

**FIGURE 2-5**  
**PCWA LOWER ZONE 1 AUBURN RAVINE AREA DISTRIBUTION CONVEYANCES**

### 2.2.3 Zone 5

The Zone 5 service area, shown in **Figure 2-6**, receives water deliveries from PG&E conveyed through Auburn Ravine, and delivered to customers along Auburn Ravine and canals used by the PCWA downstream. PCWA water supplies originating from either the South Fork Yuba and/or Bear River watersheds are purchased from PG&E and diverted to Auburn Ravine at a few locations downstream from PG&E Wise Penstock to meet raw water delivery demands in Zone 5. These diversions include the Dutch Ravine Canal, which receives flows from PG&E's South Canal and YB 136. PCWA may also deliver water to Zone 5 customers pumped from the North Fork of the American River through the ARPS and conveyed through the Auburn Ravine. The Nevada Irrigation District (NID) purchases water from PG&E below the Wise Powerhouse for release into Auburn Ravine. NID also releases water to Auburn Ravine from their North Canal, especially during the yearly PG&E outage.

Auburn Ravine is seasonally dammed at Moore Dam, where flows are diverted to Moore Canal for deliveries to PCWA Zone 5 customers. Further downstream, flows are diverted from Auburn Ravine for deliveries to PCWA Zone 5 customers at the Pleasant Grove Dam to the Pleasant Grove Canal. Several NID canals divert flows from Auburn Ravine with temporary and permanent control structures for deliveries to NID customers.

## 2.3 PCWA RAW WATER DISTRIBUTION SYSTEM OPERATIONS

The majority of the PCWA raw water distribution area is serviced by gravity flow through the canal system, as described above. Reservoirs provide flexibility in operations, allowing capture and storage of flow from portions of the upper system for release, as needed, to portions of the lower system. PCWA monitors regulating gates and staff gages throughout the system, and uses information collected to make decisions on purchase quantities from PG&E at either of the buy points described above, and adjusts deliveries in accordance with water demands and meteorological conditions.

### 2.3.1 Deliveries

PCWA's delivery schedules are for an entire year, or an irrigation season. The irrigation season is identified as April 15 to October 15. Water is sold to raw water customers by the miner's inch. One miner's inch equates to the flow of water through a 1-inch-square orifice with 6 inches of head, as shown in **Figure 2-7**. The purchase of 1 miner's inch of water for the irrigation season entitles the purchaser to 0.025 cfs, 24 hours a day, from April 15 to October 15. Most PCWA raw water customers receive their water from a service pipe that goes through the canal berm to their service box. Water deliveries to these customers equals the customer's real time raw water demand, with the number of miner's inches purchased being the maximum rate of delivery. Consequently, the actual delivery quantities through the service boxes are typically less than the quantity purchased.

