CHAPTER 6: WATER QUALITY

Introduction

The ecological values of Auburn Ravine, Coon Creek, and Doty Ravine are due in large part to the water quality characteristics of the three streams. While Markham Ravine is technically part of the watershed discussion, this stream generally has no natural flow but provides some freshwater habitats based on irrigation return flows. In the winter, Markham Ravine does deliver urban runoff and precipitation-generated flow directly to the East Side Canal.

Imported water supplies for irrigation and power production, as well as treated wastewater discharges, all augment natural stream flows at critical times of the year. As a result of augmented flows, both the quality and quantity of water is higher than it would be under natural conditions.

A comparison of the existing water quality monitoring data shows that water quality criteria are met most of the time, at most of the sampling points, for most of the constituents. There are, however, potential threats to water quality associated with nonpoint source runoff from urbanized areas and unimproved dirt roads, from wastewater treatment plant discharges, and, in the lower basin, from irrigation return flows. Water quality criteria for lead and copper are occasionally exceeded in Auburn Ravine, likely a result of urban runoff.

The purpose of this chapter is to provide an overview of the existing water quality conditions and trends in the basins.

Beneficial Uses

The Basin Plan of the State Water Resources Control Board (SWRCB) lists beneficial uses of water that form the basis for developing water quality criteria. The Central Valley Regional Water Quality Control Board (RWQCB) assigns beneficial uses for tributary streams based on the uses assigned to the named waterbody that the tributary connects with. The beneficial uses assigned to Auburn Ravine, Coon Creek, and Doty Ravine are identified below:

- Agricultural Irrigation
- Municipal and Domestic Water Supply
- Body Contact and Non-body Contact Water Recreation
- Navigation
- Canoeing and Rafting
- Warm and Cold Freshwater Aquatic Habitat
- Warm and Cold Fish Migration Habitat
- Warm and Cold Spawning Habitat
- Wildlife Habitat

Diversions And Discharges

Diversions and discharges from and to the three streams have a major influence on water quality. Figure 6-1 shows the main diversion locations and presents water quality sampling data within the ERP planning area. The major point and non-point sources of diversions and discharges in the watersheds are identified in the following discussion.

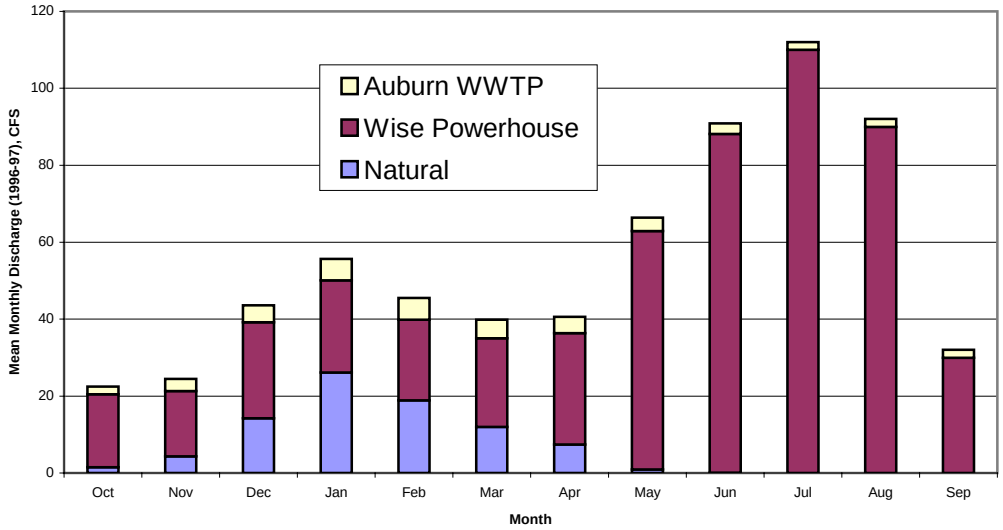
Point Sources

The Wise Powerhouse

Flows in Auburn Ravine are augmented below the City of Auburn by discharge from PG&E's Wise Powerhouse. The 1996-97 mean monthly discharge from the powerhouse averaged 36 cfs, and varied from 17 cfs in November to 110 cfs in July. On average, these flows comprised 75 percent of the flow in Auburn Ravine, varying from 43 percent in January to 98 percent in August. Some of the power plant discharge is diverted to the South Canal. At the end of the irrigation season (October 15), the plant is shut down for maintenance, for 2-6 weeks, and during some years, stream flow depends entirely on discharge from the Auburn Wastewater Treatment Plant (WWTP). Figure 6-2 shows the mean monthly discharge by water source below the WWTP, for water year (WY) 1997 (City of Auburn, 1996).

Fig 6-1

Figure 6-2. Mean Monthly Flows at Auburn Wastewater Treatment Plant



The Auburn Wastewater Treatment Plant

About 0.4 mi below the power plant discharge, the City of Auburn's Wastewater Treatment Plant (WWTP) discharges treated wastewater to Auburn Ravine. The City of Auburn's Stream Study, prepared in support of an EIR for treatment plant expansion, showed the following:

- The plant effluent is diluted about 4-fold during low flow, and 30-fold as an annual average.
- Lead and three banned chlorinated pesticides (DDT, endosulfan and endrin) show potential for exceeding water quality objectives. Lead is present in unusually high levels in the treated effluent.
- Treatment plant discharge may be expected to cause dissolved oxygen (DO) to drop below 7 mg/l less than 1 percent of the time in Auburn Ravine downstream of the discharge.
- Free ammonia concentrations are likely to exceed water quality criteria <1 percent of the time, during low flow conditions.
- pH, temperature and turbidity criteria are obtained under average conditions but may be exceeded occasionally under low-flow conditions.

- The WWTP discharge accounts for about half of the flow in Auburn Ravine when the Wise Powerhouse is off-line for maintenance in October. During this period, conductivity, total phosphorus, ammonia, turbidity, hardness and total coliforms are elevated. The City of Auburn has upgraded its WWTP to address these problems.

