nd	na	4.3	2.2		5	10	10	20	H
Chromium		7440473	2.0	na	2.0	na	nd	na	570 (III)	74 (III)		100	50	1000	1000	10
Cobalt		7440484	nd	na	nd	na	nd	na								
Copper		7440508	2.0	<40	4.0	<40	2.0	na	13	9.0	1300	1000	1000	200	500	H
Iron		7439896	nd	<40	3.0	na	13.0	na		1000	300	300	300	5000		1000
Lead		7439921	nd	<80	nd	na	nd	na	65	2.5		15	50	5000	100	H
Manganese		7439965	3.0	<30	5.0	na	20.0	na			50	50	100			
Mercury inorganic	x	7439976	nd	<0.5	nd	na	**1.2**	na	1.4	**0.77**	**0.050**	2	**1**		3	**0.01**
Molybdenum		7439987	8.0	na	6.0	na	11.0	na								
Nickel	x	7440020	6.0	<100	6.0	na	**11.0**	na	470	52	610	100	**10**	200	1000	H
Selenium		7782492	2.0	na	nd	na	1.0	na		5		50	10*	20	50	8
Silver		7440224	nd	<20	nd	na	nd	na	3.4			100	50			H
Uranium		7440611	5.0	na	3.0	na	5.0	na				20				
Zinc		7440666	1.0	<20	nd	na	1.0	na	120	120	9100.00	5000	5000	2000	50000	H

nd = Not detected

na = Not analyzed
CMC = Criterion Maximum Concentration - EPA water quality criterion for protection of aquatic life (acute exposures)
CCC = Criterion Continuous Concentration - EPA water quality criterion for protection of aquatic life (chronic exposures)
Water and Organism = EPA water quality criterion for protection of human health based on consumption of water and aquatic organisms

MCL = Maximum Contaminant Level - EPA limit for drinking water

* = As selenate
H = Hardness and indicates that the criteria are dependent on this value

1st Sampling

TABLE C.1.1

Lower Colorado River (Trace Elements in Water Column)

CONSTITUENT (µg/L)	Exceeds Any Criterion	Chemical Abstracts Service No.	All American Canal		Gila River		Northerly International Boundary		Yuma Main Drain		Wellton - Mohawk Canal		CMC (µg/L)	CCC (µg/L)	Water & Organism (µg/L)	MCL (µg/L)	CECA agua potable (µg/L)	CECA agrícola (µg/L)	CECA pecuario (µg/L)	CECA vida acuática (dulce) (µg/L)
Date			**12/04/95**		**12/05/95**		**12/05/95**		**12/06/95**		**12/06/95**									
			USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**	**USA**	**Mex**	**USA**	**Mex**								
Aluminum		7429905	5.0	<1100	nd	<1100	3.0	<1100	3.0	<1100	5.0	<1100	750	87		50-200	20	5000	5000	50
Antimony		7440360	nd	na	nd	na	nd	na	nd	na	nd	na			14	6	100	100		90
Arsenic		7440382	2.0	na	11.0	na	3.0	na	2.0	na	9.0	na	340	150		50	50	100	200	200
Barium	x	7440393	**128.0**	na	**68.0**	na	**104.0**	na	**65.0**	na	**35.0**	na			1000	2000	1000			**10**
Beryllium		7440417	nd	na	nd	na	nd	na	nd	na	nd	na				4	0.07		100	1
Boron	x	7440428	200.0	na	680.0	na	240.0	na	360.0	na	**1300.0**	na					**1000**	**700**	5000	
Cadmium		7440439	nd	na	nd	na	nd	na	nd	na	nd	na	4.3	2.2		5	10	10	20	H
Chromium		7440473	2.0	na	2.0	na	nd	na	nd	na	4.0	na	570 16	74 11		100	50	1000	1000	10
Cobalt		7440484	nd	na	nd	na	nd	na	nd	na	nd	na								
Copper	x	7440508	3.0	<40	**15.0**	<40	3.0	<40	5.0	<40	**16.0**	<40	**13**	**9**	1300	1000	1000	200	500	H
Iron		7439896	nd	<40	nd	<40	nd	<40	nd	<40	18.0	<40		1000	300	300	300	5000		1000
Lead	x	7439921	nd	<5	nd	**8.0**	nd	<5	nd	**7.0**	nd	**17.0**	65	**2.5**		**15**	50	5000	100	H
Manganese	x	7439965	3.0	<30	**225.0**	<100	21.0	<30	5.0	<30	30.0	<30			**50**	**50**	**100**			
Mercury		7439976	nd	<0.5	nd	<0.5	nd	<0.5	nd	<0.5	nd	<0.5	1.4	0.77	0.050	2	1		3	0.01
Molybdenum		7439987	7.0	na	15.0	na	8.0	na	11.0	na	40.0	na								
Nickel		7440020	4.0	<5	4.0	<5	3.0	<5	4.0	<5	7.0	<5	470	52	610	100	10	200	1000	H
Selenium	x	7782492	2.0	na	**7.0**	na	3.0	na	1.0	na	2.0	na		**5**		50	10*	20	50	8
Silver		7440224	nd	<24	nd	<24	nd	<24	nd	<24	nd	<24	3.4			100	50			H
Uranium		7440611	5.0	na	6.0	na	5.0	na	5.0	na	15.0	na				20				
Zinc		7440666	3.0	<20	8.0	<20	2.0	<20	5.0	<20	14.0	<20	120	120	9100	5000	5000	2000	50000	H
Filtered Samples																				
Antimony (total)		7440360	nd	na	nd	na	nd	na	nd	na	nd	na								
Arsenic (total)		7440382	nd	na	nd	na	nd	na	nd	na	nd	na								
Cadmium (unfiltered)		7440439	nd	na	nd	na	nd	na	nd	na	nd	na								
Chromium (tot. recov.)		7440473	nd	na	nd	na	nd	na	nd	na	nd	na								
Copper (tot. recov.)		7440508	1.0	na	14.0	na	3.0	na	1	na	5	na								
Iron (tot. recov.)		7439896	130.0	na	320.0	na	820.0	na	700	na	630	na								
Lead (tot. recov.)		7439921	nd	na	2.0	na	nd	na	nd	na	nd	na								
Manganese (tot. recov.)		7439965	20.0	na	300.0	na	110.0	na	180.0	na	810.0	na								
Mercury (tot. recov.)		7439976	nd	na	nd	na	nd	na	nd	na	nd	na								
Nickel (tot. recov.)		7440020	1.0	na	2.0	na	2.0	na	2	na	2	na								
Selenium (total)		7782492	nd	na	nd	na	nd	na	nd	na	nd	na								
Vanadium		7440622	3.3	na	15.0	na	4.6	na	6.1	na	20	na								
Zinc (tot. recov.)		7440666	nd	na	nd	na	nd	na	nd	na	10	na								

nd = Not detected

na = Not analyzed

CMC = Criterion Maximum Concentration - EPA water quality criterion for protection of aquatic life (acute exposures)

CCC = Criterion Continuous Concentration - EPA water quality criterion for protection of aquatic life (chronic exposures)

Water and Organism = EPA water quality criterion for protection of human health based on consumption of water and aquatic organisms

MCL = Maximum Contaminant Level - EPA limit for drinking water

* = As selenate

CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for drinking water, agricultural irrigation, stock use, and aquatic life (fresh water)

H = Hardness and indicates that the criteria are dependent on this value

2nd Sampling

TABLE C.1.2
Lower Colorado River
Extractable Organic Compounds

CONSTITUENT (µg/L)	Chemical Abstracts Service No.	All American Canal		Northerly International Boundary		Yuma Main Drain		Water & Organism (µg/L)	MCL (µg/L)	CECA agua potable (µg/L)	CECA recreativo (µg/L)	CECA vida acuática (dulce) (µg/L)
Date		***06/06/ 95***		***06/13/ 95***		***06/20/ 95***						
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**					
Acenaphthene	83329	nd	na	nd	na	nd	na	1200	*	20		20
Acenaphthylene	208968	nd	na	nd	na	nd	na		*			
Anthracene	120127	nd	na	nd	na	nd	na	9600	*			
BenzobFluroanthene	205992	nd	na	nd	na	nd	na	0.0044	0.2			
BenzokFluroanthene	207089	nd	na	nd	na	nd	na	0.0044				
BenzoaPyrene	50328	nd	na	nd	na	nd	na	0.0044				
Bis2-ChloroethoxyMethane	111911	nd	na	nd	na	nd	na					
Bis 2-ChloroethylEther, unfiltered recov.	111444	nd	na	nd	na	nd	na	0.031				
Bis2-ChloroisopropylEther	108601	nd	na	nd	na	nd	na	1400		30		
N-butylbenzylphthalate	85687	nd	na	nd	na	nd	na					
Chrysene	218019	nd	na	nd	na	nd	na	0.0044				
Diethyl Phthalate	84662	nd	na	nd	na	nd	na	23000		350000		
Dimethyl Phthalate	131113	nd	na	nd	na	nd	na	313000		313000		
Fluoranthene	206440	nd	na	nd	na	nd	na	300		40		40
Fluorene	86737	nd	na	nd	na	nd	na	1300				
Hexachlorocyclopentadiene	77474	nd	na	nd	na	nd	na	240	50	1		0.07
Hexachloroethane	67721	nd	na	nd	na	nd	na	1.9		20		10
Ideno1,2,3-cdPyrene	193395	nd	na	nd	na	nd	na	0.0044				
Isophorone	78591	nd	na	nd	na	nd	na	36	*	5200		1200
Nitrobenzene wat. unfil.recov.	98953	nd	na	nd	na	nd	na	17		20000		300
N-Nitrosodimethylamine	62759	nd	na	nd	na	nd	na	0.00069		0.01		
N-Nitrosodi-n-Propylamine	621647	nd	na	nd	na	nd	na	0.005				
N-Nitrosodiphenylamine	86306	nd	na	nd	na	nd	na	5.0		50		
Parachlorometacresol	59507	nd	na	nd	na	nd	na					
Phenanthrene	85018	nd	na	nd	na	nd	na					
Pyrene	129000	nd	na	nd	na	nd	na	960				
BenzoghiPerylene-1,12-benzoperylene	191242	nd	na	nd	na	nd	na					
BenzoaAnthracene-1,2-benzanthracene	56553	nd	na	nd	na	nd	na					
Benzene-o-dichloro	95501	nd	na	nd	na	nd	na	2700	600			
Benzene-1,2,4-trichloro	120821	nd	na	nd	na	nd	na					
1,2,5,6-dibenzylanthracene	53703	nd	na	nd	na	nd	na					
Benzene-1,3--dichloro	541731	nd	na	nd	na	nd	na					
Benzene-1,4-dichloro wat. unf il. recov.	106467	nd	na	nd	na	nd	na	400	75			
2-Chloronaphthalene	91587	nd	na	nd	na	nd	na	1700				0.02
2-Chlorophenol	95578	nd	na	nd	na	nd	na	120		30		40
2-Nitrophenol	88755	nd	na	nd	na	nd	na			70		2
Di-n-Octyl Phthalate	117840	nd	na	nd	na	nd	na					
2,4-Dichlorophenol	120832	nd	na	nd	na	nd	na	93		30		
2,4-Dimethylphenol	105679	nd	na	nd	na	nd	na	540		400		20
2,4-Dinitrotoluene	121142	nd	na	nd	na	nd	na	0.11	*	1		
2,4-Dinitrophenol	51285	nd	na	nd	na	nd	na	70	*	70		2

1st Sampling

CONSTITUENT (µg/L)	Chemical Abstracts Service No.	All American Canal		Northerly International Boundary		Yuma Main Drain		Water & Organism (µg/L)	MCL (µg/L)	CECA agua potable (µg/L)	CECA recreativo (µg/L)	CECA vida acuática (dulce) (µg/L)
Date		***06/06 /95***		***06/13 /95***		***06/20 /95***						
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**					
2,4,6-Trichlorophenol	88062	nd	na	nd	na	nd	na	2.1		10		10
2,6-Dinitrotoluene	606202	nd	na	nd	na	nd	na					
3,3'-Dichlorobenzidine	91941	nd	na	nd	na	nd	na	0.04				
4-Bromophenyl Phenyl Ether	84662	nd	na	nd	na	nd	na					10
4-Chlorophenyl Phenyl Ether	7005723	nd	na	nd	na	nd	na					
4-Nitrophenol	100027	nd	na	nd	na	nd	na			70		2
4,6-Dinitro-o-cresol	5334521	nd	na	nd	na	nd	na					
Phenol (C6H-5OH)	108952	nd	na	nd	na	nd	na			300	1	100
Naphthalene	117840	nd	na	nd	na	nd	na		*			20
Pentachlorophenol	87865	nd	na	nd	na	nd	na		1	30		0.5
Bis2-EthylhexylPhthalate	117817	nd	na	nd	na	nd	na	1.8		32000		
Di-n-Butyl Phthalate	84742	nd	na	nd	na	nd	na	2700				
Benzidine	92875	nd	na	nd	na	nd	na	0.00012		0.001		20
Hexachlorobenzene	118741	nd	na	nd	na	nd	na	0.00075	1	0.01		
Hexachlorobutadiene	87683	nd	na	nd	na	nd	na	0.44		4		0.9
1,2-Diphenylhydrazine	122667	nd	na	nd	na	nd	na	0.04		0.4		3

nd = Not detected
na = Not analyzed
Water and Organism = EPA water quality criterion for protection of human health based on consumption of water and aquatic organisms
MCL = Maximum Contaminant Level - EPA limit for drinking water
* = Considered, but numerical standard has not been assigned
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for drinking water, contact recreation, and aquatic life (fresh water)

1st Sampling

TABLE C.1.2
Lower Colorado River
Extractable Organic Compounds

CONSTITUENT (µg/L)	Chemical Abstracts Service No.	All American Canal		Gila River		Northerly International Boundary		Yuma Main Drain		Wellton - Mohawk Canal		Water & Organism (µg/L)	MCL (µg/L)	CECA agua potable (µg/L)	CECA recreativo (µg/L)	CECA vida acuática (dulce) (µg/L)
Date		***12/04/95***		***12/05/95***		***12/05/95***		***12/06/95***		***12/06/95***						
		USA	***Mex***	***USA***	***Mex***	***USA***	***Mex***	***USA***	***Mex***	***USA***	***Mex***					
Acenaphthene	83329	nd	na	nd	na	nd	na	nd	na	nd	na	1200	*	20		20
Acenaphthylene	208968	nd	na	nd	na	nd	na	nd	na	nd	na		*			
Anthracene	120127	nd	na	nd	na	nd	na	nd	na	nd	na	9600	*			
BenzobFluroanthene	205992	nd	na	nd	na	nd	na	nd	na	nd	na	0.0044	0.2			
BenzokFluroanthene	207089	nd	na	nd	na	nd	na	nd	na	nd	na	0.0044				
BenzoaPyrene	50328	nd	na	nd	na	nd	na	nd	na	nd	na	0.0044				
Bis 2-ChloroethylEther, unfiltered recov.	111444	nd	na	nd	na	nd	na	nd	na	nd	na	0.031				
Bis2-ChloroethoxyMethane	111911	nd	na	nd	na	nd	na	nd	na	nd	na					
Bis2-ChloroisopropylEther	108601	nd	na	nd	na	nd	na	nd	na	nd	na	1400		30		
N-butylbenzylphthalate	85687	nd	na	nd	na	nd	na	nd	na	nd	na					
Chrysene	218019	nd	na	nd	na	nd	na	nd	na	nd	na	0.0044				
Diethyl Phthalate	84662	nd	na	nd	na	nd	na	nd	na	nd	na	23000		350000		
Dimethyl Phthalate	131113	nd	na	nd	na	nd	na	nd	na	nd	na	313000		313000		
Fluoranthene	206440	nd	na	nd	na	nd	na	nd	na	nd	na	300		40		40
Fluorene	86737	nd	na	nd	na	nd	na	nd	na	nd	na	1300				
Hexachlorocyclopentadiene	77474	nd	na	nd	na	nd	na	nd	na	nd	na	240	50	1		0.07
Hexachloroethane	67721	nd	na	nd	na	nd	na	nd	na	nd	na	1.9		20		10
Ideno1,2,3-cdPyrene	193395	nd	na	nd	na	nd	na	nd	na	nd	na	0.0044				
Isophorone	78591	nd	na	nd	na	nd	na	nd	na	nd	na	36	*	5200		1200
N-Nitrosodi-n-Propylamine	621647	nd	na	nd	na	nd	na	nd	na	nd	na	0.005		20000		300
N-Nitrosodiphenylamine	86306	nd	na	nd	na	nd	na	nd	na	nd	na	5.0		0.01		
N-Nitrosodimethylamine	62759	nd	na	nd	na	nd	na	nd	na	nd	na	0.00069				
Nitrobenzene wat. unf il.recov.	98953	nd	na	nd	na	nd	na	nd	na	nd	na	17		50		
Parachlorometacresol	59507	nd	na	nd	na	nd	na	nd	na	nd	na					
Phenanthrene	85018	nd	na	nd	na	nd	na	nd	na	nd	na					
Pyrene	129000	nd	na	nd	na	nd	na	nd	na	nd	na	960				
BenzoghiPerylene-1,12-benzoperylene	191242	nd	na	nd	na	nd	na	nd	na	nd	na					
BenzoaAnthracene-1,2-benzanthracene	56553	nd	na	nd	na	nd	na	nd	na	nd	na					
Benzene-o-dichloro	95501	nd	na	nd	na	nd	na	nd	na	nd	na	2700	600			
Benzene-1,2,4-trichloro	120821	nd	na	nd	na	nd	na	nd	na	nd	na					
1,2,5,6-dibenzylanthracene	53703	nd	na	nd	na	nd	na	nd	na	nd	na					
Benzene-1,3--dichloro	541731	nd	na	nd	na	nd	na	nd	na	nd	na					
Benzene-1,4-dichloro wat. unfil. recov.	106467	nd	na	nd	na	nd	na	nd	na	nd	na	400	75			
2-Chloronaphthalene	91587	nd	na	nd	na	nd	na	nd	na	nd	na	1700				0.02
2-Chlorophenol	95578	nd	na	nd	na	nd	na	nd	na	nd	na	120		30		40
2-Nitrophenol	88755	nd	na	nd	na	nd	na	nd	na	nd	na			70		2
Di-n-Octyl Phthalate	117840	nd	na	nd	na	nd	na	nd	na	nd	na					
2,4-Dichlorophenol	120832	nd	na	nd	na	nd	na	nd	na	nd	na	93		30		
2,4-Dimethylphenol	105679	nd	na	nd	na	nd	na	nd	na	nd	na	540		400		20
2,4-Dinitrotoluene	121142	nd	na	nd	na	nd	na	nd	na	nd	na	0.11	*	1		
2,4-Dinitrophenol	51285	nd	na	nd	na	nd	na	nd	na	nd	na	70	*	70		2

2nd Sampling

TABLE C.1.2
Lower Colorado River
Extractable Organic Compounds

Page 2

CONSTITUENT (µg/L)	Chemical Abstracts Service No.	All American Canal		Gila River		Northerly International Boundary		Yuma Main Drain		Wellton - Mohawk Canal		Water & Organism (µg/L)	MCL (µg/L)	CECA agua potable (µg/L)	CECA recreativo (µg/L)	CECA vida acuática (dulce) (µg/L)
Date		*12/04/95*		***12/05/95***		***12/05/95***		***12/06/95***		***12/06/95***						
		USA	Mex	**USA**	**Mex**	**USA**	**Mex**	**USA**	**Mex**	**USA**	**Mex**					
2,4,6-Trichlorophenol	88062	nd	na	nd	na	nd	na	nd	na	nd	na	2.1		10		10
2,6-Dinitrotoluene	606202	nd	na	nd	na	nd	na	nd	na	nd	na					
3,3'-Dichlorobenzidine	91941	nd	na	nd	na	nd	na	nd	na	nd	na	0.04				
4-Bromophenyl Phenyl Ether	84662	nd	na	nd	na	nd	na	nd	na	nd	na					10
4-Chlorophenyl Phenyl Ether	7005723	nd	na	nd	na	nd	na	nd	na	nd	na					
4-Nitrophenol	100027	nd	na	nd	na	nd	na	nd	na	nd	na			70		2
4,6-Dinitro-o-cresol	5334521	nd	na	nd	na	nd	na	nd	na	nd	na		*			
Phenol (C_6H-$_5OH$)	108952	nd	na	nd	na	nd	na	nd	na	nd	na		*	300	1	100
Naphthalene	117840	nd	na	nd	na	nd	na	nd	na	nd	na					20
Pentachlorophenol	87865	nd	na	nd	na	nd	na	nd	na	nd	na		1	30		0.5
Bis2-EthylhexylPhthalate	117817	nd	na	nd	na	nd	na	nd	na	nd	na	1.8		32000		
Di-n-Butyl Phthalate	84742	nd	na	nd	na	nd	na	nd	na	nd	na	2700				
Benzidine	92875	nd	na	nd	na	nd	na	nd	na	nd	na	0.00012		0.001		20
Hexachlorobenzene	118741	nd	na	nd	na	nd	na	nd	na	nd	na	0.00075	1	0.01		
Hexachlorobutadiene	87683	nd	na	nd	na	nd	na	nd	na	nd	na	0.44		4		0.9
1,2-Diphenylhydrazine	122667	nd	na	nd	na	nd	na	nd	na	nd	na	0.04		0.4		3

nd = Not detected
na = Not analyzed
Water and Organism = EPA water quality criterion for protection of human health based on consumption of water and aquatic organisms
MCL = Maximum Contaminant Level - EPA limit for drinking water
* = Considered, but numerical standard has not been assigned
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for drinking water, contact recreation, and aquatic life (fresh water)