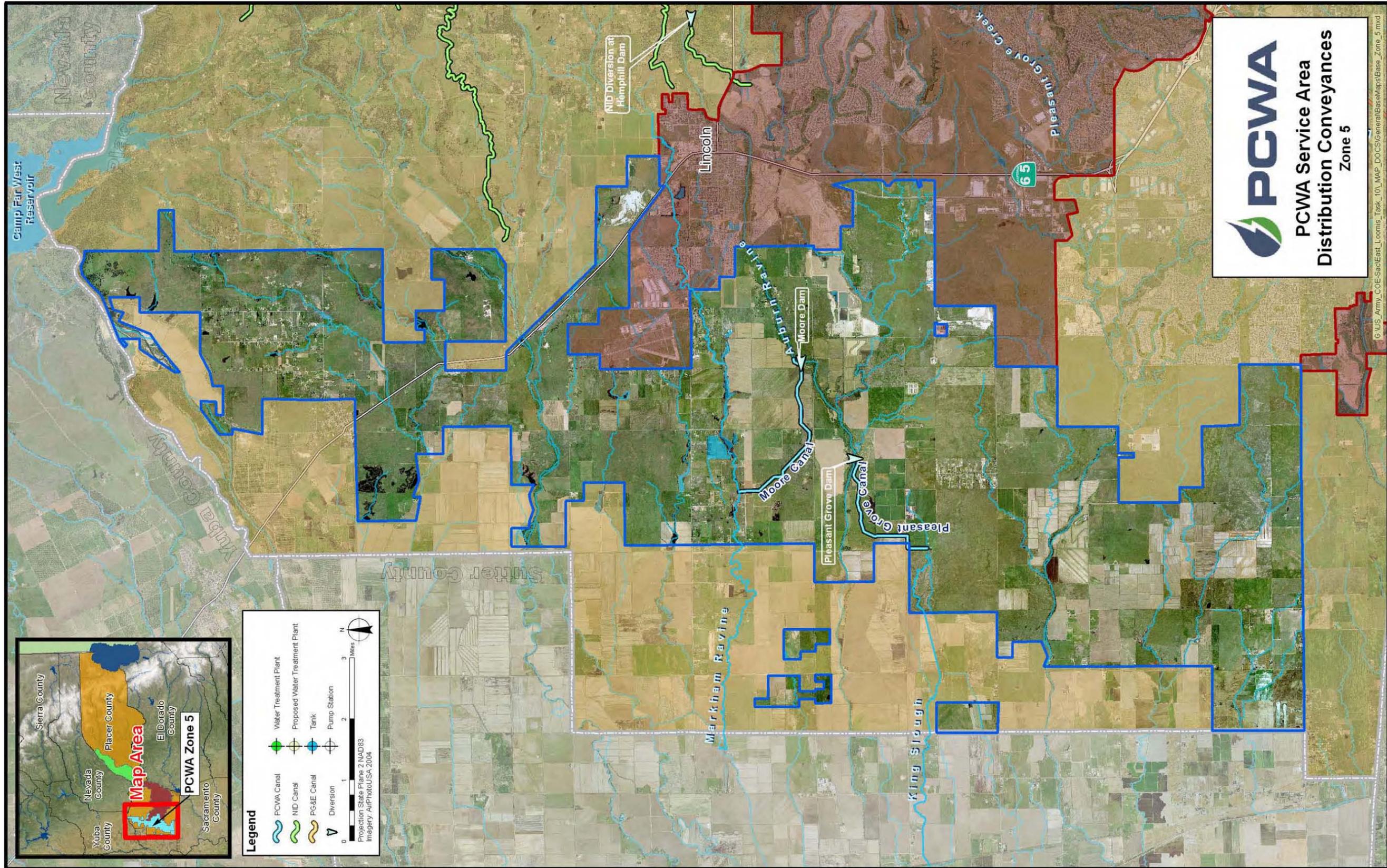
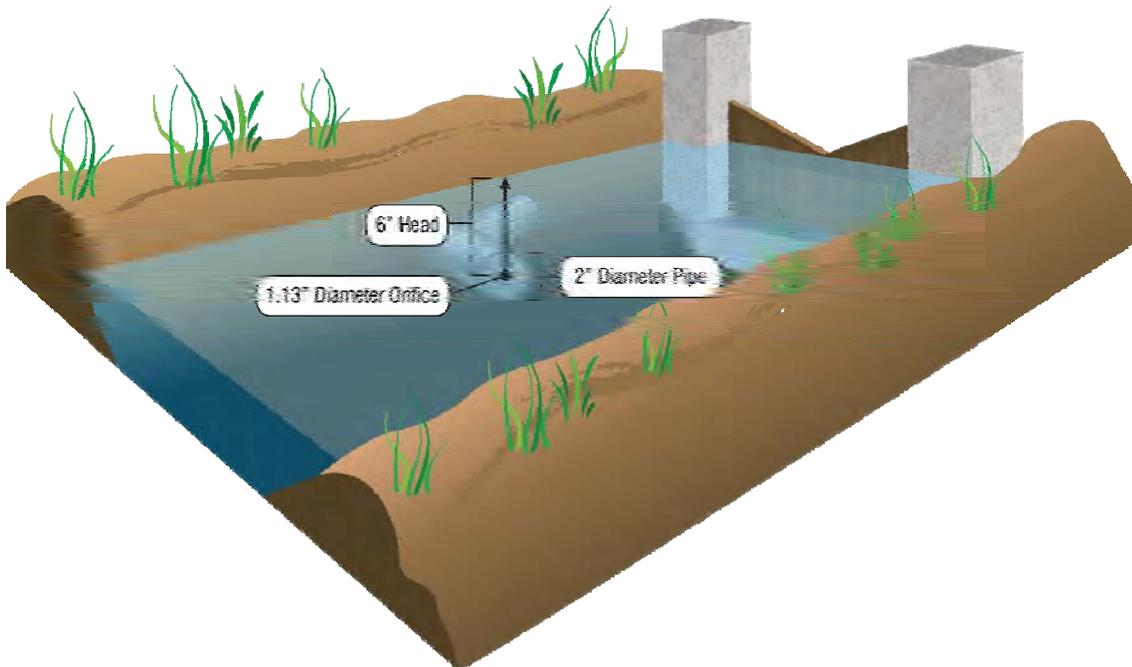


FIGURE 2-6  
PCWA ZONE 5 SERVICE AREA AND DISTRIBUTION CONVEYANCES

Orifices at delivery points may be intentionally or inadvertently removed or replaced, and/or enlarged at locations. Adjusting the size of the delivery orifice alters the rate of flow delivery at the location. Debris accumulation at a delivery orifice also affects the rate of flow, and may lead to decreases in raw water delivery quantities.