The City of Lincoln Wastewater Treatment Plants

The City of Lincoln is one of the fastest growing communities in California. To meet its immediate needs for wastewater treatment, the City will expand its treatment plant on Markham Ravine, south of Nicolaus Rd. to a capacity of 2.4 million gallons per day (mgd). Most of the treated wastewater will be discharged as irrigation. During winter months, discharge will be limited at high flows to prevent it from contributing to flooding downstream; discharge will be limited at low flows to less than 5 percent of the discharge in Auburn Ravine.

Ultimately, however, the wastewater treatment needs of Lincoln will be met by a new treatment plant with an initial capacity of up to 5 MGD and an ultimate capacity of about 12 MGD. The City anticipates that much of the treated wastewater would be used for crop irrigation, but the amounts have not yet been determined.

SMD - 1

The Placer County Department of Facilities Services operates a small WWTP north of Auburn, just west of Highway 49 on Joeger Road. The plant discharges about 2.3 mgd (3.6 cfs) to Rock Creek, just above its confluence with Dry Creek (a tributary of Coon Creek). The discharge includes a load of about 100 kg/day of ammonia-nitrogen (Feb. 2001 data); samples are not routinely analyzed for phosphorus, nitrate or Total Kjeldahl Nitrogen (TKN).

<u>Nonpoint Sources</u>

Urban Runoff

Stormwater runoff from developed areas is a major potential source of water quality degradation in the Auburn Ravine and Coon Creek basins. At present the problems are localized, but as urban and suburban development in the basins increases, the water quality impacts of urban runoff will increase. The impacts of stormwater on specific water quality constituents are discussed below, in the context of all of the potential sources of water quality degradation.

The City of Lincoln has implemented a program to address the problem of urban runoff. In one of the major developments, runoff is routed to a designed wetland, which will provide some water quality treatment as well as attenuation of flood peaks. The City has also designed a large detention basin on Orchard Creek (a tributary to Auburn Ravine below Lincoln), and requires the use of drop-inlet stormwater filters in new subdivisions.

The City of Auburn's program for addressing urban runoff water quality problems includes 1) painting drop-inlets to increase public awareness of water quality issues; 2) requiring the installation of oil and grease filters on new drop inlets, along with retrofitting in potential high-source areas; 3) requiring sand filters or other more elaborate filter systems at new industrial sites; 4) street-sweeping weekly in downtown and monthly in residential areas with curbs and gutters.

In accordance with the Placer County Flood Control and Water Conservation District requirements, both the City of Auburn and the City of Lincoln require new developments to provide flood detention (up to the 100-year event), so that post-development peak flows do not exceed 90 percent of the pre-development peak flows. This means that stormwater from impervious surfaces must either be infiltrated, or stored in detention basins. Either solution will provide some water quality benefits, but these would be hard to quantify. Heavy metals, nutrients and other potential pollutants are generally associated with the fine sediment fraction, (<60 microns (μm)), which may pass through detention basins.

In December 1999 the USEPA published the stormwater Phase II rule for municipal separate storm sewer systems (MS4s). The Phase II rule extends the National Pollutant Discharge Elimination System (NPDES) stormwater program to operators of MS4s in urbanized areas with total populations of at least 50,000 and densities of 1,000 persons/mi^2; in some cases smaller and less dense jurisdictions will be brought under the program. The minimum size of exempt construction is decreased from five acres to one acre. Both the cities of Auburn and Lincoln will be affected by the new rules, as will many private developers and owners of industrial sites in the watersheds.

Return Flows from Agriculture

West of the City of Lincoln, Auburn Ravine and Coon Creek flow onto the valley floor, which supports the intensive cultivation of rice. Here, return flows from the rice fields carry dissolved solids, nutrients, heat, and pesticides to the creeks, which ultimately flow to the East Side Canal and Cross Canal. The Department of Water Resources completed a 12-month long monthly sampling program in January 2002 with sampling locations in lower Auburn Ravine, lower Coon Creek and the East Side Canal near its confluence with the Cross Canal. Preliminary data are available and are discussed below. Data are also available on pesticide use on rice in Placer County (Appendix B).

Sanitary Sewer Cross Connections

High coliform bacteria counts (both fecal and total) have been recorded in Auburn Ravine near the City of Auburn. These have largely been the result of cross-connections between the storm sewers and the sanitary sewer system. Monitoring of coliform bacteria has helped to identify specific problems, which the City has been repairing, and reduce bacterial contamination in Auburn Ravine (Tom Fossom, pers. comm. 1/3/02).

Data Sources And Monitoring Programs

Most of the water quality data for these watersheds have been collected from sites in the Auburn Ravine and Coon Creek watersheds in order to assess the existing or likely future impacts of discharge of treated wastewater. The existing data sets are listed in Appendix B, Table B-1; sampling locations indicated in the table are indexed to the GIS map of the basins. Monitoring for WWTP compliance with NPDES permit requirements includes daily or twice-weekly sampling for DO, temperature, pH, chlorine residual, ammonium, un-ionized ammonia, turbidity or total suspended solids, and electrical conductivity. The results are typically presented as monthly averages. A brief summary of selected water quality parameters and locations are presented in Appendix B:

- Table B-2 – Summary of heavy metals (priority pollutants) for selected locations in the Auburn Ravine and Coon Creek watersheds (additional detailed data on copper and lead from Auburn Ravine near Joiner Parkway in Lincoln is presented in Appendix B);
- Table B-3 – Summary of selected water quality parameters for several stations in the Coon Creek watershed, and.
- Table B-4 – Summary of selected water quality parameters for several stations in the Auburn Ravine watershed and one East Side Canal station.

Monitoring for WWTP compliance with NPDES permit requirements includes daily or twice-weekly sampling for DO, temperature, pH, chlorine residual, ammonium, un-ionized ammonia, turbidity or total suspended solids, and electrical conductivity. The results are typically presented as monthly averages.

The California Department of Water Resources (DWR) collected water quality samples monthly (Jan 2001-Jan 2002) in lower Auburn Ravine (at Pleasant Grove Road), in Coon Creek (1 mi downstream of Trowbridge, and in the Cross Canal at the confluence of Coon Creek and Auburn Ravine. Summary data for selected parameters are presented in Tables 6-1, 6-2, and 6-3. Provisional monthly data for the 26 water quality constituents being analyzed are presented in Appendix B, Table B-6.

