CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
REGIONAL WATER QUALITY CONTROL BOARD
COLORADO RIVER BASIN REGION

DRAFT

SEDIMENTATION/SILTATION TOTAL MAXIMUM DAILY LOAD FOR THE NEW RIVER

AND

IMPLEMENTATION PLAN

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Prepared by:
Regional Board Staff

LIST OF ACRONYMS AND ABBREVIATIONS

AF	Acre-Feet
Ag	Agricultural
AFY	acre-feet per year
AMC	Adaptive Management Committee
BMP(s)	Best Management Practice(s)
CEQA	California Environmental Quality Act
CFE	Federal Commission of Electricity (Mexico)
CFR	Code of Federal Regulations
cfs	cubic feet per second
CILA	Comisión Internacional de Limites y Aguas
Clean Water Act	Federal Water Pollution Control Act
CNA	Comision Nacional del Agua (Mexican National Water Commission)
CWA	Clean Water Act, the Federal Water Pollution Control Act
CWC	California Water Code
CV	coefficient of variance
DWQIP	(IID) Drain Water Quality Improvement Plan
EIFAC	European Inland Fisheries Advisory Council
FDA	Food and Drug Administration
FRSH	Freshwater Replenishment
IBC	International Boundary Commission
IBWC	International Boundary and Water Commission, United States Section
ICFB	Imperial County Farm Bureau
IID	Imperial Irrigation District
LA(s)	Load Allocation(s)
mgd	million gallons per day
mg/L	milligram(s) per liter
MOS	Margin of Safety
MSL	Mean Sea Level
NAS	National Academy of Sciences
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
NTU	Nephelometric turbidity unit
OCP(s)	Organochlorine Pesticide(s)
Porter-Cologne Act	California Porter-Cologne Water Quality Control Act
ppb	parts per billion
ppb-dw	parts per billion, dry weight
ppb-ww	parts per billion, wet weight

LIST OF ACRONYMS AND ABBREVIATIONS (cont.)

ppm	parts per million
QAPP	Quality Assurance Project Plan
RARE	Preservation of Rare, Threatened, or Endangered Species
REC I	Water Contact Recreation
REC II	Water Non-contact Recreation
Regional Board	Regional Water Quality Control Board, Colorado River Basin Region
State Board	State Water Resources Control Board
TAC	Technical Advisory Committee
TDS	Total Dissolved Solids
TMDL(s)	Total Maximum Daily Load(s)
TSS	Total Suspended Solids
UCCE	University of California Cooperative Extension
USBR	United States Bureau of Reclamation
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WARM	Warm Freshwater Habitat
WILD	Wildlife Habitat
WLA(s)	Waste Load Allocation(s)
WQO(s)	Water Quality Objective(s)
WQS	Water Quality Standards
WWTP	Waste Water Treatment Plant

EXECUTIVE SUMMARY

The New River originates in Mexico about twenty miles south of the International Boundary, and flows northward into the United States to its terminus at the Salton Sea in Imperial County, California. The New River is dominated by wastewater discharges from Imperial Valley agriculture and Mexico's agriculture and industry.

The California Regional Water Quality Control Board, Colorado River Basin Region (Regional Board) is charged by the California Water Code (CWC) with protecting the Region's water quality. The Regional Board listed the New River on California's Clean Water Act Section 303(d) as water quality limited, in part, because the River's sediment load violates water quality objectives that protect New River beneficial uses. Water quality objectives for suspended solids, sediment, and turbidity are being violated in the New River, adversely affecting the following beneficial uses: warm freshwater habitat (WARM); wildlife habitat (WILD); preservation of rare, threatened, and endangered species (RARE); contact and non-contact water recreation (REC I and REC II); and freshwater replenishment (FRSH).

The Regional Board also is responsible for implementing pollution control measures required by the federal Clean Water Act (CWA). Federal water quality standards consist of beneficial uses designations and water quality objectives necessary to protect those uses.

The main source of sediment to the New River is agricultural runoff from the Imperial Valley and Mexico. Excess sediment in the water column and in bottom deposits adversely affects aquatic organisms. Sediment also serves as a carrier for DDT, DDT metabolites, and other insoluble pesticides including toxaphene. These deposits and chemicals pose a threat to aquatic and avian communities and people feeding on New River fish.

PROPOSED TMDL

This Sedimentation/Siltation TMDL Report (TMDL Report) identifies total allowable loads for sediment sources to the New River. When allowable loads are achieved, they are expected to eliminate sediment-caused impairments. Regional Board staff proposes that the Regional Board amend the Water Quality Control Plan for the Colorado River Basin (Basin Plan) to establish this New River Sedimentation/Siltation TMDL and Implementation Plan. Specifically, this TMDL:

- identifies sediment loading problems that prompted TMDL development
- specifies an in-stream numeric target for total suspended solids to ensure water quality objectives attainment
- identifies and quantifies sediment sources
- links water quality objectives with the TMDL
- allocates allowable loads for sediment sources so that the numeric target is met and water quality objectives are attained
- describes the Implementation Plan necessary to achieve TMDL compliance

The numeric target established by this TMDL is an annual average instream total suspended solids concentration of 200 milligrams per liter (mg/L) that applies along the entire U.S. River length. This target is about a 17% reduction of current annual mean suspended solids concentration at the New River outlet, where concentration highest.

The total sediment load to the New River corresponding to the numeric target is approximately 128,000 tons per year. This total load is allocated among the River's sediment sources, and contains a margin of safety to account for data uncertainty. Load allocations are established for: (a) all drains discharging to each of three River reaches, (b) natural sources, and (c) Mexico sources.

The Implementation Plan includes a description of:

- actions that responsible parties (e.g., dischargers and U.S. government) must take to achieve sediment load reductions
- time schedules for actions to be taken by responsible parties
- monitoring plans that determine milestone progress and TMDL adjustments

The Implementation Plan is based on the State's three-tiered approach for nonpoint source (NPS) water quality control, which is consistent with the "California Nonpoint Source Management Plan" (State Water Resources Control Board, 1998). The Plan utilizes a combination of the following three tiers:

- self-determined actions, including development and implementation of the Imperial County Farm Bureau Voluntary Program
- regulatory-encouraged actions, including the requirement that the Imperial Irrigation District develop and implement a water quality monitoring program, a sediment management program, and mitigate for associated impacts
- effluent limitations

Compliance with TMDL load allocations likely will be through the regulatory-encouraged approach.

TMDL implementation will occur in four phases and cover twelve years. Interim targets will assess water quality improvement progress. TMDL review will occur every three years and be adjusted to account for new information, to refine TMDL components, and to develop site-specific objectives and control measures.

Attached to this TMDL Report are the:

- proposed Basin Plan amendment to establish the TMDL and Implementation Plan (Attachment 1)
- Draft Regional Board Resolution to adopt the proposed Basin Plan amendment (Attachment 2)
- Environmental Checklist and Determination, as required by the California Environmental Quality Act (Attachment 3)
- documentation of project area biological resources and an impact assessment of project alternatives on those resources (i.e., Natural Environment Study), as required by various state and federal statutes (Attachment 3A)
- analysis of potential economic costs to agriculture (Attachment 4)

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1. INTRODUCTION

The New River watershed is located in southeastern California and, to a much lesser extent, in northern Baja California, Mexico, in the Colorado Desert region of the Sonoran Desert. The New River supports diverse wildlife populations and a variety of human uses. The New River is sustained and dominated by agricultural return flows discharged from Imperial Valley farmland directly into the River or indirectly through Imperial Valley Agricultural Drains (Ag Drains) operated by the Imperial Irrigation District (IID).

The State Board's 303(d) list of impaired waterbodies identifies the New River as water quality limited, in part, because sediment violates water quality objectives that protect the following beneficial uses: warm freshwater habitat (WARM); wildlife habitat (WILD); preservation of rare, threatened, and endangered species (RARE); contact and non-contact water recreation (REC I and REC II); and freshwater replenishment (FRSH) (California Regional Water Quality Control Board 1994).

The purpose of this New River Sedimentation/Siltation Total Maximum Daily Load (TMDL) is to protect New River beneficial uses by reducing the amount of polluted sediment. This TMDL applies only to the U.S. portion of the New River. The U.S. government expects to address sedimentation/siltation cooperatively with Mexico to ensure TMDL compliance where the New River enters California.

A TMDL is defined as the sum of the individual waste load allocations (WLAs) for point sources of pollution, plus the sum of the load allocation (LA) for nonpoint and natural background sources of pollution, plus a margin of safety (MOS), such that the capacity of the waterbody to assimilate pollutant loadings without violating water quality objectives is not exceeded. That is,

$$\text{TMDL} = \Sigma\text{WLA} + \Sigma\text{LA} + \text{MOS}$$

where Σ = sum, WLA = waste load allocation (for point sources), LA = load allocation (for nonpoint and natural background sources), and MOS = margin of safety.

This TMDL addresses New River sedimentation/siltation impairments, and identifies allowable sediment loads for point and nonpoint sources discharging into the New River. When allowable loads are achieved, they are expected to eliminate sediment-caused impairments.

2. PUBLIC PARTICIPATION

Significant public input occurred TMDL development. This draft TMDL will be circulated for public review before consideration of approval by the Regional Board during a public hearing.

A. TECHNICAL ADVISORY COMMITTEE (TAC)
The Imperial Valley Sedimentation/Siltation TMDL Technical Advisory Committee (Silt TMDL TAC) was formed in December 1998 to provide expert resources, scientific evaluations, and recommendations regarding development and implementation of Imperial Valley Sedimentation/Siltation TMDLs. TAC members contributed their local knowledge, experience, concerns, and viewpoints of stakeholder groups. In support of the TAC, Regional Board staff prepared agendas; distributed minutes; attended and participated in meetings[1]; and prepared and distributed information materials. TAC members are from:

- Audubon Society
- Coachella Valley Water District
- Desert Wildlife Unlimited, Inc.
- Farmers from the Imperial Valley
- Imperial County Agricultural Commissioner
- Imperial County Farm Bureau and Imperial Valley Vegetable Growers Association
- Imperial Irrigation District
- Salton Sea Authority
- Salton Sea Science Subcommittee
- Sierra Club
- Sonny Bono Salton Sea National Wildlife Refuge
- State Board
- University of California Cooperative Extension, Holtville Field Station
- U.S. Bureau of Reclamation
- US Filter Corporation
- U.S. Fish and Wildlife Service

B. PUBLIC OUTREACH
Since 1998, Regional Board staff conducted public outreach for this TMDL through presentations to:

- Imperial Irrigation District's Board of Directors
- Tribal nations during annual nonpoint source pollution prevention workshops
- Imperial Valley Community College students and faculty
- Salton Sea Authority Technical Committee
- Salton Sea Science Subcommittee
- Annual Salton Sea Symposium participants

[1] The TAC met on January 12, February 1, March 15, April 19, May 17, June 21, August 2, September 20, and October 18, 1999 ; and January 19, February 9, March 20, and April 17, 2000.

3. PROBLEM STATEMENT

This Problem Statement includes a description of: (a) violated Water Quality Objectives that prompted TMDL development, (b) watershed characteristics that contribute to sedimentation/siltation, and (c) impairments caused by sedimentation/siltation.

A. WATER QUALITY OBJECTIVES

Sediment, suspended solids, and turbidity are present in the New River at levels that violate narrative water quality objectives established by the Regional Board to protect New River beneficial uses. These violations of water quality objectives indicate that New River beneficial uses are impaired. Tables 3.1 and 3.2 summarize water quality objectives and New River beneficial uses.

Table 3.1: Water Quality Objectives

Parameter	Water Quality Objective
Sediment	The suspended sediment load and suspended sediment discharge rate to surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses.
Suspended Solids	Discharges of wastes or wastewater shall not contain suspended or settleable solids in concentrations which increase the turbidity of receiving waters, unless it can be demonstrated to the satisfaction of the Regional Board that such alteration in turbidity does not adversely affect beneficial uses.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses.

Source: California Regional Water Quality Control Board 1994

Table 3.2: Designated Beneficial Uses of the New River

Designated Beneficial Uses	Description
Warm Freshwater Habitat (WARM)	Uses of water that support warm water ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.
Wildlife Habitat (WILD)	Uses of water that support terrestrial ecosystems including, but not limited to, the preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), water, and food sources.

Preservation of Rare, Threatened, and Endangered Species (RARE)	Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance of plant or animal species established under state or federal law as rare, threatened or endangered.
Contact Recreation (REC I)[2]	Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, and use of natural hot springs.
Non-Contact Recreation (REC II)	Uses of water for recreational activities involving proximity to water, but not normally involving contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tide pool and marine life study, hunting, sightseeing, or aesthetic enjoyment of the above activities.
Freshwater Replenishment (FRSH)	Uses of water for natural or artificial maintenance of surface water quality or quantity.

Source: California Regional Water Quality Control Board 1994

B. WATERSHED CHARACTERISTICS

Hydrogeological Setting

The main source of sediment to the New River is agricultural runoff from the Imperial Valley and Mexico. The New River watershed drains approximately 175,000 acres from Imperial Valley, and 300,000 acres from the Mexicali metropolitan area and Mexicali Valley, Mexico. The River carries agricultural runoff, partially treated and untreated municipal and industrial wastewater, stormwater, and urban runoff from Mexicali Valley northward across the International Boundary into the United States. As the River travels through Imperial Valley, it is fed by: (a) agricultural runoff from about 400 miles of IID Ag Drains (accounting for about 2/3 of river flow), (b) treated municipal and industrial wastewater, and (c) stormwater and urban runoff (Table 3.3). Table 3.3 summarizes the New River's flow sources and percent flow contribution

Table 3.3: New River Flow Sources and Percent Flow Contribution

Flow Source	Percent (%) Flow Contribution
U.S. Sources	
Agricultural Runoff	62
Treated Municipal and Industrial Wastewater	2
Stormwater and Urban Runoff	<0.5
Mexican Sources	
Agricultural Runoff	25
Partially Treated and Untreated Municipal and Industrial Wastewater	8
Stormwater, Urban Runoff, Other	2.5

Soil Classifications
Local soils are mostly colloidal clays and silts. These soils tend to be cohesive, and therefore not easily erodable. This is evident in that the channel of the New River and its tributary drains remain relatively stable. Instream erosion and wind deposition are believed to be a relatively minor source of suspended sediment, therefore the principal source of suspended sediments being contributed to the River are the agricultural fields. All Imperial Valley soils are poorly drained due to low permeabilities (less than 0.5 inches per hour). Soil descriptions (Zimmerman 1981) are in Appendix A.

C. IMPAIRMENT BY SEDIMENT

The New River carries a high sediment concentration, as indicated by total suspended solids (TSS) and turbidity measurements in downstream reaches. New River data at Lack Road Bridge, just upstream of the Salton Sea outlet, are summarized in Table 3.4.

Table 3.4: TSS and Turbidity Data Upstream of the New River Outlet to the Salton Sea

Data Source	Period of Record	Record Type	TSS (mg/L)	Turbidity (NTU)
Imperial Irrigation District	1/96 - 3/98 (monthly)	mean	241	170
		maximum	460	330
		minimum	120	26

Sediment as an Impairment to Aquatic and Terrestrial Organisms
Excess sediment in the water column and in bottom deposits threatens many aquatic and terrestrial organisms that utilize New River habitat. Diversity is reduced as sediment-sensitive species disappear.

In the water column, excess sediment can: (1) clog fish gills, causing death or inhibiting growth, (2) prevent successful development of fish eggs and larvae, (3) modify natural fish movements and migration, and (4) reduce food abundance available to fish (Ohlendorf and Marois 1990). Excess sediment in the water column also can: (1) reduce light penetration, which reduces the ability of algae to produce food and oxygen, (2) affects other parameters such as temperature, and (3) interferes with mixing, which decreases oxygen and nutrient dispersion to deeper layers.

In bottom deposits, excess sediment can: (1) smother bottom-dwelling organisms, (2) cover breeding areas, and (3) smother eggs. Excess sediment in riparian habitat can bury tree and shrub roots, as well as reeds, cattails, and arrowheads used for food and cover. New River riparian areas constitute sensitive habitat, as they provide important habitat for songbirds and serve as potential wildlife movement corridors. Excess sediment in wetlands habitat can choke out plants that are used for food and cover, and can drastically reduce the health and numbers of organisms (e.g., plankton, detritus, aquatic vegetation) at the base of the food web. New River wetlands areas, as part of the Salton Sea delta, are a critical stop for migrating birds on the ecologically important Pacific Flyway, a major migratory route connecting Canada and the U.S. to Mexico and Central America.