Raw water delivery purchases are associated with parcels. New customers in the PCWA service area are permitted to purchase a maximum of 0.5 miner's inch, or 0.0055 cfs, of raw water during the irrigation season, only. If a parcel is sold and service to that parcel is terminated, the new parcel owner is only permitted to purchase 0.5 miner's inch, or 0.0055 cfs, of raw water during the irrigation season.



**FIGURE 2-7**  
**DELIVERY OF 1 MINER'S INCH TO PCWA CANAL SYSTEM CUSTOMERS**

### 2.3.2 Operations

PCWA's raw water distribution is governed by customer demand and the availability of supplies. Regular operations activities occur on a yearly, seasonal, or more routine basis.

#### 2.3.2.1 Yearly

PG&E implements an annual water delivery outage to PCWA while PG&E conducts maintenance on its system. The outage typically takes place from mid-October to mid-November, reducing water available to PCWA's Zone 1 customers from PG&E's Wise, Bear, and South canals. The amount of water available for raw water delivery depends on customer demands for treated water from PCWA's WTPs. Generally, treated water needs are met before raw water needs. During the PG&E outage, PCWA relies on stored water in surface reservoirs,

water bypassed through Zone 3, and water delivered through the ARPS to supplement flow to the WTPs and to canal customers. Water pumped from the North Fork American River through the ARPS is pumped again at PCWA's Auburn Ravine Tunnel Pump into PG&E's South Canal, and then diverted by PCWA at the Foothill WTP. Flow is greatly reduced in some areas within PCWA's raw water distribution system requiring alternative delivery schedules, such as rotating outages among canals.

### **2.3.2.2 Seasonal**

As described previously, PCWA's delivery schedules are either for an entire year, or for an irrigation season. Depending on the purchased quantity of raw water, the orifice at each delivery point in the system may be changed before each delivery season (winter and summer). PCWA replaces the orifices at delivery points with delivery schedule changes for the irrigation season during the week of April 15, and after the irrigation season during the week of October 15. Schedule changes after the irrigation season take place during PG&E's annual water delivery outages. This activity takes about 1 week to complete, with minimal interruptions to service.

PCWA also performs flood management practices. Portions of the PCWA canal system are likely to receive and convey stormwater runoff during precipitation events, typically during the winter months. During high precipitation events that generate runoff and excess flows within the canal system, blockages along the canal cause overtopping and high water leaks develop. Resulting high canal flows may also cause bank erosion along unlined canals and at canal outlets, and can damage property. During these high precipitation events, PCWA personnel use selected outlet locations along the canals to release excess water for flood management.

### **2.3.2.3 Routine**

Based on meteorological conditions and anticipated customer water demands, PCWA staff make operational decisions on purchase quantities from PG&E, as well as conveyance and storage decisions based on treated and raw water demands. Daily operations include reading water levels and flows at heads and ends of canals, and adjusting flows throughout the canal system, particularly at the reservoirs. Flows within the canals may be adjusted by canal operators through installing check boards, or temporary weirs, to alter head conditions and reduce or decrease diversions. PCWA's reservoirs allow for PCWA staff to make adjustments to outflows with a valve control. A limited number of pumps within the system are regularly visited by PCWA to check their operation and usage. Canal operators also frequently respond to customer requests related to canal deliveries through removing debris near delivery points, and installing or removing check boards to change head conditions at delivery locations.

## **2.4 PCWA RAW WATER DISTRIBUTION MAINTENANCE ACTIVITIES**

PCWA performs scheduled canal maintenance in the canal system as needed and cleans the canal on an annual basis. Maintenance activities include cleaning debris from the canals, lining leaky canal sections, repairing damaged pipes and/or flumes, and controlling vegetative growth in the canals and on the canal berms through algaecide and herbicide applications. Cleaning is

performed during the winter months and is scheduled a month or more in advance. Canal lining is conducted throughout the year. Algaecide and herbicide applications are scheduled in advance and performed on a monthly or as-needed basis during the irrigation season.