The City of Lincoln has been monitoring stream temperature in Auburn Ravine at five locations, in order to develop information for assessing the impacts of their new Wastewater Treatment and Reclamation Facility. Data (with some gaps due to equipment vandalism and theft) are available from April 1999 to November 2001. Results of some of the temperature monitoring are discussed below.

The City of Lincoln has also measured metals and metaloids (aluminum, antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium and zinc) at Joiner Parkway, approximately biweekly, from May 1999 to April 2000 (Table 6-1). Hardness was also measured, since it influences the toxicity of some of the metals.

Water Quality Issues And Concerns

Temperature

In order to acquire temperature data for evaluating the impacts of the WWTP additions and new facility, the City of Lincoln has placed recording thermistors in Auburn Ravine in five locations. Simple line graphs displaying mean daily values are shown in Figures 6-3, 6-4, and 6-5, for gaging stations at (from upstream to downstream) Fowler Road, NID just west of SR 65, and downstream of the Moore Road crossing west of Lincoln. The data indicate that stream temperatures are satisfactory for salmonid rearing throughout the year at the Fowler Road and NID sites. This conclusion is also supported by reports from local fishermen who routinely catch salmonids in mid-summer within the City of Lincoln. However, downstream at the site just west of the Moore Road crossing, summer water temperatures are too warm to support salmonid populations (the aquatic habitat in this area is primarily sandy-bottomed streambed with no pools and is unsuitable as salmonid habitat anyway). No systematic water temperature data for Coon Creek or Doty Ravine were available for analysis.

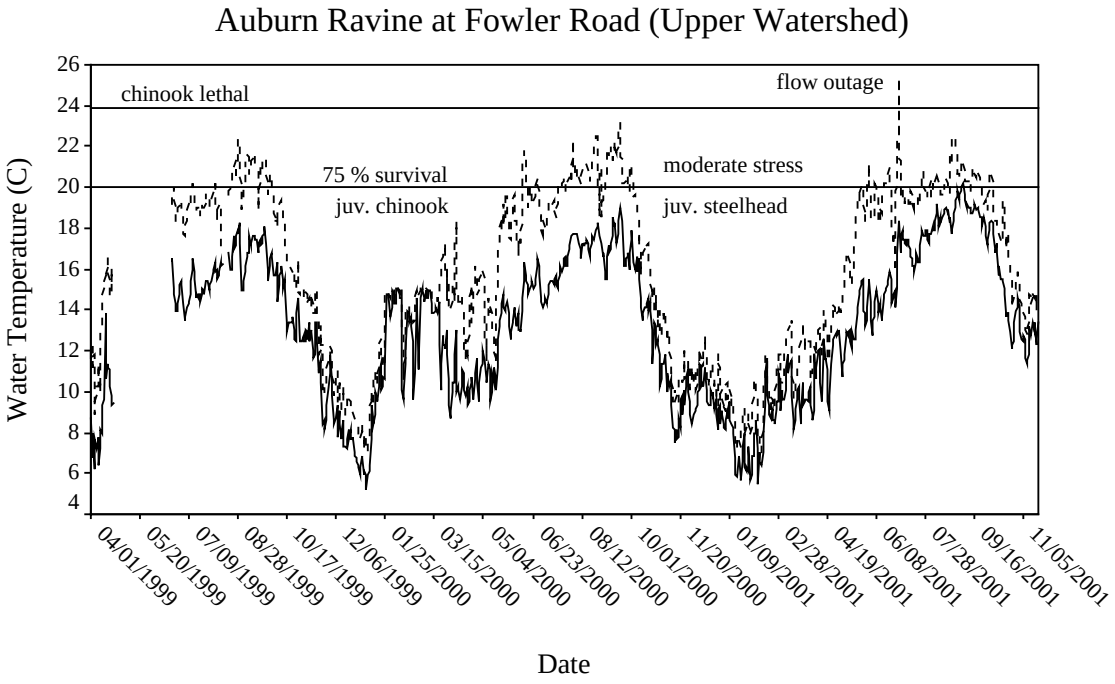


Figure 6-3. Auburn Ravine Daily Maximum and Minimum Water Temperature Data-Auburn Ravine at Fowler Road (Upper Watershed).

Data taken from April 1999 to November 2001 for the station located near Fowler Road, several miles upstream from Lincoln. Reference lines indicate published lethal maximum temperatures for chinook salmon juvenile (steelhead are approximately the same) and survival and stress data for chinook juveniles and steelhead juveniles, respectively.