Sediment as a Carrier for DDT, DDT Metabolites, and Toxaphene

The New River has one of the highest maximum Total DDT concentrations (Appendix B, Table B-2) in the Region (Appendix B, Table B-5). Total DDT concentrations in fish tissue exceed the National Academy of Sciences (NAS) recommended maximum concentration and the U.S. Food and Drug Administration (FDA) Action Level. (NAS guidelines are meant to protect species that consume DDT at all food chain levels. FDA Action Levels are meant to protect humans from chronic effects of DDT consumption, and are based on consumption quantity and frequency.)

DDT[2] was a widely used insecticide in the United States between 1942 and 1973. DDT breakdown products include the metabolites DDE[3] and DDD[4]. The sum of DDT, DDE, and DDD commonly are referred to as “Total DDT.” DDT, DDE, and DDD are known carcinogens listed in the Governor’s Proposition 65 List of Chemicals Known to the State of California to Cause Cancer or Reproductive Toxicity. DDT is also a recognized developmental toxicant. DDT was banned in the United States in 1973 and in Mexico in 1983.

DDT was used extensively in Imperial Valley as a low-cost, broad-spectrum insecticide (Setmire et al. 1993). The pesticide dicofol, currently in use in Imperial Valley, contains DDT and may contribute DDT metabolites to Imperial Valley. Studies in other areas of California show that DDT breakdown products have a very long lifetime in agricultural fields with clay soils (California Department of Food and Agriculture 1985), like the soils in Imperial Valley.

DDT and its metabolites are organochlorine pesticides (OCPs) with low water solubility. As such, they have a propensity to attach to negatively-charged clay-rich sediments, like those in Imperial Valley. Therefore, sediment-laden agricultural runoff serves as the transport mechanism by which DDT compounds adhering to soil are introduced to the Ag Drain and New River water system. DDT metabolites have been detected in bottom sediment samples in the New River and other Imperial Valley waterways (Setmire et al. 1990, Setmire et al. 1993, Eccles 1979).

DDT and its metabolites have a high propensity to store themselves in body fat, especially in the central nervous system, liver, and kidneys. In these organs, OCPs damage important enzyme functions and disrupt biochemical cell activity (U.S. Environmental Protection Agency 1989). These properties allow DDT and its breakdown products to bioaccumulate in fish and wildlife, with severe consequences for wildlife at the top of the food chain. DDT effects on birds and aquatic organisms are well-documented by scientists throughout the world. Adverse effects include egg thinning, egg breakage, decreased egg productivity, decreased hatching and fledging success, decreased nesting success, chick mortality during hatching, and death (Kaloyanova and Mostafa 1991).

Fish and bird specimens from the New River and the rest of Imperial Valley routinely have some of the highest DDE concentrations in California (State Water Resources Control Board 1978-1995, U.S. Environmental Protection Agency 1980, Ohlendorf and Miller 1984, Mora et al. 1987, Setmire et al. 1993). Some of the highest concentrations were found in birds feeding in agricultural fields on invertebrates and other food items (Setmire et al. 1993).

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[2] Dichlorodiphenyl trichloroethane

[3] Dichlorodiphenyl dichloroethylene

[4] Dichlorodiphenyl dichloroethane

Reproductive success of colonial nesting birds has declined at the Salton Sea, likely due to high levels of multiple contaminants, particularly organochlorine pesticides, in eggs (Bennett 1998). DDE-caused reproductive depression in birds has emerged as a serious concern in the Salton Sea area. Resident birds typically had higher DDE concentrations than migratory species. The endangered California brown pelican, threatened bald eagle, and endangered peregrine falcon, among others, are exposed to DDE levels that pose a high concern level and an increased risk of adverse effects (Setmire et al. 1993). People who consume New River fish also are at risk.

The New River also has the highest maximum toxaphene concentration in the Region (Appendix B, Table B-5). Toxaphene, like DDT, is an organochlorine chemical with low water solubility, a propensity to attach to soil particles, and a tendency to bioaccumulate in fish and wildlife. Toxaphene has a half-life in soil of up to 14 years (Genium Publishing Corporation 1999), has high chronic toxicity to aquatic life (U.S. Environmental Protection Agency 1989), and is a recognized Proposition 65 carcinogen. USEPA canceled all registered toxaphene uses in 1983 (Ware 1991).

4. NUMERIC TARGET

This TMDL uses numeric targets to reduce sediment loads to meet water quality objectives (Table 3.2) that protect New River designated beneficial uses (Table 3.1). Numeric targets presented herein are based on scientific literature (Wood and Armitage, 1997), monitoring data, and best professional judgment. Achieving the targets should result in the New River being unimpaired by sedimentation/siltation. TSS and turbidity were chosen as water column sediment indicators, in accordance with EPA's *Protocol for the Development of Sediment TMDLs* (U.S. Environmental Protection Agency 1999a), due to the New River's relatively stable flows and average sediment concentrations, and the availability of TSS and turbidity data.

Numeric targets are based on levels that protect aquatic life from direct effects of suspended sediments. The numeric target established by this TMDL is an annual average instream total suspended solids (TSS) concentration of 200 mg/L, and applies throughout the entire U.S. length of the New River from the International Boundary to the Salton Sea. This target is about a 35% reduction of current annual mean suspended solids concentration at the New River outlet, where concentrations are highest.

The total sediment load to the New River corresponding to the numeric target is approximately 128,000 tons per year. This total load is allocated among the River's sediment sources, and contains a margin of safety to account for data uncertainty as required. Load allocations are established for all drains discharging to each of three River reaches, for natural sources, and for Mexico sources.

The numeric target takes into account that the New River is a warmwater river, and that local aquatic organisms have developed in conjunction with high sediment loads. This target represents significant reductions in current TSS and turbidity levels, and will take several years to meet.

A. BASIS FOR NUMERIC TARGET

The National Academy of Sciences (NAS)[5] recommends the following general maximum total suspended solids (TSS) concentrations to protect aquatic life (National Academy of Sciences 1972):

High Level of Protection	25 mg/L
Moderate Protection	80 mg/L
Low Level of Protection	400 mg/L

The EPA's *Quality Criteria for Water* (U.S. Environmental Protection Agency 1986), also known as the "*Gold Book,*" reaffirmed NAS recommended criteria. NAS recommendations were based on a literature survey of direct effects of suspended solids on freshwater fish life cycles, performed by the European Inland Fisheries Advisory Council (EIFAC), an international Advisor

[5] NAS guidelines allow us to assess pollutant bioaccumulation. NAS guidelines were established to protect organisms exposed to toxic compounds and to protect species that consume these contaminated organisms. FDA action levels are intended to protect humans from chronic effects of toxic substances consumed in food. FDA action levels are based on specific assumptions of the quantities and frequency of food consumed by humans.

Institution that conducts studies on different worldwide topics (European Inland Fisheries Advisory Council 1965).

The EIFAC literature survey revealed that healthy fisheries sometimes occur at lower concentrations of 80 to 400 mg/L TSS. However, death rate is substantially greater for fish living for long periods in waters containing TSS in excess of 200 mg/L than for fish living in cleaner water. Only poor fisheries are likely to be found in waters that normally carry greater than 400 mg/L TSS (European Inland Fisheries Advisory Council 1965).

The numeric target proposed in this TMDL was based on NAS and EIFAC recommendations that suggest general levels of suspended solids that would be protective of aquatic ecosystems (not limited to coldwater streams). The 200 mg/L target is within the upper range of these recommendations. Applying background water quality would have resulted in a more stringent target.

Studies are scarce regarding suspended sediment effects on mortality or sub-lethal conditions of warmwater fish (Waters 1995). Warmwater streams are often muddy with silt and sandy bottoms, and are generally more turbid than coldwater streams (Waters 1995).

B. EXISTING CONDITIONS COMPARED TO NUMERIC TARGET

Table 4.1 compares the most recent TSS measurements at the New River outlet with the TMDL numeric target. A 17% TSS reduction is needed to meet the numeric target at the New River outlet.

Table 4.1: Comparison of Existing TSS to Numeric Target

Location	Existing TSS (mg/L)	Target TSS (mg/L)	Reduction Needed
New River at Lack Road Bridge	241*	200	17%

*Mean concentration based on all data from 1996-1998
Imperial Irrigation District

New River suspended sediment concentrations tend to increase downstream (Huston et al. 2000), as discussed in the Source Analysis section of this TMDL Report. Therefore, the New River outlet to the Salton Sea is the location with the greatest need of TSS and turbidity reduction.

5. SOURCE ANALYSIS

The source analysis identifies and quantifies sediment sources to the New River. Sedimentation in the New River watershed is a function of soils, land uses, and climate. Imperial Valley soils are cohesive due to high silt and clay content (Zimmerman 1981). Over 90% of the New River watershed is dedicated to highly productive irrigated agriculture. The Imperial Valley is arid, with an annual rainfall is about 3 inches. However, New River watershed land receives about 850,000 acre-feet per year (AFY) of irrigation water, or an average of about 5 feet of water per year.

A. SEDIMENT SOURCES

The major New River sediment sources are Imperial Valley agricultural return flows. Minor sediment sources include in-stream erosion, point source (NPDES) facilities, Mexico wastewater, and dredging. Relatively insignificant sources are stormwater runoff, and urban runoff and wind deposition. Each of these is described briefly below.

Imperial Valley Agricultural Return Flows

Imperial Valley agricultural return flows are the major sediment source to the New River. About two-thirds of the New River's flow originates from Imperial Valley irrigated agriculture. Table 5.1 shows Ag Drain general composition by water source.

Table 5.4: Average Annual Discharges to the New River, Alamo River, and Imperial Valley Ag Drains by Source (1987-1996)

Source*	AFY	Percent
Operational Spill	123,018	12
Tailwater	479,661	48
Tilewater	261,278	26
Seepage	128,165	13
Total	**992,122**	**100**

Source: Jenson and Walter 1997

* Operational spill = water that reaches the irrigation canal terminal end, but is not applied to fields, and thus must be diverted into a drainage ditch. Tailwater = water that does not percolate into soil, and exits the field's lower end into a drain, thus tending to erode fields, and acquire silt and sediment, as it crosses and exits a field. Tilewater = water that has percolated through soil, but is not absorbed by crops, thus flushing salts from soil. Seepage = subsurface water that enters a drain due to a hydraulic gradient resulting primarily from irrigation canals that are losing water.

Of these sources, tailwater is the primary sediment source. Seepage, tilewater, and operational spills consist of relatively sediment-free water, and thus serve to dilute sediment concentrations from tailwater.

Dredging

Dredging suspends large quantities of sediment, and thus is a significant source of New River suspended sediments. Many Ag Drains require periodic dredging to maintain adequate drainage, due to sediment loads received from agricultural fields. Dredging removes about 210,000 tons of sediment annually from New River watershed Ag Drains (Imperial Irrigation District 2000).

In-Stream Erosion and Wind Deposition (Natural Sources)
In-stream erosion is limited effectively by weirs or drop structures in the New River channel. This makes the New River relatively slow-moving and stable. Additionally, in-stream erosion is limited because: (a) New River channel soil material is cohesive, and (b) banks of the New River are vegetated densely with shrubs, grasses, and trees. Erosion of channel banks occurs within drains, although this is limited by concrete weirs or drop structures. Additionally, erosion is limited because channel soil material is cohesive. About 400 miles of Ag Drains service the New River watershed. Wind deposition is also considered a minor source because the surface area exposed to deposition is relatively insignificant.

Point Source (NPDES) Facilities
NPDES sources are a relatively insignificant source of sediment to the New River. Eight wastewater treatment plants and one power-generating facility are permitted to discharge into tributaries of the New River.

Mexico Wastewater
Mexico wastewater that crosses at the International Boundary serves to dilute the discharges that later enter the New River via Imperial Valley Ag Drains, as the suspended solids concentration at the International Boundary is substantially lower (about 53 mg/L) than further downstream in Imperial Valley. The flow contribution entering the U.S. from Mexico is significant, as about one-third of New River flow originates in Mexico.

Stormwater Runoff
Stormwater runoff is a relatively insignificant source of sediment to the New River due to the arid Imperial Valley climate. Stormwater runoff enters receiving waters following precipitation events.

Urban Runoff
Urban runoff is a negligible source of sediment to the New River due to Imperial Valley's arid climate and small population. Urban runoff refers to water from human activities that flow from city streets and adjacent domestic or commercial properties.

B. METHODOLOGY

The source analysis uses existing data, and identifies and quantifies natural and human-related processes and sources that contribute to New River sediment loading. Where major data gaps existed, field monitoring was conducted to address gaps. Described below are: (a) available watershed data, and (b) methods utilized to quantify sediment loads contributed by identified processes and sources.

Analysis for Point Sources

The monthly suspended sediment load from each point source of pollution (i.e., NPDES facilities) into the River and minor drains was calculated by multiplying the facility's reported monthly effluent flow times the facility's reported monthly effluent TSS concentration[6].

Analysis for Nonpoint Sources

The monthly suspended sediment load in the New River at the International Boundary with Mexico was calculated by multiplying monthly average TSS concentrations by total monthly flow. Monthly flow data for minor drains was estimated from monthly irrigation water deliveries for areas served by drains. Missing monthly flow data for major drains was estimated using statistical analyses of existing major drains flow data and the irrigation delivery data for areas served by major drains.

The monthly suspended sediment load contribution from each of the minor drains to the New River was estimated by multiplying estimated monthly flow of each minor drain by the calculated TSS concentration for the minor drains using a mass balance approach.

The monthly suspended sediment load contribution from each of the major drains to the New River was estimated by multiplying drain flow by the calculated TSS concentration for the major drains using a mass balance approach.

The potential relative contribution from drain dredging operations was estimated by using TSS monitoring data collected by Regional Board staff upstream and downstream of a dredging operation and by using IID flow data.

An estimate of the load due to stormwater runoff from urban and farmland areas in the New River watershed was calculated using actual recorded precipitation data from 1995 through 2000 for the area and using a TSS literature value of 150 mg/L for urban runoff (Horner et al. 1994).

Potential cumulative loading caused by in-stream erosion and wind deposition in drains was estimated using an empirically calculated method.

Because of limited available data, the source analysis should be viewed as an estimate of loading conditions for the drains and New River—an estimate that will be refined through on-going data acquisition and monitoring. The following paragraphs detail the analysis, available data, analysis methodology, and assumptions.

DATA AVAILABILITY

The Imperial Irrigation District (IID) maintains extensive databases on irrigation deliveries and drain flows, and also has considerable data on irrigation and drain water quality. From November 16, 1999 to March 28, 2000, Regional Board staff mailed several requests to IID asking for all available drain flow and water quality data for 1994 through 1999, as well as irrigation delivery data and other information relevant to this TMDL. In June 2001, a request was made to IID for a database update.

In January 2000, IID provided a database with drain, canal, and river flow data to Regional Board staff to facilitate development of this TMDL. In June 2001, IID provided a database

[6] The point source loading analysis was conducted only to characterize the relative contribution by nonpoint sources of pollution using a mass balance approach.

update through May 2001. IID typically measures real time flow by using a weir in combination with a measuring/recording device. IID obtains New River flow data at the Salton Sea outlet through the USGS, which interpolates flow for days for which gauged flow data is unavailable. There are various sampling sites in the data set wherein flow data for specific dates are missing. Because these instances are relatively few, the overall flow data is assumed to be accurate, within plus or minus 20%, the accuracy of flow meter instrumentation.

IID also provided TSS and turbidity data collected pursuant to its Drain Water Quality Improvement Plan (DWQIP). DWQIP sampling protocols for TSS call for collection of grab samples. A review of the plan indicates that the sampling procedure and lab analysis methods are acceptable for this source analysis. However, due to limited data, a mass balance approach was used to estimate TSS concentration.

The USGS has two sampling stations along the New River at which flow and TSS are measured. The stations are near Westmoreland and in Calexico near the International Boundary. The Westmoreland station data are used as data for the New River at the outlet. Figure C-1 in Appendix C shows sampling station locations (Surface Water Data for California: Monthly Streamflow Statistics, http://water.usgs.gov./ca/nwis/monthly). Daily recorded precipitation data also are available for the Seeley, Westmorland, and Calexico areas from 1995 through 2000.

Regional Board staff conducted sampling events in March 2001, May 2001, and June 2001 to measure TSS and turbidity in the New River, three main drains, and two minor drains for use in TMDL development and implementation. Sampling stations included four located on the New River, one at the outlet of each of three major drains, and one at the outlet of each of two minor drains, for a total of nine sampling stations. Review of results indicates a strong linear correlation (R^2 = 0.89) of TSS to turbidity (see Figure C-2 in Appendix C).