### 2.4.1 Weed and Brush Control

PCWA has an extensive weed and brush control program for their canal distribution system that includes algaecide application to waters within the canals, physical removal of vegetation and/or herbicide applications along canal berms, and herbicide applications on aquatic vegetation in PCWA reservoirs. All algaecides and herbicides are applied by PCWA staff according to Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) label instructions and PCWA application plans. Before application, PCWA evaluates the potential impacts to environmental resources, and prepares an environmental compliance document to satisfy California Environmental Quality Act (CEQA) requirements. PCWA's weed and brush control programs are described below. All algaecide and herbicide applications are performed under the supervision of a California Department of Pesticide Regulations (DPR)-certified applicator at PCWA.

#### 2.4.1.1 Physical Removal of Vegetation

PCWA staff periodically mow, disk, trim, and/or remove vegetation along canals. Physical removal of vegetation occurs on an as-needed basis.

#### 2.4.1.2 Algaecide Application

The growth of algae and other submerged aquatic weeds in the canal system can reduce capacity and flow velocity, as well as clog screens, pipes, siphons, and delivery outlets. To control algae and other submerged aquatic weeds, an aqueous copper-based algaecide (Cutrine-Plus<sup>®</sup>) is applied throughout the system on a monthly basis beginning in April and continuing through the summer delivery season. Copper sulfate, a stronger algaecide, is applied as needed to areas with acute algae growth.

During 2007, PCWA initiated the application of Algimycin-PWF<sup>®</sup>, also a copper-based algaecide, at select locations within the canal system upstream of WTPs. Water treated with Algimycin-PWF<sup>®</sup> does not cause increased chlorine demand, which is often a concern with the use of organic chelated copper algaecides in water treatment facilities (Applied Biogeochemists, 2007).

The aquatic weed control program is conducted under strict guidelines and supervised by a DPR-certified applicator and applied by DPR Qualified Applicators. PCWA maintains an application log for each of the sites shown in **Figures 2-8 to 2-11** and listed in **Table 2-1**. There are 21



*Algae growth within Boardman Canal downstream of Mammoth Reservoir*

established points of algaecide application within the system, with “spot” treatments at other locations as conditions warrant. The uppermost point of application is in the Boardman Canal as it leaves Lake Alta. The rate of application is based on the rate of flow at the point of application for the canal receiving the application and the amount of targeted vegetation growth.

The PCWA logs the following information during each aquatic pesticide application:

- Flow rate
- Application start time
- Application end time
- Pesticide(s) used
- Concentration
- Application rate
- Total amount applied
- Special-status species visually observed
- Environmental observations, including
  - Air temperature
  - Water temperature
  - Wind speed
  - Wind (calm, breezy, or windy)
  - Cloud cover (no clouds, partly cloudy, or overcast)
  - Precipitation (none, foggy, drizzle, rain, or snow)
  - Water clarity (clear water, cloudy water, or murky water)
  - Sample color (none, amber, yellow, green, brown, gray, other)
  - Sample odor (none, fresh algae smell, chlorine, sulfide, or sewage)
  - Other (algae, oily sheen, foam or suds, leaves, or trash)
- Any additional comments

