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# Implementation Plan for Dallas and Tarrant County Legacy Pollutant TMDLs

For Segments 0805, 0841, and 0841A

Prepared by the:
Strategic Assessment Division, TMDL Team
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# Implementation Plan for Dallas and Tarrant County Legacy Pollutant TMDLs

## Introduction

In keeping with the Texas commitment to restore and maintain water quality in impaired water bodies, the Texas Natural Resource Conservation Commission (TNRCC) recognized from the inception of the total maximum daily load (TMDL) program that implementation plans would need to be established for each TMDL developed.

The TMDL is a technical analysis that:

(1) determines the maximum loadings of the pollutant a water body can receive and still both attain and maintain its water quality standards, and

(2) allocates this allowable loading to point and non-point source categories in the watershed.

Based on the TMDL, an implementation plan is then developed. An implementation plan is a detailed description of regulatory and voluntary management measures that are intended to achieve the pollutant reductions identified in the TMDL, and a schedule under which the commission anticipates TMDL implementation will proceed. The plan is a flexible tool that governmental and non-governmental agencies involved in TMDL implementation will use to guide their program management. Actual implementation will be accomplished by the participating entities by rule, order, guidance, or other appropriate formal or informal action.

The implementation plan contained herein will provide the following components:

(1) a description of control actions and management measures[1] that generally will be implemented to achieve the water quality target;

(2) legal authority under which the participating agencies may require implementation of the control actions;

(3) development of a schedule for implementing activities to achieve TMDL objectives;

(4) a follow-up surface water quality monitoring plan to determine the effectiveness of the control actions and management measures undertaken;

(5) a statement as to why TNRCC has concluded that the implementation of voluntary management measures will achieve the load allocations for nonpoint sources; and

[1] Control actions refer to point source pollutant reduction strategies, generally TPDES permits. Management measures refer to nonpoint source pollutant reduction strategies, generally voluntary best management practices.

(6) identification of measurable outcomes TNRCC will review to determine whether the implementation plan has been properly executed and whether water quality standards are being achieved.

This implementation plan is designed to guide the achievement of reductions in legacy pollutant concentrations in fish tissue in Tarrant and Dallas County water bodies as defined in the adopted TMDLs.

This implementation plan was prepared by:

- the TMDL Team in the Strategic Assessment Division of the Office of Environmental Policy, Analysis, and Assessment of the TNRCC, and
- the Region 4 Office of the Field Operations Division of the Office of Compliance and Enforcement of the TNRCC.

Technical assistance was provided by:

- the Seafood Safety Division of the Texas Department of Health,
- the U.S. Geological Survey,
- the City of Fort Worth Department of Environmental Management, and
- the City of Dallas Storm Water Quality Division.

This implementation plan was approved by the TNRCC on August 10, 2001. This implementation plan, combined with the TMDL, establishes a Watershed Action Plan (WAP). A WAP provides local, regional, and state organizations a comprehensive strategy for restoring and maintaining water quality in an impaired water body. TNRCC has primary responsibility for ensuring that water quality standards are restored and maintained in impaired water bodies.

# Summary of TMDLs

The water bodies addressed by the TMDL document (*Nine Total Maximum Daily Loads for Legacy Pollutants in Streams and a Reservoir in Dallas and Tarrant Counties*, TNRCC 2000b) are portions of two Trinity River segments in Dallas and Tarrant Counties and an unclassified reservoir in southwest Dallas County (see Figure 1). These water bodies were included on the State of Texas §303(d) lists as a result of the issuance of Aquatic Life Orders by the Texas Department of Health (TDH), which prohibit the consumption of fish (Table 1; see TDH 2001). Consumption bans were issued following determinations of unacceptable human health risk due to elevated concentrations of one or more legacy pollutants in fish tissue. Legacy pollutant is a collective term used to describe substances whose uses have been banned or severely restricted by the U.S. Environmental Protection Agency (EPA). Because of their slow rate of decomposition, these substances frequently remain at elevated levels in the environment for many years after their widespread use has ended.

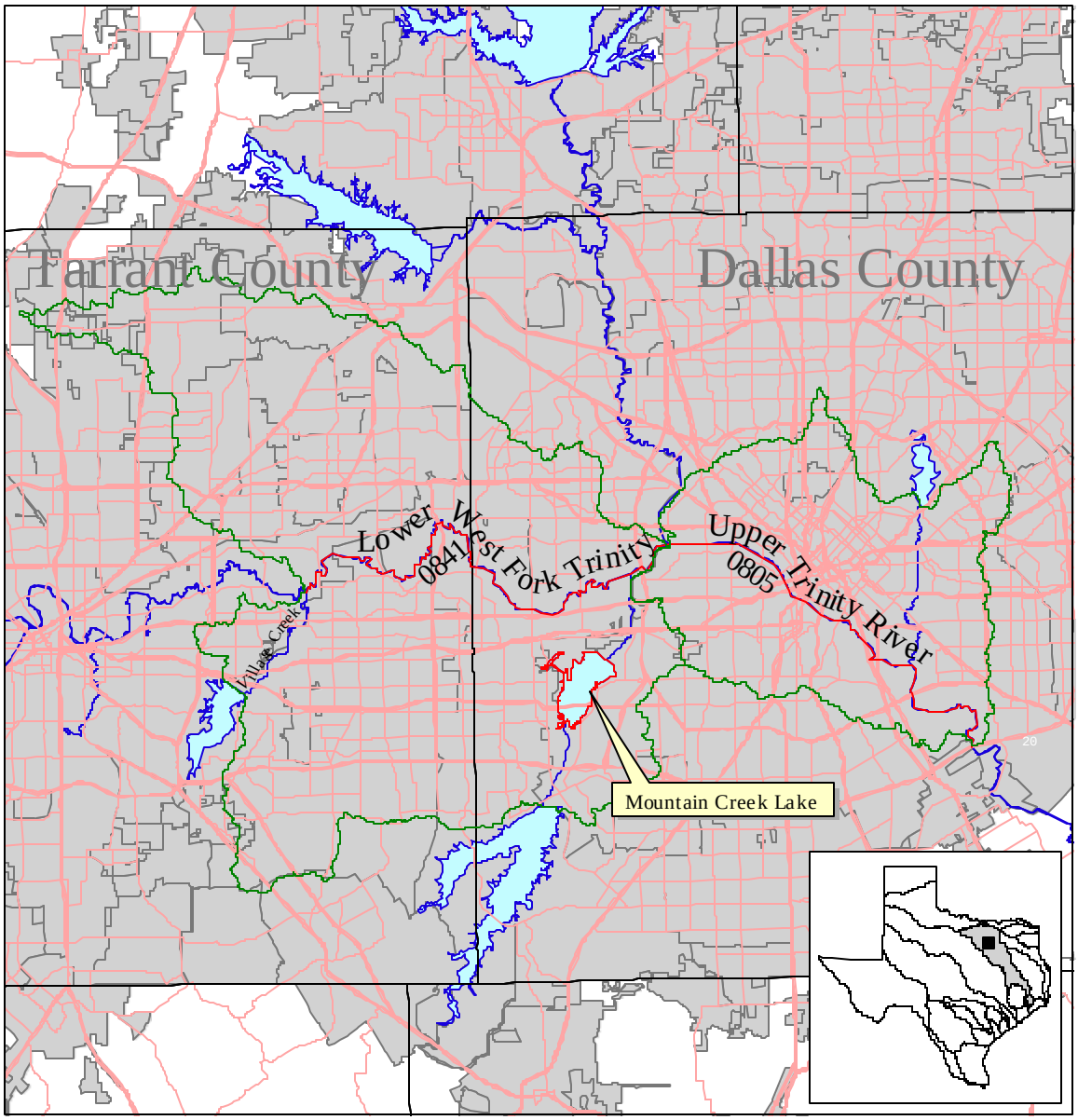


Figure 1. Locations of impaired water bodies
Lower West Fork Trinity River (Segment 0841), Upper Trinity River (Segment 0805), and Mountain Creek Lake (Segment 0841A).

TABLE 1. Water bodies listed on the 303(d) list due to legacy pollutant concentrations in fish tissue resulting in the issuance of a fish consumption ban by the Texas Department of Health, and endpoint targets necessary to meet the fish consumption use.

| Segment | Fish Tissue Contaminants | TDH Action | Endpoint Targets |
|---|---|---|---|
| 0805 - Upper Trinity River (upper 19 miles) | Chlordane | 01/1990 | $\leq$ 1.17 mg/kg chlordane in fish tissue for adults<br>$\leq$ 0.50 mg/kg chlordane in fish tissue for children |
| 0841 - Lower West Fork Trinity River | Chlordane | 01/1990 | $\leq$ 1.17 mg/kg chlordane in fish tissue for adults<br>$\leq$ 0.50 mg/kg chlordane in fish tissue for children |
| 0841A - Mountain Creek Lake | Chlordane, DDT, DDD, DDE, Dieldrin, Heptachlor epoxide, and PCBs | 04/1996 | additive cancer risk $\leq 2.33 \times 10^{-4}$<br>cumulative noncarcinogenic hazard index $\leq$ 1 |
| All water bodies | --- | --- | Removal of fish consumption ban |

Chlordane contamination in the Trinity River appears to have originated from urban runoff, as the watershed for the impaired portion is highly urbanized (Figure 2). Erosion as a result of extensive urban development over the past 10 to 15 years may have contributed chlordane attached to source soil particles.

Legacy pollutant contamination in Mountain Creek Lake (Figure 3) probably originated from a variety of land use sources. Agricultural runoff was a dominant contributor prior to the upstream construction of Joe Pool Lake in 1985; however, extensive urban development has subsequently occurred in the watershed, particularly west of the lake. The U.S. Navy is conducting RCRA Facility Investigations at the U.S. Naval Air Station Dallas (NASD) and the adjacent U.S. Naval Weapons Industrial Reserve Plant (NWIRP) on the northwest corner of the lake (Figure 4). These investigations have discovered legacy pollutant contamination (PCBs in particular) at some of the waste management units at these sites. Cleanup of legacy pollutant contamination at NASD and NWIRP is being addressed through the TNRCC Defense and State Memorandum of Agreement Program.

Because of the particular nature of these TMDLs, the TNRCC modified the typical load allocation approach of more conventional TMDLs, which typically limits the amount of a pollutant that can be added to an impaired water body. Because legacy pollutants are already restricted, and no significant additional loading is expected, the TMDLs do not specifically attempt to quantify allowable loads for these contaminants. The allowable load is based on acceptable, risk-based fish tissue concentrations.