Regional Board staff monitored TSS concentrations in the Warren Drain (Alamo River watershed) during a dredging operation on February 8, 2000 to obtain an understanding of potential TSS increases caused by such operations. TSS sampling included upstream and downstream sample collections. The TSS concentration upstream of the dredging operation was less than 30 mg/L, while the TSS concentration at 500 feet downstream of the dredging operation was over 5,000 mg/L.

All point source facilities in the watershed are required under their NPDES permits to submit regular reports to the Regional Board regarding their effluent volume and quality.

Summary of Available Data
The following flow data are available for the New River watershed:

<u>Point Source (NPDES) Facilities</u> – Daily flow data for NPDES facilities discharging into the New River watershed are available in Regional Board files. Data and calculations from 1995-2000 are presented in Table C-2 in Appendix C.

<u>New River Outlet</u> – Regional Board obtained USGS monthly flow data from 1995-2000 for the New River outlet.

<u>New River at the International Boundary</u> – Regional Board obtained USGS monthly flow data from 1995-2000 at the International Boundary.

Major Drains – IID provided monthly flow data from January 1994 through May 2001 for all four major drains. This data set contained relatively few missing data points.

Minor Drains – IID provided monthly flow data from January 1995 through May 2001 for gauged minor drains. IID gauged flows in two of fifty-one minor drains during this period. However, these drains were gauged for only a portion of that period.

Irrigation Deliveries – IID provided a database with daily records of January 1995 through May 2001 irrigation water deliveries for the watershed. Database fields included canal, drain, drain prefix, drain suffix, delivery date, and delivery quantity in acre-feet.

Precipitation -- Daily recorded precipitation data are available for the Brawley, El Centro, Calexico, and Imperial areas from 1995 through 2000.

The following TSS and turbidity data are available for the New River watershed:

Point Source (NPDES) Facilities – Complete records of NPDES effluent TSS concentrations are available from Regional Board files. Table C-2 in Appendix C presents data from 1995 through 2000.

New River Outlet – IID provided monthly TSS and turbidity data for January 1996 through March 1998 the New River outlet.

New River at the International Boundary – Monthly TSS and turbidity data for 1995-2000 at the International Boundary is available from the Regional Board's International Boundary and Water Commission (IBWC). Table C-4 in Appendix C shows this data.

Major Drains – IID provided monthly TSS and turbidity data for January 1996 through March 1998 for the Greeson drain, and for January 1998 through March 1998 for the Rice 3 drain. TSS and turbidity data for four drains also is available for three sampling events conducted by Regional Board staff in 2001. The only available data for the Fig and Rice drains is from the 2001 sampling events. Due to limited data, a mass balance approach was used to estimate TSS concentration.

Minor Drains – TSS and turbidity data for minor drains were acquired during the 2001 Regional Board staff sampling events. Due to limited data, a mass balance approach was used to estimate TSS concentration.

Drain Maintenance Operations – Regional Board staff monitored TSS and turbidity during a dredging event on February 8, 2000, to obtain an understanding of potential suspended sediment increases caused by such operations. Table C-5 in Appendix C summarizes results. Regional Board staff recognize the need to develop and implement a more comprehensive monitoring program to quantify dredging impacts.

C. POINT SOURCES

The Clean Water Act defines a point source as:

"…any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture or agricultural storm water runoff."

Point source TSS loading into the New River occurs via drains. An analysis of point source contributions to drains is presented herein only to estimate, by process of elimination, the relative contribution of nonpoint sources (e.g., tailwater and in-stream erosion).

D R A F T

Point Source (NPDES) Facilities
As described above, eight wastewater treatment plants (WWTPs) discharge effluent into drains tributary to the New River, and one geothermal power plant is permitted to discharge but currently is not doing so. TSS loading from each facility was estimated using self-monitoring data, by multiplying the average (1995-2000) TSS concentration for each month by the average (1995-2000) flow for that month. Results indicate that the facilities' sediment load is insignificant compared to overall New River sediment loading (approximately 156.000 tons annually) because the facilities' TSS is comprised mainly of biodegradable matter. The New River's sediment of concern is primarily sediment laden with insoluble pesticides. However, point source TSS loading is a concern for nutrient delivery. Facility names and average yearly discharge flow and TSS data for 1995-2000 are shown in Table 5.2. Monthly flow and TSS data are presented in Table C-2 in Appendix C.

Table 5.5: Average Annual TSS Loading from NPDES Facilities (1995-2000)[7]

Discharger	Discharge Location	Flow (AFY)	Sediment Load (tons/yr)	% of Drain or River Flow	% of New River Flow at the Outlet
City of Calexico WWTP 1	New River	2018.2	64.9	1.3%	0.42%
City of Calexico WWTP 2	New River	980.1	88.6	0.62%	0.21%
City of Brawley WWTP	New River	3936.9	194.5	1.2%	0.84%
City of Westmoreland WWTP	Trifolium Drain 6	232.1	10.5	2.1%	0.05%
Seeley County Water District	New River	109.6	6.8	0.05%	0.02%
Date Gardens Mobile Home Park	Rice 3 Drain	10.5	0.12	0.06%	0.002%
McCabe Union School District	Wildcat Drain	1.4	0.015	0.008%	0.0003%
Centinela State Prison	Dixie Drain 1-C	563.5	35.8	2.3%	0.12%
U.S. Navy Facility, El Centro	New River	128.8	3.31	0.05%	0.03%
Second Imperial Geothermal Company	New River	0.0	0.0	0.0%	0.0%

[7] Calculations based on self-monitoring effluent data for each NPDES facility.

D. NONPOINT SOURCES

Nonpoint sources are “diffuse pollution sources (i.e., without a single point of origin or not introduced into a receiving stream from a specific outlet)”, as defined by USEPA. Although a point source includes discharges from pipes and ditches, agricultural return flows discharged through pipes are exempt from the point source classification. For the purpose of this TMDL, nonpoint sources include agricultural return flows (i.e., tailwater and tilewater), wind deposition, in-stream erosion, stormwater runoff, and urban runoff. Also, the Mexico sediment contribution at the International Boundary is treated as a single nonpoint source contribution, even though it is the result of mixed point and nonpoint sources of wastes.

D R A F T

The New River at the International Boundary

The New River 1995-2000 average flow at the International Boundary was 157,443 AFY, as measured by USGS. To calculate Mexico’s contribution to New River sediment load, monthly flow (in AF per month) and TSS (in mg/L) values were multiplied. The result then was converted to tons per month by multiplying by a conversion factor of 0.0013597. Figure 5.1 shows a sample calculation. Detailed calculations are in Table C-6 in Appendix C. Yearly flow and relative TSS contributions from Mexico at the International Boundary are shown in Table 5.3. Flow across the Boundary is projected to be significantly reduced due to water consumption by power plants currently under construction in Mexicali.

- $\text{Monthly Loading} = \text{Monthly Flow x Average Monthly TSS}$

$$\text{Oct 1999 Loading (tons)} = 13650.2 \text{ acre-ft} * 61.0 \frac{\text{mg}}{\text{L}} * 0.0013597 \frac{\text{tons} * \text{L}}{\text{acre-ft} * \text{mg}} = 1{,}132.2 \text{ tons}$$

Figure 5.1: Sample Calculation – Sediment Load

Table 5.6: International Boundary Contribution

Year	Flow Volume (AFY)	Loading (tons/yr)
1995	142,384.9	10,679.7
1996	118,194.6	8,130.1
1997	157,300.5	11,399.0
1998	180,217.4	12,611.6
1999	183,662.7	12,959.4
2000	162,899.8	11,811.5
Average	**157,443.3**	**11,265.2**

In-Stream Erosion and Wind Deposition

In-stream erosion and wind erosion/deposition processes affect suspended sediment loads in the New River watershed. Data and/or research specific to each process is extremely limited.
Shearing forces at the water-streambed boundary cause in-stream erosion. Many equations are available wherein erosion is a function of velocity and streambed particle size distribution. These equations often are stream-specific (i.e., valid for use under certain conditions such as flow, soil type, percent fines in sediment load, etc.) and include constants that relate to stream conditions. Unfortunately, research generally is limited regarding quantification of constants for various stream types.

Selection of the most accurate erosion equation also is complicated by streambed composition. Cohesive bed sediments could exist if the proportion of silt-clay (<0.062mm particle diameter) is greater than ten percent. However, most research on in-stream sediment transport is related to uncohesive (i.e., unconsolidated) bed materials, which are bed materials previously deposited from upstream sources. Research involving erosion of cohesive (i.e., consolidated) bed sediments is extremely limited. The New River is unique with respect to flow, suspended sediment composition and load, and cross-sectional area. Research on streams with compatible features is extremely sparse, and parameters for in-stream erosion equations currently are unavailable. For the purposes of this TMDL, the assumption is that in-stream erosion is very little. This is justified by the fact that if in-stream erosion were significant, the channel would be increasing in width and/or depth. Observations show stream channel width and depth remain relatively unchanged from year to year.

Wind erosion occurs when wind velocity and turbulence are sufficient to dislodge soil particles. Given a sufficient velocity, the particle transport is possible for relatively long distances. Deposition occurs when velocity decreases sufficiently to cause particles to settle. Imperial Valley is known for sand storm events (with most “sand” coming from desert areas outside the New River watershed). Most wind-blown “sand” is likely to settle on land, as the watershed has more land surface area than water surface area. A fraction of this “sand” is probably soil that can remain in suspension once it hits water. However, like in-stream erosion, no data have been collected on wind deposition of TSS on the New River or Ag Drains.

For the purpose of this TMDL, the New River TSS concentration contributed by in-stream erosion and wind deposition is assumed to be 10 mg/L. Detailed calculations are shown in Table C-21 of Appendix C.

Stormwater Runoff
Stormwater runoff, a product of precipitation events, has the capacity to cause large-scale erosion in areas prone to intense storm events and erosion. Most local stormwater runoff originates from farmland, roads, and Imperial Valley communities draining into the New River watershed. However, Imperial Valley is arid, with an average annual precipitation of about 3 inches. Therefore, stormwater runoff is not a significant sediment source. The following analysis supports this conclusion.

The most potential for stormwater runoff within the watershed comes from cropped farmland, fallow fields, roads (paved and unpaved), and various urban surfaces. About 6,700 acres of urban area drain into the New River watershed, according to Imperial County data. These urban surfaces represent a wide range of runoff coefficients. A coefficient representing asphaltic cement streets (Steel and McGhee 1979) was chosen to represent a worst-case scenario.

Irrigation flows are much higher than one inch per hour. Therefore, potential stormwater runoff from farmland can be neglected except for areas that hypothetically were being irrigated just before, during, and just after the storm[8]. About 9,000 acres are irrigated on any given day on average (University of California Cooperative Extension 2000, Personal communication with Khaled Bali). Under a worst-case scenario, this acreage potentially could generate stormwater runoff, particularly if soils already were saturated. Table 5.4 summarizes the analysis.

[8] Valley farmers order water deliveries two days ahead of time. Valley irrigation scheduling factors in seasonal precipitation. However, farmers may not be able to factor in precipitation if the storm was not forecast before the order.

Table 5.4: Summary of Estimated Urban and Farmland Runoff Due to Precipitation

Year	Urban Runoff				Farmland Runoff			
	Volume (AFY)	% of River Flow	Load (tons)	% of River Load	Volume (AFY)	% of River Flow	Load (tons)	% of River Load
1995	1208.5	0.26	246.5	0.13	1620	0.35	330.41	0.17
1996	458.8	0.10	93.6	0.05	615	0.14	125.43	0.07
1997	2042.2	0.42	416.5	0.20	2737.5	0.57	558.33	0.27
1998	1824.0	0.37	372.0	0.18	2445	0.50	498.67	0.24
1999	1124.6	0.23	229.4	0.11	1507.5	0.31	307.46	0.15
2000	732.95	0.16	149.49	0.08	982.50	0.21	200.39	0.10

Source: California Department of Water Resources 1993-2001

Based on the foregoing, stormwater runoff was determined to be an insignificant sediment source for the purpose of the mass balance.

Urban Runoff

Urban runoff originates from human activities. These activities convey suspended solids into drains. However, the New River watershed population is relatively small and the climate extremely arid. Therefore, urban runoff is a negligible suspended sediment source.

Agricultural Return Flows

Flows were estimated for essentially all minor drains from 1995 through 2000, to calculate sediment loading from agricultural runoff. Monthly flow records for major drains were estimated for the same period if records were missing. Further, it was crucial to calculate a TSS concentration estimate for major and minor drains. The following sections describe procedures used to estimate flow and assemble the TSS data set.

E. FLOW ESTIMATION AND ASSUMPTIONS

Point and nonpoint source flow and sediment data from January 1995 through December 2000 (i.e., the subject period) were analyzed. Minor drain flow data was limited, and data gaps existed for major drains. Therefore, a water balance coupled with statistical inferences were used to estimate: (1) ungauged monthly flows discharged by major drains into the New River, and (2) monthly flows discharged by each minor drain for the subject period. Estimates for minor drains were based on IID water irrigation delivery data. Estimates for missing major drain monthly flow records also were based on IID water delivery records and statistical analyses of available flow data. Similarly, a mass balance was used to estimate suspended sediment contribution from each drain to the New River for the subject period. Major assumptions in this source analysis are as follows:

- The return flows in a particular drain are proportional to irrigation water deliveries to the particular area served by the drain (i.e., to the water delivered via major irrigation canals). This relationship was found to be reasonably accurate for gauged drains, where both water deliveries and return flow information were available. Therefore, similar water delivery to outflow relationships were assumed for ungauged drains.

• TSS concentrations in major drains are comparable. This assumption was based on similar geology, topography, water use, and land use within different "drainsheds," and general channel characteristics of major drains.

• TSS concentrations in minor drains are comparable. This assumption was based on similar geology, topography, water use, and land use within different "drainsheds," and general channel characteristics of minor drains.

• Most sediment re-suspended by dredging operations does not settle out. This assumption was based on small particle sizes (silt and clay) in Imperial Valley soils that filled drains prior to dredging operations.

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The first step in the analysis was to identify: (1) all drains discharging into the River, separating minor drains from major drains and their tributaries, and (2) corresponding major and minor irrigation canals. Available drain flow and irrigation water delivery data then were analyzed on a monthly basis for each major and minor drain. Data were evaluated to determine whether they were normally distributed based on their coefficient of variance (CV) (i.e., checked using appropriate statistical procedures). Data also were analyzed for potential outliers using Chauvinet's Criterion, as recommended in literature (Kennedy and Neville 1986). If a monthly flow/delivery value for any drain/canal was identified as an outlier, all discharges/deliveries for that drain/canal were reviewed to determine whether the database contained a complete record for the month. If the record was incomplete as indicated by no data entries for any given number of days, then the value was disregarded for analysis.

Major Drain Flow Estimations

Two methods were used to address flow data gaps in major drains. The first was to estimate missing monthly flows for the four major drains from available drain flow data (see Table C-7 in Appendix C) and irrigation delivery data (see Table C-8 in Appendix C). Specifically, ratios of drain flow to irrigation delivery for each month for each drain and corresponding canal were calculated for all months except the missing months. Then, the mean value, standard deviation and CV were calculated for each month of the subject period. Ratios and statistics are in Table C-9, Appendix C. Mean ratios multiplied by major canal irrigation delivery for the missing month were used to estimate missing flow values for that month for each drain. A sample calculation for a ratio and missing drain flow value for the Rice 3 Drain is illustrated in Figure 5.2. Detailed calculations are in Table C-10 in Appendix C.

$$\bullet\ \text{Oct 1998 ratio} = \frac{\text{Oct 1998 Drain Flow}}{\text{Oct 1998 Irrigation Flow}} = \frac{150\ \text{acre-feet}}{6089.3\ \text{acre-feet}} = 0.2468$$

$$\bullet\ \text{Oct 1999 Data Gap} = \text{Average(1995-2000) Oct ratio} * \text{Oct 1999 Delivery}$$
$$= 0.2735 * 6187.4\ \text{acre-feet} = 1{,}692.3\ \text{acre-feet}$$

Figure 5.2: Sample Ratio and Flow Calculation for Rice 3 Drain Flow

Minor Drain Flow Estimations

Flow estimates for minor drains were based on: (1) the assumption that monthly flow in a minor drain is proportional to the monthly amount of irrigation water delivered to the area served by the drain via the parallel minor canal, and (2) a water balance for gauged flows for the New

River and all drains and the estimated flows for major drains. The water balance was used to determine overall monthly flow contribution from minor drains (i.e., the “unaccounted” or “undistributed” New River flow) by adding monthly gauged drain flows to monthly New River flows at the International Boundary, and subtracting that result from the monthly New River outlet flow. The water balance is shown in Table C-11 in Appendix C.