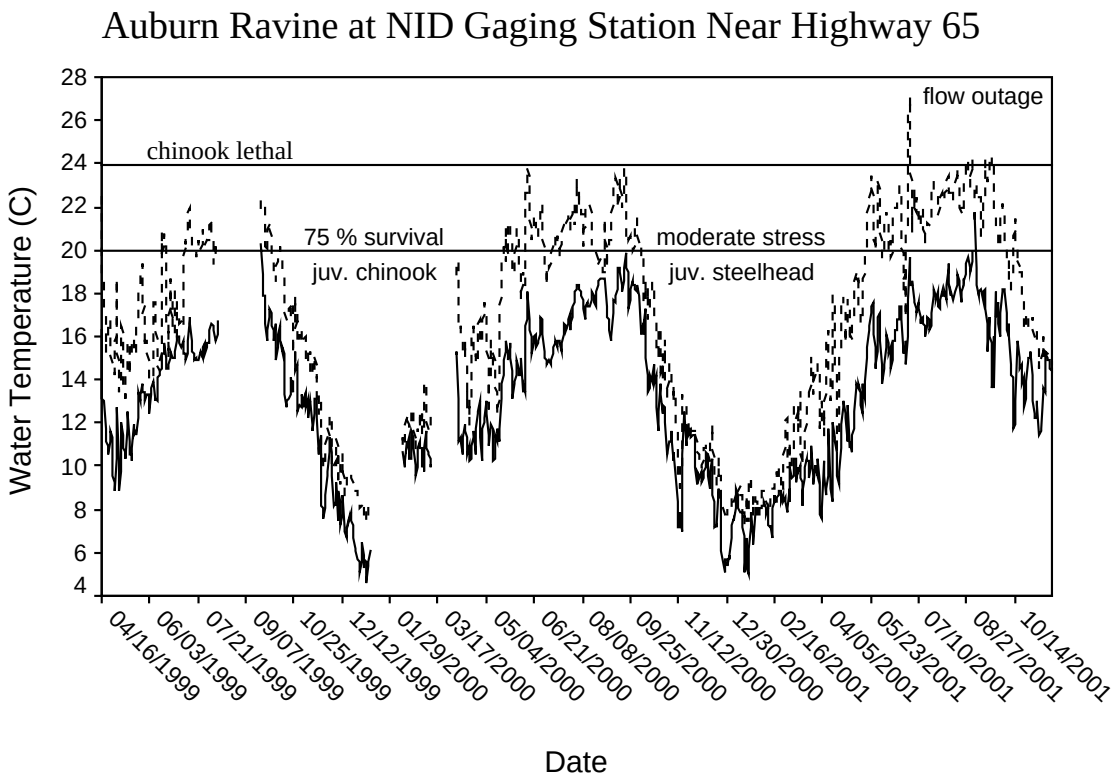


Figure 6-4. Auburn Ravine Daily Maximum and Minimum Water Temperature Data-Auburn Ravine at NID Gaging Station Near Highway 65.

Data taken from April 1999 to November 2001for the station located near the NID gaging station just west of SR 65. Reference lines indicate published lethal maximum temperatures for chinook salmon juvenile (steelhead are approximately the same) and survival and stress data for chinook juveniles and steelhead juveniles, respectively.

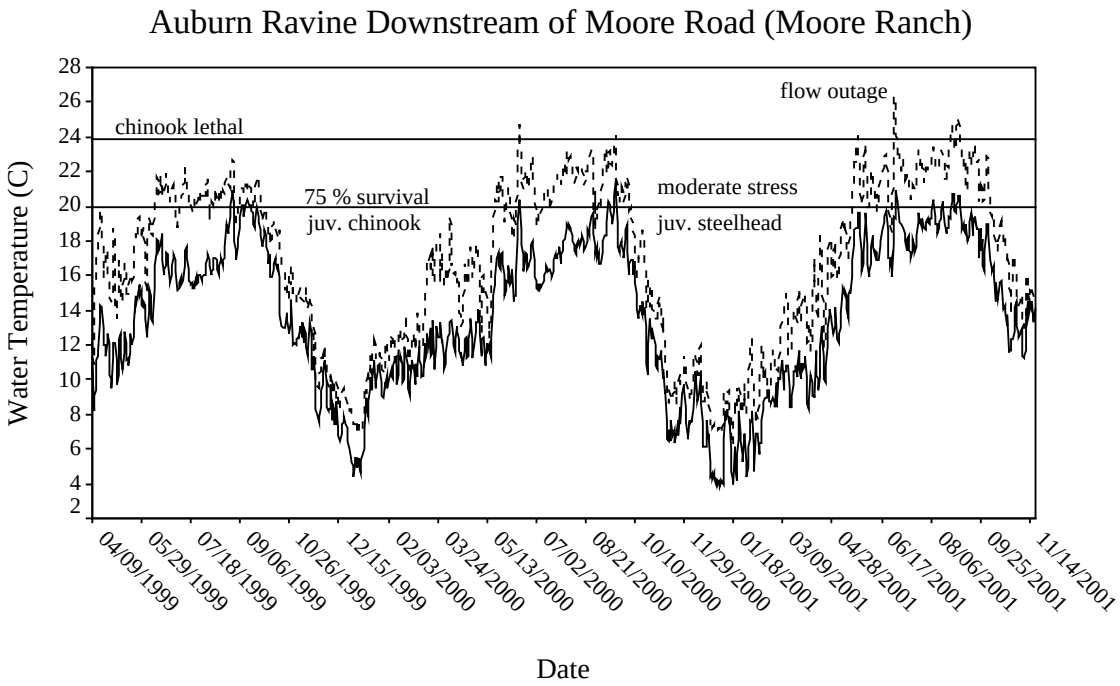


Figure 6-5. Auburn Ravine Daily Maximum and Minimum Water Temperature Data-Auburn Ravine Downstream of Moore Road.

Data taken from April 1999 to November 2001for the station located just west of the Moore Road crossing in the lower watershed. Reference lines indicate published lethal maximum temperatures for chinook salmon juvenile (steelhead are approximately the same) and survival and stress data for chinook juveniles and steelhead juveniles, respectively.

As expected, the water temperature increases in a downstream direction, since air temperature and the heat content of the stream increase in the same manner. Three management factors, however, also influence the temperature regime in Auburn Ravine. First, discharges of relatively cold water from the Wise Powerhouse dominate the flow of the stream during the summer, and are responsible for maintaining temperatures suitable for salmonids. Second, shading by riparian vegetation is important for reducing the solar radiation that reaches the stream, which accounts for most of the temperature increase in the downstream direction. Along Auburn Ravine above Lincoln, the riparian vegetation is relatively intact. Along Coon Creek, however, riparian vegetation has been cut back from the stream banks in some areas, and below Gladding Road, it has been severely damaged by cattle grazing. Third, WWTP discharges increase stream temperature. The Basin Plan requires that discharges shall not increase stream temperatures more than 5 ^{o}F above the receiving water temperature. Since the effluent from the new Lincoln Wastewater Treatment and Reclamation Facility will be 16-20 ^{o}F warmer throughout the year than the water in Auburn Ravine, the planned discharge could violate the Basin Plan temperature standard. The solution will most likely include a 12 billion gallon storage facility for the plant, as well as an amendment to the Basin Plan that will allow up to a 10 ^{o}F temperature increase during extreme low flow periods. Other alternatives involve cooling towers and land application of effluent (City of Lincoln, 1999).