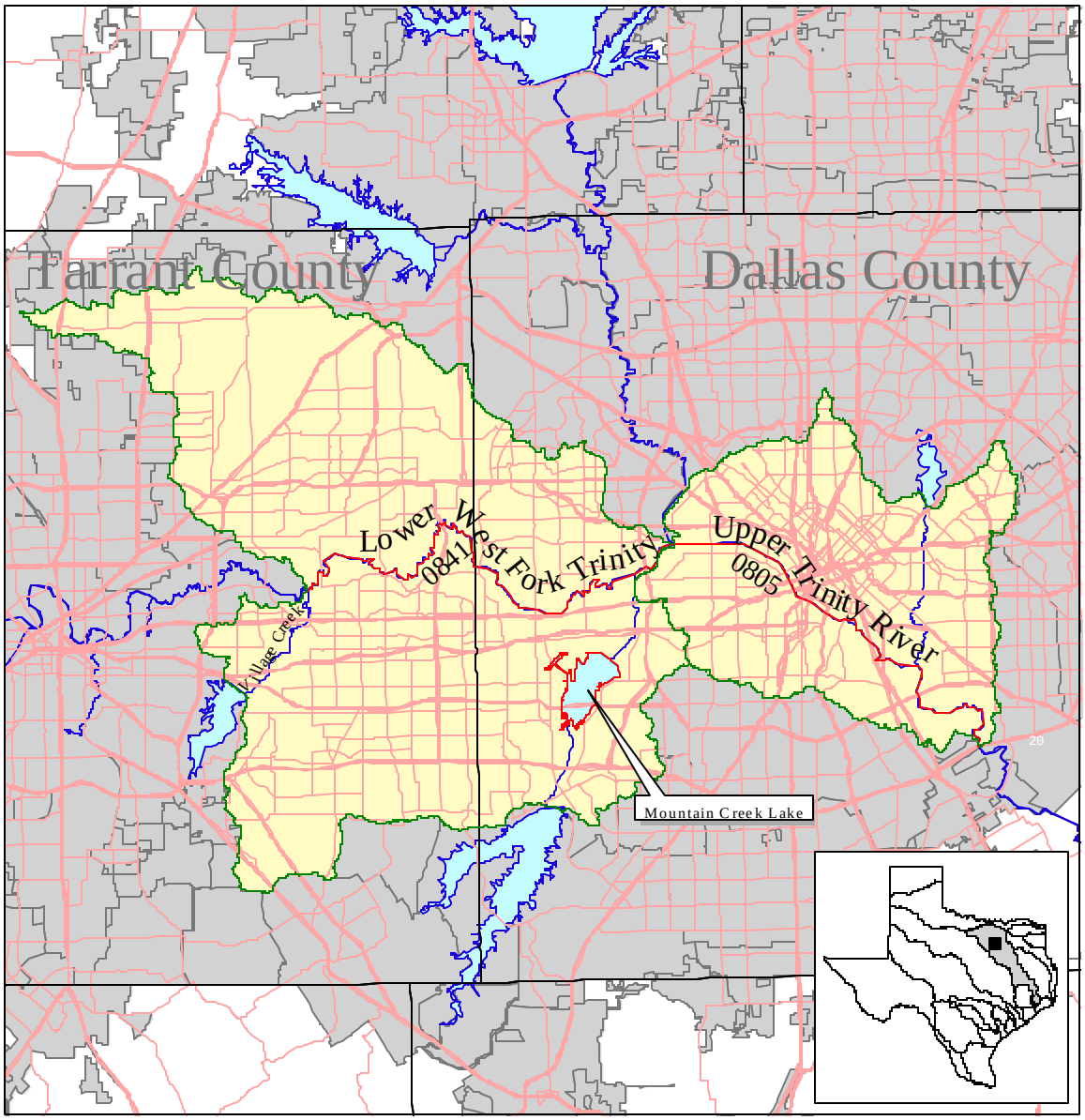


Figure 2. Lower West Fork Trinity River (Segment 0841) and Upper Trinity River (Segment 0805) watersheds.

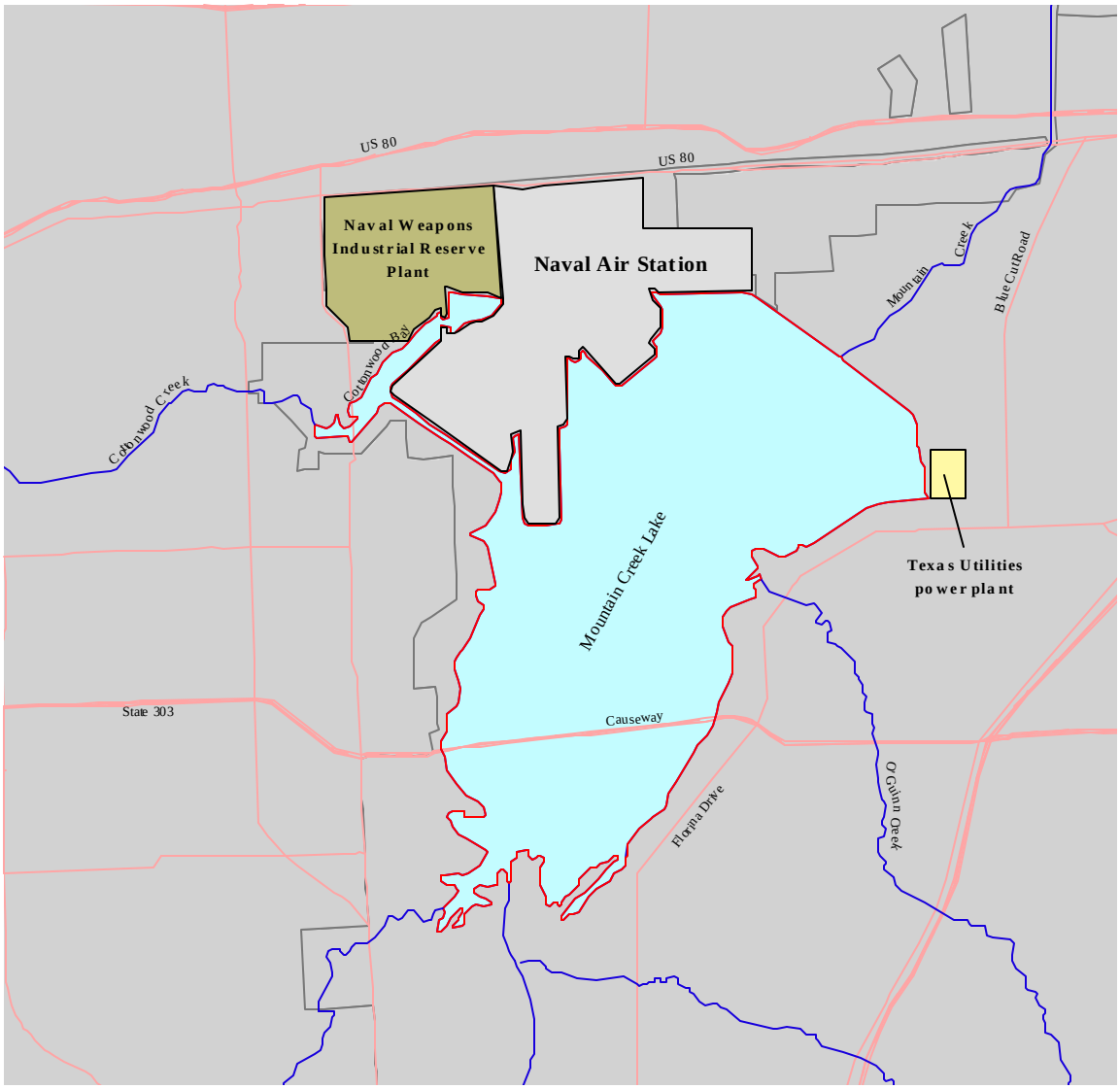


Figure 3. Mountain Creek Lake (Segment 0841A) watershed and major tributaries.

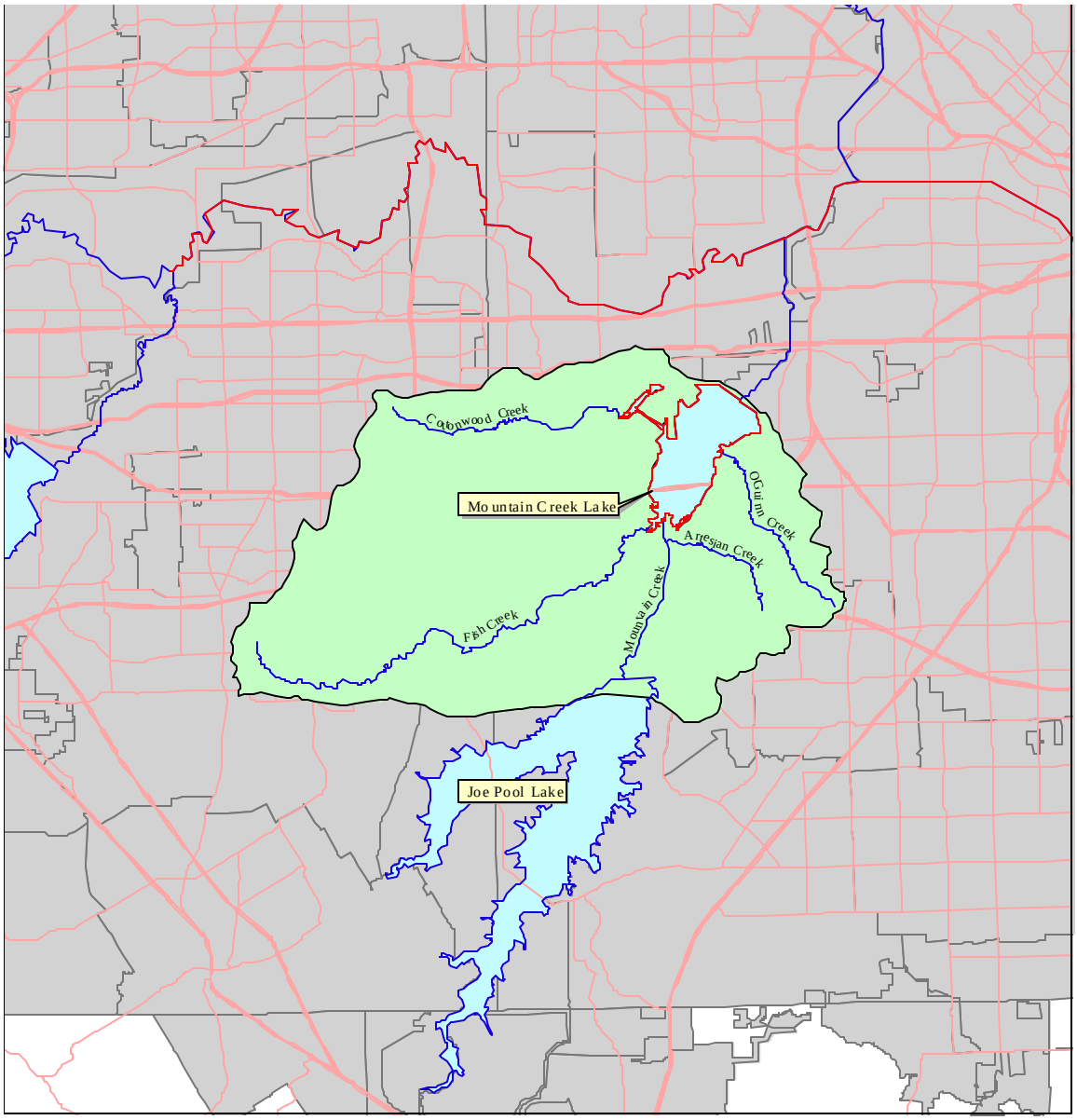


Figure 4. General area around Mountain Creek Lake (Segment 0841A).
Locations of U.S. Naval Air Station Dallas (NASD), the U.S. Naval Weapons Industrial Reserve Plant (NWIRP), and Cottonwood Bay are indicated.