IID irrigation data was used to calculate monthly irrigation deliveries for each minor canal and the total irrigation water delivered to minor drains for each month of the subject period. Table C-12 in Appendix C displays individual monthly irrigation deliveries for drains. Table C-13 in Appendix C displays total irrigation deliveries for drains. These data then were reviewed to determine whether they were normally distributed and if data contained potential outliers (see Table C-14 in Appendix C). Then, monthly ratios of irrigation deliveries for a particular minor canal to the total amount of irrigation deliveries to all minor canals for corresponding months were determined. Ratios are in Table C-15 in Appendix C. Minor drain flow for a particular month then was calculated by multiplying that month's ratio for the minor canal times the “unaccounted” New River flow for that month. The process was repeated for every minor drain and ungauged month. Minor drain calculations and flows are presented in Table C-16 and C-17 in Appendix C. A sample calculation for monthly flow in the "Vail" Drain for January 1999 is presented in Figure 5.3.

D R A F T

- Undistributed New River Flows =

$$\text{New River Outlet Flows} - \text{New River Inlet Flows} - \text{Gauged Drain Flows}$$
$$= 36{,}462.0 - 14{,}634.0 - 4358.1 = 17{,}469.9 \text{ acre}\cdot\text{ft}$$

- $$\text{January 1999 Ratio} = \frac{\text{Jan 1999 Irrigation Delivery to the "Vail" Drain}}{\text{Jan 1999 Total Irrigation Deliveries to the Minor Canals}}$$

$$\text{Vail Drain Ratio (Jan 1999)} = \frac{376.2 \text{ acre}\cdot\text{ft}}{31{,}519.2 \text{ acre}\cdot\text{ft}} = 0.01194$$

- Ungauged Drain Flows = Average Monthly Ratio x Monthly Undistributed New River Flow

$$\text{Vail Drain Flow (Jan 1999)} = 0.01194 \times 17{,}469.9 \text{ acre}\cdot\text{ft} = 208.5 \text{ acre}\cdot\text{ft}$$

Figure 5.3: Sample Calculation for Estimating the "Vail" Drain January 1999 Flow

Estimation of TSS Concentrations in Drains

A mass balance approach was utilized to estimate the effect of agricultural return flows on suspended sediment concentrations. Loading calculations for the New River outlet take into account both in-stream erosion and wind deposition. The New River load at the delta can be expressed mathematically as:

$$L_{New\ River} = (\sum L_{Drains} + L_{In\text{-}Stream\ River\ Erosion} + L_{River\ Wind\ Deposition} + L_{International\ Boundary})$$

[Equation 1]

where:

$\sum L_{Drains}$ = Sum of the load from all drains discharging into the River
$L_{In\text{-}stream\ River\ Erosion}$ = Sediment Load Contribution from in-stream erosion in the River

$L_{River\ Wind\ Deposition}$	=	Sediment Load Contribution from wind deposition of sediment in the River
$L_{Stormwater\ Runoff}$	=	Sediment Load Contribution from stormwater runoff into the Drain
$L_{International\ Boundary}$	=	Sediment Load Contribution from Mexico

D R A F T

New River in-stream erosion and wind deposition loads can be combined into a single load ($L_{w\text{-}erosion}$) for the purpose of the source analysis. The sum of the sediment load from all drains discharging into the New River can be quantified by subtracting the sum of the erosion load and Mexico load from the total New River load, or:

$$\sum L_{Drains} = L_{New\ River} - (L_{w\text{-}erosion} + L_{International\ Boundary})$$

[Equation 2]

A sample calculation to estimate $L_{Drains,average}$ is shown in Figure 5.4. Detailed calculations are in Table C-18 in Appendix C.

$$\sum L_{Drains,\ average} = L_{New\ River,\ average} - (L_{w\text{-}erosion,\ average} + L_{International\ Boundary,\ average})$$

$$\sum L_{Drains,\ average} = 155{,}745.4\ \text{tons} - (6{,}408.7 + 11{,}265.2)\ \text{tons} = 138{,}071.5\ \text{tons/year}$$

Figure 5.4: Sample Estimation of Average Annual Agricultural Drain Load in the New River

For the period of this analysis (1995-2000), the average Ag Drain sediment load is 138,071.5 tons/year, or approximately 88.7% of the current New River sediment load at the outlet. This corresponds with an average Ag Drain TSS concentration of approximately 327 mg/L.

<u>Drain Sediment Sources</u>

Understanding Ag Drain loading is important to implement appropriate controls wherever necessary Valley-wide. This section estimates relative sediment contribution of various sources, including natural inputs (e.g., wind deposition) that discharge into Ag Drains. Sources that contribute to Ag Drain TSS loading include farmland tailwater, drain dredging, in-stream drain erosion, wind deposition, stormwater and urban runoff, and NPDES facilities. Mathematically, the sediment load in any drain can be expressed as:

$$L_{Drain} = (L_{Tailwater} + L_{Dredging}) + L_{In\text{-}Stream\ Drain\ Erosion} + L_{Drain\ Wind\ Deposition} + L_{Stormwater\ Runoff} + L_{Urban\ Runoff} + L_{NPDES}$$

[Equation 3]

where:

$L_{Tailwater}$	=	Sediment Load Contribution from farmland tailwater
$L_{Dredging}$	=	Sediment Load Contribution from drain dredging
$L_{In\text{-}stream\ Drain\ Erosion}$	=	Sediment Load Contribution from in-stream drain erosion
$L_{Drain\ Wind\ Deposition}$	=	Sediment Load Contribution from wind deposition in the drain
$L_{Stormwater\ Runoff}$	=	Sediment Load Contribution from stormwater runoff into the drain
$L_{Urban\ Runoff}$	=	Sediment Load Contribution from urban runoff into the drain
L_{NPDES}	=	Sediment Load Contribution from NPDES facilities discharging into the drain

D R A F T

Sediment loading from stormwater and urban runoff can be neglected, as they are negligible sources.

Sediment loading from dredging operations is difficult to quantify. However, Regional Board staff data indicate that it is significant. IID implements a dredging program to remove deposited silt within the drainage network. According to IID,

"The primary 'problem areas' are drains that are located in sandy soils or light silty soils with slopes of less than 0.001, and that have adjacent water table of six feet or less. A drain may also be classified as a problem area for cleaning purposes due to prolific growth of aquatic vegetation or growth of grasses and annuals along the water's edge, which impedes the flow of water."

IID performs an average of two simultaneous dredging operations in the New River watershed each day. Actual dredging occurs for fifty minutes of every hour worked[9]. Dredging is accomplished using an excavator extended perpendicular to stream flow. A bucket scrapes against the bed and up the bank on each pass, removing silt from the bed, and vegetation from the bank. These materials prevent bank sloughing and act as a filter strip. For each drain, dredging length and time are dependent upon sediment volume to be removed.

The following calculation illustrates the potential dredging impact. Dredging increases downstream TSS concentration from the low hundreds to as high as 5,000 mg/L. The effect of dredging on suspended sediment at a drain outfall is calculated by determining the percent of flow in the drain affected by dredging. The affected flow then is multiplied by the concentration to determine loading. Dredging calculations are exhibited in Figure 5.5. Potential annual loading from dredging operations is shown in Table 5.5. Detailed dredging data and calculations are in Table C-22 in Appendix C.

[9] Personal communication with Mr. Steve Knell of IID on March 15, 2000.

Percent Time Dredged

- $1\text{ crew}: 50\frac{\text{min}}{\text{hr}} \times 9\frac{\text{hr}}{\text{day}} \times 4.5\frac{\text{day}}{\text{week}} \times 52\frac{\text{week}}{\text{yr}} \times \frac{\text{hr}}{60\text{ min}} \times \frac{\text{day}}{24\text{ hr}} = 73.125\frac{\text{day}}{\text{yr}}$

$73.125\frac{\text{day}}{\text{yr}} \times \frac{\text{yr}}{365\text{ days}} = 0.20$ $\Rightarrow$ 1 crew dredges 20% of the time on a yearly basis.

Therefore, for 2 crews : $2 \times 0.20 = 0.40$ $\Rightarrow$ With 2 dredging crews, dredging occurs 40% of the time on a yearly basis.

Since there are 55 drains in the Alamo Watershed :

$\frac{0.40}{55\text{ drains}} = 0.011$ $\Rightarrow$ Dredging occurs 0.7% of the time in any drain.

- Dredging Impact = Flow $\times$ 0.007 $\times$ Dredging Concentration

January 1999 Major Drains Dredging Impact =

$$3{,}072.4\text{ acre}\cdot\text{ft} \times 0.007 \times 5000\frac{\text{mg}}{\text{L}} \times 0.0013597\frac{\text{tons} \times \text{L}}{\text{acre}\cdot\text{ft} \times \text{mg}} = 146.2\text{ tons}$$

Figure 5.5: Sample Calculation for Dredging Effects

Table 5.5: Dredging Summary

Drain Type	Flow Affected (AFY)	Load (tons)
Major Drains	418.8	2,846.3
Minor Drains	1,864.1	12,315.7
Total	**2,282.9**	**15,162.0**

Dredging was combined with agricultural minor and major drain sources for this source analysis, due to the lack of dredging data.

Ag Drain erosion is much more variable than agricultural field erosion in Imperial Valley. Ag Drain erosion probably is not a significant sediment source in some locations, but may cause significant erosion in other locations by undercutting and mass wasting the drain banks. As discussed earlier, downward erosion of drains is controlled effectively by drop structures.

Nearly all drains: (a) have relatively stable channels, with no net downward erosion, or (b) are in a state of aggradation, in which more sediment is deposited (from agricultural field discharges) than is eroded and transported out of the channel, thus requiring dredging to maintain adequate drainage. Over the long term, drains have the net effect of being either a: (a) minor sediment source, where net contribution of erosion and wind deposition causes the same relative magnitude of increase in sediment concentrations as erosion within the River, or

(b) net sediment sink, where large amounts of sediment need to be removed via dredging. For this source analysis, the drain erosion contribution was combined with the contribution of irrigated agricultural fields and dredging into the general categories of agricultural drainage from major and minor drains. This was due to a lack of extensive data on tailwater sediment concentrations or long-term erosion contributions within drains.

TSS data used in the analysis of main drain loading were collected by the: (a) IID, pursuant to its DWQIP, or (b) Regional Board, during Trend Monitoring or the March 2001 sampling event. Due to the lack of available data, TSS was calculated using a mass balance approach. The data set was determined by taking the monthly load at the outlet, minus the corresponding monthly Boundary load, minus the monthly NPDES load, minus the natural source load. Detailed calculations are in Table C-19 in Appendix C.

Major Drain Loading Analysis

The four major drains provide drainage for a substantial portion of the New River watershed. The main processes affecting sediment load in major drains are field erosion, in-stream erosion, and dredging. The four major drains are gauged at their outlet to the River. Monthly major drain loading was calculated by multiplying flow by TSS. A sample loading calculation is shown in Figure 5.4, and average yearly flows and loadings for all major drains are shown in Table 5.6. The table shows that major drains are a significant source of flow and sediment to the River. Detailed calculations are in Table C-19 in Appendix C.

Table 5.6: Major Drain Flow and Loading Summary (1995-2000)

Major Drain	Average Annual Flow (AFY)	Average Annual Loading (tons/yr)
Greeson	24,107.0	11,012.8
Rice 3	18,525.7	8,309.2
Rice	4,431.0	2,038.9
Fig	10,503.5	4,703.7
Total	**57,567.2**	**26,064.6**

Minor Drain Loading Analysis

Minor drains empty directly into the New River and usually include less than two tributaries. While individual flow of any minor drain is less than that of any major drain, the total flow from minor drains is greater than the total flow from major drains for any given month.

Minor drain sediment load is due to the same processes as those of major drains. As with major drains, the flows and TSS data were estimated and measured at the outlet, thereby including all upstream inputs into minor drains. Estimated minor drain monthly flow was multiplied by estimated monthly TSS concentration to determine minor drain sediment loading. The calculation is identical to major drain loading. Table 5.7 presents the average 1995-2000 yearly flows and loading from all minor drains combined. The table shows that minor drains are a significant source of flow and sediment to the River. Detailed calculations are in Table C-20 in Appendix C.

Table 5.7: Minor Drain Flow and Loading Summary (1995-2000)

Minor Drain	Average Annual Flow (AFY)	Average Annual Loading (tons/yr)
Ungauged Minor Drains	241,104.3	107,669.5
Gauged Minor Drains	7,984.4	3,557.3
Total Minor Drains	**249,088.7**	**111,650.3**

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F. RESULTS

A New River annual summary is presented numerically in Table 5.8 and graphically in Figure 5.6. Results indicate that drain loading is responsible for nearly all New River suspended sediment loading.

Table 5.8: Sediment Source Summary (1995-2000)

	Sediment Loading (tons/yr)	Percent of Total Sediment Load	Flow (AFY)	Percent of Total Flow
Minor Drain Agricultural Discharges	111,650.3	71.7%	249,088.7	52.9%
Major Drain Agricultural Discharges	26,064.6	16.7%	57,567.2	12.2%
Point Sources (NPDES)	356.5	0.2%	7,240.0	1.5%
International Boundary	11,265.2	7.2%	157,443.3	33.4%
Natural Sources	6,408.7	4.1%	NA	NA
Total	**155,745.4**	**100%**	**471,339.2**	**100%**
Flow at Outlet (AFY)	471,339			
Outlet Concentration (mg/L)	241			

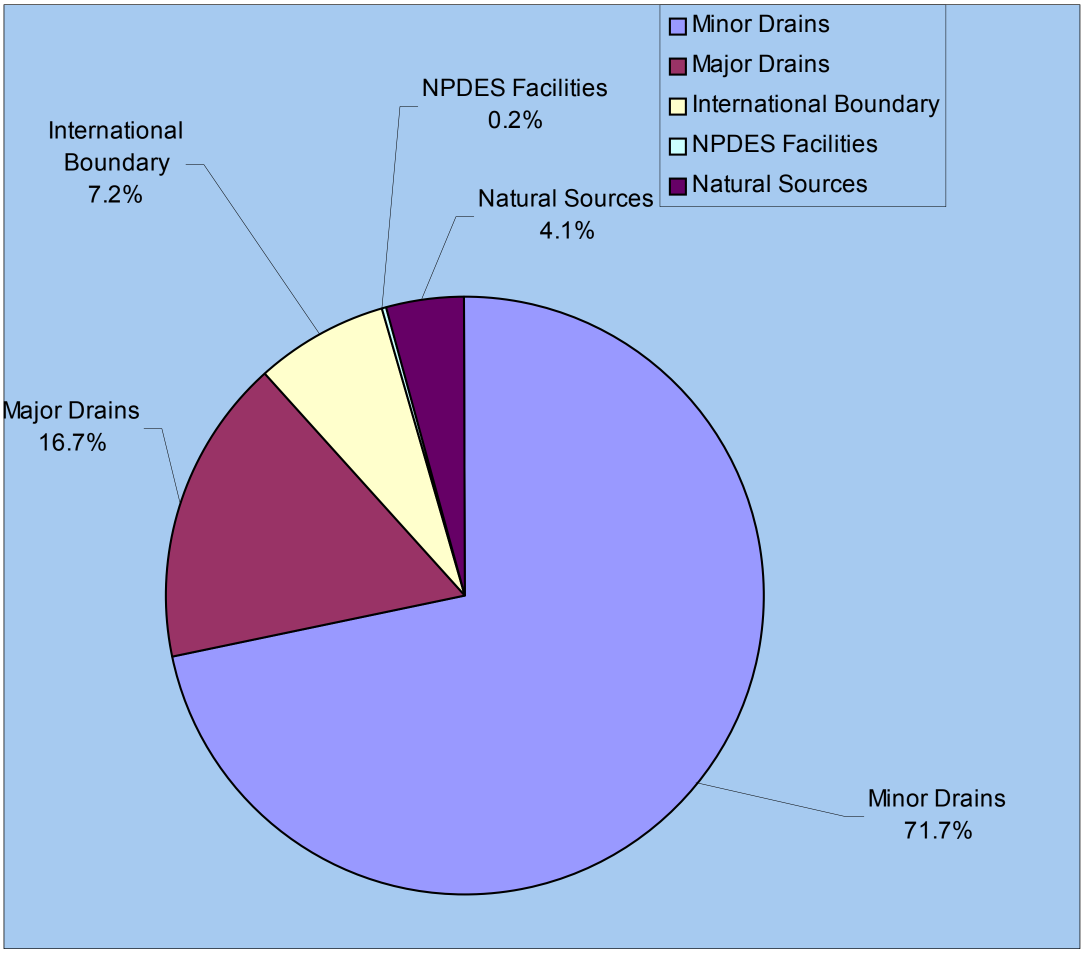

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Figure 5.6: Sources of Sediment to the New River

Proposed Activities to Refine Analysis
Several activities are proposed to refine the source analysis and verify assumptions and statistical inferences. Regional Board staff proposes that:

- flow and TSS be monitored in a representative number of minor drains, to better characterize minor drain loading.
- IID flow monitoring and monthly TSS monitoring should continue, to refine understanding of major drain loading.
- an erosion study be conducted on the New River channel and Ag Drains, to more accurately quantify the sediment amount contributed by erosion in these areas, and to identify methods to reduce Ag Drain erosion where necessary.
- wind erosion and deposition processes be studied within the New River watershed, to more accurately quantify the magnitude of sediment loading from this source.