Nutrients

Accelerated loading of biologically available nitrogen and phosphorus to a stream can cause undesirable growth of attached algae, with accompanying daily swings in pH and dissolved oxygen. Sources of nitrogen and phosphorus in Auburn Ravine and Coon Creek include the three wastewater treatment plants, urban stormwater runoff, and in lower Coon Creek especially, livestock.

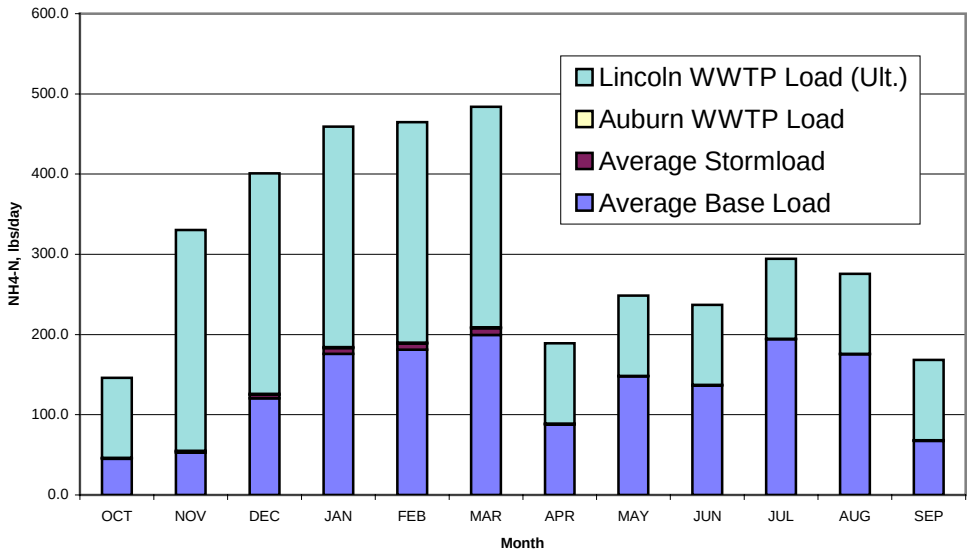
WWTP effluent is generally rich in phosphorus relative to the supply of nitrogen, and algae growth in the downstream receiving waters is likely to be N-limited. Data for the Auburn WWTP show average concentrations of 4 quarterly samples (downstream from the plant, 1995) of 0.5 mg/l nitrate nitrogen, and 0.5 mg/l total phosphorus (City of Auburn, 1996). Surprisingly, however, Auburn Ravine downstream from the WWTP discharge does not show much evidence of eutrophication (nutrient enrichment), such as large accumulations of filamentous green algae. Possibly the relatively intact riparian canopy reduces sunlight at the stream surface, and thus limits the growth of attached algae. As the water travels downstream, interaction with the hyporheic (underflow) zone and vegetation probably removes much of the nutrient load.

Although Orr Creek and Coon Creek are used by NID to convey irrigation water in the summertime, wastewater discharge from the SMD-1 plant may have a greater effect on algal growth in Coon Creek than it does in Auburn Ravine. Floating algal mats have been observed in downstream reaches of Coon Creek. Nitrate and phosphorus data from the plant are not available, but the ammonium load amounts to about 100 kg/day. Downstream monitoring of the biological conditions in the effluent-dominated reach of

upper Coon Creek would be necessary to assess the impacts of discharge. A recording BOD probe might provide useful information.

Downstream of the City of Lincoln, the waters of Auburn Ravine are influenced not only by WWTP inputs and natural stream loads, but also by nutrient inflow from stormwater runoff. Figure 6-6 shows the projected monthly average loading of ammonium as nitrogen from WWTP effluent, stormwater runoff, and base load (from tables in City of Lincoln, 1999). The stormwater contribution in this and subsequent bar graphs was estimated by applying the concentration data of the National Urban Runoff Project (NURP) to the runoff from 5% of the basin area, assuming that much of the basin is urbanized. The base load was estimated from stream water quality data, adjusted to remove the WWTP and stormwater contributions. The WWTP loads were taken from effluent data and the estimated ultimate loading from the future Lincoln WWTP. Although nitrate and phosphorus data are not available, the graph indicates that the projected Lincoln WWTP discharge will be a major source of nutrients to downstream reaches of Auburn Ravine. In unpolluted streams of the Sierra Nevada, ammonium levels are generally very low, and ammonium makes a negligible contribution to the total nitrogen load. This suggests that the background levels in Auburn Ravine are enhanced, possible from septic tank effluent.

Figure 6-6. Mean Monthly Ammonium-Nitrogen Loads in Auburn Ravine



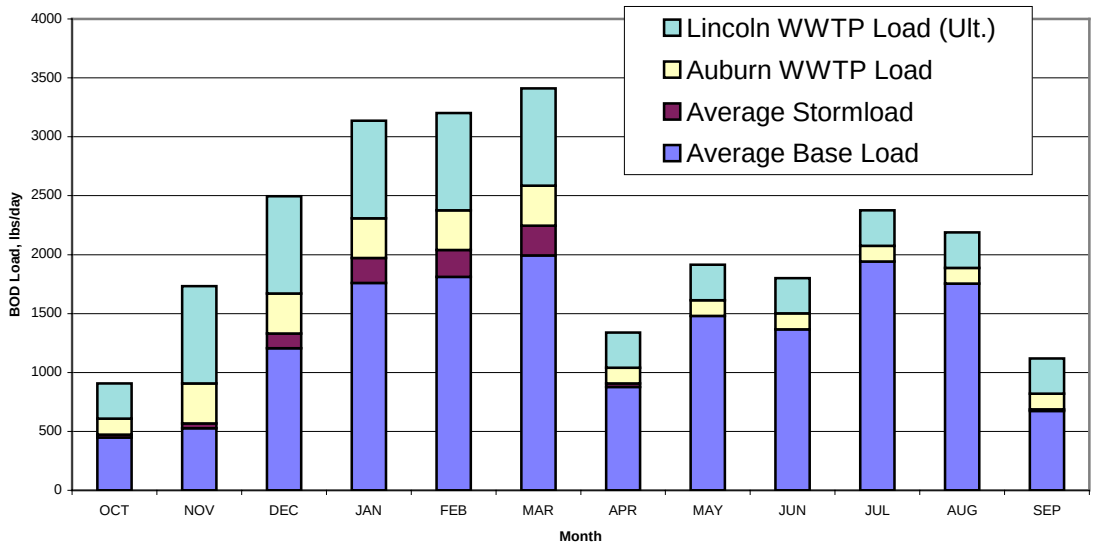
Dissolved Oxygen

Dissolved oxygen (DO) in a stream is controlled by respiratory and chemical uptake, by algal photosynthesis, and by dissolution of oxygen from the atmosphere. The capacity of water to hold dissolved oxygen decreases with temperature, so DO is often expressed as percent of saturation rather than mg/l. The input of organic matter or other reduced