EPA (1997) guidance and TDH assumptions concerning risk levels, consumer body weight, and fish consumption rates were used to develop endpoint targets for tissue contaminant levels that result in an acceptable risk level. The endpoint target of these TMDLs is the reduction of fish tissue contaminant concentrations to levels that constitute an acceptable risk to fish consumers, allowing TDH to remove the bans on fish consumption (Table 1). The ultimate endpoint goal for the affected water bodies is the complete removal of the fish consumption bans.

# Control Actions and Management Measures

Gradual declines in environmental legacy pollutant concentrations occur as a result of natural attenuation processes. Legacy pollutants in these water bodies are considered background sources that reflect site-specific application histories and loss rates. Any continuing sources of pollutant loadings occur from nonpoint source runoff, leaching, or erosion of sinks that may exist within the watersheds. Any residual contamination at the NASD or NWIRP may be a source to Mountain Creek Lake while site remediation continues. No authorized point source discharges of these pollutants are allowed by law.

Available evidence suggests that chlordane concentrations are generally declining in fish tissue in the Trinity River. Concentrations were less than the TMDL endpoint target in recent sample collections (TNRCC 2000b; see Reasonable Assurance of Success section of this document). Continuing natural attenuation is expected via degradation and metabolism of remaining chlordane, and scouring and redistribution of sediments in the river.

Remediation of any remaining contamination at the NASD or NWIRP facilities through the TNRCC Defense and State Memorandum of Agreement Program will eliminate a probable source of the PCBs in Mountain Creek Lake. Continuing natural attenuation of PCBs and the other listed contaminants in the lake is expected via degradation and metabolism of the contaminants, and the burial of contaminated sediments.

Although tissue contaminant levels are expected to continue to decline through natural attenuation processes, investigations are underway to address any remaining pollutant loads to these water bodies. As part of a $475,000 grant from the EPA, and as part of the City's storm water monitoring and management program, the City of Fort Worth Department of Environmental Management (FWDEM) is investigating the feasibility of several structural and nonstructural Best Management Practices (BMPs) to address any remaining pollutant inputs to area water bodies (see *Work Plan Summary - Mitigation Options for Urban Lakes Affected by Legacy Pollutants, FWDEM, January 2000*). Potential BMPs under investigation include:

- the use of high-efficiency street sweepers to remove any contaminated soils that have eroded from nearby land,

- storm drain cleaning to remove sediment accumulation that may include eroded contaminated source soils,
- erosion control measures at redevelopment construction sites to prevent the loss of source soils contaminated by previous use of legacy substances,
- focused watershed education and pollutant collection programs intended to remove any remaining legacy substances from continued use in the area, and
- sedimentation and filtration structural controls to capture eroded contaminated source soils prior to entry into a water body.

In any areas where monitoring activities verify sufficient loading, some of the potential BMPs can be further evaluated through controlled pilot projects. Final evaluation of the various BMPs will include considerations such as attainable pollutant loading reductions, associated environmental benefits, and technical feasibility. These evaluations will be pertinent to all of the area water bodies impaired by legacy pollutants.

FWDEM has modified Fort Worth Environmental Collection Center (ECC) record-keeping to help identify, quantify, and track the receipt of legacy pollutants in its household hazardous waste collections, in an effort to determine the extent of any recent or current use in the area. The ECC is a permanent year-round facility that accepts household hazardous waste from residents of Fort Worth and 23 other cities in the area. The ECC has periodically received chlordane, suggesting some recent or possible continued use of legacy pesticides in the area.

Dallas and most other cities in the county participate in the Dallas County Household Hazardous Waste Collection program. Collection events are held approximately every two months. The County is finalizing plans for a permanent collection center.

The cities in which these water bodies are located have storm water quality program in place. Four of these cities are covered by individual Phase I storm water permits issued by EPA (see Legal Authority section of this document). Various control actions and management measures have been implemented under these local programs, and have likely reduced any remaining legacy pollutant input to water bodies. For example, practices in place in the City of Dallas include (J.L. McDaniel, Storm Water Quality Division, City of Dallas, personal communication):

- erosion control requirements on construction sites of any size for both development and redevelopment activities,
- a public education program addressing proper pesticide use,
- use of high efficiency street sweepers on all major thoroughfares once a month,
- periodic remote television inspection and cleaning of storm sewers, and
- routing of a majority of storm water runoff to sumps before release to the Trinity River, allowing for a certain amount of sedimentation of silt and debris.

The TNRCC and local authorities will further evaluate the need for, and effectiveness of, the various mitigation and remediation options, including site-specific natural attenuation, based on the results of the BMP evaluation, assessment of ECC records, and the results of the various monitoring efforts described below in the Monitoring Plan section. These evaluations will gage the effectiveness of the various options. Decisions concerning the need for and implementation of any additional control actions or management measures, including implementation of selected BMPs, will be further developed as the results of the ongoing studies are known (see Implementation Schedule section of this document).

Remediation activities at the NASD and NWIRP facilities are continuing at this time, with oversight by the TNRCC Region 4 Waste Section and the TNRCC Remediation Division. Investigation and remediation will continue at both facilities until acceptable levels of all contaminants (legacy and non-legacy) are achieved, and TNRCC approves the final disposition of each site. The baseline environmental survey for NWIRP (EnSafe 2000) concluded that pesticides were not expected to be a problem requiring any significant remediation. Remediation of PCB contamination has been performed at the site (EnSafe 2000). U.S. Navy policy was to eliminate PCB transformers, capacitors, and PCB-containing equipment from its facilities by 1998. NWIRP began a removal program in 1991, and the Northrop Grumman Corporation reported that all PCB-containing equipment has been removed from the site (EnSafe 2000). Northrop Grumman was the site operator during that time period. As of Fall 2000, the NWIRP site is operated by Vought Aircraft Industries, Incorporated.

Cleanup activities at NASD were initiated to comply with the requirements of the TNRCC Industrial Solid Waste Part B Permit (HW-50276) for the site, and the 1993 Defense Base Realignment and Closure Act (CH2M Hill 1999d). Soil sampling at NASD detected the presence of chlordane isomers, DDT, DDE, dieldrin, heptachlor epoxide, and PCBs (Tetra Tech 1999, 2000). Corrective actions (soil excavation and removal and site restoration) have been implemented to address soil contamination (see Ch2M Hill 1999c). Pesticide residues were detected in association with normal application activities, and in former container storage areas (Tetra Tech 1999); however, these residues do not appear to be a major problem. The NASD facility investigation detected one significant site of PCB contamination, west of the crash/rescue boat dock in the south-central portion of the facility. PCB transformers and capacitors were stored in this area between 1975 and 1982 (CH2M Hill 1999a,b,d). Remediation activities at the contaminated site were completed in the summer of 2000.

In April-May 2001, TNRCC Remediation Division staff collected sediment samples for a preliminary Superfund assessment of the lake, in relation to a groundwater plume near SE 14$^{th}$ Street on the west side of Cottonwood Bay and the Navy facilities. Samples were collected in the main body of the lake and in Cottonwood Bay, and in tributary drainages in the area where the plume potentially reaches the lake. Any additional actions will be planned following evaluation of data collected during this preliminary assessment. Any significant contamination issues, concerning legacy or non-legacy pollutants, that are detected during this process will be addressed through the Superfund program.

# Legal Authority

### *TNRCC*

Texas statutory provisions require the commission to establish the level of quality to be maintained in, and to control the quality of, water in the state (Texas Water Code (TWC) §26.011). Texas fulfills its obligations under Section 303(d) of the Clean Water Act to list impaired segments and create TMDLs through functions assigned by the legislature to TNRCC. The §303(d) list is prepared by TNRCC as part of its monitoring, planning and assessment duties (TWC §26.0135).

TMDLs are part of the state water quality management plans that TNRCC is charged by statute to prepare (TWC §26.036). As the state environmental regulatory body, the Commission has primary responsibility for implementation of water quality management functions within the State (TWC §26.0136 and §26.127). The Executive Director of the TNRCC must prepare and develop, and the Commission must approve, a comprehensive plan for control of water quality in the state (TWC § 26.012). The list of impaired segments and resulting TMDLs are tools for water quality planning.

Texas Surface Water Quality Standards are contained in Title 30, Chapter 307 of the Texas Administrative Code (30 TAC Chapter 307). TNRCC procedures for implementing the these standards are described in *Implementation of the Texas Natural Resource Conservation Commission Standards Via Permitting* (RG-194, August 1995).

The TNRCC received delegation of the NPDES program from EPA on September 14, 1998, and is authorized to implement the Texas Pollutant Discharge Elimination System (TPDES), the regulatory program to control discharges of pollutants to surface waters. The TPDES program covers all permitting, surveillance and inspection, public assistance, and enforcement regulatory processes associated with waste discharges into or adjacent to any water in the state. This includes discharges of waste from industry and municipal treatment works, and discharges of storm water associated with industrial activities, construction sites, and municipal separate storm sewer systems (MS4s).

No point source wastewater permits currently authorize the discharge of any legacy pollutant into any of the water bodies addressed by these TMDLs. Any necessary regulatory action concerning the discharge of legacy pollutants will be addressed through storm water requirements:

- TNRCC assumed jurisdiction and administration of the EPA Multi-Sector Storm Water General Permit for industrial activities on September 29, 2000. TNRCC is in the process of renewing that permit as TPDES General Permit No. TXRO5000.