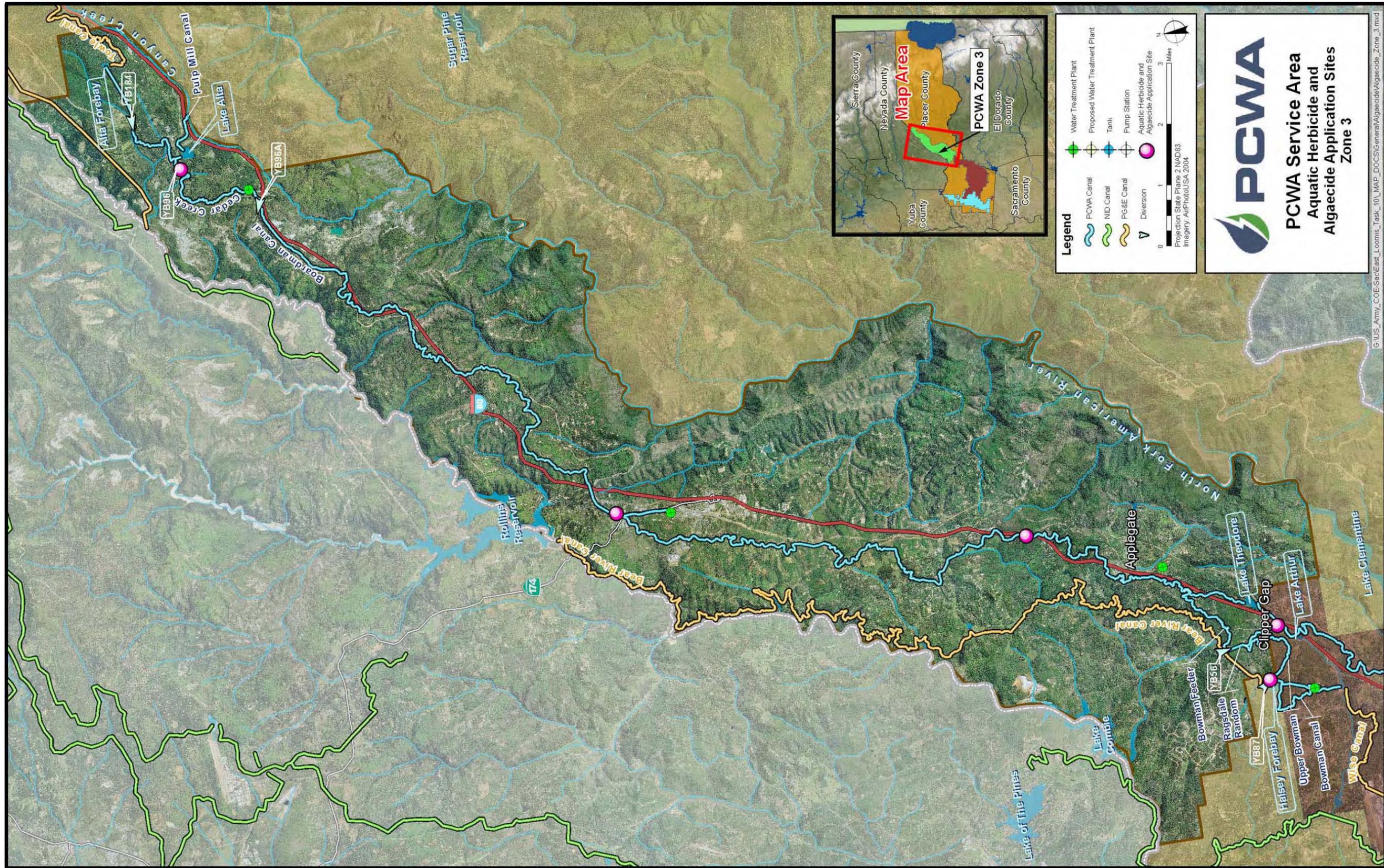