material (such as ammonium) through algae growth, WWTP discharge, or urban stormwater runoff adds to the Biochemical Oxygen Demand (BOD) of a stream.

Figure 6-7 shows the mean monthly BOD loads in Auburn Ravine associated with WWTP discharge, stormwater runoff, and the stream's baseload. The combined discharges of the Auburn and Lincoln WWTP's contribute about a third of the BOD load to the stream during the winter months, and stormwater runoff makes a lesser but significant contribution.

Figure 6-7. Mean Monthly BOD Loads in Auburn Ravine, Average Year



Unfortunately, no DO or BOD data are available for Coon Creek below the confluence with Rock Creek. In the reach below Gladding Road, where cattle have access to the stream, it is likely that aquatic organisms experience DO depletion problems during the summer. The input of WWTP effluent to Rock Creek may be related to visible growths of algae downstream in Coon Creek, and could be causing DO problems at night, but no data are available.

Heavy Metals

During periods of stormflow, concentrations of heavy metals in Auburn Ravine are elevated, probably as a result of urban runoff. For some heavy metals, toxicity is a function of water hardness (concentration of calcium plus magnesium), and the water quality criteria of the California Toxics Rule (CTR) for aquatic life take this into account. Tables 6-1 and 6-2 show that when hardness is considered, concentrations of lead and copper occasionally approach or exceed the CTR limits. For samples in which hardness was not measured directly, values of 20 mg/l (during summer irrigation flows) and 40 mg/l

(fall, winter, and early spring) were used. Established criteria for none of the other metals were exceeded.

Table 6-1. Exceedences of CTR Chronic Criterion for Copper, Auburn Ravine at Jointer Parkway.

Date of Analysis	Total Concentration g/L	Hardness mg/l	Chronic Criterion g/L	Violation?
13-May-99	2.3	20	2.3	Marginal
3-Jun-99	1.9	20	2.3	no
15-Jun-99	2.1	20	2.3	marginal
30-Jun-99	4.2	20	2.3	yes
19-Jul-99	2.4	20	2.3	yes
5-Aug-99	1.9	20	2.3	no
20-Aug-99	1.4	20	2.3	no
2-Sep-99	1.7	20	2.3	no
16-Sep-99	2.2	20	2.3	no
5-Oct-99	1.3	23	2.7	no
21-Oct-99	2.7	34	3.6	yes
2-Nov-99	1.6	50	5	no
7-Dec-99	1.2	28	3.1	no
21-Dec-99	1.2	45	4.5	no
6-Jan-00	1.3	45	4.5	no
19-Jan-00	7.8	45	4.5	yes
2-Feb-00	3.6	45	4.5	no
23-Feb-00	20.5	45	4.5	yes
1-Mar-00	6	66	6.4	marginal
22-Mar-00	2.6	45	4.5	no
3-Apr-00	2.3	20	2.3	marginal
21-Apr-00	2.8	20	2.3	yes

Data Source-Eco:Logic Inc.

Table 6-2. Exceedences of CTR Chronic Criterion for Lead, Auburn Ravine at Joiner Parkway.

Date of Analysis	Total Concentration g/L	Hardness mg/l	Chronic Criterion g/L	Violation?
13-May-99	0.784	20	0.4	yes
3-Jun-99	0.417	20	0.4	marginal
15-Jun-99	0.59	20	0.4	yes
30-Jun-99	1.51	20	0.4	yes
19-Jul-99	0.626	20	0.4	yes
5-Aug-99	0.693	20	0.4	yes
20-Aug-99	0.361	20	0.4	no
2-Sep-99	0.298	20	0.4	no
16-Sep-99	0.628	20	0.4	yes
5-Oct-99	0.216	23	0.5	no
21-Oct-99	0.434	34	0.8	no
2-Nov-99	0.292	50	1.2	no
7-Dec-99	0.288	28	0.6	no
21-Dec-99	0.259	45	1	no
6-Jan-00	0.127	45	1	no
19-Jan-00	2.19	45	1	yes
2-Feb-00	0.544	45	1	no
23-Feb-00	9.35	45	1	yes
1-Mar-00	1.77	66	1.7	marginal
22-Mar-00	0.272	45	1	no
3-Apr-00	0.538	20	0.4	yes
21-Apr-00	0.545	20	0.4	yes

Data Source - Eco:Logic Inc.

Figures B-1 through B-5 (from data in tables in City of Lincoln, 1999) in Appendix B show the estimated loading of heavy metals in Auburn Ravine, by source. The figures indicate:

- The background loading of cadmium is dominant relative to the inputs from stormwater runoff and the WWTPs;
- Stormwater runoff of copper makes a major contribution to the total copper load during winter storms, but the background concentration is important during summer months. The WWTP inputs of copper account for about 20 percent of the load in some months;
- The load of zinc is mostly accounted for by the base load; neither urban runoff nor WWTP loads are important;
- Stormwater runoff contributes up to a third of lead in some months. WWTP loads of lead are significant but not dominant; and
- Stormwater loads account for virtually all of the mercury loads; WWTP discharges are insignificant.