- Discharges of storm water associated with construction projects covering five acres or more are currently regulated by EPA under the Phase I Construction Storm Water General Permit. TNRCC will assume jurisdiction and administration of the construction permit by July 7, 2003, and will develop a state permit for renewal.
- Discharges of storm water associated with construction projects one to five acres in size, or smaller than one acre if designated, will be regulated under Phase II of the storm water program. Phase II rules were published by EPA on December 8, 1999, and became effective on December 22, 1999. TNRCC must issue a Phase II Construction General Permit by December 9, 2002. Phase II construction sites must begin obtaining permit coverage within 90 days of permit issuance.
- Discharges of storm water associated with MS4s in cities and counties with populations greater than 100,000 are currently regulated by individual MS4 permits issued by EPA under Phase I of the storm water program. TNRCC will assume jurisdiction upon expiration of each MS4 permit. MS4 permittees will apply for renewal with the TNRCC. Four cities within the watersheds addressed by this implementation plan are covered by individual MS4 permits. The City of Fort Worth permit (TXS000901) expires on November 30, 2001. The City of Dallas permit (TXS000701) expires on April 30, 2002. Permits for the City of Arlington (TXS000301) and the City of Irving (TXS001301) expire in 2003.
- Cities and counties with populations less than 100,000 will be regulated under the Phase II storm water rules. TNRCC must designate additional small MS4s, and must issue a Phase II MS4 permit by December 9, 2002. Small MS4s must obtain permit coverage within 90 days of permit issuance. Phase II MS4s will be required to identify BMPs, along with associated measurable goals and implementation schedules, for efforts such as the identification and elimination of illicit discharges, construction site runoff control, and post-construction storm water management in new development and redevelopment areas.

The TNRCC also has the regulatory authority to oversee the cleanup of sites contaminated with industrial and municipal hazardous and solid wastes. In general, remediation and closures at solid and hazardous waste facilities must comply with the requirements of 30 TAC Chapter 335, which contains the Risk Reduction Standards, the state cleanup regulations that became effective in June 1993. Remediation and closures initially reported on or after May 1, 2000 must comply with the Texas Risk Reduction Program (TRRP) rules in 30 TAC Chapter 350. At this time, both NASD and NWIRP are voluntarily developing TRRP documentation for potential use at selected remediation sites. Legal authority for the Superfund program is contained within the Texas Health and Safety Code (§361.181 and §361.402). TNRCC has conducted a preliminary Superfund assessment of Mountain Creek Lake.

Federal law requires the Department of Defense (DOD) to involve states in the cleanup of DOD hazardous waste sites such as NASD and NWIRP. The Defense and State

Memorandum of Agreement (DSMOA) program exists to coordinate efforts between the DOD and state agencies. The TNRCC DSMOA program was established in 1992.

### *Other State Agencies*

The Texas Department of Agriculture (TDA) regulates the agricultural application of pesticides, as directed by Chapter 76 of the Texas Agriculture Code. Non-agricultural application of pesticides is regulated by the Structural Pest Control Board of Texas, as per the Structural Pest Control Act.

### *Municipalities*

The water bodies addressed by this implementation plan lie within the boundaries of five municipalities (Fort Worth, Arlington, Irving, Dallas, and Grand Prairie):

**The City of Fort Worth** has the legal authority to regulate pollutant discharges through the Fort Worth City Code, Chapter 12.5 (Environment Code). Article III (Storm Water Protection) of Chapter 12.5 is administered by the FWDEM, and is the section most applicable to any legacy pollutant releases. Article III prohibits unauthorized discharges to the City storm sewer system. FWDEM is authorized to inspect facilities and conduct sampling. It is a violation of Article III to discharge storm water associated with industrial or construction activities without applicable NPDES or TPDES permit coverage. Violation of a NPDES or TPDES storm water permit is also a violation of the City Environment Code. FWDEM has the authority to require modification of a facility's Storm Water Pollution Prevention Plan if it believes the plan does not comply with permit requirements. Article IV of Chapter 12.5 provides City staff with general inspection authority for all surface water quality matters.

**The City of Arlington** administers storm water activities through the Environmental Management Division of the Department of Engineering Services. The Division administers and coordinates public education, water quality monitoring, erosion, and sediment control through plan review and construction inspections, industrial inspections, and spill response. The Division is responsible for compliance with the Arlington MS4 storm water permit, and for enforcement of the Storm Water Pollution Control Ordinance in the Arlington City Code. Arlington residents can utilize the City of Fort Worth ECC for disposal of household hazardous wastes.

**The City of Irving** administers water pollution control activities through the Water Utilities Division of the Department of Public Works. Chapter 41 (Water and Sewer Systems) of the Irving City Code contains ordinances related to operation of water, sewer, and storm sewer systems. Article X (Municipal Stormwater Drainage Regulations and Acts Adversely Affecting Water Quality) is the section most applicable to the control of any legacy pollutant releases. Section 41-61 and 41-62 of Article X contain general and specific prohibitions against unauthorized discharges. Discharges causing violations of water quality standards or state-issued discharge permits are prohibited. Section 41-62(g) requires that use of pesticides and

herbicides comply with the Federal Insecticide, Fungicide, and Rodenticide Act, and with the Texas Agriculture Code. Section 41-63 requires reporting of unauthorized releases to the City, and cleanup in compliance with any state, federal, or local law. Storm water discharges from construction and industrial activities are covered under Sections 41-64 and 41-65, respectively.

**The City of Dallas** administers storm water activities through the Department of Public Works and Transportation. The Storm Water Quality Division develops and implements pollution prevention measures, treatment/removal methods, and storm water monitoring. The Storm Water Quality Environmental Section is responsible for storm water quality monitoring, complaint investigations, industrial storm water inspections, and enforcement of Dallas water quality codes. The Storm Water Quality Engineering Section is responsible for compliance with the Dallas MS4 storm water permit. Chapter 49 (Water and Wastewater), Article IV (Water Quality) of the Dallas City Code includes enforcement options and prohibits the discharge of industrial waste into a storm sewer. Chapter 19 (Health and Sanitation), Article IX (Storm Drainage System), Section 19-118 of the Dallas City Code is the prohibition against the discharge of various substances, including chemical and industrial waste, into the storm drainage system.

**The City of Grand Prairie** Environmental Services Department performs activities related to watershed and storm water quality monitoring. General prohibition of unauthorized discharges into storm sewers and watercourses is contained within Chapter 26 (Utilities and Services), Article III (Sewer Service), Division 2 (Industrial Waste Discharges), Section 26-49 of the Grand Prairie City Code of Ordinances. Grand Prairie will be subject to the Phase II storm water regulations.

**Other** cities within the Trinity River and Mountain Creek Lake watersheds generally have a code provision that can be used to address unauthorized discharges. Many of these cities will be subject to the Phase II storm water regulations.

# Implementation Schedule

Several monitoring and evaluation projects are planned or underway as part of this implementation plan (see Table 2). Additional details of the various monitoring efforts are described in the Monitoring Plan section of this document.

The TNRCC and the U.S. Geological Survey (USGS) have provided funding for a joint investigation into legacy pollutant contributions to the affected water bodies. The Quality Assurance Project Plan (QAPP) for this project has been approved. The major project activities, and the schedule for each, are as follows:

- Analysis of sediment data collected in Mountain Creek Lake is underway.

- Suspended sediment sampling devices and associated flow gages have been installed and calibrated as described in the Monitoring Plan section of this document. Sample collection began in Spring 2001.

Table 2. Implementation schedule for monitoring, remediation activities, and evaluation of potential management measures.

| ENTITY | ACTIVITY | IMPLEMENTATION SCHEDULE |
|---|---|---|
| U.S. Geological Survey (USGS) | (1) Evaluation of Mountain Creek Lake sediment data | (1) In progress |
| | (2) Suspended sediment sampling on upstream Trinity River segments | (2) Sampling devices are in place; Sampling to begin in Spring 2001 |
| Texas Department of Health (TDH) | (1) Collection of fish for tissue analysis | (1) Trinity River sampling conducted in September 2000; Mountain Creek Lake sampling conducted in June 2000 - second round of lake sampling scheduled for Summer 2001 |
| | (2) Reassessment of tissue contaminant risk | (2) Trinity River assessment in progress; Mountain Creek Lake assessment following receipt of data from both sampling rounds - probably late 2001 to mid-2002 |
| City of Fort Worth Department of Environmental Management (FWDEM) | (1) Modify Environmental Collection Center record-keeping to track receipt of chlordane and other legacy pollutants | (1) Computer hardware/software purchased in November 2000; Tracking began in February 2001 |
| | (2) Chlordane sampling at a representative urban storm water outfall | (2) Began in March 2001 |
| | (3) Evaluation of potential BMPs | (3) Decision criteria for BMP evaluations currently being developed; BMP evaluations scheduled to begin in early 2002 |
| U.S. Navy (through various contractors) | (1) RCRA Facility Investigation and associated remediation activities at NWIRP | (1) Began in 1993 |
| | (2) RCRA Facility Investigation and associated remediation activities at NASD | (2) Began in 1994 |

| | | |
|---|---|---|
| Texas Natural Resource Conservation Commission (TNRCC) | (1) Evaluation of results of the activities conducted by USGS, TDH, and FWDEM; Coordination and planning with local authorities for any additional monitoring and/or BMP implementation<br><br>(2) Evaluation of activities related to NASD and NWIRP remediation<br><br>(3) Superfund evaluation of Mountain Creek Lake | (1) Following completion of all scheduled activities and receipt of all data - probably mid to late 2002; Interim meetings and evaluations will be conducted as appropriate<br><br>(2) Ongoing in conjunction with U.S. Navy contractor activities<br><br>(3) Preliminary assessment in progress; need for additional action to be determined |

TDH has received funding from TNRCC to conduct fish tissue sampling on a number of water bodies throughout the State, including the impaired Trinity River segments and Mountain Creek Lake, during a two-year period that began in mid-2000.

- The TDH collected fish from the Trinity River in September 2000. Tissue analyses have recently been completed. Assessment of both the September 2000 results and data collected in late 1998 is currently underway.
- TDH collected fish from Mountain Creek Lake in June 2000. A second phase of sampling is scheduled for Summer 2001. TDH will reassess tissue contaminant levels in the lake when sampling is complete.

As part of a $475,000 grant from the EPA, and as part of the Fort Worth storm water monitoring and management program, the FWDEM is investigating potential existing pollutant inputs to impaired water bodies, and the feasibility of potential BMPs to address any remaining pollutant inputs. Some of these activities are dependent upon the findings of portions of the USGS study outlined above. The major activities for this project, and the current status of each, are as follows:

- Hand-held computers and software for use in ECC record-keeping were purchased in November 2000. A digital survey form was created in September 2000, and ECC staff were trained in early 2001. Tracking of the receipt of chlordane and other legacy pollutants began in February 2001.
- Storm water sampling for chlordane characterization at a representative urban outfall in east Fort Worth began in March 2001, and will be performed six times during 2001.
- Evaluation of the potential BMPs is scheduled to begin in early 2002. Decision criteria for these evaluations are currently under development.

A variety of control actions and management measures have been implemented through local government environmental programs and Phase I MS4 permits (see Control Actions and

Management Measures section of this document). These activities have been put in place over a number of years.

Investigation and remediation activities at NWIRP and NASD began in 1993 and 1994, respectively, and continue at this time with oversight by the TNRCC Region 4 Waste Section and the TNRCC Remediation Division. Responsibility for completion of these activities lies with the U.S. Navy, although the work is being performed by a number of different contractors. Because each phase of the remediation process requires confirmation sampling, with the potential for additional remediation activities, it is difficult to estimate a final project completion date. Work will continue at each facility until acceptable levels of all contaminants are achieved, and the final disposition of each site is approved by the TNRCC. A Restoration Advisory Board provides a means for disseminating information and obtaining public input regarding activities at these sites.