2nd Sampling

TABLE C.1.3
Lower Colorado River
C-18 SPE Cartridge with GC-MS Analysis Pesticides

CONSTITUENT (µg/L)	Exceeds Any Criterion	Chemical Abstracts Service No.	All American Canal		Northerly International Boundary		Yuma Main Drain		MCL (µg/L)	CECA agua potable (µg/L)	CECA uso recreativo (µg/L)	CECA uso agrícola (µg/L)	CECA vida acuática (dulce) (µg/L)
Date			***06/06/95***		***06/13/95***		***06/20/95***						
			USA	***Mex***	***USA***	***Mex***	***USA***	***Mex***					
Propachlor		1918167	nd	na	nd	na	nd	na					
Butylate		2008415	nd	na	nd	na	nd	na					
Simazine		122349	nd	na	nd	na	nd	na	4				
Prometon		1610180	nd	na	nd	na	nd	na					
Diethyl Atrazine		6190654	nd	na	nd	na	nd	na					
Cyanizine		21725462	nd	na	nd	na	nd	na					
Fonofos		944229	nd	na	nd	na	nd	na	*				
Alpha BHC		319846	nd	na	nd	na	nd	na					1
p,p'-DDE		72559	nd	na	nd	na	E0.002	na				40	10
Chlorpyrifos		2921882	nd	na	nd	na	0.007	na					
Lindane		58899	nd	na	nd	na	nd	na	0.2	3			2
Dieldrin		60571	nd	na	nd	na	nd	na		0.0007	0.003	20	2
Metolachlor		51218452	nd	na	nd	na	nd	na					
Malathion		21755	nd	na	nd	na	nd	na	*				
Parathion		56382	nd	na	nd	na	nd	na	*	0.03			0.04
Diazinon		333415	nd	na	E0.006	na	nd	na					
Atrazine wat. dis. rec.		1912249	nd	na	nd	na	nd	na	3				
Alachlor wat. dis. rec.		15972608	nd	na	nd	na	nd	na	2				
Acetochlor wat. filt. rec.			nd	na	nd	na	nd	na					
Metribuzinsencor		21087649	nd	na	nd	na	nd	na					
2,6-Diethylaniline			nd	na	nd	na	nd	na					
Trifluralin		1582098	nd	na	E0.006	na	nd	na					
Ethalfluralin		55283686	nd	na	nd	na	nd	na					
Phorate		298022	nd	na	nd	na	nd	na					
Terbacil		5902512	nd	na	nd	na	nd	na					
Linuron		330552	nd	na	nd	na	nd	na	*				
Methylparathion		298000	nd	na	nd	na	nd	na					
EPTC		759944	nd	na	0.13	na	E0.005	na	*				
Pebulate		1114712	nd	na	nd	na	nd	na					
Tebuthiuron		34014181	nd	na	nd	na	nd	na					
Molinate		2212671	nd	na	nd	na	nd	na					
Ethoprop		13194484	nd	na	nd	na	nd	na					
Benfluralin		1861401	nd	na	nd	na	nd	na					
Carbofuran		1563662	nd	na	nd	na	nd	na	40				
Terbufos		13071799	nd	na	nd	na	nd	na					
Pronamide		23950585	nd	na	nd	na	nd	na					
Disulfoton		298044	nd	na	nd	na	nd	na					
Triallate		2303175	nd	na	nd	na	nd	na					
Propanil		709988	nd	na	nd	na	nd	na					
Carbaryl		63252	nd	na	nd	na	nd	na	*				
Thiobencarb		28249776	nd	na	nd	na	nd	na					
DCPA		1861321	nd	na	nd	na	E0.002	na	*				
Pendimethalin		40487421	nd	na	nd	na	nd	na					
Napropamide		15299997	nd	na	nd	na	nd	na					
Propargite		2312358	nd	na	nd	na	nd	na					
Methylazinphos		86500	nd	na	nd	na	nd	na					
Permethrin, cis		52645531	nd	na	nd	na	nd	na					

na = Not analyzed
nd = Not detected
E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)
MCL = Maximum Contaminant Level - EPA limit for drinking water
* = Considered, but numerical standard has not been assigned
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for drinking water, contact recreation, agricultural irrigation, and aquatic life (fresh water)

1st Sampling

TABLE C.1.3
Lower Colorado River
C-18 SPE Cartridge with GC-MS Analysis Pesticides

CONSTITUENT (µg/L)	Exceeds Any Criterion	Chemical Abstracts Service No.	All American Canal		Gila River		Northerly International Boundary		Yuma Main Drain		Wellton-Mohawk Canal		MCL (µg/L)	CECA agua potable (µg/L)	CECA uso recreativo (µg/L)	CECA uso agrícola (µg/L)	CECA vida acuática (dulce) (µg/L)
Date			***12/04/95***		***12/05/95***		***12/05/95***		***12/06/95***		***12/06/95***						
			USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**	**USA**	**Mex**	**USA**	**Mex**					
Propachlor		1918167	nd	na	nd	na	nd	na	nd	na	nd	na					
Butylate		2008415	nd	na	nd	na	nd	na	nd	na	nd	na					
Simazine		122349	E 0.003	na	0.007	na	E 0.003	na	E 0.005	na	nd	na	4				
Prometon		1610180	E 0.003	na	nd	na	E 0.004	na	nd	na	nd	na					
Diethyl Atrazine		6190654	nd	na	nd	na	nd	na	nd	na	nd	na					
Cyanizine		21725462	nd	na	nd	na	nd	na	nd	na	nd	na					
Fonofos		944229	nd	na	nd	na	nd	na	nd	na	nd	na	*				
Alpha BHC		319846	nd	na	nd	na	nd	na	nd	na	nd	na					1
p,p'-DDE		72559	nd	na	E 0.000	na	nd	na	E 0.003	na	E 0.002	na				40	10
Chlorpyrifos		2921882	nd	na	0.01	na	nd	na	0.10	na	0.02	na					
Lindane		58899	nd	na	nd	na	nd	na	nd	na	nd	na	0.2	3			2
Dieldrin		60571	nd	na	nd	na	nd	na	nd	na	nd	na		0.0007	0.003	20	2
Metolachlor		51218452	nd	na	nd	na	nd	na	nd	na	nd	na	*				
Malathion		21755	nd	na	nd	na	nd	na	nd	na	nd	na	*				
Parathion		56382	nd	na	nd	na	nd	na	nd	na	nd	na		0.03			0.04
Diazinon		333415	nd	na	E 0.003	na	E 0.002	na	0.005	na	0.015	na					
Atrazine wat. dis. rec.		1912249	E 0.004	na	nd	na	E 0.003	na	E 0.004	na	0.01	na	3				
Alachlor wat. dis. rec.		15972608	nd	na	nd	na	nd	na	nd	na	nd	na	2				
Acetochlor wat. filt. rec.			nd	na	nd	na	nd	na	nd	na	nd	na					
Metribuzinsencor		21087649	nd	na	nd	na	nd	na	nd	na	nd	na					
2,6-Diethylaniline			nd	na	nd	na	nd	na	nd	na	nd	na					
Trifluralin		1582098	nd	na	nd	na	nd	na	nd	na	nd	na					
Ethalfluralin		55283686	nd	na	nd	na	nd	na	nd	na	nd	na					
Phorate		298022	nd	na	nd	na	nd	na	nd	na	nd	na					
Terbacil		5902512	nd	na	nd	na	nd	na	nd	na	nd	na					
Linuron		330552	nd	na	nd	na	nd	na	nd	na	nd	na	*				
Methylparathion		298000	nd	na	nd	na	nd	na	nd	na	nd	na					
EPTC		759944	nd	na	nd	na	nd	na	nd	na	nd	na	*				
Pebulate		1114712	nd	na	nd	na	nd	na	nd	na	nd	na					
Tebuthiuron		34014181	nd	na	nd	na	nd	na	nd	na	nd	na					
Molinate		2212671	nd	na	nd	na	nd	na	nd	na	nd	na					
Ethoprop		13194484	nd	na	nd	na	nd	na	nd	na	nd	na					
Benfluralin		1861401	nd	na	nd	na	nd	na	nd	na	nd	na					
Carbofuran		1563662	nd	na	nd	na	nd	na	nd	na	nd	na	40				
Terbufos		13071799	nd	na	nd	na	nd	na	nd	na	nd	na					
Pronamide		23950585	nd	na	0.005	na	nd	na	0.004	na	E 0.004	na					
Disulfoton		298044	nd	na	nd	na	nd	na	nd	na	nd	na					
Triallate		2303175	nd	na	nd	na	nd	na	nd	na	nd	na					
Propanil		709988	nd	na	nd	na	nd	na	nd	na	nd	na					
Carbaryl		63252	nd	na	nd	na	nd	na	nd	na	nd	na	*				
Thiobencarb		28249776	nd	na	nd	na	nd	na	nd	na	nd	na					
DCPA		1861321	E 0.001	na	0.008	na	E 0.003	na	0.016	na	0.022	na	*				
Pendimethalin		40487421	nd	na	nd	na	nd	na	nd	na	nd	na					
Napropamide		15299997	nd	na	nd	na	nd	na	nd	na	nd	na					
Propargite		2312358	nd	na	nd	na	nd	na	nd	na	nd	na					
Methylazinphos		86500	nd	na	nd	na	nd	na	nd	na	nd	na					
Permethrin, cis		52645531	nd	na	nd	na	nd	na	nd	na	nd	na					

na = Not analyzed
nd = Not detected
E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)
MCL = Maximum Contaminant Level - EPA limit for drinking water
* = Considered, but numerical standard has not been assigned
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for drinking water, contact recreation, agricultural irrigation, and aquatic life (fresh water)
2nd Sampling

TABLE C.1.4
Lower Colorado River
CARBOPAK B SPE Cartridge with HPLC-UV Analysis Pesticides

CONSTITUENT (µg/L)	Exceeds Any Criterion	Chemical Abstracts Service No.	All American Canal	Northerly International Boundary	Yuma Main Drain	MCL(µg/L)	CECA agua potable (µg/L)
Date			***06/06/95***	***06/13/95***	***06/20/95***		
Bromacil		314409	nd	nd	nd	*	
Dicamba		1918009	nd	nd	nd	*	
Linuron		330552	nd	nd	nd	*	
MCPA		94746	nd	nd	nd		
MCPB		94815	nd	nd	nd		
Methiocarb		2032657	nd	nd	nd		
Propoxur		114261	nd	nd	nd		
Bentazon		25057890	nd	nd	nd		
2,4-DB		94826	nd	nd	nd		
Fluometuron		2164172	nd	nd	nd	*	
Oxamyl		23135220	nd	nd	nd	200	
2,4-D		94757	nd	nd	nd	70	100
2,4,5-T		93765	nd	nd	nd		
Silvex		93721	nd	nd	nd		
Trichlopyr		55335063	nd	nd	nd		
Propham		122429	nd	nd	nd		
Picloram		1918021	nd	nd	nd	500	
Oryzalin		19044883	nd	nd	nd		
Norflurazon		27314132	nd	nd	nd		
Neburon		555373	nd	nd	nd		
1-Naphthol		90153	nd	nd	nd		
Methomyl		16752775	nd	nd	nd	*	
Fenuron		101428	nd	nd	nd		
Esfenvalerate		66230044	nd	nd	nd		
DNOC		534521	nd	nd	nd		10
Diuron		330541	nd	nd	nd	*	
Dinoseb		88857	nd	nd	nd	7	
Dichlorprop		120365	nd	nd	nd		
Dichlobenil		1194656	nd	nd	nd		
Dacthal		1861321	nd	nd	nd		
Clopyralid		57754855	nd	nd	nd		
Chlorothalonil		1897456	nd	nd	nd		
Chloramben		133904	nd	nd	nd		
3-Hydroxycarbofuran			nd	nd	nd		
Carbofuran		1563662	nd	nd	nd	40	
Carbaryl		63252	nd	nd	nd	*	
Bromoxynil		1689992	nd	nd	nd	*	
Aldicarb		116063	nd	nd	nd	3	
Aldicarb sulfone		1646884	nd	nd	nd	2	
Aldicarb sulfoxide			nd	nd	nd	4	
Acifluorfen		81335377	nd	nd	nd		

nd = Not detected
MCL = Maximum Contaminant Level - EPA limit for drinking water
* = Considered, but numerical standard has not been assigned
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for drinking water

1st Sampling

TABLE C.1.4
Lower Colorado River
CARBOPAK B SPE Cartridge with HPLC-UV Analysis Pesticides

CONSTITUENT (µg/L)	Exceeds Any Criterion	Chemical Abstracts Service No.	All American Canal	Gila River	Northerly International Boundary	Yuma Main Drain	Wellton-Mohawk Canal	MCL (µg/L)	CECA agua potable (µg/L)
Date			***12/04/95***	***12/05/95***	***12/05/95***	***12/06/95***	***12/06/95***		
Bromacil		314409	nd	nd	nd	nd	nd	*	
Dicamba		1918009	nd	nd	nd	E 0.04	nd	*	
Linuron		330552	nd	nd	nd	nd	nd	*	
MCPA		94746	nd	nd	nd	nd	nd		
MCPB		94815	nd	nd	nd	nd	nd		
Methiocarb		2032657	nd	nd	nd	nd	nd		
Propoxur		114261	nd	nd	nd	nd	nd		
Bentazon		25057890	nd	nd	nd	nd	nd		
2,4-DB		94826	nd	nd	nd	nd	nd		
Fluometuron		2164172	nd	nd	nd	nd	nd	*	
Oxamyl		23135220	nd	nd	nd	nd	nd	200	
2,4-D		94757	nd	nd	nd	nd	nd	70	100
2,4,5-T		93765	nd	nd	nd	nd	nd		
Silvex		93721	nd	nd	nd	nd	nd		
Trichlopyr		55335063	nd	nd	nd	nd	nd		
Propham		122429	nd	nd	nd	nd	nd		
Picloram		1918021	nd	nd	nd	nd	nd	500	
Oryzalin		19044883	nd	nd	nd	nd	nd		
Norflurazon		27314132	nd	nd	nd	nd	nd		
Neburon		555373	nd	nd	nd	nd	nd		
1-Naphthol		90153	nd	nd	nd	nd	nd		
Methomyl		16752775	nd	nd	nd	nd	nd	*	
Fenuron		101428	nd	nd	nd	nd	nd		
Esfenvalerate		66230044	nd	nd	nd	nd	nd		
DNOC		534521	nd	nd	nd	nd	nd		10
Diuron		330541	nd	nd	nd	nd	nd	*	
Dinoseb		88857	nd	nd	nd	nd	nd	7	
Dichlorprop		120365	nd	nd	nd	nd	nd		
Dichlobenil		1194656	nd	nd	nd	nd	nd		
Dacthal		1861321	nd	nd	nd	nd	nd		
Clopyralid		57754855	nd	nd	nd	nd	nd		
Chlorothalonil		1897456	nd	nd	nd	nd	nd		
Chloramben		133904	nd	nd	nd	nd	nd		
3-Hydroxycarbofuran			nd	nd	nd	nd	nd		
Carbofuran		1563662	nd	nd	nd	nd	nd	40	
Carbaryl		63252	nd	nd	nd	nd	nd	*	
Bromoxynil		1689992	nd	nd	nd	nd	nd	*	
Aldicarb		116063	nd	nd	nd	nd	nd	3	
Aldicarb sulfone		1646884	nd	nd	nd	nd	nd	2	
Aldicarb sulfoxide			nd	nd	nd	nd	nd	4	
Acifluorfen		81335377	nd	nd	nd	nd	nd		

nd = Not detected
E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)
MCL = Maximum Contaminant Level - EPA limit for drinking water
* = Considered, but numerical standard has not been assigned
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for drinking water

2^{nd} Sampling

TABLE C.1.5
Lower Colorado River
Major Nurtients

CONSTITUENT	Exceeds Any Criterion	All American Canal		Northerly International Boundary		Yuma Main Drain		CECA agua potable (mg/L)	CECA recreativo (mg/L)	CECA agrícola (mg/L)	CECA pecuario (mg/L)	CECA vida acuática (dulce) (mg/L)
Date		***06/06/95***		***06/13/95***		***06/20/95***						
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**					
Total Nitrogen (mg/L as N)				0.49		1.50						
Dissolved Nitrogen (mg/L as N)				0.29		1.50						
Total Organic Nitrogen (mg/L as N)				0.38		0.32						
Dissolved Organic Nitrogen (mg/L as N)			0.360	0.18	0.60	0.32	0.73					
Ammonia Nitrogen (mg/L as N)	x	0.02	<0.05	0.02	<0.05	**0.08**	0.05					**0.06**
Nitrite Nitrogen (mg/L as N)		0.01		0.013		0.03		0.05			10	
Nitrate Nitrogen (mg/L as N)		0.22		0.08		1.07		5			90	
Dissolved Ammonia + Organic Nitrogen (mg/L as N)		0.20		0.20		0.40						
Total Ammonia + Organic Nitrogen (mg/L as N)		0.20		0.40		0.40						
NO_2 + NO_3 Nitrogen (mg/L as N)		0.23		0.09		1.10						
Total Phosphorus (mg/L as P)		0.01	<0.01	0.11	0.23	0.08	0.05					
Dissolved Phosphorus (mg/L as P)	x	**0.01**		**0.03**		**0.02**						**0.0001**
Ortho Phosphorus (mg/L as P)		0.01	<0.01	0.03	0.04	0.02	0.05	0.1				
Total Organic Carbon (mg/L as C)		4.40		5.50		3.80						
Dissolved Organic Carbon (mg/L as C)		2.40		4.40		2.40						

CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for drinking water, contact recreation, agricultural irrigation, stock use, and aquatic life (fresh water)

1st Sampling

TABLE C.1.5
Lower Colorado River
Major Nurtients

CONSTITUENT	Exceeds Any Criterion	All American Canal		Gila River		Northerly International Boundary		Yuma Main Drain		Wellton - Mohawk Canal		CECA agua potable (mg/L)	CECA recreativo (mg/L)	CECA agrícola (mg/L)	CECA pecuario (mg/L)	CECA vida acuática (dulce) (mg/L)
Date		***12/04/95***		***12/05/95***		***12/05/95***		***12/06/95***		***12/06/95***						
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**	**USA**	**Mex**	**USA**	**Mex**					
Total Nitrogen (mg/L as N)																
Dissolved Nitrogen (mg/L as N)																
Total Organic Nitrogen (mg/L as N)																
Dissolved Organic Nitrogen (mg/L as N)			0.61		1.41		0.61		0.86		1.65					
Ammonia Nitrogen (mg/L as N)	x	0.015	<0.05	0.03	0.05	**0.10**	**0.37**	0.05	0.05	nd	0.05					**0.06**
Nitrite Nitrogen (mg/L as N)		0.01		0.02		0.02		0.02		0.02		0.05			10	
Nitrate Nitrogen (mg/L as N)		0.19		1.78		0.44		1.58		2.28		5			90	
Dissolved Ammonia + Organic Nitrogen (mg/L as N)		0.20		0.40		0.30		0.20		0.40						
Total Ammonia + Organic Nitrogen (mg/L as N)		0.20		0.40		0.30		0.30		1.10						
NO_2 + NO_3 Nitrogen (mg/L as N)		0.20		1.80		0.46		1.60		2.30						
Total Phosphorus (mg/L as P)		0.02	<0.01	0.06	0.01	0.02	<0.01	0.70	<0.01	0.09	<0.01					
Dissolved Phosphorus (mg/L as P)	x	**0.01**		**0.02**		**0.01**		**0.02**		nd						**0.0001**
Ortho Phosphorus (mg/L as P)		0.01	<0.01	0.02	<0.01	nd	<0.01	0.02	0.01	nd	0.01	0.1				
Total Organic Carbon (mg/L as C)		2.80		4.70		3.60		2.80		6.80						
Dissolved Organic Carbon (mg/L as C)		2.60		2.40		2.40		2.30		4.10						
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for drinking water, contact recreation, agricultural irrigation, stock use, and aquatic life (fresh water)																