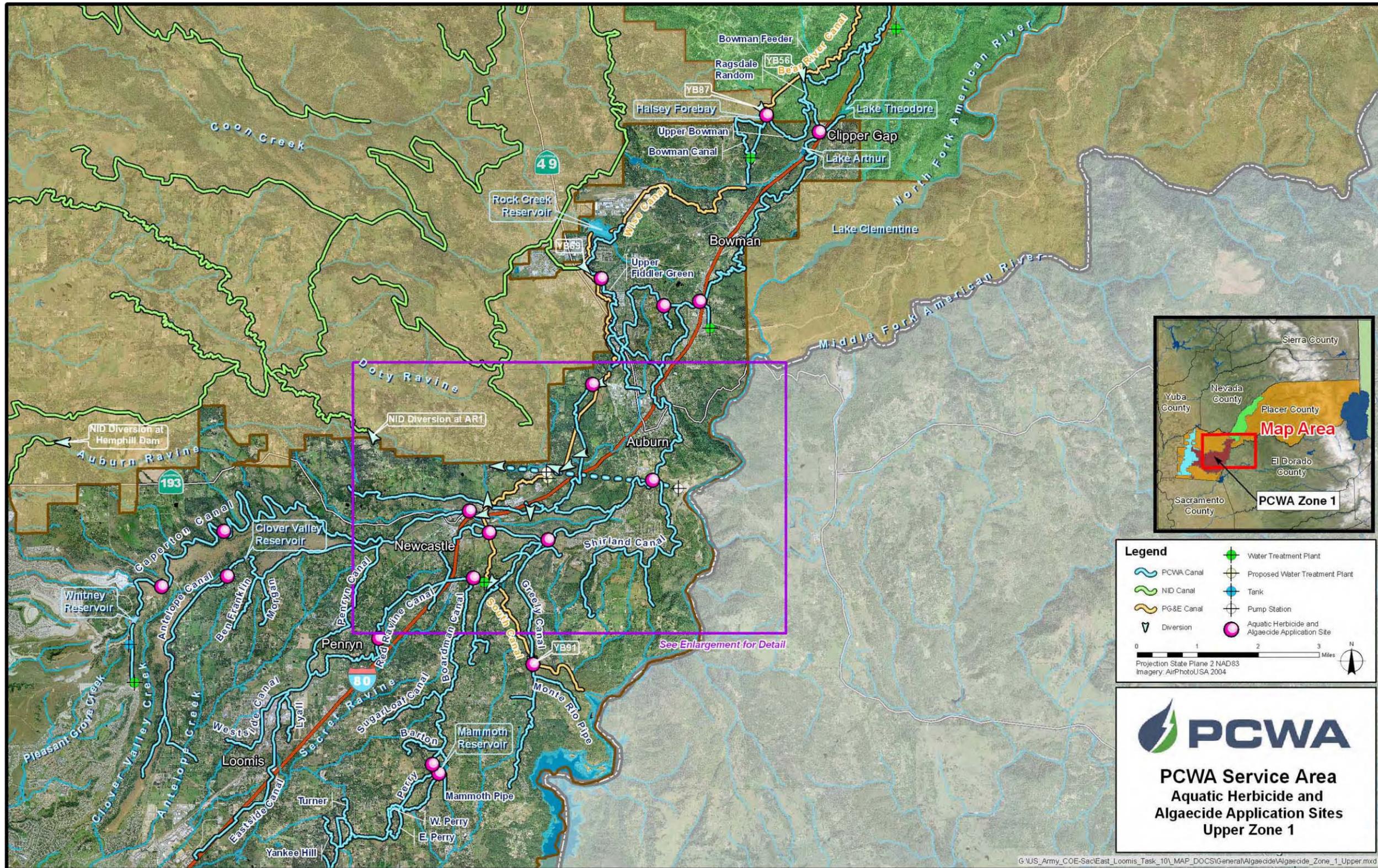
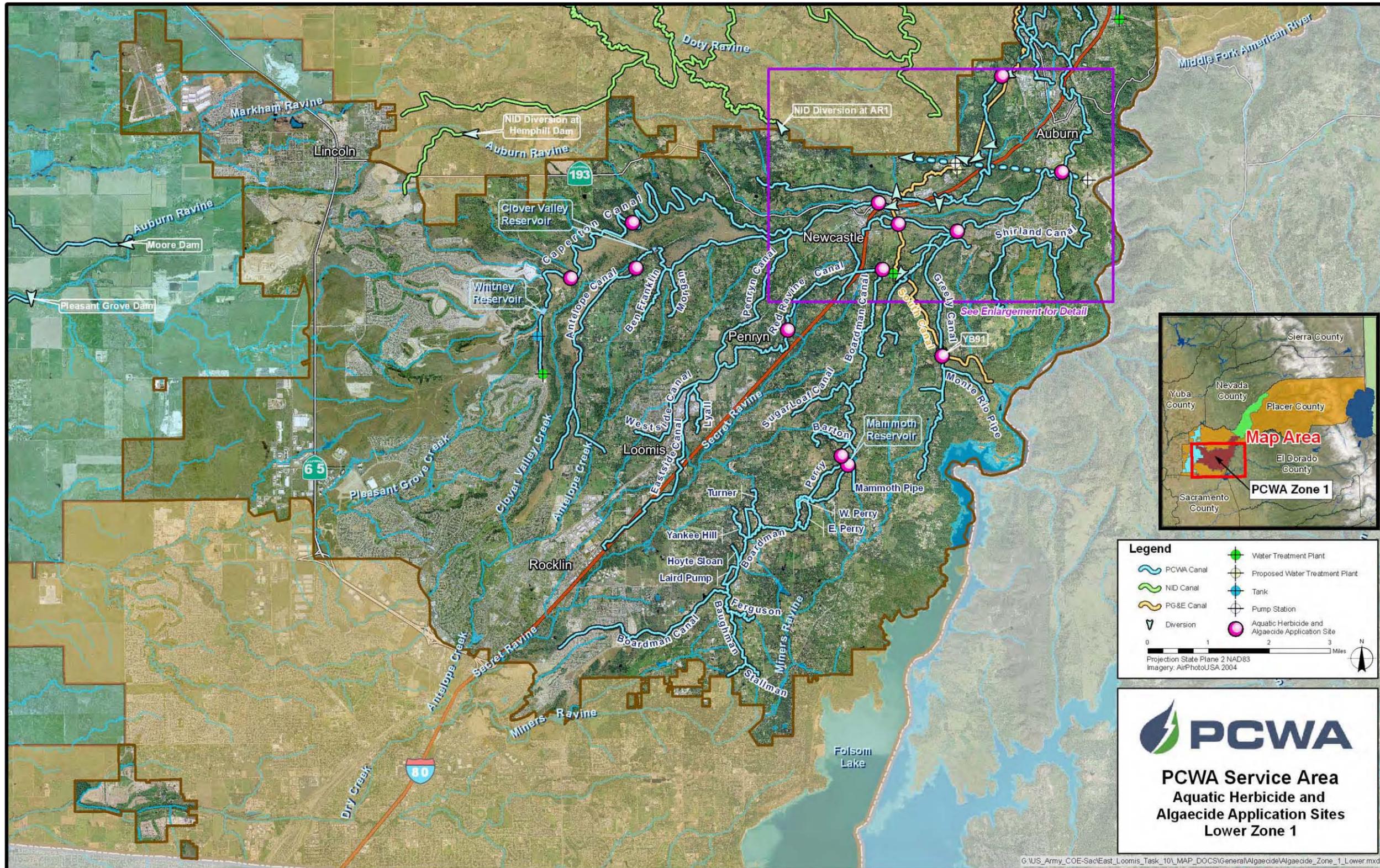