TNRCC and local authorities will further evaluate the need for, and effectiveness of, the various mitigation and remediation options, including site-specific natural attenuation, based on the results of the BMP evaluations, assessment of ECC records, the results of the various monitoring efforts, and evaluation of remediation activities at NWIRP and NASD (see Table 3). Timetables for additional monitoring and/or the implementation of any BMPs, and estimates of the time necessary for restoration of the fish consumption uses, will be further developed as results of the ongoing studies are known. Interim evaluations will be made as appropriate, with final decisions to be made following completion of all ongoing efforts, probably in mid to late 2002 for all except the NWIRP and NASD activities. The following subsections outline a general approach (summarized in Table 3) to possible subsequent actions that will depend upon results of the efforts described above.

### *Historical Loading Trends*

Contaminants present in sediment degrade slowly, and may be present for long periods of time (Oliver *et al.* 1989; Rhee *et al.* 1993; Sokol *et al.* 1998; EPA 1999). Van Metre *et al.* (1998) analyzed sediment core samples from 11 reservoirs, and determined mean sediment half-lives of 7.7 to 17 years for chlordane, 13 $\pm$ 5.8 years for total DDT, and 9.5 $\pm$ 2.2 years for PCBs. Contaminant levels in lake sediment cores have shown good agreement with production and usage histories of the parent compounds, with peak concentrations appearing at the times of peak use (Ricci *et al.* 1983; Oliver *et al.* 1989; Van Metre and Callender 1997; Van Metre *et al.* 1998; Ging *et al.* 1999). Higher concentrations generally appeared deeper in the cores, indicating that input and accumulation were decreasing with time.

If historical trends determined from the Mountain Creek Lake sediment cores indicate recent or continuing contaminant input, additional investigation will be needed to identify sources. Suspended sediment sampling will be performed, if necessary, to further isolate the source(s). If ongoing investigations indicate additional contaminant sources associated with NASD and/or NWIRP, additional remediation efforts will be conducted within the context of the ongoing

activities at these locations. If the USGS evaluations indicate unexpectedly large sediment concentrations, the need for dredging will also be evaluated.

Remediation of NASD and NWIRP should eliminate any significant remaining PCB input to Mountain Creek Lake. Natural attenuation will continue to reduce contaminant concentrations, while ongoing sedimentation will continue to bury any remaining contaminated sediment. Siltation has occurred fairly rapidly in Mountain Creek Lake,
reducing the lake storage capacity from the original 40,000 acre-feet in 1937 (Dowell and Breeding 1967) to approximately 20,200 acre-feet by 1993 (Ulery *et al*. 1993). Although residues can continue to persist in the deeper parts of sediment cores, burial by more recently deposited sediments may result in effective removal of the contaminants from bioavailability to aquatic life (Ricci *et al*. 1983).

Table 3. Evaluation outline for any subsequent actions found to be necessary based on the results of ongoing monitoring and related studies.
Any subsequent activities will be coordinated by TNRCC and local authorities. See text for additional details.

| ACTIVITY | RESULTS | SUBSEQUENT ACTION |
|---|---|---|
| (1) Analysis of Mountain Creek Lake sediment data (USGS) | (a) No substantial recent input - any existing pollutants in deeper layers of sediment | (a) Evaluate within framework of USGS conclusions - no additional action is likely to be necessary |
| | (b) Pollutant concentration and depth suggest recent or continuing input | (b) Evaluate within framework of USGS conclusions and activities in progress at NASD and NWIRP to identify current source(s), and evaluate potential BMPs and additional remediation needs |
| (2) Current pollutant loading trends determined from suspended sediment sampling (USGS) | (a) No significant current input of legacy pollutants | (a) No additional action necessary |
| | (b) Significant current loading of legacy pollutant(s) is detected | (b) (i) Use ECC tracking results to identify source area(s) to extent possible<br>(ii) Plan and implement additional sampling as necessary to isolate source(s) in downstream river segments<br>(iii) Address source(s) with appropriate BMP(s) and/or regulatory action |
| (3) Fish tissue contaminant concentrations (TDH) | (a) Removal of consumption ban by TDH due to reduction of tissue contaminant concentrations | (a) No action necessary other than follow-up tissue sampling five years after removal of the ban |
| | (b) Consumption ban remains in effect, but trend in reduction of tissue contaminant concentrations is evident | (b) (i) Continue tissue monitoring every five years to verify continuing contaminant reductions<br>(ii) Conduct follow-up tissue monitoring five years after endpoint target is achieved and ban is removed |
| | (c) No evidence of reduction in tissue contaminant concentrations based on samples collected in 2000-2006 | (c) (i) Continue addressing pollutant sources and monitoring fish tissue<br>(ii) Reevaluate TMDL time frames and need for additional approaches |

Table 3, continued. Evaluation outline for any subsequent actions found to be necessary based on the results of ongoing monitoring and related studies.

| ACTIVITY | RESULTS | SUBSEQUENT ACTION |
|---|---|---|
| (4) ECC legacy pollutant survey (FWDEM) | (a) No substantial receipt of legacy substances | (a) No additional action necessary |
| | (b) Continued receipt of legacy substances | (b) Public education program (targeted to any source area that can be identified) |
| (5) RCRA Facility Investigations and associated remediation activities at the Naval Weapons Industrial Reserve Plant and the U.S. Naval Air Station Dallas (TNRCC) | (a) Completion of investigation and all remediation activities, with final approval by TNRCC | (a) No additional action necessary |
| | (b) Ongoing investigations indicate additional contaminant sources associated with NASD and/or NWIRP | (b) Additional remediation efforts will continue until final TNRCC approval |
| (6) Preliminary Superfund Assessment of Mountain Creek Lake (TNRCC) | (a) Preliminary assessment finds additional Superfund activity is not warranted | (a) No additional Superfund action necessary |
| | (b) Preliminary assessment finds additional investigation and/or remediation is warranted | (b) Additional investigation and/or remediation efforts as required by TNRCC Remediation Division |

### *Current Pollutant Loading*

Numerous studies have documented the long-term persistence of organochlorine pesticides and their degradation products in soil. Pesticide residue concentrations in soils can span several orders of magnitude, and are a reflection of application history and loss rates (Lichtenstein *et al.* 1971; Harner *et al.* 1999). Degradation rates of organochlorine residues are highly variable, and soil half-lives of as much as 20 to 35 years have been reported (Nash and Woolson 1967; Dimond and Owen 1996; Mattina *et al.* 1999).

The release of pollutants from undisturbed soils is not generally a major problem. Mattina *et al.* (1999) examined an experimental site 38 years after chlordane application, and found vertical and horizontal movement to be minimal. Bennett *et al.* (1974) observed little lateral movement of chlordane and dieldrin residues 21 years after application, except in areas that had experienced erosion. The primary method of transport of legacy pollutants into aquatic systems is by erosion of soil and attached contaminants (Munn and Gruber 1997).

If suspended sediment sampling data indicate continuing contaminant input to affected water bodies, additional sampling will be performed as necessary to further investigate and isolate source areas. Additional suspended sediment sampling will be planned and performed through

a contract with USGS, with input and/or participation by local authorities. Identified sources will be addressed by the most appropriate BMPs and/or regulatory actions. Remediation of NASD and NWIRP should eliminate any significant PCB input to Mountain Creek Lake. If the ongoing investigations indicate additional contaminant sources associated with NASD or NWIRP, additional remediation efforts will be conducted within the context of these projects.

### *Fish Tissue Contaminant Concentrations*

A large number of factors associated with fish physiology, environmental conditions, and the form of the contaminant have been found to influence contaminant elimination from fish tissue (see literature surveyed in TNRCC 2000b). The time necessary for elimination is both long and variable. Schnoor (1981) calculated a dieldrin decrease of 15 percent per year in reservoir fish tissue. Half-lives for DDT, DDE, and PCBs in lake trout have been estimated at 9 to 10 years (see Borgmann and Whittle 1992; Van Metre *et al.* 1998). Long-term field studies have generally found that elimination rates are considerably longer than in those measured in laboratory studies (de Boer *et al.* 1994; Delorme *et al.* 1999).

The endpoint target of these TMDLs is the reduction of fish tissue contaminant concentrations to levels that constitute an acceptable risk to fish consumers, allowing TDH to remove the bans on fish consumption. If fish tissue data collected in 2000-2001 indicate that endpoint targets have been reached in a given water body, follow-up sampling will be conducted in 2006 to verify that tissue contaminants remain at acceptable levels. TDH may choose to conduct additional monitoring in any of the water bodies at any time.

If fish tissue data collected in 2000-2001 indicate that endpoint targets have not yet been reached in a water body, it will be necessary to continue tissue monitoring. Additional tissue sampling may be the only step necessary if the tissue data indicate a clear trend in the reduction of tissue contamination. Because the natural attenuation of legacy pollutants occurs gradually, collection and analysis of fish tissue on a five-year cycle beginning in 2006 should be adequate to track continuing declines and allow for periodic reassessment of consumption risk by TDH. Tissue sampling will be performed by TDH, or by another entity through an arrangement with TDH. Sampling will continue on this schedule until endpoint targets have been reached and the consumption ban removed. Follow-up sampling will be conducted approximately five years later to verify that tissue contaminants remain at acceptable levels. As in the above case, TDH may choose to conduct additional monitoring in any of the water bodies at any time.

Decreases in fish tissue concentrations of organochlorine insecticides and PCBs have been observed where no major additional inputs are occurring (see Moore and Ramamoorthy 1984; Brown *et al.* 1985; Bremle and Larsson 1998). Available fish tissue data from the Trinity River and other area water bodies indicate that legacy pollutant concentrations are decreasing as a result of natural attenuation processes (see Reasonable Assurance of Success section of this document). If tissue samples collected in 2000-2006 indicate no reduction of contaminants in a water body, reevaluation of the TMDL approach will be required for that situation.

### *Environmental Collection Center Records*

If Fort Worth ECC records indicate continued receipt of chlordane or other legacy substances, a public education effort will be warranted to encourage the cessation of any continuing use of legacy substances and the proper disposal of any remaining stocks. The effort can be targeted to specific cities or neighborhoods if the data allow source determination at that level.

### *Monitoring After Additional Action*

Subsequent remediation of source(s), implementation of BMPs, institutional controls, or other regulatory or enforcement activities will be dependent upon the nature of the source(s). Additional monitoring may be necessary to assess the adequacy of any of these additional efforts. TNRCC and local authorities will cooperate in planning this assessment monitoring when a decision is made to take a particular action in a designated location.