Mercury (Hg) limits for aquatic life have not yet been set in the CTR, but if the mercury limits in the State Water Resource Control Board's abandoned Inland Waters Surface Plan (ISWP) were adopted, the existing background levels of mercury in Auburn Ravine might exceed water quality criteria (City of Lincoln, 1998). The recent water quality monitoring by DWR in lower Coon Creek, Auburn Ravine, and Cross Canal found that mercury concentration exceeded the CTR criterion for human consumption of water in one sample (12/21/01) from Auburn Ravine. Transport of mercury is known to be highly episodic; concentrations are positively related to discharge, particulate organic carbon (POC), and dissolved organic carbon (DOC) (Shanley, et. al., 2002). The DWR monitoring data show a highly significant relationship between Hg and DOC.

The DWR monitoring program also found that copper concentrations in monthly grab samples occasionally exceeded the chronic (4-day continuous) CTR criterion in all three streams, especially during periods of high flow. On one occasion, copper exceeded the chronic criterion in Auburn Ravine in July, due to the low hardness of the water (which affects copper toxicity). Additional limits might have to be placed on discharge of heavy metals in order to meet the CTR criteria.

<u>Pesticides</u>

Most of the pesticide use in the Auburn and Coon Creek basins is probably applied to rice crops in the area downstream of Lincoln. Detailed information contained in Appendix B shows the lbs/yr of various pesticides used on rice in Placer County. Note that malathion and diazinon, two organophosphate pesticides that have been identified as water quality problems elsewhere, are not used in significant quantities on rice. However, they are monitored by DWR in Auburn Ravine and Coon Creek. Carbofuran, the most heavily used insecticide on rice in Placer County, might be a good candidate for water quality monitoring. It is highly toxic to birds, fish and humans, moderately to highly mobile, and tends to bioconcentrate.

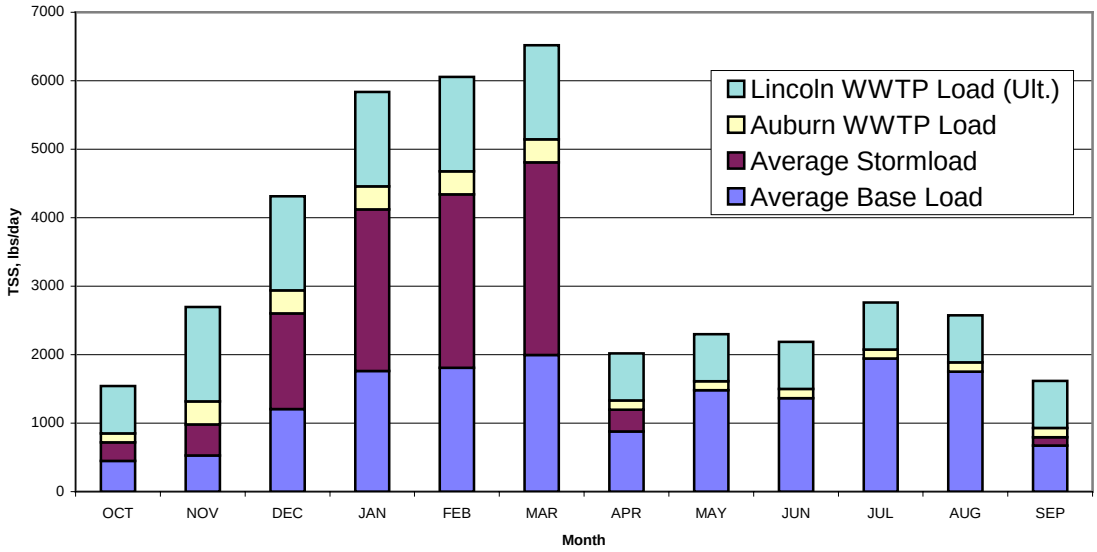
The recent DWR monitoring in the lower basin, however, did not detect measurable concentrations of any of the 19 pesticides tested for in the monthly water samples, except diazinon (Appendix B). Concentrations of this organophosphate were 10-30 nanograms/liter (ng/l) in January 2001 and March 2001 samples. The EPA chronic diazinon criterion for three acutely sensitive zooplankton species is 50 ng/l (Sacramento River Watershed Program, 2001). The source of the diazinon is not clear, but use of the pesticide on gardens is a possible source.

Turbidity and Suspended Sediment

Sediment may be both a water quality issue and a stream morphology issue. In suspension, sediment contributes to turbidity, and may violate water quality standards. During storms, when most of the sediment in a stream is transported, suspended sediment concentrations may be naturally high. At low to intermediate flows, suspended sediment concentrations and turbidity may be low, but it is at such times that sediment is most damaging to aquatic habitat, due to infilling of pools, impaction of spawning gravels, etc. The issue of sediment in the Auburn Ravine and Coon Creek basins is covered in more depth in Chapter 5: Stream Sediment.

Detailed data on the relative contribution of storm loads and WWTP discharges to mean monthly suspended sediment loads in Auburn Ravine is presented in Figure 6-8. Note that most of the winter and early spring Total Suspended Solids (TSS) loads are accounted for by stormwater runoff. Because the stormwater load estimates were derived from urban data, they probably greatly underestimate the contribution of unimproved dirt roads throughout the basins.

Figure 6-8. Mean Monthly TSS Loads in Auburn Ravine, Average Year



The Basin Plan requires that where natural turbidity is between 0 and 5 NTU's, turbidity increases shall not exceed 1 NTU. During low flow periods, the receiving waters in Auburn Ravine may have a natural turbidity of < 1 NTU, but the effluent from the City of Lincoln's Wastewater Treatment and Reclamation Facility will at times exceed 2 NTU's, and violations may occur (City of Lincoln, 1999). The problem can be addressed in part by increased storage during low flow periods; however, this would be a major expense. The City of Lincoln is seeking an amendment to the Basin Plan to allow higher turbidity increases during low flow periods than specified in the present standards.

Management Concerns

In general, water quality problems identified in this survey are related to temperature, nutrients and related dissolved oxygen, heavy metals, and pesticides. These management concerns, as well as associated negative and positive impacts, are identified in Table 6-3 below.