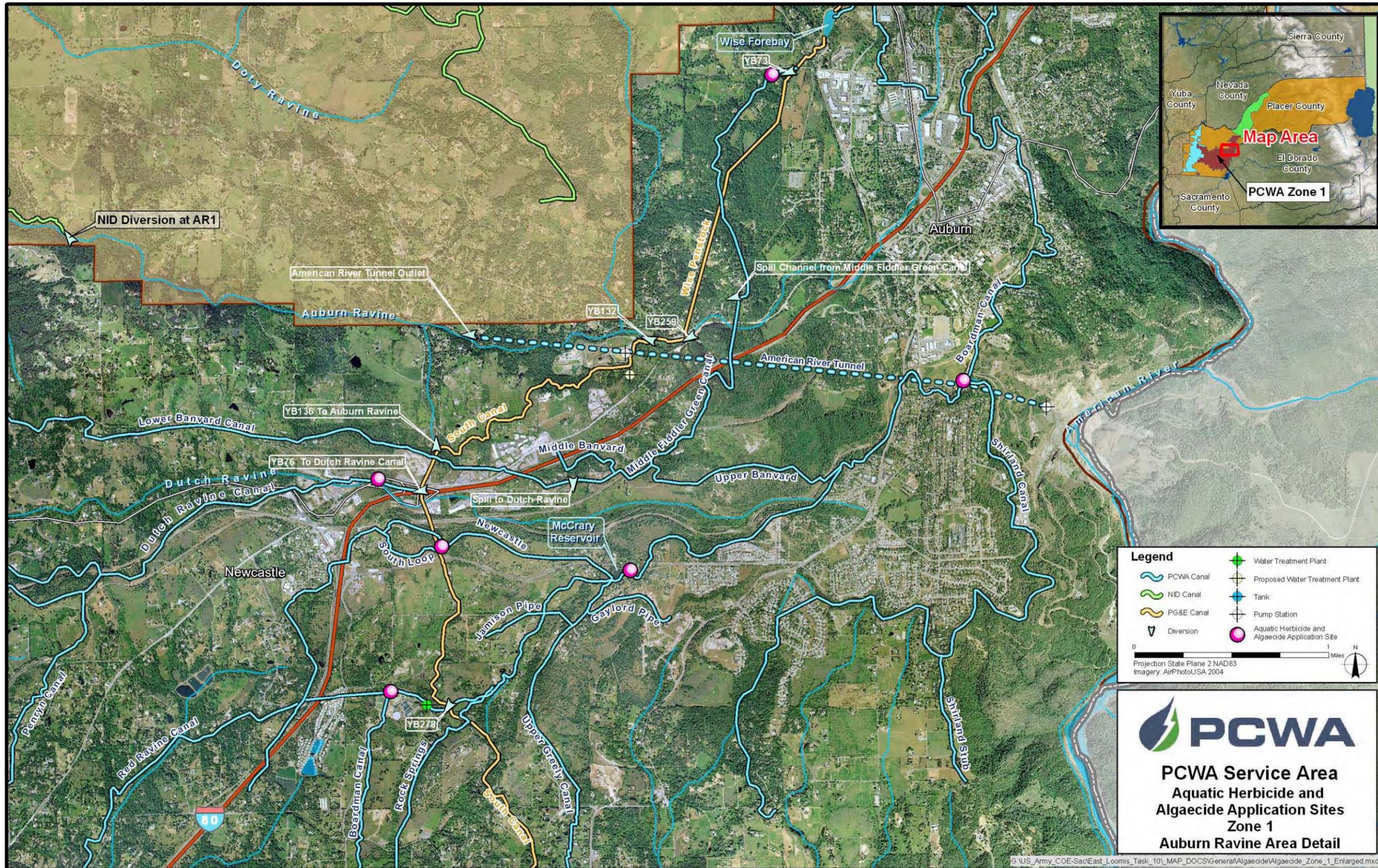