Proposed monitoring activities are described in the Implementation Plan section of this TMDL Report.

6. LINKAGE ANALYSIS

The Linkage Analysis describes the relationship between numeric targets and sediment sources, and the analytical basis upon which load allocations for these sources are based.

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A. ANALYTICAL BASIS

New River watershed flow and sedimentation regimes are relatively stable, and sediment and water sources are relatively uniform and widespread. These factors allow relatively simple linkages between sediment sources, numeric targets, and total New River assimilative capacity for sediment.

About 2/3 of the New River's total flow comes from agricultural discharges from Ag Drains, and the remaining 1/3 comes across the International Boundary from Mexico. The majority of suspended sediments are discharged to the River via drains. The Boundary flow contribution has a substantially lower suspended sediment concentration. Therefore, water from Mexico significantly dilutes sediment concentrations from drains.

Settling is not expected to occur at significant levels within the River due to particle sizes commonly found within the watershed (mostly colloidal clays and silt, with some fine sands) and the relatively short travel time of the River (approximately two days) (Huston et al. 2000). Therefore, a majority of sediments that enter the New River via tributaries are expected to travel the entire River to its delta. For these reasons, New River sediment concentration is the sum of sediment loads contributed by Ag Drains, Mexico, and natural sources, divided by the sum of flows from drains and Mexico. This equation is depicted below:

New River Sediment Concentration =
Σ Drain Sediment Loads + Σ Direct Natural Sources + Σ Boundary Sediment Loads / Σ Total Flows

[Equation 4]

New River assimilative capacity for sediment is defined as the highest sediment loading that the River can assimilate without exceeding numeric targets. Therefore, New River assimilative capacity per unit volume for any time period is defined as the sum of allowable load contribution, plus the natural source contribution, plus the Boundary contribution, plus a margin of safety, or symbolically:

$$\frac{\text{Assimilative Capacity}}{\text{Unit Volume}} = \text{Numeric Target} = \frac{\sum \text{Allowable Loads}}{\sum \text{Total Flows}} + \frac{\sum \text{Boundary Loads}}{\sum \text{Total Flows}} + \text{DNS} + \text{MOS}$$

[Equation 5]

In the following equation, Allowable loads are expressed as the Allowable Drain Concentration multiplied by Drain Flows:

$$\frac{\sum(\text{Allowable Drain Conc.})\text{ x }(\text{Drain Flows})}{\sum\text{Total Flows}} = \text{Numeric Target - }\frac{\sum\text{Boundary Loads}}{\sum\text{Total Flows}}\text{ - DNS - MOS}$$

[Equation 6]

Solving for the Allowable Drain Concentration:

$$\text{Allowable Drain Conc.} = (\text{Numeric Target - DNS - MOS})\text{ x }\frac{\sum\text{Total Flows}}{\sum\text{Drain Flows}} - \frac{\sum\text{Boundary Loads}}{\sum\text{Drain Flows}}$$

[Equation 7]

The numeric target is defined as 200 mg/L, and the margin of safety is defined as 10 mg/L. The source analysis shows that direct natural sources, channel erosion, wind deposition, and stormwater runoff are relatively minor sources, comprising about 4% (approximately 10 mg/L) of the River's current sediment load. The source analysis also shows that the average International Boundary loading contribution is about 53 mg/L. Substituting values in Equation 7 the maximum allowable concentration in the drains is:

$$\text{Allowable Drain Conc.} = (200 - 10 - 10)\text{ mg/L x }\frac{471{,}339.2\text{ AFY}}{313{,}895.9\text{ AFY}} - 53\text{ mg/L x }\frac{157{,}443.3\text{ AFY}}{313{,}895.9\text{ AFY}} = 243\text{ mg/L}$$

To convert this concentration into a sediment load for a particular time period, this concentration is multiplied by the total drain flow volume for the appropriate time period. For an average year, drain flow contribution to the New River at its outlet is approximately 313,895.9 AFY. The sum of allowable loads is then:

$$\sum\text{Allowable Loads} = 243\text{ mg/L} \times 313{,}895.9\text{ acre - feet/yr} \times \text{converstion factor} \approx 104{,}100\text{ tons/yr}$$

The total contribution of allowable loads is the sum of all load allocations and wasteload allocations defined below. These load and wasteload allocations therefore, when achieved, are expected to result in suspended sediment concentrations that are within the assimilative capacity of the New River, thus achieving the numeric target.

7. ALLOCATIONS

A. MARGIN OF SAFETY

USEPA TMDL Guidelines (U.S. Environmental Protection Agency 1991) recommend that the TMDL be reduced by a margin of safety that accounts for uncertainty. The remaining allowable pollutant load is distributed equitably among existing point sources and nonpoint sources of pollution. In mathematical terms, this is expressed as:

$$\text{TMDL} = \sum \text{Load Allocations}_{\text{nonpoint sources}} + \sum \text{Waste Load Allocations}_{\text{point sources}} + \text{MOS}$$

[Equation 8]

Most of the source analysis uncertainty relates to flow estimates and limited sediment data used to calculate current Ag Drain load contributions. An explicit margin of safety is needed to account for uncertainty inherent in calculating relative pollutant loading based on limited available data. Agricultural return flows were quantified in the source analysis using a mass balance approach by subtracting total known load contributions (Boundary and NPDES loads) that were calculated based on available flow and TSS data and the estimated Natural Source load from the measured New River sediment load at its outlet.

The margin of safety is explicitly established as 10 mg/L of New River yearly ambient sediment concentration, due to the inherent error in flow measurements upon which natural source contributions were estimated and other uncertainties stated above. This margin of safety is roughly equal to the estimated natural source load. Therefore, if the actual load from natural sources is up to double the estimated load, then the margin of safety will be adequate to ensure that numeric targets are met by current load allocations.

B. METHODOLOGY

TMDL allocations herein deal exclusively with New River sediment inputs—namely, discharges from agricultural drains, the International Boundary, and natural sources (in-stream erosion and wind deposition). The New River was divided into three sections to support TMDL monitoring and assessment, and to account for some uncertainty regarding load contribution from various drains. The three sections of the New River are:

Section 1: From the USGS gauging station immediately north of the Anza Road Bridge and New River channel (i.e., immediately downstream of the International Boundary) intersection, hereafter "NR-0," to the Evan Hewes Road Bridge and New River channel intersection, hereafter "NR-1."

Section 2: From NR-1 to Drop Structure 2, upstream of the Rutheford Road Bridge, hereafter "NR-2."

Section 3: From NR-2 to where the New River channel intersects with the Lack Road Bridge, hereafter "NR-Outlet."

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To fairly allocate mass load among drains, the total mass load for a section was based on each drain's proportion of flow to the total flow within the section on a yearly basis. This takes into account the agricultural acreage served by each drain and promotes watershed-wide BMP implementation. Yearly mass load allocations are necessary during this TMDL phase to account for monthly fluctuations and data uncertainty. As more data become available, monthly load allocations may need to be established to ensure year-round load compliance.

C. LOAD ALLOCATIONS

Load allocation computations are based on the Source Analysis section of this TMDL Report. Load allocations are required for all nonpoint sources [40 CFR Section 130.2(g)]. This TMDL divides the New River watershed into fifty-one minor drains and four major drains. Natural sources are allocated 10 mg/L, while International Boundary flows are allocated 53 mg/L. The TSS balance is due to minor and major drain loading.

The concentration used to determine total load allocation for each section is computed by adding the allocation for erosion and wind deposition to the margin of safety in terms of concentration, then subtracting this sum from the suspended sediment target concentration. Total load allocations (for all drains) for each section then is determined by multiplying total load allocation concentration by total section flow. Load allocations for each drain are determined by multiplying percent flow by total section load allocation. A sample calculation is shown in Figure 7.1. Load allocations, in tons per year for each drain, are presented in Table 7.1. Detailed calculations are in Appendix E.

- $$\text{Percent Flow} = \frac{\text{Drain Flow}}{\text{Total Section Flow}}$$

  $$\text{Trifolium 9 Drain \% Flow} = \frac{13{,}205.7 \text{ acre-ft}}{108{,}368.3 \text{ acre-ft}} = 12.19\%$$

- $$\text{Load Allocation Concentration} = \text{Target Concentration (mg/L)} - (\text{instream erosion} + \text{wind deposition}) - \text{Margin of Safety}$$

  $$\text{Load Allocation Concentration} = 243 \text{ mg/L}$$

- $$\text{Section Load Allocation} = \text{Load Allocation Concentration} \times \text{Section Flow}$$

  $$\text{Section 1 Load Allocation} =$$

  $$243 \frac{\text{mg}}{\text{L}} \times 108{,}368.3 \text{ acre} \cdot \text{ft} \times 0.0013597 \frac{\text{tons} \cdot \text{L}}{\text{acre} \cdot \text{ft} \cdot \text{mg}} = 35{,}835.1 \text{ tons}$$

Figure 7.1: Load Allocation Sample Calculation

Table 7.1: Load Allocations

River Reach	# Of Drains Included in Segment	Sediment Load Allocation (tons/year)
New River immediately downstream of International Boundary, at USGS gauging station (NR-0)	None	11,265.2
Section 1: From the USGS gauging station immediately north of the Anza Road Bridge and New River channel (i.e., immediately downstream of the International Boundary) intersection, hereafter "NR-0," to the Evan Hewes Road Bridge and New River channel intersection, hereafter "NR-1."	14	20,729.7
Section 2: From NR-1 to Drop Structure 2, upstream of the Rutheford Road Bridge, hereafter "NR-2."	17	32,350.4
Section 3: From NR-2 to where the New River channel intersects with the Lack Road Bridge, hereafter "NR-Outlet."	23	35,835.1
Direct Ag. Runoff (from fields directly to the New River)	None	14,883.5
TOTAL LOAD ALLOCATIONS	**55**	**115,063.9**
Natural Sources (instream erosion, wind deposition, etc.)	None	6,408.7
Margin of Safety	None	6,408.7
TOTAL ASSIMILATIVE CAPACITY	**55**	**127,881.3**

D. WASTELOAD ALLOCATIONS

TMDL regulations require wasteload allocations for all point sources (40 CFR Section 130.2(h). There are no waste discharges directly into the New River from point sources of pollution. However, eight NPDES facilities are permitted to discharge into drains tributary to the River. Table 5.8 shows that loading from these facilities is relatively minor compared to that of nonpoint sources. All point sources of pollution in the New River watershed have current NPDES permits, which prescribe effluent limitations for TSS concentrations and corresponding mass loading rates. Therefore, wasteload allocations for these facilities are the TSS limitations prescribed in their respective permits. Table 7.2 summarizes TSS limits for these facilities.

Table 7.2: NPDES Permitted Effluent TSS

Discharger	Daily		30 day		7-day		Maxi-mum	Average	
	TSS (mg/L)	Loading (lbs/day)	TSS (mg/L)	Loading (lbs/day)	TSS (mg/L)	Loading (lbs/day)	TSS (mg/L)	TSS (mg/L)	Loading (lbs/day)
City of Calexico WWTP			40	1,436	60	2,154			
City of Brawley WWTP			95						
City of Westmoreland WWTP			95						
Seeley County Water District			95						
Date Gardens Mobile Home Park			30		45				
McCabe Union School District			30		45				
Centinela State Prison			95						
U.S. Navy Facility, El Centro			30		45				

E. POTENTIAL SUSPENDED SEDIMENT CHANGES

The following paragraphs discuss projects that have a potential to affect suspended sediment.

Population Growth

The source analysis indicates that New River watershed sediment can be attributed almost exclusively to nonpoint sources of pollution. Future population growth within the watershed is not expected to increase the River's sediment load. A Valley-wide population increase would increase the amount of wastewater discharged from WWTPs. WWTP effluent limits for TSS are less than 100 mg/L (Table 6.2). An expanded population would decrease TSS concentration within the drains and New River. For example, an extreme case of a 400% population increase within 20 years[10] would increase NPDES discharges to 31,924.4 AFY. Assuming all WWTP effluent has a TSS concentration of 90 mg/L, the corresponding New River TSS loading would be less than 3,906.7 tons/yr, or just over 3% of the River's assimilative capacity. A sample calculation is shown in Figure 7.2.

$$\text{New River Loading} = 31{,}924.4 * 90\frac{\text{mg}}{\text{L}} * 0.0013597\frac{\text{tons} * \text{L}}{\text{acre-ft} * \text{mg}} = 3{,}906.7\frac{\text{tons}}{\text{yr}}$$

Figure 7.2: Population Effects – Sample (90 mg/L)

As this calculation indicates, loading from these facilities is negligible, even with a significant increase in watershed population.

[14] Data published by Valley of Imperial Development Alliance (VIDA) shows that population for the entire Imperial Valley is projected to increase by only 100,000 within 20 years (VIDA 1999).

Water Transfer Proposals
IID irrigation deliveries may decrease as much as 300,000 AFY because of potential water transfers between IID and other water agencies (e.g., San Diego County Water Authority). Transferred water would be irrigation water "conserved" by IID and Imperial Valley farmers. The corresponding New River flow would be 328,814 AFY (471,339 – (300,000 x (471,339/992,122) = 328,814 AFY), using the ratio of New River flows to total IID drainage system outflow (Table 4.1), and assuming that the 300,000 AFY irrigation delivery reduction will result in an equal decrease in total drain flow as a worst-case scenario. The load at the New River outlet would be 80,476 tons/yr (Figure 7.3), using the TMDL target of 200 mg/L, minus 10 mg/L contributed by natural sources, minus 10 mg/L for the Margin of Safety. Decreased irrigation deliveries result in a lower mass loading but the same concentration.

$$\text{New River Loading} = 328{,}814 * 180\frac{\text{mg}}{\text{L}} * 0.0013597\frac{\text{tons} * \text{L}}{\text{acre-ft} * \text{mg}} = 80{,}476\frac{\text{tons}}{\text{yr}}$$

Figure 7.3: IID Transfer Effects on New River Loading

Measures being evaluated by IID to conserve water include tailwater pump-back facilities and more efficient irrigation methods, which would result in decreased TSS loading and concentrations.

New River Wetlands Project
The New River Wetlands Project is a pilot system designed and implemented through collaboration of local grassroots organizations and local, state, and federal agencies. The purpose is to reduce agriculture pollution and improve water quality of the New River (New River Wetlands Project 2001). Two constructed wetlands exist: (a) Imperial Wetlands, a 68-acre site near the Rice Drain, and (b) Brawley Wetlands, a seven-acre site west of Imperial Valley Research State. Each consists of a series of ponds that settle and filter pollutants.

The first monitoring data displays promising results for significant total suspended solids reduction within the wetland. The two wetlands are very new and it will take several monitoring cycles to determine effectiveness over time. The proportion of New River flow diverted into the wetlands is relatively low and therefore the sediment load removed from the River is low. However, the sediment reduction ratio is about 95% within the wetland system. Monitoring started in January 2001, and data is available through June 2001. Results are shown here in monthly averages. Imperial Wetlands recycles about 5.2 cfs (310.9 AF/month) and removes about 132.8 tons/month. Brawley Wetlands recycles about 0.9 cfs (51.0 AF/month) and removes about 50.2 tons/month. Together, this corresponds to about 1% of the monthly sediment load at the New River outlet.

Mexicali Power Plants
In recent years, the Mexican Federal Commission of Electricity (CFE) has begun plans to increase electricity-generation capacity in Baja California to meet regional increases in population and electricity demand. CFE has contracted to build and operate a Combined Cycle Thermoelectric Power Plant with a 750-megawatt capacity located west of Mexicali[11]. This

[11] CFE also has plans to increase capacity at the existing Cerro Prieto geothermal power plant in Mexicali and to start commercial operations at the Rosarito 8 and 9 power plants in 2001 (California Regional Water Quality Control Board 2001).

power plant, “La Rosita”, will allow Baja California to satisfy its internal demand for electric power, and export surplus power to the United States (California Regional Water Quality Control Board 2001).