Table 6-3. Management Issues and Concerns related to Water Quality

Management Issue	Negative Ecological and Social Impacts	Positive Ecological and Social Impacts
WQM1 Loss of riparian vegetation along streams results in higher instream temperatures.	WQN1.1. May increase suitability of habitat for warm water exotic species that prey on salmonids. WQN1.2. May adversely affect rearing habitat for juvenile salmonids.	None
WQM2 Release of wastewater results in temperature increases and higher nutrient levels in downstream areas.	WQN2.1. May impact salmonids unless timing of release is controlled. WQN2.2. May increase suitability of habitat for warm water exotic species that prey on native salmonids. WQN2.3 May contribute to algal blooms and dissolved oxygen problems in downstream reaches.	WQP2.1 Wastewater release may provide minimal flows needed to support salmonids, if release timing is appropriate.
WQM3 Proposed increases in diversion from the American River to Auburn Ravine Basin result in higher temperatures in Auburn	WQN3.1 May increase suitability of habitat for warm water exotic species that prey on native salmonids.	WQP3.1 Enhances water supply in Placer County.

Table 6-3. Management Issues and Concerns related to Water Quality

Management Issue	Negative Ecological and Social Impacts	Positive Ecological and Social Impacts
Ravine.	WQN3.2 May contribute to algal blooms and dissolved oxygen problems in downstream reaches.	
WQM4 Cattle grazing along lower Coon Creek increases nutrient loading and BOD.	WQN4.1 May contribute to algal blooms and dissolved oxygen problems in downstream reaches. WQN4.2 May adversely affect human use of these areas.	None
WQM5 Heavy metals are mobilized during periods of high flow or summer releases to Auburn Ravine.	WQN5.1 Heavy metals may bioaccumulate in aquatic organisms. WQN5.2 Heavy metals may taint fish for human consumption.	None
WQM6 Diazinon concentrations approach toxic levels.	WQN6.1 May adversely affect aquatic species. WQN6.2 May require cutback in use if levels increase.	None
WQM7 Carbofuran (not monitored) is heavily used in rice farming and is discharged to the lower watershed.	WQN7.1 Carbofuran is highly toxic to fish and wildlife and may adversely affect fish and herpetofaunal species of concern.	None

Summary of Findings

Temperature

Temperatures are suitable for salmonids in Auburn Ravine upstream of approximately Nelson Lane in Lincoln and in Coon Creek probably upstream of Gladding Road due in large part to the use of the stream channels as conveyance facilities for irrigation water. While no systematic data are available for Doty Ravine, the water sources for summer releases into the stream are the same as for Auburn Ravine and Coon Creek, which would indicate that water temperatures are suitable for salmonids upstream of NID's Doty South Diversion Dam. Temperature may be adversely affected by:

- Loss of riparian vegetation - Local landowners, in some instances, have cleared stream banks of riparian vegetation, thus reducing shading and increasing stream temperatures.

Cattle grazing, especially along lower Coon Creek, is part of this problem.

- Release of Treated Wastewater - The Lincoln Wastewater Treatment and Reclamation Facility (and ultimately a regional treatment facility) could release water that could change the existing water temperature regime of Auburn Ravine at some times of the year. Impacts to salmonids will be avoided by compliance with the NDPES permit that requires that the discharges shall not cause the annual temperature in Auburn Ravine to increase by more than 5 °F and shall not cause the stream temperature to rise above:

  - 58 °F on a monthly average and weekly median basis from October 1 through May 31
  - 64 °F at any time from October 1 through May 31
  - 5°F over the ambient background temperature as a daily average for the period from June 1 through September 30.

Nutrients and Dissolved Oxygen

Nitrogen and phosphorus from treated wastewater, urban runoff, livestock and natural sources can stimulate the growth of algae in the creek. At night, and during periods of decay, these algae can temporarily reduce the concentration of dissolved oxygen (DO) in the stream.

- Nutrients from the SMD-1 WWTP at Rock Creek contribute significantly to the nutrient load of Coon Creek and may cause accelerated growth of algae as well as depressed nighttime DO concentrations.

- Cattle grazing along lower Coon Creek probably contributes substantially to the nutrient and BOD load of the creek.

- The Lincoln Wastewater Treatment and Reclamation Facility will increase nutrient loads in lower Auburn Ravine under some conditions. Compliance with the NPDES permit will assure that the impact is minimized as not to adversely affect beneficial uses of the stream including recreation, water supply, and preservation and enhancement of fish, wildlife, and other aquatic resources.

Heavy Metals

Heavy metals, including lead (Pb), copper (Cu), zinc (Zn), cadmium (Cd) and mercury (Hg) can be toxic to aquatic life in very low concentrations. The toxicity of some of these metals is influenced by the water's hardness (the concentration of Ca + Mg ions). Most heavy metals are strongly adsorbed onto fine sediment particles or complexed with dissolved organic matter.

- Pb and Cu concentrations sometimes exceed the limits of the California Toxics Rule (CTR), primarily during periods of heavy storm runoff, and during the summer when low-hardness water is released to Auburn Ravine.

- Mercury concentration in Auburn Ravine exceeded the CTR criterion for human consumption of water, on one occasion. Concentrations of mercury are related to stormflows and to organic carbon, but the source is not clear. Because methyl mercury concentrates up the food chain, sampling of fish in the lower part of the basin for mercury concentration should be included in a monitoring program.

- The cities of Lincoln and Auburn both have plans and policies to control the runoff of stormwater pollutants. The programs will need to be strengthened and expanded as populations grow. Projects such as underground storage of stormwater, drop-inlet filters, vacuum-powered street sweeping, and use of treatment wetlands may become increasingly important, and may figure in the new Phase II NPDES stormwater plans.

Pesticides

Sampling for 28 pesticides in the lower basin (Auburn Ravine, Coon Creek and Cross Canal) found that all except diazinon were below the level of detection. On two occasions in Coon Creek and Cross Canal and one occasion in Auburn Ravine, Diazinon concentrations were 10-30 ng/l, below the EPA threshold for chronic exposure of sensitive organisms to diazinon. Carbofuran, which is highly toxic to fish and wildlife, is the insecticide most used on rice in Placer County (about 3,600 lbs/yr on average). It should be included in the DWR water-quality monitoring program.