2nd Sampling

TABLE C.1.6
Lower Colorado River
General Water Quality Parameters

CONSTITUENT	Exceeds Any Criterion	All American Canal		Northerly International Boundary		Yuma Main Drain		CMC (mg/L)	CCC (mg/L)	Water & Organism (mg/L)	MCL (mg/L)	CECA agua potable (mg/L)	CECA recreativo (mg/L)	CECA agrícola (mg/L)	CECA pecuario (mg/L)	CECA vida acuática (dulce) (mg/L)
Date		**06/06/95**		**06/13/95**		**06/20/95**										
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**									
Temperature (°C.)		25	27.0	28	29	26	26.0					NC +2.5				NC+1.5
Flow (cfs)		7170	7170	3280	3280	155	155									
Specific Conductance (µS/cm)		1272	1278	1260	1263	2140	2150									
pH		8.3	8.0	8.3	8.3	8.2	8.0		6.5--9	5--9	6.5--8.5	5--9		4.5-9		
Total Hardness(mg/L $CaCO_3$)		353.2	338.0	268.7	249.0	514.1	487.0									
Noncarb Diss. Hardness (mg/L)		206.2	230.0	104.7	139.0	317.1	283.0									
Calcium (mg/L)		87		68		130										
Magnesium (mg/L)		33		24		46										
Sodium (mg/L)		130		150		260										
Sodium adsorption ratio		3		3.98		4.99										
Sodium percent		44		54.2		52.1										
Potassium (mg/L)		5.2		5.5		5.6										
Chloride (mg/L)	x	120	108.0	**200**	**162**	**280**	**236.0**	860	**230**			**250**		**147.5**		**250**
Sulfate (mg/L)	x	**320**	**189.0**	**150**	**47**	**480**	**413.0**					500		**130**		**0.005**
Fluoride (mg/L)		0.4		0.6		0.6					4	1.5		1	2	1
Silica (mg/L)		8.8		13		18										
Alkalinity (mg/L)	x	**147**	**181.0**	**164**	**184**	**197**	**251.0**		**20**			400				
Dissolved Solids (mg/L)	x	**832**	**786.0**	**732**	**745**	**1420**	**1338.0**					**500**		**500**	**1000**	
%Suspended Sediments <.062 mm.		90		12		94										
Bromide (mg/L)		0.1		0.1		0.2										
Suspended Sediments (mg/L)	x	24	8	**562**	50	109	52					**500**				
Cyanide (mg/L)	x					**0.1**					0.2	0.2	**0.02**	**0.02**		**0.005**
Methylene Blue Active Sub.(mg/L)												0.5				0.1
Oil and Grease (mg/L)	x		**9.87**		**0.75**		**1.81**					**np**				
Phenols (µg/L)												0.3	0.001			0.1
Dissolved Oxygen (mg/L)			7		7		7.2					4				5
Chemical Oxygen Demand (mg/L)			5		15		5									
Biochemical Oxygen Demand (mg/L)					3		1									
Total Coliform (MPN/100mL)	x		**2400**		**240**		**24000**					**2**				
Fecal Coliform (MPN/100mL)	x		**75**		**23**		**4400**					**0**				**200**

CMC = Criterion Maximum Concentration - EPA water quality criterion for protection of aquatic life (acute exposures)
CCC = Criterion Continuous Concentration - EPA water quality criterion for protection of aquatic life (chronic exposures)
Water and Organisim = EPA water quality criterion for protection of human health based on consumption of water and aquatic organisms
MCL = Maximum Contaminant Level - EPA limit for drinking water
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for drinking water, contract recreation, agricultural irrigation, stock use, and aquatic life (fresh water)
NC = Natural conditions
np = Not present

1st Sampling

TABLE C.1.6
Lower Colorado River
General Water Quality Parameters

CONSTITUENT	Exceeds Any Criterion	All American Canal		Gila River		Northerly International Boundary		Yuma Main Drain		Wellton - Mohawk Canal		CMC (mg/L)	CCC (mg/L)	Water & Organism (mg/L)	MCL (mg/L)	CECA agua potable (mg/L)	CECA recreativo (mg/L)	CECA agrícola (mg/L)	CECA pecuario (mg/L)	CECA vida acuática (dulce) (mg/L)
Date		***12/04/95***		***12/05/95***		***12/05/95***		***12/06/95***		***12/06/95***										
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**	**USA**	**Mex**	**USA**	**Mex**									
Temperature (°C.)		16	16	21	22	16	18	19	20	20	19					NC +2.5				NC+1.5
Flow (cfs)		4871	4871	148	148	1624	1624	141	141	134	134									
Specific Conductance (µS/cm)		1290	1270	2980	2930	1570	1532	2300	2250	4450	4400									
pH	x	8.3	7.8	8.4	8.0	8.3	**6.1**	8.2	8.1	8.3	8.1		**6.5--9**	5--9	**6.5--8.5**	5--9		4.5 - 9		
Total Hardness(mg/L $CaCO_3$)			342		472		371		539		702									
Noncarb Diss. Hardness (mg/L)			202		253		251		351		355									
Calcium (mg/L)		89		120		100		150		170										
Magnesium (mg/L)		34		53		38		52		87										
Sodium (mg/L)		130		470		190		300		760										
Sodium adsorption ratio																				
Sodium percent																				
Potassium (mg/L)		5		6.9		5.2		5.4		7.9										
Chloride (mg/L)	x	120	103	**520**	**447**	**180**	**155**	**310**	**270**	**740**	**199**	860	**230**			**250**		**147.5**		**250**
Sulfate (mg/L)	x	**310**	**273**	**470**	**356**	**340**	**352**	**500**	**459**	**970**	**590**					**500**		**130**		**0.005**
Fluoride (mg/L)	x	0.4		1.0		0.5		0.5		**1.7**					4	**1.5**		**1**	2	**1**
Silica (mg/L)		9.8		23.0		13.0		22.0		10.0										
Alkalinity (mg/L)	x	**146**	**175**	**261**	**309**	**168**	**206**	**225**	**263**	**319**	**374**		**20**			400				
Dissolved Solids (mg/L)	x	**822**	**666**	**1830**	**1334**	**988**	**874**	**1490**	**1436**	**2940**	**2696**					**500**		**500**	**1000**	
%Suspended Sediments <.062 mm.																				
Bromide (mg/L)		0.1		0.4		0.2		0.3		0.6										
Suspended Sediments (mg/L)		9	26	46	8	144	26	89	40	145	114					500				
Cyanide (mg/L)		nd		nd		nd		nd		nd					0.2	0.2	0.02	0.02		0.005
Methylene Blue Active Sub.(mg/L)																0.5				0.1
Alkalinity (laboratory) (mg/L)		153		268		177		237		315										
pH (laboratory)		8.0		8.1		8.0		7.9		7.9										
Oil and grease (gravimetric) (mg/L)		nd		nd		nd		nd		nd						np				
Specific Conductance (lab) (µS/cm)																		1		
Phenols (µg/L)	x	**1.0**		nd		**1.0**		**3.0**		**1.0**						**0.3**	**0.001**			**0.1**
Dissolved Oxygen (mg/L)			10.0		10.0		9.1		8.0		13.0					4				5
Chemical Oxygen Demand (mg/L)					5.0		10.0		10.0		6.6									
Biochemical Oxygen Demand (mg/L)					3.0		4.0		5.0		6.6									
Fecal Coliform (MPN/100mL)	x		<3000		**3000**		<3000		**9300**		**3.0**					**0**				**200**
Total Coliform (MPN/100mL)			<3000		**3000**		<3000		**9300**		**3.0**					**2**				

nd = Not detected
CMC = Criterion Maximum Concentration - EPA water quality criterion for protection of aquatic life (acute exposures)
CCC = Criterion Continuous Concentration - EPA water quality criterion for protection of aquatic life (chronic exposures)
Water and Organisim = EPA water quality criterion for protection of human health based on consumption of water and aquatic organisms
MCL = Maximum Contaminant Level - EPA limit for drinking water
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for drinking water, contract recreation, agricultural irrigation, stock use, and aquatic life (fresh water)
NC = Natural conditions
np = Not present

2nd Sampling

TABLE C.1.7
Lower Colorado River
Trace Elements in Suspended Sediment

CONSTITUENT	Chemical Abstracts Service No.	All American Canal	Northerly International Boundary	Yuma Main Drain
Date		***06/06/95***	***06/13/95***	***06/20/95***
Aluminum (Percent)	7429905	6.1	5	6.5
Antimony (µg/g)	7440360	1	0.5	0.8
Arsenic (µg/g)	7440382	14	5	9
Barium (µg/g)	7440393	640	550	500
Beryllium (µg/g)	7440417	2	1	2
Cadmium (µg/g)	7440439	0.8	0.26	0.47
Chromium (µg/g)	7440473	290	79	85
Copper (µg/g)	7440508	55	26	35
Lead (µg/g)	7439921	45	14	28
Manganese (µg/g)	7439965	1700	690	3400
Vanadium (µg/g)	7440622	75	84	74
Zinc (µg/g)	7440666	150	66	130
Calcium (µg/g)	7440702	5.6	3.3	7
Iron (µg/g)	7439896	3.1	2.9	3.2
Magnesium (µg/g)	7439954	1.5	0.99	1.7
Molybdenum (µg/g)	7439987	18	0.5	3.3
Neodynium (µg/g)	7440008	32	25	29
Nickel (µg/g)	7440020	150	26	43
Niobium (µg/g)	7440031	9	8	8
Phosporus (Percent)	7723140	0.15	0.09	0.13
Potassium (Percent)	7440097	1.8	1.8	1.9
Scandium (µg/g)	7440202	10	9	10
Silver (µg/g)	7440224	0.31	0.1	0.18
Sodium (Percent)	7440235	0.57	1.3	0.58
Strontium (µg/g)	7440246	350	310	380
Tantalum (µg/g)	7440257	nd	nd	nd
Thorium (µg/g)	7440291	11	6.5	9.6
Titanium (Percent)	7440326	0.26	0.46	0.28
Uranium (µg/g)	7440611	2.5	1.4	2.5
Yttrium (µg/g)	7440655	2	2	2
Ytterbium (µg/g)	7440644	22	20	22
Bismuth (µg/g)	7440699	nd	nd	nd
Cobalt (µg/g)	7440473	13	12	11
Europium (µg/g)	7440531	nd	nd	nd
Gallium (µg/g)	7440553	17	13	17
Holmium (µg/g)	7440600	nd	nd	nd
Lanthanum (µg/g)	7440531	41	30	38
Tin (µg/g)	7440315	nd	nd	nd
Lithium (µg/g)	7439932	46	23	48
Cerium (µg/g)	7440451	77	56	73
Gold (µg/g)	7440575	nd	nd	nd

1st Sampling

TABLE C.1.8
Lower Colorado River
Extractable Organic Compounds in Suspended Sediment Page 1

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	All American Canal	Northerly International Boundary	Yuma Main Drain
Date		***06/06/95***	***06/13/95***	***06/20/95***
Hexachlorobenzene	118741	nd	nd	nd
Dibutylphthalate	84742	E610.0	E47.0	E90.0
Dioctylphthalate	117840	nd	59	270
Diethylphthalate	84662	nd	E20.0	E14.0
Dimethylphthalate	131113	nd	nd	nd
Pyrene	129000	nd	nd	E17.0
Pyrene,1-methyl		nd	nd	nd
Benzo-a-pyrene	50328	nd	nd	nd
Indeno-1,2,3-cd-pyrene	193395	nd	nd	nd
2,2'-biquinoline		nd	nd	nd
Quinoline		nd	nd	nd
Phenanthridine		nd	nd	nd
Isoquinoline		nd	nd	nd
Toluene,2,4-dinitro	121142	nd	nd	nd
Toluene,2,6-dinitro	606202	nd	nd	nd
Benzo-k-fluoranthene	207089	nd	nd	nd
9H-fluorene,1-methyl		nd	nd	nd
9H-fluorene		nd	nd	nd
Isophorone	78591	nd	nd	nd
Methane, 2-chloroethoxy		nd	nd	nd
Naphthalene	91203	nd	nd	nd
Naphthalene, 1,2-dimethyl		nd	nd	nd
Naphthalene, 1,6-dimethyl		nd	nd	nd
Naphthalene, 2,3,6-trimethyl		nd	nd	nd
Naphthalene, 2,6-dimethyl		280	77	95
Naphthalene, 2-chloro	91587	nd	nd	nd
Benzo(g,h,I)perylene	191242	nd	nd	nd
Phenanthrene	85018	nd	nd	nd
Phenanthrene, 1-methyl		nd	nd	nd
4-Hcypenphenanthrene		nd	nd	nd
Phenol	108952	280	E29.0	62
3,5-Xylenol		nd	nd	nd
m-Cresol, 4-chloro		nd	nd	nd
Phenol, C8-alkyl		nd	nd	nd
Phthalate, bis-2-ethylhexyl		6400	390	930
Phthalate, butylbenzyl	85687	770	E47.0	97
Acenaphthylene	208968	nd	nd	nd
Acenaphthene	83329	nd	nd	nd
Acridine		nd	nd	nd
Dipropylamine, n-nitroso	621647	nd	nd	nd
Diphenylamine, n-nitroso	86306	nd	nd	nd

1st Sampling

TABLE C.1.8
Lower Colorado River
Extractable Organic Compounds in Suspended Sediment

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	All American Canal	Northerly International Boundary	Yuma Main Drain
Date		***06/06/95***	***06/13/95***	***06/20/95***
Anthracene	120127	nd	nd	nd
Anthracene,2-methyl		nd	nd	nd
Benz-a-anthracene	56553	nd	nd	nd
9,10-Anthraquinone		nd	nd	nd
Benzene, 1,2,4-trichloro	120821	nd	nd	nd
Benzene, o-dichloro	95501	nd	nd	nd
Benzene, m-dichloro	541731	nd	nd	nd
Benzene, p-dichloro	106467	nd	nd	nd
Azobenzene	98953	nd	nd	nd
Nitrobenzene	98953	nd	nd	nd
Benzene, pentachloronitro	82688	nd	nd	nd
Carbazole		nd	nd	nd
Chrysene	218019	nd	nd	nd
p-Cresol		nd	E27.0	nd
Thiophene, dibenzo		nd	nd	nd
4-Bromophenylphenylether	101553	nd	nd	nd
4-Chlorophenylphenylether	7705723	nd	nd	nd
Benzo-b-fluoranthene	205992	nd	nd	nd
Pentachloroanisole		nd	nd	nd
Dibenz-(a,h)-anthracene	53703	nd	nd	nd
Fluoranthene	206440	nd	nd	E9.0
Phenol, 2-chloro	955578	nd	nd	nd

nd = Not detected
E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)

1st Sampling

TABLE C.1.9
Lower Colorado River
Chlorinated Organic Compounds in Suspended Sediment

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	All American Canal	Northerly International Boundary	Yuma Main Drain
Date		***06/06/95***	***06/13/95***	***06/20/95***
cis-Nonachlor	5103731	nd	nd	nd
trans-Nonachlor	39765805	nd	nd	nd
Oxychlordane		nd	nd	nd
Aldrin	309002	nd	nd	nd
cis-Chlordane	5103742	nd	nd	nd
trans-Chlordane	5103719	nd	nd	nd
Chloroneb		nd	nd	nd
DCPA	1861321	nd	nd	nd
o,p'-DDD		nd	nd	nd
p,p'-DDD	72548	nd	nd	2.6
o,p'-DDE		nd	nd	nd
p,p'-DDE	72559	E2.4	1.1	42
o,p'-DDT		nd	nd	2.3
p,p'-DDT	50293	nd	nd	17
Dieldrin	60571	nd	nd	1.8
Endosulfan I	959988	nd	nd	nd
Endrin	72208	nd	nd	nd
Alpha BHC	319846	nd	nd	nd
Beta BHC	319857	nd	nd	nd
Heptachlor	76448	nd	nd	nd
Heptachlor epoxide	1024573	nd	nd	nd
Benzene, hexachloro	118741	nd	nd	nd
Isodrin		nd	nd	nd
Lindane	319868	nd	nd	nd
p,p'-Methoxychlor	72435	nd	nd	nd
o,p'-Methoxychlor		nd	nd	nd
Mirex	2385855	nd	nd	nd
cis-Permethrin	61949766	nd	nd	nd
trans-Permethrin	61949777	nd	nd	nd
Toxaphene	8001352	nd	nd	nd
PCB		nd	nd	nd
Pentachloroanisole		nd	nd	nd
Sample weight (g)		1.56	25	13.8

nd = Not detected
E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)

1st Sampling

TABLE C.1.10
Lower Colorado River
Trace Elements in Bed Sediment

CONSTITUENT (µg/g) (Except Where Noted)	Chemical Abstracts Service No.	All American Canal			Yuma Main Drain
Date		***06/06/95***		***06/13/95***	***06/20/95***
		USA	**Mex (mg/kg)**	**USA**	**USA**
Aluminum (Percent)	7429905	2.3		5.1	5.5
Antimony	7440360	0.7		1.2	1.1
Arsenic	7440382	2.6	1.931	5	7.2
Barium	7440508	410	34.83	550	560
Beryllium	7440417	nd		1	1
Bismuth	7440699	nd		nd	nd
Cadmium	7440439	0.1	nd	0.1	0.2
Calcium	7440702	1.6		3	6.7
Cerium	7440451	27		59	76
Chromium	7440484	11		86	39
Cobalt	7440473	2		14	9
Copper	7440508	3		14	21
Europium	7440531	nd		nd	nd
Gallium	7440553	5		11	12
Gold	7440575	nd		nd	nd
Holmium	7440600	nd		nd	nd
Iron (Percent)	7439896	0.69		3	2
Lanthanum	7440531	16		32	40
Lead	7439921	11	4.62	11	21
Lithium	7439932	8		20	30
Magnesium	7439954	0.3		0.92	1.4
Manganese	7439965	190		550	1800
Mercury	7439976	nd	nd	nd	nd
Molybdenum	7439987	nd		nd	nd
Neodymium	7440008	10		26	31
Nickel	7440020	4	0.923	24	18
Niobium	7440031	nd		10	6

1st Sampling

TABLE C.1.10
Lower Colorado River
Trace Elements in Bed Sediment

Page 2

CONSTITUENT (µg/g) (Except Where Noted)	Chemical Abstracts Service No.	All American Canal			Yuma Main Drain
Date		***06/06/95***		***06/13/95***	***06/20/95***
		USA	**Mex (mg/kg)**	**USA**	**USA**
Phosphorus (Percent)	7723140	0.02		0.08	0.09
Potassium (Percent)	7440097	1.2		1.7	1.8
Scandium	7440202	nd		6	7
Selenium	7782492	nd	nd	nd	0.6
Silver	7440224	0.1	nd	0.1	0.2
Sodium (Percent)	7440235	0.55		1.3	0.79
Strontium	7440246	120		300	350
Sulfur	7704349	nd		nd	0.19
Tantalum	7440257	nd		nd	nd
Thorium	7440291	4.2		8.9	10
Tin	7440315	nd		nd	nd
Uranium	7440611	1		2.2	2.6
Vanadium	7440622	16		93	55
Yttrium	7440655	6		20	21
Ytterbium	7440644	nd		2	2
Zinc	7440666	23		57	78
Carbon-Organic (Percent)	7440440	0.04		0.09	1.03
Carbon-Org+Inorg (Percent)		0.49		0.59	3.01
Carbon-Inorganic (Percent)		0.45		0.5	1.98
Titanium (Percent)	7440326	0.08		0.51	0.26
nd = Not detected					