This power plant project plans to divert an average of 8.7 mgd (or 13.4 cfs) of raw city sewage that now flows from the Mexicali I sewage treatment system into the Zaragoza oxidation lagoons west of the city (California Regional Water Quality Control Board 2001). The power plant will treat diverted water in a separately constructed sewage treatment plant for use in both the La Rosita and La Rosita Expansion power plants. About 95% (7.6 mgd or 11.8 cfs) of treated water will be used for cooling within the plant, and 20% (1.6 mgd or 2.5 cfs) will be discharged to the International Drain and subsequently to the New River (California Regional Water Quality Control Board 2001). All water discharges are designed to meet legal requirements and will be monitored.

Total New River streamflow will be affected by the project. During maximum water consumption periods, when river flow is below average and electricity production is at a maximum, only about 25% of withdrawn water will be returned to the New River as power plant discharge. The result is about a 5% flow reduction in the New River at the border, or a 2-3% flow reduction at the River outlet to the Salton Sea (California Regional Water Quality Control Board 2001).

Power plant discharge will have a Total Dissolved Solids (TDS) content of 5,000 to 6,000 ppm. This is a significant increase from New River TDS content, about 2,575 ppm (California Regional Water Quality Control Board 2001). (TDS is a measure of salinity.) After mixing, the resulting salinity effects on the New River will be minor.

8. IMPLEMENTATION PLAN

A. LEGAL AUTHORITY

The cornerstone of the State NPS Management Plan is a three-tiered approach, consisting of implementation of self-determined best management practices (Tier 1), regulatory-encouraged best management practices (Tier 2), and effluent limitations (Tier 3). The Regional Board is not required to sequentially move through tiers (e.g. Tier 1 to Tier 2 to Tier 3). The Regional Board may move directly to enforcement actions specified in Tier 3, depending on water quality impacts and problem severity. The Regional Board also may implement a combination of water quality control mechanisms from each tier or use other remedies (e.g., enforcement orders), as provided under the CWC.

B. OVERVIEW OF IMPLEMENTATION PLAN

The proposed Implementation Plan states that:

- Farmers that discharge sediment into the New River and/or its tributary drains must submit and implement water quality improvement plans, which identify self-determined sediment control measures.

- The Imperial Irrigation District (IID) must submit and implement a revised Drain Water Quality Improvement Plan to address water quality impacts caused by IID operation and maintenance of the drainage system.

- The U.S. Government must submit and implement measures to prevent Mexico waste discharges from violating this TMDL.

- The Imperial County Farm Bureau should implement its "Voluntary Watershed Program" throughout Imperial Valley to address sediment pollution from farmland.

The proposed implementation plan occurs in four phases, covering 12 years. USEPA Guidance (U.S. Environmental Protection Agency 1991) allows for a phased approach for TMDL development and implementation when there is insufficient data. The numeric target, load allocations, waste load allocations, and margin of safety must be set when implementing a phased approach. However, these values may be modified based on new data. In the meantime, dischargers can implement procedures to reduce pollutant loadings. This TMDL requires additional data to determine load reduction adequacy and to better determine assimilative capacities and pollution allocations.

C. DISCHARGERS AND RESPONSIBLE PARTIES

All waste dischargers are responsible for their waste quality and for ensuring that discharges do not adversely impact beneficial uses of waters of the State. For the purposes of this TMDL, dischargers include the Imperial Irrigation District, farm landowners, renters/lessors, and operators/growers discharging or potentially discharging wastes into waters of the State. USEPA and the U.S. Section of the International Boundary and Water Commission (IBWC) also are responsible parties for ensuring that Mexico discharges do not violate the TMDL.

Imperial Irrigation District (IID)
IID is the largest stakeholder within the Salton Sea Transboundary Watershed. It operates and maintains irrigation canals and Ag Drains. As the drainage management agency, IID maintains over 1,400 miles of constructed agricultural ditches (drains). IID discharges wastes into drains and the New River.

Farm Landowners, Renters/Lessors, and Operators/Growers
Landowners have discretionary control of their land, and therefore have ultimate responsibility to control practices on their lands. Landowners ultimately are responsible for cleanup regarding renter/lessor practices, to the degree that landowners are aware that the practices threaten water quality or create pollution in waters of the State. Renters/lessors also have responsibility for pollution control, as they have day-to-day control of farming operations.

Operators/growers are defined as IID agricultural water account holders, for purposes of this TMDL. Operators/growers are individuals or corporations who purchase water from IID to irrigate farmland and, as a result, are likely to discharge waste into waters of the State. Operators/growers also may be landowners. Operators/growers are dischargers, as they have day-to-day control over farming operations and waste discharges. Approximately 6,290 farm water users (i.e., operators/growers) exist in the IID (Imperial Irrigation District 1999).

U.S. Environmental Protection Agency (USEPA) and U.S. Section of the International Boundary and Water Commission (IBWC)
The IBWC is a U.S.-Mexican federal agency[12] whose responsibilities include solving International Boundary sanitation problems and other border water quality problems. USEPA is the U.S. coordinator. IBWC and USEPA have primary responsibility for ensuring that Mexico waste discharges do not violate or contribute to a violation of this TMDL downstream of the International Boundary.

D. THIRD PARTY COOPERATING AGENCIES AND ORGANIZATIONS

Cooperating agencies and organizations have technical expertise, resources, and organizational structures that facilitate effective implementation of practices to address sediment pollution.

University of California Cooperative Extension, Holtville Field Station
The University of California Cooperative Extension (UCCE) was developed to apply university resources to local communities. It offers workshops, programs, training courses, and technical assistance to growers on a broad range of agricultural topics. The UCCE Holtville Field Station conducts demonstration projects and research for erosion control.

[12] Both the United States and Mexico have commissioners appointed to IBWC. Within Mexico, IBWC is called "Comision Internacional de Limites y Aguas" (CILA).

U.S. Department of Agriculture Natural Resources Conservation Service (NRCS)
The federal Natural Resources Conservation Service (NRCS) provides technical aid in securing financial assistance to support management practice implementation. The *Field Office Technical Guide* (Natural Resources Conservation Service 1996) contains technical standards and specifications of management practices.

Imperial County Farm Bureau
The Imperial County Farm Bureau (ICFB) initiated a Voluntary Watershed Program to conduct outreach programs and to foster effective self-determined attainment of TMDL load applications. ICFB designated ten subwatershed (i.e., drainshed) groups, each covering approximately 50,000 acres of irrigated land. Figure 8.1 shows these subwatersheds. Specific goals of the Voluntary Watershed Program include:

- coordination of workshops with local technical assistance agencies
- development of local subwatershed ("drainshed") groups
- identification of a leader within each subwatershed group who provides demonstration sites for BMP field-testing
- cooperation with Regional Board staff to develop a process for subwatershed groups to track and report planned and implemented effectiveness of BMPs
- providing linkage to technical assistance agencies for BMP implementation assistance

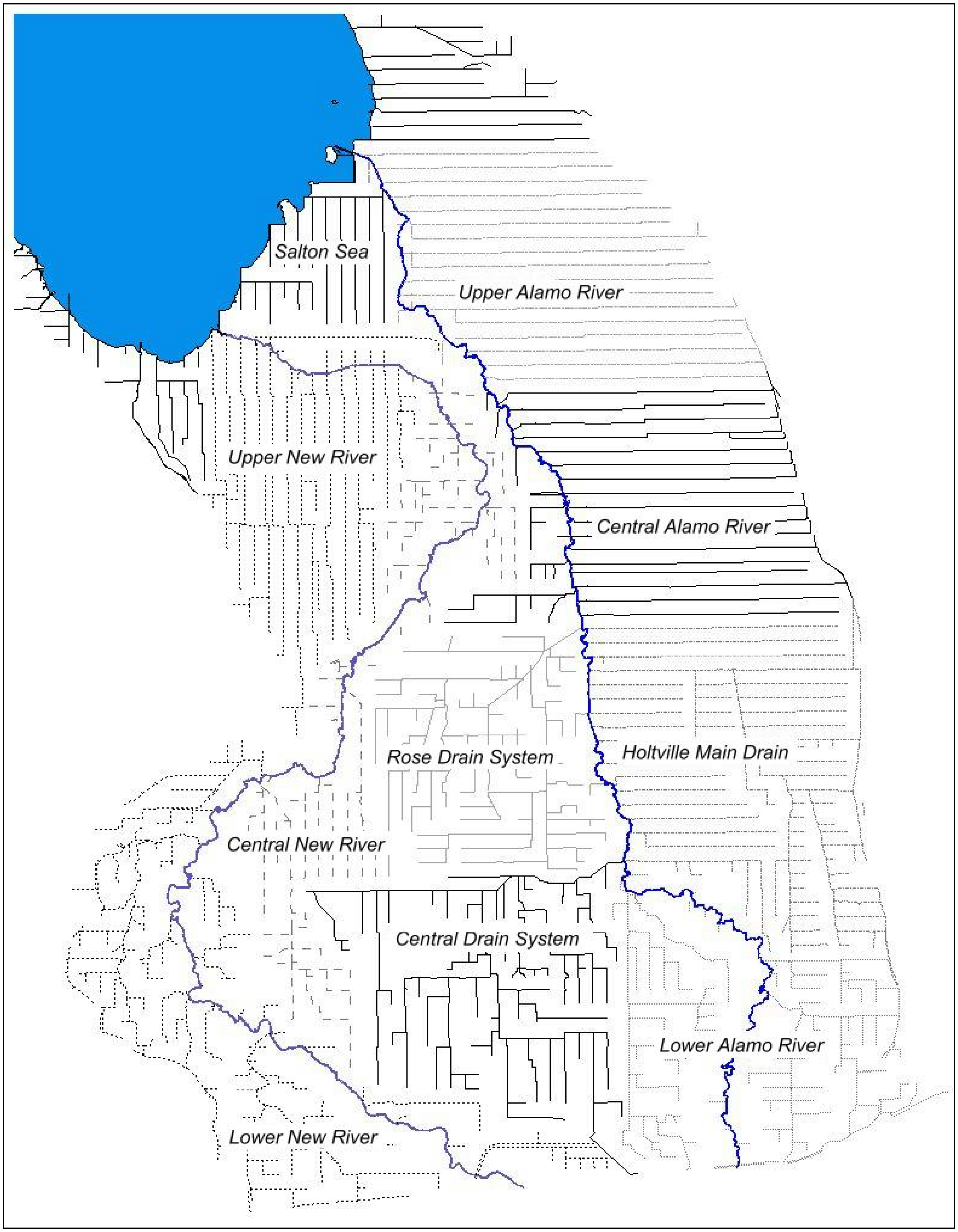

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Figure 8.1: Map of Imperial County Farm Bureau Designated Drainsheds

E. TIERED REGULATORY APPROACH TO ACHIEVE TMDL COMPLIANCE

TMDL implementation involves a three-tiered approach to nonpoint source (NPS) pollution control, consistent with the State's NPS Management Plan. The three tiers, as applied in this TMDL, are depicted in Figure 8.2.

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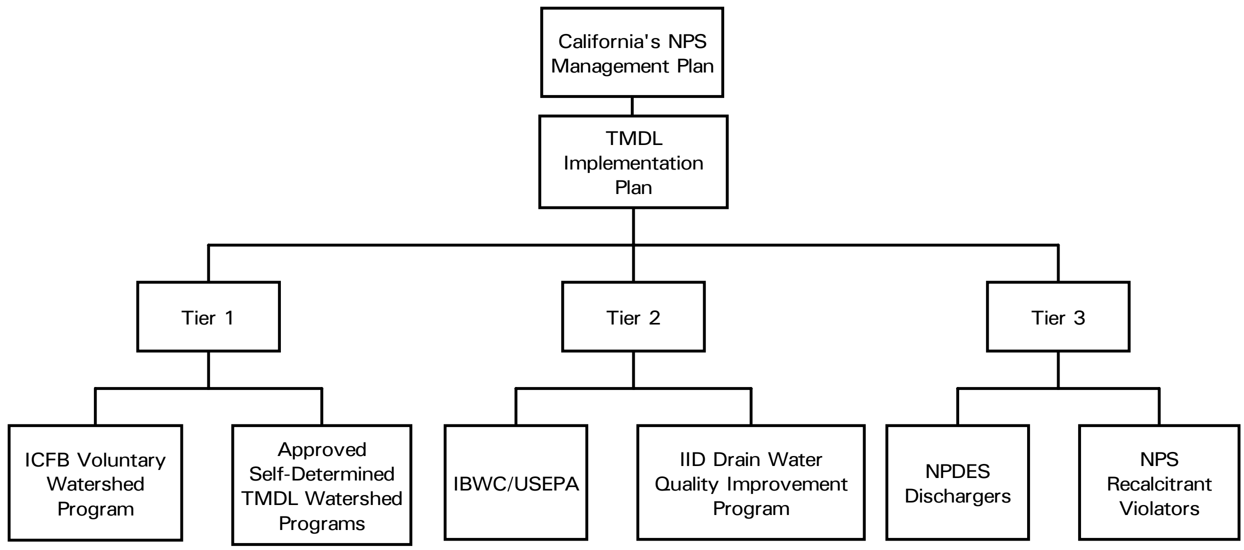

Figure 8.2: Three-Tiered TMDL Implementation Approach

Tier 1 – ICFB Voluntary Watershed Program

The California Farm Bureau Federation and Imperial County Farm Bureau (ICFB) have taken a proactive approach to educate and encourage farmers to develop and implement self-determined BMPs for sediment control through the Voluntary Watershed Program. The Regional Board fully supports this approach and will work closely with ICFB to: (a) track BMP implementation and effectiveness, (b) develop and implement subwatershed water quality monitoring programs, and (c) provide regulatory guidance as needed.

ICFB tentatively has agreed to submit to the Regional Board a list of participants in its Voluntary Watershed Program, within 80 days following one year from USEPA approval of this TMDL. It is expected that program participants cooperatively will develop subwatershed plans, further develop Farm Water Quality Management Plans, report planned implementation actions and time-bound milestones to ICFB, and report completed implementation actions to ICFB. ICFB then will report to the Regional Board the planned implementation actions, time-bound milestones, and completed implementation actions on a subwatershed basis (not on a field-by-field or operator-by-operator basis). Figure 8.3 depicts ICFB and Regional Board interaction.

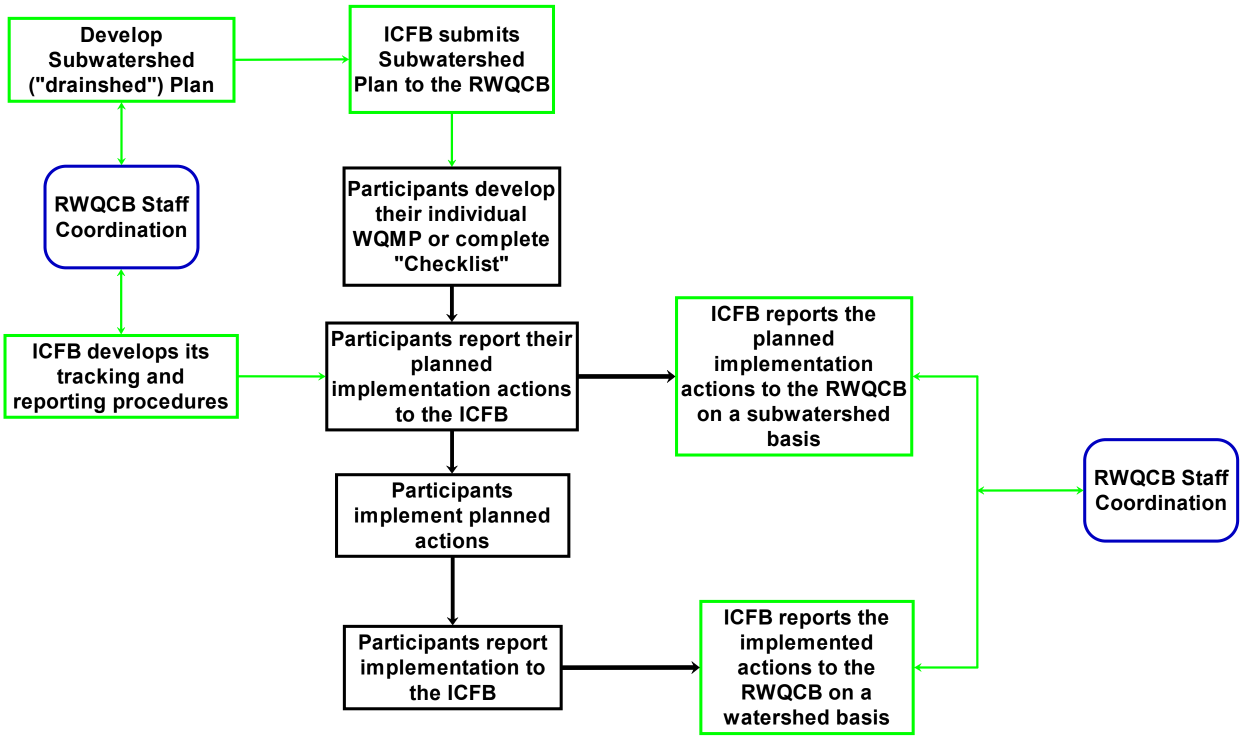

Figure 8.3: Interaction Between the ICFB Voluntary Watershed Program and the Regional Board

Regarding the Watershed Program Plan, ICFB should:

a. By (insert the date that corresponds to 30 days following one year from USEPA approval of this TMDL)**, issue letters to all potential program participants within the New River watershed that are enrolled in the ICFB Voluntary Watershed Program.

b. By (insert the date that corresponds to 120 days following one year from USEPA approval of this TMDL)**, submit the ICFB Watershed Program Plan to the Regional Board. The Plan should: (1) identify measurable environmental and programmatic goals; (2) describe aggressive, reasonable milestones and timelines for development and implementation of TMDL outreach plans; (3) describe aggressive, reasonable milestones and timelines for development of subwatershed ("drainshed") plans; and (4) describe a commitment to develop and implement a tracking and reporting program.

c. By (insert the date that corresponds to 150 days following one year from USEPA approval of this TMDL)**, provide the Regional Board with a list of program participants, organized by subwatershed ("drainshed").