### *Restoration of Fish Consumption Use*

The results of current monitoring efforts, and any subsequent need to implement one or more additional activities, will likely affect any estimates of the time necessary for restoration of the fish consumption use to these water bodies. Given current knowledge of fish tissue chlordane concentrations and potential existing environmental reservoirs of chlordane, restoration of the fish consumption use in the Trinity River segments is expected within the next ten years. Restoration of the fish consumption use in Mountain Creek Lake is expected within the next fifteen years.

Findings of the ongoing monitoring efforts, and reassessment of tissue contaminant risk by TDH, may require revision of these estimates. It is not unlikely that fish tissue and/or sediment core data from the Mountain Creek Lake will result in an upward revision of the lake estimate. Although chlordane concentrations show evidence of a decline in Trinity River fish, concerns over PCB concentrations in fish tissue collected in 1998 and 2000 may result in an extension of the fish consumption ban on one or more of those segments (see Reasonable Assurance of Success section of this document). The time frame for restoration of the fish consumption use in the Trinity River may increase as a result.

# Monitoring Plan

The TNRCC is continuing a variety of efforts to (1) determine if current loading is occurring, (2) refine the estimates of any current loading, and (3) verify decreasing pollutant loading and tissue concentration trends. TNRCC and USGS have provided funding for a joint investigation to analyze sediment legacy pollutant data in Mountain Creek Lake, and conduct suspended sediment sampling to determine the existence of any current sources and estimate current loading rates of legacy pollutants in two upstream Trinity River segments. The suspended sediment findings will be applicable to the river segments (0805 and 0841) addressed in this plan. The study includes the following activities (Draft *Legacy Pollutants in Dallas-Fort Worth Urban Lakes and Rivers, FY2000-01 Project Proposal, 28 December 1999*; Draft Project QAPP):

- USGS has previously collected core and surficial sediment samples in Mountain Creek Lake as part of U.S. Navy projects (see Jones *et al*. 1997). The accumulated data will be reviewed and interpreted within the context of the legacy pollutant TMDLs for the lake.
- Suspended sediment sampling will be conducted on two upstream Trinity River segments and tributaries (see Figure 5), to determine legacy pollutant occurrence and loading:
  - < Five suspended sediment samplers have been installed on large urban storm water inflows into the Clear Fork Trinity River (Segment 0829). Three storm events will be sampled.
  - < Automatic sampling devices have been installed on three major tributaries to the West Fork Trinity River (Segment 0806). One sampler was installed at an existing stream gaging site on Sycamore Creek, where six discrete samples will be collected during each of two runoff events. Flow-weighted composite samples will be collected during three additional runoff events. Automatic samplers and flow gages were installed on Big Fossil Creek and Little Fossil Creek, where composite samples will be collected during four storm events. Passive suspended sediment samplers have been installed at two additional locations on Segment 0806, where a single sample will be collected during each of three storm events.

Suspended sediment samples will be filtered, and the sediment analyzed for legacy pollutants. Sediment sampling devices have been installed, and a project QAPP has been approved. Sample collection is expected to begin in Spring 2001. The current contract for this project is scheduled to end on August 31, 2001. An extension may be necessary to allow adequate time for all planned sampling to be completed.

The TNRCC is cooperating with the TDH to monitor fish tissue in the impaired water bodies. Tissue monitoring is intended to better define the extent and severity of the impairments, establish spatial and temporal trends in fish tissue contamination, and monitor the reduction of

tissue concentrations to levels that allow removal of the fish consumption bans. TDH has received funding from TNRCC to conduct fish tissue

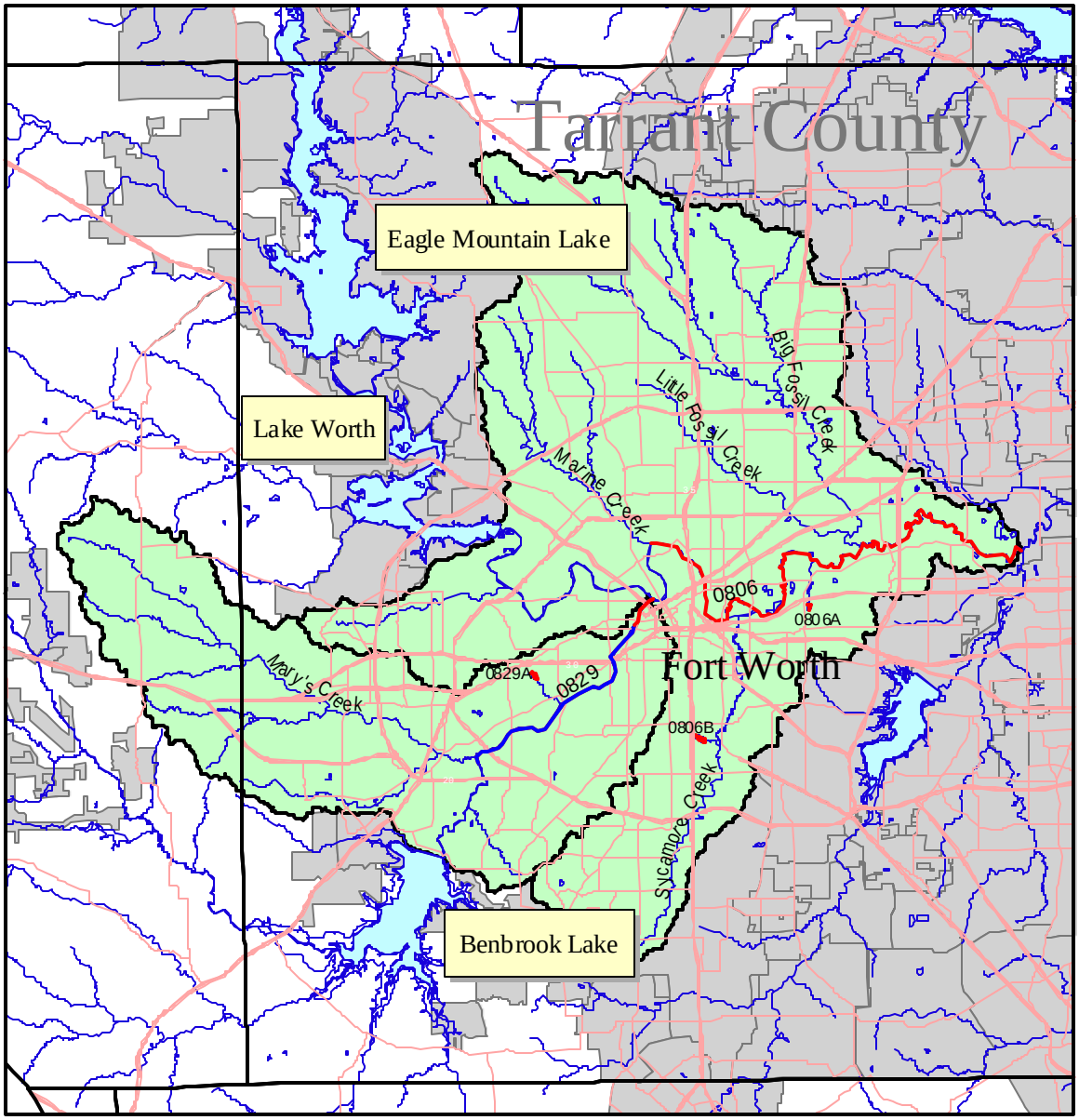


FIGURE 5. Clear Fork Trinity River (Segment 0829) and West Fork Trinity River (Segment 0806) watershed and major tributaries.
USGS suspended sediment sampling will be performed in this watershed, located immediately upstream from Segments 0841 and 0805 (see Figure 2).

sampling on a number of water bodies throughout the State during a two-year period that began in mid-2000.

- Fish were collected from several locations within the impaired Trinity River segments in September 2000. Tissue analyses were recently completed. Assessment of both the September 2000 results and data collected in late 1998 is currently underway.
- TDH collected fish from Mountain Creek Lake in June 2000. A second phase of sampling is scheduled for Summer 2001. TDH will reassess tissue contaminant levels in the lake when sampling is complete.

As part of a grant from the EPA, and as part of the Fort Worth storm water monitoring and management program, the FWDEM is investigating existing pollutant inputs to impaired water bodies and potential BMPs to address any remaining input. The City study includes the following activities (*Work Plan Summary - Mitigation Options for Urban Lakes Affected by Legacy Pollutants, FWDEM, January 2000*):

- Based on the findings of the USGS work, FWDEM may collect samples of deposited sediments in storm drains to identify areas to be used to help evaluate the effectiveness of BMPs (see Control Actions and Management Measures of this document). FWDEM may also conduct soil sampling around selected homes built prior to the 1988 chlordane ban to determine if legacy pollutant reservoirs exist as a result of past application practices. These data will assist in the evaluation of the potential for pollutant transport due to land disturbance during redevelopment, and assist in the evaluation of BMPs.
- FWDEM is adding chlordane to the analyses conducted on storm water samples collected six times per year from an outfall near Eastern Hills High School in east Fort Worth. The outfall is used as part of an ongoing storm water monitoring and characterization program, and drains an area that is primarily residential and public school land use. The information will assist in characterizing the chlordane content of runoff from a representative urban site, and may be useful in the evaluation of potential BMPs.
- FWDEM has developed a project to study and track the receipt of chlordane and other legacy pollutants at the Fort Worth ECC. Records and a user survey will be used to identify, quantify, and track the receipt of legacy pollutants to determine the extent of any recent or current use.

The TNRCC and local authorities will further evaluate the need for additional monitoring activities based on the results of the various ongoing studies. The necessary extent of any additional monitoring will be developed as the results of the TNRCC/USGS, TDH, and FWDEM projects are known (see also Implementation Schedule section of this document). Additional monitoring can be planned in cooperation with individual cities, or through the

regional storm water monitoring program coordinated by the North Central Texas Council of Governments, as appropriate. TDH may also choose to conduct additional fish tissue monitoring in any of the water bodies at any time.

- If sediment data or suspended sediment sampling indicate continuing contaminant input to a water body, additional suspended sediment sampling will be needed to isolate and delineate the source area(s). Additional sampling will be planned and performed through a contract with USGS, with input and/or participation by local authorities. Any activities related to NASD or NWIRP will also require involvement by the U.S. Navy.
- If fish tissue data collected in 2000-2001 indicate that endpoint targets have been reached in a given water body, follow-up sampling will be conducted in 2006 to verify that tissue contaminants remain at acceptable levels. Tissue sampling will be performed by TDH, or by another entity through an arrangement with TDH.
- If fish tissue data collected in 2000-2001 indicate that endpoint targets have not been reached in a water body, additional tissue monitoring will be conducted on a five-year cycle beginning in 2006 to track contaminant declines and allow for periodic reassessment of consumption risk by TDH. Tissue sampling will be performed by TDH, or by another entity through an arrangement with TDH. Sampling will continue on this schedule until endpoint targets have been reached and the consumption ban removed. Follow-up sampling will be conducted approximately five years after removal of the consumption ban to verify that tissue contaminants remain at acceptable levels.
- Additional monitoring may be necessary to assess the adequacy of any subsequent source remediation, BMP implementation, or regulatory activities that are undertaken. This monitoring may include fish tissue and/or suspended sediment sampling, and will be coordinated with local authorities. Any activities related to Mountain Creek Lake and NASD or NWIRP will also require some involvement by the U.S. Navy or a designated representative.