2nd Sampling

TABLE C.1.11
Lower Colorado River
Extractable Compounds in Bed Sediment

Page 1

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	All American Canal	Northerly International Boundary	Yuma Main Drain
Date		***06/06/95***	***06/13/95***	***06/20/95***
Hexachlorobenzene	118741	nd	nd	nd
Dibutylphthalate	84742	E22.0	nd	nd
Diethyl Phthalate	117840	nd	nd	nd
Dimethyl Phthalate	84662	nd	E9.0	nd
Dimethylphthalate	131113	nd	nd	nd
Pyrene	129000	nd	nd	E17.0
Pyrene,1-methyl		nd	nd	nd
BenzoaPyrene	50328	nd	nd	E32.0
Indeno 1,2,3-cdPyrene	193395	nd	nd	nd
2,2'-biquinoline		nd	nd	nd
Quinoline		nd	nd	nd
Phenanthridine		nd	nd	nd
Isoquinoline		nd	nd	nd
Toluene,2,4-dinitro	121142	nd	nd	nd
Toluene,2,6-dinitro	606202	nd	nd	nd
BenzokFluroanthene	207089	nd	nd	E32.0
9H-fluorene,1-methyl		nd	nd	nd
9H-fluorene		nd	nd	nd
Isophorone	78591	nd	nd	nd
Methane, 2-chloroethoxy		nd	nd	nd
Naphthalene	91203	nd	nd	nd
Naphthalene, 1,2-dimethyl		nd	nd	nd
Naphthalene, 1,6-dimethyl		nd	nd	nd
Naphthalene, 2,3,6-trimethyl		nd	nd	nd
Naphthalene, 2,6-dimethyl		nd	nd	E42.0
Naphthalene, 2-chloro	91587	nd	nd	nd
BenzoghiPerylene	191242	nd	nd	nd
Phenanthrene	85018	nd	nd	nd
Phenanthrene, 1-methyl		nd	nd	nd
4-Hcypenphenanthrene		nd	nd	nd
Phenol	108952	E21.0	110	E.24.0
3,5-Xylenol		nd	nd	nd
m-Cresol, 4-chloro		nd	nd	nd
Phenol, C8-alkyl		nd	nd	nd
Phthalate, bis-2-ethylhexyl		58	nd	110
Phthalate, butylbenzyl	85687	E27.0	nd	E44.0
Acenaphthylene	208968	nd	nd	nd
Acenaphthene	83329	nd	nd	nd
Acridine		nd	nd	nd
Dipropylamine, n-nitroso	621647	nd	nd	nd
Diphenylamine, n-nitroso	86306	nd	nd	nd

1st Sampling

TABLE C.1.11
Lower Colorado River
Extractable Compounds in Bed Sediment

Page 2

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	All American Canal	Northerly International Boundary	Yuma Main Drain
Date		***06/06/95***	***06/13/95***	***06/20/95***
Anthracene	120127	nd	nd	nd
Anthracene,2-methyl		nd	nd	nd
BenzoaAnthracene	56553	nd	nd	E22.0
9,10-Anthraquinone		nd	nd	E14.0
Benzene, 1,2,4-trichloro	120821	nd	nd	nd
Benzene, o-dichloro	95501	nd	nd	nd
Benzene, m-dichloro	541731	nd	nd	nd
Benzene, p-dichloro	106467	nd	nd	nd
Azobenzene	98953	nd	nd	nd
Nitrobenzene	98953	nd	nd	nd
Benzene, pentachloronitro		nd	nd	nd
Carbazole		nd	nd	nd
Chrysene	218019	nd	nd	nd
p-Cresol		nd	nd	E25.0
Thiophene, dibenzo		nd	nd	nd
4-Bromophenyl Phenyl Ether	101553	nd	nd	nd
4-Chlorophenyl Phenyl Ether	7705723	nd	nd	nd
BenzobFluoranthene	205992	nd	nd	E40.0
Pentachloroanisole		nd	nd	nd
Dibenzoa,hAnthracene	53703	nd	nd	nd
Fluoranthene	206440	nd	nd	E13.0
Phenol, 2-chloro	955578	nd	nd	nd
Benzocinnoline		nd	nd	nd

nd = Not detected

E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)

1st Sampling

TABLE C.1.12
Lower Colorado River
Chlorinated Organic Compounds in Bed Sediment

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	All American Canal	Northerly International Boundary	Yuma Main Drain
Date		**06/06/95**	**06/13/95**	**06/20/95**
cis-Nonachlor	5103731	nd	nd	nd
trans-Nonachlor	39765805	nd	nd	nd
Oxychlordane		nd	nd	nd
Aldrin	309002	nd	nd	nd
cis-Chlordane	5103742	nd	nd	nd
trans-Chlordane	5103719	nd	nd	nd
Chloroneb		nd	nd	nd
DCPA	1861321	nd	nd	nd
o,p'-DDD		nd	nd	1.3
p,p'-DDD	72548	nd	nd	4.4
o,p'-DDE		nd	nd	nd
p,p'-DDE	72559	nd	nd	55
o,p'-DDT		nd	nd	nd
p,p'-DDT	50293	nd	nd	3
Dieldrin	60571	nd	nd	nd
Endosulfan I	959988	nd	nd	nd
Endrin	72208	nd	nd	nd
Alpha BHC	319846	nd	nd	nd
Beta BHC	319857	nd	nd	nd
Heptachlor	76448	nd	nd	nd
Heptachlor epoxide	1024573	nd	nd	nd
Benzene, hexachloro	118741	nd	nd	nd
Isodrin	465736	nd	nd	nd
Lindane	319868	nd	nd	nd
p,p'-Methoxychlor	72435	nd	nd	nd
o,p'-Methoxychlor		nd	nd	nd
Mirex	2385855	nd	nd	nd
cis-Permethrin	61949766	nd	nd	E5.2
trans-Permethrin	61949777	nd	nd	nd
Toxaphene	8001352	nd	nd	nd
PCB		nd	nd	nd
Pentachloroanisole		nd	nd	nd

nd = Not detected
E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)

1st Sampling

TABLE C.1.13
Lower Colorado River
Volatile Organics in Water Column

CONSTITUENT (µg/L)	Chemical Abstracts Service No.	All American Canal		Northerly International Boundary		Yuma Main Drain		Water & Organism (µg/L)	MCL (µg/L)	CECA agua potable (µg/L)	CECA vida acuática (dulce) (µg/L)
Date		***06/06/95***		***06/13/95***		***06/20/95***					
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**				
Dibromomethane	74953	nd	nd	nd	nd	nd	nd				
Dichlorobromomethane	124481	nd	nd	nd	nd	nd	nd	0.56			
Carbon Tetrachloride	56235	nd	nd	nd	nd	nd	nd	0.25	5	4	300
1,2-Dichloroethane	107062	nd	nd	nd	nd	nd	nd	0.38	5	5	1200
Bromoform	75252	nd	nd	nd	nd	nd	nd	4.3	80	2	
Chlorodibromomethane	124481	nd	nd	nd	nd	nd	nd	0.41	80		
Chloroform	67663	nd	nd	nd	nd	nd	nd	5.7	80	30	300
Toluene	108883	nd	nd	nd	nd	nd	nd	6800	1000	14300	200
Benzene	71432	nd	nd	nd	nd	nd	nd	1.2	5	10	50
Chlorobenzene	108907	nd	nd	nd	nd	nd	nd	680	100	20	
Chloroethane	75003	nd	nd	nd	nd	nd	nd				
Ethylbenzene	100414	nd	nd	nd	nd	nd	nd	3100	700	1400	
Methyl Bromide	74839	nd	nd	nd	nd	nd	nd	48		2	
Methyl Chloride	74873	nd	nd	nd	nd	nd	nd			2	
Methylene Chloride	75092	nd	nd	nd	nd	nd	nd	4.7	5	2	
Tetrachloroethylene	127184	nd	nd	nd	nd	nd	nd	0.8	5	8	50
Trichlorofluoromethane		nd	nd	nd	nd	nd	nd				
1,1-Dichloroethane	75343	nd	nd	nd	nd	nd	nd				
1,1-Dichloroethylene	75354	nd	nd	nd	nd	nd	nd	0.057	7	0.3	
1,1,1-Trichloroethane	71556	nd	nd	nd	nd	nd	nd		200	18400	200
1,1,2-Trichloroethane	79005	nd	nd	nd	nd	nd	nd	0.60	5	6	200
1,1,2,2-Tetrachloroethane	79345	nd	nd	nd	nd	nd	nd	0.17		2	90
1,2-Dichlorobenzene	95501	nd	nd	nd	nd	nd	nd	2700	600		
1,2-Dichloropropane	78875	nd	nd	nd	nd	nd	nd	0.52	5		
1,2-Trans-Dichloroethylene	156605	nd	nd	nd	nd	nd	nd	700	100		
1,2,4-Trichlorobenzene	120821	nd	nd	nd	nd	nd	nd	260	70		
1,3-Dichlorobenzene	95578	nd	nd	nd	nd	nd	nd	400			
1,4-Dichlorobenzene	106467	nd	nd	nd	nd	nd	nd	400	75		
Dichlorodifluoromethane	74718	nd	nd	nd	nd	nd	nd				
Naphthalene	91203	nd	nd	nd	nd	nd	nd				20
trans-1,3-Dichloropropene	10061026	nd	nd	nd	nd	nd	nd				
cis-1,3-dichloropropene	10061015	nd	nd	nd	nd	nd	nd				
Vinyl Chloride	75014	nd	nd	nd	nd	nd	nd	2.0	2	20	
Trichloroethylene	79016	nd	nd	nd	nd	nd	nd	2.7	5	30	10
Hexachlorobutadiene	87683	nd	nd	nd	nd	nd	nd	0.44		4	0.9
cis-1,2-Dichloroethene	156592	nd	nd	nd	nd	nd	nd		70		
Styrene	100425	nd	nd	nd	nd	nd	nd		100		
1,1-Dichloropropene	563586	nd	nd	nd	nd	nd	nd				
2,2-Dichloropropane	594207	nd	nd	nd	nd	nd	nd				
1,3-Dichloropropane	142289	nd	nd	nd	nd	nd	nd				

1st Sampling

TABLE C.1.13
Lower Colorado River
Volatile Organics in Water Column

CONSTITUENT (µg/L)	Chemical Abstracts Service No.	All American Canal		Northerly International Boundary		Yuma Main Drain		Water & Organism (µg/L)	MCL (µg/L)	CECA agua potable (µg/L)	CECA vida acuática (dulce) (µg/L)
Date		***06/06/95***		***06/13/95***		***06/20/95***					
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**				
1,2,4-Trimethylbenzene	95636	nd	nd	nd	nd	nd	nd				
Isopropylbenzene	98828	nd	nd	nd	nd	nd	nd				
n-Propylbenzene	103651	nd	nd	nd	nd	nd	nd				
1,3,5-Trimethylbenzene	108678	nd	nd	nd	nd	nd	nd				
o-Chlorotoluene		nd	nd	nd	nd	nd	nd				
p-Chlorotoluene		nd	nd	nd	nd	nd	nd				
Bromochloromethane	74975	nd	nd	nd	nd	nd	nd				
n-Butylbenzene	104518	nd	nd	nd	nd	nd	nd				
sec-Butylbenzene	135988	nd	nd	nd	nd	nd	nd				
tert-Butylbenzene	98066	nd	nd	nd	nd	nd	nd				
p-Isopropyltoluene	99036	nd	nd	nd	nd	nd	nd				
1,2,3-Trichloropropane	96184	nd	nd	nd	nd	nd	nd				
1,1,1,2-Tetrachloroethane	630206	nd	nd	nd	nd	nd	nd				
1,2,3-Trichlorobenzene	87616	nd	nd	nd	nd	nd	nd				
1,2-Dibromoethane	74953	nd	nd	nd	nd	nd	nd				
Freon-113	76131	nd	nd	nd	nd	nd	nd				
Methyl tert-butylether		nd	nd	nd	nd	nd	nd				
Xylene	1330207	nd	nd	nd	nd	nd	nd		10000		
Bromobenzene	108861	nd	nd	nd	nd	nd	nd				
Dibromochloropropane	96128	nd	nd	nd	nd	nd	nd		0.2		

nd = Not detected
Water and Organism = EPA water quality criterion for protection of human health based on consumption of water and aquatic organisms
MCL = Maximum Contaminant Level - EPA limit for drinking water
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for drinking water and aquatic life (fresh water)

1st Sampling

TABLE C.2.1
New River
Trace Elements in Water Column

CONSTITUENT (µg/L)	Exceeds Any Criterion	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland		CMC (µg/L)	CCC (µg/L)	Organism only (µg/L)	CECA vida acuática (dulce) (µg/L)
Date			***03/28/95***		***03/25/95***		***03/22/95***					
			USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**				
Aluminum		7429905	5.0	na	20.0	na	3.0	na	750	87		50
Antimony		7440360	nd	na	nd	na	nd	na			4300	90
Arsenic		7440382	4.0	4	4.0	5	4.0	na	340	150		200
Barium	x	7440393	**138.0**	na	**126.0**	na	**101.0**	na				**10**
Beryllium		7440417	nd	na	nd	na	nd	na				1
Cadmium		7440439	nd	na	nd	na	nd	na	4.3	2.2		H
Chromium		7440473	6.0	na	5.0	na	4.0	na	570 (III)	74 (III)		10
Cobalt		7440484	nd	na	nd	na	nd	na				
Copper		7440508	8.0	na	6.0	na	7.0	na	13	9		H
Iron		7439896	20.0	na	68.0	na	15.0	na		1000		1000
Lead	x	7439921	nd	**29**	nd	**31**	nd	na	65	**2.5**		H
Manganese	x	7439965	**120.0**	na	**110.0**	**110**	**120.0**	**110**			**100**	
Mercury		7439976	nd	<0.5	nd	na	nd	na	1.4	0.77	0.051	0.01
Molybdenum		7439987	14.0	na	12.0	na	14.0	na				
Nickel		7440020	15.0	na	19.0	12.4	10.0	na	470	52	4600	H
Selenium		7782492	2.0	na	1.0	na	3.0	na		5		8
Silver		7440224	nd	na	nd	na	nd	na	3.4			H
Uranium		7440611	7.0	nd	6.0	nd	11.0	nd				
Zinc		7440666	8.0	nd	7.0	nd	6.0	nd	120	120		H

nd = Not detected
na = Not analyzed
CMC = Criterion Maximum Concentration - EPA water quality criterion for protection of aquatic life (acute exposures)
CCC = Criterion Continuous Concentration - EPA water quality criterion for protection of aquatic life (chronic exposures)
Organism only = EPA water quality criterion for protection of human health based on consumption of aquatic organisms
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for aquatic life (fresh water)
H = Hardness and indicates that the criteria are dependent on this value

1st Sampling

TABLE C.2.1
New River
Trace Elements in Water

CONSTITUENT (µg/L)	Exceeds Any Criterion	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland		CMC (µg/L)	CCC (µg/L)	Organism only (µg/L)	CECA vida acuática (dulce) (µg/L)
Date			***04/11/96***		***04/10/96***		***04/09/96***					
			USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**				
Aluminum		7429905	7.0	na	9.0	na	4.0	na	750	87		50
Antimony		7440360	nd	na	nd	na	nd	na			4300	90
Arsenic		7440382	4.0	4.2	4.0	3.4	5.0	4.5	340	150		200
Barium	x	7440393	**126.0**	na	**116.0**	na	**88.0**	na				**10**
Beryllium		7440417	nd	na	nd	na	nd	na				1
Boron		7440428	1300	na	1000	na	820	na				
Cadmium	x	7440439	nd	**30.1**	nd	**31.9**	nd	**18.5**	**4.3**	**2.2**		H
Chromium		7440473	4.0	<40	3.0	<40	5.0	<40	570 (III)	74 (III)		10
Cobalt		7440484	nd	<80	nd	<80	nd	<80				
Copper	x	7440508	**10.0**	<40	6.0	<40	7.0	<40	13	**9**		H
Iron		7439896	41	70	47	80	15	80		1000		1000
Lead	x	7439921	nd	**37**	nd	**36**	nd	**27**	65	**2.5**		H
Manganese	x	7439965	**215**	**230**	**187**	**130**	**104**	**110**			**100**	
Mercury	x	7439976	nd	**1.4**	nd	<0.5	nd	<0.5	1.4	**0.77**	**0.051**	**0.01**
Molybdenum		7439987	15.0	<700	14.0	<700	14.0	<700				
Nickel		7440020	12	10	13	12	5	<5	470	52	4600	H
Selenium		7782492	2.0	0.6	1.0	0.6	4.0	0.6		5		8
Silver		7440224	nd	<30	nd	<30	nd	<30	3.4			H
Uranium		7440611	6.0	na	6.0	na	10.0	na				
Zinc		7440666	6.0	na	7.0	na	5.0	na	120	120		H
Lithium			na	440	na	340	na	270				
Filtered Samples												
Antimony (total)		7440360	2.0	na	1.0	na	2.0	na				
Arsenic (total)		7440382	4.0	na	4.0	na	6.0	na				
Cadmium (unfiltered)		7440439	nd	na	nd	na	nd	na				
Chromium (tot. recov.)		7440484	1.1	na	1.0	na	5.3	na				
Copper (tot. recov.)		7440508	2.0	na	3.0	na	11.0	na				
Iron (tot. recov.)		7439896	290.0	na	290.0	na	5500.0	na				
Lead (tot. recov.)		7439921	nd	na	nd	na	5.0	na				
Manganese (tot. recov.)		7439965	210.0	na	180.0	na	380.0	na				
Mercury (tot. recov.)		7439976	nd	na	nd	na	nd	na				
Nickel (tot. recov.)		7440020	12.0	na	14.0	na	10.0	na				
Selenium (total)		7782492	2.0	na	2.0	na	5.0	na				
Vanadium		7440622	26.0	na	18.0	na	26.0	na				
Zinc (tot. recov.)		7440666	10.0	na	10.0	na	30.0	na				

nd = Not detected
na = Not analyzed
CMC = Criterion Maximum Concentration - EPA water quality criterion for protection of aquatic life (acute exposures)
CCC = Criterion Continuous Concentration - EPA water quality criterion for protection of aquatic life (chronic exposures)
Organism only = EPA water quality criterion for protection of human health based on consumption of aquatic organisms
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for aquatic life (fresh water)
H = Hardness and indicates that the criteria are dependent on
this value

2nd Sampling

TABLE C.2.2

New River

Extractable Organic Comp unds

CONSTITUENT (µg/L)	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland		Organism only (µg/L)	CECA vida acuática (dulce) (µg/L)
Date		**3/28/1995**		**3/25/1995**		**3/22/1995**			
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**		
Acenaphthylene	208968	nd	na	nd	na	nd	na		
Acenaphthene	83329	nd	na	nd	na	nd	na	2700	20
Anthracene	120127	nd	na	nd	na	nd	na	110000	
BenzobFluroanthene	205992	nd	na	nd	na	nd	na	0.049	
BenzokFluroanthene	207089	nd	na	nd	na	nd	na	0.049	
BenzoaPyrene	50328	nd	na	nd	na	nd	na	0.049	
Bis 2-ChloroethylEther, unfiltered recov.	111444	nd	na	nd	na	nd	na	1.4	238000
Bis2-ChloroethoxyMethane	111911	nd	na	nd	na	nd	na		
Bis2-ChloroisopropylEther	108601	nd	na	nd	na	nd	na		238000
N-butylbenzylphthalate	85687	nd	na	nd	na	nd	na		
Chrysene	218019	nd	na	nd	na	nd	na	0.049	
Diethyl Phthalate	84662	nd	na	nd	na	nd	na	120000	940
Dimethyl Phthalate	131113	nd	na	nd	na	nd	na	2900000	940
Fluoranthene	206440	nd	na	nd	na	nd	na	370	40
Fluorene	86737	nd	na	nd	na	nd	na	14000	
Hexachlorocyclopentadiene	77474	nd	na	nd	na	nd	na	17000	
Hexachloroethane	67721	nd	na	nd	na	nd	na	8.9	10
Ideno1,2,3-cdPyrene	193395	nd	na	nd	na	nd	na	0.049	
Isophorone	78591	nd	na	nd	na	nd	na	2600	1200
N-Nitrosodi-n-Propylamine	621647	nd	na	nd	na	nd	na	1.4	5850
N-Nitrosodiphenylamine	86306	nd	na	nd	na	nd	na	16	5850
N-Nitrosodimethylamine	62759	nd	na	nd	na	nd	na	8.1	300
Nitrobenzene wat. unfil.recov.	98953	nd	na	nd	na	nd	na		
Parachlorometacresol	59507	nd	na	nd	na	nd	na		
Phenanthrene	85018	nd	na	nd	na	nd	na		
Pyrene	129000	nd	na	nd	na	nd	na	11000	
BenzoghiPerylene-1,12-benzoperylene	191242	nd	na	nd	na	nd	na		
BenzoaAnthracene-1,2-benzanthracene	56553	nd	na	nd	na	nd	na	0.049	
Benzene-o-dichloro	95501	nd	na	nd	na	nd	na		
Benzene-1,2,4-trichloro	120821	nd	na	nd	na	nd	na		
1,2,5,6-dibenzylanthracene	53703	nd	na	nd	na	nd	na		
Benzene-1,3--dichloro	541731	nd	na	nd	na	nd	na		
Benzene-1,4-dichloro wat. unfil. recov.	106467	nd	na	nd	na	nd	na		
2-Chloronaphthalene	91587	nd	na	nd	na	nd	na	4300	
2-Chlorophenol	95578	nd	na	nd	na	nd	na	400	40
2-Nitrophenol	88755	nd	na	nd	na	nd	na		2
Di-n-Octyl Phthalate	117840	nd	na	nd	na	nd	na		
2,4-Dichlorophenol	120832	nd	na	nd	na	nd	na	790	20
2,4-Dimethylphenol	105679	nd	na	nd	na	nd	na	2300	20
2,4-Dinitrotoluene	121142	nd	na	nd	na	nd	na	9.1	330
2,4-Dinitrophenol	51285	nd	na	nd	na	nd	na	14000	2