** Upon State approval (i.e., approval by the Regional Board, State Water Resources Control Board, and Office of Administrative Law), this parenthetical "formula" will be replaced by a particular date, based on the USEPA approval date.

d. Submit semi-monthly reports to the Regional Board's Executive Officer that describe: (1) progress of each subwatershed group, (2) planned or conducted technical assistance workshops, and (3) any other pertinent information.

Regarding procedures for tracking and reporting, ICFB should:

a. By (insert the date that corresponds to 180 days following <u>one year from USEPA approval of this TMDL</u>)[**], submit a plan to the Regional Board's Executive Officer describing tracking and reporting processes and procedures for: (1) implementation of BMPs and other proven management practices, and (2) BMP performance.

b. Implement the tracking and reporting procedures.

c. Submit semi-monthly written reports to the Regional Board's Executive Officer assessing data trends and adoption level of tracking and reporting for each subwatershed ("drainshed").

d. Submit a yearly summary report to the Regional Board's Executive Officer by February 15th of each year.

If ICFB does not develop plans and mechanisms in accordance with the schedule set herein, the Regional Board will need to consider Tier 2 and Tier 3 regulatory approaches for individual dischargers.

Tier 1 – Approved Self-Determined TMDL Watershed Programs
Farmers/growers not participating in the ICFB Voluntary Watershed Program must submit self-determined sediment control programs to the Regional Board by (insert the date that corresponds to 90 days following <u>one year from USEPA approval of this TMDL</u>)[**]. A sediment control program may be submitted by an individual farmer/grower (Individual Program) or by a group of farmers/growers (Group Program). In either case, the program must address the following:

1. Farm owner name, business address, mailing address, and phone number
2. Farm operator/grower name, business address, mailing address, and phone number
3. Resource inventory of (soils, animals, etc.)
4. Problem assessment (site conditions, crops, potential or current NPS problems)
5. Goal statement (measurable outcomes or products)
6. Existing and/or alternative sediment management practices (technical/economic feasibility, desired outcome, etc.)
7. Implementation timetable for sediment management practices (measured in water quality improvement and/or implementation level)
8. Monitoring (progress toward goals, management decision effectiveness)
9. Mechanism for reporting planned and completed implementation actions to the Regional Board

[**] Upon State approval (i.e., approval by the Regional Board, State Water Resources Control Board, and Office of Administrative Law), this parenthetical "formula" will be replaced by a particular date, based on the USEPA approval date.

A Group Program may address Items 1 through 7, above, for individuals enrolled in the group. The Group Program must provide sufficient information so that the Regional Board can determine:

- which responsible parties are enrolled in the program on a drain- or drainshed-basis
- types of sediment problems (i.e., severity, magnitude, and frequency) the group or drain/drainshed face
- proposed group sediment management practices
- implementation timetable for management practices (measured in water quality improvement and/or implementation level)

Regarding Items 8 and 9, above, a group may provide a single monitoring and reporting plan as long as results are representative of the efficiency of the group's various control practices, in order to measure overall water quality improvements. Reported BMP implementation is submitted to the Regional Board under penalty of perjury.

At the request of responsible parties or groups furnishing a program, program portions that might disclose trade secrets shall not be made available for public inspection, but shall be made available to governmental agencies for use in determining further studies (CWC Section 13267(b)(2)). These program portions shall be available for use by the Regional Board or any state agency in judicial review or enforcement proceedings involving the person or group that furnished the report.

Tier 2 – IBWC and USEPA
By (insert the date that corresponds to 90 days following one year from USEPA approval of this TMDL)[**], the U.S. Section of the IBWC and/or USEPA must submit a technical report describing proposed measures the U.S. Government will undertake to ensure that Mexico waste discharges do not violate or contribute to a violation of the TMDL, pursuant to CWC § 13225.

Tier 2 – IID Drain Water Quality Improvement Program
In 1994, the Regional Board's Executive Officer requested IID take "accelerated action to address degraded water quality conditions in Imperial Valley drainage ways." In response, IID submitted its Drain Water Quality Improvement Plan (DWQIP). The DWQIP was established in 1994 as Tier 2/regulatory-based encouragement for nonpoint source pollution control. IID implemented short-term demonstrations of BMPs to reduce sediment runoff and implemented a monitoring program in agreement with Regional Board staff from 1996 through 1997. The DWQIP was suspended in 1999 upon recommendation of Regional Board staff so that the DWQIP could be revised to meet needs of the TMDL process.

IID must submit a revised DWQIP that includes proposed comprehensive water quality monitoring, sediment control measurements, monitoring time schedules, and implementation assurances, pursuant to CWC 13267. Sediment control measures must focus on operation and maintenance impacts (e.g., dredging, vegetation removal, blown tailwater discharge pipes, etc.) of the New River watershed drainage system. More specifically, by (insert the date that corresponds to 90 days following one year from USEPA approval of this TMDL)[**], IID must submit to the Regional Board a revised DWQIP with a proposed program to control and monitor water quality impacts caused by drain maintenance operations within the New River watershed and dredging operations in the New River. The revised DWQIP is subject to Regional Board Executive Officer approval and must address, but need not be limited to, Items 1 and 2, below:

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1. Drain Maintenance and New River Delta Dredging Controls

The revised DWQIP must consist of:

- Control measures to ensure that drainage maintenance operations[13] (e.g., dredging and vegetation removal) in drains and the New River Delta do not cause TMDL exceedance
- Timelines for implementation of control practices
- Mechanisms to assess performance of control practices

Implementation of control practices must include: (a) appropriate seasonal restrictions to avoid impacts on sensitive resources, and (b) certified CEQA documents should the practices fall outside the scope of functionally-equivalent CEQA documents in this TMDL (Attachments 3 and 3A).

2. Drain Water Quality Monitoring Plan

The revised DWQIP must consist of:

- Water quality impacts caused by drain dredging operations
- New River Delta dredging effects on water quality and Delta habitat
- Representative water column[14] samples from all major drains and a statistically representative number from small drains tributary to the New River, for analyses of flow, TSS, turbidity, selenium, total organic carbon, nutrients, persistent pesticides (e.g., DDT and metabolites), pesticides applied by irrigation practices (e.g., ETPC), pesticides used as pre-emergents and post-emergents by crop and season, and pesticides used for drain and channel weed control (e.g., diuron)
- A statistically representative number of irrigation water locations, for TSS
- A statistically representative number of drains located sufficiently upstream of outfalls to the River, to determine how much silt is reduced by field BMPs
- Sediment impacts from storm events

[**] Upon State approval (i.e., approval by the Regional Boar, State Water Resources Control Board, and Office of Administrative Law), this parenthetical "formula" will be replaced by a particular date, based on the USEPA approval date.

[13] For the purpose of this section, control practices should be prioritized based on feasibility and potential effectiveness, and may include dredging reduction and/or elimination in any area within the New River watershed.

[14] Samples from the last drain weir before the drain outfalls to the River will be considered representative of the water column.

Also, no later than (insert the date that corresponds to 120 days following one year from USEPA approval of this TMDL)**, and on a semi-annual basis thereafter, IID must submit to the Regional Board the following information on agricultural dischargers within the District:

- Names and mailing addresses of all property owners engaged in irrigated agriculture within the IID service area, and property locations
- Names and mailing addresses of all water account holders within the IID service area, their water account numbers, and irrigated field locations
- For each parcel within the IID service area, the parcel location, irrigation canals and gates serving the parcel, drop boxes draining the parcel, drains that these drop boxes empty into, and fields within each parcel
- For each field within the IID service area, the parcel within that each field is located within, area and location of each field within the parcel, irrigation canals and gates serving each field, drop boxes draining each field, drains that these drop boxes empty into, and crops cultivated on each field.

To the extent practical, the above information should be submitted in an electronic, tabular, and easily geo-referenced format.

Further, no later than 60 days following Regional Board Executive Officer approval of the revised DWQIP, the IID must submit to the Executive Officer for approval a Quality Assurance Project Plan (QAPP) for the revised DWQIP, prepared in accordance with *Requirements for Quality Assurance Project Plans for Environmental Data Operations*, EPA QA/R-5 (U.S. Environmental Protection Agency 2001). No later than 30 days following Regional Board Executive Officer approval of the QAPP, the IID must implement the QAPP and submit monthly, quarterly, and annual monitoring reports to the Executive Officer. Monthly reports are due on the 15th day of the month and must transmit the previous month's monitoring results, progress towards implementation of control practices, and performance of control practices. Quarterly reports are due on the 15th day of the month following the calendar's quarter and must transmit a quarterly summary of results for the previous three months. Annual reports are due on February 15 and must summarize the year's data, quality control reports, and any data trends.

Tier 3 – NPDES Dischargers
NPDES facilities are not responsible parties for this TMDL, as they contribute an insignificant sediment amount and negligible suspended solids amount (as measured by TSS) into the New River watershed (see Source Analysis section of this TMDL Report). Therefore, no additional effluent limitations for these facilities are necessary to meet TMDL objectives.

Tier 3 – NPS Recalcitrant Violators
Aggressive enforcement is necessary to adequately deal with responsible parties who fail to implement self-determined or regulatory-encouraged sediment control measures. To this end, the Regional Board may use any of the following:

- Implementation and enforcement of CWC § 13267 to ensure that all responsible parties submit, in a prompt and complete manner, the Water Quality Management Plan defined above.

** Upon State approval (i.e., approval by the Regional Boar, State Water Resources Control Board, and Office of Administrative Law), this parenthetical "formula" will be replaced by a particular date, based on the USEPA approval date.

- Consideration of adoption of waste discharge requirements, pursuant to CWC § 13263, for any responsible party who fails to implement voluntary or regulatory-encouraged sediment controls.

- Consideration of adoption of enforcement orders pursuant to CWC § 13304 against any responsible party who violates Regional Board waste discharge requirements and/or fails to implement voluntary or regulatory-encouraged sediment control measures to prevent and mitigate sediment pollution or threatened pollution of surface waters.

- Consideration of adoption of enforcement orders pursuant to CWC § 13301 against those who violate Regional Board waste discharge requirements and/or prohibitions.

- Consideration of Administrative Civil Liability Complaints, pursuant to the California Water Code, against any responsible party who fails to comply with Regional Board orders, prohibitions, and requests.

- Consideration of adoption of referrals of recalcitrant violators of Regional Board orders and prohibitions to the District Attorney or Attorney General for criminal or civil prosecution, respectively.

In assessing the load allocation compliance status of any Tier 1 or Tier 2 responsible party, Regional Board staff recommends that the Regional Board consider water quality results and the degree to which the responsible party has implemented, or is implementing, sediment control measures.

F. BEST MANAGEMENT PRACTICES

Best Management Practices (BMPs) are methods applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters. Landowners/operators are the best parties to identify which BMPs are most appropriate for TMDL attainment, based on site-specific and crop-specific conditions. Technical resource agencies and organizations may be of assistance.

Public Involvement in BMP Identification and Development

During TMDL development, the Technical Advisory Committee formed an On-Field Sediment BMP Subcommittee who prepared a list of recommended BMPs (Appendix F). Additionally, the UCCE submitted a list of recommended BMPs (Appendix G). Regional Board staff evaluated both lists and discussed BMPs with TMDL TAC members at three TAC meetings, during which language revisions were made. Those changes are incorporated herein.

On-Field Sediment-Control BMPs

On-field sediment-control BMPs work by limiting irrigation water velocity and/or making the field more resistant to erosive forces. BMP effectiveness can be increased greatly when used in conjunction with other BMPs. The following on-field, sediment-control BMPs (references are in brackets) are available for implementation:

- **Maintenance of Field Drainage Structure (Imperial Irrigation District Regulation No. 39)**
  Imperial Irrigation District's Regulation 39 states, in part, "It is the responsibility of each water user to maintain a tailwater structure and approach channel in acceptable condition, in order to qualify for delivery of water. An acceptable structure shall have vertical walls and a permanent, level grade board set a maximum of 12 inches below the natural surface. If the situation warrants, and at the discretion of the district, 18 inches maximum may be allowed".

  {Imperial Irrigation District Regulation No. 39, Silt TMDL TAC, Consistent with Natural Resource Conservation Service (NRCS) Field Office Technical Guide (FOTG) Conservation Practice "Structure for Water Control" (Code 587), Consistent with Jones & Stokes BMP #1: Improved Drop Box}

- **Tailwater Drop Box with Raised Grade Board**
  This practice involves maintenance of the grade board at an elevation high enough to minimize erosion. In many situations, the grade board elevation can be set higher than required by IID regulations, especially when anticipated tailwater flows will not reach an elevation that will cause crop damage. Jones & Stokes (Jones & Stokes Associates 1996) rated this BMP as having a demonstrated positive sediment transport reduction effect and a relatively low cost.

  {Silt TMDL TAC, Consistent with NRCS FOTG Conservation Practice "Structure for Water Control" (Code 587), Consistent with Jones & Stokes BMP #1: Improved Drop Box }

- **Improved Drop Box with Widened Weir and Raised Grade Board**
  This practice involves widening the drop box overpour weir and maintaining the grade board at an elevation high enough to minimize erosion. Widening the drop box overpour weir enables the weir elevation to be set higher without raising the surface elevation of water above the acceptable level. Higher weir elevations allow an increased tailwater ditch cross-section, and reduced erosion when water leaving the field enters the tailwater ditch. Jones & Stokes (Jones & Stokes Associates 1996) rated this BMP as having a demonstrated positive sediment transport reduction effect (sediment reduction efficiency of 40% to 60%) and a relatively low cost.

  {Silt TMDL TAC, Consistent with NRCS FOTG Conservation Practice "Structure for Water Control" (Code 587), Jones & Stokes BMP #1: Improved Drop Box }

- **"Pan Ditch" -- Enlarged Tailwater Ditch Cross-section**
  This practice involves deepening and widening the tailwater ditch, which results in decreased tailwater velocity and depth. Water must be checked downstream of the oversized area to make the water cross-section as large as practical. The slower the velocity, the more sediment will settle out of the water and stay in the field, and the less will be picked up by moving water. The effectiveness of this BMP is further improved by planting grass filter strips in the tailwater ditch and/or installing tailwater ditch checks.

  {Silt TMDL TAC}

- **Tailwater Ditch Checks or Check Dams**
  Tailwater Ditch Checks are temporary or permanent dams that hold water level well above ground. They can be placed at intervals in tailwater ditches, especially those with steeper

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slopes. They increase the cross-section of the stream of water, decrease water velocity and reduce erosion, and may cause sediment already in the water to settle out. Tailwater Ditch Checks can be constructed of plastic, concrete, fiber, metal, or other suitable material. If plastic sheets are used, care must be taken not to allow plastic pieces to be carried downstream with water. In order to be effective, this BMP must be utilized where water velocities will not wash out check dams or sides of the tailwater ditch around the dams. Tailwater ditch checks or check dams are expected to work best in wide "pan ditches" where tailwater stream width can be increased effectively. Jones & Stokes (Jones & Stokes Associates 1996) rated this BMP as having a likely positive effect on sediment transport reduction and a relatively low cost.