# Reasonable Assurance of Success

Restrictions on the use of legacy pollutants generally have resulted in a slow but steady decline in environmental residues (Smith *et al.* 1988). Reconstructed contaminant trends in lake sediment cores have shown good agreement with production and usage histories of the parent compounds, with peak concentrations appearing at the times of peak use (Ricci *et al.* 1983; Oliver *et al.* 1989; Van Metre and Callender 1997; Van Metre *et al.* 1998; Ging *et al.* 1999). Higher concentrations generally appeared deeper in the cores, indicating that input and accumulation were decreasing with time. Although residues continue to persist in deeper parts of the cores, burial by more recently deposited sediments may result in effective removal of the contaminants from bioavailability to aquatic life (Ricci *et al.* 1983).

Decreases in fish and human tissue concentrations of organochlorine insecticides and PCBs have been observed where no major additional inputs are occurring (see Moore and Ramamoorthy 1984; Brown *et al.* 1985; Hovinga *et al.* 1992; Bremle and Larsson 1998; Schiff and Allen 2000). Reviews of tissue data collected from a variety of water bodies in northern Europe between 1967 and 1995 have found a significant decrease in organochlorine concentrations over time (Skåre *et al.* 1985; Bignert *et al.* 1998). Total DDT and PCB concentrations showed annual decreases of 6.2 to 12 percent and 3.6 to 13 percent, respectively over this time period. Fish tissue concentrations of total DDT, chlordane, and dieldrin have declined across the U.S. since uses of these substances were discontinued (Schmitt *et al.* 1990; USGS 2000). The DDE component of total DDT has increased as a result of continued degradation. Total chlordane levels were stable, although a shift from the *cis*- to the *trans*- isomer between the mid-1970s and mid-1980s suggested a smaller influx of chlordane to the environment (Schmitt *et al.* 1990.

Declining tissue DDT and PCB concentrations have been reported in various locations and fish species in the Great Lakes (Scheider *et al.* 1998). Wszolek *et al.* (1979) found that DDE had decreased considerably from 1970 levels in a similar age group of fish. DDT concentrations in Lake Michigan and Lake Superior fish decreased steadily, to approximately 10 to 25 percent of 1969 levels by the late 1970s (see Bierman and Swain 1982). DDT and PCB concentrations in Lake Ontario spottail shiners in 1987 were significantly reduced from 1975 levels (Suns *et al.* 1991). Chlordane residues were near the detection limit in the shiner samples.

Total PCB concentrations in Lake Michigan fish declined, and then appeared to stabilize in the 1980s as a result of the large pools of PCBs that are being recycled in the environment (Stow *et al.* 1995). Modeling results indicate that PCBs in Lake Michigan salmonids will continue to decline very slowly over the next decade (Lamon *et al.* 1998). Lake Ontario lake trout PCB levels have been declining at a half-life of approximately ten years, although concentrations in two other species have not declined appreciably (see Borgmann and Whittle 1992). Less consistent trends in tissue PCB levels may be a reflection of the congener-specific nature of PCB metabolism and degradation. The pattern of decline in total PCBs may be dominated by declines in the less chlorinated congeners (Brown *et al.* 1985). In addition, strong oscillations in PCB levels influenced by food web interactions can be superimposed on a gradual decline (see Borgmann and Whittle 1992).

Continuing decreases in environmental legacy pollutant levels are expected, although the necessary time frame is subject to debate. In addition to degradation and biotransformation of compounds, there may also be a shift towards the atmosphere in the overall partitioning of some organochlorines (see Jones and de Voogt 1999; Gevao *et al.* 2000). Although residues may continue to persist in deeper sediments, burial by more recently deposited sediments may result in effective removal of the contaminants from bioavailability to aquatic life (Bopp *et al.* 1982; Ricci *et al.* 1983). Contaminants can also become so strongly attached to sediment particles

over time that bioavailability may decline as a result. Severe extraction procedures used during analysis may not always reflect actual availability to biota (see Jones and de Voogt 1999).

**Trinity River**

Available sediment and fish tissue data from the Trinity River indicate that chlordane concentrations are decreasing as a result of natural attenuation processes. Chlordane concentrations in Trinity River sediment declined between 1974 and 1993 (see discussion in TNRCC 2000a,b). During recent dredging and widening of a portion of the Trinity River in Dallas, no chlordane was detected during analysis of the dredge material from the river channel (J.L. McDaniel, Storm Water Quality Division, City of Dallas, personal communication).

Fish tissue data collected from the impacted Trinity River segments by various entities is available for several dates and locations. These samples frequently consisted of a relatively small number of fish, and species collections most often included largemouth bass and/or one or more of the bottom-feeding common carp, smallmouth buffalo, and blue catfish. Fillet samples from individual fish were used by TDH for risk analysis, and are recommended for making decisions on consumption advisories and bans (EPA 1995). Mean chlordane levels for each sample date and location in Segments 0806, 0841, and 0805 (Figure 2 and 5) were calculated using available fish fillet data, to see if any change was apparent in tissue concentrations (Table 4). The site in Segment 0806 was included to provide additional data because it is in the downstream end of the segment, near the upstream end of Segment 0841.

There is evidence of a decline in chlordane tissue concentrations, although the amount of data is generally limited. Sample collections near Loop 820 in Segment 0806 in 1990 and 1996 show a decline in the mean chlordane level from 0.13 to 0.03 mg/kg. The maximum concentration also declined from 0.28 to 0.06 mg/kg. All of these values are less than the smallest endpoint target for chlordane in the Trinity river segments (0.50 mg/kg for children; TNRCC 2000b). The samples consisted of five and three fish in 1990 and 1996, respectively, and included smallmouth buffalo, blue catfish, and a freshwater drum.

The only data available for Segment 0841 is the 1998 sample of ten fish collected downstream from Belt Line Road. This location is near the downstream end of the segment; however, the mean chlordane concentration (0.04 mg/kg) is similar to that of the most recent sample collected at Loop 820 in Segment 0806. This suggests a general decline in tissue chlordane levels through both segments. Both the mean and maximum concentration in this sample were less than the smallest endpoint target for chlordane in the Trinity river segments (0.50 mg/kg for children; TNRCC 2000b).

Samples were collected at the upstream end of Segment 0805, at the confluence with the Elm Fork Trinity River, in late 1998. Earlier samples were collected closer to downtown Dallas, at Sylvan Avenue in 1990 and at Commerce Street in 1988 and 1996. These locations are relatively close, and taken together, the data suggest a general decline in tissue chlordane concentrations. The mean declined from 0.71 mg/kg in 1988 (four fish at Commerce), to 0.39

mg/kg in 1990 (four fish at Sylvan), to 0.14 mg/kg in 1996 (three fish at Commerce). The 1990 mean and the 1996 mean and maximum were less than the smallest endpoint target for chlordane in the Trinity river segments (0.50 mg/kg for children; TNRCC 2000b).

TABLE 4. Mean and range of chlordane fish tissue (fillet) concentrations (mg/kg) through time at Trinity River locations.

N = number of fish. nd = less than detection limit. na = not applicable. Raw data were obtained from Kleinsasser and Linam (1989), Texas Department of Health (*Fish Tissue Sampling Data 1970-1997* and unpublished 11/1998 data), and Texas Parks & Wildlife Department (unpublished data).

| **SAMPLE MONTH/YEAR =>** | | 08/1987 | 01-04/1988 | 10/1990 | 07/1996 | 11/1998 |
|---|---|---|---|---|---|---|
| **SEGMENT - SAMPLE LOCATION** | | **FISH TISSUE (FILLETS) CONCENTRATION (mg/kg)** | | | | |
| **0806** - West Fork Trinity at East Loop 820 | N<br>Mean<br>Range | na | na | 5<br>0.13<br>nd-0.28 | 3<br>0.03<br>nd-0.06 | na |
| **0841** - West Fork Trinity downstream from Belt Line Road (Grand Prairie) | N<br>Mean<br>Range | na | na | na | na | 10<br>0.04<br>nd-0.13 |
| **0805** - Trinity River at Elm Fork Trinity confluence | N<br>Mean<br>Range | na | na | na | na | 10<br>0.24<br>nd-0.84 |
| **0805** - Trinity River near downtown Dallas (Sylvan and Commerce) | N<br>Mean<br>Range | na | 4<br>0.71<br>0.50-0.84 | 4<br>0.39<br>nd-0.98 | 3<br>0.14<br>0.02-0.29 | na |
| **0805** - Trinity River at South Loop 12 (Dallas) | N<br>Mean<br>Range | 1<br>0.50<br>--- | na | na | 3<br>0.18<br>0.04-0.26 | na |

The 1998 mean at the Elm Fork confluence (0.24 mg/kg) is higher than the 1996 samples near downtown, but less than that of the two earlier downtown collections, and less than the smallest endpoint target for chlordane. The 1998 mean is influenced by higher concentrations (0.39-0.84 mg/kg) in three of the ten fish in that sample. Two of those fish were longnose gar, which are not typical gamefish. When the two gar are excluded, the mean chlordane concentration in the remaining eight fish is 0.18 mg/kg, which is similar to the 1996 sample mean (0.14 mg/kg).

Fish were collected at the most downstream location at South Loop 12 in 1987 and 1996. The 1987 sample was a single smallmouth buffalo at 0.50 mg/kg chlordane. The mean and maximum in three smallmouth buffalo collected in 1996 were 0.18 and 0.26 mg/kg, respectively. Both values are less than the smallest endpoint target for chlordane. A decline is suggested, although the sample sizes in this area of the segment are very small.

In January 2001, the TNRCC received a draft TDH risk assessment (TDH 2000) of tissue data from thirty fish collected at three sites along the Trinity River in November 1998. The three sample locations included the West Fork Trinity River at Belt Line Road in Segment 0841 in Grand Prairie, and the Trinity River at Mockingbird, near the Elm Fork Trinity River confluence, in Segment 0805 in west Dallas. The other site lies within the impacted portion of the upstream Segment 0806. Chlordane concentrations ranged from less than the detection limit (<0.01 mg/kg) to a maximum of 0.84 mg/kg. The average chlordane concentration (0.136 mg/kg) was less than the smallest TMDL endpoint target value for chlordane in both Trinity River segments (TNRCC 2000b).

The draft risk assessment (TDH 2000) states that the average concentrations of all contaminants (including chlordane) in fish collected in November 1998 were less than their respective cancer risk levels. Concentrations of chlordane were also less than the noncarcinogenic risk level. Although the assessment does not propose to remove the fish consumption ban due to concerns associated with PCB concentrations, the data provide additional evidence of declining tissue chlordane concentrations as a result of natural attenuation. Preliminary data from the September 2000 sampling suggests a condition similar to that observed in 1998 (TDH staff, personal communication). TDH plans to perform additional sampling in 2001, including Segment 0805 downstream from the current impairment, to better define the extent of the PCB contamination.