1st Sampling

TABLE C.2.2
New River
Extractable Organic Compounds

CONSTITUENT (µg/L)	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland		Organism only (µg/L)	CECA vida acuática (dulce) (µg/L)
Date		**03/28/95**		**03/25/95**		**03/22/95**			
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**		
2,4,6-Trichlorophenol	88062	nd	na	nd	na	nd	na	6.5	10
2,6-Dinitrotoluene	606202	nd	na	nd	na	nd	na		330
3,3'-Dichlorobenzidine	91941	nd	na	nd	na	nd	na	0.077	
4-Bromophenyl Phenyl Ether	84662	nd	na	nd	na	nd	na		10
4-Chlorophenyl Phenyl Ether	7005723	nd	na	nd	na	nd	na		
4-Nitrophenol	100027	nd	na	nd	na	nd	na		2
4,6-Dinitro-o-cresol	5334521	nd	na	nd	na	nd	na		
Phenol (C6H-5OH)	108952	nd	na	nd	na	nd	na		100
Naphthalene	117840	nd	na	nd	na	nd	na		20
Pentachlorophenol	87865	nd	na	nd	na	nd	na		0.5
Bis2-EthylhexylPhthalate	117817	nd	na	nd	na	nd	na	5.9	940
Di-n-Butyl Phthalate	84742	nd	na	nd	na	nd	na	12000	
Benzidine	92875	nd	na	nd	na	nd	na	0.00054	20
Hexachlorobenzene	118741	nd	na	nd	na	nd	na	0.00077	250
Hexachlorobutadiene	87683	nd	na	nd	na	nd	na	50	0.9
1,2-Diphenylhydrazine	122667	nd	na	nd	na	nd	na	0.54	3
nd = Not detected									
na = Not analyzed									
Organism only = EPA water quality criterion for protection of human health based on consumption of aquatic organisms									
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for aquatic life (fresh water)									

1st Sampling

TABLE C.2.2
New River
Extractable Organic Compounds

CONSTITUENT (µg/L)	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland		Organism only (µg/L)	CECA vida acuática (dulce) (µg/L)
Date		***04/11/96***		***04/10/96***		***04/09/96***			
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**		
Acenaphthylene	208968	nd	na	nd	na	nd	na		
Acenaphthene	83329	nd	na	nd	na	nd	na	2700	20
Anthracene	120127	nd	na	nd	na	nd	na	110000	
BenzobFluroanthene	205992	nd	na	nd	na	nd	na	0.049	
BenzokFluroanthene	207089	nd	na	nd	na	nd	na	0.049	
BenzoaPyrene	50328	nd	na	nd	na	nd	na	0.049	
Bis 2-ChloroethylEther, unfiltered recov.	111444	nd	na	nd	na	nd	na	1.4	238000
Bis2-ChloroethoxyMethane	111911	nd	na	nd	na	nd	na		
Bis 2-ChloroethylEther, unfiltered recov.	108601	nd	na	nd	na	nd	na		238000
N-butylbenzylphthalate	85687	nd	na	nd	na	nd	na		
Chrysene	218019	nd	na	nd	na	nd	na	0.049	
Diethyl Phthalate	84662	nd	na	nd	na	nd	na	120000	940
Dimethyl Phthalate	131113	nd	na	nd	na	nd	na	2900000	940
Fluoranthene	206440	nd	na	nd	na	nd	na	370	40
Fluorene	86737	nd	na	nd	na	nd	na	14000	
Hexachlorocyclopentadiene	77474	nd	na	nd	na	nd	na	17000	
Hexachloroethane	67721	nd	na	nd	na	nd	na	8.9	10
Ideno1,2,3-cdPyrene	193395	nd	na	nd	na	nd	na	0.049	
Isophorone	78591	nd	na	nd	na	nd	na	2600	1200
N-Nitrosodi-n-Propylamine	621647	nd	na	nd	na	nd	na	1.4	5850
N-Nitrosodiphenylamine	86306	nd	na	nd	na	nd	na	16	5850
N-Nitrosodimethylamine	62759	nd	na	nd	na	nd	na	8.1	300
Nitrobenzene wat. unfil.recov.	98953	nd	na	nd	na	nd	na		
Parachlorometacresol	59507	nd	na	nd	na	nd	na		
Phenanthrene	85018	nd	na	nd	na	nd	na		
Pyrene	129000	nd	na	nd	na	nd	na		
BenzoghiPerylene-1,12-benzoperylene	191242	nd	na	nd	na	nd	na		
BenzoaAnthracene-1,2-benzanthracene	56553	nd	na	nd	na	nd	na		
Benzene-o-dichloro	95501	nd	na	nd	na	nd	na		
Benzene-1,2,4-trichloro	120821	nd	na	nd	na	nd	na		
1,2,5,6-dibenzylanthracene	53703	nd	na	nd	na	nd	na		
Benzene-1,3--dichloro	541731	nd	na	nd	na	nd	na		
Benzene-1,4-dichloro wat. unfil. recov.	106467	nd	na	nd	na	nd	na		
2-Chloronaphthalene	91587	nd	na	nd	na	nd	na	4300	
2-Chlorophenol	95578	nd	na	nd	na	nd	na	400	40
2-Nitrophenol	88755	nd	na	nd	na	nd	na		2
Di-n-Octyl Phthalate	117840	nd	na	nd	na	nd	na		
2,4-Dichlorophenol	120832	nd	na	nd	na	nd	na	790	20
2,4-Dimethylphenol	105679	nd	na	nd	na	nd	na	2300	20
2,4-Dinitrotoluene	121142	nd	na	nd	na	nd	na	9.1	330
2,4-Dinitrophenol	51285	nd	na	nd	na	nd	na	14000	2

2nd Sampling

TABLE C.2.2
New River
Extractable Organic Compounds

CONSTITUENT (µg/L)	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland		Organism only (µg/L)	CECA vida acuática (dulce) (µg/L)
Date		***04/11/96***		***04/10/96***		***04/09/96***			
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**		
2,4,6-Trichlorophenol	88062	nd	na	nd	na	nd	na	6.5	10
2,6-Dinitrotoluene	606202	nd	na	nd	na	nd	na		330
3,3'-Dichlorobenzidine	91941	nd	na	nd	na	nd	na	0.077	
4-Bromophenyl Phenyl Ether	84662	nd	na	nd	na	nd	na		10
4-Chlorophenyl Phenyl Ether	7005723	nd	na	nd	na	nd	na		
4-Nitrophenol	100027	nd	na	nd	na	nd	na		2
4,6-Dinitro-o-cresol	5334521	nd	na	nd	na	nd	na		
Phenol (C6H-5OH)	108952	nd	na	nd	na	nd	na		100
Naphthalene	117840	nd	na	nd	na	nd	na		20
Pentachlorophenol	87865	nd	na	nd	na	nd	na		0.5
Bis2-EthylhexylPhthalate	117817	nd	na	nd	na	nd	na	5.9	940
Di-n-Butyl Phthalate	84742	nd	na	nd	na	nd	na	12000	
Benzidine	92875	nd	na	nd	na	nd	na	0.00054	20
Hexachlorobenzene	118741	nd	na	nd	na	nd	na	0.00077	250
Hexachlorobutadiene	87683	nd	na	nd	na	nd	na	50	0.9
1,2-Diphenylhydrazine	122667	nd	na	nd	na	nd	na	0.54	3

nd = Not detected
na = Not analyzed
Organism only = EPA water quality criterion for protection of human health based on consumption of aquatic organisms
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for aquatic life (fresh water)

2nd Sampling

TABLE C.2.3
New River
C-18 SPE Cartridge with GC-MS Analysis Pesticides

CONSTITUENT (µg/L)	Exceeds Any Criterion	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland		CECA protección de vida acuática dulce (µg/L)
Date			***03/28/95***		***03/25/95***		***03/22/95***		
			USA	***Mex***	***USA***	***Mex***	***USA***	***Mex***	
Propachlor		1918167	nd	na	nd	na	nd	na	
Butylate		2008415	nd	na	nd	na	nd	na	
Simazine		122349	nd	na	nd	na	0.01	na	
Prometon		1610180	nd	na	nd	na	E0.005	na	
Diethyl Atrazine		6190654	nd	na	nd	na	E0.006	na	
Cyanizine		21725462	nd	na	nd	na	nd	na	
Fonofos		944229	nd	na	nd	na	nd	na	
Alpha BHC		319846	nd	na	nd	na	nd	na	1
p,p'-DDE		72559	nd	na	nd	na	nd	na	10
Chlorpyrifos		2921882	0.024	na	0.023	na	0.010	na	
Lindane		58899	nd	na	nd	na	nd	na	2
Dieldrin		60571	nd	na	nd	na	nd	na	2
Metolachlor		51218452	nd	na	nd	na	nd	na	
Malathion		21755	0.044	na	0.060	na	0.1	na	
Parathion		56382	nd	na	nd	na	nd	na	0.04
Diazinon		333415	0.055	na	0.110	na	0.076	na	
Atrazine wat. dis. rec .		1912249	nd	na	nd	na	0.13	na	
Alachlor wat. dis. rec.		15972608	nd	na	nd	na	nd	na	
Acetochlor wat. filt. rec.			nd	na	nd	na	nd	na	
Metribuzinsencor		21087649	nd	na	nd	na	E0.007	na	
2,6-Diethylaniline			nd	na	nd	na	nd	na	
Trifluralin		1582098	nd	na	E0.003	na	0.340	na	
Ethalfluralin		55283686	nd	na	nd	na	nd	na	
Phorate		298022	nd	na	nd	na	nd	na	
Terbacil		5902512	nd	na	nd	na	nd	na	
Linuron		330552	nd	na	nd	na	0.087	na	
Methylparathion		298000	nd	na	nd	na	nd	na	
EPTC		759944	0.014	na	0.015	na	0.210	na	
Pebulate		1114712	nd	na	nd	na	nd	na	
Tebuthiuron		34014181	nd	na	nd	na	nd	na	
Molinate		2212671	nd	na	nd	na	nd	na	
Ethoprop		13194484	nd	na	nd	na	nd	na	
Benfluralin		1861401	nd	na	nd	na	nd	na	
Carbofuran		1563662	nd	na	E2.100	na	nd	na	
Terbufos		13071799	nd	na	nd	na	nd	na	
Pronamide		23950585	nd	na	nd	na	nd	na	
Disulfoton		298044	nd	na	nd	na	nd	na	
Triallate		2303175	nd	na	nd	na	nd	na	
Propanil		709988	nd	na	nd	na	nd	na	
Carbaryl		63252	E0.018	na	E0.150	na	nd	na	
Thiobencarb		28249776	nd	na	nd	na	nd	na	
DCPA		1861321	0.005	na	0.008	na	0.096	na	
Pendimethalin		40487421	nd	na	nd	na	0.069	na	
Napropamide		15299997	nd	na	nd	na	nd	na	
Propargite		2312358	nd	na	nd	na	nd	na	
Methylazinphos		86500	nd	na	nd	na	nd	na	
Permethrin, cis		52645531	nd	na	nd	na	nd	na	

nd = Not detected
na = Not analyzed
E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)
CECA = Criterios Ecologicos de Calidad del Agua - ecological water quality criteria for aquatic life (fresh water)

1st Sampling

TABLE C.2.3
New River
C-18 SPE Cartridge GC-MS Analysis Pesticides

CONSTITUENT (µg/L)	Exceeds Any Criterion	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland		CECA protección de vida acuática dulce (µg/L)
Date			***04/11/96***		***04/10/96***		***04/09/96***		
			USA	***Mex***	***USA***	***Mex***	***USA***	***Mex***	
Propchlor		1918167	nd	na	nd	na	nd	na	
Butylate		2008415	nd	na	nd	na	nd	na	
Simazine		122349	nd	na	nd	na	0.013	na	
Prometon		1610180	nd	na	nd	na	nd	na	
Diethyl Atrazine		6190654	nd	na	nd	na	E 0.05	na	
Cyanizine		21725462	nd	na	nd	na	nd	na	
Fonofos		944229	nd	na	nd	na	0.004	na	
Alpha BHC		319846	nd	na	nd	na	nd	na	1
p,p'-DDE		72559	nd	na	nd	na	nd	na	10
Chlorpyrifos		2921882	0.026	na	0.042	na	0.012	na	
Lindane		58899	nd	na	nd	na	nd	na	2
Dieldrin		60571	nd	na	nd	na	nd	na	2
Metolachlor		51218452	nd	na	nd	na	nd	na	
Malathion		21755	E 0.100	na	E 0.059	na	0.120	na	
Parathion		56382	nd	na	nd	na	nd	na	0.04
Diazinon		333415	0.059	na	0.170	na	0.077	na	
Atrazine wat. dis. rec.		1912249	0.016	na	0.026	na	E 2.600	na	
Alachlor wat. dis. rec.		15972608	nd	na	nd	na	nd	na	
Acetochlor wat. filt. rec.			nd	na	nd	na	nd	na	
Metribuzinsencor		21087649	nd	na	nd	na	0.015	na	
2,6-Diethylaniline			nd	na	nd	na	nd	na	
Trifluralin		1582098	nd	na	nd	na	0.110	na	
Ethalfluralin		55283686	nd	na	nd	na	nd	na	
Phorate		298022	nd	na	nd	na	nd	na	
Terbacil		5902512	nd	na	nd	na	nd	na	
Linuron		330552	nd	na	nd	na	0.032	na	
Methylparathion		298000	nd	na	nd	na	nd	na	
EPTC		759944	0.011	na	0.015	na	nd	na	
Pebulate		1114712	nd	na	nd	na	nd	na	
Tebuthiuron		34014181	nd	na	nd	na	nd	na	
Molinate		2212671	nd	na	nd	na	nd	na	
Ethoprop		13194484	nd	na	nd	na	nd	na	
Benfluralin		1861401	nd	na	nd	na	0.004	na	
Carbofuran		1563662	E 0.031	na	E 0.078	na	E 0.420	na	
Terbufos		13071799	nd	na	nd	na	nd	na	
Pronamide		23950585	nd	na	nd	na	nd	na	
Disulfoton		298044	nd	na	0.042	na	E 0.014	na	
Triallate		2303175	nd	na	nd	na	nd	na	
Propanil		709988	E 0.018	na	nd	na	nd	na	
Carbaryl		63252	E 0.035	na	E 0.056	na	E 0.017	na	
Thiobencarb		28249776	nd	na	nd	na	nd	na	
DCPA		1861321	0.004	na	0.006	na	0.067	na	
Pendimethalin		40487421	nd	na	nd	na	0.059	na	
Napropamide		15299997	nd	na	nd	na	nd	na	
Propargite		2312358	nd	na	nd	na	nd	na	
Methylazinphos		86500	nd	na	nd	na	nd	na	
Permethrin, cis		52645531	nd	na	nd	na	nd	na	

nd = Not detected
na = Not analyzed
E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)
CECA = Criterios Ecologicos de Calidad del Agua - ecological water quality criteria for aquatic life (fresh water)

2nd Sampling

TABLE C.2.4
New River
CARBOPAK B SPE Cartridge with HPLC-UV Analysis Pesticides

CONSTITUENT (µg/L)	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland	
Date		***03/28/95***		***03/25/95***		***03/22/95***	
		USA	***Mex***	***USA***	***Mex***	***USA***	***Mex***
Bromacil	314409	nd	na	nd	na	nd	na
Dicamba	1918009	nd	na	nd	na	nd	na
Linuron	330552	nd	na	nd	na	0.05	na
MCPA	94746	nd	na	nd	na	nd	na
MCPB	94815	nd	na	nd	na	nd	na
Methiocarb	2032657	nd	na	nd	na	nd	na
Propoxur	114261	nd	na	nd	na	nd	na
Bentazon	25057890	nd	na	nd	na	nd	na
2,4-DB	94826	nd	na	nd	na	nd	na
Fluometuron	2164172	nd	na	nd	na	nd	na
Oxamyl	23135220	nd	na	nd	na	nd	na
2,4-D	94757	nd	na	nd	na	0.12	na
2,4,5-T	93765	nd	na	nd	na	nd	na
Silvex	93721	nd	na	nd	na	nd	na
Trichlopyr	55335063	nd	na	nd	na	nd	na
Propham	122429	nd	na	nd	na	nd	na
Picloram	1918021	nd	na	nd	na	nd	na
Oryzalin	19044883	nd	na	nd	na	nd	na
Norflurazon	27314132	nd	na	nd	na	nd	na
Neburon	555373	nd	na	nd	na	nd	na
1-Naphthol	90153	nd	na	nd	na	nd	na
Methomyl	16752775	nd	na	nd	na	nd	na
Fenuron	101428	nd	na	nd	na	nd	na
Esfenvalerate	66230044	nd	na	nd	na	nd	na
DNOC	534521	nd	na	nd	na	nd	na
Diuron	330541	nd	na	nd	na	nd	na
Dinoseb	88857	nd	na	nd	na	nd	na
Dichlorprop	120365	nd	na	nd	na	nd	na
Dichlobenil	1194656	nd	na	nd	na	nd	na
Dacthal	1861321	nd	na	nd	na	nd	na
Clopyralid	57754855	nd	na	nd	na	nd	na
Chlorothalonil	1897456	nd	na	nd	na	nd	na
Chloramben	133904	nd	na	nd	na	nd	na
3-Hydroxycarbofuran		nd	na	nd	na	nd	na
Carbofuran	1563662	nd	na	nd	na	1.4	na
Carbaryl	63252	nd	na	nd	na	nd	na
Bromoxynil	1689992	nd	na	nd	na	0.06	na
Aldicarb	116063	nd	na	nd	na	nd	na
Aldicarb sulfone	1646884	nd	na	nd	na	nd	na
Aldicarb sulfoxide		nd	na	nd	na	nd	na
Acifluorfen	81335377	nd	na	nd	na	nd	na

nd = Not detected
na = Not analyzed

1st Sampling

TABLE C.2.4
New River
CARBOPACK B SPE Cartridge with HPLC-UV Analysis Pesticides

CONSTITUENT (µg/L)	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland	
Date		***04/11/96***		***04/10/96***		***04/09/96***	
		USA	***Mex***	***USA***	***Mex***	***USA***	***Mex***
Bromacil	314409	nd	na	nd	na	nd	na
Dicamba	1918009	nd	na	nd	na	nd	na
Linuron	330552	nd	na	nd	na	nd	na
MCPA	94746	nd	na	nd	na	nd	na
MCPB	94815	nd	na	nd	na	nd	na
Methiocarb	2032657	nd	na	nd	na	nd	na
Propoxur	114261	nd	na	nd	na	nd	na
Bentazon	25057890	nd	na	nd	na	nd	na
2,4-DB	94826	nd	na	nd	na	nd	na
Fluometuron	2164172	nd	na	nd	na	nd	na
Oxamyl	23135220	nd	na	nd	na	nd	na
2,4-D	94757	nd	na	nd	na	nd	na
2,4,5-T	93765	nd	na	nd	na	nd	na
Silvex	93721	nd	na	nd	na	nd	na
Trichlopyr	55335063	nd	na	nd	na	nd	na
Propham	122429	nd	na	nd	na	nd	na
Picloram	1918021	nd	na	nd	na	nd	na
Oryzalin	19044883	nd	na	nd	na	nd	na
Norflurazon	27314132	nd	na	nd	na	nd	na
Neburon	555373	nd	na	nd	na	nd	na
1-Naphthol	90153	nd	na	nd	na	nd	na
Methomyl	16752775	nd	na	nd	na	nd	na
Fenuron	101428	nd	na	nd	na	nd	na
Esfenvalerate	66230044	nd	na	nd	na	nd	na
DNOC	534521	nd	na	nd	na	nd	na
Diuron	330541	nd	na	nd	na	0.560	na
Dinoseb	88857	nd	na	nd	na	nd	na
Dichlorprop	120365	nd	na	nd	na	nd	na
Dichlobenil	1194656	nd	na	nd	na	nd	na
Dacthal	1861321	nd	na	nd	na	nd	na
Clopyralid	57754855	nd	na	nd	na	nd	na
Chlorothalonil	1897456	nd	na	nd	na	nd	na
Chloramben	133904	nd	na	nd	na	nd	na
3-Hydroxycarbofuran		nd	na	nd	na	nd	na
Carbofuran	1563662	nd	na	nd	na	nd	na
Carbaryl	63252	nd	na	nd	na	nd	na
Bromoxynil	1689992	nd	na	nd	na	nd	na
Aldicarb	116063	nd	na	nd	na	nd	na
Aldicarb sulfone	1646884	nd	na	nd	na	nd	na
Aldicarb sulfoxide		nd	na	nd	na	nd	na
Acifluorfen	81335377	nd	na	nd	na	nd	na

nd = Not detected
na = Not analyzed

2nd Sampling

TABLE C.2.5
New River
Major Nutrients

CONSTITUENT	Exceeds Any Criterion	Mexicali		Calexico		Westmorland		CECA vida acuática (dulce) (mg/L)
Date		***03/28/95***		***03/25/95***		***03/22/95***		
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**	
Total Nitrogen (mg/L as N)		3.7		8.1		10.0		
Dissolved Nitrogen (mg/L as N)		3.3		7.0		9.9		
Total Organic Nitrogen (mg/L as N)		1.0		2.0		1.1		
Dissolved Organic Nitrogen (mg/L as N)		0.6		0.9		1.0		
Ammonia Nitrogen (mg/L as N)	x	**2.2**	**2.0**	**5.7**	**5.5**	**3.5**	**3.7**	**0.06**
Nitrite Nitrogen (mg/L as N)		0.4		0.2		4.5		
Nitrate Nitrogen (mg/L as N)		0.4		0.2		4.5		
Dissolved Ammonia + Organic Nitrogen (mg/L as N)		2.8		6.6		4.5		
Total Ammonia + Organic Nitrogen (mg/L as N)		3.2		7.7		4.6		
NO_2 + NO_3 Nitrogen (mg/L as N)		0.5		0.4		5.4		
Total Phosphorus (mg/L as P)		0.8	0.5	1.4	1.4	0.9	0.6	
Dissolved Phosphorus (mg/L as P)	x	**0.8**		**0.7**		**0.6**		**0.0001**
Ortho Phosphorus (mg/L as P)		0.6	0.48	0.3	1.4	0.6	0.51	
Total Organic Carbon (mg/L as C)		12.0		17.0		12.0		
Dissolved Organic Carbon (mg/L as C)		6.1		8.0		6.3		
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for aquatic life (fresh water)								