FIGURE 2-8  
ZONE 3 AQUATIC HERBICIDE AND ALGAEICIDE APPLICATION SITES





**FIGURE 2-10**  
**LOWER ZONE 1 AQUATIC HERBICIDE AND ALGAEICIDE APPLICATION SITES**



**FIGURE 2-11**  
**LOWER ZONE 1 AUBURN RAVINE AREA AQUATIC HERBICIDE AND ALGAECIDE APPLICATION SITES**

**TABLE 2-1  
PCWA AQUATIC HERBICIDE AND ALGAEICIDE APPLICATION SITES**

| Zone 3 Application Sites  | Zone 1 Application Sites                                 |
|---|--|
| Cedar Creek (YB 96)   | Boardman Canal at Luther and Channel Hill Rd (356+05)    |
| Boardman Canal at Colfax Header Box (YB 49)                       | Bowman Canal (YB 87)                                     |
| Boardman Canal at Heather Glenn and 49er spill (1289+42)          | Freeman and Shockley canals at Luther Rd (22+79)         |
| Boardman Canal at Clipper Gap (YB 179) (Zone 1 application point) | Upper Fiddler Green at RR Spill (85+83)                  |
|   | Boardman Canal at Foothill Water Treatment Plant (YB 78) |
|   | Middle Fiddler Green Canal at Raccoon Hollow (16+40)     |
|   | Shirland Canal at Pacific (YB 147)                       |
|   | Dutch Ravine Canal at Ridge and Taylor Rd (11+60)        |
|   | Boardman Canal at McCrary Reservoir (YB 92)              |
|   | Caperton Canal at Clark Tunnel Rd (316+80)               |
|   | Caperton Canal below Caperton Reservoir                  |
|   | Newcastle Canal at Head of South Loop (50+92)            |
|   | Lower Greely Canal (YB 91)                               |
|   | Red Ravine Canal at Gilardi Rd (126+45)                  |
|   | Lower Antelope Canal and Antelope Stub Canal (194+05)    |
|   | Boardman Canal below Mammoth Reservoir (343+22)          |
|   | Perry Canal at Mammoth Drive and Hooter Spill (23+51)    |

Key:  
YB = Pacific Gas and Electric Yuba-Bear Buy Point

Copper sulfate, Cutrine-Plus<sup>®</sup>, and Algimycin-PWF<sup>®</sup> are toxic to fish. The toxicity to fish varies with the species and their developmental stage, and with the physical and chemical characteristics of the water. Copper toxicity to fish generally increases as water hardness and pH decreases (Pimental 1971). Fish eggs are more resistant than young fish fry to the toxic effects of copper sulfate (Gangstad 1986). Copper will bind to soil particles and organic matter in water and settle out of solution, but it will not degrade chemically or biologically. Cutrine-Plus<sup>®</sup>, a chelated copper compound contains less copper than copper sulfate and because the copper is gradually released from its chelate, it is less toxic to fish than copper sulfate (Ross and Lembi 1985).

**2.4.1.3 Herbicide Application**

The growth of plants on canal berms can damage the berm through destabilizing the canal banks, as well as decrease canal flow velocities algal mat buildup can decrease canal flow capacities, and increase the accumulation of debris in the channel. Plant growth is controlled as needed with the application of herbicide. This is typically performed in the late spring at the beginning of the summer delivery season, when plants have emerged. Glyphosate and triclopyr herbicides are used in the PCWA system. Specific herbicides typically include Garlon4<sup>TM</sup> (triclopyr), Rodeo<sup>®</sup> (glyphosate), Roundup<sup>®</sup> (glyphosate), or AquaMaster<sup>TM</sup> (glyphosate). Applications usually involve a tank mix of herbicides to control the growth of different types of vegetation. PCWA also performs a pre-emergent application on the walking side of berms for the lower portion of the canal system after the first soaking rain of the wet season; sometime between