{Silt TMDL TAC, Jones & Stokes BMP #2: Portable Check Dams}

- **Field to Tailditch Transition**
  This practice involves controlling water flow from the field into the tailwater ditch through spillways or pipes without washing across and eroding soil. Spillways might be constructed of plastic, concrete, metal, or other suitable material. If plastic sheets are used, care must be taken not to allow plastic pieces to be carried downstream with water. This procedure may be useful on fields irrigated in border strips and furrows. Care must be taken to address erosion that may be caused where the spillway discharges to the tailditch.

  {Silt TMDL TAC}

- **Furrow Dikes (also known as "C-Taps")**
  Furrow dikes are small dikes created in furrows to manage water velocity in the furrow. They can be constructed of earth and built with an attachment to tillage equipment, pre-manufactured "C-Taps," or other material, including rolled fiber mat, plastic, etc. Jones & Stokes (Jones & Stokes Associates 1996) rated this BMP as having a likely positive sediment transport reduction effect and a relatively low cost.
  {Silt TMDL TAC}

- **Filter Strips**
  This practice involves border elimination on the field's last 20 to 200 feet. The planted crop is maintained to the field's end, and tailwater from upper lands is used to irrigate the crop at the ends of adjacent lower lands. The main slope on the field's lower end should be no greater than on the balance of the field. A reduced slope might be better. With no tailwater ditch, very little erosion occurs as water slowly moves across a wide area of the field to the tailwater box. Some sediment might settle out as the crop slows the water as it moves across the field. This could be used with water-tolerant crops or special soil conditions. Jones & Stokes (Jones & Stokes Associates 1996) rated this BMP as having a demonstrated positive sediment transport reduction effect (sediment reduction efficiency of 40% to 65%) and a relatively low to medium cost.

  {Silt TMDL TAC, Consistent with NRCS FOTG Conservation Practice "Filter Strip" (Code 393), Jones & Stokes BMPs #4: Filter Strips}

- **Irrigation Water Management**

Irrigation water management is defined as determining and controlling irrigation water rate, amount, and timing in a planned manner. Effective implementation can result in minimizing on-farm soil erosion and subsequent sediment transport into receiving waters. Specific irrigation water management methods include: surge irrigation, tailwater cutback, irrigation scheduling, and runoff reduction. In some cases, irrigation water management could include employment of an additional irrigator to better monitor and manage irrigation water and potential erosion.

{Consistent with NRCS FOTG Conservation Practice "Improved Water Application" (Code 197, CA Interim), Consistent with NRCS FOTG Conservation Practice "Irrigation Water Management" (Code 449), Jones & Stokes BMPs #8: Improved Irrigation Scheduling, #9: Gated Pipe Irrigation, #11:Cut-Back Irrigation, #12: Cablegation, #15: Surge Irrigation}

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- **Irrigation Land Leveling**
  This practice involves maintaining or adjusting field slope to avoid excessive slopes or low spots at a field's tail end. It might be advantageous in some cases to maintain a reduced main or cross slope, which facilitates more uniform distribution of irrigation water and can result in reduced salt build-up in soil, increased production, reduced tailwater, and decreased erosion. Jones & Stokes (Jones & Stokes Associates 1996) rated this BMP as having a sediment reduction efficiency of 10% to 50%, and a medium to high cost.

  {Silt TMDL TAC, Consistent with NRCS FOTG Conservation Practice "Irrigation Land Leveling" (Code 464), Jones & Stokes BMPs #13 and #14: Land Leveling, Slope Adjustments, Tail End Flattening, and Dead Leveling}

- **Sprinkler Irrigation**
  Sprinkler irrigation involves water distribution by means of sprinklers or spray nozzles. The purpose is to apply irrigation water efficiently and uniformly to maintain adequate soil moisture for optimum plant growth without causing excessive water loss, erosion, or reduced water quality. Jones & Stokes (Jones & Stokes Associates 1996) rated this BMP as having a demonstrated positive sediment transport reduction effect (sediment reduction efficiency of 25% to 35% if utilized during germination, and 90% to 95% for an established crop), and a relatively high cost.

  {Consistent with NRCS FOTG Conservation Practice "Irrigation System, Sprinkler" (Code 442), Jones & Stokes BMPs #17 and #18: Irrigation Sprinkler Systems}

- **Drip Irrigation**

Drip irrigation consists of a network of pipes and emitters that apply water to soil surface or subsurface in the form of spray or small stream.

- **Reduced Tillage**

This practice involves elimination of at least one cultivation per crop. It integrates weed control practices to maximize effectiveness, but minimizes erosion and sedimentation that may occur in the furrow**.**

Off-Field Sediment Control BMPs

The following off-field sediment-control BMPs (references are in brackets) are available for implementation:

- **Channel Vegetation / Grassed Waterway**
  This practice involves establishing and maintaining adequate plant cover on channel banks to stabilize channel banks and adjacent areas, and to establish maximum side slopes. This practice reduces erosion and sedimentation, thus reducing bank failure potential.

{Consistent with NRCS FOTG Conservation Practice “Channel Vegetation” (Code 322), and NRCS FOTG Conservation Practice “Grassed Waterway” (Code 412)}

- **Irrigation Canal or Lateral**
  This practice applies to irrigation drainage channels. One objective is to prevent erosion or water quality degradation. Drainage channels should be designed to develop velocities that are non-erosive for the soil materials from which the channel is constructed.

  {Consistent with NRCS FOTG Conservation Practice “Irrigation Canal or Lateral” (Code 320)}

- **Sedimentation Basins**
  Sedimentation basins collect and store debris or sediment. Sedimentation basin capacity should be sufficient to store irrigation tailwater flows long enough to allow most sediments within the water to settle out. Sedimentation basins also must be cleaned regularly to maintain capacity and effectiveness.

Effectiveness Monitoring
Effectiveness monitoring (also known as management monitoring) is used to evaluate effectiveness of a BMP/management practice or set of BMPs/management practices. Effectiveness monitoring should be implemented in conjunction with technical assistance (e.g., UCCE) to ensure that data will be useful in activity assessment.

There is currently a lack of quantitative data on performance of applicable BMPs under local conditions. Performance data will be considered in future TMDL revisions. Regional Board staff will work cooperatively with ICFB and IID to determine appropriate monitoring protocols and tracking/reporting protocols to assess BMP performance.

Sediment BMP Performance is defined as:

Sediment BMP Performance = TSS (No BMP) – TSS (With BMP)

or

$$\text{Sediment BMP Performance} = \frac{\text{Tons of sediment}}{\text{Year}}(\text{No BMP}) - \frac{\text{Tons of sediment}}{\text{Year}}(\text{With BMP})$$

[Equation 8]

Sediment BMP Efficiency is defined as:

$$\text{Sediment BMP Efficiency} = 100 \; * \; \frac{TSS_{\text{no BMP}} - TSS_{\text{with BMP}}}{TSS_{\text{no BMP}}}$$

or

$$100 * \frac{\text{Tons of Sediment/Year (No BMP)} - \text{Tons of Sediment/Year (With BMP)}}{\text{Tons of Sediment/Year (No BMP)}}$$

[Equation 9]

where:

$TSS_{No\ BMP}$ = TSS concentration without BMP under a specified set of operational conditions

$TSS_{With\ BMP}$ = TSS concentration with BMP under the same specified set of operational conditions

G. ADAPTIVE MANAGEMENT COMMITTEE

The Regional Board Executive Officer will establish an Adaptive Management Committee (AMC) comprised of stakeholder representatives and agencies. The AMC will meet at least semi-annually. Regional Board staff will provide AMC with formal results of water quality monitoring and tracking. AMC will evaluate overall BMP implementation and performance, evaluate water quality improvements, and make appropriate recommendations for TMDL compliance and/or modification. IID and ICFB will have the opportunity to report their progress toward attainment of milestones set forth in this TMDL and in plans submitted by them pursuant to this Implementation Plan.

Proven BMPs currently are available to address New River sediment loading. Therefore, this Implementation Plan does not require a schedule for development of management practices. However, the AMC and/or subwatershed groups can prioritize BMPs for refinement and performance assessment, and can identify new management practices.

H. INTERIM NUMERIC TARGETS

The Regional Board's goal is attainment of TMDL allocations by the year 2013. Time-bound interim numeric targets are shown in Table 8.1.

Table 8.1: Interim Numeric Targets for TMDL Attainment

Phase	Time Period	Estimated Reduction*	Interim Target (mg/L)
Phase 1	2002 through 2004 (Years 1 – 3)	5%	229
Phase 2	2005 through 2007 (Years 4 – 6)	7%	213
Phase 3	2008 through 2010 (Years 7 – 9)	4%	204

Phase	Time Period	Estimated Reduction*	Interim Target (mg/L)
Phase 4	2011 through 2013 (Years 10 – 12)	2%	200

* Percent reductions indicate the reduction required in TSS load from the New River average concentration at the beginning of each phase, starting with the 1996-1998 average concentration of 241 mg/L.

I. WATER QUALITY MONITORING AND IMPLEMENTATION TRACKING PROGRAM

It is important to track TMDL implementation, monitor water quality progress, and modify TMDLs and Implementation Plans as necessary because the Regional Board wants to:

- Address uncertainty that may have existed during TMDL development
- Oversee TMDL implementation to ensure that implementation is occurring
- Ensure TMDL effectiveness, given watershed changes that may have occurred after TMDL development

The Regional Board will conduct the TMDL Monitoring and Tracking Program pursuant to a Quality Assurance Project Plan (QAPP). The QAPP will be developed by Regional Board staff and will be ready for implementation within 180 days after USEPA approval of this TMDL. Regional Board staff will perform two types of monitoring: (1) water quality monitoring, and (2) implementation tracking. Both are described below.

Water Quality Monitoring
Monitoring program objectives include:

- assessment of water quality objectives attainment
- verification of pollution source allocations
- calibration or modification of selected models (if any)
- calculation of dilutions and pollutant mass balances
- evaluation of point and nonpoint source control implementation and effectiveness
- evaluation of in-stream water quality
- evaluation of water quality temporal and spatial trends

Stations will be located along the New River to obtain continuous data on indicator parameters for suspended solids (e.g., turbidity), using optical backscatter instrumentation and correlating data with grab sample data. Representative grab samples will be taken at the following stations, to the extent that resources provide:

- New River at NR-0
- New River at NR-1

- New River at NR-2
- New River at NR-Outlet

The following parameters will be sampled. Frequency is in brackets.

- Flow [Quarterly]
- Field turbidity [Quarterly]
- Lab turbidity (EPA Method No. 180.1) [Quarterly]
- Total Suspended Solids (EPA Method No. 160.2) [Quarterly]
- Ortho Phosphate (EPA Method No. 300.0) [Quarterly]
- Total Phosphorus (EPA Method No. 365.2 or 365.3) [Quarterly]
- Total DDT (EPA Method No. 8081) [Annually]
- Selenium [Quarterly]

Implementation Tracking
Regional Board staff will develop a plan to track TMDL implementation, within 180 days of USEPA approval of this TMDL and Implementation Plan. Objectives are to:

- Assess, track, and account for practices already in place
- Measure milestone attainment
- Ground-truth the level of implementation
- Report progress toward NPS water quality control implementation, in accordance with the State Board NPS Program Plan

J. MEASURES OF SUCCESS, AND FAILURE SCENARIOS

Measures of Success
The primary measure of success for TMDL implementation is attainment of interim numeric targets and corresponding interim load allocations, with attainment of final TMDL load allocations. Another measure of success may be the level of Tier 2 and Tier 3 compliance.

Failure Scenarios
Two failure scenarios exist regarding TMDL implementation. The first is failing to meet water quality improvement goals (interim numeric targets and corresponding load allocations) coupled with *achievement* of implementation milestones. If this scenario materializes, BMPs and interim targets will be re-evaluated and adjusted. The second failure scenario involves failure to meet water quality improvement goals (interim numeric targets and corresponding load allocations) coupled with *failure* to achieve implementation milestones. If this scenario materializes, the Regional Board shall consider more stringent regulatory mechanisms.

K. TMDL REVIEW SCHEDULE

Quarterly and Annual Reports
Regional Board staff shall present quarterly and yearly reports to the Regional Board describing progress toward milestone attainment. Reports will assess:

• Water quality improvement (in terms of total suspended sediments, total sediment loads, DDT and metabolites, and total phosphate)
• BMP implementation trends and effectiveness
• Whether milestones were met on time or at all. If milestones were not met, the reports will discuss reasons and make recommendations.
• Level of compliance with measures and timelines agreed to in Program Plans and Drainshed Plans

Triennial Review
The first TMDL review is scheduled to conclude three years after TMDL approval to provide adequate time for implementation and data collection. Subsequent reviews will be conducted concurrently with the Basin Plan Triennial Review. The TMDL review schedule is shown in Table 8.2.

Table 8.2: TMDL Review Schedule*

Activity	Date
Approval	2002
Begin First Review	July 2003
End Review (Regional Board Public Hearing)	April 2004
Submit Administrative Record to State Board	May 2004
Begin Second Review	July 2005
End Review (Regional Board Public Hearing)	June 2006
Submit Administrative Record to State Board	July 2006
Begin Third Review	July 2008
End Review (Regional Board Public Hearing)	June 2009
Submit Administrative Record to State Board	July 2009
Etc.	

* Dates are contingent upon Regional Board and State Board approval.

Regional Board staff proposes that the Regional Board hold public hearings at least every three years to review sediment control progress. At these hearings, it is proposed that the Regional Board consider:

• monitoring results
• progress toward milestone attainment

- BMP implementation trends
- modification and/or addition of management practices for sediment discharge control
- revision of TMDL components and/or development of site-specific water quality objectives

9. PROPOSED AMENDMENT

The Proposed Basin Plan Amendment:

- Updates references to the State's Nonpoint Source Pollution Control Program
- Includes Regional Nonpoint Source Control Program elements
- Deletes dated information that is no longer accurate
- Establishes a numeric target of 200 mg/L of total suspended solids for the entire U.S. reach of the New River
- Adds a section for this proposed TMDL that:
    - Summarizes New River Sedimentation/Siltation TMDL elements, including the Problem Statement, Numeric Target, Source Analysis, Margin of Safety, Seasonal Variations and Critical Conditions, Loading Capacity, and Load Allocations and Wasteload Allocations
    - Establishes interim numeric targets
    - Designates responsible parties and management actions
    - Lists recommended Best Management Practices (BMPs), with estimated implementation costs and financing sources
    - Describes recommended actions for cooperating agencies
    - Describes TMDL compliance monitoring and enforcement activities
    - Describes Regional Board water quality monitoring and implementation tracking activities to assess TMDL implementation
    - Describes public reporting activities
    - Describes the Regional Board review process

10. ECONOMIC IMPACTS

A. COST ANALYSIS SUMMARY

The State Board Economics Unit prepared a Cost Analysis (Attachment 4) that evaluates implementation costs of several alternative management practices. After omitting the high-cost outlier, the annual costs for various irrigation drainage management practices ranged from about $6 per acre for the wide-profile ditch, to about $40 per acre for additional vegetable irrigation labor. This cost range appears to be quite broad. However, cost-share comparison reveals that both amounts represent increases of up to 1% in per-acre gross production costs for field crops (annual production costs of $500 - $800) and vegetables (annual production costs of $3,000 - $5,000). This cost-share comparison is less accurate for non-vegetable row-crops, which have production costs of about $1,500 per acre.

B. FEDERAL TECHNICAL ASSISTANCE

U.S. Department of Agriculture's Natural Resources Programs
The Natural Resources Conservation Service (NRCS) offers landowners financial, technical, and educational assistance to implement conservation practices on privately-owned land. These programs include:

Environmental Quality Incentives Program -- offers financial, educational, and technical help to implement BMPs such as manure management systems, pest management, and erosion control, to improve environment health. Cost-sharing may pay up to 75% of costs of certain conservation practices.

National Conservation Buffer Initiative -- created to help landowners establish conservation buffers, such as riparian areas along rivers, streams, and wetlands.

Clean Water Act Section 319(h)
Federal NPS water quality implementation grants are available each year on a competitive basis. These grants range from $25,000 to $350,000 and require a 40% non-federal match. The Regional Board administers these grants.

Clean Water Act Section 205(j)
Federal water quality planning grants are available each year on a competitive basis. These grants range from $25,000 to $120,000 and require a 25% non-federal match. The Regional Board administers these grants.

C. STATE TECHNICAL ASSISTANCE

University of California Cooperative Extension Programs
U.C. Cooperative Extension offers technical assistance regarding BMPs and erosion control.

D. POTENTIAL FUNDING SOURCES

Potential funding sources include:

- Private financing by individual sources
- Bond indebtedness or loans from government institutions
- Surcharges on water deliveries to lands contributing to sediment pollution
- Taxes and fees levied by the IID for drainage management
- State and/or federal grants and low-interest loans
- Single-purpose appropriations from federal and/or state legislative bodies

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