1st Sampling

TABLE C.2.5
New River
Major Nutrients

CONSTITUENT	Exceeds Any Criterion	Mexicali		Calexico		Westmorland		CECA vida acuática (dulce) (µg/L)
Date		***04/11/96***		***04/10/96***		***04/09/96***		
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**	
Total Nitrogen (mg/L as N)								
Dissolved Nitrogen (mg/L as N)								
Total Organic Nitrogen (mg/L as N)								
Dissolved Organic Nitrogen (mg/L as N)								
Ammonia Nitrogen (mg/L as N)	x	**2.90**	**2.55**	**6.70**	**6.80**	**5.00**	**4.75**	**0.06**
Nitrite Nitrogen (mg/L as N)		0.02		0.03		1.00		
Nitrate Nitrogen (mg/L as N)		1.28		0.05		4.30		
Dissolved Ammonia + Organic Nitrogen (mg/L as N)		3.40		7.70		5.60		
Total Ammonia + Organic Nitrogen (mg/L as N)		3.50		9.80		6.10		
NO_2 + NO_3 Nitrogen (mg/L as N)		1.30		0.08		5.30		
Total Phosphorus (mg/L as P)		1.30	0.90	2.10	2.52	1.30	1.24	
Dissolved Phosphorus (mg/L as P)	x	**1.30**		**0.71**		**0.65**		**0.0001**
Ortho Phosphorus (mg/L as P)		0.81	0.78	0.20	1.01	0.58	0.39	
Total Organic Carbon (mg/L as C)		14.00		24.00		6.50		
Dissolved Organic Carbon (mg/L as C)		8.00		10.00		6.10		
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for aquatic life (fresh water)								

2nd Sampling

TABLE C.2.6
New River
General Water Quality Parameters

CONSTITUENT	Exceeds Any Criterion	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland		CMC (mg/L)	CCC (mg/L)	CECA vida acuática (dulce) (mg/L)
Date			**03/28/95**		**03/25/95**		**03/22/95**				
			USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**			
Temperature (°C)			19.5	21.0	19.5	21.0	19.5	21.2			NC+1.5
Flow (cfs)			187	187	212	212	742	742			
Specific Conductance (µS/cm)			5980	6130	5290	5370	4150	4180			
pH			7.8	7.9	7.9	7.9	7.9	6.7		6.5--9	
Total Hardness(mg/L $CaCO_3$)			1134	1045	1002	947	811	785			
Noncarb Diss. Hardness (mg/L)			862	543	693	464	575	362			
Calcium (mg/L)		7439896	240		220		180				
Magnesium (mg/L)		7439954	130		110		88				
Sodium (mg/L)		7440235	930		770		590				
Sodium adsorption ratio			12		10.6		9				
Sodium percent			63.3		61.8		60.7				
Potassium (mg/L)		7440097	30	21.48	25		15				
Chloride (mg/L)	x		**1300**	**1275**	**1200**	**1091**	**820**	**725**	**860**	**230**	**250**
Sulfate (mg/L)	x		**840**	**707**	**750**	**649**	**710**	**610**			**0.005**
Fluoride (mg/L)			0.7		0.7		0.6				1
Silica (mg/L)			20		19		15				
Alkalinity (mg/L)	x		**273**	**342**	**309**	**429**	**236**	**289**		**20**	
Dissolved Solids (mg/L)			3910	4086	3450	3368	2740	2648			
%Suspended Sediments <.062 mm.			61		13		70				
Bromide (mg/L)			1.9		1.5		0.9				
Suspended Sediments (mg/L)			16	26	13	32	451	254			
Cyanide (mg/L)											0.005
Methylene Blue Active Sub. (mg/L)											0.1
Oil and Grease (gravimetric) (mg/L)				6.63		5.6		1.77			
Phenols (mg/L)											0.1
Dissolved Oxygen (mg/L)	x			**2.33**		**2.33**		6.30			**5**
Chemical Oxygen Demand (mg/L)				98		102		63			
Biochemical Oxygen Demand (mg/L)				9		19		14			
Fecal Coliform (MPN/100mL)				150000*		24000		240000			
Total Coliform (MPN/100mL)											

CMC = Criterion Maximum Concentration - EPA water quality criterion for protection of aquatic life (acute exposures)
CCC = Criterion Continuous Concentration - EPA water quality criterion for protection of aquatic life (chronic exposures)

CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality for aquatic life (fresh water)

NC = Natural conditions

* = Exceeds the quantitative standard in IBWC Minute No. 264; monthly average value at New River upstream of discharge canal in MX established at 30,000 col/100mL; no single sample to exceed 60,000 col/100 mL.

1st Sampling

TABLE C.2.6

New River

General Water Quality Parameters

CONSTITUENT	Exceeds Any Criterion	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland		CMC (mg/L)	CCC (mg/L)	CECA vida acuática (dulce) (mg/L)
Date			**04/11/96**		**04/10/96**		**04/09/96**				
			USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**			
Temperature (°C)			24	23	24	22	22	22			NC+1.5
Flow (cfs)			145	145	177	177	777	777			
Specific Conductance (µS/cm)			6140	6230	5060	5040	3870	3830			
pH			7.8	7.8	7.9	7.3	7.9	7.6		6.5--9	
Total Hardness(mg/L $CaCO_3$)				958.0		941.0		753.0			
Noncarb Diss. Hardness (mg/L)				804		479		428			
Calcium (mg/L)		7439896	240		200		160				
Magnesium (mg/L)		7439954	120		100		81				
Sodium (mg/L)		7440235	900		730		530				
Sodium adsorption ratio											
Sodium percent											
Potassium (mg/L)		7440097	28	26.74	23	24.65	14	14.63			
Chloride (mg/L)	x		**1400**	**1280**	**1100**	**1002**	**720**	**764**	**860**	**230**	**250**
Sulfate (mg/L)	x		**910**	**589**	**750**	**395**	**690**	**491**			**0.005**
Fluoride (mg/L)			0.7		0.7		0.6				1
Silica (mg/L)			18		17		13				
Alkalinity (mg/L)	x		**300**	**337**	**318**	**350**	**240**	**245**		**20**	
Dissolved Solids (mg/L)			3880	3318	3230	2878	2500	2582			
%Suspended Sediments <.062 mm.											
Bromide (mg/L)			1.7		1.3		0.8				
Suspended Sediments (mg/L)			26	48	27	54	831	52			
Cyanide (mg/L)			nd	nd	nd	nd	nd	nd			0.005
Methylene Blue Active Sub.(mg/L)		57125	1.4		1.6		nd				0.1
Alkalinity (laboratory) (mg/L)			305		332		200				
pH (laboratory)			7.5		7.3		7.1				
Oil and Grease (gravimetric) (mg/L)			<1	6.6	<1	3.4	<1	4.1			
Specific Conductance (lab) (µS/cm)			5970		4980		3770				
Phenols (mg/L)			nd	nd	0.002	nd	nd	nd			0.1
Dissolved Oxygen (mg/L)	x			**0.2**		**1.42**		7.7			**5**
Chemical Oxygen Demand (mg/L)				48		67		39			
Biochemical Oxygen Demand (mg/L)				13		21		22			
Fecal Coliform (MPN/100mL)				240000*		240		4600000			
Total Coliform (MPN/100mL)											

nd = Not detected

CMC = Criterion Maximum Concentration - EPA water quality criterion for protection of aquatic life (acute exposures)

CCC = Criterion Continuous Concentration - EPA water quality criterion for protection of aquatic life (chronic exposures)

CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality for aquatic life (fresh water)

NC = Natural conditions

* = Exceeds the quantitative standard in IBWC Minute No. 264; monthly average value at New River upstream of discharge canal in MX established at 30,000 col/100mL; no single sample to exceed 60,000 col/100 mL.

2nd Sampling

TABLE C.2.7
New River
Trace Elements in Suspended Sediment

CONSTITUENT	Chemical Abstracts Service No.	Mexicali	Calexico	Westmorland
Date		***03/28/95***	***03/25/95***	***03/22/95***
Aluminum (Percent)	7429905	6.1	1.8	7.9
Antimony (µg/g)	7440360	1.1	0.7	0.8
Arsenic (µg/g)	7440382	15	10	11
Barium (µg/g)	7440393	420	180	500
Beryllium (µg/g)	7440417	1	nd	2
Cadmium (µg/g)	7440439	1.3	1.7	0.56
Chromium (µg/g)	7440473	97	67	100
Copper (µg/g)	7440508	120	89	38
Lead (µg/g)	7439921	52	70	27
Manganese (µg/g)	7439965	940	620	780
Vanadium (µg/g)	7440622	79	22	100
Zinc (µg/g)	7440666	350	250	120
Calcium (µg/g)	7440702	4.1	1.8	5.1
Iron (ug/g)	7439896	3.2	1.1	3.4
Magnesium (µg/g)	7439954	1.5	2	1.9
Molybdenum (µg/g)	7439987	7.5	5.7	4.6
Neodynium (µg/g)	7440008	21	6	28
Nickel (µg/g)	7440020	200	150	53
Niobium (µg/g)	7440031	6	nd	10
Phosporus (Percent)	7723140	0.92	6.5	0.2
Potassium (Percent)	7440097	1.7	2.4	2.1
Scandium (µg/g)	7440202	9	2	11
Silver (µg/g)	7440224	0.6	3.3	0.42
Sodium (Percent)	7440235	0.55	0.41	0.55
Strontium (µg/g)	7440246	360	240	320
Tantalum (µg/g)	7440257	nd	nd	nd
Thorium (µg/g)	7440291	8.4	2.2	12
Titanium (Percent)	7440326	0.24	0.06	0.32
Uranium (µg/g)	7440611	3.1	1.4	3.5
Yttrium (µg/g)	7440655	2	nd	2
Ytterbium (µg/g)	7440644	15	4	21
Bismuth (µg/g)	7440699	nd	nd	nd
Cobalt (µg/g)	7440473	11	5	13
Europium (µg/g)	7440531	nd	nd	nd
Gallium (µg/g)	7440553	14	6	19
Holmium (µg/g)	7440600	nd	nd	nd
Lanthanum (µg/g)	7440531	27	7	36
Tin (µg/g)	7440315	nd	37	nd
Lithium (µg/g)	7439932	48	15	59
Cerium (µg/g)	7440451	47	13	64
Gold (µg/g)	7440575	nd	nd	nd

nd = Not detected

1st Sampling

TABLE C.2.8
New River
Extractable Organic Compounds in Suspended Sediment

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	Mexicali	Calexico	Westmorland
Date		***03/28/95***	***03/25/95***	***03/22/95***
Hexachlorobenzene	118741	nd	nd	nd
Dibutylphthalate	84742	nd	nd	210
Dioctylphthalate	117840	7300	5600	nd
Diethylphthalate	84662	nd	nd	nd
Dimethylphthalate	131113	nd	nd	nd
Pyrene	129000	nd	nd	nd
Pyrene,1-methyl		nd	nd	nd
Benzo-a-pyrene	50328	nd	nd	nd
Indeno-1,2,3-cd-pyrene	193395	nd	nd	nd
2,2'-biquinoline		nd	nd	nd
Quinoline		nd	nd	nd
Phenanthridine		nd	nd	nd
Isoquinoline		nd	nd	nd
Toluene,2,4-dinitro	121142	nd	nd	nd
Toluene,2,6-dinitro	606202	nd	nd	nd
Benzo-k-fluoranthene	207089	nd	nd	nd
9H-fluorene,1-methyl		nd	nd	nd
9H-fluorene		nd	nd	nd
Isophorone	78591	nd	nd	nd
Methane, 2-chloroethoxy		nd	nd	nd
Naphthalene	91203	nd	nd	nd
Naphthalene, 1,2-dimethyl		nd	nd	nd
Naphthalene, 1,6-dimethyl		nd	nd	nd
Naphthalene, 2,3,6-trimethyl		nd	nd	nd
Naphthalene, 2,6-dimethyl		830	1800	120
Naphthalene, 2-chloro	91587	nd	nd	nd
Benzo(g,h,I)perylene	191242	nd	nd	nd
Phenanthrene	85018	nd	nd	nd
Phenanthrene, 1-methyl		nd	nd	nd
4-Hcypenphenanthrene		nd	nd	nd
Phenol	108952	1100	1300	E30.0
3,5-Xylenol		nd	nd	nd
m-Cresol, 4-chloro		nd	nd	nd
Phenol, C8-alkyl		nd	nd	nd
Phthalate, bis-2-ethylhexyl		nd	nd	3600
Phthalate, butylbenzyl	85687	nd	nd	100
Acenaphthylene	208968	nd	nd	nd
Acenaphthene	83329	nd	nd	nd
Acridine		nd	nd	nd
Dipropylamine, n-nitroso	621647	nd	nd	nd
Diphenylamine, n-nitroso	86306	nd	nd	nd

1st Sampling

TABLE C.2.8
New River
Extractable Organic Compounds in Suspended Sediment

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	Mexicali	Calexico	Westmorland
Date		***03/28/95***	***03/25/95***	***03/22/95***
Anthracene	120127	nd	nd	nd
Anthracene,2-methyl		nd	nd	nd
Benz-a-anthracene	56553	nd	nd	nd
9,10-Anthraquinone		nd	nd	nd
Benzene, 1,2,4-trichloro	120821	nd	nd	nd
Benzene, o-dichloro	95501	nd	nd	nd
Benzene, m-dichloro	541731	nd	nd	nd
Benzene, p-dichloro	106467	nd	nd	nd
Azobenzene	98953	nd	nd	nd
Nitrobenzene	98953	nd	nd	nd
Benzene, pentachloronitro	82688	nd	nd	nd
Carbazole		nd	nd	nd
Chrysene	218019	nd	nd	E49.0
p-Cresol		nd	430	81
Thiophene, dibenzo		nd	nd	nd
4-Bromophenylphenylether	101553	nd	nd	nd
4-Chlorophenylphenylether	7705723	nd	nd	nd
Benzo-b-fluoranthene	205992	nd	nd	nd
Pentachloroanisole		nd	nd	nd
Dibenz-(a,h)-anthracene	53703	nd	320	nd
Fluoranthene	206440	nd	nd	nd
Phenol, 2-chloro	955578	nd	nd	nd
Benzocinnoline		nd	nd	nd

nd = Not detected
E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)

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TABLE C.2.9
New River
Chlorinated Organic Compounds in Suspended Sediment

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	Westmorland	Calexico	Mexicali
Date		***03/22/95***	***03/25/95***	***03/28/95***
cis-Nonachlor	5103731	nd	nd	E21.0
trans-Nonachlor	39765805	nd	nd	62.0
Oxychlordane		nd	nd	nd
Aldrin	309002	nd	nd	nd
cis-Chlordane	5103742	nd	E20.0	69.0
trans-Chlordane	5103719	nd	nd	75.0
Chloroneb		nd	nd	nd
DCPA	1861321	32.0	nd	nd
o,p'-DDD		nd	nd	nd
p,p'-DDD	72548	nd	E25.0	E120
o,p'-DDE		nd	nd	nd
p,p'-DDE	72559	43.0	49.0	81.0
o,p'-DDT		nd	nd	nd
p,p'-DDT	50293	4.8	nd	130
Dieldrin	60571	nd	nd	nd
Endosulfan I	959988	nd	nd	nd
Endrin	72208	nd	nd	nd
Alpha BHC	319846	nd	nd	nd
Beta BHC	319857	nd	nd	nd
Heptachlor	76448	nd	nd	nd
Heptachlor epoxide	1024573	nd	nd	nd
Benzene, hexachloro	118741	nd	nd	nd
Isodrin		nd	nd	nd
Lindane	319868	nd	nd	nd
p,p'-Methoxychlor	72435	nd	nd	nd
o,p'-Methoxychlor		nd	nd	nd
Mirex	2385855	nd	nd	nd
cis-Permethrin	61949766	nd	nd	nd
trans-Permethrin	61949777	nd	nd	nd
Toxaphene	8001352	nd	nd	nd
PCB		nd	nd	nd
Pentachloroanisole		nd	nd	nd
Sample weight (g)		11.5	2.6	1.9

nd = Not detected
E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)