**Mountain Creek Lake**

Sediment and fish tissue samples were collected in Mountain Creek Lake in 1994-1996 as part of a two-phase USGS study (Jones *et al.* 1997) conducted for the U.S. Navy in conjunction with the facility investigations at NWIRP and NASD. The greatest legacy pollutant concentrations found in Mountain Creek Lake surface sediments were PCBs in Cottonwood Bay (0.8 mg/kg) adjacent to NWIRP, and in the main lake adjacent to NASD (0.680 mg/kg) (see Figure 4). Pesticide residue levels were generally less than 0.01 mg/kg. Heptachlor epoxide was not detected in any of the sediment samples. Sediment core samples collected in Cottonwood Bay contained PCB concentrations of 0.67-2.0 mg/kg at the mid-point of the bay and 0.30-4.0 mg/kg in the north end of the bay. No subsequent sediment data is currently available to determine if any changes have occurred in PCB concentrations. Evaluation of core sample data is in progress to reconstruct legacy pollutant trends. USGS has recently collected additional sediment samples in Cottonwood Bay, in order to fill data gaps and better delineate contaminant concentrations, as part of the ongoing ecological and human health risk assessment being conducted for NWIRP and NASD.

Remediation of NASD and NWIRP should eliminate any significant remaining PCB sources to Mountain Creek Lake. Natural attenuation will continue to reduce contaminant concentrations, while ongoing sedimentation will continue to bury any remaining contaminated sediment. Siltation has occurred fairly rapidly in Mountain Creek Lake, reducing the lake storage capacity from the original 40,000 acre-feet in 1937 (Dowell and Breeding 1967) to approximately 20,200 acre-feet by 1993 (Ulery *et al.* 1993). Similar attenuation processes appear to be

occurring in three small urban lakes in Fort Worth that are also on the §303(d) list for legacy pollutants in fish tissue. Samples of recent sediment deposits were collected from these lakes in May 1999 by the FWDEM and the Trinity River Authority. Pesticide residue and PCB concentrations were less than their detection limits (0.0007 mg/kg and 0.02 mg/kg, respectively) in all three lakes, suggesting that there have been no recent contaminant inputs to the lakes, and that any remaining contaminated sediments are being buried, thus reducing their bioavailability (TNRCC 2000a).

Fish samples for the first phase of the USGS study (Jones *et al*. 1997) were collected at the upstream end of the lake, in the northwest corner adjacent to NASD, and in Cottonwood Bay. Contaminants were more commonly found in whole fish (carp), and the concentrations in whole fish were greater than those in fillets (largemouth bass), as would be expected. PCBs and DDE were detected in both whole fish and fillets at all three locations. PCB concentrations were generally elevated at the NASD and Cottonwood Bay sites relative to the upstream lake location. The chlordane isomers *cis*- and *trans*-nonachlor were detected in both whole fish and fillets at the site near NASD. Dieldrin, DDT, and heptachlor epoxide were not detected in any of the tissue samples.

Phase II fish samples consisted of fillets (both skin-on and skin-off) from individual largemouth bass, channel catfish, and common carp; and eviscerated whole-body channel catfish (Jones *et al.* 1997). Fish from Mountain Creek Lake are reportedly cooked and consumed in all of these conditions (TDH 1996). Samples were collected in the same general areas sampled in Phase I, as well as along the northeast lake shoreline (see Figure 4). Chlordane, DDE, and PCBs (Aroclors 1254 and 1260) were the most commonly detected legacy pollutants. The other pesticide residues were generally at concentrations less than the detection limit, and at very low concentrations when detected.

Tissue concentration ranges were compiled for the most commonly detected Phase II contaminants using data from Jones *et al*. (1997) (see Table 5). The greatest fillet values for chlordane and DDE were found at the upstream end of the lake. The greatest fillet values for PCBs were found adjacent to NASD, in Cottonwood Bay, and at the upstream end of the lake. The greatest whole fish values for chlordane, DDE, and PCBs were from the upstream location, Cottonwood Bay, and the northeast portion of the lake.

The presence of the larger contaminant concentrations in several areas of the lake is probably a reflection of the movement of fish throughout the lake, as well as the widespread use of legacy substances. Higher contaminant levels were generally more apparent in fish collected in Cottonwood Bay and adjacent to NASD. No subsequent fish tissue data is currently available, so no evaluation of any changes can be made at this time. Fish tissue collected from the three Fort Worth urban lakes between 1994 and 2000 exhibited decreasing concentrations in legacy pollutants (see TNRCC 2000a). This suggests that contaminant levels will also decline in Mountain Creek Lake fish as a result of the remediation of pollutant sources associated with NASD and natural attenuation processes in the lake.

TABLE 5. Phase II concentrations ranges of most common legacy pollutants in Mountain Creek Lake fish tissue.

Data summarized from Jones *et al*. (1997). Fillet data includes individual fish of three species (largemouth bass, channel catfish, and common carp), with both skin on and skin off. Whole fish are eviscerated channel catfish. N = number of fish. nd = less than detection limit.

| | **FILLET TISSUE CONCENTRATION (mg/kg)** | | | |
|---|---|---|---|---|
| **SAMPLE AREA** | **CHLORDANE** | **DDE** | **PCB 1254** | **PCB 1260** |
| Upstream end of lake (N = 8) | nd - 0.580 | 0.0089 - 0.150 | nd - 0.410 | 0.005 - 1.7 |
| Northeast shoreline (N = 11) | nd - 0.029 | nd - 0.081 | nd - 0.021 | nd - 0.073 |
| Cottonwood Bay (N = 13) | nd - 0.087 | nd - 0.030 | 0.015 - 0.110 | 0.053 - 0.420 |
| Adjacent to NASD (N = 21) | nd - 0.120 | nd - 0.065 | nd - 0.470 | 0.022 - 1.67 |
| | **WHOLE-BODY TISSUE CONCENTRATION (mg/kg)** | | | |
| **SAMPLE AREA** | **CHLORDANE** | **DDE** | **PCB 1254** | **PCB 1260** |
| Upstream end of lake (N = 1) | 0.220 | 0.160 | 0.074 | 1.0 |
| Northeast shoreline (N = 2) | 0.031 - 0.207 | 0.022 - 0.134 | 0.027 - 0.140 | 0.081 - 0.860 |
| Cottonwood Bay (N = 5) | 0.074 - 0.290 | 0.025 - 0.110 | 0.064 - 0.420 | 0.180 - 2.2 |
| Adjacent to NASD (N = 1) | 0.017 | 0.023 | 0.044 | 0.091 |

### Current Investigations and Subsequent Action

The TNRCC/USGS investigation is evaluating existing sediment data and using suspended sediment sampling to describe historical trends in the occurrence of legacy pollutants, and to determine the existence and identity of any existing source of pollutants (see Monitoring Plan section of this document for details). The use of sediment coring and high volume suspended sediment sampling and analysis has proven to be an effective approach to identifying and quantifying the source of legacy pollutants in other water bodies in the state of Texas, most recently in the Donna Reservoir and Canal system in south Texas.

In 1999 and 2000, the USGS and the TNRCC conducted a series of high volume suspended sediment sampling events in the Donna Canal, and collected sediment core samples from the Donna Reservoir (see *USGS Final Progress Memorandum: Investigation of PCBs on Suspended Sediment in Donna Canal, Texas, 15 December 2000*). The results yielded significant detections of PCBs in suspended sediment at specific sampling points in the canal. The PCBs in suspended sediment showed a decreasing trend in concentration in a downstream direction from the highest detectable PCB value. Through the combined use of sediment coring and suspended sediment analysis, the location of the source of PCBs in the Donna system was narrowed from within a total length of eight miles to a 75-meter reach of the canal.

If sediment data or suspended sediment sampling identify a current source to any of the water bodies being studied, implementation of one or more BMPs may be appropriate. Furthermore, delineation of potential source areas in a manner similar to that of the Donna Canal may help optimize the implementation of selected BMPs. Many of the BMP options being examined by FWDEM have been successful in mitigating pollutant releases (NCTCOG 1993, 1999; WEF and ASCE 1998). Evaluation by FWDEM will assist in determining which may be most successful should it be necessary to implement one or more of these measures. Local storm water programs provide a mechanism for implementing many of the potential BMPs.

More drastic alternatives, such as dredging and/or the eradication of contaminated fish communities and restocking, have also been successful in restoring a fish consumption use (O'Meara *et al*. 2000); however, this approach is probably better justified at heavily contaminated sites impacted by point source discharges and major spills due to its expense and accompanying environmental concerns. Recent sediment sampling in Cottonwood Bay will better delineate contamination in Mountain Creek Lake. Evaluation of this data will help to determine the need for any remediation activities within the lake.

# Measurable Outcomes

The following outcomes will denote the attainment of various implementation steps:

(1) Completion of Mountain Creek Lake sediment data analysis by USGS

(2) Completion of suspended sediment project
  (a) suspended sediment sampling and laboratory analyses
  (b) data analysis and evaluation of current pollutant loading

(3) Completion of 2000-2001 fish tissue sampling

(4) Completion of reassessment of fish tissue risk by TDH

(5) Completion of Fort Worth ECC tracking study and data analysis

(6) Completion of BMP evaluations

(7) Completion of remediation activities at NWIRP

(8) Completion of remediation activities at NASD

(9) Completion of preliminary Superfund analysis at Mountain Creek Lake

(10) Completion of any additional suspended sediment sampling
  (a) planning/completion of sampling events and laboratory analyses

(b) data analysis and evaluation of source areas

(11) Completion of additional fish tissue sampling at five-year intervals
(a) sampling events and laboratory analyses
(b) reassessment of fish tissue risk by TDH

(12) Planning and implementation of any additional remediation activities, BMPs, and/or regulatory strategies.

The most significant outcome for determining the success of the TMDLs and the implementation plan will be the removal of the fish consumption bans by TDH. Interim outcomes that indicate progress towards this goal are:

- Continued reductions in fish tissue contaminant concentrations beyond those already observed,
- Reduction of fish tissue contaminant concentrations to a level that allows TDH to modify a consumption ban by removing some of the contaminants, shift to an advisory for certain groups at greater risk, or limit the advisory to specific fish species, and
- Reduction of fish tissue contaminant concentrations to levels that meet the endpoint target concentrations and acceptable risk levels, but where TDH has not yet removed the consumption ban.

TDH has the authority and jurisdiction for the decision to issue or remove fish consumption bans and advisories. Subsequent risk assessments by TDH may result in no change to a ban, removal of the ban, or a shift to an advisory for certain groups at greater risk. The ultimate endpoint goal for the affected water bodies is the protection of all groups and complete removal of the fish consumption bans.

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