1st Sampling

TABLE C.2.10
New River
Trace Elements in Bed Sediment

CONSTITUENT	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland	
Date		***03/28/95***		***03/25/95***		***03/22/95***	
		USA	**Mex (mg/kg)**	**USA**	**Mex (mg/kg)**	**USA**	**Mex (mg/kg)**
Aluminum (Percent)	7429905	4.3		3.7		4.2	
Antimony (µg/g)	7440360	1		2		1	
Arsenic (µg/g)	7440382	5.8		4.1		2.3	
Barium (µg/g)	7440508	560		570		840	
Beryllium (µg/g)	7440417	nd		nd		nd	
Bismuth (µg/g)	7440699	nd		nd		nd	
Cadmium (µg/g)	7440439	0.4		0.3		0.1	
Calcium (µg/g)	7440702	3.2	218	2.5	179	2.2	103
Cerium (µg/g)	7440451	30		22		21	
Chromium (µg/g)	7440484	36	0.12	20	0.15	9	<0.04
Cobalt (µg/g)	7440473	13	<0.08	5	<0.08	2	<0.08
Copper (µg/g)	7440508	560	0.27	570	<0.4	840	<0.04
Europium (µg/g)	7440531	nd		nd		nd	
Gallium (µg/g)	7440553	9		7		8	
Gold (µg/g)	7440575	nd		nd		nd	
Holmium (µg/g)	7440600	nd		nd		nd	
Iron (Percent)	7439896	1.6	71	0.93	102	0.55	32
Lanthanum (µg/g)	7440531	18		14		12	
Lead (µg/g)	7439921	45		43		9	
Lithium (µg/g)	7439932	20	0.05	20	0.08	8	<0.03
Magnesium (µg/g)	7439954	0.77	33.6	0.47	54.51	0.23	13.9
Manganese (µg/g)	7439965	340	1.9	210	2.8	270	1.7
Mercury (µg/g)	7439976	0.35		nd		nd	
Molybdenum (µg/g)	7439987	2	<0.67	nd	<0.67	nd	<0.67
Neodymium (µg/g)	7440008	13		9		9	
Nickel (µg/g)	7440020	51		14		5	
Niobium (µg/g)	7440031	4		nd		nd	
Phosporus (Percent)	7723140	0.09		0.09		0.05	
Potassium (Percent)	7440097	1.7	9.8	1.7	13.95	1.5	2.6
Scandium (µg/g)	7440202	4		2		nd	
Selenium (µg/g)	7782492	1.2		1.2		0.2	
Silver (µg/g)	7440224	0.9	<0.024	0.5	<0.024	nd	<0.024
Sodium (Percent)	7440235	0.92		0.94		1.4	
Strontium (µg/g)	7440246	230		210		290	
Sulfur (µg/g)	7704349	0.32		0.22		nd	
Tantalum (µg/g)	7440257	nd		nd		nd	
Thorium (µg/g)	7440291	4.9		3.6		2.4	
Tin (µg/g)	7440315	nd		nd		nd	
Uranium (µg/g)	7440611	1.9		1.6		0.77	
Vanadium (µg/g)	7440622	38		21		11	
Yttrium (µg/g)	7440655	10		7		5	
Ytterbium (µg/g)	7440644	1		nd		nd	
Zinc (µg/g)	7440666	120		81		26	
Carbon-Organic (Percent)	7440440	1.13		0.68		0.12	
Carbon-Org+Inorg (Percent)		nd		nd		nd	
Carbon-Inorganic (Percent)		0.71		0.63		0.33	
Titanium (Percent)	7440326	0.18		0.11		0.07	

nd = Not detected

1st Sampling

TABLE C.2.10
New River
Trace Elements in Bed Sediment

CONSTITUENT	Chemical Abstracts Service No.	Mexicali	Calexico	Westmorland
Date		***04/11/96***	***04/10/96***	***04/09/96***
Aluminum (Percent)	7429905	7	9	4
Antimony (µg/g)	7440360	3	2	2
Arsenic (µg/g)	7440382	4	4	5
Barium (µg/g)	7440508	126	116	88
Beryllium (µg/g)	7440417	3	2	2
Bismuth (µg/g)	7440699			
Cadmium (µg/g)	7440439	3	2	2
Calcium (µg/g)	7440702	240	200	160
Cerium (µg/g)	7440451			
Chromium (µg/g)	7440484	4	3	5
Cobalt (µg/g)	7440473	3	2	2
Copper (µg/g)	7440508	10	6	7
Europium (µg/g)	7440531			
Gallium (µg/g)	7440553			
Gold (µg/g)	7440575			
Holmium (µg/g)	7440600			
Iron (Percent)	7439896	41	47	15
Lanthanum (µg/g)	7440531			
Lead (µg/g)	7439921	3	2	2
Lithium (µg/g)	7439932			
Magnesium (µg/g)	7439954	120	100	81
Manganese (µg/g)	7439965	215	187	104
Mercury (µg/g)	7439976	0.1	0.1	0.1
Molybdenum (µg/g)	7439987	15	14	14
Neodymium (µg/g)	7440008			
Nickel (µg/g)	7440020	12	13	5
Niobium (µg/g)	7440031			
Phosphorus (Percent)	7723140	1.3	0.71	0.65
Potassium (Percent)	7440097	28	23	14
Scandium (µg/g)	7440202			
Selenium (µg/g)	7782492	2	1	4
Silver (µg/g)	7440224	3	2	2
Sodium (Percent)	7440235	900	730	530
Strontium (µg/g)	7440246			
Sulfur (µg/g)	7704349			
Tantalum (µg/g)	7440257			
Thorium (µg/g)	7440291			
Tin (µg/g)	7440315			
Uranium (µg/g)	7440611	6	6	10
Vanadium (µg/g)	7440622	26	18	26
Yttrium (µg/g)	7440655			
Ytterbium (µg/g)	7440644			
Zinc (µg/g)	7440666	6	7	5
Carbon-Organic (Percent)	7440440	8	10	6.1
Carbon-Org+Inorg (Percent)				
Carbon-Inorganic (Percent)				
Titanium (Percent)	7440326			

2nd Sampling

TABLE C.2.11
New River
Extractable Organic Compounds in Bed Sediment

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland	
Date		***03/28/95***		***03/25/95***		***03/22/95***	
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**
Hexachlorobenzene	118741	nd	na	nd	na	nd	na
Dibutylphthalate	84742	95	na	87	na	E38.0	na
Dioctylphthalate	117840	450	na	150	na	nd	na
Diethyl Phthalate	84662	E15.0	na	E13.0	na	nd	na
Dimethyl Phthalate	131113	E18.0	na	nd	na	nd	na
Pyrene	129000	170	na	220	na	nd	na
Pyrene,1-methyl		52	na	E49.0	na	nd	na
BenzoaPyrene	50328	nd	na	89	na	nd	na
Ideno1,2,3-cdPyrene	193395	nd	na	110	na	nd	na
2,2'-biquinoline		nd	na	nd	na	nd	na
Quinoline		nd	na	nd	na	nd	na
Phenanthridine		nd	na	E18.0	na	nd	na
Isoquinoline		nd	na	E21.0	na	nd	na
Toluene,2,4-dinitro	121142	nd	na	nd	na	nd	na
Toluene,2,6-dinitro	606202	nd	na	nd	na	nd	na
BenzokFluroanthene	207089	87	na	92	na	nd	na
9H-fluorene,1-methyl		60	na	E19.0	na	nd	na
9H-fluorene		E17.0	na	E11.0	na	nd	na
Isophorone	78591	nd	na	nd	na	nd	na
Methane, 2-chloroethoxy		nd	na	nd	na	nd	na
Naphthalene	91203	E18.0	na	E25.0	na	nd	na
Naphthalene, 1,2-dimethyl		nd	na	nd	na	nd	na
Naphthalene, 1,6-dimethyl		99	na	E27.0	na	nd	na
Naphthalene, 2,3,6-trimethyl		74	na	E18.0	na	nd	na
Naphthalene, 2,6-dimethyl		210	na	76	na	nd	na
Naphthalene, 2-chloro	91587	nd	na	nd	na	nd	na
BenzoghiPerylene	191242	nd	na	61	na	nd	na
Phenanthrene	85018	87	na	110	na	nd	na
Phenanthrene, 1-methyl		150	na	61	na	nd	na
4-Hcypenphenanthrene		nd	na	E44.0	na	nd	na
Phenol	108952	E27.0	na	E16.0	na	E6.0	na
3,5-Xylenol		nd	na	nd	na	nd	na
m-Cresol, 4-chloro		nd	na	nd	na	nd	na
Phenol, C8-alkyl		nd	na	nd	na	nd	na
Phthalate, bis-2-ethylhexyl		1800	na	1700	na	130	na
Phthalate, butylbenzyl	85687	120	na	97	na	E37.0	na
Acenaphthylene	208968	nd	na	E8.0	na	nd	na
Acenaphthene	83329	nd	na	E7.0	na	nd	na
Acridine		nd	na	nd	na	nd	na
Dipropylamine, n-nitroso	621647	nd	na	nd	na	nd	na
Diphenylamine, n-nitroso	86306	nd	na	nd	na	nd	na

1st Sampling

TABLE C.2.11
New River
Extractable Organic Compounds in Bed Sediment

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland	
Date		***03/28/95***		***03/25/95***		***03/22/95***	
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**
Anthracene	120127	E34.0	na	E24.0	na	nd	na
Anthracene,2-methyl		120	na	E35.0	na	nd	na
BenzoaAnthracene	56553	84	na	110	na	nd	na
9,10-Anthraquinone		nd	na	nd	na	nd	na
Benzene, 1,2,4-trichloro	120821	nd	na	E28.0	na	nd	na
Benzene, o-dichloro	95501	E6.0	na	E21.0	na	nd	na
Benzene, m-dichloro	541731	nd	na	nd	na	nd	na
Benzene, p-dichloro	106467	160	na	86	na	nd	na
Azobenzene	98953	nd	na	nd	na	nd	na
Nitrobenzene	98953	nd	na	nd	na	nd	na
Benzene, pentachloronitro		nd	na	nd	na	nd	na
Carbazole		nd	na	E18.0	na	nd	na
Chrysene	218019	110	na	120	na	nd	na
p-Cresol		nd	na	300	na	nd	na
Thiophene, dibenzo		nd	na	nd	na	nd	na
4-Bromophenyl Phenyl Ether	101553	nd	na	nd	na	nd	na
4-Chlorophenyl Phenyl Ether	7705723	nd	na	nd	na	nd	na
BenzobFluoranthene	205992	90	na	89	na	nd	na
Pentachloroanisole		nd	na	nd	na	nd	na
Dibenzoa,hAnthracene	53703	nd	na	nd	na	nd	na
Fluoranthene	206440	150	na	220	na	nd	na
Phenol, 2-chloro	955578	nd	na	nd	na	nd	na
Benzocinnoline		nd	na	nd	na	nd	na

nd = Not detected

na = Not analyzed

E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)

TABLE C.2.11
New River
Extractable Organic Compounds in Bed Sediment

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland	
Date		***04/11/96***		***04/10/96***		***04/09/96***	
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**
Hexachlorobenzene	118741	nd	na	nd	na	nd	na
Dibutylphthalate	84742	110.0	na	110.0	na	87.0	na
Dioctylphthalate	117840	E 600.0	na	E 750.0	na	E 41.0	na
Diethyl Phthalate	84662	E 39.0	na	E 44.0	na	E 34.0	na
Dimethyl Phthalate	131113	nd	na	nd	na	nd	na
Pyrene	129000	100.0	na	290.0	na	E 35.0	na
Pyrene,1-methyl		E 46.0	na	67.0	na	E 20.0	na
BenzoaPyrene	50328	62.0	na	160.0	na	nd	na
Indeno 1,2,3-cdPyrene	193395	nd	na	nd	na	nd	na
2,2'-biquinoline		nd	na	nd	na	E 41.0	na
Quinoline		nd	na	nd	na	nd	na
Phenanthridine		nd	na	nd	na	nd	na
Isoquinoline		E 23.0	na	nd	na	nd	na
Toluene,2,4-dinitro	121142	nd	na	nd	na	nd	na
Toluene,2,6-dinitro	606202	nd	na	nd	na	nd	na
BenzokFluroanthene	207089	53.0	na	150.0	na	nd	na
9H-fluorene,1-methyl		nd	na	E 44.0	na	nd	na
9H-fluorene		E 29.0	na	E 33.0	na	E 19.0	na
Isophorone	78591	nd	na	nd	na	nd	na
Methane, 2-chloroethoxy		nd	na	nd	na	nd	na
Naphthalene	91203	E 11.0	na	53.0	na	nd	na
Naphthalene, 1,2-dimethyl		E 31.0	na	E 29.0	na	nd	na
Naphthalene, 1,6-dimethyl		79.0	na	110.0	na	nd	na
Naphthalene, 2,3,6-trimethyl		58.0	na	62.0	na	nd	na
Naphthalene, 2,6-dimethyl		480.0	na	690.0	na	E 26.0	na
Naphthalene, 2-chloro	91587	nd	na	nd	na	nd	na
BenzoghiPerylene	191242	nd	na	nd	na	nd	na
Phenanthrene	85018	58.0	na	278.0	na	E 15.0	na
Phenanthrene, 1-methyl		60.0	na	90.0	na	nd	na
4-Hcypenphenanthrene		nd	na	nd	na	nd	na
Phenol	108952	E 25.0	na	E 24.0	na	E 10.0	na
3,5-Xylenol		nd	na	nd	na	nd	na
m-Cresol, 4-chloro		nd	na	nd	na	nd	na
Phenol, C8-alkyl		nd	na	nd	na	nd	na
Phthalate, bis-2-ethylhexyl		E 13000.0	na	E 14000.0	na	E 670.0	na
Phthalate, butylbenzyl	85687	nd	na	100.0	na	51.0	na
Acenaphthylene	208968	nd	na	E 49.0	na	nd	na
Acenaphthene	83329	nd	na	E 21.0	na	nd	na
Acridine		nd	na	nd	na	nd	na
Dipropylamine, n-nitroso	621647	nd	na	nd	na	nd	na
Diphenylamine, n-nitroso	86306	nd	na	nd	na	nd	na

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TABLE C.2.11
New River
Extractable Organic Compounds in Bed Sediment

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland	
Date		***04/11/96***		***04/10/96***		***04/09/96***	
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**
Anthracene	120127	E 36.0	na	E 48.0	na	E 24.0	na
Anthracene,2-methyl		E 45.0	na	56.0	na	E 35.0	na
BenzoaAnthracene	56553	E 37.0	na	110.0	na	E 17.0	na
9,10-Anthraquinone		nd	na	120.0	na	nd	na
Benzene, 1,2,4-trichloro	120821	nd	na	nd	na	nd	na
Benzene, o-dichloro	95501	nd	na	nd	na	nd	na
Benzene, m-dichloro	541731	nd	na	nd	na	nd	na
Benzene, p-dichloro	106467	nd	na	94.0	na	nd	na
Azobenzene	98953	nd	na	nd	na	nd	na
Nitrobenzene	98953	nd	na	nd	na	nd	na
Benzene, pentachloronitro		nd	na	nd	na	nd	na
Carbazole		nd	na	nd	na	nd	na
Chrysene	218019	150.0	na	200.0	na	E 25.0	na
p-Cresol		110.0	na	610.0	na	E 27.0	na
Thiophene, dibenzo		nd	na	nd	na	nd	na
4-Bromophenyl Phenyl Ether	101553	nd	na	nd	na	nd	na
4-Chlorophenyl Phenyl Ether	7705723	nd	na	nd	na	nd	na
BenzobFluoranthene	205992	50.0	na	190.0	na	nd	na
Pentachloroanisole		nd	na	nd	na	nd	na
Dibenzoa,hAnthracene	53703	nd	na	nd	na	nd	na
Fluoranthene	206440	86.0	na	300.0	na	E 33.0	na
Phenol, 2-chloro	955578	nd	na	nd	na	nd	na
Benzocinnoline		nd	na	nd	na	nd	na
Mesitol		nd	na	E 23.0	na	nd	na

nd = Not detected
na = Not analyzed
E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)

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TABLE C.2.12
New River
Chlorinated Organic Compounds in Bed Sediment

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland	
Date		***03/28/95***		***03/25/95***		***03/22/95***	
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**
cis-Nonachlor	5103731	E1.2	na	nd	na	nd	na
trans-Nonachlor	39765805	4.1	na	1.6	na	nd	na
Oxychlordane		nd	na	nd	na	nd	na
Aldrin	309002	nd	na	nd	na	nd	na
cis-Chlordane	5103742	5.1	na	1.9	na	nd	na
trans-Chlordane	5103719	5.4	na	2	na	nd	na
Chloroneb		nd	na	nd	na	nd	na
DCPA	1861321	nd	na	nd	na	nd	na
o,p'-DDD		nd	na	nd	na	nd	na
p,p'-DDD	72548	E16.0	na	nd	na	nd	na
o,p'-DDE		nd	na	nd	na	nd	na
p,p'-DDE	72559	12	na	9.6	na	1.8	na
o,p'-DDT		nd	na	nd	na	nd	na
p,p'-DDT	50293	E25.0	na	nd	na	nd	na
Dieldrin	60571	nd	na	nd	na	nd	na
Endosulfan I	959988	nd	na	nd	na	nd	na
Endrin	72208	nd	na	nd	na	nd	na
Alpha BHC	319846	nd	na	nd	na	nd	na
Beta BHC	319857	nd	na	nd	na	nd	na
Heptachlor	76448	nd	na	nd	na	nd	na
Heptachlor epoxide	1024573	nd	na	nd	na	nd	na
Benzene, hexachloro	118741	nd	na	nd	na	nd	na
Isodrin	465736	nd	na	nd	na	nd	na
Lindane	319868	nd	na	nd	na	nd	na
p,p'-Methoxychlor	72435	nd	na	nd	na	nd	na
o,p'-Methoxychlor		nd	na	nd	na	nd	na
Mirex	2385855	nd	na	nd	na	nd	na
cis-Permethrin	61949766	nd	na	nd	na	nd	na
trans-Permethrin	61949777	nd	na	nd	na	nd	na
Toxaphene (µg/Kg)	8001352	nd	na	nd	na	nd	na
PCB (µg/Kg)		nd	na	nd	na	nd	na
Pentachloroanisole		nd	na	nd	na	nd	na

nd = Not detected
na = Not analyzed
E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)

1[st] Sampling

TABLE C.2.12
New River
Chlorinated Organic Compounds in Bed Sediment

CONSTITUENT (µg/Kg)	Chemical Abstracts Service No.	Mexicali		Calexico		Westmorland	
Date		***04/11/96***		***04/10/96***		***04/09/96***	
		USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**
cis-Nonachlor	5103731	nd	na	nd	na	nd	na
trans-Nonachlor	39765805	4.60	na	3.60	na	nd	na
Oxychlordane		nd	na	nd	na	nd	na
Aldrin	309002	nd	na	nd	na	nd	na
cis-Chlordane	5103742	8.40	na	6.10	na	nd	na
trans-Chlordane	5103719	9.70	na	6.80	na	nd	na
Chloroneb		nd	na	nd	na	nd	na
DCPA	1861321	nd	na	nd	na	nd	na
o,p'-DDD		nd	na	nd	na	nd	na
p,p'-DDD	72548	E 24.0	na	E 18.0	na	E 1.60	na
o,p'-DDE		nd	na	nd	na	nd	na
p,p'-DDE	72559	19.00	na	18.00	na	20.00	na
o,p'-DDT		nd	na	nd	na	nd	na
p,p'-DDT	50293	nd	na	7.80	na	nd	na
Dieldrin	60571	nd	na	nd	na	nd	na
Endosulfan I	959988	nd	na	nd	na	nd	na
Endrin	72208	nd	na	nd	na	nd	na
Alpha BHC	319846	nd	na	nd	na	nd	na
Beta BHC	319857	nd	na	nd	na	nd	na
Heptachlor	76448	nd	na	nd	na	nd	na
Heptachlor epoxide	1024573	nd	na	nd	na	nd	na
Benzene, hexachloro	118741	nd	na	nd	na	nd	na
Isodrin	465736	nd	na	nd	na	nd	na
Lindane	319868	nd	na	nd	na	nd	na
p,p'-Methoxychlor	***72435****	nd	na	nd	na	nd	na
o,p'-Methoxychlor		nd	na	nd	na	nd	na
Mirex	2385855	nd	na	nd	na	nd	na
cis-Permethrin	61949766	nd	na	nd	na	6.70	na
trans-Permethrin	61949777	nd	na	nd	na	nd	na
Toxaphene	8001352	nd	na	nd	na	nd	na
PCB		200	na	150	na	nd	na
Pentachloroanisole		nd	na	nd	na	nd	na

nd = Not detected
na = Not analyzed
E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)

2nd Sampling

TABLE C.2.13
New River
Volatile Organics in Water Column

CONSTITUENT (µg/L)	Exceeds Any Criterion	Chemical Abstracts Service No.	Westmorland		Calexico		Mexicali		Organism only (µg/L)	CECA vida acuática (dulce) (µg/L)
Date			***03/22/95***		***03/25/95***		***03/28/95***			
			USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**		
Dibromomethane		74953	nd	nd	nd	nd	nd	nd		
Dichlorobromomethane		124481	nd	nd	nd	nd	nd	nd		
Carbon Tetrachloride		56235	nd	nd	nd	nd	nd	nd	4.4	300
1,2-Dichloroethane		107062	nd	nd	nd	nd	nd	nd		1200
Bromoform		75252	nd	nd	nd	nd	nd	nd		
Chlorodibromomethane		124481	nd	nd	nd	nd	nd	nd	34	
Chloroform		67663	nd	nd	E0.300	nd	nd	nd	470	300
Toluene		108883	nd	nd	1.00	nd	1.00	nd	200000	200
Benzene		71432	nd	nd	nd	nd	nd	nd	71	50
Chlorobenzene		108907	nd	nd	nd	nd	nd	nd	21000	
Chloroethane		75003	nd	nd	nd	nd	nd	nd		
Ethylbenzene		100414	nd	nd	nd	nd	nd	nd	29000	
Methyl Bromide		74839	nd	nd	nd	nd	nd	nd	4000	
Methyl Chloride		74873	nd	nd	nd	nd	nd	nd		
Methylene Chloride		75092	nd	nd	nd	nd	nd	nd	1600	
Tetrachloroethylene		127184	nd	nd	nd	nd	nd	nd	8.85	50
Trichlorofluoromethane			nd	nd	nd	nd	nd	nd		
1,1-Dichloroethane		75343	nd	nd	nd	nd	nd	nd		
1,1-Dichloroethylene		75354	nd	nd	nd	nd	nd	nd	3.2	11600
1,1,1-Trichloroethane		71556	nd	nd	nd	nd	nd	nd		200
1,1,2-Trichloroethane		79005	nd	nd	nd	nd	nd	nd	42	200
1,1,2,2-Tetrachloroethane		79345	nd	nd	nd	nd	nd	nd	11	90
1,2-Dichlorobenzene		95501	nd	nd	nd	nd	nd	nd		
1,2-Dichloropropane		78875	nd	nd	nd	nd	nd	nd	39	
1,2-Trans-Dichloroethylene		156605	nd	nd	nd	nd	nd	nd	140000	
1,2,4-Trichlorobenzene		120821	nd	nd	nd	nd	nd	nd		
1,3-Dichlorobenzene		95578	nd	nd	nd	nd	nd	nd		
1,4-Dichlorobenzene		106467	nd	nd	0.700	nd	E0.600	nd		
Dichlorodifluoromethane		74718	nd	nd	nd	nd	nd	nd		
Naphthalene		91203	nd	nd	nd	nd	nd	nd		20
trans-1,3-Dichloropropene		10061026	nd	nd	nd	nd	nd	nd		
cis-1,3-dichloropropene		10061015	nd	nd	nd	nd	nd	nd		
Vinyl Chloride		75014	nd	nd	nd	nd	nd	nd	525	
Trichloroethylene		79016	nd	nd	nd	nd	nd	nd	81	10
Hexachlorobutadiene		87683	nd	nd	nd	nd	nd	nd		0.9
cis-1,2-Dichloroethene		156592	nd	nd	nd	nd	nd	nd		
Styrene		100425	nd	nd	nd	nd	nd	nd		
1,1-Dichloropropene		563586	nd	nd	nd	nd	nd	nd		
2,2-Dichloropropane		594207	nd	nd	nd	nd	nd	nd		
1,3-Dichloropropane		142289	nd	nd	nd	nd	nd	nd		

1st Sampling

TABLE C.2.13
New River
Volatile Organics in Water Column

Page 2

CONSTITUENT (µg/L)	Exceeds Any Criterion	Chemical Abstracts Service No.	Westmorland		Calexico		Mexicali		Organism only (µg/L)	CECA vida acuática (dulce) (µg/L)
Date			***03/22/95***		***03/25/95***		***03/28/95***			
			USA	**Mex**	**USA**	**Mex**	**USA**	**Mex**		
1,2,4-Trimethylbenzene		95636	nd	nd	E0.500	nd	E0.400	nd		
Isopropylbenzene		98828	nd	nd	nd	nd	nd	nd		
n-Propylbenzene		103651	nd	nd	nd	nd	nd	nd		
1,3,5-Trimethylbenzene		108678	nd	nd	nd	nd	nd	nd		
o-Chlorotoluene			nd	nd	nd	nd	nd	nd		
p-Chlorotoluene			nd	nd	nd	nd	nd	nd		
Bromochloromethane		74975	nd	nd	nd	nd	nd	nd		
n-Butylbenzene		104518	nd	nd	nd	nd	nd	nd		
sec-Butylbenzene		135988	nd	nd	nd	nd	nd	nd		
tert-Butylbenzene		98066	nd	nd	nd	nd	nd	nd		
p-Isopropyltoluene		99036	nd	nd	E0.400	nd	E0.400	nd		
1,2,3-Trichloropropane		96184	nd	nd	nd	nd	nd	nd		
1,1,1,2-Tetrachloroethane		630206	nd	nd	nd	nd	nd	nd		
1,2,3-Trichlorobenzene		87616	nd	nd	nd	nd	nd	nd		
1,2-Dibromoethane		74953	nd	nd	nd	nd	nd	nd		
Freon-113		76131	nd	nd	nd	nd	nd	nd		
Methyl tert-butylether			nd	nd	nd	nd	nd	nd		
Xylene		1330207	nd	nd	1.10	nd	1.00	nd		
Bromobenzene		108861	nd	nd	nd	nd	nd	nd		
Dibromochloropropane		96128	nd	nd	nd	nd	nd	nd		

nd = Not detected
E = Estimated value (chemical was present in insufficient quantities to be reliably quantified; it is below the minimum reporting value)
Organism only = EPA water quality criterion for protection of human health based on consumption of aquatic organisms
CECA = Criterios Ecológicos de Calidad del Agua - ecological water quality criteria for aquatic life (fresh water)

1st Sampling

APPENDIX D

MAXIMUM TISSUE RESIDUE LEVELS (MTRLs)

APPENDIX D

Maximum Tissue Residue Levels (MTRLs) Calculated from Water Quality Objectives and BCF for Carcinogens Analyzed in the Study

Substance	Water Quality Objective [a] (µg/l)	BCF [b] (l/kg)	MTRL [c] (µg/kg, ppb)
aldrin	0.00013	**d**	0.05
arsenic	5.0 [e]	44	200.0 (0.2 ppm)
chlordane (total)	0.00008	14100	1.1
DDT (total)	0.00059	53600	32.0
dieldrin	0.00014	4670	0.65
heptachlor	0.00016	11200	1.8
heptachlor epoxide	0.00007	11200	0.8
hexachlorobenzene (HCB)	0.00066	8690	6.0
hexachlorocyclohexane (HCH), alpha	0.0039	130	0.5
hexachlorocyclohexane (HCH), beta	0.014	130	1.8
hexachlorocyclohexane (HCH), gamma	0.019	130	2.5
PCBs (total)	0.00007	31200	2.2
toxaphene	0.00067	13100	8.8

Maximum Tissue Residue Levels (MTRLs) Calculated from Water Quality Objectives and BCF for Non-carcinogens Analyzed in the Study

Substance	Water Quality Objective [a] (mg/l)	BCF [b] (l/kg)	MTRL [c] (mg/kg, ppm)
cadmium	0.01	64	0.64
endosulfan (total)	0.0009	270	0.25 (250 ppb)
endrin	0.0008	3970	3.0 (3,000 ppb)
mercury	0.000012	**f**	1.0
nickel	0.6	47	28.0

a. From Draft November 26, 1990 Functional Equivalent Document - Development of Water Quality Plans For: Inland Surface Waters of California and Enclosed Bays and Estuaries of California (SWRCB 1990a) and the Draft April 9, 1991 Supplement to the Functional Equivalent Document (SWRCB 1991). MTRLs were not developed for objectives based on maximum contaminant levels (MCLs) or taste and odor criteria.

b. Bioconcentration Factors taken from the EPA 1980 Ambient Water Quality Criteria Documents for each substance.

c. MTRLs were calculated by multiplying the Water Quality Objective by the BCF, except for aldrin, arsenic, and mercury.

d. Aldrin MTRL is derived from a combination of aldrin and dieldrin risk factors and BCFs as recommended in the EPA 1980 "Ambient Water Quality Criteria for Aldrin/Dieldrin" (EPA 1980).

e. Arsenic MTRL was calculated from the formula NSRL ÷ (WI/BCF) + FC = MTRL. [NSRL (California's No Significant Risk Level for arsenic) = 10 µg/d, WI (Water Intake) = 2 l/d, FC (daily fish consumption) = 0.0065 kg/d].

f. The MTRL for mercury is the FDA action level. The water quality objective for mercury in the Inland Surface Waters Plan is based on the FDA action level as recommended in the EPA 1985 "Ambient Water Quality Criteria for Mercury" (EPA 1985).

Quantitation Limit for Synthetic Organic Compounds and Trace Elements Analyzed in Flesh

Compound	Quantitation Limit (µg/kg, ppb wet weight)
aldrin	5
chlorbenside	50
cis-chlordane	5
trans-chlordane	5
chlordene, alpha	5
chlordene, gamma	5
chlorpyrifos	10
dacthal	5
DDD, o,'p	10
DDD, p,p'	10
DDE, o,p'	10
DDE, p,p'	5
DDMU,p,p'	15
DDT, o,p'	10
DDT, p,p'	10
diazinon	50
dichlorobenzophenone-p,p'	30
dicofol (Kelthane)	100
dieldrin	5
endosulfan I	5
endosulfan II	70
endosulfan sulfate	85
endrin	15
ethion	20
HCH, alpha	2
HCH, beta	10
HCH, gamma	2
HCH, delta	5
heptachlor	5
heptachlor epoxide	5
HCB	2
methoxychlor	15
cis-nonachlor	5
trans-nonachlor	5
oxadiazon	5
oxychlordane	5
parathion, ethyl	10
parathion, methyl	10
PCB 1248	50
PCB 1254	50
PCB 1260	50
tetradifon (Tedion)	10
toxaphene	100
arsenic	50 (0.05 ppm)
cadmium	10 (0.01 ppm)
mercury	20 (0.02 ppm)
nickel	100 (0.1 ppm)

APPENDIX E

SYNTHETIC ORGANIC COMPOUNDS IN FISH LIPIDS

APPENDIX E

Organic Chemicals in Lipid Data in Fish (ppb, lipid weight)

Station	Species Code	Date	Aldrin	alpha-chlordane	cis-chlordane	gamma-chlordane	trans-chlordane	cis nonachlor	trans-nonachlor	oxy-chlordane	Total chlordane
Westmorland	CP[1]	06/16/95	nd[2]	nd	nd	nd	nd	nd	nd	nd	nd
Westmorland	CCF	06/16/95	nd	nd	657.4	nd	484.4	346.0	830.4	nd	2318.3
Westmorland	CP	04/10/96	nd	nd	567.7	nd	436.7	318.8	611.4	nd	1934.5
Westmorland	CCF	04/10/96	nd	nd	310.7	nd	234.5	155.4	367.2	nd	1067.8
Calexico	CP	06/28/95	nd	81.3	634.1	141.5	520.3	195.1	471.5	nd	2043.9
All American Canal	CP	06/14/95	nd	nd	70.7	nd	nd	89.9	118.7	nd	279.4
All American Canal	CCF	06/14/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
All American Canal	CP	12/05/95	nd	nd	nd	nd	nd	nd	295.2	nd	295.2
All American Canal	LMB	12/05/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
Yuma Main Drain/Outlet	CP	06/21/95	364.4	nd	nd	nd	nd	nd	nd	nd	nd

[1] Fish species: CP (carp); CCF (channel catfish); LMB (largemouth bass)
[2] nd means that the chemical is not detected

APPENDIX E (Continued)

Station	Species Code	Date	Chlorpyri-fos	Dacthal	Dieldrin	Dicofol	Diazinon	Endosulfa I	Endo-sulfan II	Endo-sulfan sulfate	Total Endo-sulfan
Westmorland	CP[1]	06/16/95	nd[2]	1146.4	1093.5	nd	nd	1199.3	nd	nd	1199.3
Westmorland	CCF	06/16/95	588.2	865.1	1107.3	nd	nd	1280.3	nd	nd	1280.3
Westmorland	CP	04/10/96	nd	4279.5	611.4	nd	nd	2751.1	1703.1	nd	4454.1
Westmorland	CCF	04/10/96	nd	3389.8	762.7	nd	nd	3107.3	1638.4	nd	4745.8
Calexico	CP	06/28/95	748.0	95.9	126.8	nd	1056.9	nd	nd	nd	nd
All American Canal	CP	06/14/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
All American Canal	CCF	06/14/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
All American Canal	CP	12/05/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
All American Canal	LMB	12/05/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
Yuma Main Drain/Outlet	CP	06/21/95	nd	nd	nd	nd	nd	5668.0	2024.3	2064.8	9757.1

[1] Fish species: CP (carp); CCF (channel catfish); LMB (largemouth bass)
[2] nd means that the chemical is not detected

APPENDIX E (Continued)

Station	Species Code	Date	o,p' DDD	p,p' DDD	o,p'DDE	p,p'DDE	o,p DDT	p,p' DDT	p,pDDMU	p,p DDMS	Total DDT
Westmorland	CP[1]	06/16/95	nd[2]	2645.5	nd	146384.5	nd	nd	nd	na[3]	149030.0
Westmorland	CCF	06/16/95	nd	2110.7	nd	38062.3	nd	657.4	553.6	na	41384.1
Westmorland	CP	04/10/96	611.4	2532.8	nd	31004.4	nd	nd	698.7	na	34847.2
Westmorland	CCF	04/10/96	nd	1158.2	nd	20904.0	nd	452.0	nd	na	22514.1
Calexico	CP	06/28/95	325.2	1528.5	nd	2926.8	nd	nd	nd	na	4780.5
All American Canal	CP	06/14/95	nd	251.8	nd	2997.6	nd	nd	nd	na	3249.4
All American Canal	CCF	06/14/95	nd	223.1	nd	1501.0	nd	nd	nd	na	1724.1
All American Canal	CP	12/05/95	nd	479.7	nd	9225.1	nd	nd	nd	na	9704.8
All American Canal	LMB	12/05/95	nd	nd	nd	15384.6	nd	nd	nd	na	15384.6
Yuma Main Drain/Outlet	CP	06/21/95	nd	1052.6	nd	23886.6	nd	nd	nd	na	24939.3

[1] Fish species: CP (carp); CCF (channel catfish); LMB (largemouth bass)
[2] nd means that the chemical is not detected
[3] na means that the sample was not analyzed for the chemical

APPENDIX E (Continued)

Station	Species Code	Date	Endrin	Ethion	alpha-HCH	beta-HCH	delta-HCH	Lindane	Total HCH	Heptachlor -epoxide	HCB
Westmorland	CP[1]	06/16/95	nd[2]	nd	nd	nd	nd	nd	nd	nd	nd
Westmorland	CCF	06/16/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
Westmorland	CP	04/10/96	nd	nd	nd	nd	nd	nd	nd	nd	170.3
Westmorland	CCF	04/10/96	nd	nd	nd	nd	nd	nd	nd	nd	118.6
Calexico	CP	06/28/95	nd	nd	nd	nd	nd	68.3	68.3	nd	162.6
All American Canal	CP	06/14/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
All American Canal	CCF	06/14/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
All American Canal	CP	12/05/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
All American Canal	LMB	12/05/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
Yuma Main Drain/Outlet	CP	06/21/95	364.4	nd	364.4	nd	nd	nd	nd	nd	nd

[1] Fish species: CP (carp); CCF (channel catfish); LMB (largemouth bass)
[2] nd means that the chemical is not detected

APPENDIX E (Continued)

Station	Species Code	Date	Methoxy-chlor	Oxa-diazon	Ehtyl-parathion	Methyl-parathion	PCB 1248	PCB 1254	PCB 1260	Total PCB	Toxaphene
Westmorland	CP[1]	06/16/95	nd[2]	nd	nd	nd	nd	nd	21164.0	21164.0	17636.7
Westmorland	CCF	06/16/95	nd	nd	nd	nd	nd	nd	2733.6	2733.6	25951.6
Westmorland	CP	04/10/96	nd	nd	nd	nd	nd	4803.5	10917.0	15720.5	11790.4
Westmorland	CCF	04/10/96	nd	nd	nd	nd	nd	nd	2570.6	2570.6	8192.1
Calexico	CP	06/28/95	nd	nd	nd	nd	2926.8	1593.5	nd	4520.3	1951.2
All American Canal	CP	06/14/95	nd	nd	nd	nd	nd	1007.2	599.5	1606.7	nd
All American Canal	CCF	06/14/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
All American Canal	CP	12/05/95	nd	nd	nd	nd	nd	2583.0	1992.6	4575.6	nd
All American Canal	LMB	12/05/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
Yuma Main Drain/Outlet	CP	06/21/95	nd	nd	nd	nd	nd	nd	nd	nd	5668.0

[1] Fish species: CP (carp); CCF (channel catfish); LMB (largemouth bass)
[2] nd means that the chemical is not detected

APPENDIX E (Continued)

Station	Species Code	Date	Aldrin	alpha-chlordane	cis-chlrodane	gamma-chlordane	trans-chlordane	cis nonachlor	trans-nonachlor	oxy-chlordane	Total chlordane
Yuma Main Drain/Outlet	LMB[1]	06/21/95	nd[2]	nd	nd	nd	nd	nd	nd	nd	nd
Yuma Main Drain/Outlet	CP	04/10/96	nd	nd	273.5	nd	nd	nd	538.1	nd	811.7
Yuma Main Drain/Outlet	CCF	04/10/96	nd	nd	316.9	nd	nd	nd	464.5	nd	781.4
Colorado R/Inter Boundary	CP	06/13/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
Colorado R/Inter Boundary	LMB	06/13/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
Colorado R/Inter Boundary	CP	12/05/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
Colorado R/Inter Boundary	LMB	12/05/95	nd	nd	nd	nd	nd	nd	nd	nd	nd

[1] Fish species: CP (carp); CCF (channel catfish); LMB (largemouth bass)
[2] nd means that the chemical is not detected

APPENDIX E (Continued)

Station	Species Code	Date	Chlorpyri-fos	Dacthal	Dieldrin	Dicofol	Diazinon	Endosulfa I	Endo-sulfan II	Endo-sulfan sulfate	Total Endo-sulfan
Yuma Main Drain/Outlet	LMB[1]	06/21/95	nd[2]	nd	nd	nd	nd	nd	nd	nd	nd
Yuma Main Drain/Outlet	CP	04/10/96	nd	493.3	394.6	nd	nd	nd	nd	nd	nd
Yuma Main Drain/Outlet	CCF	04/10/96	nd	404.4	333.3	nd	nd	nd	nd	nd	nd
Colorado R/Inter Boundary	CP	06/13/95	nd	nd	nd	nd	nd	90.3	nd	nd	nd
Colorado R/Inter Boundary	LMB	06/13/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
Colorado R/Inter Boundary	CP	12/05/95	nd	271.4	nd	nd	nd	297.4	nd	nd	297.4
Colorado R/Inter Boundary	LMB	12/05/95	nd	nd	nd	nd	nd	nd	nd	nd	nd

[1] Fish species: CP (carp); CCF (channel catfish); LMB (largemouth bass)
[2] nd means that the chemical is not detected

APPENDIX E (Continued)

Station	Species Code	Date	o,p' DDD	p,p' DDD	o,p'DDE	p,p'DDE	o,p DDT	p,p' DDT	p,pDDMU	p,p DDMS	Total DDT
Yuma Main Drain/Outlet	LMB[1]	06/21/95	nd[2]	nd	nd	6666.7	nd	nd	nd	na	66666.7
Yuma Main Drain/Outlet	CP	04/10/96	538.1	2735.4	627.8	76233.2	nd	nd	986.5	na	81121.1
Yuma Main Drain/Outlet	CCF	04/10/96	nd	2732.2	765.0	51366.1	nd	1803.3	nd	na	56666.7
Colorado R/Inter Boundary	CP	06/13/95	nd	nd	nd	3055.6	nd	nd	nd	na	3055.6
Colorado R/Inter Boundary	LMB	06/13/95	nd	nd	nd	13740.5	nd	nd	nd	na	13740.5
Colorado R/Inter Boundary	CP	12/05/95	nd	nd	nd	8178.4	nd	nd	nd	na	8178.4
Colorado R/Inter Boundary	LMB	12/05/95	nd	nd	nd	8469.5	nd	nd	nd	na	8469.5

[1] Fish species: CP (carp); CCF (channel catfish); LMB (largemouth bass)
[2] nd means that the chemical is not detected

APPENDIX E (Continued)

Station	Species Code	Date	Endrin	Ethion	alpha-HCH	beta-HCH	delta-HCH	Lindane	Total HCH	Heptachlor -epoxide	HCB
Yuma Main Drain/Outlet	LMB[1]	06/21/95	nd[2]	nd	nd	nd	nd	nd	nd	nd	nd
Yuma Main Drain/Outlet	CP	04/10/96	nd	nd	nd	nd	nd	nd	nd	nd	nd
Yuma Main Drain/Outlet	CCF	04/10/96	nd	nd	nd	nd	nd	nd	nd	nd	nd
Colorado R/Inter Boundary	CP	06/13/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
Colorado R/Inter Boundary	LMB	06/13/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
Colorado R/Inter Boundary	CP	12/05/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
Colorado R/Inter Boundary	LMB	12/05/95	nd	nd	nd	nd	nd	nd	nd	nd	nd

[1] Fish species: CP (carp); CCF (channel catfish); LMB (largemouth bass)
[2] nd means that the chemical is not detected

APPENDIX E (Continued)

Station	Species Code	Date	Methoxy-chlor	Oxa-diazon	Ehtyl-parathion	Methyl-parathion	PCB 1248	PCB 1254	PCB 1260	Total PCB	Toxaphene
Yuma Main Drain/Outlet	LMB[1]	06/21/95	nd[2]	nd	nd	nd	nd	nd	nd	nd	nd
Yuma Main Drain/Outlet	CP	04/10/96	nd	nd	nd	nd	nd	4932.7	nd	4932.7	18385.7
Yuma Main Drain/Outlet	CCF	04/10/96	nd	nd	nd	nd	nd	3770.5	nd	3770.5	22950.5
Colorado R/Inter Boundary	CP	06/13/95	nd	nd	nd	nd	nd	nd	nd	nd	1805.6
Colorado R/Inter Boundary	LMB	06/13/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
Colorado R/Inter Boundary	CP	12/05/95	nd	nd	nd	nd	nd	nd	nd	nd	nd
Colorado R/Inter Boundary	LMB	12/05/95	nd	nd	nd	nd	nd	nd	nd	nd	nd

[1] Fish species: CP (carp); CCF (channel catfish); LMB (largemouth bass)
[2] nd means that the chemical is not detected